

HP Archive

This vintage Hewlett Packard document was preserved
and distributed by

[www. hparchive.com](http://www.hparchive.com)

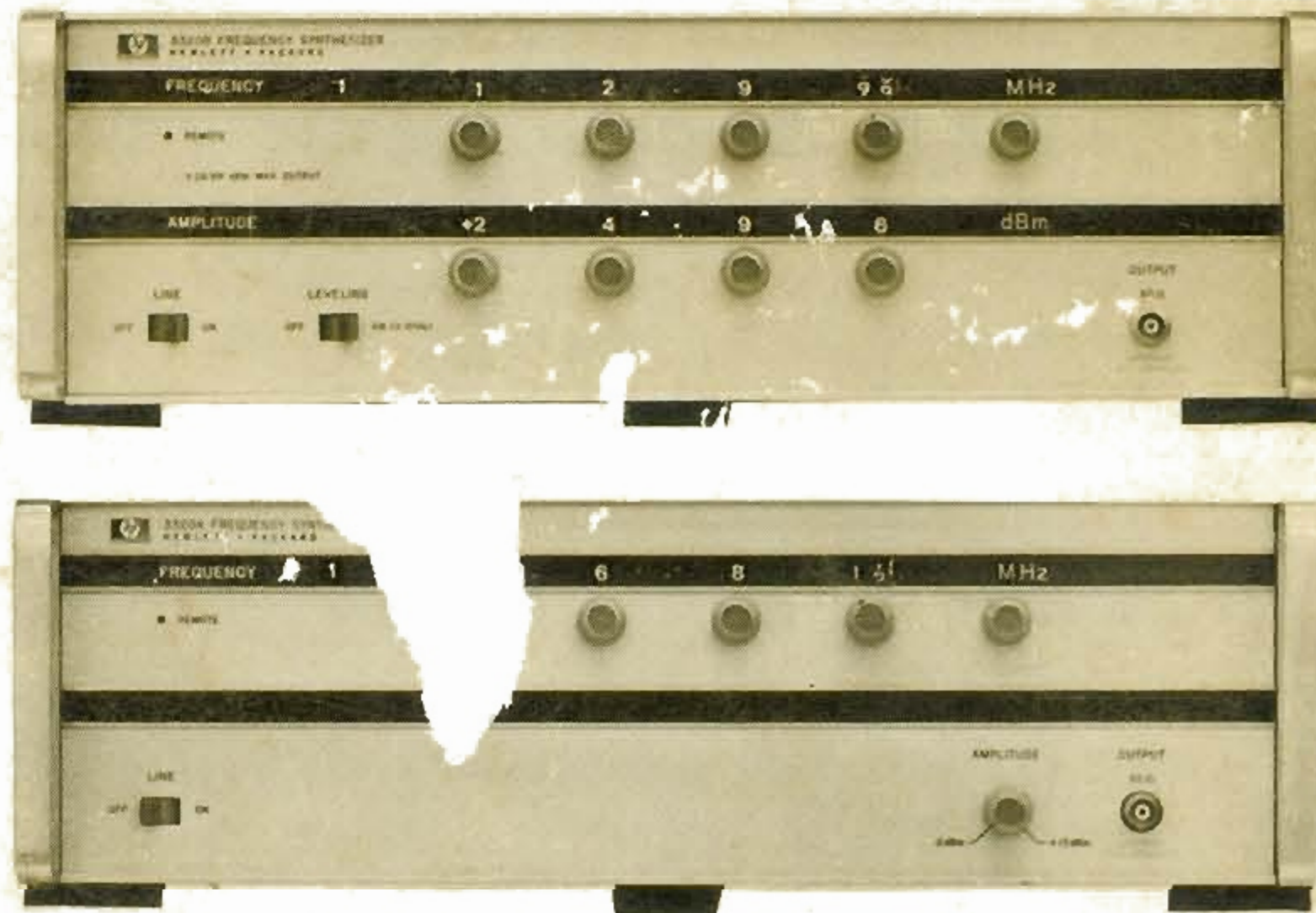
Please visit us on the web !

On-line curator: Louis Taber

OPERATING AND SERVICE MANUAL

FREQUENCY SYNTHESIZER

3320A/B



HEWLETT  PACKARD

HEWLETT  PACKARD

CERTIFICATION

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

WARRANTY AND ASSISTANCE

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

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

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



W.J. FORD SURPLUS ENTERPRISES
A DIVISION OF 3125661 CANADA INC.
21 MARKET ST. N. (corner Market & William)
P.O. Box 606, SMITHS FALLS, ONT. K7A 4T6
TELEPHONE (613) 283-5195 FAX (613) 283-0637

OPERATING AND SERVICE MANUAL

Manual Part No. 03320-90001
Microfiche Part No. 03320-90051

MODEL 3320A/B FREQUENCY SYNTHESIZER

The main body of this instruction manual applies to

Serial Number 1138A-00276 (Model 3320A)
1319A-00691 (Model 3320B)

and higher. Any changes made in instruments having serial numbers higher than the above number will be found in a "Manual Changes" supplement supplied with this manual. Be sure to examine this supplement for any changes which apply to your instrument and record these changes in the manual. Backdating information for instruments with lower serial numbers will be found in Section VIII.

Copyright Hewlett-Packard Company 1971
P.O. Box 301, Loveland, Colorado, 80537 U.S.A.

TABLE OF CONTENTS

| Section | Page | Section | Page |
|--|------|---|------|
| I. GENERAL INFORMATION | 1-1 | 4-15. Reference Section | 4-2 |
| 1-1. Introduction | 1-1 | 4-17. Functional Block Description | 4-2 |
| 1-3. Specifications | 1-1 | 4-19. Controller Section | 4-2 |
| 1-6. Description | 1-1 | 4-41. Frequency Section | 4-7 |
| 1-9. Options | 1-3 | 4-49. Amplitude Section | 4-7 |
| 1-12. Accessories Supplied | 1-3 | 4-56. Reference Section | 4-9 |
| 1-14. Accessories Available | 1-3 | 4-62. Unique Circuits | 4-10 |
| 1-16. Instrument and Manual Identification | 1-3 | 4-63. 3320B Thermopile Circuitry | 4-10 |
| | | 4-70. The ÷ N Counter | 4-11 |
| Section | Page | Section | Page |
| II. INSTALLATION | 2-1 | V. MAINTENANCE | 5-1 |
| 2-1. Introduction | 2-1 | 5-1. Introduction | 5-1 |
| 2-3. Initial Inspection | 2-1 | 5-3. Test Equipment | 5-1 |
| 2-5. Power Requirements | 2-1 | 5-5. Performance Tests | 5-1 |
| 2-7. Grounding Requirements | 2-1 | 5-7. Frequency Accuracy, Vernier Out | 5-1 |
| 2-10. Environmental Requirements | 2-2 | 5-9. Frequency Accuracy, Vernier In | 5-1 |
| 2-12. Repackaging for Shipment | 2-2 | 5-11. Harmonic Distortion | 5-3 |
| 2-16. Power Cords and Receptacles | 2-2 | 5-13. Spurious | 5-4 |
| 2-18. Interfacing | 2-2 | 5-15. Signal to Phase Noise | 5-4 |
| 2-19. Remote BCD Options | 2-2 | 5-17. Amplitude Accuracy, Absolute | 5-6 |
| 2-22. Remote GPIB Option | 2-2 | 5-19. 3320A Frequency Response, 0.01 Hz - 13 MHz. 3320B Frequency Response, 0.01 Hz - 10 Hz | 5-6 |
| Section | Page | 5-21. 3320B Frequency Response, 10 Hz - 13 MHz | 5-7 |
| III. Operating Instructions | 3-1 | 5-23. 3320B Attenuator Accuracy, 10 kHz | 5-7 |
| 3-1. Introduction | 3-1 | 5-25. 3320B Attenuator Frequency Response | 5-8 |
| 3-3. Controls, Indicators and Connectors | 3-1 | 5-27. Adjustment Procedures | 5-11 |
| 3-5. Front Panel Operation | 3-1 | 5-29. Power Supply | 5-11 |
| 3-7. Frequency | 3-1 | 5-31. Reference Oscillator | 5-11 |
| 3-9. Amplitude | 3-1 | 5-33. VTO Linearity | 5-11 |
| 3-12. Leveling | 3-1 | 5-35. Vernier | 5-11 |
| 3-14. Remote BCD Programming | 3-1 | 5-37. Amplitude Reference, 3320B | 5-12 |
| 3-16. Remote Enable | 3-1 | 5-39. Carrier Balance | 5-12 |
| 3-18. 3320B Amplitude | 3-2 | 5-41. Amplitude | 5-12 |
| 3-20. Frequency | 3-3 | 5-43. Harmonics, 3320B | 5-13 |
| 3-22. Vernier | 3-3 | 5-45. Leveling, 3320B | 5-13 |
| 3-24. Range | 3-3 | 5-47. Transient Response, 3320B | 5-14 |
| 3-26. Leveling | 3-3 | 5-49. General Maintenance Information | 5-14 |
| 3-28. Delay and Response | 3-3 | 5-51. Front Panel Removal | 5-14 |
| 3-34. Remote GPIB Programming | 3-4 | 5-53. Front Panel Disassembly | 5-15 |
| 3-48. Handshake | 3-6 | 5-55. Front Panel Assembly | 5-16 |
| 3-52. Delay Flag | 3-7 | 5-57. Impedance Cam Settings | 5-16 |
| 3-56. End Output | 3-9 | | |
| 3-58. Reference Crystal Oven | 3-9 | Section | Page |
| Section | Page | VI. REPLACEABLE PARTS | 6-1 |
| IV. THEORY OF OPERATION | 4-1 | 6-1. Introduction | 6-1 |
| 4-1. Introduction | 4-1 | 6-4. Ordering Information | 6-1 |
| 4-3. General Description | 4-1 | 6-6. Non-Listed Parts | 6-1 |
| 4-6. Simplified Block Diagram | 4-1 | | |
| 4-7. Introduction | 4-1 | | |
| 4-9. Controller Section | 4-1 | | |
| 4-11. Frequency Section | 4-2 | | |
| 4-13. Amplitude Section | 4-2 | | |

| Section | Page | Section | Page |
|---|------|---|------|
| VII. CIRCUIT DIAGRAMS AND TROUBLESHOOTING | 7-1 | 8-13. Change 5, for Serial Numbers 1138A-00135 and Below (3320A), 1139A-00250 and Below (3320B) | 8-2 |
| 7-1. Introduction | 7-1 | 8-15. Change 6, for Serial Numbers 1139A-00340 and Below (3320B) | 8-2 |
| 7-3. Troubleshooting | 7-1 | 8-17. Change 7, for Serial Numbers 1138A-00185 and Below (3320A), 1139A-00540 and Below (3320B) | 8-2 |
| 7-6. Schematic Diagrams | 7-1 | 8-19. Change 8, for Serial Numbers 1139A-00590 and Below (3320B) | 8-2 |
| VIII. BACKDATING | 8-1 | 8-21. Change 9, for Serial Numbers 1138A-00275 and Below (3320A), 1319A-00690 and Below (3320B) | 8-3 |
| 8-1. Introduction | 8-1 | | |
| 8-3. Instrument Serial Number Sequence | 8-1 | | |
| 8-5. Change 1, for Serial Numbers 1121A-00110 and Below (3320A), 1122A-00120 and Below (3320B) | 8-1 | | |
| 8-7. Change 2, 3320B | 8-2 | | |
| 8-9. Change 3, 3320B | 8-2 | | |
| 8-11. Change 4, for Serial Numbers 1138A-00135 and Below (3320A), 1139A-00200 and Below (3320B) | 8-2 | | |

APPENDICES
A. CODE LIST OF MANUFACTURERS
B. SALES AND SERVICE OFFICES

LIST OF TABLES

| Table | Page |
|--|---------|
| 1-1. Specifications | 1-1 |
| 1-2. General Information | 1-2/1-3 |
| 1-3. Accessories Supplied | 1-3 |
| 1-4. Accessories Available | 1-3 |
| 2-1. GPIB Bus Cables | 2-3 |
| 3-1. Frequency Control Settings | 3-1 |
| 3-2. Amplitude and Frequency Settling Times | 3-4 |
| 3-3. Addressing Codes | 3-4 |
| 3-4. GPIB Bus Signal Mnemonics | 3-5 |
| 3-5. ASCII Programming Codes | 3-5 |
| 3-6. GPIB Programming | 3-6 |
| 3-7. Settling Times | 3-7 |
| 4-1. 3320A/B Ranges | 4-2 |
| 4-2. GPIB Bus Signal Mnemonics | 4-4 |
| 4-3. Frequency Setting vs. ÷ N Number | 4-12 |
| 4-4. Preset Number | 4-14 |
| 5-1. Test Equipment Required | 5-2 |
| 5-2. 3320A Frequency Response (0.01 Hz - 13 MHz) | 5-6 |
| 5-3. 3320B Frequency Response (0.01 Hz - 10 Hz) | 5-7 |
| 5-4. 3320B Frequency Response (10 Hz - 13 MHz) | 5-7 |
| 5-5. Output Attenuator | 5-9 |
| 5-6. 3320B Frequency Response | 5-9 |
| 5-7. Readout Disks Positions | 5-16 |
| 8-1. Serial Number Index | 8-1 |

LIST OF ILLUSTRATIONS

| Figure | Page | Figure | Page |
|--|---------|---|-----------|
| 2-1. Power Module | 2-1 | 7-3. Frequency Generating Section Troubleshooting Tree | 7-7/7-8 |
| 2-2. Power Receptacles | 2-2 | 7-4. Amplitude Section Troubleshooting Tree | 7-9/7-10 |
| 2-3. BCD Remote Connector | 2-2 | 7-5. Controller Functional Block Diagram | 7-11/7-12 |
| 2-4. GPIB Remote Connector | 2-3 | 7-6. Controller Configurations | 7-13/7-14 |
| 2-5. Typical GPIB Bus System | 2-3 | 7-7. Analog Functional Block Diagram | 7-15/7-16 |
| 3-1. Controls, Indicators, and Connectors | 3-0 | 7-8. Common Assemblies, Top and Bottom View | 7-17/7-18 |
| 3-2. BCD Input Connector | 3-2 | 7-9. Panel Interface A20. 3320A Standard, Options 001, 002, 006 | 7-19/7-20 |
| 3-3. BCD Timing Sequence | 3-4 | 7-10. Panel Interface A21. 3320B Standard, Options 001, 002, 006 | 7-21/7-22 |
| 3-4. GPIB Input Connector | 3-5 | 7-11. BCD Frequency Control. p/o A23, 3320A Option 003, 3320B Option 004 | 7-23/7-24 |
| 3-5. Programming Example | 3-7 | 7-12. BCD Frequency Control. p/o A23, 3320A Option 003, 3320B Option 004 | 7-25/7-26 |
| 3-6. Handshake Timing Diagram | 3-8 | 7-13. BCD Amplitude Control A24B. 3320B Option 004 | 7-27 |
| 3-7. Option 002 Circuit Diagram | 3-9 | 7-14. GPIB Input A37 and GPIB Controller A38, 3320B Option 007 | 7-29/7-30 |
| 4-1. Simplified 3320A/B Block Diagram | 4-1 | 7-15. GPIB Latches A25, 3320B Option 007 | 7-31/7-32 |
| 4-2. Frequency Generation | 4-2 | 7-16. GPIB Frequency Control. p/o A23, 3320B Option 007 | 7-33/7-34 |
| 4-3. Reference Sources | 4-3 | 7-17. GPIB Frequency Control. p/o A23, 3320B Option 007 | 7-35/7-36 |
| 4-4. 3320A Standard Controller | 4-3 | 7-18. GPIB Amplitude Control A24B, 3320B Option 007 | 7-37/7-38 |
| 4-5. 3320B Standard Controller | 4-3 | 7-19. VTO A3 | 7-39/7-40 |
| 4-6. 3320A BCD Controller | 4-3 | 7-20. ÷ N Counter A2 | 7-41/7-42 |
| 4-7. 3320B BCD Controller | 4-3 | 7-21. Range Divider A4 | 7-43/7-44 |
| 4-8. Typical GPIB Bus System | 4-4 | 7-22. Range Divider A5, 3320A/B Standard. Range Divider A6, 3320A/B Option 006 | 7-45/7-46 |
| 4-9. GPIB Controller | 4-5 | 7-23. Mixer Preamp A10 | 7-47/7-48 |
| 4-10. VTO and Phase Lock Loop | 4-6 | 7-24. Power Amplifier A12A, 3320A | 7-49/7-50 |
| 4-11. Range Dividers | 4-7 | 7-25. Power Amplifier A14, Attenuator A15; 3320B | 7-51/7-52 |
| 4-12. 3320A Amplitude Section | 4-8 | 7-26. Modulator A9A, 3320A | 7-53/7-54 |
| 4-13. 3320B Amplitude Section | 4-8 | 7-27. Modulator A9B, 3320B | 7-55/7-56 |
| 4-14. Simplified Amplitude Reference | 4-9 | 7-28. Detector A12B, 3320B | 7-57/7-58 |
| 4-15. Reference Section | 4-9 | 7-29. Amplitude Reference A11, 3320B | 7-59/7-60 |
| 4-16. Vernier Oscillator | 4-10 | 7-30. 20 MHz Reference Oscillator A8, Reference Phase Lock. p/o A7 | 7-61/7-62 |
| 4-17. AC/DC Converter in the Amplitude Section | 4-11 | 7-31. Vernier Reference Oscillator A1, Reference Phase Lock. p/o A7 | 7-63/7-64 |
| 4-18. AC/DC Converter with Overload Circuits | 4-11 | 7-32. Power Supplies; A16A, A17A 3320A. A16B, A17B 3320B | 7-65/7-66 |
| 4-19. ÷ N Control Logic Diagram | 4-13 | 7-33. Wiring Diagram | 7-67/7-68 |
| 5-1. Harmonic Distortion | 5-3 | | |
| 5-2. 3320 Output Section | 5-4 | | |
| 5-3. Spurious | 5-5 | | |
| 5-4. Signal to Phase Noise | 5-5 | | |
| 5-5. 3320B Frequency Response (10 Hz - 13 MHz) | 5-7 | | |
| 5-6. 3320B Attenuator Accuracy | 5-8 | | |
| 5-7. 50 Ohm to 75 Ohm Adapter | 5-10 | | |
| 5-8. Chassis Mounted Components | 5-13 | | |
| 5-9. Front Panel and Vernier Control Mechanical Parts | 5-17 | | |
| 6-1. External Mechanical Parts | 6-33 | | |
| 6-2. Internal Mechanical Parts | 6-34 | | |
| 6-3. Front Panel and Vernier Control Mechanical Parts | 6-35 | | |
| 7-1. System Component Isolation and GPIB Troubleshooting Tree | 7-3/7-4 | | |
| 7-2. Reference Frequency Troubleshooting Tree | 7-5/7-6 | | |

SECTION I GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This section contains general information about the Model 3320A/B Frequency Synthesizer. A general description plus information on specifications, accessories, and instrument identification is given.

1-3. SPECIFICATIONS.

1-4. Table 1-1 is a complete list of the Model 3320A/B critical specifications that are governed by tolerances. Table 1-2 contains general information that describes the operating characteristics of the 3320A/B.

1-5. Any change in the specifications due to manufacturing, design, or traceability to the U.S. National Bureau of Standards will be covered by revised pages in this manual. This manual supercedes all previous information concerning specifications of the 3320.

1-6. DESCRIPTION.

1-7. The Hewlett-Packard Model 3320A/B Frequency Synthesizer provides accurate and stable frequencies from 0.001 Hz to 12.9999 MHz. Frequency selection is by three controls that provide three digits of resolution plus an

Table 1-1. Specifications.

| <p>Frequency accuracy Vernier Out: $\pm 0.001\%$ of setting for 6 mo. 0°C to 55°C. Vernier In: $\pm 0.01\%$ of range for 6 mo, 0°C to 55°C.</p> <p>Frequency stability Long term: ± 10 parts in 10^6 of setting per year (Vernier Out) with ambient temperature reference. Optional high stability crystal reference oven available (Option 002).</p> <p>Signal to phase noise (integrated). > 40 dB in 30 kHz band, excluding ± 1 Hz, centered on carrier. 10 MHz range, Vernier Out. Improves on lower frequency ranges.</p> <p>Spurious: > 60 dB down.</p> | <p>Harmonic distortion: with output frequencies $> 0.1\%$ of range at full output amplitude any harmonically related signal will be less than the following specified levels.</p> <ul style="list-style-type: none"> - 60 dB with output from 5 Hz to 100 kHz. - 50 dB with output from 100 kHz to 1 MHz. - 40 dB with output from 1 MHz to 13 MHz. <p style="text-align: center;">3320A AMPLITUDE SECTION</p> <p>Amplitude: maximum 2 V rms $\pm 10\%$ open circuit. maximum 1 V rms $\pm 10\%$ into 50 Ω.</p> <p>Frequency response: ± 2 dB over total range.</p> | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|---------------------------------|--------------------------|--------------------|--|----------|------------|--------------|--------------------------|----------------------|----------------------|-----------|------------|----------------------|----------------------|-----------|-----------|-----------------------|-----------------------|-----------|-----------|------------------------|-------------------------|-----------|-----------|
| <p>3320B AMPLITUDE SECTION</p> <p>Amplitude accuracy (absolute): ± 0.05 dB at 10 kHz and +26.99 dBm (20°C to 30°C).</p> <p>Attenuator accuracy (10 kHz reference): ± 0.02 dB/10 dB step.</p> <p>Frequency response (10 kHz reference):</p> | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="text-align: left;">3320B ATTENUATOR SETTINGS (dBm)</th> <th colspan="2" style="text-align: center;">SPECIFICATION (dB)</th> </tr> <tr> <th style="text-align: left;">Standard</th> <th style="text-align: left;">Option 001</th> <th style="text-align: center;">LEVELING OFF</th> <th style="text-align: center;">LEVELING ON (> 10 Hz)</th> </tr> </thead> <tbody> <tr> <td>+ 26.99 to - 3.00</td> <td>+ 24.99 to - 5.00</td> <td style="text-align: center;">± 0.5</td> <td style="text-align: center;">± 0.05</td> </tr> <tr> <td>- 3.01 to - 23.00</td> <td>- 5.01 to - 25.00</td> <td style="text-align: center;">± 0.5</td> <td style="text-align: center;">± 0.1</td> </tr> <tr> <td>- 23.01 to - 53.00</td> <td>- 25.01 to - 55.00</td> <td style="text-align: center;">± 0.5</td> <td style="text-align: center;">± 0.2</td> </tr> <tr> <td>- 53.01 to - 69.99*</td> <td>- 55.01 to - 69.99**</td> <td style="text-align: center;">± 0.5</td> <td style="text-align: center;">± 0.4</td> </tr> </tbody> </table> | | 3320B ATTENUATOR SETTINGS (dBm) | | SPECIFICATION (dB) | | Standard | Option 001 | LEVELING OFF | LEVELING ON (> 10 Hz) | + 26.99 to - 3.00 | + 24.99 to - 5.00 | ± 0.5 | ± 0.05 | - 3.01 to - 23.00 | - 5.01 to - 25.00 | ± 0.5 | ± 0.1 | - 23.01 to - 53.00 | - 25.01 to - 55.00 | ± 0.5 | ± 0.2 | - 53.01 to - 69.99* | - 55.01 to - 69.99** | ± 0.5 | ± 0.4 |
| 3320B ATTENUATOR SETTINGS (dBm) | | SPECIFICATION (dB) | | | | | | | | | | | | | | | | | | | | | | | |
| Standard | Option 001 | LEVELING OFF | LEVELING ON (> 10 Hz) | | | | | | | | | | | | | | | | | | | | | | |
| + 26.99 to - 3.00 | + 24.99 to - 5.00 | ± 0.5 | ± 0.05 | | | | | | | | | | | | | | | | | | | | | | |
| - 3.01 to - 23.00 | - 5.01 to - 25.00 | ± 0.5 | ± 0.1 | | | | | | | | | | | | | | | | | | | | | | |
| - 23.01 to - 53.00 | - 25.01 to - 55.00 | ± 0.5 | ± 0.2 | | | | | | | | | | | | | | | | | | | | | | |
| - 53.01 to - 69.99* | - 55.01 to - 69.99** | ± 0.5 | ± 0.4 | | | | | | | | | | | | | | | | | | | | | | |
| <p>* - 73.00 dBm, remote control. ** - 75.00 dBm, remote control.</p> | | | | | | | | | | | | | | | | | | | | | | | | | |

Table 1-2. General Information.

| <p>Frequency range: 0.01 Hz to 13 MHz in 7 ranges. Frequency ranges: 10 MHz 1000 kHz 100 kHz 10 kHz 1000 Hz 100 Hz } Optional 10 Hz } 30% overrange on all ranges.</p> <p>Frequency resolution:</p> <table border="1"> <thead> <tr> <th>Range</th> <th>Vernier Out (local or remote)</th> <th>Vernier In (local)</th> <th>Vernier In (remote)</th> </tr> </thead> <tbody> <tr> <td>10 MHz</td> <td>10 kHz</td> <td>10 Hz</td> <td>1 kHz</td> </tr> <tr> <td>1000 kHz</td> <td>1 kHz</td> <td>1 Hz</td> <td>100 Hz</td> </tr> <tr> <td>100 kHz</td> <td>100 Hz</td> <td>0.1 Hz</td> <td>10 Hz</td> </tr> <tr> <td>10 kHz</td> <td>10 Hz</td> <td>0.01 Hz</td> <td>1 Hz</td> </tr> <tr> <td>1000 Hz</td> <td>1 Hz</td> <td>1 mHz</td> <td>0.1 Hz</td> </tr> <tr> <td>100 Hz</td> <td>0.1 Hz</td> <td>0.1 mHz</td> <td>0.01 Hz</td> </tr> <tr> <td>10 Hz</td> <td>0.01 Hz</td> <td>0.01 mHz</td> <td>0.001 Hz</td> </tr> </tbody> </table> <p>Internal frequency standard: 20 MHz ambient temperature crystal. Optional 5 MHz reference crystal oven available (Option 002).</p> <p>Phase locking: the 3320A/B may be phase locked with a 200 mV to 2 V rms signal that is any subharmonic of 20 MHz from 1 MHz through 10 MHz (e.g., 1 MHz, 2 MHz, 2.5 MHz, 5 MHz, 10 MHz). BNC female connector.</p> <p>Rear panel output: front or rear panel output is available. Can be easily changed by routing internal cable to front or rear female BNC connectors. No degradation of performance for rear panel output.</p> <p>Auxiliary outputs Tracking output: 20 MHz to 33 MHz offset signal. Tracks main output with 20 MHz offset. Rear panel female BNC, > 100 mV rms/50 Ω. 1 MHz reference output: sine wave, rear panel female BNC, > 220 mV rms/50 Ω (> 0 dBm/50 Ω). Low level output: same frequency as main output but remains between 50 mV rms and 158 mV rms (into 50 Ω) depending on main output level setting. May be used as counter output if wanted. Rear panel female BNC, sine wave.</p> | Range | Vernier Out (local or remote) | Vernier In (local) | Vernier In (remote) | 10 MHz | 10 kHz | 10 Hz | 1 kHz | 1000 kHz | 1 kHz | 1 Hz | 100 Hz | 100 kHz | 100 Hz | 0.1 Hz | 10 Hz | 10 kHz | 10 Hz | 0.01 Hz | 1 Hz | 1000 Hz | 1 Hz | 1 mHz | 0.1 Hz | 100 Hz | 0.1 Hz | 0.1 mHz | 0.01 Hz | 10 Hz | 0.01 Hz | 0.01 mHz | 0.001 Hz | <p>Power requirements: 115 V or 230 V ± 10%, 48 Hz to 63 Hz, < 110 W, (400 Hz operation on special basis).</p> <p>Weight 3320A: 45 lb. (20,4 kg). Shipping: 59 lb (26,7 kg). 3320B: 47 lb. (21,3 kg). Shipping: 61 lb. (27,5 kg).</p> <p>Outline drawing:</p> <p>OPTIONS</p> <p>75 Ohm Output Impedance Option 001 3320A/B</p> <p>Attenuation and output referenced to 75 Ω. Amplitude range (3320B only): + 24.99 dBm to - 69.99 dBm (- 75.00 dBm under remote control) into 75 Ω. (3320A only): - 2 dBm to + 11 dBm into 75 Ω.</p> <p>Reference Crystal Oven* Option 002 3320A/B</p> <p>5 MHz crystal in temperature stabilized oven. Long term stability: ± 1 part in 10⁸/day. ± 1 part in 10⁷/mo.</p> <p>Frequency accuracy: ± 1 part in 10⁷ of setting per month. For field installation order accessory kit HP 11237A.</p> <p>Parallel BCD Remote Control* Option 003 3320A Only</p> <p>Allows digital remote control of frequency only on 3320A. Digital control of output level is not available on 3320A. The most significant digit of the Vernier may be programmed thus giving four digits, plus 30% overrange, control of frequency in seven ranges (two are optional). Control lines required: 24 plus remote line. Logic levels: TTL, "1" state low, non-isolated. Frequency switching and settling time: ± 0.01% range, 15 ms, ± 0.001% range, 60 ms. For field installation order accessory kit HP 11238A.</p> <p>Parallel BCD Remote Control* Option 004 3320B Only</p> <p>Allows full digital remote control of frequency and amplitude. ① Four digits of frequency, overrange, frequency range, Vernier In/Out, four digits of amplitude, and leveling loop response times are all controlled digitally. All front panel controls, except line switch, are disabled in remote. Control lines required: 40 plus remote line. Logic levels: TTL, "1" state low, non-isolated. Frequency switching and settling time: ± 0.01% range, 15 ms; ± 0.001% range, 60 ms. Amplitude switching and settling time: < 1.5 s to rated accuracy. For field installation order accessory kit HP 11238B.</p> |
|---|----------------------------------|----------------------------------|------------------------|------------------------|--------|--------|-------|-------|----------|-------|------|--------|---------|--------|--------|-------|--------|-------|---------|------|---------|------|-------|--------|--------|--------|---------|---------|-------|---------|----------|----------|---|
| Range | Vernier Out (local or remote) | Vernier In (local) | Vernier In (remote) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 MHz | 10 kHz | 10 Hz | 1 kHz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1000 kHz | 1 kHz | 1 Hz | 100 Hz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 100 kHz | 100 Hz | 0.1 Hz | 10 Hz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 kHz | 10 Hz | 0.01 Hz | 1 Hz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1000 Hz | 1 Hz | 1 mHz | 0.1 Hz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 100 Hz | 0.1 Hz | 0.1 mHz | 0.01 Hz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 Hz | 0.01 Hz | 0.01 mHz | 0.001 Hz | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>3320A AMPLITUDE SECTION</p> <p>Amplitude range: 0 dBm to + 13 dBm range through 3/4 turn front panel control (not programmable).</p> <p>Output impedance: 50 Ω.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>3320B AMPLITUDE SECTION</p> <p>Amplitude range: + 26.99 dBm (1/2 watt) to - 69.99 dBm (- 73.00 dBm under remote control) into 50 Ω. (+ 26.99 dBm = 5 V rms into 50 Ω).</p> <p>Amplitude resolution: 0.01 dB.</p> <p>Output impedance: 50 Ω.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>GENERAL 3320A/B</p> <p>Operating temperature: 0°C to 55°C.</p> <p>Storage temperature: - 40°C to + 70°C.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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

| <p>GPIB Remote Control* Option 007 3320B Only</p> <p>Allows bit-parallel word-serial digital remote control of all functions. ① A 3320B with this option will recognize an address and then accept instructions in a serial fashion. Instructions are in a 7-bit parallel ASCII code. Due to the addressing feature, up to ten 3320B's (with this option) may be programmed from one programmer. The HP 3260A Marked Card Programmer may be used as a programmer for this option.</p> <p>This option requires 8 digital input lines for full control. ① Seven of the eight are programming input lines and one is a data command line.</p> <p>Full digital isolation is standard with this option.</p> <p>Timing: max of 5 μs per word required to input program data.</p> <p>Logic level requirements: (same as parallel BCD remote). Switching and settling times for frequency and amplitude are the same as with the parallel BCD remote option. For field installation, order accessory kit HP 11239B.</p> | <p>Logic Level Requirements for All Digital Remote Control Options.</p> <table border="1"> <thead> <tr> <th>State</th> <th>Requirements</th> </tr> </thead> <tbody> <tr> <td>"Low" (logical "1")</td> <td>0 V to 0.4 V (5 mA max.) or contact closure to ground through < 80 ohms.</td> </tr> <tr> <td>"High" (logical "0")</td> <td>+ 2.4 V to + 5 V or removal of contact closure to ground.</td> </tr> </tbody> </table> <p>100 Hz and 10 Hz Ranges* Option 006 3320A/B</p> <p>Adds two lower frequency ranges, 100.0 Hz and 10.00 Hz, yielding greater resolution for low frequency outputs (see resolution section of specifications). These two ranges are fully programmable if digital remote options are installed.</p> <p>For field installation order accessory kit HP 11240A.</p> <p>*Field installable.</p> <p>① Except last vernier digit and line switch.</p> | State | Requirements | "Low" (logical "1") | 0 V to 0.4 V (5 mA max.) or contact closure to ground through < 80 ohms. | "High" (logical "0") | + 2.4 V to + 5 V or removal of contact closure to ground. |
|---|--|-------|--------------|---------------------|--|----------------------|---|
| State | Requirements | | | | | | |
| "Low" (logical "1") | 0 V to 0.4 V (5 mA max.) or contact closure to ground through < 80 ohms. | | | | | | |
| "High" (logical "0") | + 2.4 V to + 5 V or removal of contact closure to ground. | | | | | | |

overrange digit, and a vernier control that provides two digits of resolution. A range control provides five ranges of 1000 Hz, 10 kHz, 100 kHz, 1000 kHz, and 10 MHz. The output frequencies are derived from a precision single frequency source by an indirect synthesis technique.

1-8. In the 3320A, the output amplitude is selected by a 0–13 dBm continuous potentiometer. Maximum output voltage is 1 V rms into 50 Ω . The 3320B has a range of +26.99 dBm to -69.99 dBm with a resolution of 0.01 dB. The output amplitude can be selected in steps of 0.01 dB, 0.1 dB, 1.0 dB, or 10 dB. Maximum output voltage of the 3320B is 5 V rms into 50 Ω .

1-9. OPTIONS.

1-10. The 3320A/B series of instruments include a total of nine options. These options are as follows:

| 3320A Options | 3320B Options | Description |
|---------------|---------------|------------------------------|
| 001 | 001 | 75 Ω Output Impedance |
| 002 | 002 | Reference Crystal Oven |
| 003 | 004 | Parallel BCD Remote Control |
| 006 | 006 | 100 Hz and 10 Hz Ranges |
| | 007 | GPIB Remote Control |

1-11. The 3320B Option 007, GPIB (General Purpose Interface Bus) Remote Control utilizes a seven line data bus, a three line transfer bus, and four additional control bus lines to manage the flow of information over the data bus and the transfer bus. Data information is transferred in an ASCII (American Standard Code for Information Interchange) code. For more information concerning this and other options, refer to Table 1-2, Section III, or your local Sales and Service Office.

1-12. ACCESSORIES SUPPLIED.

1-13. Accessories supplied with the 3320A/B are listed in Table 1-3.

Table 1-3. Accessories Supplied.

| hp- Model or Part No. | Qty | Description |
|-----------------------|-----|-------------------|
| 03320-84401 | 1 | Rack Mounting Kit |
| 11235A | 1 | GPIB Adapter |

1-14. ACCESSORIES AVAILABLE.

1-15. Accessories available for the 3320A/B are listed in Table 1-4.

Table 1-4. Accessories Available.

| hp- Model or Part No. | Description |
|-----------------------|---|
| 3260A | Marked Card Programmer |
| 11237A | Option 002 Kit |
| 11238A | Option 003 Kit (A only) |
| 11238B | Option 004 Kit (B only) |
| 11239B | Option 007 Kit (B only) |
| 11240A | Option 006 Kit |
| 11048C | 50 Ω Feedthrough |
| 11094B | 75 Ω Feedthrough (Opt. 001 only) |

1-16. INSTRUMENT AND MANUAL IDENTIFICATION.

1-17. This manual applies to instruments with the serial number prefix shown on the title page. If changes have been made in the instrument since this manual was printed, a "Manual Changes" supplement supplied with the manual will define these changes. Be sure to record these changes in your manual. Backdating information in Section VIII adapts the manual to instruments with serial number prefixes lower than those shown on the title page. Part numbers for the manual and the microfiche copy of the manual are also shown on the title page.

SECTION II INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains information and instructions necessary for the installation and shipping of the Model 3320A/B Frequency Synthesizer. Included are initial inspection procedures, power and grounding requirements, environmental information, power cord information, interfacing 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 marks or scratches and in perfect electrical order upon receipt. To confirm this, the instrument should be inspected for physical damage in transit, and the electrical performance should be tested using the procedure outlined in Paragraph 5-7. If there is damage or deficiency, see the warranty inside the front cover of this manual.

2-5. POWER REQUIREMENTS.

2-6. The 3320 can be operated from any source of 115 V \pm 10% at 48 to 66 Hz. The power receptacle on the rear panel contains the switch for selecting 115 V or 230 V operation and the input power fuse. The instrument leaves the manufacturer with the 115 V/230 V switch in the 115 V position. It is necessary to set the switch in the 230 V position when operating from a 230 V source. Use the following procedure and Figure 2-1 for setting the 115 V/230 V switch:

a. Disconnect power cord and slide the cover to the left to gain access to the fuse compartment (Figure 2-1a).

b. Remove the Line Fuse by pulling outward on the Fuse Puller (Figure 2-1b).

c. With the Fuse Puller positioned as shown (Figure 2-1c), set the 115 V/230 V Selector Switch to the position that corresponds with the line voltage to be used.

d. Replace the Line Fuse using a 3 A, 250 V for 115 V operation or a 1.5 A, 250 V for 230 V operation.

2-7. GROUNDING REQUIREMENTS.

2-8. To protect operating personnel, the National Electrical Manufacturer's Association (NEMA) recommends that the instrument panel and cabinet be grounded. The Model 3320A/B is equipped with a three-conductor power cable which, when plugged into an appropriate receptacle,

grounds the instrument. The offset pin on the power cable is the ground wire.

2-9. To preserve the protection feature when operating the instrument from a two-contact outlet, use a three-prong to two-prong adapter and connect the pigtail on the adapter to power line ground.

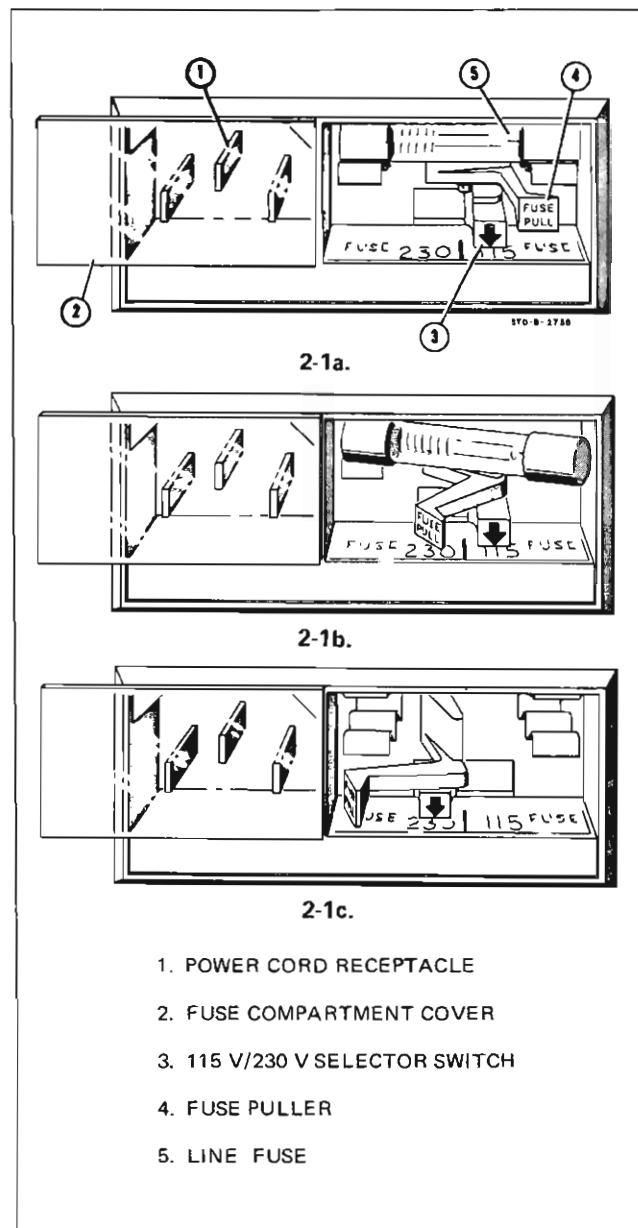


Figure 2-1. Power Module.

2-10. ENVIRONMENTAL REQUIREMENTS.

2-11. The Model 3320A/B is equipped with a cooling fan mounted on the rear panel. The instrument should not be mounted in any manner which would obstruct the flow of air into the rear panel and out the perforated covers. The filters for the cooling fan can be removed and replaced or flushed with soapy water. Two extra filters are furnished as spares. The Model 3320A/B should not be operated where the ambient temperature range exceeds 0° C to 55° C (32° F to 131° F) or stored where the ambient temperature range exceeds -40° C to 70° C (-40° F to 158° F).

2-12. REPACKAGING FOR SHIPMENT.

2-13. The following paragraphs contain a general guide for repackaging the instrument for shipment. Refer to Paragraph 2-14 if the original container is to be used; 2-15 if it is not. If you have any questions, contact your nearest -hp- Sales and Service Office (See Appendix B for office locations).

2-14. Place the instrument in the original container with appropriate packing material and seal well with strong tape or metal bands.

2-15. If the original container is not to be used, proceed as follows:

- a. Wrap the instrument in heavy paper or plastic before placing in an inner container.
- b. Place packing material around all sides of the instrument and protect the panel face with cardboard strips.
- c. Place the instrument and the inner container in a heavy carton or wooden box and seal with strong tape or metal bands.

d. Mark the shipping container "DELICATE INSTRUMENT", "FRAGILE", etc.

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.

2-16. POWER CORDS AND RECEPTACLES.

2-17. Figure 2-2 illustrates the standard power receptacle (wall outlet) configurations that are used throughout the United States and in other countries. The -hp- part number shown directly above each receptacle drawing is the part

number for a 3320 power cord equipped with the appropriate mating plug for that receptacle. 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. The 3320 power cord, power input receptacle and mating connectors meet the safety standards set forth by the International Electrotechnical Commission (IEC).

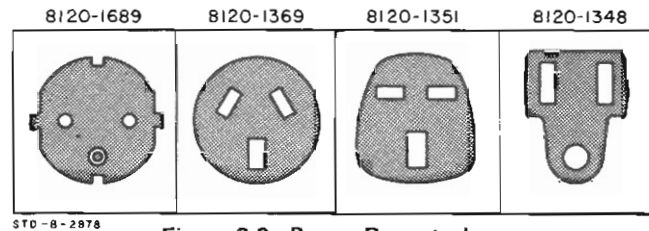


Figure 2-2. Power Receptacles.

2-18. INTERFACING.

2-19. Remote BCD Options.

2-20. The 3320A Option 003 and the 3320B Option 004 are designed for remote programming from an external BCD source. The remote input/output connector is shown in Figure 2-3. A complete description of the input/output signals and logic levels is given in Section III.

2-21. An interfacing connector (-hp- Part Number 1251-3056) and two connector covers (-hp- Part Number 10513-4001) are supplied for external connections. This connector can be wired to contribute to the user's application. A field installation kit (-hp- Part Number 11238A for the 3320A, or 11238B for the 3320B) is available for converting a standard 3320A or 3320B to a BCD remote controlled option. Installation instructions are supplied with the kit.

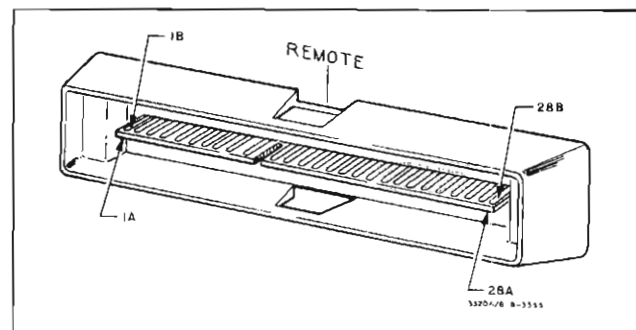


Figure 2-3. BCD Remote Connector.

2-22. Remote GPIB Option.

2-23. The 3320B Option 007 is designed for remote programming from an external GPIB (General Purpose Interface Bus, see Paragraph 1-11) source. The remote input/output connector is shown in Figure 2-4. A complete description of the input/output signals and logic levels required is given in Section III.

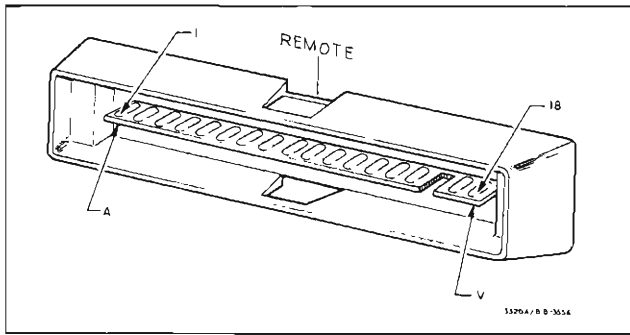


Figure 2-4. GPIB Remote Connector.

2-24. Remote programming sources for the 3320B Option 007 include the -hp- Model 3260A Marked Card Programmer, the -hp- 9800 series Calculators, and the -hp- 2100 series computers. The -hp- 11235A Adapter must be used to interface all -hp- GPIB sources to the 3320B remote input.

2-25. There are three GPIB bus cables available (See Table 2-1). Up to 15 instruments may be connected in parallel using these cables; however, the following two restrictions must be observed.

1. When more than two instruments are connected to the bus, the cable length added for each additional instrument cannot exceed six feet per unit.
2. The total cable length to all units cannot exceed 51 feet.

The cables are listed with their respective lengths, in Table 2-1. A typical bus system is shown in Figure 2-5.

Table 2-1. GPIB Bus Cables.

| Accessory Number | Length |
|------------------|--------|
| 10631A | 3 ft. |
| 10631B | 6 ft. |
| 10631C | 12 ft. |

2-26. The -hp- Model 3260A Marked Card Reader supplies its own interface cable. If the card reader cable is -hp- Part No. 03260-61607, an 11235A Adapter must be used to interface the card reader to the 3320B. If the card reader cable is -hp- Part No. 03260-61605, the 11235A Adapter is

not required. However, the following card reader cable modification must be performed for proper operation.

3260A CABLE (03260-61605) MODIFICATION

(For use with 3320B Option 007)

1. Remove the four screws holding the cover on the interface card on the end of the W1 Cable.
2. Move the violet wire to pin 8.
3. Move the white wire to pin 18.
4. Move the key from pin J to pin T.
5. Replace the screws and covers.
6. The modification is complete.

2-27. The -hp- 9800 series Calculators can be interfaced to the 3320B using the -hp- 11144A Interface Card, a 10631A/B/C GPIB bus cable, and the 11235A Adapter.

2-28. The -hp- Model 2114, 2115, 2116 or 2100 computers can be interfaced using the -hp- Model 59310 Interface Kit. The 59310 kit includes an interface cable, a computer I/O card, and computer programming instructions. An -hp- 11235A Adapter must be used to interface the cable supplied with the 59310 kit to the 3320B.

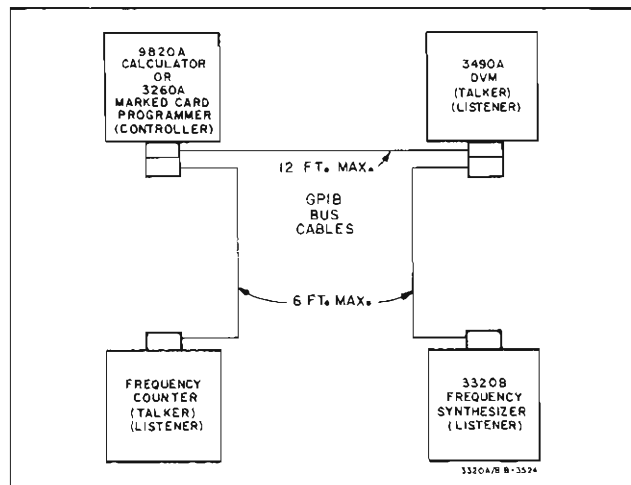
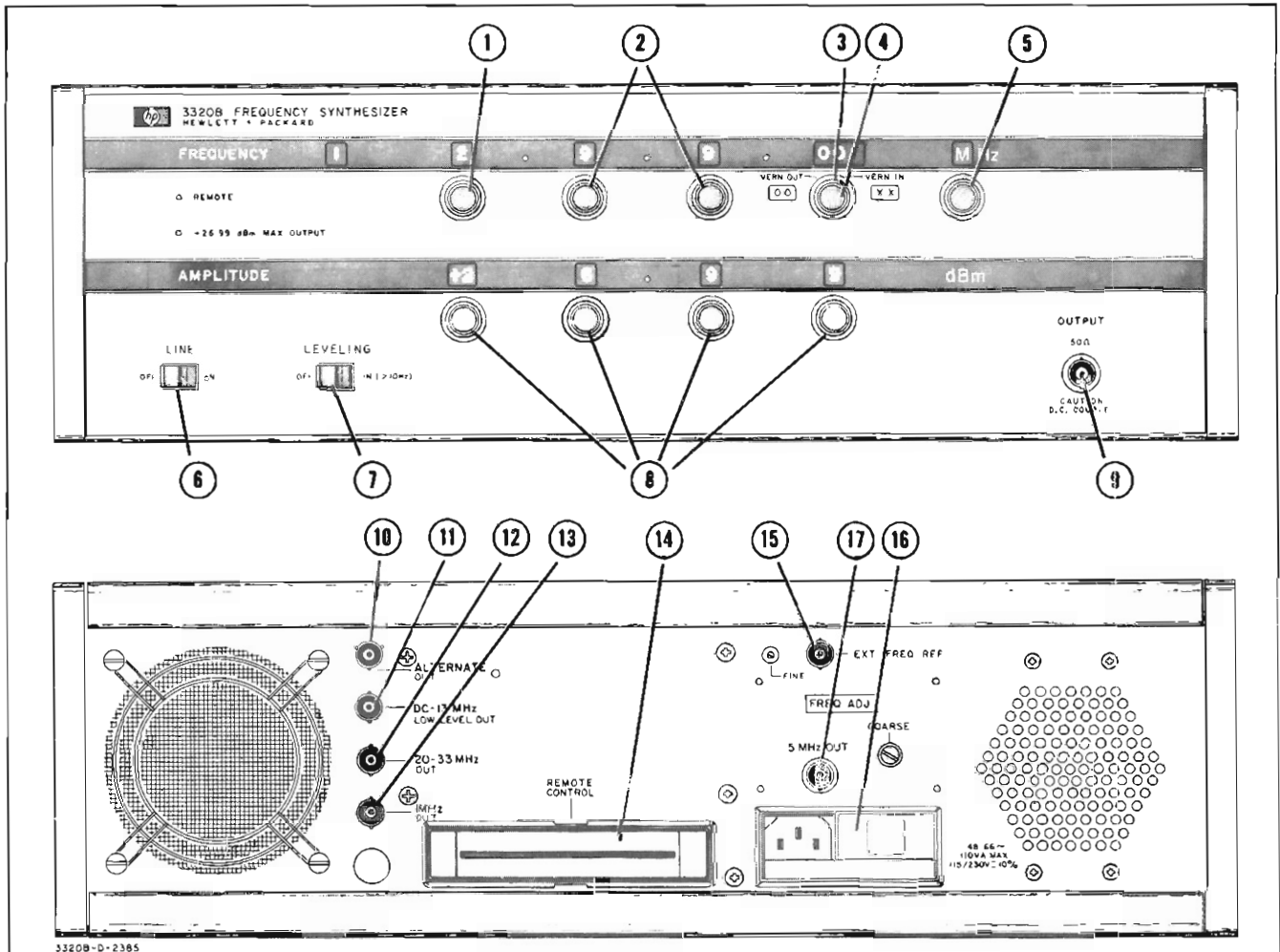


Figure 2-5. Typical GPIB Bus System.



3320B-D-2385

- | | |
|---|--|
| <p>① Frequency control for most significant digit of output frequency. Also controls overrange digit (Paragraph 3-7).</p> <p>② Frequency controls for second and third significant digit of output frequency (Paragraph 3-7).</p> <p>③ Vernier: Controls two least significant digits of frequency (Paragraph 3-7).</p> <p>④ VERN IN/VERN OUT: Turns vernier oscillator on or off (Paragraph 3-7).</p> <p>⑤ RANGE: Controls range of frequency. 5 ranges in standard instrument - 1000 Hz, 10 kHz, 100 kHz, 1000 kHz, 10 MHz (Paragraph 3-7).</p> <p>⑥ LINE: Power on/off control.</p> <p>⑦ LEVELING: Controls the amplitude stability. Short loop for < 10 Hz. Long loop for > 10 Hz (Paragraph 3-12).</p> <p>⑧ AMPLITUDE: Sets output amplitude from + 26.99 dBm to - 69.99 dBm (Paragraph 3-9).</p> <p>⑨ Output jack: 3320A = 1 V rms into 50 ohms. 0-13 dB continuous adjustment. 3320B = 5 V rms into 50 ohms. + 26.99 dBm = -69.99 dBm, 0.01 dB resolution.</p> | <p>⑩ Rear output: Same output as front panel output jack. Must move cable connector to rear jack from front jack. (See Section VIII, Manual Backdating)</p> <p>⑪ LOW LEVEL OUTPUT: Comes through 30 dB pad from output amplifier. Amplitude follows electronic attenuator setting (9.99 dB).</p> <p>⑫ 20-33 MHz: Output from Mixer board. Indicates selected frequency out of Frequency Generating portion of Synthesizer (tracks front panel with 20 MHz offset).</p> <p>⑬ 1 MHz: Divided output of Reference Oscillator out of Reference Phase Lock board.</p> <p>⑭ Remote input connector for options 003, 004, and 007 (BCD and GPIB) (Paragraphs 3-14, 3-17).</p> <p>⑮ External Phase Lock: Input for Reference 5 MHz External Oven or External Phase Lock Signal.</p> <p>⑯ Ac power input: Includes input power assembly.</p> <p>⑰ Option 002 Reference Oscillator. 5 MHz crystal oscillator output and adjustments.</p> |
|---|--|

Figure 3-1. Controls, Indicators, and Connectors.

SECTION III OPERATING INSTRUCTIONS

3-1. INTRODUCTION.

3-2. This section contains information necessary for operation of the -hp- Model 3320A/B Frequency Synthesizer. Included are descriptions and identification of front and rear panel controls, indicators and connectors, operating instructions, and remote programming information.

3-3. CONTROLS, INDICATORS and CONNECTORS.

3-4. A brief description of each control, indicator and connector is given in Figure 3-1. Controls, indicators and connectors requiring additional information are referenced to descriptive paragraphs within this section.

3-5. FRONT PANEL OPERATION.

3-6. The following paragraphs contain information for setting frequency, amplitude and leveling. Also included is information on remote programming and input/output connectors.

3-7. Frequency.

3-8. The 3320A/B provides five digits of frequency resolution plus an overrange digit. The frequency is determined by the position of the RANGE control, the two Vernier controls (VERN IN/VERN OUT and vernier frequency), and the three FREQUENCY controls. The three FREQUENCY controls set the three most significant digits and the overrange digit. The RANGE control places the decimal point. The vernier controls allow the operator to adjust two additional digits of frequency from 00 to 99. When the vernier control is in the VERN OUT position, these additional digits are always 00. Table 3-1 shows the control settings for maximum output in each of the five range positions.

Table 3-1. Frequency Control Settings.

| Range | Frequency Digits (MAX) | Vernier Digits (MAX) |
|-------|------------------------|----------------------|
| Hz | 1299. | 99 |
| kHz | 12.99 | 99 |
| kHz | 129.9 | 99 |
| kHz | 1299. | 99 |
| MHz | 12.99 | 99 |

3-9. Amplitude.

3-10. The 3320A output amplitude is adjusted by a

0–13 dB potentiometer. Maximum output voltage for the 3320A is 1 V rms into 50 ohms or 2 V rms open circuit.

3-11. The 3320B output amplitude is adjusted by four front panel AMPLITUDE controls. Output levels from +26.99 dBm to -69.99 dBm with a resolution of 0.01 dB are obtainable. Each amplitude control operates independently, allowing changes of 0.01 dB, 0.1 dB, 1 dB or 10 dB in the output level. Maximum output voltage is 5 V rms into 50 ohms or 10 V rms open circuit.

3-12. Leveling.

3-13. The 3320B frequency response is determined by the position of the LEVELING control. For frequencies below 10 Hz, the LEVELING control should be in the OFF position. This prevents the thermopile in the leveling loop from responding to the instantaneous value of the output sine wave. For frequencies above 10 Hz, the thermopile will respond only to the true rms value of the output frequency, therefore, the LEVELING control should be in the ON (> 10 Hz) position.

3-14. REMOTE BCD PROGRAMMING.

3-15. The 3320A Option 003 and 3320B Option 004 can be remotely programmed with an 8-4-2-1 BCD code. All functions of the 3320A can be programmed with the exception of amplitude, the last vernier digit, and the power switch. All functions of the 3320B can be programmed with the exception of the last vernier digit and the power switch. There is no internal storage capability, therefore, the program lines must be held until the program is changed. Figure 3-2 shows the BCD input connector and the signal inputs for each pin. Paragraphs 3-16 through 3-33 explain each input/output signal. Logic levels for the BCD input/outputs are as follows:

| State | Requirements |
|------------------------|---|
| L = LOW (logical "1") | 0 V to 0.4 V (5 mA max.) or contact closure to ground through <80 ohms. |
| H = HIGH (logical "0") | + 2.4 V to + 5 V or removal of contact closure to ground. |

3-16. Remote Enable.

3-17. The signal input labeled REN controls the remote/local mode of operation (REN LOW = remote, REN HIGH = local). When the 3320A/B is programmed to the remote mode, the front panel controls have no effect.

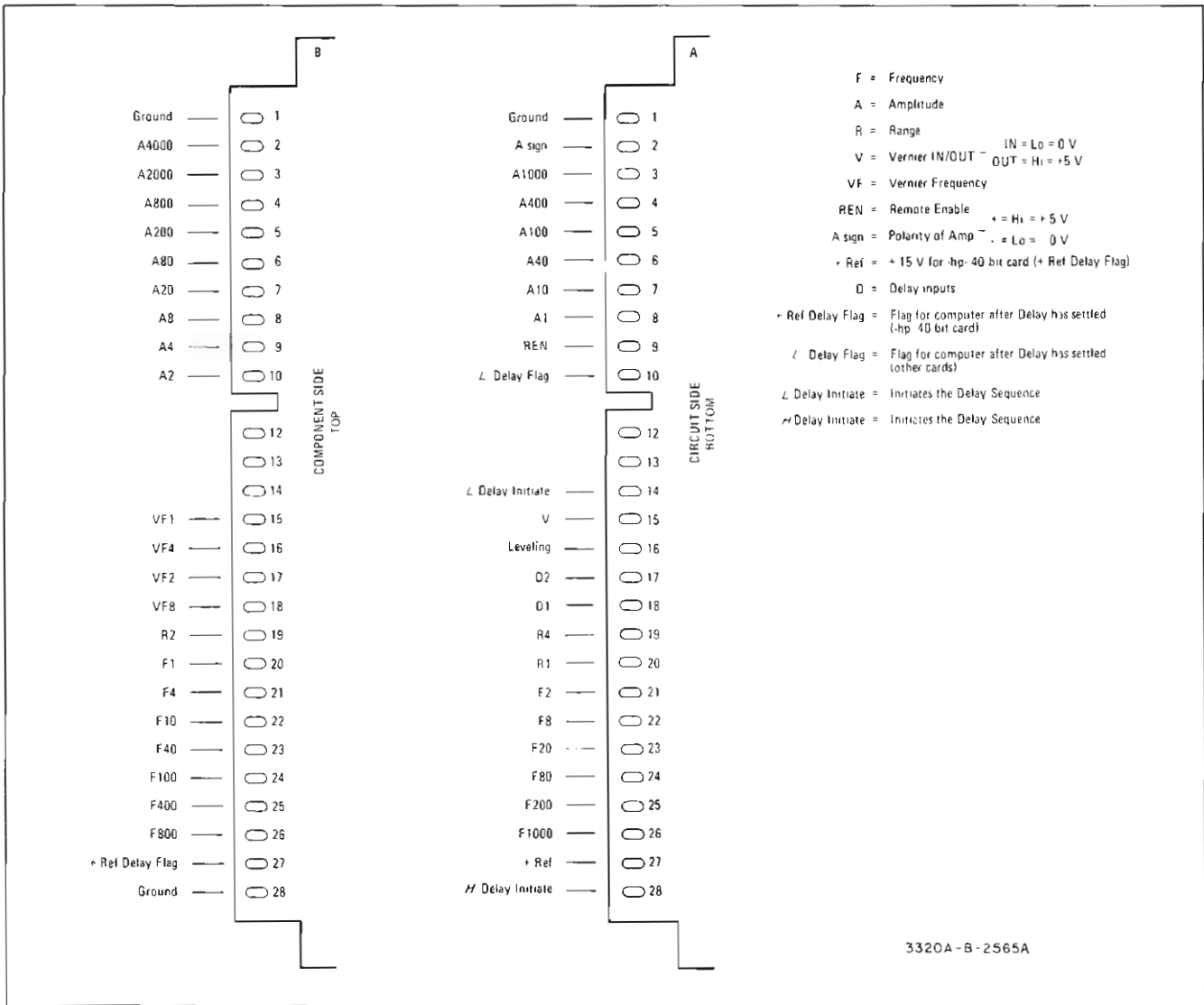
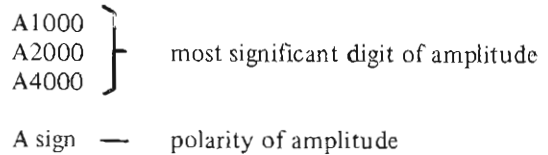
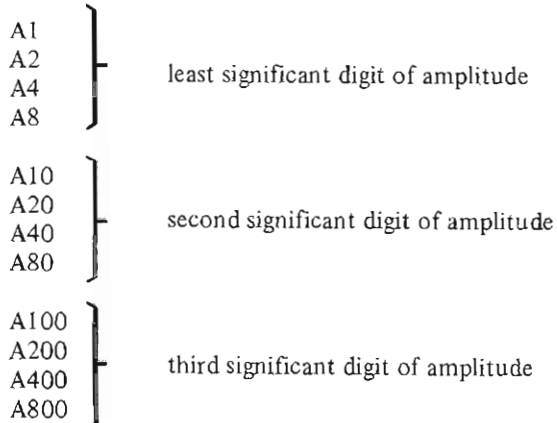


Figure 3-2. BCD Input Connector.

3-18. 3320B Amplitude.

3-19. The 16 signal inputs prefaced A control the four amplitude digits and the sign of the amplitude. The inputs representing each digit are as follows:



Each digit is programmed by applying an 8-4-2-1 BCD code representing the digit desired. The three least significant digits can be selected from 0 to 9. The most significant digit can be selected from 0 to 7. The A sign input determines the polarity of the amplitude. For a + dBm the input level must be HIGH. For a - dBm the input level must be LOW.

CAUTION

When remote programming is used, the minimum output is -73.00 dBm (-75.00 dBm Option 001). If the 3320B is programmed for a lower level, the output voltage increases.

Example amplitude program:

desired amplitude = -12.34 dBm

| | |
|----------------|---------------------|
| <u>LSD</u> | <u>2 nd SD</u> |
| A1 = H | A10 = L |
| A2 = H | A20 = L |
| A4 = L | A40 = H |
| A8 = H | A80 = H |
| <u>3 rd SD</u> | <u>MSD and Sign</u> |
| A100 = H | A1000 = L |
| A200 = L | A2000 = H |
| A400 = H | A4000 = H |
| A800 = H | A sign = L |

3-20. Frequency.

3-21. The 13 signal inputs prefaced F control the three most significant frequency digits plus the overrange digit. The inputs representing each digit are as follows:

| | |
|------------------------------|---|
| F1 F2 F4 F8 | } least significant digit of frequency |
| F10 F20 F40 F80 | } second significant digit of frequency |
| F100 F200 F400 F800 | } most significant digit of frequency |
| F1000 | — overrange digit |

Each digit is programmed by applying an 8-4-2-1 BCD code representing the digit desired. All frequency digits can be selected from 0 to 9. The overrange digit can be either a 0 or a 1. **NOTE:** Although the maximum frequency of the 3320A/B is specified as 12.99 MHz, it is possible to program a higher frequency. However, the response is not specified and will deteriorate.

Example frequency Program:

desired frequency = 12.34 MHz *

| | |
|------------|----------------|
| <u>LSD</u> | <u>2 nd SD</u> |
| F1 = H | F10 = L |
| F2 = H | F20 = L |
| F4 = L | F40 = H |
| F8 = H | F80 = H |

| | |
|-----------------|------------------|
| <u>3 rd MSD</u> | <u>Overrange</u> |
| F100 = H | F1000 = L |
| F200 = L | |
| F400 = H | |
| F800 = H | |

* MHz RANGE programmed (See Paragraph 3-24).

3-22. Vernier.

3-23. The signal input prefaced V and the four signal inputs prefaced VF control the vernier in/out and the vernier frequency. Programming conditions for vernier in/out are HIGH = out and LOW = in. Only the first vernier digit can be remotely programmed. Programming is accomplished by applying an 8-4-2-1 BCD code representing the digit desired.

3-24. Range.

3-25. The three signal inputs prefaced R control the position of the range switch. Each position is designated by a number. There are five range positions available (seven in the 3320A/B Option 006). Programming is accomplished by applying a 4-2-1 BCD code representing the number for the range position desired. The following list identifies the range position by number and respective range:

| | |
|--------------|--------------|
| 0 = 10 Hz | } Option 006 |
| 1 = 100 Hz | |
| 2 = 1000 Hz | |
| 3 = 10 kHz | |
| 4 = 100 kHz | |
| 5 = 1000 kHz | |
| 6 = 10 MHz | |

3-26. Leveling.

3-27. The signal input labeled Leveling controls the leveling mode of operation (leveling HIGH = ON (> 10 Hz), leveling LOW = OFF). The programmed frequency (or group of frequencies) must be considered when selecting the leveling mode. If a frequency of 10 Hz or less is programmed, the leveling should be programmed OFF. This will eliminate any distortion of the 3320B output caused by the leveling loop (see Paragraph 3-12). If a frequency greater than 10 Hz is programmed, the leveling should be programmed ON (> 10 Hz).

3-28. Delay and Response.

3-29. The two signal inputs prefaced D and the signal input/outputs labeled Delay Flag, L Delay Initiate, H Delay Initiate, + Ref. and + Ref. Delay Flag control the delay and response time of the 3320A/B.

3-30. The delay is simply an internal clock which counts for the time interval programmed by the D1 and D2 inputs. During the count sequence, the clock outputs a flag to the

external controller. This flag can be monitored to determine the accuracy which the 3320A/B frequency and the 3320B amplitude has settled. Table 3-2 lists the delay codes, the clock time interval and the tolerances to which the frequency and amplitude have settled. Figure 3-3 shows the timing sequence of the delay.

3-31. The delay sequence is started by programming a Delay Initiate (data strobe). Two Delay Initiate inputs are available. If the strobe output from the external controller is HIGH true, the H Delay Initiate input must be used. If the strobe output from the controller is LOW true, the L Delay Initiate input must be used.

NOTE

The H Delay Initiate input is not TTL compatible. It may require a minimum of +4 V applied to this input to initiate the delay sequence.

3-32. There are also two delay flag (Holdoff Flag) outputs available. The L Delay Flag output is standard LOW true TTL logic. When it is necessary to have a HIGH true delay flag, the positive reference voltage from the external controller (such as the -hp- 12556A 40 bit BCD Interface Card) can be applied to the + Ref. input. The + Ref. Delay Flag will be held at the + Ref. potential while the delay sequence is in progress. When the delay sequence is completed, the + Ref. Delay Flag will go LOW.

3-33. When the 3320B is programmed for a low frequency (below 1000 Hz) and the leveling is ON (> 10 Hz), the output can become distorted due to the response of the 3320B amplitude section. This response can be slowed to eliminate the distortion. This is accomplished by programming a delay code of 3. With all other delay codes, the response is in the fast mode. When the 3320B is in the local mode, the response is always in the slow mode.

NOTE

When going from local to remote, the response is automatically set to the fast mode (delay code 0) Therefore, if low frequencies are programmed, the response should be set to the slow mode (delay code 3).

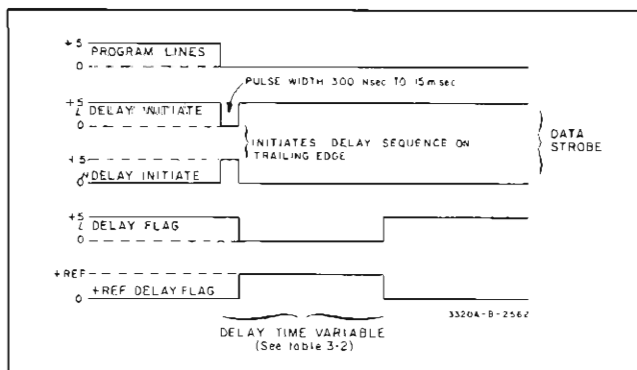


Figure 3-3. BCD Timing Sequence.

Table 3-2. Amplitude and Frequency Settling Times.

| Delay Code | Time Interval | % of Range Frequency Tolerance | Amplitude Tolerance |
|------------|---------------|--------------------------------|-----------------------|
| 0 | 15 ms | .01 | -- |
| 1 | 60 ms | .001 | -- |
| 2 | 300 ms | -- | 1 % |
| * 3 | 1500 ms | -- | within rated accuracy |

* Response in slow mode (See Paragraph 3-33).

3-34. REMOTE GPIB PROGRAMMING.

3-35. The GPIB (General Purpose Interface Bus) remote control option permits the Model 3320B to operate on a single data/control bus with several other instruments. A typical GPIB bus system is shown in Figure 4-8. Each bus contains eight data lines and seven control lines. The ASCII (American Standard Code for Information Interchange) code format is used to transfer data on the eight data lines.

3-36. A total of 15 instruments may be connected in parallel to the bus. Each instrument on the bus is assigned an address (or addresses) so that it can be selected individually by an external controller. This enables the external controller to determine which instruments will be communicating on the bus at any given time. An instrument will have a listen address if it can receive data, a talk address if it can transmit data, or both a listen and a talk address if it can both receive and transmit data. For example, the 3320B GPIB option has only a listen address, which allows the controlling instrument to instruct the 3320B to receive programming information as outlined in the following paragraphs.

Table 3-3. Addressing Codes.

| Address | 40 | 20 | 10 | 4 | 2 | 1 |
|---------|----|----|----|---|---|---|
| 40 | 1 | 0 | 0 | 0 | 0 | 0 |
| 41 | 1 | 0 | 0 | 0 | 0 | 1 |
| 42 | 1 | 0 | 0 | 0 | 1 | 0 |
| 43 | 1 | 0 | 0 | 0 | 1 | 1 |
| 44 | 1 | 0 | 0 | 1 | 0 | 0 |
| 45 | 1 | 0 | 0 | 1 | 0 | 1 |
| 46 | 1 | 0 | 0 | 1 | 1 | 0 |
| 47 | 1 | 0 | 0 | 1 | 1 | 1 |
| 50 | 1 | 0 | 1 | 0 | 0 | 0 |
| 51 | 1 | 0 | 1 | 0 | 0 | 1 |
| 52 | 1 | 0 | 1 | 0 | 1 | 0 |
| 53 | 1 | 0 | 1 | 0 | 1 | 1 |
| 54 | 1 | 0 | 1 | 1 | 0 | 0 |
| 55 | 1 | 0 | 1 | 1 | 0 | 1 |
| 56 | 1 | 0 | 1 | 1 | 1 | 0 |
| 57 | 1 | 0 | 1 | 1 | 1 | 1 |
| 60 | 1 | 1 | 0 | 0 | 0 | 0 |
| 61 | 1 | 1 | 0 | 0 | 0 | 1 |
| 62 | 1 | 1 | 0 | 0 | 1 | 0 |
| 63 | 1 | 1 | 0 | 0 | 1 | 1 |
| 64 | 1 | 1 | 0 | 1 | 0 | 0 |
| 65 | 1 | 1 | 0 | 1 | 0 | 1 |
| 66 | 1 | 1 | 0 | 1 | 1 | 0 |
| 67 | 1 | 1 | 0 | 1 | 1 | 1 |
| 70 | 1 | 1 | 1 | 0 | 0 | 0 |
| 71 | 1 | 1 | 1 | 0 | 0 | 1 |
| 72 | 1 | 1 | 1 | 0 | 1 | 0 |
| 73 | 1 | 1 | 1 | 0 | 1 | 1 |
| 74 | 1 | 1 | 1 | 1 | 0 | 0 |
| 75 | 1 | 1 | 1 | 1 | 0 | 1 |
| 76 | 1 | 1 | 1 | 1 | 1 | 0 |

3-37. The listen address for the 3320B is normally the ASCII character 3, octal code 063, but may be changed by means of internal jumper wires on the GPIB Input Assembly (A37). Instructions for changing the address are given in Note 2, Figure 7-14. Table 3-3 lists the different addresses which can be assigned.

3-38. A principal advantage of the GPIB bus system is that all information is routed over the same 15 lines. For this reason standard cables are used to connect each instrument to the bus. Section II lists the GPIB bus cables available.

3-39. For convenience and brevity, each GPIB bus signal line is identified by a mnemonic, which is an abbreviation of the signal name. Table 3-4 lists the seven control lines and eight data lines used on the GPIB bus.

Table 3-4. GPIB Bus Signal Mnemonics.

| Mnemonic | Signal Name |
|----------|--|
| DAC | Data Accepted |
| DAV | Data Valid |
| MRE | Multiple Response Enable |
| REN | Remote Enable |
| RFD | Ready For Data |
| SRQ | Service Request |
| EOP | End Output |
| DI01 | Data Input/Output bits 1 through 8. |
| DI02 | |
| DI03 | |
| DI04 | |
| DI05 | |
| DI06 | |
| DI07 | |
| DI08 | |

3-40. An H preceding a mnemonic indicates that the signal is HIGH true, L indicates LOW is true. For example, L DAV indicates that a LOW true signal is required for a data Valid signal. All GPIB lines are LOW true except H RFD and H DAC, which are HIGH true. Table 1-2 lists the signal levels required.

NOTE

In the 3320B the Data Input/Output bit 8 (DI08) and Service Request (SRQ) are not used (no connections).

3-41. All 3320B front panel functions are programmable with the exception of the last vernier digit and the line. Table 3-5 lists each of the functions and the octal codes, the ASCII character for each code, and the seven bit binary code for each octal code. The binary code is applied to the seven Data Input lines on the remote input/output connector. Figure 3-4 shows the remote connector pin numbers and the input/output signals for each pin.

Table 3-5. ASCII Programming Codes.

| Character | Octal | Binary | |
|-----------|-------|---------|--|
| ? | 077 | 0111111 | *Address clear |
| A | 101 | 1000001 | Amplitude preface |
| C | 103 | 1000011 | Command (initiates delay) |
| D | 104 | 1000100 | Delay code preface |
| F | 106 | 1000110 | Frequency preface |
| K | 113 | 1001011 | Vernier "IN" |
| M | 115 | 1001101 | Vernier "OUT" |
| R | 122 | 1010010 | Range preface |
| V | 126 | 1010110 | Vernier preface |
| + | 053 | 0101011 | Polarity of amplitude |
| - | 055 | 0101101 | Polarity of amplitude |
| 0 | 060 | 0110000 | } Digits for address*; amplitude, frequency, vernier, etc. |
| 1 | 061 | 0110001 | |
| 2 | 062 | 0110010 | |
| 3 | 063 | 0110011 | |
| 4 | 064 | 0110100 | |
| 5 | 065 | 0110101 | |
| 6 | 066 | 0110110 | |
| 7 | 067 | 0110111 | } Function execute Local enable |
| 8 | 070 | 0111000 | |
| 9 | 071 | 0111001 | |
| | 054 | 0101100 | |
| I | 111 | 1001001 | |

* Address and clear must be accompanied by an MRE. On the 3260A Card Reader, MRE = 200 (address = 267, clear = 277).

| Range Codes | | |
|-------------|----------|-----------------------------|
| Character | Range | |
| 0 | 10 Hz | } optional (A6 assembly) |
| 1 | 100 Hz | |
| 2 | 1000 Hz | |
| 3 | 10 kHz | |
| 4 | 100 kHz | |
| 5 | 1000 kHz | |
| 6 | 10 MHz | |

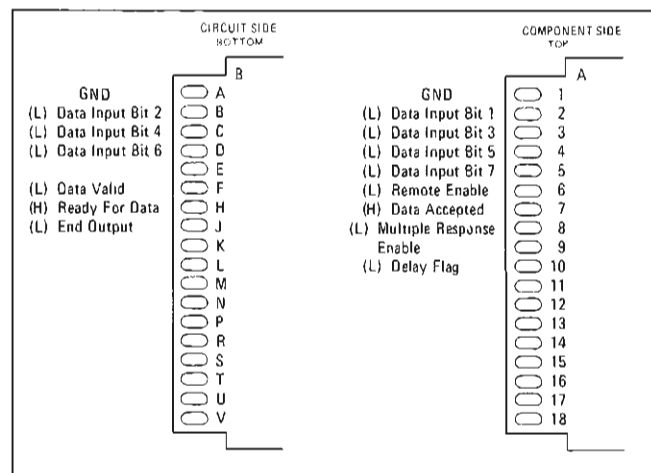


Figure 3-4. GPIB Input Connector.

3-42. The first step in GPIB programming is to address the 3320B. Addressing is accomplished by applying the address code to the data line, setting the MRE (Multiple Response Enable) LOW, and setting DAV (Data Valid) LOW. An example program is listed in Table 3-6. The 3320B does not

have to be in the remote mode to be addressed. Conversely, it must be addressed before it can be put into the remote mode.

NOTE

When power is initially applied the 3320B may or may not be addressed. This is why the "Address Clear" command (ASCII ?) is recommended prior to addressing any instrument(s) on the GPIB Bus.

3-43. To put the 3320B into the remote mode (after it has been addressed) set the REN (Remote Enable) LOW, MRE HIGH, apply the Function Execute code (ASCII comma) to the data lines, and set DAV LOW. The REN can be set LOW at any time prior to the Function Execute (ie., while addressing) but the 3320B will not go into the remote mode until the Function Execute and L DAV is applied. The Function Execute can be applied during the function programming sequence (See Notes, Table 3-6).

Table 3-6. GPIB Programming.

| Example: 5.0 kHz frequency Vernier Out, - 5.00 dBm Amplitude 60 ms delay. | | | | | | | | |
|--|------------------------|--------------|------|------|------|------|------|------|
| Instruction | State or Octal Code | Binary Codes | | | | | | |
| | | D107 | D106 | D105 | D104 | D103 | D102 | D101 |
| | | 100 | 40 | 20 | 10 | 4 | 2 | 1 |
| MRE | LOW | | | | | | | |
| Clear | 077* | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| Address | 063 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| REN | LOW | | | | | | | |
| MRE | HIGH | | | | | | | |
| R | 122 | 1 | 0 | 1 | 0 | 0 | 1 | 0 |
| 4 | 064 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| ,* | 054 | 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| F* | 106 | 1 | 0 | 0 | 0 | 1 | 1 | 0 |
| 5 | 065 | 0 | 1 | 1 | 0 | 1 | 0 | 1 |
| 0 | 060 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| , | 054 | 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| m | 115 | 1 | 0 | 0 | 1 | 1 | 0 | 1 |
| A | 101 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| . | 055 | 0 | 1 | 0 | 1 | 1 | 0 | 1 |
| 5 | 065 | 0 | 1 | 1 | 0 | 1 | 0 | 1 |
| 0 | 060 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | 060 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| , | 054 | 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| D | 104 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 1 | 061 | 0 | 1 | 1 | 0 | 0 | 0 | 1 |
| , | 054 | 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| C | 103 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |

*Each code applied to the data lines must be followed by a DAV LOW.

**Instrument goes to remote mode at this time.

3-44. When power is initially applied, the 3320B may go to the remote mode for a few seconds, then to the local mode even if REN is held LOW. It will remain in the local mode until the address and a Function Execute is programmed.

3-45. When programmed to the remote mode, the condition of the 3320B output depends on the position of a jumper wire on the A38 assembly (See Figure 7-14). If there is a jumper wire between points A and B on the A38 assembly, the 3320B will go to the conditions listed below:

FREQUENCY 800 Hz
 RANGE 1000 Hz
 AMPLITUDE - 69.00 dBm
 VERNIER OUT/0 Hz
 DELAY 1500 ms
 LEVELING ON(> 10 Hz)

If there is no jumper between points A and B on the A38 assembly, the 3320B will go to the previously remote programmed conditions when programmed to the remote mode. The 3320B leaves the factory with no jumper.

3-46. The second step in GPIB programming is the function programming. This is accomplished by applying the ASCII code, representing the information desired, to the seven data lines and strobing the information into the 3320B. The LDAV is the strobe pulse. Each seven bit code applied to the data lines must be accompanied by an LDAV. The programming information for each 3320B function is applied in two parts, the preface command representing the function (ie., V for Vernier) and the desired digits for that function (ie., 99 for a Vernier setting of 99). After each preface command and the digits have been strobed into the 3320B, they must be followed by a Function Execute.

3-47. If all functions have been programmed and it is desired to reprogram a specific function, it is only necessary to reprogram that function. When frequency or amplitude is programmed the instrument assumes the leading zeros. Loading sequence of the digits programmed are from right to left. If an amplitude polarity is not programmed, the instrument assumes a + polarity. Figure 3-5 shows an example program using a marked card for the 3260A Marked Card Programmer. The 3260A does not handshake. The strobe marks on the right edge of the card represent the DAV. The 200 bit on the card represents the MRE.

3-48. Handshake.

3-49. The Data Valid (DAV), Ready for Data (RFD), and Data Accepted (DAC) signals form a "handshake" sequence, controlling the timing for data transfer on the Data lines. When an address code or a programming instruction is applied to the seven data lines, the external controller must set the DAV LOW. This indicates to the 3320B that data is available on the data lines. If the 3320B is not processing previous data, the RFD will be HIGH and the DAC will be LOW. Approximately three microseconds after the DAV is set LOW by the external controller, the 3320B will set DAC HIGH and RFD LOW. The DAC indicates to the controller that the 3320B has accepted the data and is processing it. The RFD signal indicates to the external controller that the 3320B is not ready for more data. When the 3320B has set

RFD LOW and DAC HIGH, the external controller can remove the DAV and the data from the data lines and replace it with new data. The cycle repeats until all programming is completed. Figure 3-6 shows the timing relationship between the DAV, RFD, and DAC signals.

3-50. It is not necessary for the external controller to monitor the RFD or DAC signals. However, if these signals are not monitored, the external controller must wait approximately three microseconds before removing the LDAV and the data from the data lines and applying new data, and approximately two microseconds before setting DAV LOW again. This ensures the 3320B has had time to accept and process the previous data.

3-51. The RFD line is also controlled by the delay programmed (See Paragraph 3-52). As soon as a Delay Initiate code (Octal code 103) is programmed, the RFD will remain LOW for the length of time programmed by the delay. If the RFD signal is monitored, the user can be sure the 3320B amplitude and frequency has settled to the desired tolerance when the RFD goes HIGH.

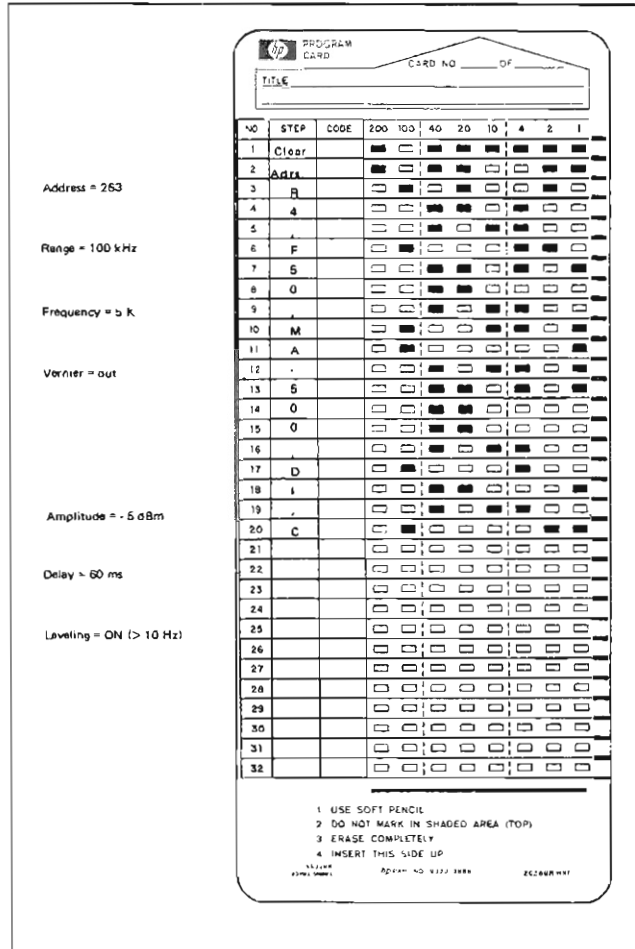


Figure 3-5. Programming Example.

3-52. Delay Flag.

3-53. The delay is generated by an internal clock which counts for the time internal programmed on the data lines. At the end of the count sequence, the clock outputs a flag to the external controller (delay flag or RFD). This flag can be monitored to determine the accuracy which the 3320B frequency and amplitude has settled. Table 3-7 lists the delay codes, the clock time interval, and the tolerances which the frequency and amplitude have settled. The programmed delay code must be followed by a Delay Initiate (ASCII character C). This code initiates the delay sequence. The Delay Initiate code does not have to be followed by a Function Execute code.

Example: To program a delay of 60 ms,

ASCII D - delay preface
 Programming I - delay code (60 ms)
 Characters , - Function Execute
 C - Delay Initiate

Table 3-7. Settling Times.

| Remote Control | | 3320 Operation | | | |
|------------------------|------------|----------------|---------------|----------------------------------|---------------------|
| Frequency of Operation | Delay Code | Leveling Mode | Settling Time | Frequency Tolerance (% of Range) | Amplitude Tolerance |
| ≥ 1000 Hz | 0 | On | 15 ms | .01 | - |
| | 1 | On | 60 ms | .001 | - |
| | 2 | On | 300 ms | | 1% |
| 10 Hz ≤ f ≤ 1000 Hz | 3* | On | 1500 ms | | ** |
| ≤ 10 Hz | 4 | Off | 15 ms | .01 | - |
| | 5 | Off | 60 ms | .001 | - |
| | 6 | Off | 300 ms | | 1% |
| | 7 | Off | 1500 ms | | ** |

* Use delay code 3 to eliminate distortion caused by low frequency and leveling on.
 ** Denotes amplitude within rated accuracy.

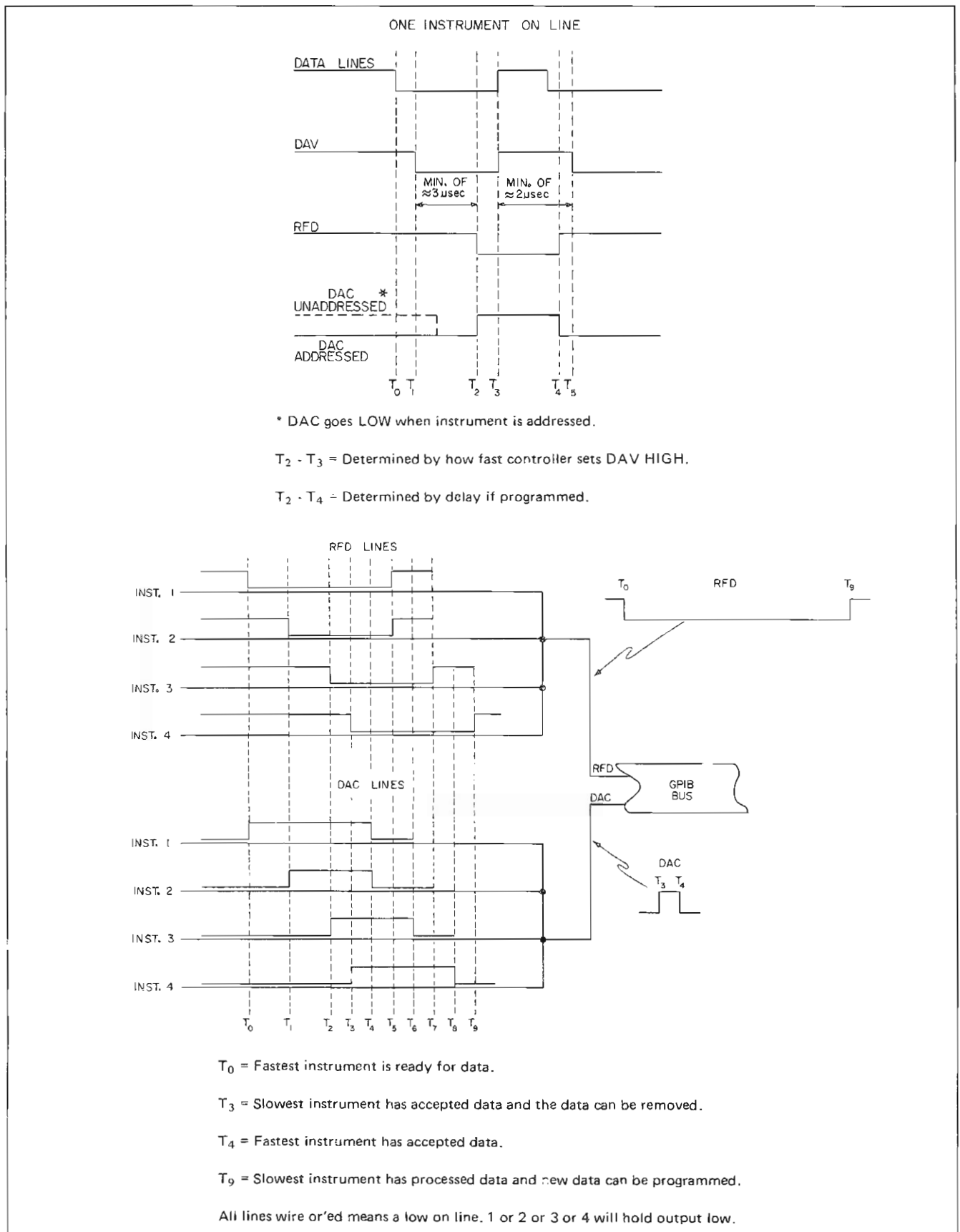


Figure 3-6. Handshake Timing Diagram.

3-54. When the 3320B is programmed for a low frequency (below 1000 Hz) and the leveling is ON (> 10 Hz), the output can become distorted due to the response time of the amplitude section. The response can be slowed to eliminate this distortion by programming a delay code of 3. With all other delay codes the response is in the fast mode.

3-55. The delay code programmed also controls the leveling mode of operation (Delay Codes 0–3, LEVELING ON (> 10 Hz), Delay Code 4–7, LEVELING OFF). The programmed frequency (or group of frequencies) must be considered when selecting the leveling mode. If a frequency of 10 Hz or less is programmed, the leveling should be programmed OFF. This will eliminate any distortion of the 3320B output caused by the leveling loop (See Paragraph 3-12). If a frequency greater than 10 Hz is programmed, the leveling should be programmed ON (> 10 Hz).

3-56. End Output.

3-57. The End Output (EOP) signal allows the external controller to terminate all activity on the GPIB bus lines. When this line is set low by the controller, the 3320B and all other instruments paralleled to the bus lines, will set all data lines, MRE, DAV, RFD, and DAC HIGH.

3-58. REFERENCE CRYSTAL OVEN.

3-59. The 3320A/B Option 002 is a standard instrument with an oven controlled, 5 MHz, reference crystal oscillator. The signal from the 5 MHz oscillator is applied to the reference phase lock assembly to phase lock the 20 MHz VCXO. The result is an increase in 3320A/B output frequency accuracy and stability (See Table 1-2). An Option 002 Field Installation Kit is obtainable by ordering Accessory Kit 11237A.

3-60. For operation, connect a short jumper cable between the 5 MHz OUT and EXT FREQ REF (both on rear panel). A circuit diagram for the Option 002 is shown in Figure 3-7.

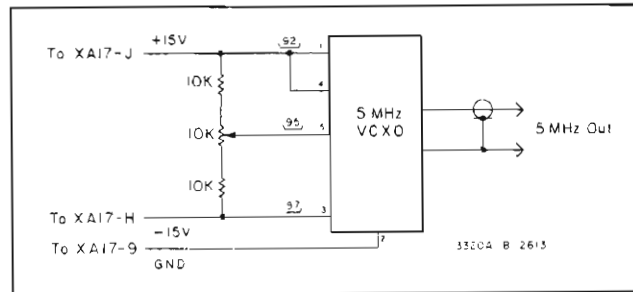


Figure 3-7. Option 002 Circuit Diagram.

SECTION IV THEORY OF OPERATION

4.1. INTRODUCTION.

4-2. This section contains the theory of operation for the 3320A/B. Included is a general description, a simplified block description, a functional block description, and basic circuit theory on unique circuits.

4.3. GENERAL DESCRIPTION.

4-4. The -hp- Model 3320A/B Frequency Synthesizer provides a wide range of accurate and stable frequencies with variable amplitude settings. The frequency range is from 0.001 Hz to 12.9999 MHz. Five digits of frequency resolution plus an overrange is provided in five ranges. The 3320A amplitude is variable from 0 dBm to 13 dBm into 50 ohms by a front panel potentiometer. The 3320B amplitude is variable from +26.99 dBm to -69.99 dBm into 50 ohms in steps of 0.01 dB, 0.1 dB, 1 dB or 10 dB.

4-5. Options available which increase the flexibility of the 3320A/B are as follows:

| OPTION | DESCRIPTION |
|---------|---|
| 001 | 75 ohm output |
| 002 | A high stability reference oscillator. (Increases frequency stability and accuracy.) |
| 003,004 | BCD remote programming. |
| 006 | Two extra ranges (100 Hz and 10 Hz) to increase the low frequency resolution to 0.00001 Hz. |
| 007 | GPIB remote programming. |

The discussion on theory in this section will include these options where applicable.

4.6. SIMPLIFIED BLOCK DIAGRAM.

4-7. Introduction.

4-8. The 3320A/B can be divided into four basic sections: controller, frequency, amplitude, and reference (see Figure 4-1). The signal out of the 3320A/B is developed in the frequency section and applied to the amplitude section where it is translated down in frequency and the level is determined. Both frequency and amplitude are referenced

to a crystal oscillator in the reference section. In the 3320B, both frequency and amplitude are controlled by BCD signals from the controller section. In the 3320A, the frequency only is controlled by BCD signals from the controller. The amplitude of the 3320A is controlled by a 0-13 dBm front panel potentiometer. The BCD signals from the controller are, in turn, controlled by front panel switch settings or GPIB remote programming.

4-9. Controller Section.

4-10. The controller section of the 3320A/B processes information from the front panel controls or the remote inputs into BCD codes for controlling the frequency in the 3320A/B and amplitude in the 3320B. As shown in the Controller Configuration diagram (Figure 7-6), the complexity of the controller section varies with the 3320 Model and Options. Refer to Paragraph 4-19 for a detailed block discussion of each controller type.

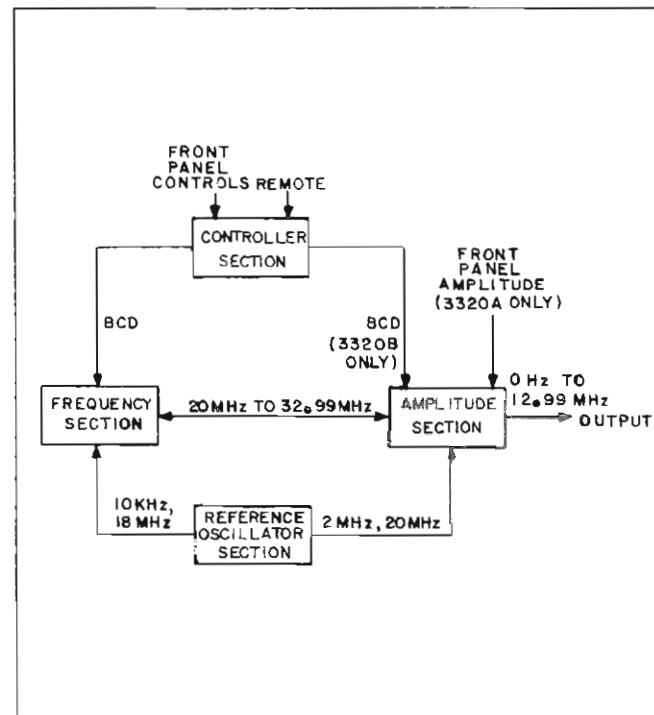


Figure 4-1. Simplified 3320A/B Block Diagram.

Table 4-1. 3320A/B Ranges.

| Range Position | Range Dividers Used | Frequency Applied to Amplitude Section |
|------------------|---------------------|--|
| 10 MHz | 0 | 20 MHz to 32.99 MHz |
| 1000 kHz | 1 | 20 MHz to 21.299 MHz |
| 100 kHz | 2 | 20 MHz to 20.1299 MHz |
| 10 kHz | 3 | 20 MHz to 20.01299 MHz |
| 1000 Hz | 4 | 20 MHz to 20.001299 MHz |
| 100 Hz } Option | 5 | 20 MHz to 20.0001299 MHz |
| 10 Hz } 006 only | 6 | 20 MHz to 20.00001299 MHz |

4-11. Frequency Section.

4-12. The 3320A/B signal is developed in the frequency section by an indirect synthesis technique. This method uses a voltage tuned oscillator (VTO) phase-locked to a standard reference oscillator (see Figure 4-2). The VTO frequency then becomes as stable and accurate as the reference oscillator. The output of the VTO (20 MHz to 32.99 MHz) is applied to a range switch. If the range switch is in the MHz position, the VTO output is applied directly to the amplitude section. If the range switch is in any position other than the MHz position, the output of the VTO is applied to a series of range dividers. Table 4-1 lists the range positions, the number of range dividers used on each range switch position, and the output frequencies of each range divider. Each range divider uses a divide and mix technique to increase the resolution while decreasing the maximum output frequency of the 3320A/B.

4-13. Amplitude Section.

4-14. The 3320A amplitude and the three least significant digits of the 3320B amplitude are controlled by amplitude modulating a 20 MHz signal from the reference oscillator. This signal is mixed with the signal from the frequency section. The 3320B also has a 10 dB/step attenuator at the output for 90 dB of level control.

4-15. Reference Section.

4-16. There are two frequency references in the 3320A/B; the 20 MHz Reference Oscillator and the Vernier Oscillator (see Figure 4-3). When the VERN IN/OUT control is in the VERN IN position, the Vernier Oscillator is the source for the VTO and phase-lock circuitry. The 20 MHz Reference Oscillator is the source for the range dividers and the 3320A/B amplitude section. This allows the operator to adjust the last two digits of the 3320A/B output frequency by adjusting the frequency of the Vernier Oscillator. When the VERN IN/OUT control is in the VERN OUT position, the 20 MHz Reference Oscillator is the source for all 3320A/B circuits.

4-17. FUNCTIONAL BLOCK DESCRIPTION.

4-18. The functional block description is broken into four parts: frequency section, amplitude section, controller section, and reference section. For illustration assistance, refer to the Functional Block Diagrams (Figures 7-5 and 7-7), the Controller Configuration (Figure 7-6), and the schematics in Section VII.

4-19. Controller Section.

4-20. The following is a functional block description of the various controller sections used in the 3320A/B synthesizers. The controller processes information from the front panel or remote input, into a BCD format for controlling the frequency and amplitude sections as shown in Figure 4-1. The complexity of the controller section increases from front panel control only, as in the 3320A standard, to

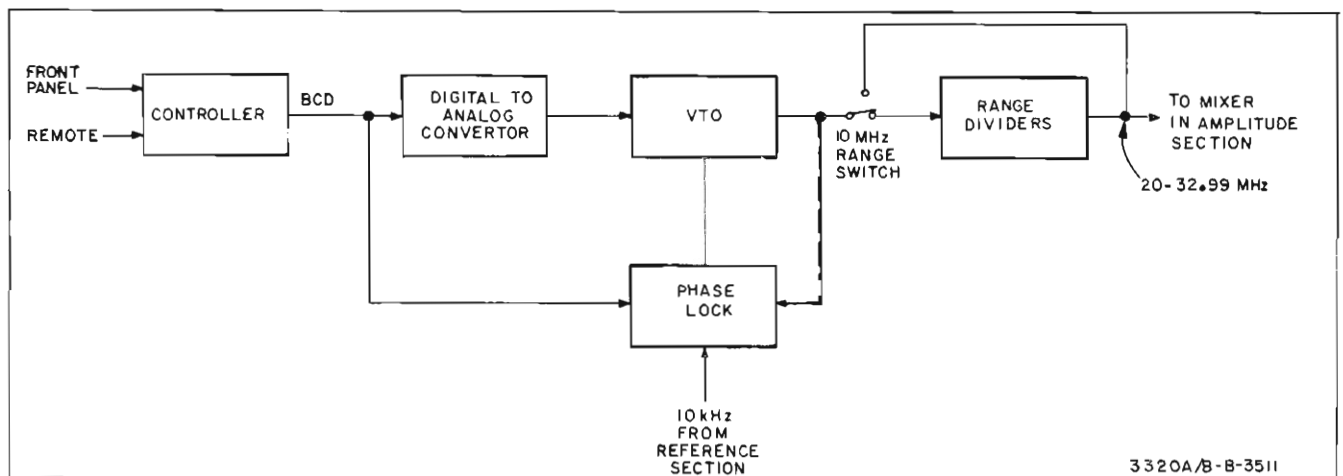


Figure 4-2. Frequency Generation.

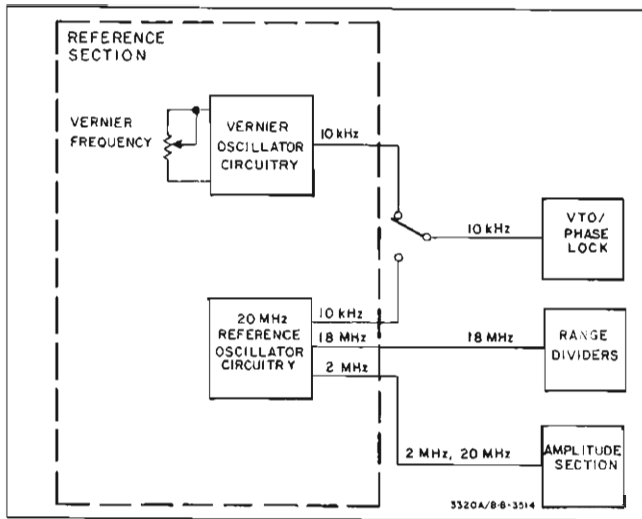


Figure 4-3. Reference Sources.

GPIB control, as in the 3320B Option 007. The various 3320A/B controller sections are shown in the controller Configuration diagram, Figure 7-6. Each controller is discussed in the following paragraphs.

4-21. 3320A Standard Controller. The controller for the standard Model 3320A is shown in Figure 4-4. The BCD codes representing the front panel frequency, range, leveling and vernier in/out settings are converted in the A20 assembly and applied to the frequency section. The amplitude setting is controlled manually by the amplitude potentiometer on the front panel.

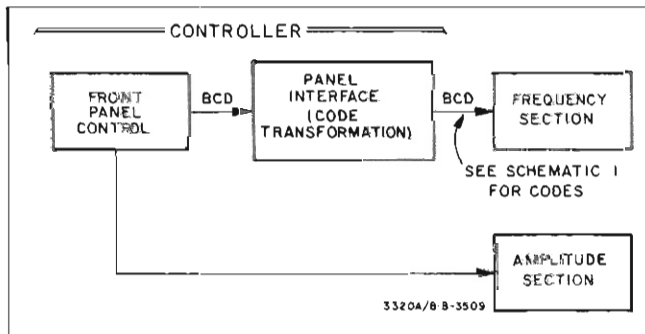


Figure 4-4. 3320A Standard Controller.

4-22. 3320B Standard Controller. The controller for the standard Model 3320B consists of the front panel and the panel interface assembly as shown in Figure 4-5. The BCD data representing the front panel frequency setting is converted in the panel interface block and applied to the frequency sections. The BCD data representing the front panel amplitude setting is added to a preset BCD number in the panel interface assembly. This addition provides the proper BCD code for controlling the amplitude section. Since the 3320B output is calibrated in dBm, the magnitude of the preset BCD number depends on the output impedance of the 3320B.

4-23. 3320A BCD Option 003. The 3320A Option 003 controller is shown in Figure 4-6. Option 003 can be

controlled from the front panel or remotely with parallel BCD lines as outlined in Section III of this manual. In local control (front panel) the BCD code representing the frequency, range, and vernier in/out setting are converted in the BCD control circuits. The converted BCD code from the BCD control circuits is applied to the frequency section through the A22 Cable Board. In remote control mode the BCD information from the remote lines is converted in the BCD control circuits and applied to the frequency section. The Delay Flag shown in Figure 4-6 remains low for the amount of delay time programmed per Section III. The amplitude setting for Model 3320A Option 003 is controlled manually by the front panel potentiometer.

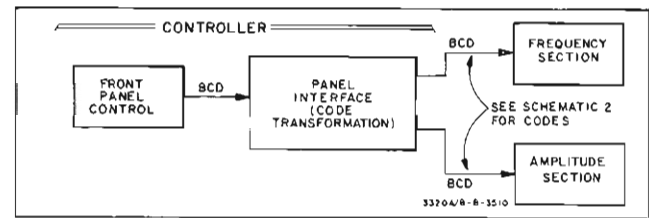


Figure 4-5. 3320B Standard Controller.

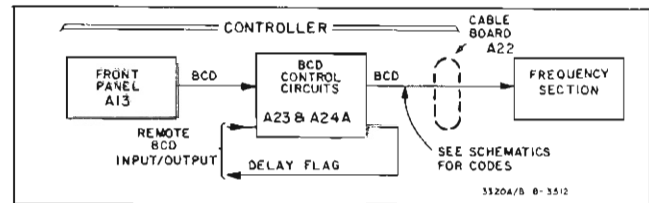


Figure 4-6. 3320A BCD Controller.

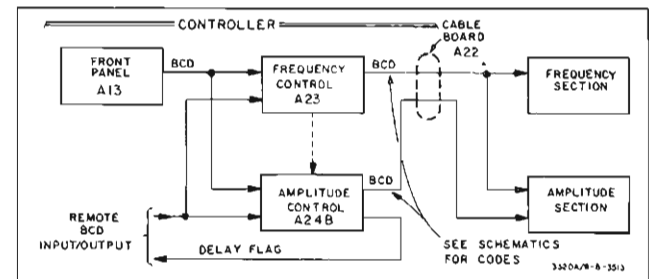


Figure 4-7. 3320B BCD Controller.

4-24. 3320B BCD Option 004. The 3320B Option 004 controller is shown in Figure 4-7. Option 004 can be controlled from the front panel or remotely with parallel BCD lines as outlined in Section III of this manual. In local control the BCD data from the front panel is processed by A23 and A24B assemblies as shown in Figure 4-7. In remote control mode the BCD data from the remote input lines is processed by A23 and A24B.

4-25. The frequency control block (A23) converts the BCD codes representing frequency, range, leveling, and vernier in/out settings into appropriate BCD codes for controlling the frequency and amplitude leveling. The BCD data representing the amplitude setting is added to a preset BCD number in the amplitude control block (A24). This

addition provides the proper BCD code for controlling the amplitude sections. Since the 3320B output is calibrated in dBm, the magnitude of the preset BCD number depends on the output impedance of the 3320B. The delay flag shown in Figure 4-7 remains low for the amount of delay time programmed. Although the delay flag(s) comes from the A24B assembly, the actual timing is performed by the A23 assembly as indicated by the dotted line in Figure 4-7.

4-26. 3320B GPIB Option 007. The GPIB (General Purpose Interface Bus) remote control option permits the Model 3320B to operate on a single data/control bus with several other instruments. A typical GPIB bus system is shown in Figure 4-8. A total of 15 instruments may be connected in parallel to the bus. Each instrument on the bus is assigned an address (or addresses) so that it can be selected individually by an external controller. This enables the external controller to determine which instruments will be communicating on the bus at any given time. An instrument will have a listen address if it can receive data, a talk address if it can transmit data, or both a listen and a talk address if it can both receive and transmit data. For example, the 3320B GPIB option has only a listen address, which allows the controlling instrument to instruct the 3320B to receive programming information as outlined in Paragraph 3-34. The listen address for the 3320B is normally the ASCII character 3, octal code 063, but may be changed as outlined in Section III. The 3320B GPIB option is directly compatible with the -hp- 9800 series calculators. The -hp- 3260A Marked Card Programmer may also be used as the remote controller.

4-27. GPIB Bus Connections. A principal advantage of the GPIB bus system is that all information is routed over the

same 15 lines. For this reason standard cables (which may be various lengths) are used to connect each instrument to the bus. The cable contains eight data lines and seven control lines. Section III of this manual describes the function of each GPIB bus line. Section II lists the GPIB bus cables available.

4-28. For convenience and brevity, each GPIB bus signal line is identified by a mnemonic, which is an abbreviation of the signal name. Table 4-2 lists the seven control lines and eight data lines used on the GPIB bus.

Table 4-2. GPIB Bus Signal Mnemonics.

| Mnemonic | Signal Name |
|----------|--|
| DAC | Data Accepted |
| DAV | Data Valid |
| MRE | Multiple Response Enable |
| REN | Remote Enable |
| RFD | Ready For Data |
| SRQ | Service Request |
| EOP | End Output |
| DIO1 | Data Input/Output bits 1 through 8. |
| DIO2 | |
| DIO3 | |
| DIO4 | |
| DIO5 | |
| DIO6 | |
| DIO7 | |
| DIO8 | |

4-29. An H preceding a mnemonic indicates that the signal is HIGH true, L indicates LOW is true. For example, L DAV indicates that a LOW true signal is required for a data Valid signal. All GPIB lines are LOW true except H RFD

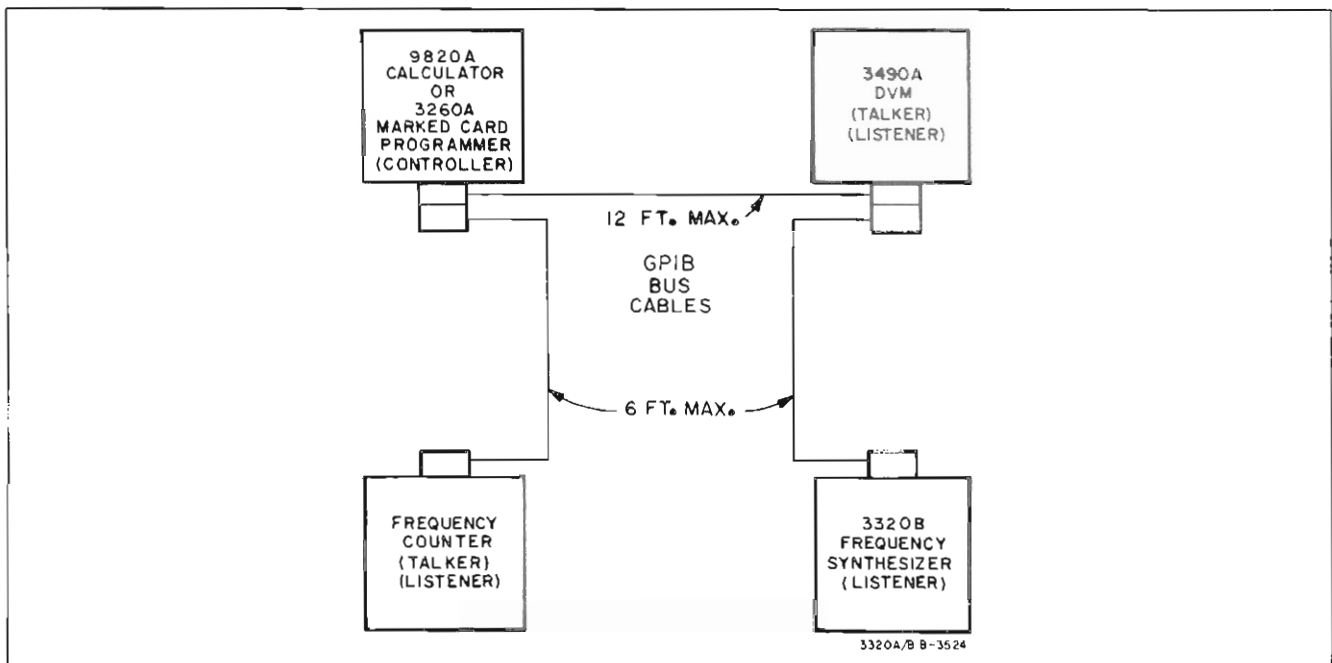


Figure 4-8. Typical GPIB Bus System.

and H DAC, which are HIGH true. Table 1-2 lists the signal levels required.

NOTE

In the 3320B the Data Input/Output bit 8 (DIO8) and Service Request (SRQ) are not used (no connections).

4-30. GPIB Basic Theory and Operation. The 3320B GPIB circuits employ both combinational and sequential logic to convert the ASCII data input into parallel BCD data for controlling the various settings of frequency and amplitude. A block diagram of the GPIB circuits is shown in Figure 4-9.

4-31. By means of the GPIB control lines, each appropriate ASCII character on the data lines is accepted by the Input Circuit. As each data character is accepted, a Data Accepted Signal (H DAC) is supplied back to the remote controller to indicate that the data has been accepted. After a data character has been processed, RFD is allowed to go HIGH, indicating to the remote controller that the 3320B is ready for new data.

4-32. To provide isolation, each ASCII character and various control data is transferred to the controller block by means of pulse transformers or photo-couplers. The controller decodes the ASCII character into a "Preface Command" or "Numerical Data". For example, if the ASCII characters A, 1, 2, 3 and 4 were accepted by the Input Circuit in sequence, the first character A would be decoded in the controller and applied to the Latches (storage registers) as an Amplitude Preface Command. The next four ASCII characters, being numerals, would be decoded as numerical data and applied to the Latches prefaced by the earlier Amplitude Preface Command.

4-33. The Latches and associated circuits function primarily as a series to parallel converter. It converts the preface commands and the serial numerical data from the controller into stored parallel BCD data.

4-34. The main function of the BCD Circuits is to process the BCD format used for controlling the frequency and amplitude sections.

4-35. The BCD data for the frequency setting is converted to 9's complement and applied directly to the frequency section of the 3320B. The 9's complement of a number is a

number which, when added to the first number, equals nine. For example, the 9's complement of a BCD 2 is a BCD 7 since $2 + 7 = 9$. The BCD data for the amplitude settings is added to a preset BCD number in the BCD Circuits. This BCD addition provides the proper BCD numbers for controlling the amplitude reference and 10 dB/step attenuator in the amplitude section of the 3320B. Since the 3320B output is calibrated in dBm, the magnitude of the preset BCD number depends on the output impedance of the 3320B.

4-36. In addition to processing the amplitude and frequency data, the BCD circuit also processes the remaining programmable parameters such as vernier frequency, leveling and delay. The delay flag shown in Figure 4-9 holds the GPIB RFD LOW for the amount of delay time programmed.

NOTE

A more detailed functional block diagram of all the assemblies (A37, A38, A25, A23 and A24B) used in the GPIB controller is shown in Figure 7-5.

4-37. Reset Conditions. When power is first applied to the 3320B, Reset and Clear signals from the controller block reset the latches to the turn on conditions given in Section III. However, the Reset signal also clears the Remote Flip-Flop, forcing the 3320B into local (front panel) control. Local control is automatic when power is initially applied even if the REN is held LOW.

4-38. Addressing the 3320B. When the MRE is LOW, the Input Circuit waits for the DAV to go LOW indicating that the data information is valid. When L DAV is received, the information on the data lines, LDIO1 through LDIO7, are compared to the 3320B address. If they match, the 3320B is addressed and the DAC signal is allowed to go HIGH to indicate that the address has been accepted.

NOTE

When power is initially applied the 3320B may or may not be addressed. This is why the "Address Clear" command (ASCII ?) is recommended prior to addressing any instrument(s) on the GPIB Bus.

4-39. Remote Programming. After the 3320B has been

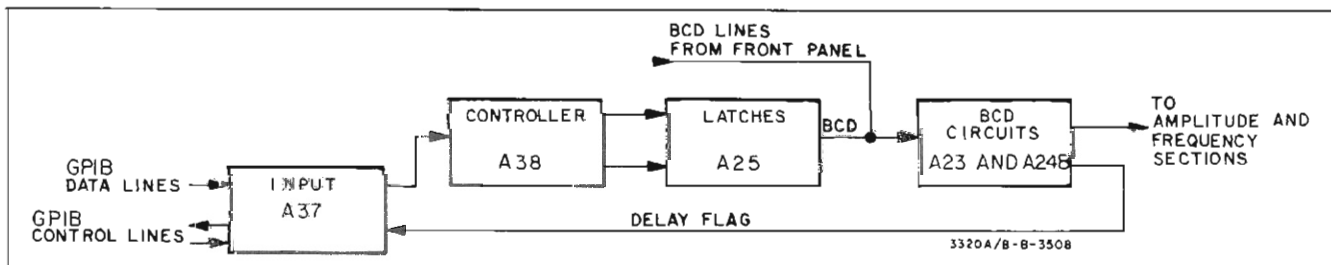


Figure 4-9. GPIB Controller.

addressed to listen, it may be placed into the remote control mode. Remote control is selected by REN and applying a "Function Execute" command (ASCII comma) to the data lines. The 3320B will not go into remote mode by simply holding REN LOW. The 3320B will remain in local mode until a Function Execute command (ASCII comma) is received on the data lines. This Function Execute command must follow the programming of each preface command (parameter) as discussed in Section III. The first Function Execute in a programming sequence sets the Remote Flip-Flop to the remote mode, and transfers any prefaced data to the Latches. Any following Function Execute command simply transfers the prefaced data to the Latches.

NOTE

The 3320B must be addressed before it can be placed in remote control.

4-40. Local Control. In local control, the BCD circuits process the BCD data coming from the front panel settings (switch closures to ground). The input, controller and latch circuits have no function during local control. The 3320B GPIB option may be put into local control by one of the following methods:

1. Initially applying power.
2. By giving a "Local Enable" command (ASCII Character I) during remote control.
3. By controlling the REN.

NOTE

Some "special" 3320B instruments have a front panel switch to control the REN and force local control. For more information, see notes on Schematic No. 6.

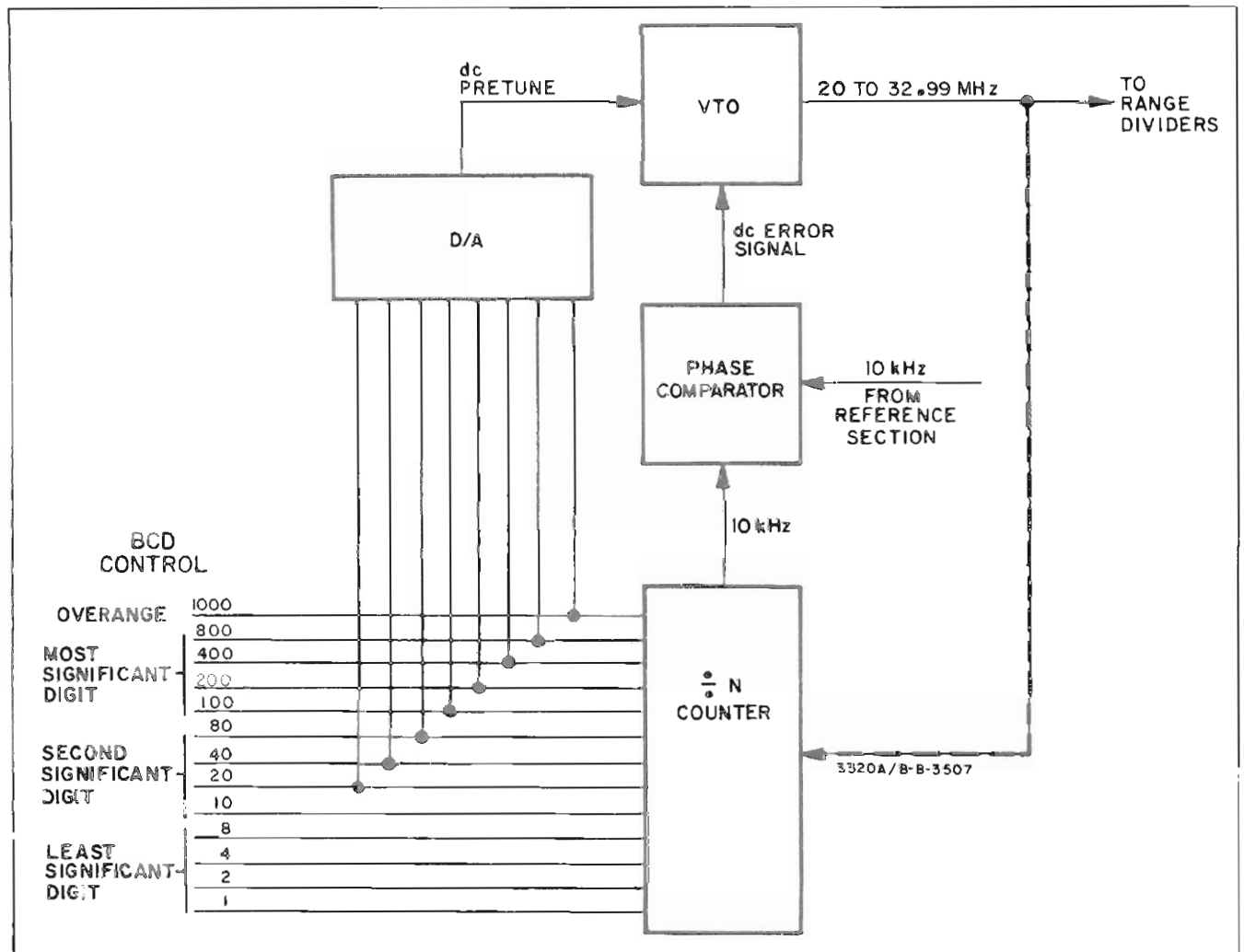


Figure 4-10. VTO and Phase Lock Loop.

4-41. Frequency Section.

4-42. The frequency section of the 3320A/B is composed of a BCD controlled voltage tuned oscillator (VTO), phase locked to a 10 kHz reference signal, and six range dividers, including Option 006 (see Figure 4-2).

4-43. The output frequency of the frequency section is variable from 20 MHz to 32.99 MHz with the vernier in/out control in the vernier out position. With the vernier in/out control in the vernier in position, two more additional digits are variable via the vernier oscillator making the output frequency of the frequency section 20 MHz to 32.9999 MHz. In the following discussion, the frequencies given are considered to be with the vernier in/out in the vernier out position. Refer to Paragraph 4-60 for a discussion of the vernier oscillator.

4-44. **VTO, Phase-Lock Circuitry.** The BCD signal, from the controller section, for the overrange digit and the two most significant digits of 3320A/B output frequency, is applied to a D/A converter on the VTO assembly (see Figure 4-10). The D/A converter converts the BCD signal to a dc voltage which is applied to the VTO as a pretune voltage. This sets the VTO close to the desired frequency.

4-45. Precise frequency control is achieved by phase-locking the output of the VTO to a 10 kHz reference signal from the reference oscillator. This is accomplished by applying the output of the VTO to a $\div N$ counter. The $\div N$ number is controlled by the same BCD signal which pretuned the VTO plus the BCD signal for the remainder of the frequency digits. This signal sets the $\div N$ counter in such a manner that the counter will divide the output of the VTO to 10 kHz (refer to Paragraph 4-70 for a detailed discussion on the $\div N$ counter). The 10 kHz output from the $\div N$ counter is applied to a phase comparator where it is compared to a 10 kHz signal from the reference oscillator. Any difference in phase between the two signals will be developed as a dc voltage. This dc voltage is applied to the VTO to correct its frequency.

4-46. **Range Dividers.** The output signal of the VTO is applied either to the amplitude section or to a series of range dividers, depending on the position of the range control. Seven ranges are available on the 3320A/B, including Option 006. Table 4-1 lists the range positions, the number of range dividers used for each position, and the output frequency of each range divider.

4-47. With the range control in the 10 MHz position, the output of the VTO (20 MHz to 32.99 MHz) is applied directly to the amplitude section. In the amplitude section, the signal is mixed with 20 MHz and the difference frequency (0 Hz to 12.99 MHz) is available at the 3320A/B output jack.

4-48. With the range switch in any position other than the MHz position, the output of the VTO is applied to one or more of the range dividers. Each divider uses a divide and mix technique to increase the resolution of the output signal by one decade while decreasing the maximum frequency by one decade (see Figure 4-11). For example, if the range control is placed in the 1000 kHz position, the VTO output (20 MHz to 32.99 MHz) is divided by 10 (2 MHz to 3.299 MHz) and mixed with 18 MHz from the reference section. The sum of these two signals (20 MHz to 21.299 MHz) is applied to the amplitude section. This signal is mixed with 20 MHz in the amplitude section, and the difference frequency (0 Hz to 1299 kHz) is available at the 3320A/B output jack.

4-49. Amplitude Section.

4-50. **3320A Amplitude.** The 3320A output signal is variable from 0 dBm to 13 dBm, into 50 ohms, by a front panel potentiometer. The potentiometer applies a dc voltage to a modulator to amplitude modulate a 20 MHz signal from the reference section (see Figure 4-12). The leveled (amplitude modulated) 20 MHz is applied to a mixer where it is mixed with the 20 MHz to 32.99 MHz from the frequency section. The difference frequency out of the mixer (0 Hz to 12.99 MHz) is amplified, filtered, and amplified again before it is applied to the 3320A output.

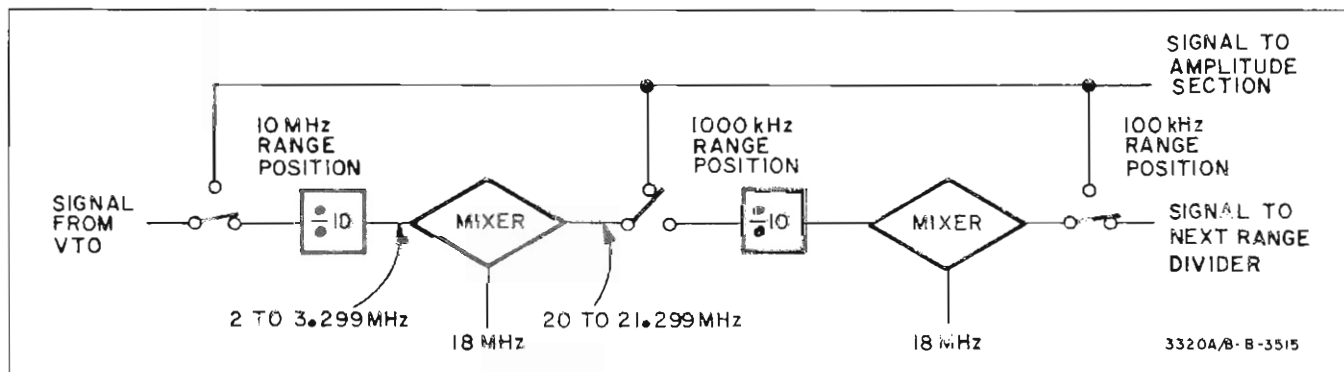


Figure 4-11. Range Dividers.

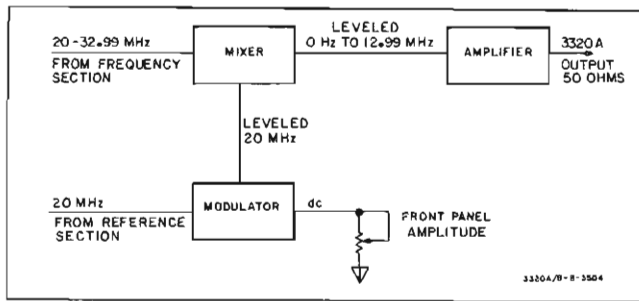


Figure 4-12. 3320A Amplitude Section.

4-51. **3320B Amplitude.** The 3320B output signal is variable from +26.99 dBm to -69.99 dBm (-73.00 dBm in remote mode) into 50 ohms. The three least significant digits are controlled by amplitude modulating the 20 MHz from the reference section with a dc voltage and applying the modulated 20 MHz to the output mixer (see Figure 4-13). The most significant digit is controlled by a 10 dB/step attenuator at the 3320B output.

4-52. The dc voltage used to modulate the 20 MHz signal originates in the D/A converter assembly (A11). The D/A converter consists of a counter, clocked with a 2 MHz signal

from the Reference Oscillator, and a series of FET switches controlling the charge and discharge of a capacitor (see Figure 4-14). The BCD signal from the controller section determines the length of time the counter counts. At T_0 , switch A is closed allowing C_1 to charge to 10 V. Switch A is opened and switch B is closed allowing C_1 to discharge through R_1 . When the counter has counted the length of time allowed by the BCD signal, switch B is opened and switch C is closed. The dc voltage remaining on C_1 is transferred to holding capacitor, C_2 . From C_2 , the dc level is applied to the Modulator as a pretune dc, and the Leveling assembly.

4-53. The Leveling assembly consists of a thermopile circuit and a comparator (see Figure 4-13). The signal applied to the thermopile circuit is determined by the position of the LEVELING control. When the LEVELING control is in the ON position, the 3320B output is applied to the thermopile circuit. When the LEVELING control is in the OFF position, the 20 MHz from the modulator is applied to the thermopile circuit. The thermopile circuit detects the signal and applies the dc to the comparator. This dc is compared to the dc from the D/A converter. Any difference in the two dc levels is applied to the modulator

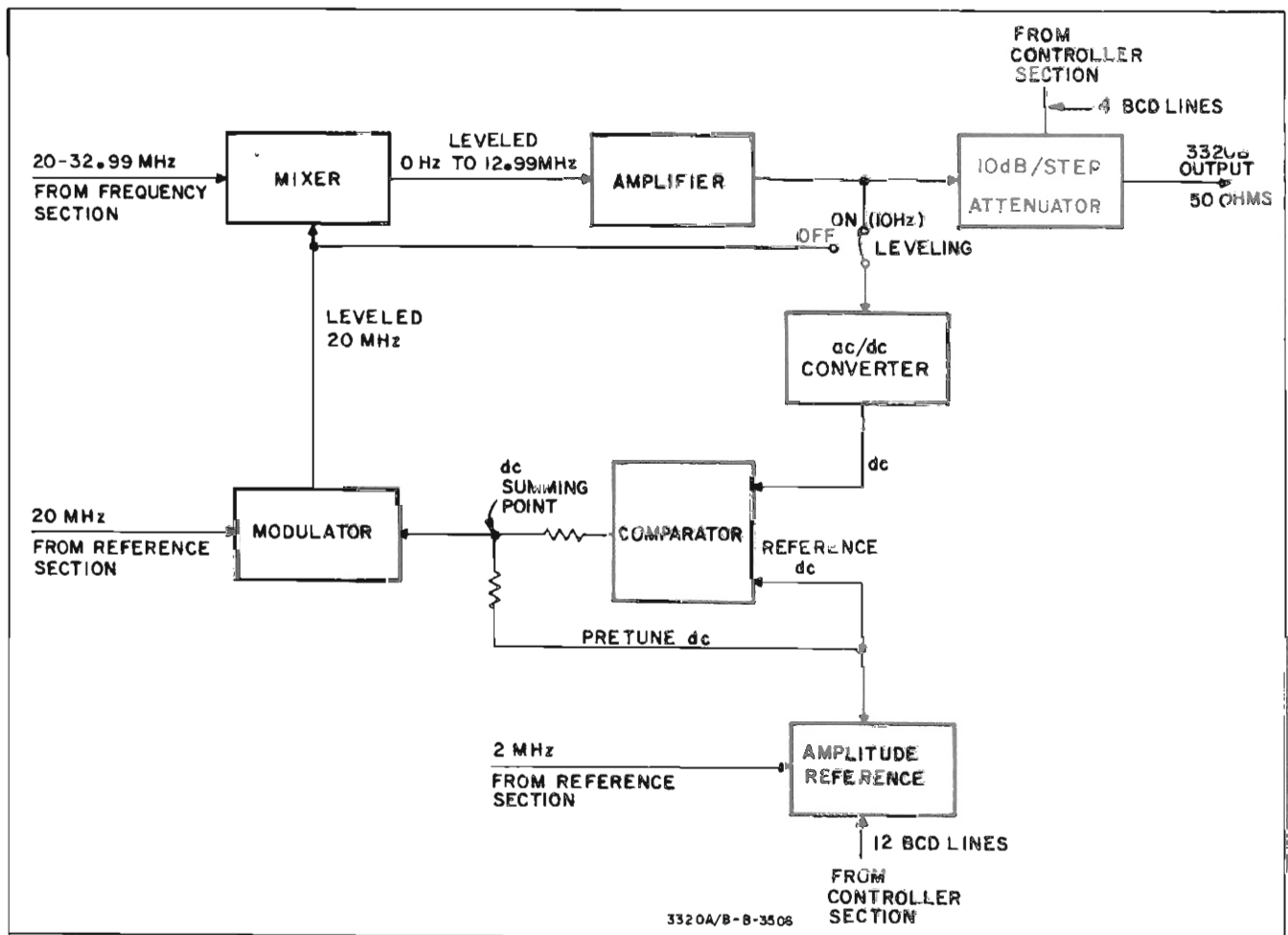


Figure 4-13. 3320B Amplitude Section.

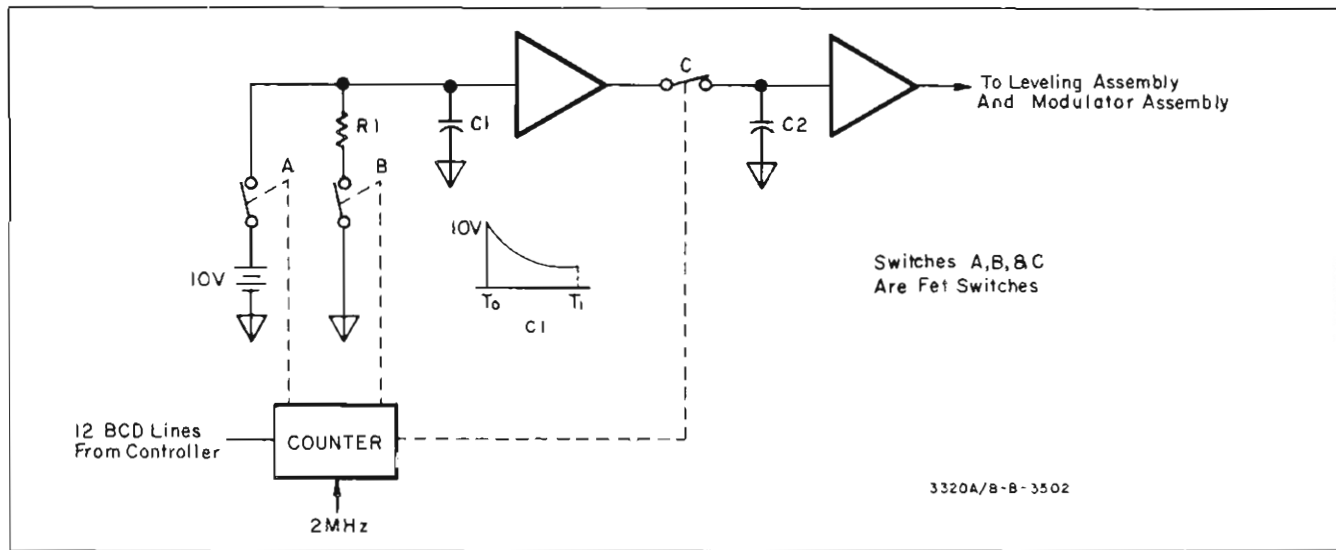


Figure 4-14. Simplified Amplitude Reference.

to correct the amplitude of the leveled 20 MHz. See Paragraph 4-63 for a detailed discussion of the thermopile circuitry.

4-54. The leveled 20 MHz is applied to a mixer where it is mixed with the 20 MHz to 32.99 MHz from the frequency section. The difference frequency out of the mixer (0 Hz to 12.99 MHz) is amplified, filtered, and amplified again before it is applied to a BCD controlled 10 dB/step attenuator assembly.

4-55. The 10 dB/step attenuator is capable of switching in up to 90 dB of attenuation in 10 dB steps. The leveled 20 MHz is capable of applying 9.99 dB of attenuation in 0.01 dB, 0.1 dB, or 1 dB steps. These two attenuators work in conjunction to cover the 3320B range of +26.99 to

-69.99 dBm. At +26.99 dBm, both attenuators are applying 0 dB of attenuation. When attenuation is added, the first 9.99 dB is from the leveled 20 MHz. Then at +16.99 dBm, the 10 dB/step attenuator will supply 10 dB of attenuation and the leveled 20 MHz is back to 0 dB of attenuation. This operation continues through the attenuation range to -69.99 dBm. The switching points of the 10 dB/step attenuator below 0 dBm is -3.01 dBm, -13.01 dBm, -23.01 dBm, etc.

4-56. Reference Section.

4-57. The reference section of the 3320A/B consists of two voltage controlled crystal oscillators; a vernier oscillator, which is switched in and out with the vernier control, and a

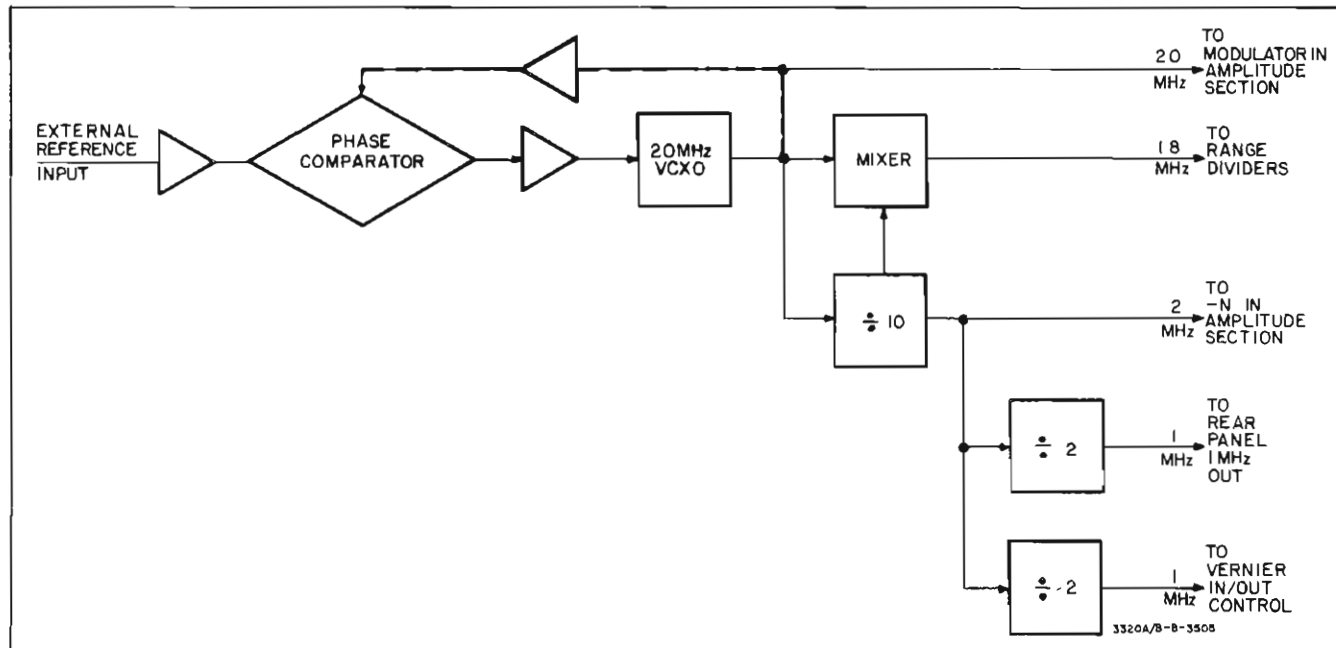


Figure 4-15. Reference Section.

20 MHz oscillator. The vernier oscillator can be used to vary the last two digits of the 3320A/B output frequency. The 20 MHz oscillator can be phase-locked to an external reference source.

4-58. 20 MHz Reference Oscillator. There are four frequencies supplied by the 20 MHz Reference Oscillator; 20 MHz, 18 MHz, 2 MHz, and 1 MHz (see Figure 4-15). The 20 MHz signal is applied to the amplitude section level control modulator directly from the 20 MHz oscillator. The 20 MHz signal is also applied to a $\div 10$ circuit and a mixer circuit on the 20 MHz Reference Oscillator assembly. The 2 MHz signal out of the $\div 10$ is applied to the mixer and mixed with the 20 MHz signal. The difference frequency of 18 MHz is applied to the range dividers in the frequency generating section. The 2 MHz from the $\div 10$ circuit is also applied to the $\div N$ Variable Modulus Counter in the amplitude section and to two $\div 2$ circuits on the 20 MHz Reference Oscillator assembly. The 1 MHz from one of the $\div 2$ circuits is applied to the rear panel 1 MHz OUT jack. The 1 MHz from the second $\div 2$ circuit is applied to the VERN IN/OUT control. With the VERN IN/OUT control in the VERN OUT position, the 1 MHz is applied to a $\div 100$ circuit on the Vernier Oscillator assembly. The 10 KHz from the $\div 100$ circuit is applied to the phase-lock loop in the frequency generating section.

4-59. A phase-lock circuit is provided for phase locking an external frequency reference to the 20 MHz oscillator. The external frequency reference, such as the 5 MHz oven stabilized reference oscillator (Option 002) is applied to a phase comparator on the Phase-Lock assembly. Here, it is compared to a portion of the 20 MHz output. Any difference in phase between the two signals will create a dc voltage which is applied to the 20 MHz oscillator to change its output frequency.

4-60. Vernier Oscillator. The Vernier Oscillator is a 10 MHz voltage controlled crystal oscillator. The output of the oscillator is applied to a $\div 10$ circuit (see Figure 4-16). The 1 MHz from the $\div 10$ circuit is applied to the VERN IN/OUT control. With the VERN IN/OUT control in the VERN IN position, the 1 MHz from the $\div 10$ circuit is applied to a $\div 100$ circuit. The 10 KHz from the $\div 100$ circuit is applied to the phase-lock loop in the frequency generating section.

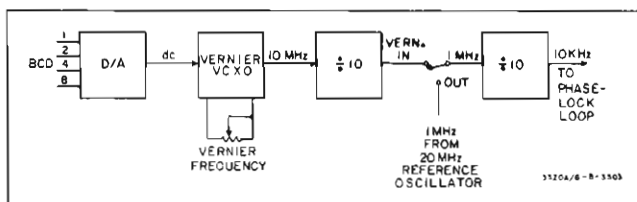


Figure 4-16. Vernier Oscillator.

4-61. The Vernier Oscillator can be tuned by either a front panel vernier control or by remote programming. The front panel control allows the 10 MHz from the oscillator to be varied which in turn varies the 10 kHz reference to the phase-lock loop in the frequency section. Varying the

10 kHz reference will vary the last two digits of the 3320A/B output frequency (Vernier digits) from 00 to 99. Remote programming allows the most significant of these two digits to be varied from 0 to 9. Remote programming can be accomplished by the BCD remote programming Option 003 for the 3320A model or by the BCD remote programming Option 004 or ASCII remote programming Option 007 in the 3320B. With all programming options, a BCD 8-4-2-1 signal is applied to a D/A converter on the Vernier Oscillator assembly. The dc voltage from the D/A is applied to the oscillator to vary its output frequency.

4-62. UNIQUE CIRCUITS.

4-63. 3320B Thermopile Circuitry.

4-64. When the 3320B LEVELING is ON (> 10 Hz), the AC/DC converter monitors the output of the power amplifier (see Figure 4-13). The converter converts this signal to a dc voltage which is compared to a dc amplitude reference. The resulting difference voltage is amplified by the comparator. The comparator output changes the level of the 20 MHz output of the Modulator. This, in turn, changes the level out of the mixer and the power amplifier. The level change out of the power amplifier is monitored by the converter and allows the converter output to approach the amplitude reference level.

4-65. When the 3320B LEVELING circuit is off, the AC/DC converter monitors the 20 MHz output of the Modulator (see Figure 4-13). The AC/DC converter converts this signal to a dc voltage which is compared to a dc amplitude reference. The resulting difference voltage is amplified by the comparator and used to adjust the 20 MHz output of the Modulator. When the LEVELING circuit is off, the Mixer and Power Amplifier are not included in the amplitude leveling loop.

4-66. AC/DC Converter. A simplified diagram of the AC/DC converter is shown in Figure 4-17. The converter utilizes a thermopile and responds to the RMS value of the input signal. The input signal drives a resistive load which is the heater element for the thermopile. The extremely flat frequency response of the thermopile allows the leveling loop to function effectively over a very broad frequency range.

4-67. An increased signal level into the converter causes point 2 to go more positive which will cause point 3 to go more positive. This increased voltage at 3 increases the voltage at 4. This causes point 4 to approach the same voltage as point 2. Since the thermopiles are matched, the RMS voltage at point 1 is very nearly equal to the dc level at point 3 (1 volt ac at point 1 yields 1 volt dc at point 3).

4-68. Protection Circuits. A simplified diagram of the AC/DC converter and the associated protection circuits are shown in Figure 4-18. The protection circuits are designed to protect the thermopile and Output Amplifier from overvoltage caused by instrument malfunction or by accidental application of voltage to the output terminals. If the

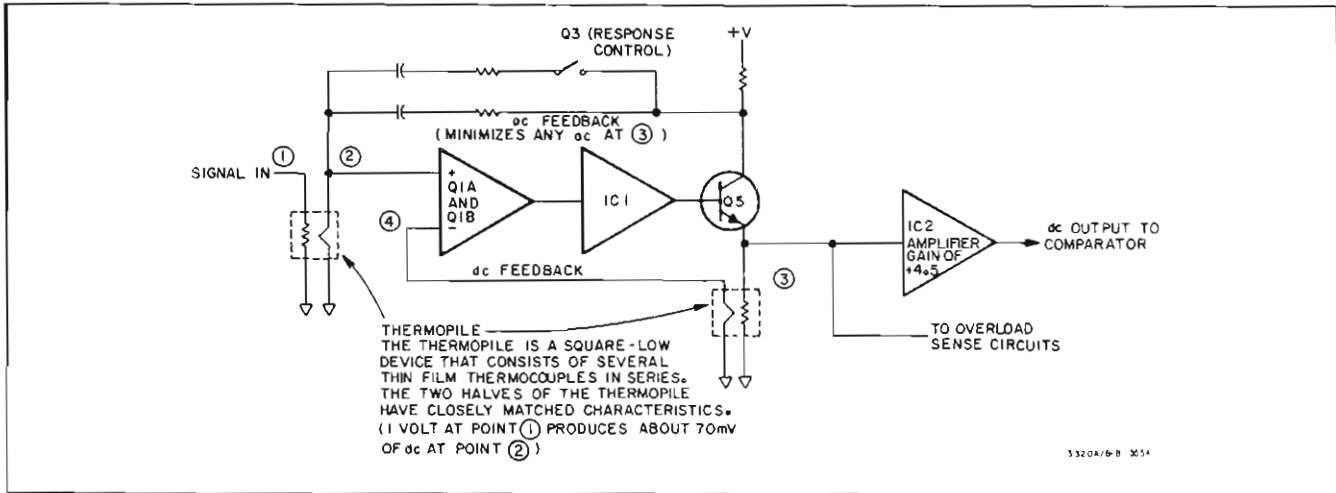


Figure 4-17. AC/DC Converter In The Amplitude Section.

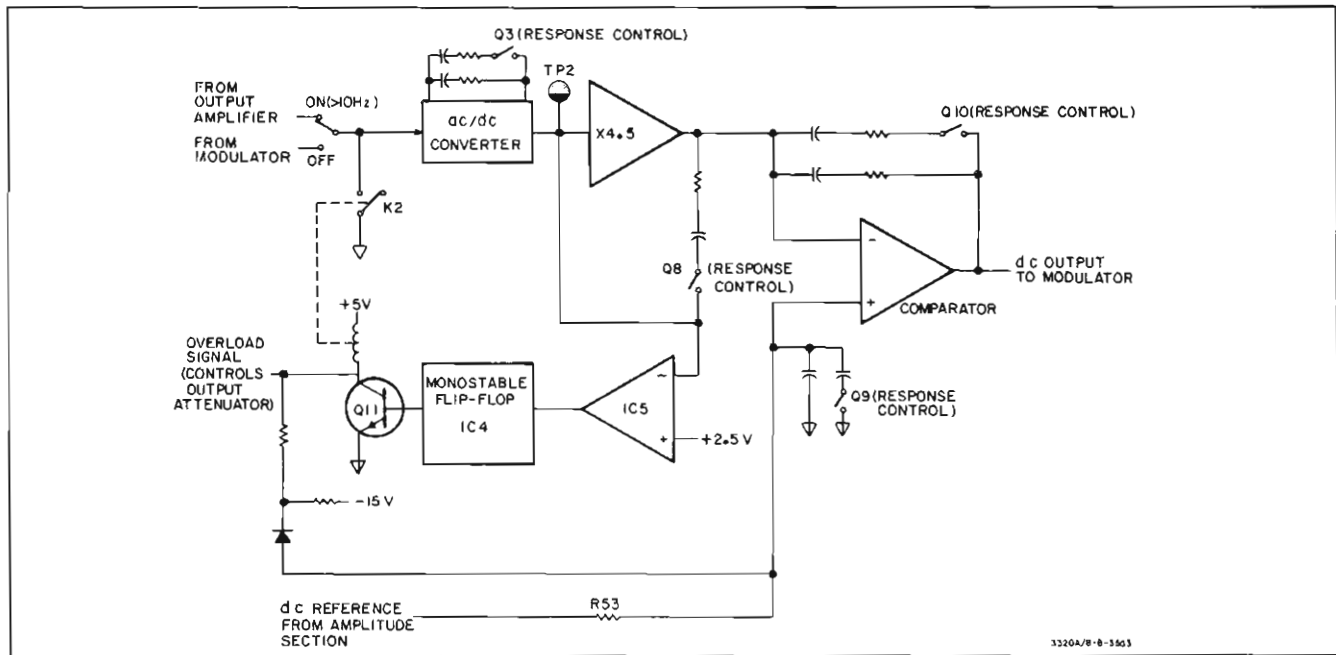


Figure 4-18. AC/DC Converter With Overload Circuits.

voltage at TP2 exceeds about +2.5 volts, IC5 sets the Monostable Flip-Flop. This causes K2 to close shorting the converter input to ground and the output attenuator to provide at least 40 dB of attenuation. While the Monostable Flip-Flop is set, the voltage at TP2 approaches 0 volts. At the end of 5 seconds, the Monostable returns to its normal state. If the overload condition still exists, the Monostable is set again. The resistor and diode between the output of Q11 and the dc reference pulls the dc reference line negative during overload. This reduces the 20 MHz signal out of the Modulator.

4-69. The response is set to SLOW for the standard 3320B. This requires the four response control switches shown in Figure 4-18 to be closed. Options 003, 004 and 007 allow

the response to be remotely programmed to FAST. FAST response requires these four switches to be open.

4-70. The ÷ N Counter.

4-71. Refer to Figure 4-10 for the block diagram of the VTO Phase Lock Loop containing the ÷ N Counter. The purpose of the VTO Phase Lock Loop is to provide an output frequency to the amplitude section. The range of the output frequency from the VTO depends on the position of the vernier control switch:

| Vernier | VTO Output |
|---------|-------------------|
| In | 20 to 32.9999 MHz |
| Out | 20 to 32.99 MHz |

The actual output frequency depends on the frequency setting selected.

NOTE

For the following discussion, the vernier in/out control is considered to be in the out position.

4-72. The function of the ÷ N Counter in the VTO Phase Lock Loop is to divide the output of the VTO (20 to 32.99 MHz) by some number N. The number N is determined by the BCD control lines from the controller. The output of the ÷ N Counter is compared with the 10 kHz reference signal from the frequency reference section. If the output of the ÷ N Counter is not equal to the 10 kHz reference signal, an error signal is generated to tune the VTO to the proper frequency. When the output of the ÷ N is exactly 10 kHz, the Loop is phase locked to the 10 kHz reference and the VTO will be tuned to the correct frequency. When a new frequency is selected, a different ÷ N number is set by the BCD control lines. At the same time, the D/A converter pretunes the VTO to a frequency close to the required output and then the Phase Lock Loop tunes the VTO to the required frequency. When the loop is phase locked, the output of the ÷ N counter is 10 kHz and the frequency of the VTO is given by the following formula:

$$\text{VTO frequency} = N \times 10 \text{ kHz}$$

Where N = ÷ N number between 2000 and 3299

Since the 3320A/B uses Range Dividers to provide additional resolution, the output of the VTO always varies between 20 MHz and 3299 MHz independent of RANGE setting. The ÷ N number varies between 2000 and 3299 at each range setting as shown in Table 4-3.

4-73. The ÷ N Counter utilizes three presettable decade counters and the control circuits shown in Figure 4-19. The presettable counters and the A Flip-Flop are set to a "preset" number by the BCD control lines. The counter starts counting the VTO cycles starting with the preset

number. The ÷ N Counter counts up to a maximum number of 3999 (Sense No.). Each time the 3999 number is reached, a completed pulse is supplied to the Phase Comparator.

The basic sequence of operation for the ÷ N Counter is:

- 1) Load Preset Number (from BCD control lines).
- 2) Count VTO frequency until counter reaches 3999 (maximum count).
- 3) Provide output pulse to Phase Comparator.
- 4) Repeat cycle.

Since the maximum number that the counter can achieve is 3999, the preset number may be determined by subtracting the N number from 3999 (preset = 3999 - N), for example:

Maximum frequency (any range)
 VTO = 32.99 MHz
 N = 3299
 Preset Number = 0700 = 3999 - 3299

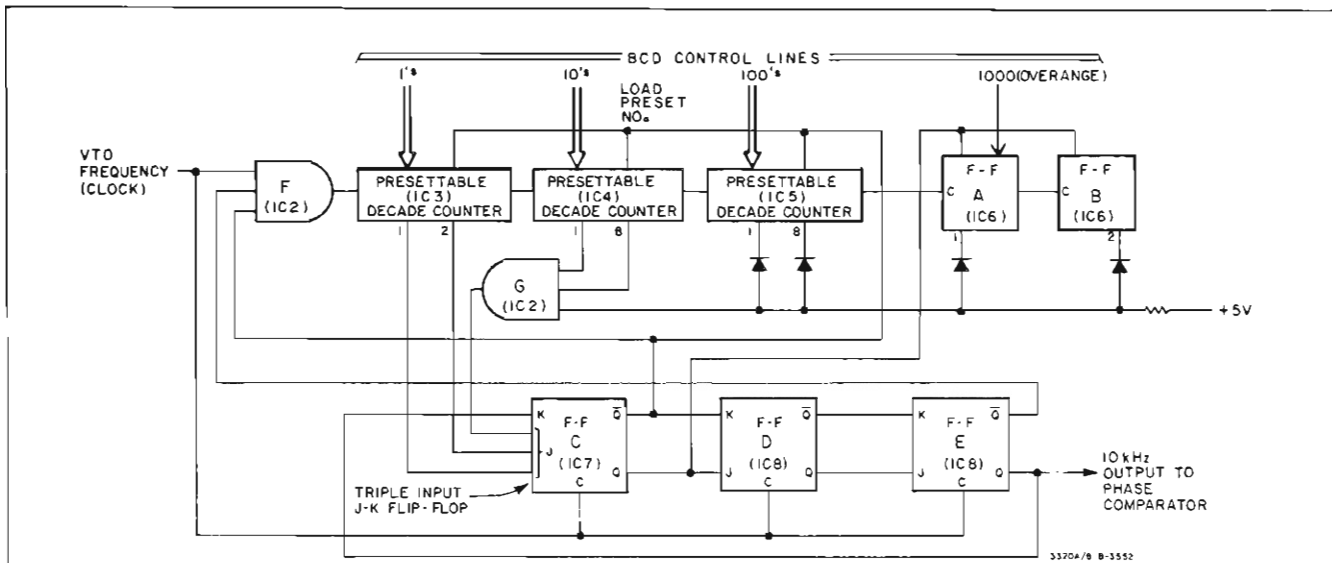
Minimum frequency (0 Hz)
 VTO = 20.00 MHz
 N = 2000
 Preset Number = 1999 = 3999 - 2000

If the VTO frequency is unknown, proceed as follows:

1. To determine the VTO frequency, add 20 MHz to the desired output frequency.
2. To determine the N number, divide the VTO frequency by 10 kHz. This number is always between 2000 and 3299.
3. To determine the preset number, subtract the N number from 3999. This number is always between 0700 and 1999.

Table 4-3. Frequency Setting vs. ÷ N Number.

| FREQUENCY RANGE/SETTING | | | | | F _{VTO} (A3TP3) | ÷ N Number |
|-------------------------|----------|-----------|-----------|----------|-----------------------------|---------------|
| 10 MHz | 1000 kHz | 100 kHz | 10 kHz | 1000 Hz | | |
| 0 Hz | 0 Hz | 0 Hz | 0 Hz | 0 Hz | 20 MHz | 2000 |
| 5 MHz | 500 kHz | 50 kHz | 5 kHz | 500 Hz | 25 MHz | 2500 |
| 10 MHz | 1000 kHz | 100 kHz | 10 kHz | 10000 Hz | 30 MHz | 3000 |
| 12.99 MHz | 1299 kHz | 129.9 kHz | 12.99 kHz | 1299 Hz | 32.99 MHz | 3299 |



| Counting Sequence | Flip-Flops | | Presettable Decade Counters | | | | Flip-Flops | | | Gates | | Remarks |
|-------------------|------------|---|-----------------------------|-----|-------|-------|------------|---|---|----------|----------|---|
| | B | A | IC5 | IC4 | IC3 | | C | D | E | F | G | |
| | | | | | BCD 2 | BCD 1 | | | | | | |
| Preset Number | 0 | * | * | * | * | * | 0 | 0 | 0 | Enabled | Disabled | Start of Cycle |
| Preset + 1 | † | † | † | † | † | † | ↑ | ↑ | ↑ | ↑ | . | |
| . | . | . | . | . | . | . | ↑ | ↑ | ↑ | ↑ | . | |
| . | . | . | . | . | . | . | ↑ | ↑ | ↑ | ↑ | . | |
| 3990 | 1 | 1 | 9 | 9 | 0 | 0 | ↑ | ↑ | ↑ | ↑ | Enabled | Gate G Enabled |
| . | 1 | 1 | 9 | 9 | 0 | 1 | ↑ | ↑ | ↑ | ↑ | ↑ | |
| . | 1 | 1 | 9 | 9 | 1 | 0 | ↓ | ↓ | ↓ | ↓ | ↓ | |
| 3993 | 1 | 1 | 9 | 9 | 1 | 1 | 0 | 0 | 0 | Enabled | Enabled | |
| 3994 | 0 | * | * | * | * | * | 1 | 0 | 0 | Disabled | Disabled | Counters and F-F 1 are preset. F-F B is cleared. |
| 3995 | 0 | * | * | * | * | * | 1 | 1 | 0 | ↑ | ↑ | |
| 3996 | 0 | * | * | * | * | * | 1 | 1 | 1 | ↑ | ↑ | Output to phase comparator goes high |
| 3997 | 0 | * | * | * | * | * | 0 | 1 | 1 | ↓ | ↓ | |
| 3998 | 0 | * | * | * | * | * | 0 | 0 | 1 | Disabled | ↓ | |
| 3999 | 0 | * | * | * | * | * | 0 | 0 | 0 | Enabled | Disabled | Output to phase comparator goes low and cycle repeats |

* Set to preset number
 † Preset number + 1

Figure 4-19. ÷ N Control Logic Diagram.

An example of how the preset number is determined by the BCD control lines is shown in Table 4-4.

G is enabled. At 3993, all three J inputs at Flip-Flop C are high. At 3994, Gate F is disabled but the count continues by clocking Flip-Flops C, D, and E until 3999 is reached. At 3996, the output to the phase comparator goes high and remains high until 3999 is reached.

4-74. The table in Figure 4-19 shows the counting sequence for the ÷ N Counter. When the counter reaches 3990, Gate

Table 4-4. Preset Number.

| Title | Overrange Digit | Most Significant Digit | 2nd Most Significant Digit | 3rd Most Significant Digit |
|--------------------------------------|-----------------|------------------------|----------------------------|----------------------------|
| Frequency Control Digits | 1 | 2 | 6 | 5 |
| BCD Code of Frequency Control Digits | 1 | 0010 | 0110 | 0101 |
| Code to ÷N Counter | 1 | 0111* | 0011* | 0100* |
| Preset Number | 0 | 7 | 3 | 4 |

*The required preset number is the 9's complement of the corresponding Frequency Control Digits

Summation of table:

$$N = 3999 - 734 = 3265$$

$$VTO \text{ Frequency} = 3265 \times 10 \text{ kHz} = 32.650000 \text{ MHz}$$

SECTION V

MAINTENANCE

5-1. INTRODUCTION.

5-2. This section contains the information necessary for maintenance of the Model 3320A/B Frequency Synthesizer. Included is a list of test equipment required, in-cabinet performance tests for standard and options, adjustment procedures for standard and options, and front panel disassembly procedures.

5-3. TEST EQUIPMENT.

5-4. The test equipment required for the maintenance of the 3320A/B is listed in Table 5-1. If the recommended model is not available, use a substitute that meets the required characteristics.

NOTE

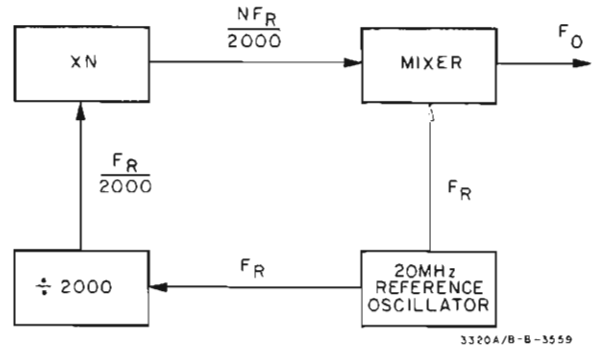
To insure proper stabilization of all circuitry, allow a 30-minute warmup period before beginning any performance tests or adjustment procedures.

5-5. PERFORMANCE TESTS.

5-6. The following performance tests compare the 3320A/B performance with the list of specifications given in Table 1-1. These tests may be used for incoming inspection, periodic maintenance, or to verify specifications after repair. A Performance Test Card is provided at the end of this section for recording the performance of the instrument during the performance tests. The card may be removed from the manual as a permanent record. If the instrument fails to meet any of its specifications, perform the adjustment procedures outlined in Paragraph 5-27. During the performance test, periodically vary the line voltage $\pm 10\%$ with a power line transformer to insure proper operation at various ac line voltages. When checking the performance of Option 001, use a 75 ohm to 50 ohm adapter on the output of the 3320A/B (excluding Paragraphs 5-17 and 5-21). Refer to Figure 5-7 for part numbers and diagram of 75 ohm to 50 ohm adapter.

5-7. Frequency Accuracy, Vernier Out.

5-8. This performance test insures the 3320A/B meets the Frequency Accuracy performance specifications listed in Table 1-1 when the vernier control is in the out position. The output frequency of the 3320A/B is derived from the 20 MHz Oscillator as follows:



The XN circuitry is controlled by a phase lock loop. If either the $\div 2K$ or the XN number is incorrect, the loop will not lock. The following formula can be used to derive F_O :

$$F_O = \frac{N F_R}{2000} - F_R = F_R \frac{(N - 2000)}{2000} = F_R (K)$$

If $F_O = F_R(K)$ and if the phase lock loop is locked up, any frequency error in F_O must be due to F_R (20 MHz). This performance test measures the accuracy of the 20 MHz Reference Oscillator and the output of the 3320A/B to insure phase lockup. The Frequency Accuracy specification listed in Table 1-1 with the Vernier out is $\pm 0.001\%$ of setting.

a. Connect an electronic counter to the 1 MHz output jack on the 3320A/B rear panel. The counter indication should be 1.000000 MHz \pm 10 Hz.

b. Connect the counter to the 3320A/B front panel OUTPUT jack.

c. Set the 3320A/B RANGE to MHz and FREQUENCY to 12.22. Set VERN IN/OUT to VERN OUT. The counter indication should be 12.220000 MHz \pm 122 Hz.

d. Set the 3320A/B FREQUENCY to 1.10. The counter indication should be 1.100000 MHz \pm 11 Hz.

e. Set the 3320A/B FREQUENCY to 00.01. Set the counter TIME BASE to .1 μ s and FUNCTION to PERIOD AVERAGE 10 K. The counter indication should be 100.00000 μ s \pm 1 ns.

5-9. Frequency Accuracy, Vernier In.

5-10. The 3320A/B uses two unrelated reference oscillators to derive the output frequency when the vernier control is

Table 5-1. Test Equipment Required.

| Instrument Type | Required Characteristics | Recommended Model |
|-----------------------|---|--|
| Electronic Counter | Frequency: dc to 33 MHz Time Base: .1 μ sec to 10 sec Period Average: 1 to 100 K Output: 100 kHz, 1 MHz, 10 MHz (rear panel) 10 MHz (front panel) Sensitivity: 1 mV | -hp- Model 5245L with 5261A plug-in |
| Wave Analyzer | Frequency: 20 Hz to 16 MHz Amplitude: 100 μ V to 30 V B.W.: 10 Hz Outputs: Recorder Dynamic Range: > 70 dB | -hp- Models 312A and 3590A (with 3593A plug-in) |
| ac Voltmeter | Range: 7.000 mV \pm 70 μ V to 5 V \pm 25 mV Frequency: 50 Hz to 100 kHz | -hp- Model 3450A |
| ac Voltmeter | Dynamic Range: 100 dB B.W.: 1 Hz | -hp- Model 403A |
| Oscilloscope | Dual channel (Ch. B. Trigger); Frequency: dc to 13 MHz Accuracy: \pm .1% of setting | -hp- Model 180A (with 1801A and 1820A plug-ins.) |
| dc Voltmeter | Voltage Range: 100 mV to 30 V Accuracy: \pm 0.05% | -hp- Model 3450A |
| Spectrum Analyzer | Frequency: 10 MHz to 48 MHz Response: \pm 0.5 dB | -hp- Model 8553B/8552A (in 141S display) |
| Attenuator | Attenuation: 20 dB in 10 dB steps Accuracy: \pm 0.01 dB | -hp- Model 355D with known error |
| Attenuator | Attenuator: 10 dB in 1 dB steps | -hp- Model 355C |
| Thermocouple | Input: 3 V rms Output: 7.0 mV dc Input Impedance: 50 ohms and 75 ohms | -hp- Model 11049A -hp- Model 11049-H01 (for Option 001) |
| Double Balanced Mixer | Frequency: 100 kHz to 13 MHz | -hp- Model 10534A |
| Low Pass Filter | Frequency: 150 kHz | See Figure 5-4 |
| Low Pass Filter | Frequency: 15 kHz | See Figure 5-5 |
| Feed thru Termination | Impedance: 50 ohms \pm 0.2% 75 ohms \pm 0.2% | -hp- Model 11048C -hp- Model 11094C |
| Resistors | 10 ohm (2 each) 100 ohm (1 each) 10 kilohm (1 each) | -hp- Part No. 0757-0489 -hp- Part No. 0757-0178 -hp- Part No. 0757-0340 |
| Capacitors | .0068 μ F (1 each) 1300 pF (1 each) .012 μ F (1 each) 1600 pF (1 each) | -hp- Part No. 0160-0159 -hp- Part No. 0160-2221 -hp- Part No. 0160-0301 -hp- Part No. 0160-2223 |
| Coil | 150 μ h (1 each) | -hp- Part No. 9100-1639 |
| Oscillator | Signal to Noise Ratio: > 60 dB down Spurious: > 80 dB down Frequency: 5 MHz and 1 MHz | -hp- 105A/B |
| Frequency Doubler | Frequency: 5 MHz Impedance: 50 ohms | -hp- Model 10515A |

in the IN position. This performance test insures the instrument meets the Frequency Accuracy specifications listed in Table 1-1. The specification is 0.01% of range.

- a. Connect an electronic counter to the 3320A/B front panel OUTPUT jack.
- b. Set the 3320A/B RANGE to MHz, VERN IN/OUT to VERN IN, and FREQUENCY to 00.0150. The counter indication should be 15.000 kHz \pm 1.0 kHz.
- c. Set the 3320A/B FREQUENCY to 12.9999. The counter indication should be 12.9999 MHz \pm 1.0 kHz.
- d. Step the RANGE to each of the lower positions. The counter indication in Step c should be divided by 10 with each step.

5-11. Harmonic Distortion.

5-12. This performance test insures the 3320A/B meets the Harmonic Distortion specification listed in Table 1-1. The specification is divided into three frequency ranges: - 60 dB from 5 Hz to 100 kHz, - 50 dB from 100 kHz to 1 MHz, and - 40 dB from 1 MHz to 13 MHz.

3320A:

- a. Connect the equipment as shown in Figure 5-1.
- b. Set the 3320A front panel controls as follows:

AMPLITUDE Full CW
 VERN IN/OUT VERN IN
 RANGE 100 kHz
 FREQUENCY 010.0

- c. Set the 355D to 10 dB, the 355C to 3 dB, and adjust the wave analyzer for a 0 dBm meter indication at 10 kHz.
- d. Tune the wave analyzer to the second, third, and fourth harmonics of the 10 kHz signal. Harmonic levels should be at least 60 dB below the reference level set in Step c.
- e. Repeat Steps c and d for the following FREQUENCY and RANGE settings:

| RANGE | FREQUENCY | Specifications |
|----------|-----------|----------------|
| 100 kHz | 129.9 | - 50 dB |
| 1000 kHz | 0150 | - 50 dB |
| 1000 kHz | 1299 | - 40 dB |
| 10 MHz | 04.00 | - 40 dB |

- f. Exchange the wave analyzer with a spectrum analyzer.
- g. Set the 3320A FREQUENCY to 7.00. Adjust the spectrum analyzer to display the 7.00 MHz reference signal and the second, third, and fourth harmonics.
- h. The harmonic signals should be at least 40 dB below the 7.00 MHz reference.

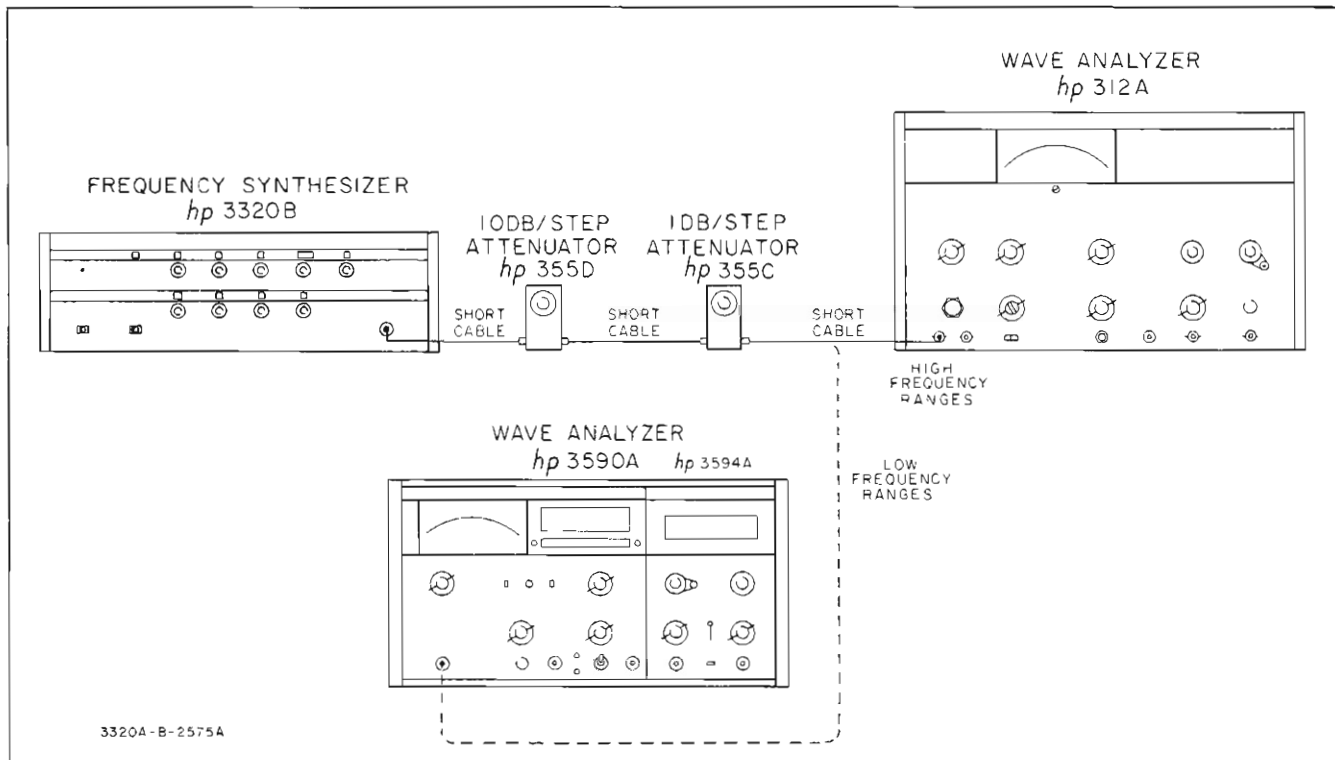


Figure 5-1. Harmonic Distortion.

i. Repeat Steps g and h for the frequency of 12.99 MHz.

3320B:

a. Use same procedure as 3320A with the following exceptions:

(1) In Step b, set AMPLITUDE to +26.99 dBm (+24.99, Option 001) and LEVELING to OFF.

(2) In Step c, set 355D to 20 dB and 355C to 7 dB.

5-13. Spurious.

5-14. This performance test insures the 3320A/B meets the Spurious (short term stability) specification listed in Table 1-1. The specification is >60 dB below the selected output or -110 dBm into 50 ohms, whichever is greater. A wave analyzer is used to check random spurious and 2, 1 spurious. The 2, 1 spurious is generated by the mixing action used to develop the 3320A/B output frequency (See Figure 5-2). The 2, 1 spurious is equal to $2F_2 - F_1$. For example, if the 3320A/B is programmed for an output frequency of 8 MHz, $F_1 = 28$ MHz and $2F_2 - F_1 = 40$ MHz - 28 MHz = 12 MHz = 2, 1 spurious. 10 kHz and 60 Hz sidebands are checked at 10 MHz by mixing the 3320A/B output frequency to 100 kHz and 10 kHz and monitoring the sidebands with a wave analyzer.

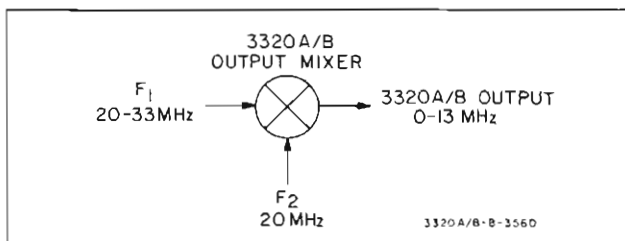


Figure 5-2. 3320 Output Section.

a. Connect a wave analyzer to the 3320A/B front panel OUTPUT jack. The 3590A wave analyzer with the 3593A or 3594A plug-in will cover the lower frequencies of the 3320A/B. The 312A wave analyzer will cover the upper frequencies.

b. Set the LEVELING ON (>10 Hz) (3320B) and adjust the 3320A/B AMPLITUDE and the wave analyzer for a convenient reference level on the wave analyzer meter.

c. Tune the wave analyzer through the entire frequency range of the 3320A/B. The wave analyzer meter indication should be >60 dB below the reference set in Step b or -110 dBm, whichever is greater.

NOTE

The 2, 1 spurious for a 3320A/B output frequency of 13 MHz is 7 MHz (40 MHz - 33 MHz). In Step c above, be sure to check at 7 MHz with the wave analyzer.

d. Connect the equipment as shown in Figure 5-3 (insure the 5 MHz oscillator is at 5,000,000.0 Hz).



DO NOT EXCEED THE RATED INPUT OF MIXER.

e. Set the 3320A/B RANGE to 10 MHz and FREQUENCY to 10.10. In 3320B, set LEVELING to ON (>10 Hz).

f. Adjust the amplitude of the 3320A/B and the wave analyzer to 0.1 V meter indication at 100 kHz.

g. Tune the wave analyzer to 90 kHz, 80 kHz, 70 kHz, and 60 kHz. Meter indications for 10 kHz sidebands should be >60 dB below the reference set in Step f or -110 dBm, whichever is greater.

h. Set the 3320A/B FREQUENCY to 10.01 and repeat Step f for 10 kHz.

i. Tune the wave analyzer to 10.060 kHz, 10.120 kHz, 10.240 kHz, and 10.300 kHz. Meter indications for the 60 Hz sidebands should be >60 dB below the reference set in Step f or -110 dBm, whichever is greater.

5-15. Signal To Phase Noise.

5-16. This performance test insures the 3320A/B meets the Signal to Phase Noise specifications listed in Table 1-1. The specification for signal to phase noise is >40 dB down in a 30 kHz band, excluding ± 1 Hz centered on carrier. This test uses a 5 MHz oscillator, with a frequency doubler, as a reference frequency. The output of the 3320A/B and the reference frequency are mixed and the difference signal is applied to a wideband ac voltmeter. When the 5 MHz oscillator is tuned slightly off frequency, the phase of the 3320A/B output signal will drift slightly. As the 3320A/B output and the reference oscillator drift through phase quadrature, the ac voltmeter will peak. This peak value is the maximum phase noise.

a. Connect the 5 MHz oscillator to a counter and adjust the frequency for 5,000,000.0 Hz.

b. Connect the equipment as shown in Figure 5-4.



DO NOT EXCEED THE RATED INPUT OF MIXER.

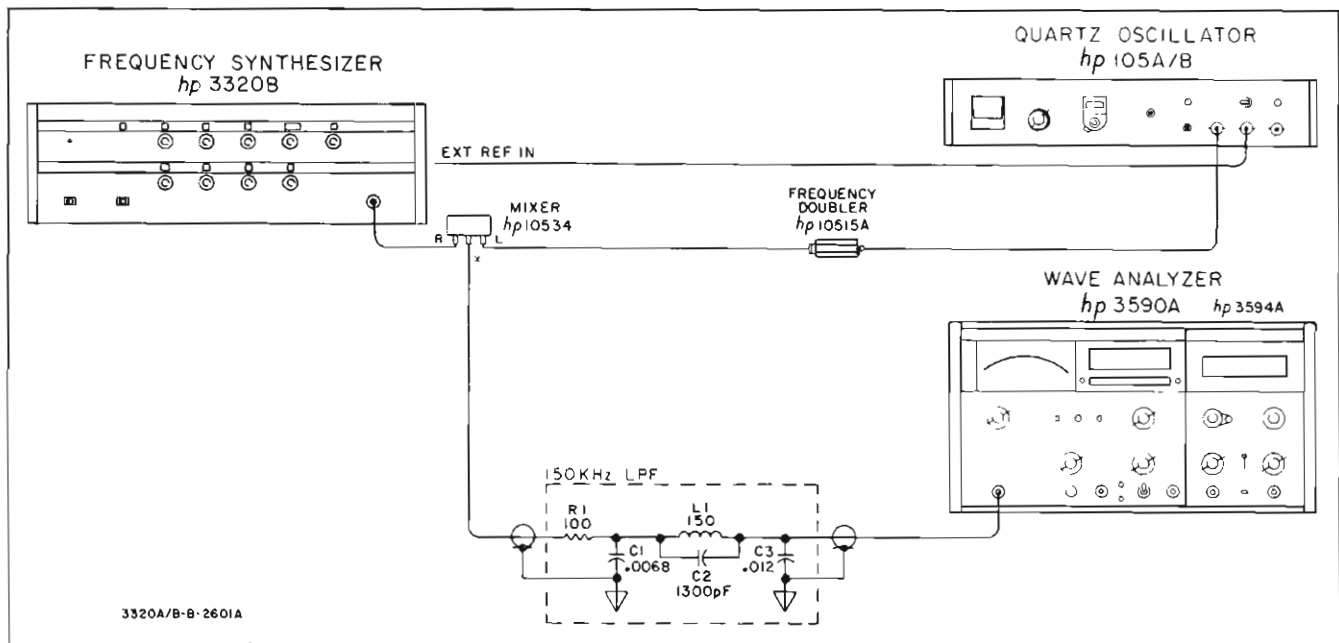


Figure 5-3. Spurious.

c. Set the 3320A/B RANGE to 10 MHz, FREQUENCY to 10.01, and VERN IN/VERN OUT to OUT. Adjust the 3320A/B amplitude for a convenient reference level on the ac voltmeter.

d. Set the oscilloscope DISPLAY to ALT B Trigger and adjust for a convenient display of both channels. The channel A signal will not lock.

e. Set the 3320A/B FREQUENCY to 10.00. Adjust the frequency of the 5 MHz oscillator until the channel A display on the oscilloscope is drifting *very* slowly.

f. Ground the Channel B input terminal on the oscilloscope and adjust the display for a convenient reference. Set the input terminal to dc.

g. Disconnect Channel B of the oscilloscope from point A (Figure 5-4) and connect to point B.

h. The oscilloscope display on Channel B should drift through 0 Vdc when the 3320A/B signal and the reference oscillator signal are in phase quadrature. The indication on the ac voltmeter, when the Channel B oscilloscope display is at 0 Vdc, should be > 40 dB below the reference set in Step c.

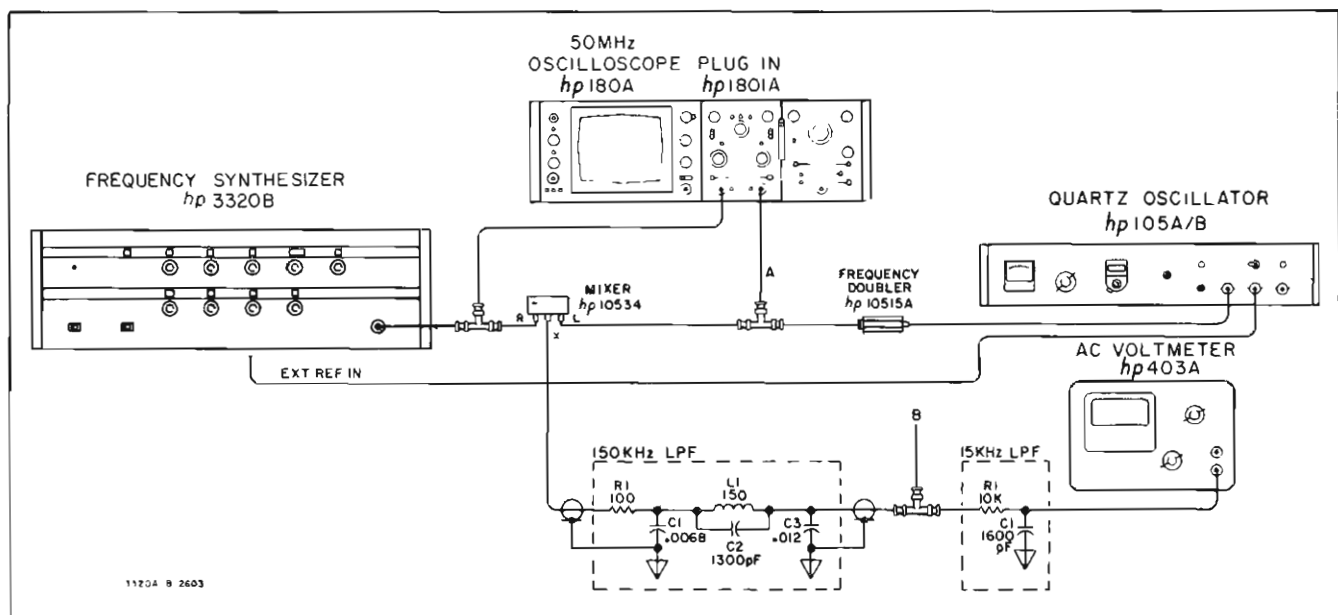


Figure 5-4. Signal to Phase Noise.

5-17. Amplitude Accuracy, Absolute.

5-18. This performance test insures the 3320A/B meets the absolute amplitude accuracy specifications listed in Table 1-1. The specifications are:

3320A Standard and Option 001:
 1 V rms \pm 10% into 50 ohms (75 ohms, Option 001).
 2 V rms \pm 10% open circuit.

3320B Standard:
 5.0 V rms \pm 0.5% into 50 ohms.
 10.0 V rms \pm 0.5% open circuit.

3320B Option 001:
 4.86 V rms \pm 0.5% into 75 ohms
 9.73 V rms \pm 0.5% open circuit.

3320A:

- a. Connect an ac voltmeter to the 3320A front panel OUTPUT jack through a 50 ohm load (75 ohm load, Option 001).
- b. Set the AMPLITUDE full clockwise. The ac voltmeter indication should be 1 V rms \pm 0.1 V rms.
- c. Remove the 50 ohm load (75 ohm load, Option 001). The ac voltmeter indication should be 2 V rms \pm 0.2 V rms.

3320B:

- a. Set the 3320B front panel controls as follows:

AMPLITUDE (3320B Standard) . . . + 26.99 dBm
 (3320B, Option 001) . . . + 24.99 dBm
 VERN IN/OUT VERN OUT
 RANGE 10 kHz
 FREQUENCY 10.00
 LEVELING ON (> 10 Hz)

- b. Connect an ac voltmeter to the 3320B front panel OUTPUT jack through a 50 ohm load (75 ohm load, Option 001). The ac voltmeter indication should be 5.000 V rms \pm 0.025 V rms (4.863 V rms \pm 0.024 V rms, Option 001).
- c. Remove the 50 ohm load (75 ohm load, Option 001). The ac voltmeter indication should be 10.000 V rms \pm 0.05 V rms (9.726 V rms \pm 0.048 V rms, Option 001).

**5-19. 3320A Frequency Response, 0.01 Hz - 13 MHz.
 3320B Frequency Response, 0.01 Hz - 10 Hz.**

5-20. This performance test insures the 3320A meets the Frequency Response specification listed in Table 1-1 over its entire frequency range. This test also insures the 3320B meets the Frequency Response specification listed in Table 1-1 from 0.01 Hz to 10 Hz. The specification for the

3320A is \pm 2 dB. The specification for the 3320B is \pm 0.5 dB (referenced to 10 kHz). The total frequency response specification for the 3320B covers all frequencies at all settings of the 10 dB output level attenuator. To test total frequency response of the 3320B perform this test; Frequency Response, 10 Hz - 13 MHz, Paragraph 5-21; and 3320B Output Attenuator Frequency Response, Paragraph 5-25.

3320A:

- a. Connect an oscilloscope to the 3320A front panel OUTPUT jack.
- b. Set the 3320A AMPLITUDE full CW, VERN IN/OUT to VERN OUT, RANGE to 10 kHz, and FREQUENCY to 10.00.
- c. Ground the input terminal of the oscilloscope and adjust the vertical position control to position the sweep at center. Set the input terminal to dc and adjust the vertical gain for 8 cm display.
- d. Set the oscilloscope vertical position control so the positive peaks of the display are on the center line.
- e. Set the 3320A front panel controls to the positions listed in Table 5-2. The peaks on the oscilloscope display should not vary more than 1 cm positive and 0.8 cm negative.

Table 5-2. 3320A Frequency Response (0.01 Hz - 13 MHz).

| RANGE | FREQUENCY | VERN IN/OUT |
|----------|-----------|-------------|
| 10 MHz | 12.99 | OUT |
| 10 MHz | 00.01 | OUT |
| 1000 kHz | 1299. | OUT |
| 1000 kHz | 0001. | OUT |
| 100 kHz | 129.9 | OUT |
| 100 kHz | 000.1 | OUT |
| 10 kHz | 12.99 | OUT |
| 10 kHz | 00.01 | OUT |
| 1000 Hz | 1299. | OUT |
| 1000 Hz | 0001. | OUT |
| 1000 Hz | 0000.99 | IN |
| 1000 Hz | 0000.50 | IN |
| 1000 Hz | 0000.10 | IN |

3320B:

- a. Connect an oscilloscope to the 3320B front panel OUTPUT jack.
- b. Set the 3320B front panel controls as follows:

AMPLITUDE (Standard) + 26.99 dBm
 (Option 001) + 24.99 dBm
 VERN IN/OUT VERN IN
 RANGE 10 kHz
 FREQUENCY 10.00
 LEVELING OFF

- c. Perform Steps c and d of the 3320A section of this performance check.
- d. Set the 3320B FREQUENCY, RANGE, and Vernier to the positions listed in Table 5-3. The peaks on the oscilloscope should not vary more than ± 0.2 cm.

Table 5-3. 3320B Frequency Response (0.01 Hz - 10 Hz).

| RANGE | FREQUENCY | Vernier |
|---------|-----------|---------|
| 1000 Hz | 0010 | 00 |
| 1000 Hz | 0005 | 00 |
| 1000 Hz | 0001 | 00 |
| 1000 Hz | 0000 | 99 |
| 1000 Hz | 0000 | 55 |
| 1000 Hz | 0000 | 10 |
| 1000 Hz | 0000 | 01 |

- d. Set the 3320B RANGE and FREQUENCY to the positions listed in Table 5-4. The dc voltmeter indication should not vary more than $\pm 70 \mu\text{V}$. Multiply the dc voltmeter indications by 71.5 to transpose the errors to mV indications. Record these adjusted indications. These readings will be used in the 3320B Output Attenuator Frequency Response performance test.

Table 5-4. 3320B Frequency Response (10 Hz - 13 MHz).

| RANGE | FREQUENCY |
|----------|-----------|
| 10 MHz | 12.99 |
| 10 MHz | 00.01 |
| 1000 kHz | 1299 |
| 1000 kHz | 0001 |
| 100 kHz | 129.9 |
| 100 kHz | 000.1 |
| 10 kHz | 12.99 |
| 10 kHz | 00.01 |
| 1000 Hz | 1299 |
| 1000 Hz | 0010 |

5-21. 3320B Frequency Response, 10 Hz - 13 MHz.

5-22. This performance test insures the 3320B meets the Frequency Response specifications listed in Table 1-1 with the 10 dB attenuator in the straight through position. The specification is ± 0.05 dB (referenced to 10 kHz).

- a. Set the 3320B front panel controls as follows:

AMPLITUDE (Standard) + 26.99 dBm
 (Option 001) + 24.99 dBm
 VERN IN/OUT VERN OUT
 RANGE 10 kHz
 FREQUENCY 10.00
 LEVELING ON (> 10 Hz)

- b. Connect the equipment as shown in Figure 5-5.
- c. Adjust the AMPLITUDE of the 3320B for a 7.000 mV $\pm 10 \mu\text{V}$ indication on the dc voltmeter.

NOTE

Do not change the setting of the 3320B 10 dB attenuator.

5-23. 3320B Attenuator Accuracy, 10 kHz.

5-24. This performance test insures the 3320B meets the attenuator accuracy specification listed in Table 1-1. The specification is ± 0.02 dB/10 dB step, 10 kHz, referenced to the straight-through position of the output attenuator. This specification is accumulative as attenuation is added to the output. The tolerance for each added step is equal to the tolerance of the previous step plus 0.02 dB. The output of the 3320B is applied to a wave analyzer through a calibrated attenuator. The wave analyzer detects the 3320B output signal and applies the detected signal to a dc voltmeter. The dc voltmeter indications are recorded for later use in determining the 3320B output attenuator frequency response.

- a. Connect the equipment as shown in Figure 5-6.

NOTE

This performance test uses a 355A 10 dB attenuator with a known accuracy on the 0 dB and 10 dB settings. The error in the attenuator must be considered in determining the error of the 3320B.

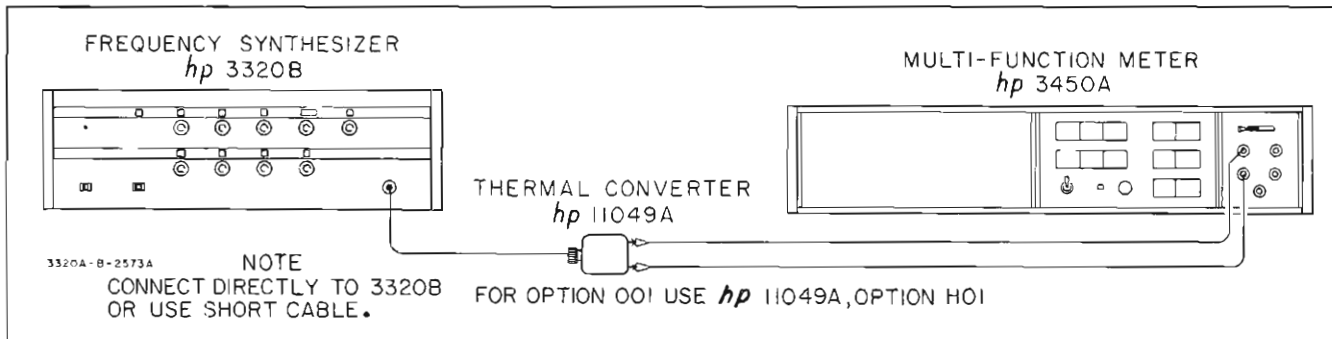


Figure 5-5. 3320B Frequency Response (10 Hz - 13 MHz).

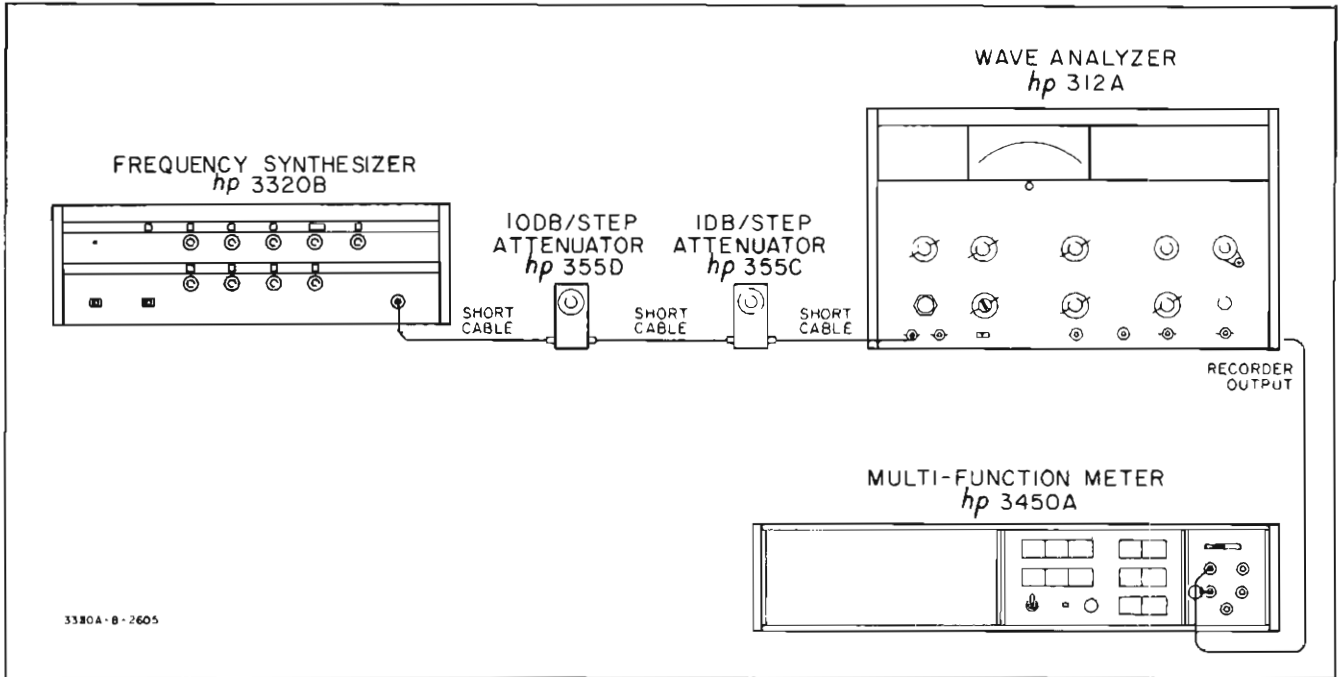


Figure 5-6. 3320B Attenuator Accuracy.

b. Set the 3320B front panel controls as follows:

- AMPLITUDE (Standard) + 25.00 dBm
- (Option 001) + 24.00 dBm
- VERN IN/OUT VERN OUT
- RANGE 10 kHz
- FREQUENCY 10.00
- LEVELING ON (> 10 Hz)

c. Set the 355D to 10 dB and adjust the 355C and the wave analyzer for a 1.000 V dc indication on the dc voltmeter.

d. Set the 3320B AMPLITUDE to +15.00 dBm (+14.00 dBm, Option 001). Set the 355D to 0 dB and record the difference between the dc voltmeter indication and the reference set in Step c.

e. Set the 355D to 10 dB and down range the wave analyzer 10 dB. Adjust the 355C and the wave analyzer for a 1.000 V dc indication on the dc voltmeter.

f. Set the 3320B AMPLITUDE to +5.00 dBm (+4.00 dBm, Option 001) and set the 355D to 0 dB. Algebraically add and record the difference between the dc voltmeter indication and the reference set in Step e to the difference recorded in Step d.

g. Repeat Steps e and f for the remaining attenuator settings listed in Table 5-5. In Step f, algebraically add to the previously recorded difference instead of the difference recorded in Step d.

h. Specifications for each position of the output attenuator are as follows:

| Attenuator (dBm) | | Specification (mV) (accumulative) |
|------------------|------------|--------------------------------------|
| Standard | Option 001 | |
| + 15.00 | + 14.00 | ± 2 |
| + 5.00 | + 4.00 | ± 4 |
| - 5.00 | - 6.00 | ± 6 |
| - 15.00 | - 16.00 | ± 8 |
| - 25.00 | - 26.00 | ± 10 |
| - 35.00 | - 36.00 | ± 12 |
| - 45.00 | - 46.00 | ± 14 |
| - 55.00 | - 56.00 | ± 16 |
| - 65.00 | - 66.00 | ± 18 |

5-25. 3320B Attenuator Frequency Response.

5-26. This performance test insures the 3320B meets the Frequency Response specifications listed in Table 1-1 at all positions of the 3320B 10 dB output attenuator. All specifications are referenced to 10 kHz. The specifications are listed again in Table 5-6. The last three digits of amplitude (i.e. 6.99 digits in +26.99 dBm) are controlled by electronic attenuation in the 3320B Output Section. Frequency Response is not affected by this attenuation, therefore, this performance test evaluates only the most significant digit (10 dB attenuator). Each step of the attenuator is measured and the measurement recorded for a specific frequency, using the previous step as a reference, until all steps have been measured at that frequency. Then the procedure is repeated at another frequency. When all steps have been measured at all desired frequencies, the recorded information is used in conjunction with the recorded information in Paragraph 5-21 and 5-23 to determine the frequency response of the 10 dB attenuator.

Table 5-5. Output Attenuator.

| 3320B Attenuator (dBm) | | 355D (dB) | Wave Analyzer (dBm) |
|------------------------|---------------|-----------|--------------------------------|
| Standard | Option 001 | | |
| + 25.00 (Ref) | + 24.00 (Ref) | 10 | + 10 |
| + 15.00 | + 14.00 | 0 | Record dc Voltmeter Indication |
| + 15.00 (Ref) | + 14.00 (Ref) | 10 | 0 |
| + 5.00 | + 4.00 | 0 | Record dc Voltmeter Indication |
| + 5.00 (Ref) | + 4.00 (Ref) | 10 | - 10 |
| - 5.00 | - 6.00 | 0 | Record dc Voltmeter Indication |
| - 5.00 (Ref) | - 6.00 (Ref) | 10 | - 20 |
| - 15.00 | - 16.00 | 0 | Record dc Voltmeter Indication |
| - 15.00 (Ref) | - 16.00 (Ref) | 10 | - 30 |
| - 25.00 | - 26.00 | 0 | Record dc Voltmeter Indication |
| - 25.00 (Ref) | - 26.00 (Ref) | 10 | - 40 |
| - 35.00 | - 36.00 | 0 | Record dc Voltmeter Indication |
| - 35.00 (Ref) | - 36.00 (Ref) | 10 | - 50 |
| - 45.00 | - 46.00 | 0 | Record dc Voltmeter Indication |
| - 45.00 (Ref) | - 46.00 (Ref) | 10 | - 60 |
| - 55.00 | - 56.00 | 0 | Record dc Voltmeter Indication |
| - 55.00 (Ref) | - 56.00 (Ref) | 10 | - 70 |
| - 65.00 | - 66.00 | 0 | Record dc Voltmeter Indication |

a. Connect the equipment as shown in Figure 5-6.

AMPLITUDE (Standard) + 25.00 dBm
 (Option 001) + 24.00 dBm
 VERN IN/OUT VERN OUT
 RANGE 10 kHz
 FREQUENCY 10.00
 LEVELING ON (> 10 Hz)

NOTE

This performance test uses a 355D 10 dB attenuator with a known accuracy on the 0 dB and 10 dB settings. The error in the attenuator should be used in determining the error of the 3320B.

c. Set the 355D to 10 dB and adjust the 355C and wave analyzer for a 1.000 V dc indication on the dc voltmeter.

d. Set the 3320B AMPLITUDE to + 15.00 dBm (+ 14.00 dBm, Option 001). Set the 355D to 0 dB and record the difference between the dc voltmeter indication and the reference set in Step c.

b. Set the 3320B front panel controls as follows:

Table 5-6. 3320B Frequency Response.

| 3320B ATTENUATOR SETTINGS (dBm) | | SPECIFICATION (dB) | |
|---------------------------------|--------------------------|--------------------|-----------------------|
| Standard | Option 001 | LEVELING OFF | LEVELING ON (> 10 Hz) |
| + 26.99 to - 3.00 | + 24.99 to - 5.00 | ± 0.5 | ± 0.05 |
| - 3.01 to - 23.00 | - 5.01 to - 25.00 | ± 0.5 | ± 0.1 |
| - 23.01 to - 53.00 | - 25.01 to - 55.00 | ± 0.5 | ± 0.2 |
| - 53.01 to - 69.99 * | - 55.01 to - 69.99 ** | ± 0.5 | ± 0.4 |

* - 73.00 dBm, remote control.
 ** - 75.00 dBm, remote control.

e. Repeat Steps c and d for settings listed in Table 5-5.

NOTE

The Attenuator settings marked Ref. in Table 5-5 are the settings used in Step c.

f. Repeat Steps c, d, and e for frequencies listed in Table 5-4.

NOTE

The reference frequency for the frequency response specification is 10 kHz. Due to the amount of error in the test equipment used, the frequency response of a specific attenuator step cannot be determined by comparing directly to 10 kHz on that step (See Step g).

g. To determine the frequency response of each step, the recorded indications of Step d are compared as follows:

(1) For the + 15.00 dBm (+ 14.00, Option 001) step frequency response, use the following formula:

$A = B + C - D$ where

A = The relationship of the recorded error (Step d), measured at a specific frequency, to 10 kHz.

B = The recorded error (Step d)

C = The adjusted error at the same frequency as B recorded in Paragraph 5-21, Step d.

D = The recorded error at 10 kHz measured on the + 15.00 dBm attenuator step in Paragraph 5-23, Step d.

Example:

B = The recorded error at 1 MHz (Step d) = + 2 mV.

C = The adjusted error at 1 MHz recorded in Paragraph 5-21, Step d = - 1 mV.

D = The recorded error at 10 kHz measured on the + 15.00 dBm (+ 14.00, Option 001) attenuator step in Paragraph 5-23, Step d = - 1 mV.

$A = 2 \text{ mV} + (-1 \text{ mV}) - (-1 \text{ mV}) = 2 \text{ mV} - 1 \text{ mV} + 1 \text{ mV} = 2 \text{ mV}$. Indicates 1 MHz is 2 mV positive in respect to 10 kHz on the + 15.00 dBm attenuator step.

(2) Once the frequency response for the + 15.00 dBm (+ 14.00, Option 001) attenuator step has

been calculated, it must be used in the formula, $A = B + C - D$, for C. The procedure (Step g (1)) will then be repeated for the + 5.00 dBm attenuator step.

(3) Repeat the procedure (Step g (1)) for each of the remaining steps of the attenuator using the calculations of the preceding steps for C in the formula.

(4) The frequency response specifications are as follows:

| 3320B Attenuator Settings (dBm) | | Specification |
|---------------------------------|-----------------------|-----------------------|
| Standard | Option 001 | LEVELING ON (> 10 Hz) |
| + 26.99 to - 3.00 | + 24.99 to - 5.00 | ± 5 mV |
| - 3.01 - 23.00 | - 5.01 to - 25.00 | ± 12 mV |
| - 23.01 to - 53.00 | - 25.01 to - 55.00 | ± 23 mV |
| - 53.01 - 69.99 * | - 55.01 - 69.99 ** | ± 45 mV |

* 73.00 dBm, remote control.

** 75.00 dBm, remote control.

h. Repeat steps b through e with the LEVELING OFF, FREQUENCY 00.05, and RANGE 1000 Hz. The specification is ± 60 mV on all attenuator settings.

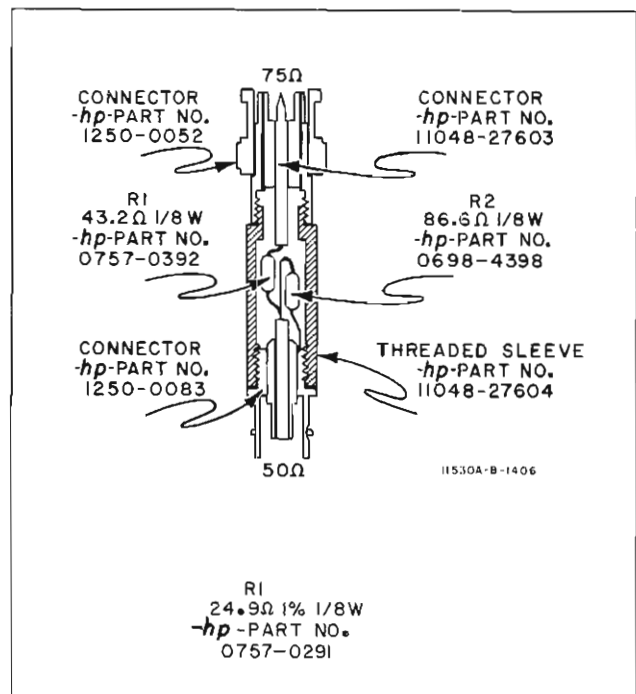


Figure 5-7. 50 Ohm To 75 Ohm Adapter.

5-27. ADJUSTMENT PROCEDURES.

5-28. The following is a complete adjustment procedure for the 3320A/B. This procedure should be conducted only if the 3320A/B has failed the performance tests. If proper performance cannot be achieved by the adjustment procedures, refer to the troubleshooting procedures, Section VII.

5-29. Power Supply.

5-30. This adjustment procedure sets the + 15 V dc supply and checks the voltages of the - 15 V dc, ± 5 V dc, and ± 30 V dc supplies.

a. Connect a dc voltmeter between A17 pin L (+ 15 V dc) and A17 pin 10 (ground).

b. Adjust A17R23 (+ 15 V adjust) for 14.950 V dc to 15.050 V dc.

c. Connect the dc voltmeter to the following pins and insure each voltage is within the tolerances shown.

| | | |
|------------|-------|--------------------|
| A17 pin 14 | | 5.000 to 5.300 |
| A17 pin p | | 5.000 to 5.300 |
| A17 pin 7 | | - 4.850 to - 5.370 |
| A17 pin 8 | | - 14.8 to - 15.2 |

d. Connect the dc voltmeter ground to A17 pin 4. Check the following voltages to insure they are within the tolerances shown.

| | | |
|-----------|-------|----------------------|
| A17 pin B | | 29.125 to 30.875 |
| A17 pin C | | - 28.800 to - 31.200 |

5-31. Reference Oscillator.

5-32. This adjustment procedure sets the 20 MHz Reference Oscillator by monitoring the 1 MHz output on the rear panel of the 3320A/B. It also sets the External Reference Phase Lock circuitry.

NOTE

If the 3320A/B being adjusted is an Option 002, steps b and c of this performance test do not need to be performed. If the 3320A/B being adjusted is not an Option 002, step a of this performance test does not need to be performed.

a. Disconnect the short cable between the EXT FREQ REF and the 5 MHz OUT on the 3320A/B rear panel. Connect the electronic counter to the 5 MHz OUT and adjust the COURSE and FINE adjustments on the 3320A/B rear panel for 5,000,000 Hz. Reconnect the short cable between the EXT FREQ REF and the 5 MHz OUT. Connect the oscilloscope to A7TP1

b. Connect the oscilloscope to A7TP1. Connect the rear panel output of the counter to the EXT FREQ REF input on the rear panel of the 3320A/B.

c. Set the counter rear panel MODE to INT STD FREQ and OUTPUT STD FREQ to 10 MHz.

d. Adjust A8C4 (20 MHz ADJUST) until the display on the oscilloscope is a sinewave > 6 V p-p.

e. Ground the oscilloscope input and adjust trace for center of display. Set oscilloscope input to dc and readjust A8C4 for 0 V dc with no sinewave on oscilloscope display.

f. Connect the counter to the 1 MHz OUT on the rear panel of the 3320A/B. Counter indication should be 1 MHz ± 1 Hz.

5-33. VTO Linearity.

5-34. This adjustment procedure sets the VTO for a linear output over the 3320A/B frequency range.

a. Connect the dc voltmeter to A3TP2. Set the 3320A/B FREQUENCY to 12.99 and adjust A3R38 (PRETUNE ADJUST) for a voltmeter indication of - 10 V dc ± 0.3 V dc.

b. Connect the dc voltmeter to A3TP1. Set the 3320A/B FREQUENCY from 00.99 to 12.99 in 1 MHz steps. The dc voltmeter indication should not be more negative than - 4V dc on each frequency setting.

5-35. Vernier.

5-36. This adjustment procedure sets the Vernier Oscillator for a 10 kHz swing (VTO output) on the front panel Vernier.

a. Set the 3320A/B FREQUENCY TO 12.99, RANGE to 10 MHz, VERN IN/VERN OUT to VERN IN.

b. Connect the dc voltmeter to A1TP1. Adjust A1R1 (DC REF ADJ) for a dc voltmeter indication of - 6.06 V dc ± 0.02 V dc.

c. Connect the counter to the 3320A/B rear panel L.O. OUTPUT (20-33 MHz). Set the 3320A/B FREQUENCY to 0000, adjust A1R50 for 20 MHz ± 100 Hz.

d. Connect the oscilloscope to A1TP2 through a 6.8 pF capacitor. Adjust A1C3 (10 MHz LEVEL ADJUST) for maximum signal on oscilloscope display. Display should be > 250 mV p-p.

e. Set the 3320A/B Vernier to 99. Adjust A1R34 (10 kHz ADJUST) for 20,010,000 Hz to 20,010,075 Hz indication on the counter.

f. Set the 3320A/B Vernier to 50. Adjust A1R50 (5 kHz ADJUST) for 20,004,950 Hz to 20,005,050 Hz indication on the counter.

g. Set the 3320A/B Vernier to 00. Adjust A1C6 (0 Hz ADJUST) for 19,999,950 Hz to 20,000,000 Hz indication on the counter.

h. Repeat steps e, f, and g until all limits are met.

i. Set the 3320A/B Vernier to 99, FREQUENCY to 12.99. If necessary readjust A1R34 (10 kHz ADJUST) for 33,000,000 Hz to 33,000,100 Hz indication on the counter.

5-37. Amplitude Reference, 3320B.

5-38. This adjustment procedure sets the reference dc level from the D/A Converter.

a. Connect the dc voltmeter to A11TP1.

b. Set the 3320B AMPLITUDE to 16.99 dBm (-5.01 dBm, Option 001). Adjust A11R10 (REFERENCE ADJUST) for 10.0000 V dc \pm 0.0005 V dc (9.729 V dc \pm 0.005 mV dc, Option 001) indication on the dc voltmeter.

c. Set the 3320B AMPLITUDE to 17.00 dBm (-5.00 dBm, Option 001). Adjust A11R16 (DECAY ADJUST) for 3.1659 V dc \pm 0.0002 V dc (3.0801 V dc \pm 0.002 V dc, Option 001) indication on the dc voltmeter.

5-39. Carrier Balance.

5-40. This adjustment procedure sets the output of the Mixer for minimum carrier signal feed thru and maximum common mode rejection.

a. Set the 3320A/B FREQUENCY to 0100, RANGE to 1000 Hz, and LEVELING to OFF (3320B).

b. Connect the ac voltmeter to A10TP1. Adjust A10R37 (AC SIGNAL NULL) for a null indication on the ac voltmeter (< 100 mV ac).

c. Remove the brown cable from the Pre-Amp output on the A10 assembly. Move the green cable from the 20-30 MHz out on the A10 assembly to the Pre-Amp output jack.

d. Connect the spectrum analyzer through the 355D attenuator to the 3320A/B rear panel L.O. OUTPUT (20-33 MHz).

NOTE

Set 355D attenuator to 20 dB before connecting to 3320A/B.

e. Set the 3320A/B FREQUENCY to 12.99 and RANGE to 10 MHz.

f. Adjust A10R31 (CARRIER NULL) for minimum amplitude of the 32.99 MHz signal on the spectrum analyzer display.

g. Return the green cable to the 20-33 MHz jack on the A10 assembly. Replace the brown cable to the Pre-Amp output on the A10 assembly.

5-41. Amplitude.

5-42. This adjustment procedure sets the amplitude section of the 3320A/B for minimum temperature drift, minimum dc offset, and proper output voltage level.

3320B:

a. Set the 3320B FREQUENCY to 10.00, RANGE to 10 K, and AMPLITUDE to +17.00 dBm (+15.00 dBm, Option 001). Remove the red cable from the 20 MHz input on the A12B assembly. Remove the clear cable from the 0-13 MHz input on the A12B assembly. Short A12BTP2 to ground with a jumper cable.

b. Using jumper cables connect a 5 ohm resistor (two 10 ohm resistors in parallel) between A12BTP1 and ground. Connect Channel A input of the oscilloscope across the 5 ohm resistor.

c. Set the oscilloscope INPUT to dc and VOLTS/DIV to .1 (.01 if 10:1 divider probe is used). Adjust oscilloscope display for a convenient reference.

d. Adjust A12BR10 (OFFSET ADJUST) until there is a noticeable (approximately 1.5 cm) dc level shift (either up or down) on the oscilloscope display then readjust A12BR10 in the opposite direction until the dc level on the oscilloscope display is on the threshold of shifting back.

e. Remove the 5 ohm resistor and all jumper cables. Replace the red cable to the 20 MHz input and the clear cable to the 0-13 MHz input on the A12B assembly.

f. Connect the dc voltmeter to the 3320B front panel output jack.

g. Set the 3320B AMPLITUDE to +26.99 dBm (+24.99 dBm, Option 001).

h. Adjust A10R45 (DC OFFSET) for a 0 V dc \pm 2 mV dc indication on the dc voltmeter.

i. Connect the ac voltmeter through a 50 ohm load (75 ohm load, Option 001) to the 3320B front panel output jack.

j. Set the 3320B FREQUENCY to 10.00, RANGE to 10 kHz, AMPLITUDE to +26.99 dBm (+24.99 dBm, Option 001), and LEVELING to ON (> 10 Hz).

k. Adjust A12BR30 (+5 V ADJ) for 5.000 V ac \pm 0.001 V ac (4.8646 V ac \pm 0.0012 V ac, Option 001) indication on the ac voltmeter. If A12BR30 does not have enough range remove A1BAR2 (thermocouple), rotate it 180°, and replace it back on the A12B assembly. Repeat adjustment of A12BR30.

l. Set the 3320B AMPLITUDE to +17.00 dBm (+15.00 dBm, Option 001) and adjust A12BR34 (1.583 V ADJ) for 1.583 V ac \pm 0.001 V ac (1.540 V ac \pm 0.002 V ac, Option 001) indication on the ac voltmeter.

3320A:

a. Connect the dc voltmeter to the 3320A front panel output jack. Set the 3320A AMPLITUDE Full C W.

b. Remove the brown cable from the input of the A12A assembly. Connect a jumper cable between A12A J1 and ground.

c. Adjust A12AR11 (DC OFFSET) for 0 V dc \pm 2 mV dc indication on the dc voltmeter.

d. Remove the shorting cable from A12A J1 and replace the brown cable. Adjust A10R45 (DC OFFSET) for a 0 V dc \pm 2 mV dc indication on the dc voltmeter.

e. Connect the ac voltmeter through a 50 ohm load (75 ohm load, Option 001) to the 3320A front panel output jack.

f. Adjust A9AR52 (AMPLITUDE ADJUST) for 1.000 V ac \pm 0.1 V ac indication on the ac voltmeter.

5-43. Harmonics, 3320B.

5-44. This adjustment procedure sets the harmonic level of the 3320B output signal to a minimum.

a. Connect the spectrum analyzer through the 355D (set to 40 dB) attenuator to the 3320B front panel output jack.

b. Set the 3320B FREQUENCY to 12.99, RANGE to 10 MHz, AMPLITUDE to +26.99 dBm (+24.99 dBm, Option 001), and LEVELING to ON (> 10 Hz).

c. Adjust A14R55 (BIAS ADJUST) until the third harmonic of the 12.99 MHz signal is approximately 42 dB below the 12.99 MHz fundamental on the spectrum analyzer display.

5-45. Leveling, 3320B.

5-46. This adjustment procedure sets the 3320B output signal for equal ac levels when switching from LEVELING OFF to LEVELING ON (> 10 Hz).

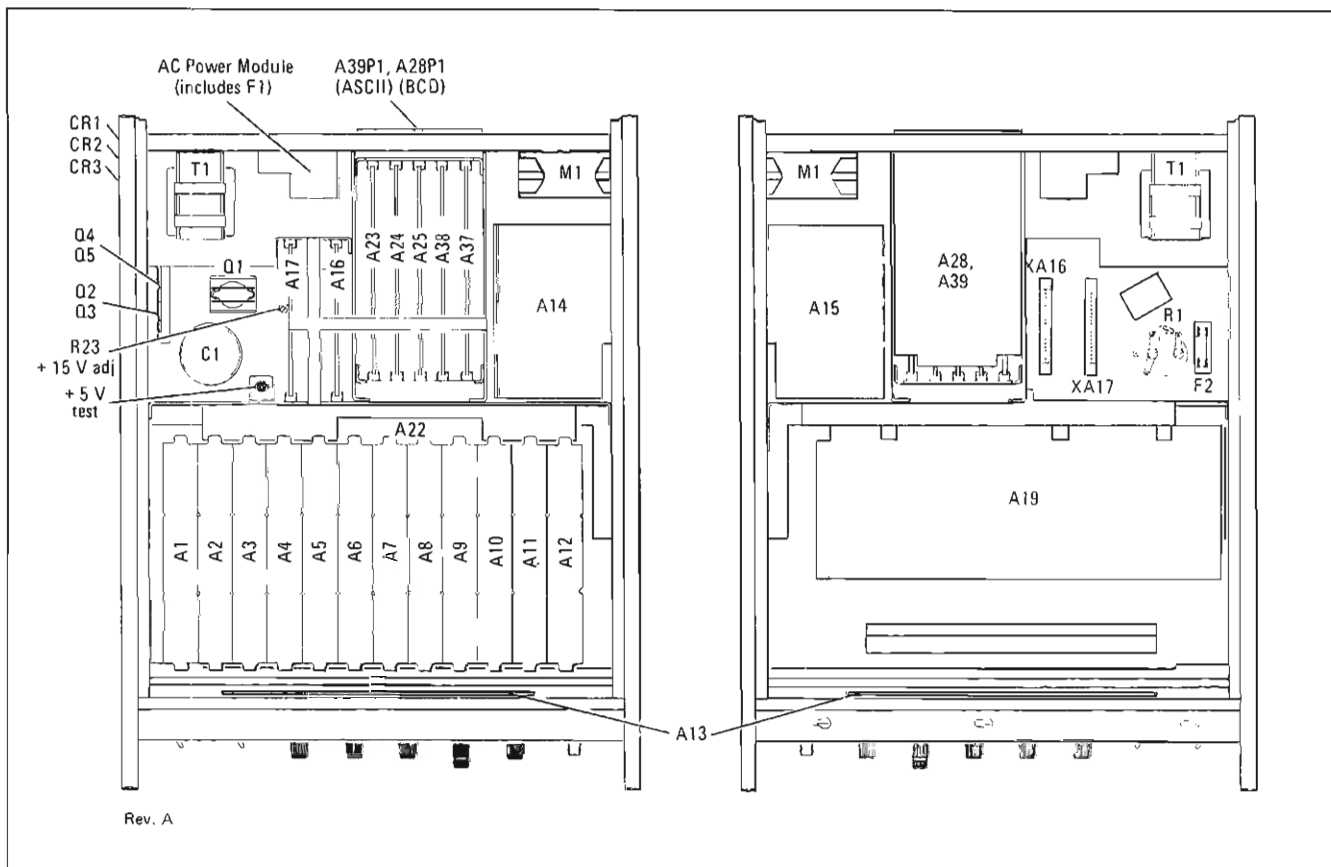


Figure 5-8. Chassis Mounted Components.

a. Connect the ac voltmeter to the 3320B front panel output jack.

b. Set the 3320B FREQUENCY to 10.00, RANGE to 10 kHz, AMPLITUDE to +16.99 dBm (+14.99 dBm, Option 001), and LEVELING to ON (> 10 Hz). Record the ac voltmeter indication.

c. Set the 3320B LEVELING to OFF and adjust A9BC24 (LEVELING OFF ADJUST) to the same ac voltmeter indication as recorded in step b ± 10 mV ac.

5-47. Transient Response, 3320B.

5-48. This adjustment procedure sets the 3320B Leveling loop transient response.

a. Connect the dc voltmeter to A12BTP3.

b. Set the 3320B FREQUENCY to 10.00, RANGE to 10 kHz, and AMPLITUDE to +16.99 dBm (+14.99 dBm, Option 001). Record dc voltmeter indication.

c. Set 3320B AMPLITUDE to +17.99 dBm (+15.99 dBm, Option 001). Adjust A9BR27 (PRETUNE ADJUST) for the same dc voltmeter indication as recorded in step b.

d. Adjusting A9BR27 effects the voltage indication at +16.99 dBm. Repeat steps b and c until the two indications are within ± 200 mV dc.

GENERAL MAINTENANCE INFORMATION

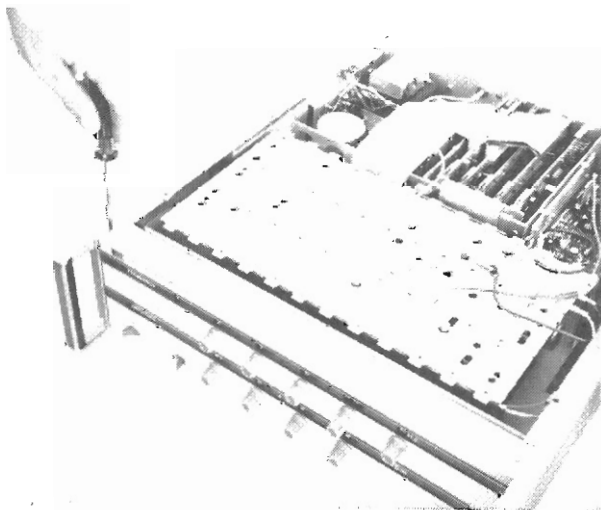
5-49. GENERAL MAINTENANCE INFORMATION.

5-50. The following paragraphs contain information on front panel removal, front panel disassembly and front panel assembly. Also included is a cam positioning information for 50 ohm and 75 ohm instruments.

5-51. Front Panel Removal.

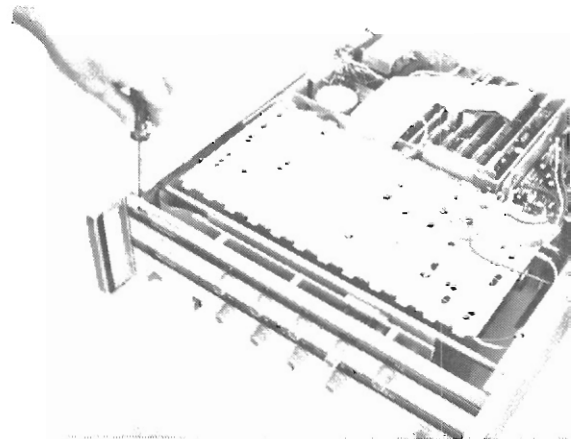
5-52. The following procedure provides information for removing the 3320A/B front panel.

Step A



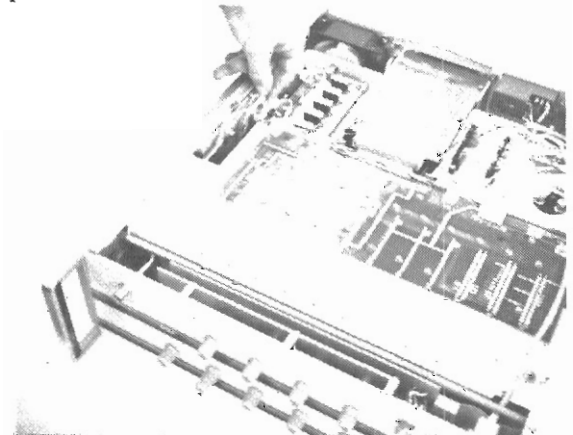
Remove top and bottom covers, MP21 and MP25.

Step B



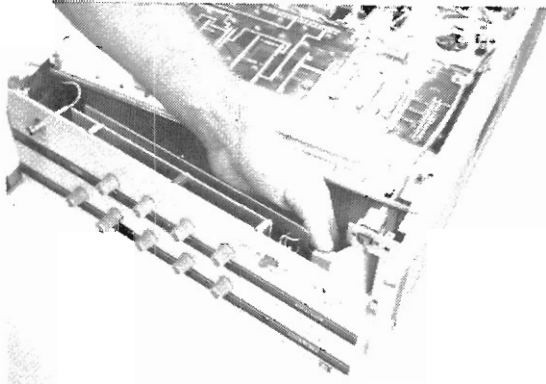
Remove four screws holding front panel to side castings.

Step C



Turn instrument upside down and remove the output cable at J9.

Step D

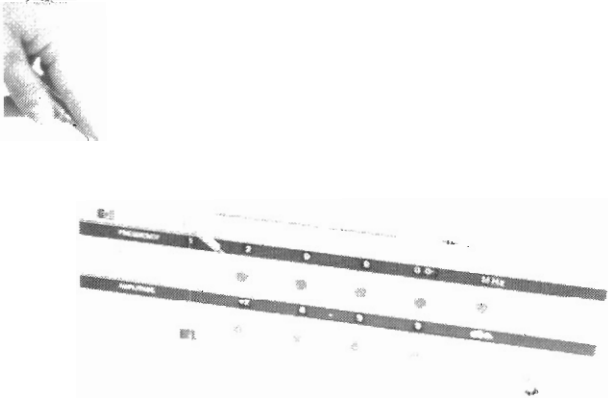


Remove the ribbon cable from the A13 Switch Assembly and remove the front panel.

5-53. Front Panel Disassembly.

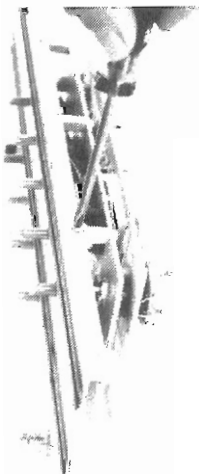
5-54. The following procedure provides information for disassembling the 3320A/B front panel. This will allow replacement of the switch wafers on the A13 Switch Assembly. On earlier 3320A/B instruments the switch wafers were not replaceable. Refer to the backdating Section VIII for serial number breakdown for the earlier instruments.

Step A



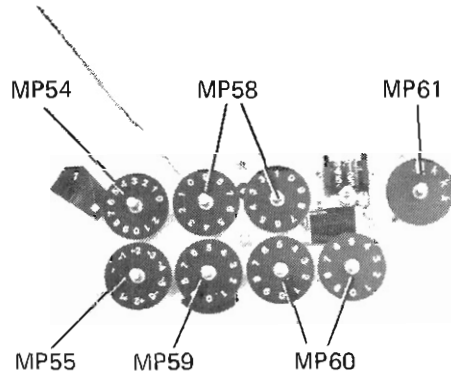
Remove front panel knobs and leveling switch.

Step B



Remove the six screws holding the front panel to the A13 Switch Assembly. Unsolder decimal indicator wires (Note wire colors and destinations).

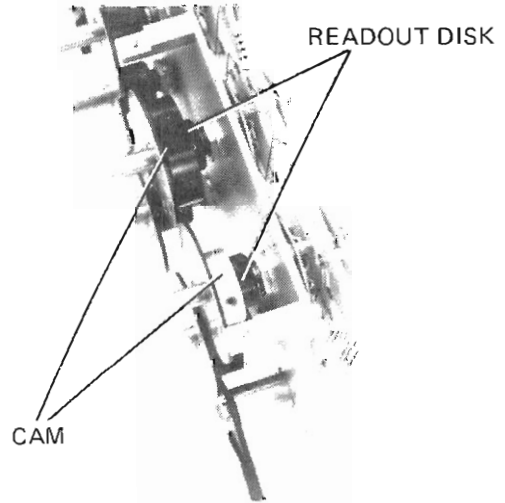
Step C



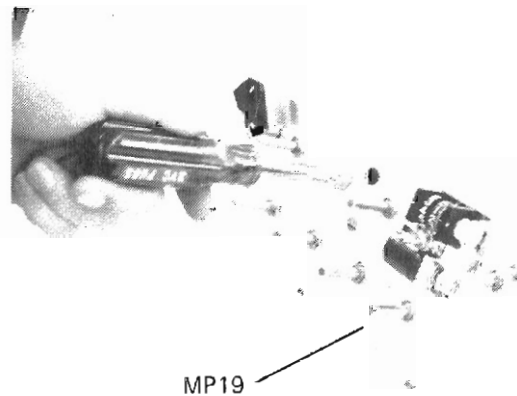
Remove Readout Disks (MP54, MP55, MP58 - 2 each, MP59 - 3 each, MP60).

NOTE

MP54, MP55, MP59 and MP61 Readout Disks have cams mounted on them. Do not loosen the Allen screws on the cams.



Step D



Remove mounting nuts holding A13 Switch Assembly to MP19.

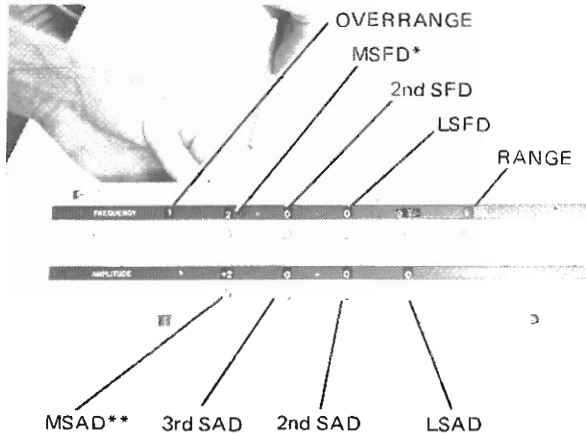
5-55. Front Panel Assembly.

5-56. The following procedure provides information for assembling the 3320A/B front panel.

Step A

Replace MP19 with locking nuts. (See Paragraph 5-54, Step D). Slide Readout Disks onto switch shafts. (Do not tighten Allen screws). Replace and fasten front panel. (See Paragraph 5-54, Step B).

Step B



* Most significant frequency digit.

** Most significant amplitude digit.

Set the frequency, Range and amplitude switches as follows:

- MSFD CW
- 2nd SFD, LSFD, 3rd SAD,
2nd SAD, LSAD gap in rotor blade is up.
(See Figure below).
- MSAD CW
- Range CW, then CCW one position.

Hold Readout Disks in positions listed in Table 5-7 and tighten Allen screws.

NOTE

Maintain approximately 1/16 inch clearance between Readout Disk and front panel. This will prevent scratching of Readout Disks when they are rotated.

TOP OF ASSEMBLY

ROTOR BLADE GAP

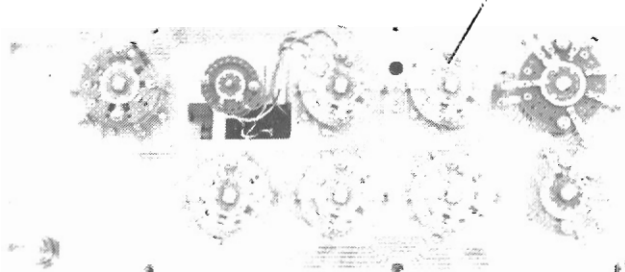


Table 5-7. Readout Disks Positions.

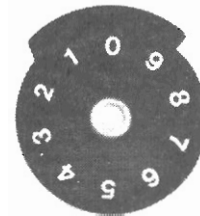
| Readout Disk | Number In Front Panel Window |
|-------------------|------------------------------|
| Overrange, MSFD * | 12 |
| 2nd SFD | 0 |
| LSFD | 0 |
| Range | 3rd K (next to M) |
| MSAD | + 2 |
| 3rd SAD | 0 |
| 2nd SAD | 0 |
| LSAD | 0 |

* On MSFD and overrange digit, rotate the Readout Disk until the cam trips the overrange flag for a 1 in the overrange window. Continue to rotate the Readout Disk until a 2 appears in the MSFD window.

5-57. Impedance Cam Settings.

5-58. The following procedures indicate the proper positioning of the impedance cams. These cams are located on the 2nd SAD Readout Disk (See Paragraph 5-56, Step B). Proper positioning of this cam prevents the amplitude controls from being set higher than the maximum output dBm. The maximum output for the standard 3320B is + 26.99 dBm. The maximum output for the 3320B Option 001 is + 24.99 dBm.

Standard 3320B:



Loosen Allen screws on cam, position cam as shown above, tighten Allen screws.

3320B Option 001:



Loosen Allen screws on cam, position cam as shown above, tighten Allen screws.

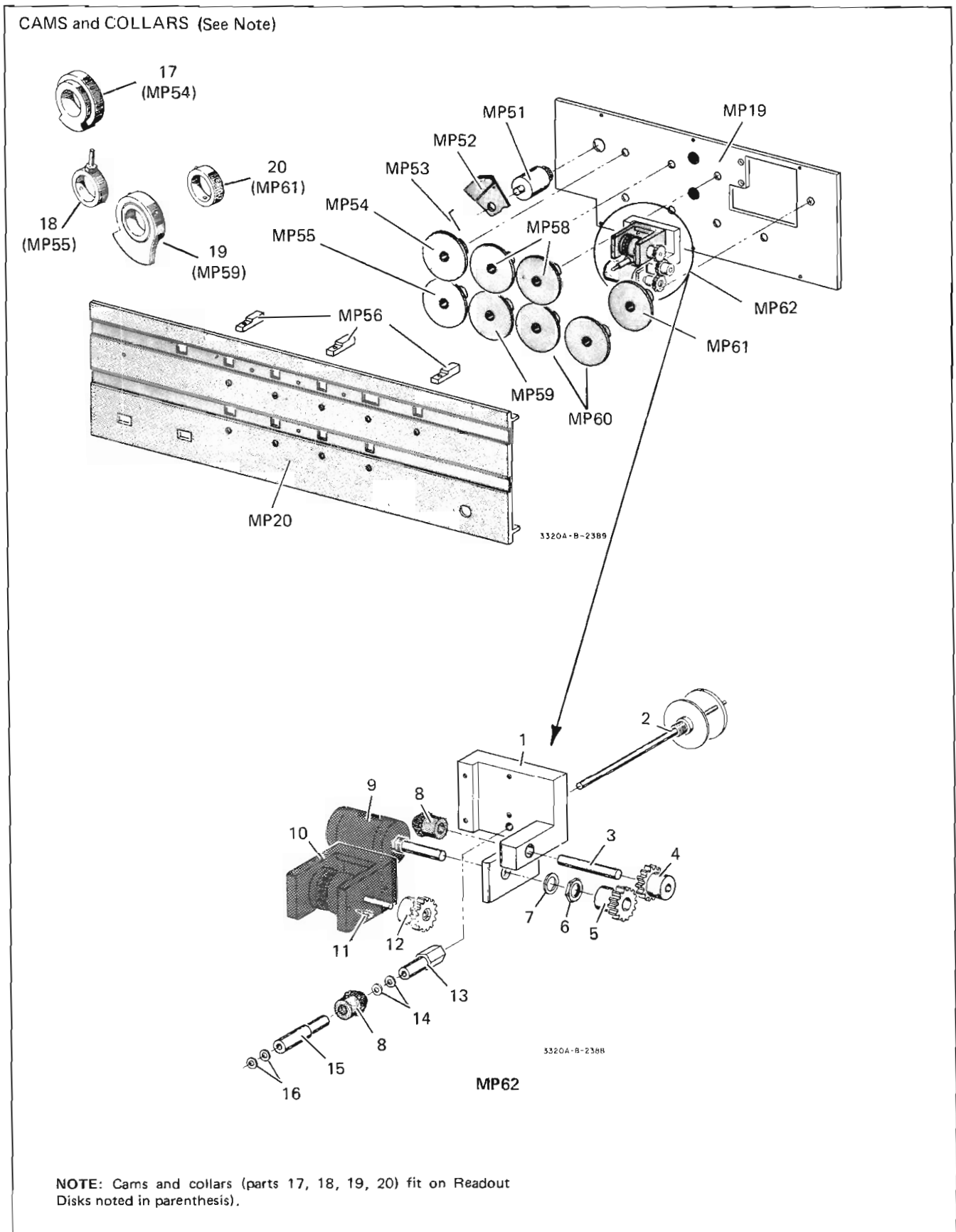


Figure 5-9. Front Panel and Vernier Control Mechanical Parts.

PERFORMANCE TEST CARD

Hewlett-Packard Model 3320A/B
Frequency Synthesizer

Test Performed By _____

Serial No. _____

Date _____

Frequency Accuracy

Vernier Out

| | | | |
|-----------|------------------|-------|-------------------|
| 1 MHz | .9999990 MHz | _____ | 1.0000010 MHz |
| 12.22 MHz | 12.219878 MHz | _____ | 12.220122 MHz |
| 1.10 MHz | 1.099989 MHz | _____ | 1.100011 MHz |
| 00.01 MHz | 99.99900 μ s | _____ | 100.00100 μ s |

Vernier In

| | | | |
|----------------|-------------|-------|-------------|
| 00.0150 MHz | 14.000 kHz | _____ | 16.000 kHz |
| 12.9999 MHz | 12.9989 MHz | _____ | 13.0009 MHz |
| 1000 kHz Range | | _____ | |
| 100 kHz Range | | _____ | |
| 10 kHz Range | | _____ | |
| 1000 Hz Range | | _____ | |

Harmonic Distortion

| | | |
|-----------|-------|----------|
| 10 kHz | _____ | > -60 dB |
| 129.9 kHz | _____ | > -50 dB |
| 150 kHz | _____ | > -50 dB |
| 1299 kHz | _____ | > -40 dB |
| 4 MHz | _____ | > -40 dB |
| 7 MHz | _____ | > -40 dB |
| 12.99 MHz | _____ | > -40 dB |

Spurious

_____ > -60 dB or -110 dBm

Signal to Phase Noise

_____ > -40 dB

3320A Amplitude Accuracy

| | | | |
|--------------|-----------|-------|-----------|
| 50 Ohm load | 0.9 V rms | _____ | 1.1 V rms |
| Open circuit | 1.8 V rms | _____ | 2.2 V rms |

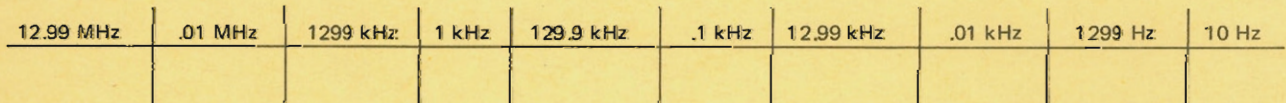
3320B Amplitude Accuracy

| | | | |
|--------------|-------------|-------|-------------|
| 50 Ohm load | 4.975 V rms | _____ | 5.025 V rms |
| Open circuit | 9.95 V rms | _____ | 10.05 V rms |

Frequency Response

| | | | |
|----------------------|-----------------|-------|-----------------|
| 3320A | -0.8 cm | _____ | + 1 cm |
| 3320B, 0.01 Hz—10 Hz | -0.2 cm | _____ | + 0.2 cm |
| 3320B, 10 Hz—13 MHz | 6930 μ V dc | _____ | 7070 μ V dc |

Adjusted Errors:



SECTION VI REPLACEABLE PARTS

6-1. INTRODUCTION.

6-2. This section contains information for ordering replacement parts. Table 6-1 lists parts in alphameric order of their reference designators and indicates the -hp- part number of each part, with any applicable notes, and provides the following:

- a. Total quantity used in the instrument (TQ column). The total quantity of a part is given the first time the part number appears.
- b. Description of the part. See list of abbreviations below.
- c. Typical manufacturer of the part in a five-digit code. See Appendix A for a list of manufacturers.
- d. Manufacturer's part number.

6-3. Miscellaneous parts are listed at the end of Table 6-1.

6-4. ORDERING INFORMATION.

6-5. To obtain replacement parts, address order or inquiry to your local Hewlett-Packard Field Office. See Appendix B for a list of office locations. Identify parts by their Hewlett-Packard part numbers. Rebuilt boards can be purchased at a reduced price on an exchange basis. See Page 6-31 for a list of 3320A/B rebuilt boards and their part numbers. For more information contact your local Hewlett-Packard Field Office.

6-6. NON-LISTED PARTS.

- 6-7. 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.

| 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 encaps encapsulated F farad(s) FET field effect transistor fix 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 coefficient, 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 | fernto | f | 10 ⁻¹⁵ |
| | deci | d | 10 ⁻¹ | atto | a | 10 ⁻¹⁸ |
| 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 | | | |

STD-8-2734

Table 6-1. Replaceable Parts.

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|-----|--------------------------------------|----------|-----------------|
| A1 | 03320-66501 | 1 | BOARD ASSY:VERNIER OSCILLATOR | 28480 | 03320-66501 |
| A1C1 | C160-2009 | 8 | C:FXD MICA 820 PF 5% 300VDCW | 00853 | RDM15F821J3C |
| A1C2 | 0140-0193 | 1 | C:FXD MICA 82 PF 5% | 28480 | 0140-0193 |
| A1C3 | 0121-0436 | 2 | C:VAR AIR 2.4-24.5 PF | 74970 | 189-509-105 |
| A1C4 | 0150-0093 | 120 | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A1C5 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A1C6 | 0121-0432 | 2 | C:VAR AIR 1.7-14.1 PF | 74970 | 189-505-105 |
| A1C7 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A1C8 | 0180-1746 | 29 | C:FXD ELECT 15 UF 10% 20VDCW | 28480 | 0180-1746 |
| A1C9 | 0180-1746 | | C:FXD ELECT 15 UF 10% 20VDCW | 28480 | 0180-1746 |
| A1C10 | 0180-1746 | | C:FXD ELECT 15 UF 10% 20VDCW | 28480 | 0180-1746 |
| A1C11 | 0150-0046 | 3 | C:FXD 68 PF | 78488 | Type GA |
| A1C12 | 0180-1746 | | C:FXD ELECT 15 UF 10% 20VDCW | 28480 | 0180-1746 |
| A1C13 | 0180-1746 | | C:FXD ELECT 15 UF 10% 20VDCW | 28480 | 0180-1746 |
| A1C14 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A1C15 | 0180-1746 | | C:FXD ELECT 15 UF 10% 20VDCW | 28480 | 0180-1746 |
| A1CR1 | 1901-0040 | 57 | DIODE:SILICON 30MA 30WV | C7263 | FDG1088 |
| A1CR2 | 0122-0059 | 4 | DIODE:VOLTAGE VARIABLE CAPACITANCE | 28480 | C122-0059 |
| A1CR3 | 1901-0040 | | DIODE:SILICON 30MA 30WV | C7263 | FDG1088 |
| A1IC1 | 1826-0043 | 27 | IC:LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-0043 |
| A1IC2 | 1826-0043 | | IC:LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-0043 |
| A1IC3 | 1826-0043 | | IC:LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-0043 |
| A1IC4 | 1820-0584 | 24 | IC:TTL QUAD 2-INPT NOR GATE | 28480 | 1820-0584 |
| A1IC5 | 1820-0751 | 6 | IC:DIGITAL | 01295 | SN74196N |
| A1IC6 | 1820-0584 | | IC:TTL QUAD 2-INPT NOR GATE | 28480 | 1820-0584 |
| A1IC7 | 1820-0751 | | IC:DIGITAL | 01295 | SN74196N |
| A1IC8 | 1820-0751 | | IC:DIGITAL | 01295 | SN74196N |
| A1IC9 | 1826-0043 | | IC:LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-0043 |
| A1L1 | 9140-0180 | 1 | COIL/CHOKE 2.70 UH 10% | 28480 | 9140-0180 |
| A1L2 | 9100-1621 | 1 | COIL/CHCKE 18 UH 10% | 28480 | 9100-1621 |
| A1L3 | 9140-0107 | 9 | COIL:FXD RF 27 UH 10% | 99800 | 1840-38 |
| A1L5 | 9140-0107 | | COIL:FXD RF 27 UH 10% | 99800 | 1840-38 |
| A1L6 | 9140-0107 | | COIL:FXD RF 27 UH 10% | 99800 | 1840-38 |
| A1L7 | 9140-0107 | | COIL:FXD RF 27 UH 10% | 99800 | 1840-38 |
| A1Q1 | 1853-0020 | 10 | TSTR:SI PNP(SELECTED FROM 2N3702) | 28480 | 1853-0020 |
| A1Q2 | 1853-0020 | | TSTR:SI PNP(SELECTED FROM 2N3702) | 28480 | 1853-0020 |
| A1Q3 | 1853-0020 | | TSTR:SI PNP(SELECTED FROM 2N3702) | 28480 | 1853-0020 |
| A1Q4 | 1853-0020 | | TSTR:SI PNP(SELECTED FROM 2N3702) | 28480 | 1853-0020 |
| A1Q5 | 1853-0020 | | TSTR:SI PNP(SELECTED FROM 2N3702) | 28480 | 1853-0020 |
| A1Q6 | 1854-0019 | 16 | TSTR:SI NPN | 28480 | 1854-0019 |
| A1Q7 | 1854-0019 | | TSTR:SI NPN | 28480 | 1854-0019 |
| A1Q8 | 1854-0019 | | TSTR:SI NPN | 28480 | 1854-0019 |
| A1Q9 | 1854-0404 | 21 | TSTR:SI NPN | 28480 | 1854-0404 |
| A1Q10 | 1853-0020 | | TSTR:SI PNP(SELECTED FROM 2N3702) | 28480 | 1853-0020 |
| A1Q11 | 1854-0404 | | TSTR:SI NPN | 28480 | 1854-0404 |
| A1R1 | 2100-2489 | 1 | R:VAR FLM 5K OHM 10% LIN 1/2W | 28480 | 2100-2489 |
| A1R2 | 0698-3382 | 1 | R:FXD MET FLM 5.49K OHM 1% 1/8W | 19701 | MF40 T-0 |
| A1R3 | 0698-3279 | 16 | R:FXD MET FLM 4990 OHM 1% 1/8W | 28480 | 0698-3279 |
| A1R4 | 0757-0452 | 1 | R:FXD MET FLM 27.4K OHM 1% 1/8W | 28480 | 0757-0452 |
| A1R5 | 0757-0441 | 1 | R:FXD MET FLM 8.25K OHM 1% 1/8W | 28480 | 0757-0441 |
| A1R6 | 0757-0289 | 3 | R:FXD MET FLM 13.3K OHM 1% 1/8W | 28480 | 0757-0289 |
| A1R7 | 0757-0442 | 22 | R:FXD MET FLM 10.0K OHM 1% 1/8W | 28480 | 0757-0442 |
| A1R8 | 0698-3279 | | R:FXD MET FLM 4990 OHM 1% 1/8W | 28480 | 0698-3279 |
| A1R9 | 0757-0283 | 10 | R:FXD MET FLM 2.00K OHM 1% 1/8W | 28480 | 0757-0283 |
| A1R10 | 0698-4479 | 3 | R:FXD FLM 14K OHM 1% 1/8W | 28480 | 0698-4479 |
| A1R12 | 0698-3259 | 5 | R:FXD FLM 7.87K OHM 1% 1/8W | 28480 | 0698-3259 |
| A1R13 | 0698-3259 | | R:FXD FLM 7.87K OHM 1% 1/8W | 28480 | 0698-3259 |
| A1R14 | 0757-0283 | | R:FXD MET FLM 2.00K OHM 1% 1/8W | 28480 | 0757-0283 |
| A1R15 | 0698-4479 | | R:FXD FLM 14K OHM 1% 1/8W | 28480 | 0698-4479 |
| A1R16 | 0698-4480 | 2 | R:FXD MET FLM 15.8K OHM 1% 1/8W | 28480 | 0698-4480 |
| A1R17 | 0698-4480 | | R:FXD MET FLM 15.8K OHM 1% 1/8W | 28480 | 0698-4480 |
| A1R18 | 0757-0283 | | R:FXD MET FLM 2.00K OHM 1% 1/8W | 28480 | 0757-0283 |
| A1R19 | 0698-4479 | | R:FXD FLM 14K OHM 1% 1/8W | 28480 | 0698-4479 |
| A1R20 | 0698-3160 | 3 | R:FXD MET FLM 31.6K OHM 1% 1/8W | 28480 | 0698-3160 |
| A1R21 | 0698-3160 | | R:FXD MET FLM 31.6K OHM 1% 1/8W | 28480 | 0698-3160 |
| A1R23 | 0698-3558 | 2 | R:FXD MET FLM 4.02K OHM 1% 1/8W | 28480 | 0698-3558 |
| A1R24 | 0698-4489 | 1 | R:FXD FLM 28K OHM 1% 1/8W | 28480 | 0698-4489 |
| A1R25 | 0757-0460 | 2 | R:FXD MET FLM 61.9K OHM 1% 1/8W | 28480 | 0757-0460 |
| A1R26 | 0757-0460 | | R:FXD MET FLM 61.9K OHM 1% 1/8W | 28480 | 0757-0460 |
| A1R27 | 0698-4473 | 3 | R:FXD FLM 8.06K OHM 1% 1/8W | 28480 | 0698-4473 |
| A1R28 | 0757-0459 | 2 | R:FXD MET FLM 56.2K OHM 1% 1/8W | 28480 | 0757-0459 |
| A1R29 | 0757-0442 | | R:FXD MET FLM 10.0K OHM 1% 1/8W | 28480 | 0757-0442 |
| A1R30 | 0757-0442 | | R:FXD MET FLM 10.0K OHM 1% 1/8W | 28480 | 0757-0442 |
| A1R32 | 0698-3519 | 1 | R:FXD MET FLM 12.4K OHM 1% 1/8W | 28480 | 0698-3519 |
| A1R33 | 0698-3279 | | R:FXD MET FLM 4990 OHM 1% 1/8W | 28480 | 0698-3279 |
| A1R34 | 2100-3103 | 2 | R:VAR CERMET 10K OHM 10% TYPE P 3/4W | 28480 | 2100-3103 |

† See Section VIII, Manual Backdating.

Table 6-1. Replaceable Parts (cont'd)

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|-----|--------------------------------------|----------|--------------------|
| A1R35 | 0698-3279 | | R:FXD MET FLM 4990 OHM 1% 1/8W | 28480 | 0698-3279 |
| A1R36 | 0698-3279 | | R:FXD MET FLM 4990 OHM 1% 1/8W | 28480 | 0698-3279 |
| A1R37 | 0757-0283 | | R:FXD MET FLM 2.00K OHM 1% 1/8W | 28480 | 0757-0283 |
| A1R38 | 0757-0401 | 4 | R:FXD MET FLM 100 OHM 1% 1/8W | 28480 | 0757-0401 |
| A1R39 | 0757-0442 | | R:FXD MET FLM 10.0K OHM 1% 1/8W | 28480 | 0757-0442 |
| A1R40 | 0757-0430 | 2 | R:FXD MET FLM 2.21K OHM 1% 1/8W | 28480 | 0757-0430 |
| A1R41 | 0757-0442 | | R:FXD MET FLM 10.0K OHM 1% 1/8W | 28480 | 0757-0442 |
| A1R42 | 0698-3279 | | R:FXD MET FLM 4990 OHM 1% 1/8W | 28480 | 0698-3279 |
| A1R43 | 0698-4486 | 1 | R:FXD MET FLM 24.9K OHM 1% 1/8W | 28480 | 0698-4486 |
| A1R44 | 0757-0459 | | R:FXD MET FLM 56.2K OHM 1% 1/8W | 28480 | 0757-0459 |
| A1R45 | 0698-4473 | | R:FXD FLM 8.06K OHM 1% 1/8W | 28480 | 0698-4473 |
| A1R46 | 0757-0401 | | R:FXD MET FLM 100 OHM 1% 1/8W | 28480 | 0757-0401 |
| A1R47 | 0757-0401 | | R:FXD MET FLM 100 OHM 1% 1/8W | 28480 | 0757-0401 |
| A1R48 | 0698-3279 | | R:FXD MET FLM 4990 OHM 1% 1/8W | 28480 | 0698-3279 |
| A1R49 | 0757-0290 | 2 | R:FXD MET FLM 6.19K OHM 1% 1/8W | 28480 | 0757-0290 |
| A1R50 | 2100-3103 | | R:VAR CERMET 10K OHM 10% TYPE P 3/4W | 28480 | 2100-3103 |
| A1R51 | 0698-4435 | 2 | R:FXD FLM 2.49K OHM 1% 1/8W | 28480 | 0698-4435 |
| A1R53 | 0757-0442 | | R:FXD MET FLM 10.0K OHM 1% 1/8W | 28480 | 0757-0442 |
| A1R54 | 0757-0283 | | R:FXD MET FLM 2.00K OHM 1% 1/8W | 28480 | 0757-0283 |
| A1R55 | 0757-0283 | | R:FXD MET FLM 2.00K OHM 1% 1/8W | 28480 | 0757-0283 |
| A1R56 | 0684-1051 | 3 | R:FXD COMP IMEGOHM 10% 1/4W | 01121 | CB 1051 |
| A1R57 | 0757-0280 | 10 | R:FXD MET FLM 1K OHM 1% 1/8W | 28480 | 0757-0280 |
| A1R58 | | | UNASSIGNED | | |
| A1R59 | 0684-1051 | 4 | R:FXD COMP IMEGOHM 10% 1/4W | 01121 | CB 1051 |
| A1R60 | 0684-3321 | | R:FXD COMP 3300 OHM 10% 1/4W | 01121 | CB 3321 |
| A1R61 | 0698-3279 | | R:FXD MET FLM 4990 OHM 1% 1/8W | 28480 | 0698-3279 |
| A1TP1 | C8443-00041 | 4 | TEST POINT | 28480 | 08443-00041 |
| A1TP2 | 08443-00041 | | TEST POINT | 28480 | 08443-00041 |
| A1Y1 | 0410-0437 | 1 | CRYSTAL:QUARTZ | 28480 | 0410-0437 |
| A2 | 03320-66502 | 1 | BOARD ASSY:N- SAMPLER | 28480 | 03320-66502 |
| A2C1 | 0180-1702 | 1 | C:FXD ELECT 180 UF 20% 6VDCW | 56289 | 150D187X00C6R2-DYS |
| A2C2 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A2C3 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A2C4 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A2C5 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A2C6 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A2C7 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A2C8 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A2C9 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A2C11 | 0180-1746 | | C:FXD ELECT 15 UF 10% 20VDCW | 28480 | 0180-1746 |
| A2C12 | 0150-0084 | 21 | C:FXD CER 0.1 UF +80-20% 100VDCW | 56289 | 33C4185-CDH |
| A2C13 | 0180-0194 | 1 | C:FXD TA 150 UF 10% 15VDCW | 56289 | 150D157X9015S2-DYS |
| A2C14 | 0150-0084 | | C:FXD CER 0.1 UF +80-20% 100VDCW | 56289 | 33C4185-CDH |
| A2C15 | 0150-0084 | | C:FXD CER 0.1 UF +80-20% 100VDCW | 56289 | 33C4185-CDH |
| A2C16 | 0160-0194 | 1 | C:FXD MY 0.015 UF 10% | 56289 | 192P15392-PTS |
| A2C17 | 0160-2229 | 1 | C:FXD MICA 3000 PF 5% | 28480 | 0160-2229 |
| A2C18 | 0160-2199 | 3 | C:FXD MICA 30 PF 5% 300VDCW | 28480 | 0160-2199 |
| A2C19 | 0160-2291 | | C:FXD MY 0.18 UF 10% 80VDCW | 56289 | 192P1849R8-PTS |
| A2C21 | 0150-0084 | | C:FXD CER 0.1 UF +80-20% 100VDCW | 56289 | 33C4185-CDH |
| A2C22 | 0180-1746 | | C:FXD ELECT 15 UF 10% 20VDCW | 28480 | 0180-1746 |
| A2C23 | 0180-1746 | | C:FXD ELECT 15 UF 10% 20VDCW | 28480 | 0180-1746 |
| A2C24 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A2C25 | 0170-0040 | 1 | C:FXD MY 0.047 UF 10% 200VDCW | 56289 | 192P47392-PTS |
| A2C26 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A2CR1 | 1910-0016 | | DIODE:GER 50 MA 60 WIV | 93332 | D2361 |
| A2CR2 | 1910-0016 | | DIODE:GER 50 MA 60 WIV | 93332 | D2361 |
| A2CR3 | 1910-0016 | | DIODE:GER 50 MA 60 WIV | 93332 | D2361 |
| A2CR4 | 1910-0016 | | DIODE:GER 50 MA 60 WIV | 93332 | D2361 |
| A2CR5 | 1901-0040 | | DIODE:SILICDN 30MA 30WV | 07263 | FDG1088 |
| A2CR6 | 1901-0050 | 8 | DIODE:SI 200 MA AT 1V | 07263 | FDA 6308 |
| A2CR7 | 1901-0053 | 3 | DIODE:SILICON 30VDCW | 07263 | FD3444 |
| A2CR8 | 1901-0050 | | DIODE:SI 200 MA AT 1V | 07263 | FDA 6308 |
| A2CR9 | 1901-0053 | | DIODE:SILICON 30VDCW | 07263 | FD3444 |
| A2CR11 | 1901-0040 | | DIODE:SILICON 30MA 30WV | 07263 | FDG1088 |
| A2CR12 | 1901-0050 | | DIODE:SI 200 MA AT 1V | 07263 | FDA 6308 |
| A2CR13 | 1901-0040 | | DIODE:SILICON 30MA 30WV | 07263 | FDG1088 |
| A2CR14 | 1901-0050 | | DIODE:SI 200 MA AT 1V | 07263 | FDA 6308 |
| A2IC1 | 1820-0370 | 1 | IC:TTL QUAD 2-INPT NAND GATE | 01295 | SN4478 |
| A2IC2 | 1820-0686 | 1 | IC:TTL TRIPLE 3-INPT AND GATE | 01295 | SN24654 |
| A2IC3 | 1820-0751 | | IC:DIGITAL | 01295 | SN74196N |
| A2IC4 | 1820-0751 | | IC:DIGITAL | 01295 | SN74196N |
| A2IC5 | 1820-0751 | 1 | IC:DIGITAL | 01295 | SN74196N |
| A2IC6 | 1820-0752 | 1 | IC:DIGITAL TTL | 01295 | SN33586 |
| A2IC7 | 1820-0469 | 1 | IC:DIGITAL TTL HI-SPEED F/F | 01295 | SN19234 |
| A2IC8 | 1820-0696 | 1 | IC:DIGITAL TTL DUAL J-K FF | 04713 | SC9150PK |

† See Section VIII, Manual Backdating

Table 6-1. Replaceable Parts (cont'd)

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|-----|-------------------------------------|----------|--------------------|
| A2IC9 | 1826-0066 | 1 | IC: LINEAR | 07263 | SL22486 |
| A2L1 | 9100-1618 | 8 | COIL: MOLEDED CHOKE 5.60 UH | 28480 | 9100-1618 |
| † A2L2 | | | NOT ASSIGNED | | |
| A2L3 | 9100-1618 | | COIL: MOLEDED CHOKE 5.60 UH | 28480 | 9100-1618 |
| A2L4 | 9100-1629 | 3 | COIL/CHOKE 47.0 UH 5% | 28480 | 9100-1629 |
| A2L5 | 9140-0137 | 1 | CHOKE/COIL: FXD 1000 UH 5% | 28480 | 9140-0137 |
| A2Q1 | 1854-0019 | | TSTR: SI NPN | 28480 | 1854-0019 |
| A2Q3 | 1854-0354 | 7 | TSTR: SI NPN | 28480 | 1854-0354 |
| A2Q2 | 1853-0203 | 27 | TSTR: SI PNP | 28480 | 1853-0203 |
| A2Q5 | 1854-0404 | | TSTR: SI NPN | 28480 | 1854-0404 |
| A2Q4 | 1854-0404 | | TSTR: SI NPN | 28480 | 1854-0404 |
| A2Q6 | 1854-0404 | | TSTR: SI NPN | 28480 | 1854-0404 |
| A2R1 | 0683-2715 | 1 | R: FXD COMP 270 OHM 5% 1/4W | 01121 | CB 2715 |
| A2R2 | 0683-3315 | 7 | R: FXD COMP 330 OHM 5% 1/4W | 01121 | CB 3315 |
| A2R3 | 0683-5125 | 17 | R: FXD COMP 5100 OHM 5% 1/4W | 01121 | CB 5125 |
| A2R4 | 0683-5125 | | R: FXD COMP 5100 OHM 5% 1/4W | 01121 | CB 5125 |
| A2R5 | 0683-2025 | 14 | R: FXD COMP 2000 OHM 5% 1/4W | 01121 | CB 2025 |
| A2R6 | 0683-2025 | | R: FXD COMP 2000 OHM 5% 1/4W | 01121 | CB 2025 |
| A2R7 | 0683-2025 | | R: FXD COMP 2000 OHM 5% 1/4W | 01121 | CB 2025 |
| † A2R8 | | | NOT ASSIGNED | | |
| † A2R9 | 0683-1015 | 16 | R: FXD COMP 100 OHM 5% 1/4W | 01121 | CB 1015 |
| A2R11 | 0683-1535 | 7 | R: FXD COMP 15K OHM 5% 1/4W | 01121 | CB 1535 |
| A2R12 | 0683-2025 | | R: FXD COMP 2000 OHM 5% 1/4W | 01121 | CB 2025 |
| A2R13 | 0683-1015 | 4 | R: FXD COMP 100 OHM 5% 1/4W | 01121 | CB 1015 |
| A2R14 | 0683-2025 | | R: FXD COMP 2000 OHM 5% 1/4W | 01121 | CB 2025 |
| A2R15 | 0698-6745 | 1 | R: FXD FLM 22 OHM 5% 1/8W | 28480 | 0698-6745 |
| A2R16 | 0757-0280 | | R: FXD MET FLM 1K OHM 1% 1/8W | 28480 | 0757-0280 |
| A2R17 | 0757-0280 | | R: FXD MET FLM 1K OHM 1% 1/8W | 28480 | 0757-0280 |
| A2R18 | 0698-4123 | 7 | R: FXD MET FLM 499 OHM 1% 1/8W | 28480 | 0698-4123 |
| A2R19 | 0757-0442 | | R: FXD MET FLM 10.0K OHM 1% 1/8W | 28480 | 0757-0442 |
| A2R21 | 0757-0442 | | R: FXD MET FLM 10.0K OHM 1% 1/8W | 28480 | 0757-0442 |
| A2R22 | 0757-0346 | 8 | R: FXD MET FLM 10 OHM 1% 1/8W | 28480 | 0757-0346 |
| A2R23 | 0757-0346 | | R: FXD MET FLM 10 OHM 1% 1/8W | 28480 | 0757-0346 |
| A2R24 | 0757-0346 | | R: FXD MET FLM 10 OHM 1% 1/8W | 28480 | 0757-0346 |
| A2R25 | 0757-0346 | | R: FXD MET FLM 10 OHM 1% 1/8W | 28480 | 0757-0346 |
| A2R26 | 0757-0438 | 8 | R: FXD MET FLM 5.11K OHM 1% 1/8W | 28480 | 0757-0438 |
| A2R27 | 0757-0442 | | R: FXD MET FLM 10.0K OHM 1% 1/8W | 28480 | 0757-0442 |
| A2R28 | 0698-3497 | 1 | R: FXD FLM 6.04K OHM 1% 1/8W | 28480 | 0698-3497 |
| A2R29 | 0757-0442 | | R: FXD MET FLM 10.0K OHM 1% 1/8W | 28480 | 0757-0442 |
| A2R31 | 0757-0438 | | R: FXD MET FLM 5.11K OHM 1% 1/8W | 28480 | 0757-0438 |
| A2R32 | 0757-0438 | | R: FXD MET FLM 5.11K OHM 1% 1/8W | 28480 | 0757-0438 |
| A2R33 | 0757-0438 | | R: FXD MET FLM 5.11K OHM 1% 1/8W | 28480 | 0757-0438 |
| A2R34 | 0757-0438 | | R: FXD MET FLM 5.11K OHM 1% 1/8W | 28480 | 0757-0438 |
| A2R35 | 0757-0442 | | R: FXD MET FLM 10.0K OHM 1% 1/8W | 19701 | MF4C T-0 |
| A2T1 | 9100-1393 | 1 | TRANSFORMER: TOROID | 28480 | 9100-1293 |
| A3 | 03320-66503 | 1 | BOARD ASSY: VTO | 28480 | 03320-66503 |
| A3C1 | 0180-C291 | 21 | C: FXD ELECT 1.0 UF 10% 35VDCW | 56289 | 150D105X9035A2-DYS |
| A3C2 | 0160-0157 | 1 | C: FXD MYLAR 4700 PF 10% 200VDCW | 56289 | 182P47792-P.TS |
| A3C3 | 0140-0207 | 2 | C: FXD MICA 390 PF 5% 300VDCW | 00853 | RDML5F391J3S |
| A3C4 | 0160-0207 | 3 | C: FXD MYLAR 0.01UF 5% 200VDCW | 28480 | 0160-C207 |
| A3C5 | 0160-0207 | | C: FXD MYLAR 0.01UF 5% 200VDCW | 28480 | 0160-0207 |
| A3C6 | 0170-0063 | 1 | C: FXD MY 0.020 UF 10% 400VDCW | 56289 | 148P170A-PUM |
| A3C8 | 0180-1746 | | C: FXD ELECT 15 UF 10% 20VDCW | 28480 | 0180-1746 |
| A3C9 | 0150-0093 | | C: FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A3C10 | 0180-1746 | | C: FXD ELECT 15 UF 10% 20VDCW | 28480 | 0180-1746 |
| A3C12 | 0160-2199 | | C: FXD MICA 30 PF 5% 300VDCW | 28480 | 0160-2199 |
| A3C13 | 0160-2199 | | C: FXD MICA 30 PF 5% 300VDCW | 28480 | 0160-2199 |
| A3C14 | 0150-0093 | | C: FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A3C15 | 0150-0093 | | C: FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A3C16 | 0150-0093 | | C: FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A3C17 | 0150-0093 | | C: FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A3C18 | 0150-0093 | | C: FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A3C19 | 0150-0093 | | C: FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A3C20 | 0150-0093 | | C: FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A3C21 | 0150-0084 | | C: FXD CER 0.1 UF +80-20% 100VDCW | 56289 | 33C4185-CDH |
| A3C22 | 0150-0084 | | C: FXD CER 0.1 UF +80-20% 100VDCW | 56289 | 33C4185-CDH |
| A3C23 | 0180-0374 | 7 | C: FXD TANT. 10 UF 10% 20VDCW | 56289 | 150D106X9020B2-DYS |
| A3C24 | 0180-0374 | | C: FXD TANT. 10 UF 10% 20VDCW | 56289 | 150D106X9020B2-DYS |
| A3C25 | 0150-0093 | | C: FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A3C26 | 0150-0093 | | C: FXD CER 0.01 UF +80-20% 100VDCW | 28480 | 0150-0093 |
| A3CR1 | 1901-0518 | 2 | DIODE: HOT CARRIER | 28480 | 1901-0518 |
| A3CR2 | 1901-0518 | | DIODE: HOT CARRIER | 28480 | 1901-0518 |
| A3CR3 | 0122-0059 | | DIODE: VOLTAGE VARIABLE CAPACITANCE | 28480 | 0122-0059 |
| A3CR4 | 0122-0059 | | DIODE: VOLTAGE VARIABLE CAPACITANCE | 28480 | 0122-0059 |
| A3IC1 | 1826-0043 | | IC: LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-0043 |
| A3IC2 | 1820-0306 | 1 | INTEGRATED CIRCUIT | 28480 | 1820-0306 |
| A3IC3 | 1826-0043 | | IC: LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-0043 |

† See Section VIII, Manual Backdating.

Table 6-1. Replaceable Parts (cont'd)

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|-----|-----------------------------------|----------|-----------------|
| A3IC4 | 1826-0043 | | IC:LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-0043 |
| A3L1* | 9140-0096 | 4 | COIL:FXD RF 1 UH | 28480 | 9140-0096 |
| A3L4 | 9140-0179 | 2 | COIL/CHCKE 22.0 UH 10% | 28480 | 9140-0179 |
| A3L3 | 9140-0098 | 2 | COIL:FXD RF 2.2 UH | 28480 | 9140-0098 |
| A3L5 | 9100-1629 | | COIL/CHCKE 47.0 UH 5% | 28480 | 9100-1629 |
| A3L6 | 9100-1629 | | COIL/CHCKE 47.0 UH 5% | 28480 | 9100-1629 |
| A3P1 | 1250-1314 | 4 | CONNECTOR:RF COAX,CENTER CONTACT | 98291 | 52-054-0000 |
| A3Q1 | 1854-0404 | | TSTR:SI NPN | 28480 | 1854-0404 |
| A3Q2 | 1854-0404 | | TSTR:SI NPN | 28480 | 1854-0404 |
| A3Q3 | 1854-0404 | | TSTR:SI NPN | 28480 | 1854-0404 |
| A3Q4 | 1854-0404 | | TSTR:SI NPN | 28480 | 1854-0404 |
| A3Q5 | 1854-0404 | | TSTR:SI NPN | 28480 | 1854-0404 |
| A3Q6 | 1854-0404 | | TSTR:SI NPN | 28480 | 1854-0404 |
| A3Q7 | 1854-0404 | | TSTR:SI NPN | 28480 | 1854-0404 |
| A3Q8 | 1854-0404 | | TSTR:SI NPN | 28480 | 1854-0404 |
| A3Q9 | 1854-0404 | | TSTR:SI NPN | 28480 | 1854-0404 |
| A3Q10 | 1853-0010 | 10 | TSTR:SI PNP(SELECTED FROM 2N3251) | 28480 | 1853-0010 |
| A3Q11 | 1854-0345 | 6 | TSTR:SI NPN | 80131 | 2N5179 |
| A3Q12 | 1854-0345 | | TSTR:SI NPN | 80131 | 2N5179 |
| A3Q13 | 1854-0345 | | TSTR:SI NPN | 80131 | 2N5179 |
| A3Q14 | 1854-0404 | | TSTR:SI NPN | 28480 | 1854-0404 |
| A3Q15 | 1854-0404 | | TSTR:SI NPN | 28480 | 1854-0404 |
| A3Q16 | 1954-0404 | | TSTR:SI NPN | 28480 | 1854-0404 |
| A3Q17 | 1853-0010 | | TSTR:SI PNP(SELECTED FROM 2N3251) | 28480 | 1853-0010 |
| A3R1 | 0683-6825 | 11 | R:FXD COMP 6800 OHM 5% 1/4W | 01121 | CB 6825 |
| A3R2 | 0683-7535 | 10 | R:FXD COMP 75K OHM 5% 1/4W | 01121 | CB 7535 |
| A3R3 | 0683-5145 | 2 | R:FXD COMP 510K OHM 5% 1/4W | 01121 | CB 5145 |
| A3R4 | 0683-5145 | | R:FXD COMP 510K OHM 5% 1/4W | 01121 | CB 5145 |
| A3R5 | 0683-6825 | | R:FXD COMP 6800 OHM 5% 1/4W | 01121 | CB 6825 |
| A3R6 | 0683-7535 | 5 | R:FXD COMP 75K OHM 5% 1/4W | 01121 | CB 7535 |
| A3R7 | 0683-2045 | 1 | R:FXD COMP 200K OHM 5% 1/4W | 01121 | CB 2045 |
| A3R8 | 0683-3045 | 1 | R:FXD COMP 300K OHM 5% 1/4W | 01121 | CB 3045 |
| A3R9 | 0683-6825 | | R:FXD COMP 6800 OHM 5% 1/4W | 01121 | CB 6825 |
| A3R10 | 0683-7535 | | R:FXD COMP 75K OHM 5% 1/4W | 01121 | CB 7535 |
| A3R12 | 0683-1045 | 6 | R:FXD COMP 100K OHM 5% 1/4W | 01121 | CB 1045 |
| A3R13 | 0683-1545 | 3 | R:FXD COMP 150K OHM 5% 1/4W | 01121 | CB 1545 |
| A3R14 | 0683-6825 | | R:FXD COMP 6800 OHM 5% 1/4W | 01121 | CB 6825 |
| A3R15 | 0683-7535 | | R:FXD COMP 75K OHM 5% 1/4W | 01121 | CB 7535 |
| A3R16 | 0757-0465 | 2 | R:FXD MET FLM 100K OHM 1% 1/8W | 28480 | 0757-0465 |
| A3R17 | 0757-0465 | | R:FXD MET FLM 100K OHM 1% 1/8W | 28480 | 0757-0465 |
| A3R18 | 0683-6825 | | R:FXD COMP 6800 OHM 5% 1/4W | 01121 | CB 6825 |
| A3R19 | 0683-7535 | | R:FXD COMP 75K OHM 5% 1/4W | 01121 | CB 7535 |
| A3R20 | 0698-3228 | 4 | R:FXD MET FLM 49.9K OHM 1% 1/8W | 28480 | 0698-3228 |
| A3R22 | 0698-3228 | | R:FXD MET FLM 49.9K OHM 1% 1/8W | 28480 | 0698-3228 |
| A3R23 | 0683-6825 | | R:FXD COMP 6800 OHM 5% 1/4W | 01121 | CB 6825 |
| A3R24 | 0683-7535 | | R:FXD COMP 75K OHM 5% 1/4W | 01121 | CB 7535 |
| A3R25 | 0757-0449 | 9 | R:FXD FLM 20K OHM 1% 1/8W | 28480 | 0757-0449 |
| A3R26 | 0757-0453 | 2 | R:FXD MET FLM 30.1K OHM 1% 1/8W | 28480 | 0757-0453 |
| A3R27 | 0683-6825 | | R:FXD COMP 6800 OHM 5% 1/4W | 01121 | CB 6825 |
| A3R28 | 0683-7535 | | R:FXD COMP 75K OHM 5% 1/4W | 01121 | CB 7535 |
| A3R29 | 0757-0442 | | R:FXD MET FLM 10.0K OHM 1% 1/8W | 28480 | 0757-0442 |
| A3R30 | 0757-0446 | | R:FXD MET FLM 15.0K OHM 1% 1/8W | 28480 | 0757-0446 |
| A3R32 | 0683-6825 | | R:FXD COMP 6800 OHM 5% 1/4W | 01121 | CB 6825 |
| A3R33 | 0683-7535 | | R:FXD COMP 75K OHM 5% 1/4W | 01121 | CB 7535 |
| A3R34 | 0757-0442 | | R:FXD MET FLM 10.0K OHM 1% 1/8W | 28480 | 0757-0442 |
| A3R35 | 0757-0442 | | R:FXD MET FLM 10.0K OHM 1% 1/8W | 28480 | 0757-0442 |
| A3R36 | 0698-3182 | 1 | R:FXD MET FLM 46.4K OHM 1% 1/8W | 19701 | MF4C T-0 |
| A3R37 | 0757-0445 | 1 | R:FXD FLM 13K OHM 1% 1/8W | 28480 | 0757-0445 |
| A3R38 | 2100-2521 | 2 | R:VAR FLM 2000 OHM 10% LIN 1/2W | 28480 | 2100-2521 |
| A3R39 | 0683-6825 | | R:FXD COMP 6800 OHM 5% 1/4W | 01121 | CB 6825 |
| A3R40 | 0683-2215 | 1 | R:FXD COMP 220 OHM 5% 1/4W | 01121 | CB 2215 |
| A3R41 | 0683-1015 | | R:FXD COMP 100 OHM 5% 1/4W | 01121 | CB 1015 |
| A3R42 | 0757 0273 | | R:FXD MET FLM 3.01 K OHM 1% 1/8 W | 75042 | CEA T-0 |
| A3R43 | 0757-0283 | | R:FXD MET FLM 2.00K OHM 1% 1/8W | 28480 | 0757-0283 |
| A3R44 | 0683-6825 | | R:FXD COMP 6800 OHM 5% 1/4W | 01121 | CB 6825 |
| A3R45 | 0757-0437 | 2 | R:FXD MET FLM 4750 OHM 1% 1/8W | 28480 | 0757-0437 |
| A3R46 | 0757-0420 | 1 | R:FXD MET FLM 750 OHM 1% 1/8W | 28480 | 0757-0420 |
| A3R47 | 0757-0410 | 1 | R:FXD MET FLM 301 OHM 1% 1/8W | 28480 | 0757-0410 |
| A3R48 | 0757-1094 | 2 | R:FXD MET FLM 1.47K OHM 1% 1/8W | 28480 | 0757-1094 |
| A3R49 | 0757-1094 | | R:FXD MET FLM 1.47K OHM 1% 1/8W | 28480 | 0757-1094 |
| A3R50 | 0683-5105 | | R:FXD COMP 51 OHM 5% 1/4W | 01121 | CB 5105 |
| A3R52, R53 | 0757-0449 | | R:FXD FLM 20K OHM 1% 1/8W | 28480 | 0757-0449 |
| A3R54 | 0757-0449 | | R:FXD FLM 20K OHM 1% 1/8W | 28480 | 0757-0449 |
| A3R55 | 0757-0447 | 4 | R:FXD FLM 16.2K OHM 1% 1/8W | 28480 | CMF-1/10-32 T-1 |

Table 6-1. Replaceable Parts (cont d).

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|-----|------------------------------------|----------|----------------------|
| A3R56 | 0757-0442 | | R:FXD FLM 10KDHM 1% 1/8W | 81837 | CMF-1/10-32 T-1 |
| A3R57 | 0683-2025 | | R:FXD COMP 2000 OHM 5% 1/4W | 01121 | C8 2025 |
| A3R58 | 0683-6825 | | R:FXD COMP 6800 OHM 5% 1/4W | 01121 | C8 6825 |
| A3R59 | 0683-5105 | | R:FXD COMP 51 OHM 5% 1/4W | 01121 | C8 5105 |
| A3R60 | 0683-3915 | 2 | R:FXD COMP 390 OHM 5% 1/4W | 01121 | C8 3915 |
| A3R62 | 0683-3915 | | R:FXD COMP 390 OHM 5% 1/4W | 01121 | C8 3915 |
| A3R63 | 0683-3325 | 8 | R:FXD COMP 3300OHM 5% 1/4W | 01121 | C8 3325 |
| A3R64 | 0683-1025 | 56 | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | C8 1025 |
| A3R65 | 0683-2025 | | R:FXD COMP 2000 OHM 5% 1/4W | 01121 | C8 2025 |
| A3R66 | 0683-5105 | | R:FXD COMP 51 OHM 5% 1/4W | 01121 | C8 5105 |
| A3R67 | 0683-3315 | | R:FXD COMP 330 OHM 5% 1/4W | 01121 | C8 3315 |
| A3R68 | 0683-1625 | 1 | R:FXD COMP 1600 OHM 5% 1/4W | 01121 | C8 1625 |
| A3R69 | 0683-4325 | 4 | R:FXD COMP 4300 OHM 5% 1/4W | 01121 | C8 4325 |
| A3R70 | 0683-5105 | | R:FXD COMP 51 OHM 5% 1/4W | 01121 | C8 5105 |
| A3R71 | 0683-5115 | 14 | R:FXD COMP 510 OHM 5% 1/4W | 01121 | C8 5115 |
| A3R72 | 0683-5115 | | R:FXD COMP 510 OHM 5% 1/4W | 01121 | C8 5115 |
| A3R73 | 0683-5105 | | R:FXD COMP 51 OHM 5% 1/4W | 01121 | C8 5105 |
| A3R74 | 0683-6225 | 1 | R:FXD COMP 6200 OHM 5% 1/4W | 01121 | C8 6225 |
| A3R75 | 0683-3025 | | R:FXD COMP 3000 OHM 5% 1/4W | 01121 | C8 3025 |
| A3R76 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | C8 1025 |
| A3R77 | 0683-2425 | 7 | R:FXD COMP 2400 OHM 5% 1/4W | 01121 | C8 2425 |
| A3R78 | 0683-2015 | 8 | R:FXD COMP 200 OHM 5% 1/4W | 01121 | C8 2015 |
| A3R79 | 0757-0444 | | R:FXD MET FLM 12.1K OHM 1% 1/8W | 28480 | 0757-0444 |
| A3R80 | 0757-0451 | 1 | R:FXD MET FLM 24.3K OHM 1% 1/8W | 28480 | 0757-0451 |
| A3R81 | 0698-4473 | | R:FXD FLM 8.06K OHM 1% 1/8W | 28480 | 0698-4473 |
| A3R82 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | C8 1025 |
| A3R83 | 0757-0449 | | R:FXD FLM 20K OHM 1% 1/8W | 28480 | 0757-0449 |
| A3R84 | 0757-0449 | | R:FXD FLM 20K OHM 1% 1/8W | 28480 | 0757-0449 |
| A3R85 | 0757-0447 | | R:FXD FLM 16.2K OHM 1% 1/8W | 28480 | 0757-0447 |
| A4 | 03320-66504 | 1 | BOARD ASSY RNG DIV | 28480 | 03320-66504 |
| A4A1 | 03320-62701 | 1 | FILTER ASSY | 28480 | 03320-62701 |
| A4A2 | 03320-62702 | 2 | FILTER ASSY | 28480 | 03320-62702 |
| A4C1 | 0150-0C50 | 47 | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C0678102E102ZS26-CDH |
| A4C2 | 0150-0C93 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A4C3 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C0678102E102ZS26-CDH |
| A4C4 | 0160-0939 | 2 | C:FXD MICA 430 PF 5% 300 VDCW | 28480 | 0160-0939 |
| A4C5 | 0160-0938 | 9 | C:FXD MICA 1000 PF 5% | 72136 | RDM15E102J1C |
| A4C6 | 0160-2035 | 2 | C:FXD MICA 750 PF 5% 300VDCW | 00853 | RDM15F751J3C |
| A4C7 | 0160-0939 | | C:FXD MICA 430 PF 5% 300 VDCW | 28480 | 0160-0939 |
| A4C8 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A4C9 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A4C10 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A4C11 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C0678102E102ZS26-CDH |
| A4C12 | 0150-0C93 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A4C13 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C0678102E102ZS26-CDH |
| A4C14 | 0150-0C50 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C0678102E102ZS26-CDH |
| A4C15 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C0678102E102ZS26-CDH |
| A4C16 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C0678102E102ZS26-CDH |
| A4C17 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A4C18 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C0678102E102ZS26-CDH |
| A4C19 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C0678102E102ZS26-CDH |
| A4C20 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C0678102E102ZS26-CDH |
| A4C21 | 0150-0C93 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A4C22 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A4C23 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C0678102E102ZS26-CDH |
| A4C24 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C0678102E102ZS26-CDH |
| A4C25 | 0150-0C50 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C0678102E102ZS26-CDH |
| A4C26 | 0150-0C93 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A4C27 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C0678102E102ZS26-CDH |
| A4C28 | 0160-2009 | | C:FXD MICA 820 PF 5% 300VDCW | 00853 | C0678102E102ZS26-CDH |
| A4C29 | 0160-0938 | | C:FXD MICA 1000 PF 5% | 72136 | RDM15F821J3C |
| A4C30 | 0160-0938 | | C:FXD MICA 1000 PF 5% | 72136 | RDM15E102J1C |
| A4C31 | 0150-0C93 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A4C32 | 0150-0C93 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A4C33 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A4C34 | 0150-0C50 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C0678102E102ZS26-CDH |
| A4C35 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A4C36 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C0678102E102ZS26-CDH |
| A4C37 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C0678102E102ZS26-CDH |
| A4C38 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C0678102E102ZS26-CDH |
| A4C39 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C0678102E102ZS26-CDH |
| A4C40 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A4C41 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C0678102E102ZS26-CDH |
| A4C42 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C0678102E102ZS26-CDH |
| A4C43 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C0678102E102ZS26-CDH |
| A4C44 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |

Table 6-1. Replaceable Parts (cont'd).

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|-----|------------------------------------|----------|----------------------|
| A4C45 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A4C46 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C067B102E102Z526-CDH |
| A4C47 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C067B102E102Z526-CDH |
| A4C48 | 0180-1746 | | C:FXD ELECT 15 UF 10% 20VDCW | 28480 | 0180-1746 |
| A4C49 | 0180-1746 | | C:FXD ELECT 15 UF 10% 20VDCW | 28480 | 0180-1746 |
| A4IC1 | 1820-0450 | 5 | IC: DIGITAL | 18324 | N8290A |
| A4IC2 | 1820-0427 | 5 | IC: LINEAR MODULE | 04713 | SC82326K |
| A4IC3 | 1826-0058 | 8 | IC: LINEAR VIDEO AMPLIFIER | 18324 | NE 501A |
| A4IC4 | 1826-0058 | | IC: LINEAR VIDEO AMPLIFIER | 18324 | NE 501A |
| A4IC5 | 1820-0450 | 4 | IC: DIGITAL TTL | 18324 | N8290A |
| A4IC6 | 1820-0427 | | IC: LINEAR MODULE | 04713 | SC82326K |
| A4IC7 | 1826-0058 | | IC: LINEAR VIDEO AMPLIFIER | 18324 | NE 501A |
| A4IC8 | 1826-0058 | | IC: LINEAR VIDEO AMPLIFIER | 18324 | NE 501A |
| A4L1 | 9100-3248 | 2 | COIL:FXD 10 UH | 28480 | 9100-3248 |
| A4L2 | 9100-3248 | | COIL:FXD 10 UH | 28480 | 9100-3248 |
| A4L3 | 9100-3247 | 3 | COIL:FXD 15 UH | 28480 | 9100-3247 |
| A4L4 | 9100-1618 | | COIL:MOLDED CHOKE 5.60 UH | 28480 | 9100-1618 |
| A4L5 | 9100-1618 | | COIL:MOLDED CHOKE 5.60 UH | 28480 | 9100-1618 |
| A4L6 THRU L11 | 9170 0016 | | FERRITE BEADS | 28480 | 9170 0016 |
| A4P1 | 1250-1314 | | CONNECTOR RF COAX, CENTER CONTACT | 98291 | 52-054 0000 |
| A4Q1 | 1853-0203 | | TSTR:SI PNP | 28480 | 1853-0203 |
| A4Q2 | 1853-0203 | | TSTR:SI PNP | 28480 | 1853-0203 |
| A4Q3 | 1854-0009 | 6 | TSTR:SI NPN | 80131 | 2N709 |
| A4Q4 | 1854-0071 | 18 | TSTR:SI NPN(SELECTED FROM 2N3704) | 28480 | 1854-0071 |
| A4Q5 | 1854-0071 | | TSTR:SI NPN(SELECTED FROM 2N3704) | 28480 | 1854-0071 |
| A4Q6 | 1853-0010 | | TSTR:SI PNP(SELECTED FROM 2N3251) | 28480 | 1853-0010 |
| A4Q7 | 1854-0071 | | TSTR:SI NPN(SELECTED FROM 2N3704) | 28480 | 1854-0071 |
| A4Q8 | 1853-0203 | | TSTR:SI PNP | 28480 | 1853-0203 |
| A4Q9 | 1853-0203 | | TSTR:SI PNP | 28480 | 1853-0203 |
| A4Q10 | 1854-0009 | | TSTR:SI NPN | 80131 | 2N709 |
| A4Q11 | 1854-0071 | | TSTR:SI NPN(SELECTED FROM 2N3704) | 28480 | 1854-0071 |
| A4Q12 | 1854-0071 | | TSTR:SI NPN(SELECTED FROM 2N3704) | 28480 | 1854-0071 |
| A4Q13 | 1853-0010 | | TSTR:SI PNP(SELECTED FROM 2N3251) | 28480 | 1853-0010 |
| A4Q14 | 1854-0071 | | TSTR:SI NPN(SELECTED FROM 2N3704) | 28480 | 1854-0071 |
| A4R1 | 0683-6215 | 30 | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A4R2 | 0683-5625 | 10 | R:FXD COMP 5600 OHM 5% 1/4W | 01121 | CB 5625 |
| A4R3 | 0683-5625 | | R:FXD COMP 5600 OHM 5% 1/4W | 01121 | CB 5625 |
| A4R4 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A4R5 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A4R6 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A4R7 | 0683-2015 | | R:FXD COMP 200 OHM 5% 1/4W | 01121 | CB 2015 |
| A4R8 | 0683-8215 | | R:FXD COMP 820 OHM 5% 1/4W | 01121 | CB 8215 |
| A4R9 | 0683 4715 | | R:FXD COMP 470 OHM 5% 1/4W | 01121 | CB 4715 |
| A4R10 | 0683-5105 | | R:FXD COMP 51 OHM 5% 1/4W | 01121 | CB 5105 |
| A4R11 | 0683-6815 | 1 | R:FXD COMP 680 OHM 5% 1/4W | 01121 | CB 6815 |
| A4R12 | 0683-7505 | 1 | R:FXD COMP 75 OHM 5% 1/4W | 01121 | CB 7505 |
| A4R13 | 0683-2225 | 8 | R:FXD COMP 2.2K OHM 5% 1/4W | 01121 | CB 2225 |
| A4R14 | 0683-5105 | | R:FXD COMP 51 OHM 5% 1/4W | 01121 | CB 5105 |
| A4R15 | 0683-1125 | 10 | R:FXD COMP 1100 OHM 5% 1/4W | 01121 | CB 1125 |
| A4R16 | 0683-3615 | 1 | R:FXD COMP 360 OHM 5% 1/4W | 01121 | CB 3615 |
| A4R17 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A4R18 | 0683-1315 | 9 | R:FXD COMP 130 OHM 5% 1/4W | 01121 | CB 1315 |
| A4R19 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A4R20 | 0683-4715 | 5 | R:FXD COMP 470 OHM 5% 1/4W | 01121 | CB 4715 |
| A4R21 | 0683-1315 | | R:FXD COMP 130 OHM 5% 1/4W | 01121 | CB 1315 |
| A4R23 | 0683-3325 | 13 | R:FXD COMP 3300 OHM 5% 1/4W | 01121 | CB 3325 |
| A4R24 | 0683-3025 | | R:FXD COMP 3000 OHM 5% 1/4W | 01121 | CB 3025 |
| A4R25 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A4R26 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A4R27 | 0683-4735 | 6 | R:FXD COMP 47K OHM 5% 1/4W | 01121 | CB 4735 |
| A4R28 | 0683-6835 | 4 | R:FXD COMP 68K OHM 5% 1/4W | 01121 | CB 6835 |
| A4R29 | 0683-1125 | | R:FXD COMP 1100 OHM 5% 1/4W | 01121 | CB 1125 |
| A4R30 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A4R31 | 0683-1045 | | R:FXD COMP 100K OHMS 5% 1/4W | 01121 | CB 1045 |
| A4R32 | 0683-2735 | 9 | R:FXD COMP 27K OHM 5% 1/4W | 01121 | CB 2735 |
| A4R33 | 0683-7525 | 7 | R:FXD COMP 7500 OHM 5% 1/4W | 01121 | CB 7525 |
| A4R34 | 0683-5125 | | R:FXD COMP 5100 OHM 5% 1/4W | 01121 | CB 5125 |
| A4R35 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A4R36 | 0683-5625 | | R:FXD COMP 5600 OHM 5% 1/4W | 01121 | CB 5625 |
| A4R37 | 0683-5625 | | R:FXD COMP 5600 OHM 5% 1/4W | 01121 | CB 5625 |
| A4R38 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A4R39 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A4R40 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A4R41 | 0683-2015 | | R:FXD COMP 200 OHM 5% 1/4W | 01121 | CB 2015 |
| A4R42 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A4R43 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |

1 See Section VIII, Manual Backdating

Table 6-1. Replaceable Parts (cont'd).

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|-----|-------------------------------------|---------------------|----------------------|
| A4R44 | 0683-5105 | 3 | R:FXD COMP 51 OHM 5% 1/4W | 01121 | CB 5105 |
| A4R45 | 0683-9115 | | R:FXD COMP 910 OHM 5% 1/4W | 01121 | CB 9115 |
| A4R46 | 0683-1115 | | R:FXD COMP 110 OHM 5% 1/4W | 01121 | CB 1115 |
| A4R48 | 0683-5105 | | R:FXD COMP 51 OHM 5% 1/4W | 01121 | CB 5105 |
| A4R47 | 0683-4325 | | R:FXD COMP 4300 OHM 5% 1/4W | 01121 | CB 4325 |
| A4R49 | 0683-1125 | 4 | R:FXD COMP 1100 OHM 5% 1/4W | 01121 | CB 1125 |
| A4R50 | 0683-7515 | | R:FXD COMP 750 OHM 5% 1/4W | 01121 | CB 7515 |
| A4R51 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A4R52 | 0683-1315 | | R:FXD COMP 130 OHM 5% 1/4W | 01121 | CB 1315 |
| A4R53 | 0683-2425 | | R:FXD COMP 2400 OHM 5% 1/4W | 01121 | CB 2425 |
| A4R54 | 0683-8215 | 5 | R:FXD COMP 820 OHM 5% 1/4W | 01121 | CB 8215 |
| A4R55 | 0683-1315 | | R:FXD COMP 130 OHM 5% 1/4W | 01121 | CB 1315 |
| A4R57 | 0683-3325 | | R:FXD COMP 3300 OHM 5% 1/4W | 01121 | CB 3325 |
| A4R58 | 0683-3025 | | R:FXD COMP 3000 OHM 5% 1/4W | 01121 | CB 3025 |
| A4R59 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A4R60 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A4R61 | 0683-4735 | | R:FXD COMP 47K OHM 5% 1/4W | 01121 | CB 4735 |
| A4R62 | 0683-6835 | | R:FXD COMP 68K OHM 5% 1/4W | 01121 | CB 6835 |
| A4R63 | 0683-1125 | | R:FXD COMP 1100 OHM 5% 1/4W | 01121 | CB 1125 |
| A4R64 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A4R65 | 0683-1045 | | R:FXD COMP 100K OHMS 5% 1/4W | 01121 | CB 1045 |
| A4R66 | 0683-2735 | | R:FXD COMP 27K OHM 5% 1/4W | 01121 | CB 2735 |
| A4R67 | 0683-7525 | | R:FXD COMP 7500 OHM 5% 1/4W | 01121 | CB 7525 |
| A4R68 | 0683-5125 | | R:FXD COMP 5100 OHM 5% 1/4W | 01121 | CB 5125 |
| A5 | 03320-66505 | | 1 | BOARD ASSY: RNG DIV | 28480 |
| A5A1,A2 | 03320-62702 | | FILTER ASSY | 28480 | 03320-62702 |
| A5C1 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C067B102E102ZS26-CDH |
| A5C2 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K8C0011 |
| A5C3 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C067B102E102ZS26-CDH |
| A5C4 | | | NOT ASSIGNED | | |
| A5C7 | 0160-0938 | | C:FXD MICA 1000 PF 5% | 72136 | 80M15E102J1C |
| A5C5 | 0160-2009 | | C:FXD MICA 820 PF 5% 300VDCW | 00853 | 80M15F621J3C |
| A5C6 | 0160-0938 | | C:FXD MICA 1000 PF 5% | 72136 | 80M15E102J1C |
| A5C8 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C067B102E102ZS26-CDH |
| A5C9 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K8C0011 |
| A5C10 | 0150-0050 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K8C0011 |
| A5C11 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C067B102E102ZS26-CDH |
| A5C12 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K8C0011 |
| A5C13 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C067B102E102ZS26-CDH |
| A5C14 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C067B102E102ZS26-CDH |
| A5C15 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C067B102E102ZS26-CDH |
| A5C16 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K8C0011 |
| A5C17 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C067B102E102ZS26-CDH |
| A5C18 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C067B102E102ZS26-CDH |
| A5C19 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K8C0011 |
| A5C20 | 0150-0050 | | C:FXD CER 1000 PF +80 20% 1000 VDCW | 56289 | C067B102E102ZS26-CDH |
| A5C21 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100 VDCW | 72982 | 801-K800011 |
| A5C22 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000 VDCW | 56289 | C067B102E102ZS26-CDH |
| A5C23 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C067B102E102ZS26-CDH |
| A5C24 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C067B102E102ZS26-CDH |
| A5C25 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K8C0011 |
| A5C26 | 0150-0050 | | C:FXD CER 1000 PF +80 20% 1000 VDCW | 56289 | C067B102E102ZS26-CDH |
| A5C27 | 0160-2009 | | C:FXD MICA 820 PF 5% 300 VDCW | 00853 | 80M15F821J3C |
| A5C28 | 0160-0938 | | C:FXD MICA 1000 PF 5% | 72136 | 80M15E102J1C |
| A5C29 | 0160-0938 | | C:FXD MICA 1000 PF 5% | 72136 | 80M15E102J1C |
| A5C30 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K8C0011 |
| A5C31 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C067B102E102ZS26-CDH |
| A5C32 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K8C0011 |
| A5C33 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K8C0011 |
| A5C34 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C067B102E102ZS26-CDH |
| A5C35 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K8C0011 |
| A5C36 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C067B102E102ZS26-CDH |
| A5C37 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C067B102E102ZS26-CDH |
| A5C38 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C067B102E102ZS26-CDH |
| A5C39 | 0150 0083 | | C:FXD CER 0.01 UF +80-20% 100 VDCW | 72982 | 801 K800011 |
| A5C40 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C067B102E102ZS26-CDH |
| A5C41 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C067B102E102ZS26-CDH |
| A5C42 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A5C43 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C067B102E102ZS26-CDH |
| A5C44 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A5C45 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C067B102E102ZS26-CDH |
| A5C46 | 0150-0050 | | C:FXD CER 1000 PF +80-20% 1000VDCW | 56289 | C067B102E102ZS26-CDH |
| A5C47 | 0180-1746 | | C:FXD ELECT 15 UF 10% 20 VDCW | 28480 | 0180-1746 |
| A5C48 | 0180-1746 | | C:FXD ELECT 15 UF 10% 20 VDCW | 28480 | 0180-1746 |
| A51C1 | 1820-0450 | | IC: DIGITAL TTL | 18324 | N8290A |
| A51C2 | 1820-0427 | | IC: LINEAR MOQULE | 04713 | SC82326K |
| A51C3 | 1826-0058 | | IC: LINEAR VIDEO AMPLIFIER | 18324 | NE 501A |

Table 6-1. Replaceable Parts (cont'd)

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|-----|-----------------------------------|----------|-----------------|
| A5IC4 | 1826-0058 | | IC:LINEAR VIDEO AMPLIFIER | 18324 | NE 501A |
| A5IC5 | 1820-0450 | | IC:DIGITAL TTL | 18324 | N8290A |
| A5IC6 | 1820-0427 | | IC:LINEAR MODULE | 04713 | SC8232GK |
| A5IC7 | 1826-0058 | | IC:LINEAR VIDEO AMPLIFIER | 18324 | NE 501A |
| A5IC8 | 1826-0058 | | IC:LINEAR VIDEO AMPLIFIER | 18324 | NE 501A |
| A5L1 | 9100-3247 | | COIL:FXD 15 UH | 28480 | 9100-3247 |
| A5L2 | 9100-3247 | | COIL:FXD 15 UH | 28480 | 9100-3247 |
| A5L3 | 9100-1618 | | COIL:MOLDED CHOKE 5.60 UH | 28480 | 9100-1618 |
| A5L4 | 9100-1618 | | COIL:MOLDED CHOKE 5.60 UH | 28480 | 9100-1618 |
| A5L6 THRU L11 | 9170-0016 | 7 | BEAD: MAGNETIC SHIELDING | 02114 | 56 590-65/38 |
| A5P1 | 1250-1314 | | CONNECTOR RF COAX, CENTER CONTACT | 98291 | 52 054 0000 |
| A5Q1 | 1853-0203 | | TSTR:SI PNP | 28480 | 1853-0203 |
| A5Q2 | 1853-0203 | | TSTR:SI PNP | 28480 | 1853-0203 |
| A5Q3 | 1854-0009 | | TSTR:SI NPN | 80131 | 2N709 |
| A5Q4 | 1854-0071 | | TSTR:SI NPN(SELECTED FROM 2N3704) | 28480 | 1854-0071 |
| A5Q5 | 1854-0071 | | TSTR:SI NPN(SELECTED FROM 2N3704) | 28480 | 1854-0071 |
| A5Q6 | 1853-0010 | | TSTR:SI PNP(SELECTED FROM 2N3251) | 28480 | 1853-0010 |
| A5Q7 | 1854-0071 | | TSTR:SI NPN(SELECTED FROM 2N3704) | 28480 | 1854-0071 |
| A5Q8 | 1853-0203 | | TSTR:SI PNP | 28480 | 1853-0203 |
| A5Q9 | 1853-0203 | | TSTR:SI PNP | 28480 | 1853-0203 |
| A5Q10 | 1854-0009 | | TSTR:SI NPN | 80131 | 2N709 |
| A5Q11 | 1854-0071 | | TSTR:SI NPN(SELECTED FROM 2N3704) | 28480 | 1854-0071 |
| A5Q12 | 1854-0071 | | TSTR:SI NPN(SELECTED FROM 2N3704) | 28480 | 1854-0071 |
| A5Q13 | 1853-0010 | | TSTR:SI PNP(SELECTED FROM 2N3251) | 28480 | 1853-0010 |
| A5Q14 | 1854-0071 | | TSTR:SI NPN(SELECTED FROM 2N3704) | 28480 | 1854-0071 |
| A5R1 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A5R2 | 0683-5625 | | R:FXD COMP 5600 OHM 5% 1/4W | 01121 | CB 5625 |
| A5R3 | 0683-5625 | | R:FXD COMP 5600 OHM 5% 1/4W | 01121 | CB 5625 |
| A5R4 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A5R5 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A5R6 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A5R7 | 0683-2015 | | R:FXD COMP 200 OHM 5% 1/4W | 01121 | CB 2015 |
| A5R8 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A5R9 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A5R10 | 0683-5105 | | R:FXD COMP 51 OHM 5% 1/4W | 01121 | CB 5105 |
| A5R11 | 0683-9115 | | R:FXD COMP 910 OHM 5% 1/4W | 01121 | CB 9115 |
| A5R12 | 0683-1115 | | R:FXD COMP 110 OHM 5% 1/4W | 01121 | CB 1115 |
| A5R13 | 0683-4325 | | R:FXD COMP 4300 OHM 5% 1/4W | 01121 | CB 4325 |
| A5R14 | 0683-5105 | | R:FXD COMP 51 OHM 5% 1/4W | 01121 | CB 5105 |
| A5R15 | 0683-1125 | | R:FXD COMP 1100 OHM 5% 1/4W | 01121 | CB 1125 |
| A5R16 | 0683-7515 | | R:FXD COMP 750 OHM 5% 1/4W | 01121 | CB 7515 |
| A5R17 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A5R18 | 0683-1315 | | R:FXD COMP 130 OHM 5% 1/4W | 01121 | CB 1315 |
| A5R19 | 0683-2425 | | R:FXD COMP 2400 OHM 5% 1/4W | 01121 | CB 2425 |
| A5R20 | 0683-8215 | | R:FXD COMP 820 OHM 5% 1/4W | 01121 | CB 8215 |
| A5R21 | 0683-1315 | | R:FXD COMP 130 OHM 5% 1/4W | 01121 | CB 1315 |
| A5R22 | 0683-3325 | | R:FXD COMP 3300 OHM 5% 1/4W | 01121 | CB 3325 |
| A5R23 | 0683-3025 | | R:FXD COMP 3000 OHM 5% 1/4W | 01121 | CB 3025 |
| A5R24 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A5R25 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A5R26 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A5R27 | 0683-4735 | | R:FXD COMP 47K OHM 5% 1/4W | 01121 | CB 4735 |
| A5R28 | 0683-6835 | | R:FXD COMP 68K OHM 5% 1/4W | 01121 | CB 6835 |
| A5R29 | 0683-1125 | | R:FXD COMP 1100 OHM 5% 1/4W | 01121 | CB 1125 |
| A5R30 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A5R31 | 0683-1045 | | R:FXD COMP 100K OHMS 5% 1/4W | 01121 | CB 1045 |
| A5R32 | 0683-2735 | | R:FXD COMP 27K OHM 5% 1/4W | 01121 | CB 2735 |
| A5R33 | 0683-7525 | | R:FXD COMP 7500 OHM 5% 1/4W | 01121 | CB 7525 |
| A5R34 | 0683-5125 | | R:FXD COMP 5100 OHM 5% 1/4W | 01121 | CB 5125 |
| A5R35 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A5R36 | 0683-5625 | | R:FXD COMP 5600 OHM 5% 1/4W | 01121 | CB 5625 |
| A5R37 | 0683-5625 | | R:FXD COMP 5600 OHM 5% 1/4W | 01121 | CB 5625 |
| A5R38 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A5R39 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A5R40 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A5R41 | 0683-2015 | | R:FXD COMP 200 OHM 5% 1/4W | 01121 | CB 2015 |
| A5R42 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A5R43 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A5R44 | 0683-5105 | | R:FXD COMP 51 OHM 5% 1/4W | 01121 | CB 5105 |
| A5R45 | 0683-9115 | | R:FXD COMP 910 OHM 5% 1/4W | 01121 | CB 9115 |
| A5R46 | 0683-1115 | | R:FXD COMP 110 OHM 5% 1/4W | 01121 | CB 1115 |
| A5R47 | 0683-4325 | | R:FXD COMP 4300 OHM 5% 1/4W | 01121 | CB 4325 |
| A5R48 | 0683-5105 | | R:FXD COMP 51 OHM 5% 1/4W | 01121 | CB 5105 |
| A5R49 | 0683-1125 | | R:FXD COMP 1100 OHM 5% 1/4W | 01121 | CB 1125 |
| A5R50 | 0683-7515 | | R:FXD COMP 750 OHM 5% 1/4W | 01121 | CB 7515 |

Table 6-1. Replaceable Parts (cont'd).

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|-----|---|----------|--------------------|
| A5R51 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A5R52 | 0683-1315 | | R:FXD COMP 130 OHM 5% 1/4W | 01121 | CB 1315 |
| A5R53 | 0683-2425 | | R:FXD COMP 2400 OHM 5% 1/4W | 01121 | CB 2425 |
| A5R54 | 0683-8215 | | R:FXD COMP 820 OHM 5% 1/4W | 01121 | CB 8215 |
| A5R55 | 0683-1315 | | R:FXD COMP 130 OHM 5% 1/4W | 01121 | CB 1315 |
| A5R57 | 0683-3325 | | R:FXD COMP 3300 OHM 5% 1/4W | 01121 | CB 3325 |
| A5R58 | 0683-3025 | | R:FXD COMP 3000 OHM 5% 1/4W | 01121 | CB 3025 |
| A5R59 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A5R60 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A5R61 | 0683-4735 | | R:FXD COMP 47K OHM 5% 1/4W | 01121 | CB 4735 |
| A5R62 | 0683-6835 | | R:FXD COMP 68K OHM 5% 1/4W | 01121 | CB 6835 |
| A5R63 | 0683-1125 | | R:FXD COMP 1100 OHM 5% 1/4W | 01121 | CB 1125 |
| A5R64 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A5R65 | 0683-1045 | | R:FXD COMP 100K OHMS 5% 1/4W | 01121 | CB 1045 |
| A5R66 | 0683-2735 | | R:FXD COMP 27K OHM 5% 1/4W | 01121 | CB 2735 |
| A5R67 | 0683-7525 | | R:FXD COMP 7500 OHM 5% 1/4W | 01121 | CB 7525 |
| A5R68 | 0683-5125 | | R:FXD COMP 5100 OHM 5% 1/4W | 01121 | CB 5125 |
| A6 (OPTION 006) | 03320-66505 | | IDENTICAL TO A5. REFER TO A5 PARTS LIST | 28480 | 03320-66505 |
| A7 | 03320-66507 | | PC ASSEMBLY: PHASE LOCK | 28480 | 03320-66507 |
| A7 C1 | 0180-1746 | 4 | C: FXD 15 UF 10% 20 VDCW | 56289 | 150D156X9020B2-DYS |
| A7 C2 | 0140-0190 | 1 | C: FXD MICA 39 PF 5% | 72136 | RDM15E390J3C |
| A7 C3 | 0160-0763 | 1 | C: FXD MICA 5 PF 10% | 72136 | RDM15C050K5S |
| A7 C4, C5 | 0150-0093 | 9 | C: FXD 01 UF +80% 20% 100 VDCW | 91418 | TA |
| A7 C5 | 0140-0200 | | C: FXD 390 PF 5% | 00853 | RDM15F391J3S |
| A7 C7, C8 | 0150-0093 | | C: FXD 01 UF +80% -20% 100 VDCW | 91418 | TA |
| A7 C9 | 0160-0205 | 1 | C: FXD MICA 10 PF 5% | 72136 | RDM15C100J5S |
| A7 C11, C12 | 0150-0093 | | C: FXD 01 UF +80% 20% 100 VDCW | 91418 | TA |
| A7 C14, C15 | 0150-0093 | | C: FXD 01 UF +80% 20% 100 VDCW | 91418 | TA |
| A7 C16 | 0180-0291 | 1 | C: FXD 1 UF 10% 35 VDCW | 56289 | 150D105X9035A2 DYS |
| A7 C17 | 0140-0190 | | C:FXD 39 PF 5% | 72316 | RDM15E390J3C |
| A7 C20, C21 | 0180-1746 | | C: FXD 15 UF 10% 20 VDCW | 56289 | 150D156X9020B2 DYS |
| A7 C22 | 0150-0093 | | C: FXD 01 UF +80% 20% 100 VDCW | 91418 | TA |
| A7 C23 | 0170-0066 | 1 | C: FXD MYLAR 10% 027 UF 200 VDCW | 56289 | 192P27392-PTS |
| A7 C24 | 0160-0155 | 1 | C: FXD .0033 UF 200 VDCW | 56289 | 5C13C-CML |
| A7 C25, C26 | 0160-2221 | 2 | C: FXD MICA 1300PF 5% | 72136 | RDM19F132J3C |
| A7 C27 | 0180-1746 | | C: FXD 15 UF 10% 20 VDCW | 56289 | 150D156X9020B2 DYS |
| A7 CR1 THRU CR6 | 1901-0040 | 6 | DIODE: SI 50MA 2 PF 2NS 30V | 0763 | FDG1088 |
| A7 IC1 | 1820-092319 | 1 | IC: QUAD 2 INPUT NOR GATE | 04713 | SC7527PK |
| A7 IC2, IC3 | 1826-0043 | 2 | IC: LINEAR OP. AMP | 12040 | SL12795 |
| A7 IC4 | 1820-0595 | 1 | IC: DUAL DIGITAL | 12040 | DM74L73N |
| A7 L1 | 9100-3314 | 1 | COIL: MOLDED | 28480 | 9100-3314 |
| A7 L2 THRU L4 | 9140-0179 | 4 | COIL MOLDED CHOKE | 28480 | 9140-0179 |
| A7 L6 | 9100-3315 | 1 | COIL: MOLDED | 28480 | 9100-3315 |
| A7 L7 | 9140-0179 | | COIL: MOLDED CHOKE | 28480 | 9140-0179 |
| A7 L8 | 9100-3313 | 1 | COIL MOLDED | 28480 | 9100-3313 |
| A7 J1, J2 | 1250-1195 | 2 | CONNECTOR: R F | 98291 | 52 053 0000 |
| A7 Q1 | 1853-0203 | 1 | TSTR: SI NPN | 04713 | SS5651 |
| A7 Q2 | 1854-0009 | 1 | TSTR | 04713 | SS7376K |
| A7 Q3 | 1854-0019 | 1 | TSTR: SI NPN | 04713 | S-6516 |
| A7 Q4 THRU Q6 | 1854-0071 | 3 | TSTR: SI NPN | 01295 | SKA1124 |
| A7 R1 | 0683-1525 | 1 | R: FXD COMP 1500 Ω 5% 1/4 W | 01121 | CB1525 |
| A7 R2 | 0683-1025 | 5 | R: FXD COMP 1000 Ω 5% 1/4 W | 01121 | CB1025 |
| A7 R3 | 0683-1315 | 1 | R: FXD COMP 130 Ω 5% 1/4 W | 01121 | CB1315 |
| A7 R4 | 0683-4315 | 1 | R: FXD COMP 430 Ω 5% 1/4 W | 01121 | CB4315 |
| A7 R5, R6 | 0683-2015 | 2 | R: FXD COMP 200 Ω 5% 1/4 W | 01121 | CB2015 |
| A7 R7 | 0683-5115 | 1 | R: FXD COMP 510 OHM 5% 1/4 W | 01121 | CB5115 |
| A7 R8, R9 | 0683-1515 | 2 | R: FXD COMP 150 OHM 5% 1/4 W | 01121 | CB1515 |
| A7 R12, R13 | 0683-2725 | 2 | R: FXD COMP 2700 OHM 5% 1/4 W | 01121 | CB2725 |
| A7 R14, R15 | 0683-1235 | 2 | R: FXD COMP 12 K OHM 5% 1/4 W | 01121 | CB1235 |
| A7 R16 | 0683-2025 | 4 | R: FXD COMP 2000 OHM 5% 1/4 W | 01121 | CB2025 |
| A7 R17 | 0683-5125 | 3 | R: FXD COMP 5100 OHM 5% 1/4 W | 01121 | CB5125 |
| A7 R20 | 0683-1035 | 2 | R: FXD COMP 10 K OHM 5% 1/4 W | 01121 | CB1035 |
| A7 R21 | 0683-1025 | | R: FXD COMP 1000 OHM 5% 1/4 W | 01121 | CB1025 |
| A7 R22 | 0683-1805 | 1 | R: FXD COMP 18 OHM 5% 1/4 W | 01121 | CB1805 |
| A7 R23 | 0683-1045 | 1 | R: FXD COMP 100 K OHM 5% 1/4 W | 01121 | CB1045 |
| A7 R24 | 0683-5125 | | R: FXD COMP 5100 OHM 5% 1/4 W | 01121 | CB5125 |
| A7 R25 | 0683-2035 | 1 | R: FXD COMP 20 K OHM 5% 1/4 W | 01121 | CB2035 |
| A7 R26 | 0683-1625 | 1 | R: FXD COMP 1600 OHM 5% 1/4 W | 01121 | CB1625 |
| A7 R27 | 0683-2025 | | R: FXD COMP 2000 OHM 5% 1/4 W | 01121 | CB2025 |
| A7 R28 | 0683-9115 | 1 | R: FXD COMP 910 OHM 5% 1/4 W | 01121 | CB9115 |
| A7 R29 | 0683-3605 | 1 | R: FXD COMP 36 OHM 5% 1/4 W | 01121 | CB3605 |
| A7 R30 | 0683-2025 | | R: FXD COMP 2000 OHM 5% 1/4 W | 01121 | CB2025 |
| A7 R31 | 0683-1025 | | R: FXD COMP 1000 OHM 5% 1/4 W | 01121 | CB1025 |
| A7 R32 | 0683-3325 | 1 | R: FXD COMP 3300 OHM 5% 1/4 W | 01121 | CB3325 |
| A7 R33 | 0683-0275 | 1 | R: FXD COMP 2.7 OHM 5% 1/4 W | 01121 | CB2765 |

† See Section VIII, Manual Backdating

Table 6-1. Replaceable Parts (cont'd).

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|-----|------------------------------------|----------|------------------|
| A7 R34 | 0683 1025 | | R: FXD COMP 1000 OHM 5% 1/4 W | 01121 | CB1025 |
| A7 R35, R36 | 0683-1055 | 2 | R: FXD COMP 1 MEGOHM 5% 1/4 W | 01121 | CB1055 |
| A7 R37 | 0683-4325 | 1 | R: FXD COMP 4300 OHM 5% 1/4 W | 01121 | CB4325 |
| A7 R38 | 0683 2225 | 1 | R: FXD COMP 2200 OHM 5% 1/4 W | 01121 | CB2225 |
| A7 R39 | 0683 5125 | | R: FXD COMP 5100 OHM 5% 1/4 W | 01121 | CB5125 |
| A7 R40 | 0683-1035 | | R: FXD COMP 10 K OHM 5% 1/4 W | 01121 | CB1035 |
| A7 R41 | 0683 1025 | | R: FXD COMP 1000 OHM 5% 1/4 W | 01121 | CB1025 |
| A7 R42 | 0683-2025 | | R: FXD COMP 2000 OHM 5% 1/4 W | 01121 | CB2025 |
| A7 R43 | 0683 3005 | 1 | R: FXD COMP 30 OHM 5% 1/4 W | 01121 | CB3005 |
| A7 T1 | 9100-1362 | 2 | TRANSFORMER TOROID | 28480 | 9100-1362 |
| A7 T2 | 9100 1361 | 1 | TRANSFORMER TOROID | 28480 | 9100-1361 |
| A7 T3 | 9100-1362 | | TRANSFORMER TOROID | 28480 | 9100 1362 |
| A8 | 03320-66508 | 1 | BOARD ASSY:REFERENCE OSC ILLATOR | 28480 | 03320-66508 |
| A8C1 | 0150-0122 | 7 | C:FXD CER 2000 PF 20% 500VDCW | 72982 | 801-000-Y5S-202M |
| A8C2 | 0180-1746 | | C:FXD ELECT 15 UF 10% 20VDCW | 28480 | 0180-1746 |
| A8C3 | 0160-0181 | 1 | C:FXD MICA 30PF 5% 300VDCW | 14655 | ROM15F300J35 |
| A8C4 | 0121-0436 | | C:VAR AIR 2.4-24.5 PF | 74970 | 189-509-105 |
| A8C5 | 0160-2322 | 1 | C:FXD MICA 18 PF 5% 100VDCW | 00853 | RDH15C180J15 |
| A8C6 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A8C7 | 0160-2203 | 1 | C:FXD MICA 91 PF 5% | 72136 | RDH15F910J3C |
| A8C8 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A8C9 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A8C10 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A8C11 | 0160-2C09 | | C:FXD MICA 820 PF 5% 300VDCW | 00853 | RDH15F821J3C |
| A8C12 | 0140-0179 | 2 | C:FXD MICA 1000 PF 2% | 28480 | 0140-0179 |
| A8C13 | 0140-0179 | | C:FXD MICA 1000 PF 2% | 28480 | 0140-0179 |
| A8C14 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A8C15 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A8C16 | 0150-0C93 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A8C17 | 0150-0C93 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A8C18 | 0140-0222 | 3 | C:FXD MICA 240 PF 1% 300VDCW | 28480 | 0140-0222 |
| A8C19 | 0150-0122 | | C:FXD CER 2000 PF 20% 500VDCW | 72982 | 801-000-Y5S-202M |
| A8C20 | 0150-0C93 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A8C21 | 0150-0C93 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A8C22 | 0150-0122 | | C:FXD CER 2000 PF 20% 500VDCW | 72982 | 801-000-Y5S-202M |
| A8C23 | 0150-0122 | | C:FXD CER 2000 PF 20% 500VDCW | 72982 | 801-000-Y5S-202M |
| A8C24 | 0140-0222 | | C:FXD MICA 240 PF 1% 300VDCW | 28480 | 0140-0222 |
| A8C25 | 0150-0C93 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A8C26 | 0150-0C93 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A8C27 | 0140-0222 | | C:FXD MICA 240 PF 1% 300VDCW | 28480 | 0140-0222 |
| A8C28 | 0150-0122 | | C:FXD CER 2000 PF 20% 500VDCW | 72982 | 801-000-Y5S-202M |
| A8C29 | 0150-0122 | | C:FXD CER 2000 PF 20% 500VDCW | 72982 | 801-000-Y5S-202M |
| A8C30 | 0150-0122 | | C:FXD CER 2000 PF 20% 500VDCW | 72982 | 801-000-Y5S-202M |
| A8C31 | 0140-0210 | 1 | C:FXD MICA 270 PF 5% | 28480 | 0140-0210 |
| A8C32 | 0160-2225 | 1 | C:FXD MICA 2000 PF 5% 300VDCW | 72136 | RDH19F202J3C |
| A8C33 | 0150-0C93 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A8C34 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A8C35 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A8C36 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A8C37 | 0150-0C93 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A8C38 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A8C39 | 0150-0C93 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A8C40 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| † A8C41 | | | UNASSIGNED | | |
| † A8C42 | | | UNASSIGNED | | |
| † A8C43 | | | UNASSIGNED | | |
| † A8C44 | | | UNASSIGNED | | |
| † A8C45 | | | UNASSIGNED | | |
| † A8C46 | | | UNASSIGNED | | |
| A8C47 | 0180-1746 | | C:FXD ELECT 15 UF 10% 20VDCW | 28480 | 0180-1746 |
| A8C48 | 0180-1746 | | C:FXD ELECT 15 UF 10% 20VDCW | 28480 | 0180-1746 |
| A8C49 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A8C50 | 0180-1746 | | C:FXD ELECT 15 UF 10% 20VDCW | 28480 | 0180-1746 |
| A8CR1 | 0122-0059 | | DIODE:VOLTAGE VARIABLE CAPACITANCE | 28480 | 0122-0059 |
| A8IC1 | 1820-0450 | | IC:DIGITAL TTL | 18324 | N8290A |
| A8IC2 | 1820-0427 | | IC:LINEAR MODULE | 04713 | SC8232GK |
| † A8P1 | | | UNASSIGNED | | |
| A8L1 | 9140-0179 | | COIL/CHOKER 22.0 UH 10% | 28480 | 9140-0179 |

† See Section VIII, Manual Backdating.

Table 6-1. Replaceable Parts (cont'd)

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|-----|----------------------------------|----------|-----------------|
| A8L2 | 9100-1620 | 3 | COIL:MOLDED CHOKE 15.0 UH 10% | 28480 | 9100-1620 |
| A8L3 | 9140-0088 | 4 | COIL:RF 0.33 UH 5% | 95265 | N8-0.37 PS |
| A8L4 | 9140-0088 | | COIL:RF 0.33 UH 5% | 95265 | N8-0.37 PS |
| A8L5 | 9140-0088 | | COIL:RF 0.33 UH 5% | 95265 | N8-0.37 PS |
| A8L6 | 9140-0088 | | COIL:RF 0.33 UH 5% | 95265 | N8-0.37 PS |
| † A8L7 | | | UNASSIGNED | | |
| A8L8 | 9140-0107 | | COIL:FXD RF 27 UH 10% | 99800 | 1840-38 |
| A8L9 | 9140-0107 | | COIL:FXD RF 27 UH 10% | 99800 | 1840-38 |
| A8L10 | 9140-0107 | | COIL:FXD RF 27 UH 10% | 99800 | 1840-38 |
| A8L11 | 9100-1618 | | COIL:MOLDED CHOKE 5.60 UH | 28480 | 9100-1618 |
| A8Q1 | 1854-0C19 | | TSTR:SI NPN | 28480 | 1854-0C19 |
| A8Q2 | 1854-0019 | | TSTR:SI NPN | 28480 | 1854-0019 |
| A8Q3 | 1853-0203 | | TSTR:SI PNP | 28480 | 1853-0203 |
| A8Q4 | 1853-0203 | | TSTR:SI PNP | 28480 | 1853-0203 |
| A8Q5 | 1854-0009 | | TSTR:SI NPN | 80131 | 2N709 |
| A8Q6 | 1854-0009 | | TSTR:SI NPN | 80131 | 2N709 |
| A8Q7 | 1854-0019 | | TSTR:SI NPN | 28480 | 1854-0019 |
| A8Q8 | 1854-0019 | | TSTR:SI NPN | 28480 | 1854-0019 |
| A8Q9 | 1853-0203 | | TSTR:SI PNP | 28480 | 1853-0203 |
| A8Q10 | 1853-0203 | | TSTR:SI PNP | 28480 | 1853-0203 |
| A8Q11 | 1853-0203 | | TSTR:SI PNP | 28480 | 1853-0203 |
| A8Q12 | 1853-0203 | | TSTR:SI PNP | 28480 | 1853-0203 |
| † A8Q13 | | | UNASSIGNED | | |
| † A8Q14 | | | UNASSIGNED | | |
| A8R1 | 0683-5125 | | R:FXD COMP 5100 OHM 5% 1/4W | 01121 | CB 5125 |
| A8R2 | 0757-0442 | | R:FXD MET FLM 10.0 K OHM 1% 1/8W | 28480 | 0757-0442 |
| A8R3 | 0757-0453 | | R:FXD MET FLM 30.1 K OHM 1% 1/8W | 28480 | 0757-0453 |
| A8R4 | 0698-3499 | 2 | R:FXD FLM 40-2K OHM 1% 1/8W | 28480 | 0698-3499 |
| A8R5 | 0683-4715 | | R:FXD COMP 470 OHM 5% 1/4W | 01121 | CB 4715 |
| A8R6 | 0683-1535 | | R:FXD COMP 15K OHM 5% 1/4W | 01121 | CB 1535 |
| A8R7 | 0683-3035 | 2 | R:FXD COMP 30K OHM 5% 1/4W | 01121 | CB 3035 |
| A8R8 | 0683-3035 | | R:FXD COMP 30K OHM 5% 1/4W | 01121 | CB 3035 |
| A8R9 | 0683-4715 | | R:FXD COMP 470 OHM 5% 1/4W | 01121 | CB 4715 |
| A8R10 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A8R11 | 0683-2025 | | R:FXD COMP 2000 OHM 5% 1/4W | 01121 | CB 2025 |
| A8R12 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A8R13 | 0683-5625 | | R:FXD COMP 5600 OHM 5% 1/4W | 01121 | CB 5625 |
| A8R14 | 0683-5625 | | R:FXD COMP 5600 OHM 5% 1/4W | 01121 | CB 5625 |
| A8R15 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A8R16 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A8R17 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A8R18 | 0683-2015 | | R:FXD COMP 200 OHM 5% 1/4W | 01121 | CB 2015 |
| A8R19 | 0683-3315 | | R:FXD COMP 330 OHM 5% 1/4W | 01121 | CB 3315 |
| A8R20 | 0683-1035 | 5 | R:FXD COMP 10K OHM 5% 1/4W | 01121 | CB 1035 |
| A8R21 | 0683-2025 | | R:FXD COMP 2000 OHM 5% 1/4W | 01121 | CB 2025 |
| A8R22 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A8R23 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A8R24 | 0683-1015 | | R:FXD COMP 100 OHM 5% 1/4W | 01121 | CB 1015 |
| A8R25 | 0683-9125 | 1 | R:FXD COMP 9100 OHM 5% 1/4W | 01121 | CB 9125 |
| A8R26 | 0683-3025 | | R:FXD COMP 3000 OHM 5% 1/4W | 01121 | CB 3025 |
| A8R27 | 0683-3025 | | R:FXD COMP 3000 OHM 5% 1/4W | 01121 | CB 3025 |
| A8R28 | 0683-5105 | | R:FXD COMP 51 OHM 5% 1/4W | 01121 | CB 5105 |
| A8R29 | 0683-5105 | | R:FXD COMP 51 OHM 5% 1/4W | 01121 | CB 5105 |
| A8R30 | 0683-1315 | | R:FXD COMP 130 OHM 5% 1/4W | 01121 | CB 1315 |
| A8R31 | 0683-7525 | | R:FXD COMP 7500 OHM 5% 1/4W | 01121 | CB 7525 |
| A8R32 | 0683-3315 | | R:FXD COMP 330 OHM 5% 1/4W | 01121 | CB 3315 |
| A8R33 | 0683-3315 | | R:FXD COMP 330 OHM 5% 1/4W | 01121 | CB 3315 |
| A8R34 | 0683-4705 | 9 | R:FXD COMP 47 OHM 5% 1/4W | 01121 | CB 4705 |
| A8R35 | 0683-4705 | | R:FXD COMP 47 OHM 5% 1/4W | 01121 | CB 4705 |
| A8R36 | 0683-3315 | | R:FXD COMP 330 OHM 5% 1/4W | 01121 | CB 3315 |
| A8R37 | 0683-2225 | | R:FXD COMP 2.2K OHM 5% 1/4W | 01121 | CB 2225 |
| A8R38 | 0683-1015 | | R:FXD COMP 100 OHM 5% 1/4W | 01121 | CB 1015 |
| A8R39 | 0683-2225 | | R:FXD COMP 2.2K OHM 5% 1/4W | 01121 | CB 2225 |
| A8R40 | 0683-4705 | | R:FXD COMP 47 OHM 5% 1/4W | 01121 | CB 4705 |
| A8R41 | 0683-1035 | | R:FXD COMP 10K OHM 5% 1/4W | 01121 | CB 1035 |
| A8R42 | 0683-1035 | | R:FXD COMP 10K OHM 5% 1/4W | 01121 | CB 1035 |
| A8R43 | 0683-3315 | | R:FXD COMP 330 OHM 5% 1/4W | 01121 | CB 3315 |
| A8R44 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A8R45 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A8R46 | 0683-4705 | | R:FXD COMP 47 OHM 5% 1/4W | 01121 | CB 4705 |
| A8R47 | 0683-4715 | | R:FXD COMP 470 OHM 5% 1/4W | 01121 | CB 4715 |
| A8R48 | 0683-5125 | | R:FXD COMP 5100 OHM 5% 1/4W | 01121 | CB 5125 |
| A8R49 | 0683-5125 | | R:FXD COMP 5100 OHM 5% 1/4W | 01121 | CB 5125 |
| A8R50 | 0683-4705 | | R:FXD COMP 47 OHM 5% 1/4W | 01121 | CB 4705 |
| A8R51 | 0683-5125 | | R:FXD COMP 5100 OHM 5% 1/4W | 01121 | CB 5125 |

† See Section VIII, Manual Backdating.

Table 6-1. Replaceable Parts(Cont'd)

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|-----|--|----------------|---------------------|
| A8R52 | 0683-2015 | | R:FXD COMP 200 OHM 5% 1/4W | 01121 | CB 2015 |
| A8R53 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A8R54 | 0683-6215 | | R:FXD COMP 620 OHM 5% 1/4W | 01121 | CB 6215 |
| A8R55 | 0683-4705 | | R:FXD COMP 47 OHM 5% 1/4W | 01121 | CB 4705 |
| A8R56 | 0683-4715 | | R:FXD COMP 470 OHM 5% 1/4W | 01121 | CB 4715 |
| A8R57 | 0683-5125 | | R:FXD COMP 5100 OHM 5% 1/4W | 01121 | CB 5125 |
| A8R58 | 0683-5125 | | R:FXD COMP 5100 OHM 5% 1/4W | 01121 | CB 5125 |
| A8R59 | 0683-4705 | | R:FXD COMP 47 OHM 5% 1/4W | 01121 | CB 4705 |
| A8R60 | 0683-5125 | | R:FXD COMP 5100 OHM 5% 1/4W | 01121 | CB 5125 |
| A8R61 | 0683-2015 | | R:FXD COMP 200 OHM 5% 1/4W | 01121 | CB 2015 |
| † A8R62 | | | UNASSIGNED | | |
| † A8R63 | | | UNASSIGNED | | |
| † A8R64 | | | UNASSIGNED | | |
| † A8R65 | | | UNASSIGNED | | |
| † A8R66 | | | UNASSIGNED | | |
| † A8R67 THRU R71 | | | UNASSIGNED | | |
| † A8T1 | | | UNASSIGNED | | |
| A8Y1 | 0410-0438 | 1 | CRYSTAL QUARTZ | 28480 | 0410-0438 |
| A9A (3320A ONLY) | 03320-66533 | 1 | PC ASSY- MODULATOR A9A IS IDENTICAL TO A9B WITH THE FOLLOWING EXCEPTIONS: NOT ASSIGNED NOT ASSIGNED NOT ASSIGNED C:FXD ELECT 15 UF 10% 20 VDCW | 28480 | 03320-66533 |
| A9C1 THRU A9C17 | | | NOT ASSIGNED | | |
| A9C24 | | | NOT ASSIGNED | | |
| A9C32 | | | NOT ASSIGNED | | |
| A9C35 | 0180-1746 | | C:FXD ELECT 15 UF 10% 20 VDCW | 56289 | 150D156X901082-DYS |
| A9C1 THRU A9C3 | | | NOT ASSIGNED | | |
| A9D1 THRU A9D5 | | | NOT ASSIGNED | | |
| A9R1 THRU A9R23 | | | NOT ASSIGNED | | |
| A9R43 | 0698-3557 | | | | |
| A9R44 | 0683-3315 | | R:FXD FLM 806 OHM 1% 1/8 W | 14674 | C4T 0 obd |
| A9R45 | 0698-4448 | | R:FXD COMP 330 OHM 5% 1/4 W R:FXD FLM 294 OHM 1% 1/8 W | 01121 14674 | CB3315 C4T 0 obd |
| A9R47 | | | NOT ASSIGNED | | |
| A9R51 | 0698-3510 | | R:FXD FLM 453 OHM 1% 1/8 W | 72136 | MF4C T 0 obd |
| A9R52 | 2100-248987 | | R-VAR COMP 5K OHM 10% 1/2W | 28480 | 2100-2489 |
| A9B (3320B ONLY) | 03320-66509 | 1 | PC ASSY- MODULATOR | 28480 | 03320-66509 |
| A9C1 | 0180-0374 | | C:FXD TANT. 10 UF 10% 20 VDCW | 56289 | 150D106X901082-DYS |
| A9C2 | 0180-1735 | 4 | C:FXD ELECT 0.22 UF 10% 35 VDCW | 28480 | 0180-1735 |
| A9C3 | 0180-1735 | | C:FXD ELECT 0.22 UF 10% 35 VDCW | 28480 | 0180-1735 |
| A9C4 | 0180-0374 | | C:FXD TANT. 10 UF 10% 20 VDCW | 56289 | 150D106X902082-DYS |
| A9C5 | 0180-0373 | 1 | C:FXD ELECT 0.68 UF 10% 35 VDCW | 56289 | 150D684X9035A2-DYS |
| A9C6 | 0180-1743 | 3 | C:FXD ELECT 0.1 UF 10% 35 VDCW | 56289 | 150D104X9035A2-DYS |
| A9C7 | 0180-0154 | 2 | C:FXD MICA MY 0.0022 UF 10% 200 VDCW | 56289 | 192P22292-PTS |
| A9C8 | 0180-0154 | | C:FXD MICA MY 0.0022 UF 10% 200 VDCW | 56289 | 192P22292-PTS |
| A9C9 | 0180-1743 | | C:FXD ELECT 0.1 UF 10% 35 VDCW | 56289 | 150D104X9035A2-DYS |
| A9C10 | 0180-0159 | 1 | C:FXD MY 0.0068 UF 10% 200 VDCW | 56289 | 192P68262-PTS |
| A9C11 | 0180-1743 | | C:FXD ELECT 0.1 UF 10% 35 VDCW | 56289 | 150D104X9035A2-DYS |
| A9C13 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100 VDCW | 72982 | 801-K800011 |
| A9C14 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100 VDCW | 72982 | 801-K800011 |
| A9C15 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100 VDCW | 72982 | 801-K800011 |
| A9C16 | 0160-2201 | 1 | C:FXD MICA 51 PF 5% | 72136 | RDM15E10J1C |
| A9C17 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100 VDCW | 72982 | 801-K800011 |
| A9C18 | 0140-0191 | 1 | C:FXD MICA 56 PF 5% 300 VDCW | 19701 | RDM15E560J 300 V |
| A9C19 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100 VDCW | 72982 | 801-K800011 |
| A9C20 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100 VDCW | 72982 | 801-K800011 |
| A9C21 | 0180-1746 | | C:FXD ELECT 15 UF 10% 20 VDCW | 28480 | 0180-1746 |
| A9C22 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100 VDCW | 72982 | 801-K800011 |
| A9C23 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100 VDCW | 72982 | 801-K800011 |
| A9C24 | 0121-0432 | | C:VAR AIR 1.7-14.1 PF | 74970 | 189-505-105 |
| A9C25 | 0160-0958 | | C:FXD MICA 390 PF 5% 300 VDCW | 00853 | RDM15F391J3S |
| A9C26 | 0160-2150 | 1 | C:FXD MICA 33 PF 5% | 28480 | 0160-2150 |
| A9C27 | 0160-0378 | 2 | C:FXD MICA 27 PF 5% | 72136 | RDM15E270J5S |
| A9C28 | 0160-2202 | 2 | C:FXD MICA 75 PF 5% | 28480 | 0160-2202 |
| A9C29 | 0160-0196 | 1 | C:FXD MICA 24 PF 5% 300 VDCW | 04062 | RDM15C240J3S |
| A9C30 | 0160-2202 | | C:FXD MICA 75 PF 5% | 28480 | 0160-2202 |
| A9C31 | 0160-0378 | | C:FXD MICA 27 PF 5% | 72136 | RDM15E270J5S |
| A9C32 | 0180-1746 | | C:FXD ELECT 15 UF 10% 20 VDCW | 28480 | 0180-1746 |
| A9C33 | 0180-1746 | | C:FXD ELECT 15 UF 10% 20 VDCW | 28480 | 0180-1746 |
| A9C34, A9C35 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100 VDCW | 72982 | 801-K800011 |
| A9CR1 | 1901-0040 | | DIODE: SILICON 30 MA 30 WV | 07263 | FOG1088 |
| A9CR2 | 1901-0040 | | DIODE: SILICON 30 MA 30 WV | 07263 | FOG1088 |
| A9IC1 | 1826-0043 | | IC: LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-0043 |
| A9IC2 | 1826-0043 | | IC: LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-0043 |
| A9IC3 | 1826-0043 | | IC: LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-0043 |
| A9IC4 | 1826-0043 | | IC: LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-0043 |
| A9IC5 | 1826-0043 | | IC: LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-0043 |
| A9IC6 | 1821-0001 | 1 | TRANSISTOR ARRAY: SiNPN | 02735 | CA3046 |
| A9J1 | 1250-1195 | 5 | CONNECTOR, RF SUB-MINIATURE SERIES | 98291 | 52 053-0000 |

† See Section VIII, Manual Backdating.

Table 6-1. Replaceable Parts (cont'd).

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|-----|-------------------------------------|----------|--------------------|
| A9L1 | 9140-0096 | | COIL: FXD RF 1 UH | 28480 | 9140-0096 |
| A9L2 | 9140-0096 | | COIL: FXD RF 1 UH | 18480 | 9140-0096 |
| A9L3 | 9140-0107 | | COIL: FXD RF 27 UH 10% | 99800 | 1840 38 |
| A9L4 | 9140-0096 | | COIL: FXD RF 1 UH | 18480 | 9140-0096 |
| A9L5 | 9140 0111 | | COIL: FXD RF 3.3 UH | 28480 | 9140-0111 |
| A9L6 | 9140-0112 | 2 | COIL: FXD RF 4.7 UH | 28480 | 9140-0112 |
| A9L7 | 9140-0111 | 2 | COIL: FXD RF 3.3 UH | 28480 | 9140-0112 |
| A9L8 | 9140-0107 | | COIL: FXD RF 27 UH 10% | 99800 | 1840 38 |
| A9Q1 | 1854 0071 | | TSTR: SI NPN (SELECTED FROM 2N3704) | 28480 | 1854-0071 |
| A9Q2 | 1853-0020 | | TSTR: SI PNP (SELECTED FROM 2N3702) | 28480 | 1853 0020 |
| A9Q3 | 1854 0071 | | TSTR: SI NPN (Selected from 2N3704) | 28480 | 1853-0071 |
| A9Q4 | 1855 0081 | 4 | TSTR: SI FET | 80131 | 2N5245 |
| A9Q5 | 1855-0081 | | TSTR: SI FET | 80131 | 2N5245 |
| A9Q6 | 1853-0066 | 2 | TSTR: SI PNP | 80131 | 2N4250 |
| A9Q7 | 1854-0019 | | TSTR: SI NPN | 28480 | 1854-0019 |
| A9Q8 | 1854-0019 | | TSTR: SI NPN | 28480 | 1854 0019 |
| A9Q9 | 1854-0019 | | TSTR: SI NPN | 28480 | 1854-0019 |
| A9Q10 | 1853 0066 | | TSTR: SI PNP | 80131 | 2N4250 |
| A9R1 | 0698 3518 | 5 | R: FXD FLM 7.32 K OHM 1% 1/8 W | 28480 | 0698 3518 |
| A9R2 | 0698 3518 | | R: FXD FLM 7.32 K OHM 1% 1/8 W | 28480 | 0698 3518 |
| A9R3 | 0757-0463 | 2 | R: FXD MET FLM 82.5 K OHM 1% 1/8 W | 28480 | 0757-0463 |
| A9R4 | 0757-0280 | | R: FXD MET FLM 1 K OHM 1% 1/8 W | 28480 | 0757 0280 |
| A9R5 | 0757-0444 | | R: FXD MET FLM 12.1 K OHM 1% 1/8 W | 28480 | 0757 0444 |
| A9R6 | 0698 4307 | 4 | R: FXD FLM 14.3 K OHM 1% 1/8 W | 28480 | 0698 4307 |
| A9R7 | 0698-4482 | 2 | R: FXD FLM 17.4 K OHM 1% 1/8 W | 28480 | 0698-4482 |
| A9R8 | 0698 3259 | | R: FXD FLM 7.87 K OHM 1% 1/8 W | 28480 | 0698-3259 |
| A9R9, A9R10 | 0683 2735 | | R: FXD COMP 27 K OHM 5% 1/4 W | 01121 | CB2735 |
| A9R11 | 0683-4755 | | R: FXD COMP 4.7 MEG OHM 5% 1/4 W | 01121 | CB 4755 |
| A9R12, A9R13 | 0683-2735 | | R: FXD COMP 27 K OHM 5% 1/4 W | 01121 | CB2735 |
| A9R14 | 0683-4755 | | R: FXD COMP 4.7 MEG OHM 5% 1/4 W | 01121 | CB4755 |
| A9R15 | 0683 2735 | | R: FXD COMP 27 K OHM 5% 1/4 W | 01121 | CB2735 |
| A9R16, A9R17 | 0698-3518 | | R: FXD FLM 7.32 K OHM 1% 1/8 W | 28480 | 0698 3518 |
| A9R18 | 0757-0463 | | R: FXD MET FLM 82.5 K OHM 1% 1/8 W | 28480 | 0757-0463 |
| A9R19 | 0757 0280 | | R: FXD MET FLM 1 K OHM 1% 1/8 W | 28480 | 0757-0280 |
| A9R20 | 0757-0444 | | R: FXD MET FLM 12.1 K OHM 1% 1/8 W | 28480 | 0757 0444 |
| A9R21 | 0698 4307 | | R: FXD FLM 14.3 K OHM 1% 1/8 W | 28480 | 0698-4307 |
| A9R22 | 0698 4482 | | R: FXD FLM 17.4 K OHM 1% 1/8 W | 28480 | 0698-4482 |
| A9R23 | 0698 3259 | | R: FXD FLM 7.87 K OHM 1% 1/8 W | 28480 | 0698-3259 |
| A9R24 | 0683-4725 | 2 | R: FXD COMP 4700 OHM 5% 1/4 W | 01121 | CB4725 |
| A9R25 | 0698 3493 | 1 | R: FXD FLM 4.12 K OHM 1% 1/8 W | 28480 | 0698-3493 |
| A9R26 | 0757-0349 | 1 | R: FXD MET FLM 22.6 K OHM 1% 1/8 W | 28480 | 0757-0349 |
| A9R27 | 2100-2521 | | R: VAR FLM 2000 OHM 10% LIN 1/2 W | 28480 | 2100-2521 |
| A9R28 | 0757 0273 | 3 | R: FXD MET FLM 3.01 K OHM 1% 1/8 W | 28480 | 0757 0273 |
| A9R29 | 0698-4123 | | R: FXD MET FLM 499 OHM 1% 1/8 W | 28480 | 0698-4123 |
| A9R30 | 0698 4123 | | R: FXD MET FLM 499 OHM 1% 1/8 W | 28480 | 0698-4123 |
| A9R31 | 0698 4123 | | R: FXD MET FLM 499 OHM 1% 1/8 W | 28480 | 0698-4123 |
| A9R32 | 0757-0438 | | R: FXD MET FLM 5.11 K OHM 1% 1/8 W | 28480 | 0757-0438 |
| A9R33 | 0698 4476 | 1 | R: FXD FLM 10.2 K OHM 1% 1/8 W | 28480 | 0698-4476 |
| A9R34 | 0698-4415 | 1 | R: FXD FLM 165 OHM 1% 1/8 W | 28480 | 0698-4415 |
| A9R35 | 0757-0280 | | R: FXD MET FLM 1 K OHM 1% 1/8 W | 28480 | 0757 0280 |
| A9R36 | 0757-0200 | 1 | R: FXD MET FLM 5.62 K OHM 1% 1/8 W | 28480 | 0757-0200 |
| A9R38 | 0757-0281 | 3 | R: FXD MET FLM 2.74 K OHM 1% 1/8 W | 28480 | 0757-0281 |
| A9R39 | 0683 4705 | | R: FXD COMP 47 OHM 5% 1/4 W | 01121 | CB 4705 |
| A9R40 | 0757-0280 | | R: FXD MET FLM 1 K OHM 1% 1/8 W | 28480 | 0757-0280 |
| A9R41 | 0683-4705 | | R: FXD COMP 47 OHM 5% 1/4 W | 01121 | CB4705 |
| A9R42 | 0757 0397 | 1 | R: FXD MET FLM 68.1 OHM 1% 1/8 W | 28480 | 0757 0397 |
| A9R43 | 0757-0426 | 2 | R: FXD FLM 1.3 K OHM 1% 1/8 W | 28480 | 0757-0426 |
| A9R44 | 0757-0346 | | R: FXD MET FLM 10 OHM 1% 1/8 W | 28480 | 0757-0346 |
| A9R45 | 0757-0415 | 1 | R: FXD MET FLM 475 OHM 1% 1/8 W | 28480 | 0757-0415 |
| A9R46 | 0757-0384 | 3 | R: FXD FLM 20 OHM 1% 1/8 W | 28480 | 0757-0384 |
| A9R47 | 0757-0398 | 2 | R: FXD MET FLM 75 OHM 1% 1/8 W | 28480 | 0757 0398 |
| A9R48 | 0757-0277 | 13 | R: FXD MET FLM 48.9 OHM 1% 1/8 W | 28480 | 0757-0277 |
| A1J | 03320-66510 | 1 | BOARD ASSY: AMP | 28480 | 03320-66510 |
| A10C1 | 0160-2200 | 1 | C:FXD MICA 43 PF 5% | 72136 | RDML5E430J3C |
| A10C2 | 0140-0202 | 1 | C:FXD MICA 15 PF 5% 500VDCW | 28480 | 0140-0202 |
| A10C3 | 0140-0146 | 1 | C:FXD MICA 82 PF 5% 300VDCW | 14655 | RDML5E820J3S |
| A10C4 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A10C5 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A10C6 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A10C7 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A10C8 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A10C10 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A10C11 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A10C12 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A10C14 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A10C15 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A10C16 | 0180-0291 | | C:FXD ELECT 1.0 UF 10% 35VDCW | 56289 | 150D105X9035A2-DYS |
| A10C17 | 0180-0197 | 5 | C:FXD ELECT 2.2 UF 10% 20VDCW | 56289 | 150D225X9020A2-DYS |

Table 6-1. Replaceable Parts (cont'd).

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|--------------------------------|-----------------------------------|---------------------------------|--------------------|
| A10C18 | 0150-0093 | 3 | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A10C20 | 0160-0157 | | C:FXD MY 0.0047 UF 10% 200VDCW | 56289 | 192P47292-PTS |
| A10C21 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A10C22 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A10C23 | 0180-0197 | | C:FXD ELECT 2.2 UF 10% 20VDCW | 56289 | 150D225X9020A2-DYS |
| A10C24 | 0150-0042 | | C:FXD TI 4.7 PF 5% 500VDCW | 78488 | TYPE GA |
| A10C25 | 0160-0488 | 1 | C:FXD CER 10 PF 2% 500VDCW | 71471 | CN-1 |
| A10C26 | 0160-3306 | 1 | C:FXD MICA 25+/-0.5 PF 100VDCW | 00853 | RD15C250D1C |
| A10C27 | 0160-0205 | 1 | C:FXD MICA 10 PF 5% | 28480 | 0160-0205 |
| A10C28 | 0180-0291 | | C:FXD ELECT 1.0 UF 10% 35VDCW | 56289 | 150D105X9035A2-DYS |
| A10C30 | 0160-2009 | | C:FXD MICA 820 PF 5% 300VDCW | 00853 | RD15F821J3C |
| A10C31 | 0180-0291 | | C:FXD ELECT 1.0 UF 10% 35VDCW | 56289 | 150D105X9035A2-DYS |
| A10C32 | 0180-0291 | | C:FXD ELECT 1.0 UF 10% 35VDCW | 56289 | 150D105X9035A2-DYS |
| A10C33 | 0140-0176 | | 3 | C:FXD MICA 100 PF 2% | 28480 |
| A10C34 | 0160-0157 | C:FXD MY 0.0047 UF 10% 200VDCW | | 56289 | 192P47292-PTS |
| A10C35 | 0140-0198 | C:FXD MICA 200 PF 5% | | 72136 | RD15F201J3C |
| A10C36 | 0160-0174 | 1 | C:FXD CER 0.47 UF +80-20% 25VDCW | 56289 | 5C11B75-CML |
| A10C38 | 0150-0C84 | | C:FXD CER 0.1 UF +80-20% 100VDCW | 56289 | 33C41B5-CDH |
| A10C39 | 0150-0C84 | 1 | C:FXD CER 0.1 UF +80-20% 100VDCW | 56289 | 33C41B5-CDH |
| A10C40 | 0180-0291 | | C:FXD ELECT 1.0 UF 10% 35VDCW | 56289 | 150D105X9035A2-DYS |
| A10C41 | 0180-0291 | | C:FXD ELECT 1.0 UF 10% 35VDCW | 56289 | 150D105X9035A2-DYS |
| A10C42 | 0180-1746 | | C:FXD ELECT 15 UF 10% 20VDCW | 28480 | 0180-1746 |
| A10C43 | 0180-0197 | | C:FXD ELECT 2.2 UF 10% 20VDCW | 56289 | 150D225X9020A2-DYS |
| A10C44 | 0180-1746 | | 9 | C:FXD ELECT 15 UF 10% 20VDCW | 28480 |
| A10C45 | 0180-0197 | C:FXD ELECT 2.2 UF 10% 20VDCW | | 56289 | 150D225X9020A2-DYS |
| A10CR1 | 1901-0044 | DIODE:SILICON 20MA/1V | | 28480 | 1901-0044 |
| A10CR2 | 1901-0044 | DIODE:SILICON 20MA/1V | | 28480 | 1901-0044 |
| A10CR3 | 1901-0044 | DIODE:SILICON 20MA/1V | | 28480 | 1901-0044 |
| A10IC1 | 1858-0015 | 1 | | IC HEX LIMITER | 28480 |
| A10IC2 | 1826-C062 | | IC HEX MIXER | 28480 | 1826-0062 |
| A10IC3 | 1826-0043 | | IC:LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-0043 |
| A10IC4 | 1826-0043 | | IC:LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-0043 |
| A10IC5 | 1826-0043 | | IC:LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-0043 |
| A10J1 | 1250-1195 | 2 | CONNECTOR:RF SUB-MINIATURE SERIES | 98291 | 52-053-0000 |
| A10J2 | 1250-1195 | | CONNECTOR:RF SUB-MINIATURE SERIES | 98291 | 52-053-0000 |
| A10L1 | 9140-0106 | | COIL:FXD 0.47 UH | 28480 | 9140-0106 |
| A10L2 | 9140-C098 | | COIL:FXD RF 2.2 UH | 28480 | 9140-0098 |
| A10L3 | 9140-0106 | | COIL:FXD 0.47 UH | 28480 | 9140-0106 |
| A10L4 | 9140-0114 | | 6 | COIL:FXD RF 10 UH | 28480 |
| A10L5 | 9100-1620 | COIL:MOLDED CHOKE 15.0 UH 10% | | 28480 | 9100-1620 |
| A10L6 | 9100-3316 | COIL:FXD 5.6 UH | | 28480 | 9100-3316 |
| A10L7 | 9100-3311 | COIL:FXD 6.0 UH | | 28480 | 9100-3311 |
| A10L8 | 9140-0114 | COIL:FXD RF 10 UH | | 28480 | 9140-0114 |
| A10L9 | 9140-0114 | 1 | | COIL:FXD RF 10 UH | 28480 |
| A10L10 | 9140-0114 | | COIL:FXD RF 10 UH | 28480 | 9140-0114 |
| A10L11 | 9100-1620 | | COIL:MOLDED CHOKE 15.0 UH 10% | 28480 | 9100-1620 |
| A10P1 | 1250-1314 | | CONNECTOR:RF COAX,CENTER CONTACT | 98291 | 52-054-0000 |
| A10Q1 | 1854-0019 | | TSTR:SI NPN | 28480 | 1854-0019 |
| A10Q2 | 1854-0019 | | TSTR:SI NPN | 28480 | 1854-0019 |
| A10Q3 | 1854-0404 | TSTR:SI NPN | 28480 | 1854-0404 | |
| A10Q4 | 1854-0457 | TSTR:SI NPN | 28480 | 1854-0457 | |
| A10Q6 | 1853-0203 | 1 | TSTR:SI PNP | 28480 | 1853-0203 |
| A10Q7 | 1854-0404 | | TSTR:SI NPN | 28480 | 1854-0404 |
| A10Q8 | 1854-0019 | | TSTR:SI NPN | 28480 | 1854-0019 |
| A10Q9 | 1853-0203 | | TSTR:SI PNP | 28480 | 1853-0203 |
| A10R1 | 0698-3279 | | R:FXD MET FLM 4990 OHM 1% 1/8W | 28480 | 0698-3279 |
| A10R2 | 0757-0407 | | R:FXD MET FLM 200 OHM 1% 1/8W | 28480 | 0757-0407 |
| A10R3 | 0698-3498 | | 1 | R:FXD MET FLM 8.66K OHM 1% 1/8W | 28480 |
| A10R4 | 0757-0398 | R:FXD MET FLM 75 OHM 1% 1/8W | | 28480 | 0757-0398 |
| A10R5 | 0757-0388 | R:FXD FLM 30.1 OHM 1% 1/8W | | 28480 | 0757-0388 |
| A10R6 | 0698-3434 | R:FXD MET FLM 34.8 OHM 1% 1/8W | | 28480 | 0698-3434 |
| A10R7 | 0698-4420 | R:FXD FLM 226 OHM 1% 1/8W | | 28480 | 0698-4420 |
| A10R8 | 0698-4406 | R:FXD FLM 115 OHM 1% 1/8W | | 28480 | 0698-4406 |
| A10R9 | 0698-4433 | R:FXD FLM 2260 OHM 1% 1/8W | | 28480 | 0698-4433 |
| A10R10 | 0698-4445 | 1 | R:FXD FLM 5.76K OHM 1% 1/8W | 28480 | 0698-4445 |
| A10R11 | 0698-3512 | | R:FXD FLM 1180 OHM 1% 1/8W | 28480 | 0698-3512 |
| A10R12 | 0698-4452 | | R:FXD FLM 374 OHM 1% 1/8W | 28480 | 0698-4452 |
| A10R13 | 0698-4123 | | R:FXD MET FLM 499 OHM 1% 1/8W | 28480 | 0698-4123 |
| A10R14 | 0698-4452 | R:FXD FLM 374 OHM 1% 1/8W | 28480 | 0698-4452 | |
| A10R16 | 0757-0277 | 1 | R:FXD MET FLM 49.9 OHM 1% 1/8W | 28480 | 0757-0277 |
| A10R17 | 0757-0277 | | R:FXD MET FLM 49.9 OHM 1% 1/8W | 28480 | 0757-0277 |
| A10R18 | 0757-0434 | | R:FXD MET FLM 3.65K OHM 1% 1/8W | 28480 | 0757-0434 |
| A10R19 | 0698-3484 | | R:FXD FLM 6650 OHM 1% 1/8W | 28480 | 0698-3484 |
| A10R20 | 0698-4474 | 3 | R:FXD FLM 8450 OHM 1% 1/8W | 28480 | 0698-4474 |
| A10R21 | 0757-0289 | | R:FXD MET FLM 13.3K OHM 1% 1/8W | 28480 | 0757-0289 |
| A10R22 | 0698-4435 | | R:FXD FLM 2.49K OHM 1% 1/8W | 28480 | 0698-4435 |
| A10R23 | 0757-0427 | | R:FXD MET FLM 1.5K OHM 1% 1/8W | 28480 | 0757-0427 |

Table 6-1. Replaceable Parts (cont'd)

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|-----|------------------------------------|----------|-----------------|
| A10R24 | 0757-0408 | 1 | R:FXD MET FLM 243 OHM 1% 1/8W | 28480 | 0757-0408 |
| A10R25 | 0757-0405 | 2 | R:FXD FLM 162 OHM 1% 1/8W | 19701 | MF4C T 0 |
| A10R26 | 0757 0405 | | R:FXD FLM 162 OHM 1% 1/8W | 19701 | MF4C T 0 |
| A10R27 | 0757-0289 | | R:FXD MET FLM 13.3K OHM 1% 1/8W | 28480 | 0757-0289 |
| A10R28 | 0757-0281 | | R:FXD MET FLM 2.74K OHM 1% 1/8W | 28480 | 0757-0281 |
| A10R29 | 0757-0281 | | R:FXD MET FLM 2.74K OHM 1% 1/8W | 28480 | 0757-0281 |
| A10R30 | 0757-0317 | 1 | R:FXD MET FLM 1.33K OHM 1% 1/8W | 28480 | 0757-0317 |
| A10R31 | 2100-2574 | 1 | R:VAR CERMET 500 OHM 10% LIN 1/2W | 28480 | 2100-2574 |
| A10R32 | 0698-4426 | 2 | R:FXD FLM 1580 OHM 1% 1/8W | 28480 | 0698-4426 |
| A10R34 | 0757-0291 | 8 | R:FXD FLM 24.9 OHM 1% 1/8W | 28480 | 0757-0291 |
| A10R35 | 1810-0078 | 1 | RESISTIVE NETWORK | 28480 | 1810-0078 |
| A10R36 | 0757-0449 | | R:FXD FLM 20K OHM 1% 1/8W | 28480 | 0757-0449 |
| A10R37 | 2100-3154 | 2 | R:VAR 1K OHM 10% LIN | 28480 | 2100-3154 |
| A10R38 | 0757-0449 | | R:FXD FLM 20K OHM 1% 1/8W | 28480 | 0757-0449 |
| A10R39 | 0757-0291 | | R:FXD FLM 24.9 OHM 1% 1/8W | 28480 | 0757-0291 |
| A10R40 | 0757-0438 | | R:FXD MET FLM 5.11K OHM 1% 1/8W | 28480 | 0757-0438 |
| A10R41 | 0757-0442 | | R:FXD MET FLM 10.0K OHM 1% 1/8W | 28480 | 0757-0442 |
| A10R42 | 0698-3279 | | R:FXD MET FLM 4990 OHM 1% 1/8W | 28480 | 0698-3279 |
| A10R44 | 0684-3911 | 4 | R:FXD COMP 390 OHM 10% 1/4W | 01121 | CB 3911 |
| A10R45 | 2100-2054 | 2 | R:VAR CERMET 50K OHM 10% 3/4W | 28480 | 2100-2054 |
| A10R46 | 0698-4211 | 1 | R:FXD FLM 158K OHM 1% 1/8W | 28480 | 0698-4211 |
| A10R47 | 0698-4508 | 1 | R:FXD FLM 78.7K OHM 1% 1/8W | 28480 | 0698-4508 |
| A10R48 | 0757-0278 | 1 | R:FXD MET FLM 1.76K OHM 1% 1/8W | 28480 | 0757-0278 |
| A10R49 | 0698-3268 | 1 | R:FXD FLM 11.5K OHM 1% 1/8W | 28480 | 0698-3268 |
| A10R50 | 0698-4457 | 1 | R:FXD FLM 576 OHM 1% 1/8W | 28480 | 0698-4457 |
| A10R51 | 0757-0277 | | R:FXD MET FLM 49.9 OHM 1% 1/8W | 28480 | 0757-0277 |
| A10R52 | 0757-0438 | | R:FXD MET FLM 5.11K OHM 1% 1/8W | 28480 | 0757-0438 |
| A10R53 | 0757-0277 | | R:FXD MET FLM 49.9 OHM 1% 1/8W | 28480 | 0757-0277 |
| A10R54 | 0757-0280 | | R:FXD MET FLM 1K OHM 1% 1/8W | 28480 | 0757-0280 |
| A10R55 | 0698-3151 | 3 | R:FXD MET FLM 2.87K OHM 1% 1/8W | 28480 | 0698-3151 |
| A10R56 | 0698-4369 | 1 | R:FXD FLM 23.2 OHM 1% 1/8W | 28480 | 0698-4369 |
| A10R57 | 0698-3151 | | R:FXD MET FLM 2.87K OHM 1% 1/8W | 28480 | 0698-3151 |
| A10R59 | 0757-0414 | 2 | R:FXD FLM 432 OHM 1% 1/8W | 28480 | 0757-0414 |
| A10R60 | 0757-0438 | | R:FXD MET FLM 5.11K OHM 1% 1/8W | 28480 | 0757-0438 |
| A10R61 | 0698-3558 | | R:FXD MET FLM 4.02K OHM 1% 1/8W | 28480 | 0698-3558 |
| A10R62 | 0757-0442 | | R:FXD MET FLM 10.0K OHM 1% 1/8W | 28480 | 0757-0442 |
| A10R63 | 0757-0442 | | R:FXD MET FLM 10.0K OHM 1% 1/8W | 28480 | 0757-0442 |
| A10R64 | 0684-5641 | 1 | R:FXD COMP 560K OHM 10% 1/4W | 01121 | CB 5641 |
| A10R65 | 0757-0437 | | R:FXD MET FLM 4750 OHM 1% 1/8W | 28480 | 0757-0437 |
| A10R66 | 0757-0277 | | R:FXD MET FLM 49.9 OHM 1% 1/8W | 28480 | 0757-0277 |
| A10R67 | 0684-5611 | 1 | R:FXD COMP 560 OHM 10% 1/4W | 01121 | CB 5611 |
| A10R68 | 0757-0277 | | R:FXD MET FLM 49.9 OHM 1% 1/8W | 28480 | 0757-0277 |
| A10R69 | 0757-0277 | | R:FXD MET FLM 49.9 OHM 1% 1/8W | 28480 | 0757-0277 |
| A10R70 | 0698-4123 | | R:FXD MET FLM 499 OHM 1% 1/8W | 28480 | 0698-4123 |
| A10R72 | 0698-3262 | 3 | R:FXD MET FLM 40.2 OHM 1% 1/8W | 28480 | 0698-3262 |
| A10R73 | 0698-3262 | | R:FXD MET FLM 40.2 OHM 1% 1/8W | 28480 | 0698-3262 |
| A10R74 | 0698-4123 | | R:FXD MET FLM 499 OHM 1% 1/8W | 28480 | 0698-4123 |
| A10R75 | 0757-0277 | | R:FXD MET FLM 49.9 OHM 1% 1/8W | 28480 | 0757-0277 |
| A10T1 | 9100-1362 | | TRANSFORMER:TOROID | 28480 | 9100-1362 |
| A10T2 | 9100-1361 | 1 | TRANSFORMER:TOROID | 28480 | 9100-1361 |
| A11 | 03320-66511 | 1 | BOARD ASSY:D/A CONVERTER | 28480 | 03320-66511 |
| A11(Doption 001) | 03320-66540 | 1 | BOARD ASSY:D/A CONVERTER | 28480 | 03320-66540 |
| A11C1 | 0160-0157 | | C:FXD MY 0.0047 UF 10% 200VDCW | 56289 | 192P47292-PTS |
| A11C2 | 0160-0207 | | C:FXD MYLAR 0.01 UF 5% 200 VDCW | 28480 | 0160-0207 |
| A11C3 | 0160-0496 | 1 | C:FXD MICA 22000 PF 1% 100VDCW | 00853 | RDM30F223F1C |
| A11C4 | 0150-0C84 | | C:FXD CER 0.1 UF +80-20% 100VDCW | 56289 | 33C4185-C0H |
| A11C5 | 0170-0055 | 1 | C:FXD MY 0.1UF 20% 200VDCW | 56289 | 192P10402 |
| A11C6 | 0180-1746 | | C:FXD ELECT 15 UF 10% 20VDCW | 28480 | 0180-1746 |
| A11C8 | 0180-1746 | | C:FXD ELECT 15 UF 10% 20VDCW | 28480 | 0180-1746 |
| A11C9 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A11C10 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A11C11 | 0180-1746 | | C:FXD ELECT 15 UF 10% 20VDCW | 28480 | 0180-1746 |
| A11C12 | 0150-0083 | | C:FXD CER 0.01 UF +80-20% 100 VDCW | 72982 | 801-K800011 |
| A11CR1 | 1901-0040 | | DIODE:SILICON 30MA 30WV | 07263 | FDG1088 |
| A11CR2 | 1901-0040 | | DIODE:SILICON 30MA 30WV | 07263 | FDG1088 |
| A11CR3 | 1902-0048 | 1 | DIODE:BREAKDOWN 6.81V 5% | 04713 | SZ10939-134 |
| A11CR4 | 1902-0692 | 1 | DIODE:TC REFERENCE 6.3V 1% | 28480 | 1902-0692 |
| A11CR5 | 1901-0040 | | DIODE:SILICON 30MA 30WV | 07263 | FDG1088 |
| A11IC1 | 1820-0583 | | IC:TTL QUAD 2-INPT NAND GATE | 28480 | 1820-0583 |
| A11IC2 | 1820-0703 | 17 | IC:DIGITAL TTL DECADE COUNTER | 28480 | 1820-0703 |
| A11IC3 | 1820-0703 | 3 | IC:DIGITAL TTL DECADE COUNTER | 28480 | 1820-0703 |
| A11IC4 | 1820-0703 | | IC:DIGITAL TTL DECADE COUNTER | 28480 | 1820-0703 |
| A11IC5 | 1820-0595 | 7 | IC:TTL DUAL J-K MASTER SLAVE F/F | 28480 | 1820-0595 |
| A11IC6 | 1820-0207 | 4 | IC:TTL MONOSTABLE MULTIVIBRATOR | 28480 | 1820-0207 |
| A11IC7 | 1820-0207 | | IC:TTL MONOSTABLE MULTIVIBRATOR | 28480 | 1820-0207 |
| A11IC8 | 1826-0043 | | IC:LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-0043 |

Table 6-1. Replaceable Parts (cont'd)

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number | |
|-----------------------|----------------|---------------------------------|-------------------------------------|-----------------------------|-----------------|-----------|
| A11IC9 | 1826-0043 | 2 | IC:LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-0043 | |
| A11IC10 | 1826-0043 | | IC:LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-0043 | |
| A11L1, L2 | 9140-0137 | | COIL:FXD RF 1000 UH 5% | 28480 | 9140-0137 | |
| A11L2 | 9140-0037 | | COIL:5MH | 99848 | 35000-15-502 | |
| A11L3 | 9100-1618 | | COIL:MOLED CHOKE 5.60 UH | 28480 | 9100-1618 | |
| A11Q1 | 1853-0020 | 5 | TSTR:SI PNP(SELECTED FROM 2N3702) | 28480 | 1853-0020 | |
| A11Q2 | 1854-0351 | | TSTR:SI NPN | 04713 | 2N3904 | |
| A11Q3 | 1855-0386 | | TSTR:FET N-CHANNEL | 80131 | 2N4392 | |
| A11Q4 | 1854-0404 | | TSTR:SI NPN | 28480 | 1854-0404 | |
| A11Q5 | 1853-0010 | | TSTR:SI PNP(SELECTED FROM 2N3251) | 28480 | 1853-0010 | |
| A11Q6 | 1853-0020 | 3 | TSTR:SI PNP(SELECTED FROM 2N3702) | 28480 | 1853-0020 | |
| A11Q7 | 1854-0351 | | TSTR:SI NPN | 04713 | 2N3904 | |
| A11Q8 | 1855-0386 | | TSTR:FET N-CHANNEL | 80131 | 2N4392 | |
| A11Q9 | 1853-0020 | | TSTR:SI PNP(SELECTED FROM 2N3702) | 28480 | 1853-0020 | |
| A11Q10 | 1854-0351 | | TSTR:SI NPN | 04713 | 2N3904 | |
| A11Q11 | 1855-0386 | 51 | TSTR:FET N-CHANNEL | 80131 | 2N4392 | |
| A11R1 | 0757-0449 | | R:FXD FLM 20K OHM 1% 1/8W | 28480 | 0757-0449 | |
| A11R2 | 0757-0449 | | R:FXD FLM 20K OHM 1% 1/8W | 28480 | 0757-0449 | |
| A11R3 | 0683-4725 | | R:FXD COMP 4700 OHM 5% 1/4W | 01121 | CB 4725 | |
| A11R4 | 0683-1525 | | R:FXD COMP 1500 OHM 5% 1/4W | 01121 | CB 1525 | |
| A11R5 | 0683-2225 | 1 | R:FXD COMP 2.2K OHM 5% 1/4W | 01121 | CB 2225 | |
| A11R6 | 0683-1035 | | R:FXD COMP 10K OHM 5% 1/4W | 01121 | CB 1035 | |
| A11R8 | 0757-0274 | | R:FXD MET FLM 1.21K OHM 1% 1/8W | 28480 | 0757-0274 | |
| A11R9 | 0698-8026 | | R:FXD FLM 161K OHM 0.5% 1/8W | 28480 | 0698-8026 | |
| A11R9 (Option 001) | 0698-3202 | | R:FXD MET FLM 174K OHM 1% 1/8W | 28480 | 0698-3202 | |
| A11R10 | 2100-3095 | | R:VAR CERMET 700 OHM 10% TYPE P3/4W | 28480 | 2100-3095 | |
| A11R11 | 0698-6670 | | R:FXD MET FLM 1K OHM 0.5% 1/8W | 28480 | 0698-6670 | |
| A11R12 | 0683-3335 | | R:FXD COMP 33 K OHM 5% 1/4W | 01121 | CB 3335 | |
| A11R13 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 | |
| A11R15 | 0698-8027 | | R:FXD FLM 19.3K OHM 0.5% 1/8W | 28480 | 0698-8027 | |
| A11R16 | 2100-3154 | | R:VAR 1K OHM 10% LIN | 28480 | 2100-3154 | |
| A11R17 | 0683-2225 | | 2 | R:FXD COMP 2.2K OHM 5% 1/4W | 01121 | CB 2225 |
| A11R18 | 0698-4484 | | | R:FXD FLM 19.1K OHM 1% 1/8W | 28480 | 0698-4484 |
| A11R19 | 0683-2225 | | | R:FXD COMP 2.2K OHM 5% 1/4W | 01121 | CB 2225 |
| A11R20 | 0683-1035 | | | R:FXD COMP 10K OHM 5% 1/4W | 01121 | CB 1035 |
| A11R21 | 0683-2225 | | | R:FXD COMP 2.2K OHM 5% 1/4W | 01121 | CB 2225 |
| A11R22 | 0698-4484 | | 1 | R:FXD FLM 19.1K OHM 1% 1/8W | 28480 | 0698-4484 |
| A11R24 | 0683-2225 | R:FXD COMP 2.2K OHM 5% 1/4W | | 01121 | CB 2225 | |
| A11R25 | 0683-1525 | R:FXD COMP 1500 OHM 5% 1/4W | | 01121 | CB 1525 | |
| A11R26 | 0683-5635 | R:FXD COMP 56K OHMS 5% 1/4W | | 01121 | CB 5635 | |
| A11R27 | 0683-1025 | R:FXD COMP 1000 OHM 5% 1/4W | | 01121 | CB 1025 | |
| A11R28 | 0683-1025 | R:FXD COMP 1000 OHM 5% 1/4W | | 01121 | CB 1025 | |
| A11R29 | 0683-2235 | R:FXD COMP 22K OHM 5% 1/4W | | 01121 | CB 2235 | |
| A11R30 | 0698-3228 | R:FXD MET FLM 49.9K OHM 1% 1/8W | 28480 | 0698-3228 | | |
| A11R31 | 0698-4459 | R:FXD FLM 634 OHM 1% 1/8W | 28480 | 0698-4459 | | |
| A12A (3320A ONLY) | 03320-66518 | 1 | AMPLIFIER ASSY | 28480 | 03320-66518 | |
| A12 C1 | 0160-2198 | 4 | C:FXD MICA 20 PF 5% | 72136 | RD15C200J3C | |
| A12 C2 | 0140-0176 | | C:FXD MICA 100 PF 2% | 28480 | 0140-0176 | |
| A12 C3 | 0160-3691 | | C:FXD MICA 75 PF 1% 100VDCW | 72136 | RD15E750F1S | |
| A12 C4 | 0140-0218 | | C:FXD MICA 160 PF 2% | 28480 | 0140-0218 | |
| A12 C5 | 0160-0205 | | C:FXD MICA 10 PF 5% | 28480 | 0160-0205 | |
| A12 C6 | 0140-0228 | 2 | C:FXD MICA 360 PF 1% 300VDCW | 28480 | 0140-0228 | |
| A12 C7 | 0140-0226 | | C:FXD MICA 320 PF 1% | 28480 | 0140-0226 | |
| A12 C8 | 0160-2198 | | C:FXD MICA 20 PF 5% | 72136 | RD15C200J3C | |
| A12 C9 | 0140-0220 | | C:FXD MICA 200 PF 1% 300VDCW | 28480 | 0140-0220 | |
| A12 C10 | 0160-2009 | | C:FXD MICA 820 PF 5% 300VDCW | 00853 | RD15F821J3C | |
| A12 C12 | 0150-0093 | 2 | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K80C011 | |
| A12 C13 | 0150-0C84 | | C:FXD CER 0.1 UF +80-20% 100VDCW | 56289 | 33C4185-CDH | |
| A12 C14 | 0150-0C84 | | C:FXD CER 0.1 UF +80-20% 100VDCW | 56289 | 33C4185-CDH | |
| A12 C15 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 | |
| A12 C16 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 | |
| A12 C17 | 0180-2398 | | C:FXD ELECT 600 UF +75-10% 15VDCW | 56289 | 39D607G015E14 | |
| A12 C18 | 0150-0C84 | | C:FXD CER 0.1 UF +80-20% 100VDCW | 56289 | 33C4185-CDH | |
| A12 C19 | 0150-0C84 | | C:FXD CER 0.1 UF +80-20% 100VDCW | 56289 | 33C4185-CDH | |
| A12 C20 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 | |
| A12 C22 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 | |
| A12 C23 | 0180-2398 | 2 | C:FXD ELECT 600 UF +75-10% 15VDCW | 56289 | 39D607G015E14 | |
| A12 C24 | 0150-0121 | | C:FXD CER 0.1 UF +80-20% 50 VDCW | 56289 | 5C5081-CM1 | |
| A12 C25 | 0150-0121 | | C:FXD CER 0.1 UF +80-20% 50 VDCW | 56289 | 5C5081-CM1 | |
| A12 C26 | 0180-1746 | | C:FXD ELECT 15 UF 10% 20VDCW | 28480 | 0180-1746 | |
| A12 CR1 | 1901-0040 | | DIODE:SILICON 30MA 30MV | 07263 | FDG1088 | |
| A12 CR2 | 1901-0040 | | DIODE:SILICON 30MA 30MV | 07263 | FDG1088 | |
| A12 CR3 | 1901-0040 | DIODE:SILICON 30MA 30MV | 07263 | FDG1088 | | |
| A12 CR4 | 1901-0040 | DIODE:SILICON 30MA 30MV | 07263 | FDG1088 | | |
| A12 CR5 | 1901-0040 | DIODE:SILICON 30MA 30MV | 07263 | FDG1088 | | |
| A12 CR6 | 1901-0040 | DIODE:SILICON 30MA 30MV | 07263 | FDG1088 | | |

Table 6-1. Replaceable Parts (cont'd)

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number | |
|-----------------------|----------------|-----------------------------------|----------------------------------|-----------------|--------------------|-----------|
| A12 CR7 | 1901-0050 | 2 | DIODE:SI 200 MA AT 1V | 07263 | FDA 6308 | |
| A12 CR8 | 1902-0554 | | DIODE BREAKDOWN:10V 1W | 28480 | 1902-0554 | |
| A12 CR9 | 1901-0050 | | DIODE:SI 200 MA AT 1V | 07263 | FDA 6308 | |
| A12 CR10 | 1902-0554 | | DIODE BREAKDOWN:10V 1W | 28480 | 1902-0554 | |
| A12 F1 | 2110-0027 | | FUSE:0.125A 250V | 75915 | 312.125 | |
| A12 J1 | 1251-2969 | 6 | CONNECTOR:PHONO, SINGLE JACK | 27264 | 15-24-0501 | |
| A12 J2 | 1251-2969 | | CONNECTOR:PHONO, SINGLE JACK | 27264 | 15-24-0501 | |
| A12 J3 | 1251-2969 | | CONNECTOR:PHONO, SINGLE JACK | 27264 | 15-24-0501 | |
| A12 L1 | 9100-3319 | | COIL:FXD 0.74 UH | 28480 | 9100-3319 | |
| A12 L2 | 9100-3318 | | COIL:FXD 0.58 UH | 28480 | 9100-3318 | |
| A12 L3 | 9100-3318 | | COIL FXD 0.58 UH | 28480 | 9100-3318 | |
| A12 L4 | 9170-0016 | | BEAD: MAGNETIC SHIELDING | 02114 | 56-590-65A 1/38 | |
| A12 L5 | 9170-0016 | | BEAD:MAGNETIC SHIELDING | 02114 | 56-590-65/38 | |
| A12 L6 | 9170-0016 | | BEAD:MAGNETIC SHIELDING | 02114 | 56-590-65/38 | |
| A12 L7 | 9170-0016 | | BEAD:MAGNETIC SHIELDING | 02114 | 56-590-65A 1/38 | |
| A12 L8, L9 | 9140-0180 | | COIL:FXD RF 2.7 UH 10% | 99800 | 1537-22 | |
| A12 Q1 | 1854-0345 | | 1 | TSTR:SI NPN | 80131 | 2N5179 |
| A12 Q2 | 1854-0345 | | | TSTR:SI NPN | 80131 | 2N5179 |
| A12 Q3 | 1853-0203 | | | TSTR:SI PNP | 28480 | 1853-0203 |
| A12 Q4 | 1854-0019 | | | TSTR:SI NPN | 28480 | 1854-0019 |
| A12 Q5 | 1854-0053 | | | TSTR:SI NPN | 80131 | 2N2218 |
| A12 Q6 | 1854-0345 | | | TSTR:SI NPN | 80131 | 2N5179 |
| A12 Q7 | 1853-0203 | TSTR:SI PNP | | 28480 | 1853-0203 | |
| A12 Q8 | 1853-0012 | TSTR:SI PNP | | 80131 | 2N2904A | |
| A12 R1 | C757-0378 | R:FXD MET FLM 11.0 OHM 1% 1/8W | | 28480 | 0757-0378 | |
| A12 R2 | C658-4354 | R:FXD FLM 11.8 OHM 1% 1/8W | | 28480 | 0698-4354 | |
| A12 R3 | 0698-3441 | R:FXD MET FLM 215 OHM 1% 1/8W | | 28480 | 0698-3441 | |
| A12 R4 | 0757-0395 | R:FXD MET FLM 56.2 OHM 1% 1/8W | | 28480 | 0757-0395 | |
| A12 R5 | 0698-4449 | R:FXD MET FLM 309 OHM 1% 1/8W | | 91637 | CMF-1/10-32 T-1 | |
| A12 R6 | 0698-4380 | R:FXD FLM 45.3 OHM 1% 1/8W | | 91637 | CMF-1/10-32 T-1 | |
| A12 R7 | 2100-2583 | R. VAR CERMET 10 OHM 2% LIN 1/2 W | | 28480 | 2100-2583 | |
| A12 R8 | 0698-4380 | R:FXD FLM 45.3 OHM 1% 1/8 W | 91637 | CMF-1/10-32 T-1 | | |
| A12 R10 | 0884-4701 | R:FXD COMP 47 OHM 10% 1/4W | 01121 | CB4701 | | |
| A12 R11 | 0757-0338 | R:FXD MET FLM 1.00K OHM 1% 1/4W | 28480 | 0757-0338 | | |
| A12 R12 | C658-4195 | R:FXD MET FLM 1.02K OHM 1% 1/8W | 28480 | 0698-4195 | | |
| A12 R133 | 0684-8201 | R:FXD COMP 82 OHM 10% 1/4W | 01121 | CB8201 | | |
| A12 R14 | 0698-0082 | R:FXD MET FLM 464 OHM 1% 1/8W | 28480 | 0698-0082 | | |
| A12 R15 | 0684-4701 | R:FXD COMP 47 OHM 10% 1/4W | 01121 | CB 4701 | | |
| A12 R16 | 0698-4452 | R:FXD FLM 374 OHM 1% 1/8W | 28480 | 0698-4452 | | |
| A12 R17 | C757-0284 | R:FXD MET FLM 150 OHM 1% 1/8W | 28480 | 0757-0284 | | |
| A12 R18 | C757-0389 | R:FXD FLM 33.2 OHM 1% 1/8W | 19701 | MF4C T-0 | | |
| A12 R19 | 0757-0346 | R:FXD MET FLM 10 OHM 1% 1/8W | 28480 | 0757-0346 | | |
| A12 R20 | 0757-0346 | R:FXD MET FLM 10 OHM 1% 1/8W | 28480 | 0757-0346 | | |
| A12 R21 | 0757-0389 | R:FXD FLM 33.2 OHM 1% 1/8W | 19701 | MF4C T-0 | | |
| A12 R22 | C698-4447 | R:FXD MET FLM 280 OHM 1% 1/8W | 28480 | 0698-4447 | | |
| A12 R23 | 0757-0284 | R:FXD MET FLM 150 OHM 1% 1/8W | 28480 | 0757-0284 | | |
| A12 R24 | C698-4452 | R:FXD FLM 374 OHM 1% 1/8W | 28480 | 0698-4452 | | |
| A12 R25 | 0684-4701 | R:FXD COMP 47 OHM 10% 1/4W | 01121 | CB 4701 | | |
| A12 R26 | 0698-4449 | R:FXD FLM 309 OHM 1% 1/8W | 28480 | 0698-4449 | | |
| A12 R27 | 0698-3259 | R:FXD FLM 7.87K OHM 1% 1/8W | 28480 | 0698-3259 | | |
| A12 R28 | 0698-4471 | R:FXD FLM 7.15K OHM 1% 1/8W | 28480 | 0698-4471 | | |
| A12 R29 | 0684-4701 | R:FXD COMP 47 OHM 10% 1/4W | 01121 | CB 4701 | | |
| A12 R30 | 0698-4465 | R:FXD FLM 931 OHM 1% 1/8W | 28480 | 0698-4465 | | |
| A12 R31 | 0684-4721 | R:FXD COMP 4700 OHM 10% 1/4W | 01121 | CB 4721 | | |
| A12 R32 | 0684-4721 | R:FXD COMP 4700 OHM 10% 1/4W | 01121 | CB 4721 | | |
| A12 R33 OPTION 001 | 0757-0710 | R:FXD FLM 73.2 OHM 1% 1/4W | 01295 | MC60 T-1 | | |
| A12 R33 (Std) | 0698-3228 | R:FXD FLM 49.9 OHM 1% 1/8W | 28480 | 0698-3228 | | |
| A12 R34 | 0698-4428 | R:FXD FLM 1.69 K OHM 1% 1/8 W | 91637 | CMF 1/10-32 T-1 | | |
| A12 R35, R36 | 0684 4701 | R:FXD COMP 47 OHM 10% 1/4 W | 01121 | CB4701 | | |
| A12 R37, R38 | 0684 1001 | R:FXD COMP 10 OHM 10% 1/4 W | 01121 | CB 1001 | | |
| A12 B (3320B ONLY) | 03320-66512 | 1 | BOARD ASSY-DETECTOR | 28480 | 03320-66512 | |
| A12 A1 | 03320-66701 | | TRANSISTOR ASSY | 28480 | 03320-66701 | |
| A12 A2 | 0853-0017 | | THERMO COUPLE | 28480 | 0853-0017 | |
| A12 C1 | 0180-0291 | | C:FXD ELECT 1.0 UF 10% 35VDCW | 56289 | 1500105X9035A2-DYS | |
| A12 C2 | 0180-0291 | | C:FXD ELECT 1.0 UF 10% 35VDCW | 56289 | 1500105X9035A2-DYS | |
| A12 C3 | 0160-0182 | | C:FXD MICA 47PF 5% 300VDCW | 14655 | RDH15E470J3S | |
| A12 C4 | 0160-0298 | | C:FXD MY 0.0015 UF 10% 200VDCW | 56289 | 192P15292-PTS | |
| A12 C5 | 0160-3183 | | C:FXD MY 0.47 UF 20% 50VDCW | 84411 | HEW 101 | |
| A12 C6 | 0170-0079 | | C:FXD MY 0.047UF 20% 50VDCW | 84411 | STYLE 3 TYPE 601PE | |
| A12 C7 | 0160-0161 | | C:FXD MY 0.01 UF 10% 200VDCW | 56289 | 192P10392-PTS | |
| A12 C8 | 0160-0161 | | C:FXD MY 0.01 UF 10% 200VDCW | 56289 | 192P10392-PTS | |
| A12 C9 | 0160-0161 | | C:FXD MY 0.01 UF 10% 200VDCW | 56289 | 192P10392-PTS | |
| A12 C10 | 0180-0374 | | C:FXD TANT. 10 UF 10% 20VDCW | 56289 | 150D106X902082-DYS | |
| A12 C11 | 0160-3077 | | C:FXD MYLAR .027 UF 10% 100 VDCW | 56289 | 225P2739W81-PWM | |
| A12 C12 | 0160-3077 | | C:FXD MYLAR .027 UF 10% 100 VDCW | 56289 | 225P2739W81-PWM | |
| A12 C13 | 0160-0161 | C:FXD MY 0.01 UF 10% 200VDCW | 56289 | 192P10392-PTS | | |
| A12 C14 | 0160-2611 | C:FXD MY 1 UF 10% 50VDCW | 84411 | HEW 101 | | |
| A12 C15 | 0160-0161 | C:FXD MY 0.01 UF 10% 200VDCW | 56289 | 192P10392-PTS | | |

Table 6-1 Replaceable Parts. (cont'd).

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|--------------------------------|-------------------------------------|-------------------------------------|--------------------|
| A12 C16 | 0160-2611 | 1 | C:FXD MY 1 UF 10% 50VDCW | 84411 | HEW 101 |
| A12 C17 | 0180-0197 | | C:FXD ELECT 2.2 UF 10% 20VDCW | 56289 | 1500225X9020A2-DYS |
| A12 C18 | 0180-0060 | | C:FXD AL ELECT 200 UF +75-10% 3VDCW | 56289 | 30D207G003CC2-DSM |
| A12 C19 | 0160 2322 | | C:FXD MICA 18 PF 5% 100VDCW | 00853 | RDM15C180J15 |
| A12 CR1, CR2 | 1901 0040 | | DIODE.SILICON 30MA 30WV | 07263 | FDG1088 |
| A12 CR3 | 1901-0040 | 3 | DIODE:SILICON 30MA 30WV | 07263 | FDG1088 |
| A12 CR4 | 1902-0049 | | DIODE:BREAKDOWN 6.19V 5% | 04713 | S210939-122 |
| A12 CR5 | 1901-0053 | | DIODE:SILICON 30VDCW | 07263 | FD3444 |
| A12 CR6 | 1901-0040 | | DIODE:SILICON 30MA 30WV | 07263 | FDG1088 |
| A12 CR7 | 1902-0049 | | DIODE:BREAKDOWN 6.19V 5% | 04713 | S210939-122 |
| A12 CR8 | 1901-0040 | 1 | DIODE:SILICON 30MA 30WV | 07263 | FDG1088 |
| A12 CR9 | 1901-0040 | | DIODE:SILICON 30MA 30WV | 07263 | FDG1088 |
| A12 CR10 | 1901-0040 | | DIODE:SILICON 30MA 30WV | 07263 | FDG1088 |
| A12 IC1 | 1826-0043 | | IC:LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-0043 |
| A12 IC2 | 1826-0043 | | IC:LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-0043 |
| A12 IC3 | 1826-0043 | 2 | IC:LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-0043 |
| A12 IC4 | 1820-0207 | | IC:TTL MONOSTABLE MULTIVIBRATOR | 28480 | 1820-0207 |
| A12 IC5 | 1826-0043 | | IC:LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-0043 |
| A12 J1, J2 | 1251 2969 | | CONNECTOR PHONO | 27264 | 15-24-0501 |
| A12 K1 | 0490-0863 | | RELAY MULTI-REED | 28480 | 0490-0863 |
| A12 K2 | 0490-1015 | RELAY- REED COIL 10 VA 250 V | 15636 | R2731-2 | |
| A12 Q1 | 1854-0404 | 4 | TSTR:SI NPN | 28480 | 1854-0404 |
| A12 Q2 | 1853-0012 | | TSTR:SI PNP | 80131 | 2N2904A |
| A12 Q3 | 1855-0368 | | TSTR:FET SI NPN N-CHANNEL | 28480 | 1855-0368 |
| A12 Q5 | 1854-0210 | | TSTR:SI NPN | 80131 | 2N2222 |
| A12 Q6 | 1854-0210 | | TSTR:SI NPN | 80131 | 2N2222 |
| A12 Q7 | 1854-0404 | 1 | TSTR:SI NPN | 28480 | 1854-0404 |
| A12 Q8 | 1855-0368 | | TSTR:FET SI NPN N-CHANNEL | 28480 | 1855-0368 |
| A12 Q9 | 1855-0368 | | TSTR:FET SI NPN N-CHANNEL | 28480 | 1855-0368 |
| A12 Q10 | 1855-0368 | | TSTR:FET SI NPN N-CHANNEL | 28480 | 1855-0368 |
| A12 Q11 | 1854-0210 | | TSTR:SI NPN | 80131 | 2N2222 |
| A12 Q12 | 1854-0210 | 2 | TSTR:SI NPN | 80131 | 2N2222 |
| A12 R1 | 0684-4721 | | R:FXD COMP 4700 OHM 10% 1/4W | 01121 | CB 4721 |
| A12 R2 | 0684-2231 | | R:FXD COMP 22K OHM 10% 1/4W | 01121 | CB 2231 |
| A12 R3 | 0684-2231 | | R:FXD COMP 22K OHM 10% 1/4W | 01121 | CB 2231 |
| A12 R4 | 0684-4731 | | R:FXD COMP 47K OHM 10% 1/4W | 01121 | CB 4731 |
| A12 R5 | 0684-4751 | 4 | R:FXD COMP 4.7 MEGOHM 10% 1/4W | 01121 | CB 4751 |
| A12 R6 | 0684-2251 | | R:FXD COMP 2.2 MEGOHM 10% 1/4W | 01121 | CB 2251 |
| A12 R7 | 0698-4499 | | R:FXD FLM 54.9K OHM 1% 1/8W | 28480 | 0698-4499 |
| A12 R8 | 0698-8004 | | R:FXD FLM 200K OHM 0.1% 1/8W | 28480 | 0698-8004 |
| A12 R10 | 2100-3056 | | 2 | R:VAR CERMET 5K OHM 10% TYPE P 3/4W | 28480 |
| A12 R12 | 0698-8004 | R:FXD FLM 200K OHM 0.1% 1/8W | | 28480 | 0698-8004 |
| A12 R13 | 0757-0472 | R:FXD MET FLM 200K OHM 1% 1/8W | | 28480 | 0757-0472 |
| A12 R14 | 0757-0472 | R:FXD MET FLM 200K OHM 1% 1/8W | | 28480 | 0757-0472 |
| A12 R15 | 0684-4731 | R:FXD COMP 47K OHM 10% 1/4W | | 01121 | CB 4731 |
| A12 R17 | 0698-4530 | 1 | R:FXD FLM 232K OHM 1% 1/8W | 28480 | 0698-4530 |
| A12 R18 | 0757-0446 | | R:FXD MET FLM 15.0K OHM 1% 1/8W | 28480 | 0757-0446 |
| A12 R19 | 0757-0280 | | R:FXD MET FLM 1K OHM 1% 1/8W | 28480 | 0757-C280 |
| A12 R20 | 0698-4462 | | R:FXD FLM 768 OHM 1% 1/8W | 28480 | 0698-4462 |
| A12 R21 | 0757-0728 | | R:FXD MET FLM 619 OHM 1% 1/4W | 28480 | 0757-0728 |
| A12 R22 | 0757-0428 | 3 | R:FXD MET FLM 1.62K OHM 1% 1/8W | 28480 | 0757-0428 |
| A12 R23 | 0757-0427 | | R:FXD MET FLM 1.5K OHM 1% 1/8W | 28480 | 0757-0427 |
| A12 R24 | 0684-3331 | | R:FXD COMP 33K OHM 10% 1/4W | 01121 | CB 3331 |
| A12 R25 | 0698-8005 | | R:FXD FLM 75 OHM .001% 1/8W | 28480 | 0698-8005 |
| A12 R27 | 0698-3228 | | R:FXD MET FLM 49.9K OHM 1% 1/8W | 19701 | MF4C T-0 |
| A12 R28 | 0757-0270 | 3 | R:FXD MET FLM 249K OHM 1% 1/8W | 28480 | 0757-0270 |
| A12 R29 | 0698-8007 | | R:FXD FLM 7.054K OHM .001% 1/8W | 28480 | 0698-8007 |
| A12 R30 | 2100-3122 | | R:VAR CERMET 100 OHM 10% 3/4W | 28480 | 2100-3122 |
| A12 R31 | 0698-8006 | | R:FXD FLM 1.772K OHM .001% 1/8W | 28480 | 0698-8006 |
| A12 R32 | 0698-3262 | | R:FXD MET FLM 40.2 OHM 1% 1/8W | 28480 | 0698-3262 |
| A12 R33 | 0698-3582 | 1 | R:FXD MET FLM 41.2K OHM 1% 1/8W | 28480 | 0698-3582 |
| A12 R34 | 2100-3054 | | R:VAR CERMET 50K OHM 10% 3/4W | 28480 | 2100-3054 |
| A12 R35 | 0684-1221 | | R:FXD COMP 12 K OHM 10% 1/4W | 01121 | CB 1221 |
| A12 R36 | 0684-1061 | | R:FXD COMP 10 MEGOHM 10% 1/4W | 01121 | CB 1061 |
| A12 R37 | 0684-4751 | | R:FXD COMP 4.7 MEGOHM 10% 1/4W | 01121 | CB 4751 |
| A12 R38 | 0684-4751 | 2 | R:FXD COMP 4.7 MEGOHM 10% 1/4W | 01121 | CB 4751 |
| A12 R39 | 0684-1021 | | R:FXD COMP 1000 OHM 10% 1/4W | 01121 | CB 1021 |
| A12 R40 | 0698-3228 | | R:FXD MET FLM 49.9K OHM 1% 1/8W | 28480 | 0698-3228 |
| A12 R41 | 0698-3499 | | R:FXD FLM 40.2K OHM 1% 1/8W | 28480 | 0698-3499 |
| A12 R42 | 0684-4751 | | R:FXD COMP 4.7 MEGOHM 10% 1/4W | 01121 | CB 4751 |
| A12 R43 | 0684-6811 | 1 | R:FXD COMP 680 OHM 10% 1/4W | 01121 | CB 6811 |
| A12 R44 | 0684-3311 | | R:FXD COMP 330 OHM 10% 1/4W | 01121 | CB 3311 |
| A12 R45 | 0684-3321 | | R:FXD COMP 3300 OHM 10% 1/4W | 01121 | CB 3321 |
| A12 R46 | 0684-4731 | | R:FXD COMP 47K OHM 10% 1/4W | 01121 | CB 4731 |
| A12 R47 | 0684-1021 | | R:FXD COMP 1000 OHM 10% 1/4W | 01121 | CB 1021 |
| A12 R48 | 0698-3180 | 1 | R:FXD MET FLM 31.8 K OHM 1% 1/8W | 28480 | 0698-3180 |
| A12 R49 | 0698-3226 | | R:FXD MET FLM 649 K OHM 1% 1/8W | 28480 | 0698-3226 |
| A12 R50 | 0684-8821 | | R:FXD MET COMP 68 K OHM 10% 1/4W | 01121 | CB6821 |

Table 6-1. Replaceable Parts(Cont'd)

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|--|--|--------|---|--|--|
| A12R51 A12R52 A12R53 A12R54 A12R55 | 0684-4731 0684-1051 0757-0270 0684-1001 0684 1001 | 2 | R: FXD COMP 47 K OHM 10% 1/4 W R: FXD COMP 1 MEGOHM 10% 1/4 W R: FXD MET FLM 249K OHM 1% 1/8 W R: FXD COMP 10 OHM 10% 1/4 W R: FXD COMP 10 OHM 10% 1/4 W | 01121 01171 28480 01121 01121 | C84731 C81051 0757-0270 C81001 C81001 |
| A13A (3320A ONLY) A13R1 | 03320-61902 0698-4416 3130-0471 3130-0473 3130-0472 3130-0477 3130-0472 3130-0477 3130-0474 3130-0475 3130-0478 | 1 | PC ASSY: SWITCH R: FXD FLM 169 OHM 1% 1/8 W MSFD: WAFER MSFD: DETENT 2ND SFD: WAFER 2ND SFD: DETENT LSFD: WAFER LSFD, DETENT RANGE: TOP WAFER RANGE: BOTTOM WAFER RANGE: DETENT | 28480 91637 28480 28480 28480 28480 28480 28480 28480 28480 28480 | CMF 1/10 32 T-1 obd 3130-0471 3130-0473 3130 0472 3130-0477 3130-0472 3130 0477 3130-0474 3130-0475 3130 0478 |
| A13B (3320B ONLY) A13R1 | 03320-61901 0698-4416 3130-0471 3130-0473 3130-0472 3130-0477 3130-0472 3130-0477 3130-0476 3130-0479 3130-0472 3130-0477 3130-0472 3130-0477 3130-0477 3130-0472 3130-0477 3130-0474 3130-0475 3130-0478 | 1 | PC ASSY: SWITCH R: FXD FLM 169 OHM 1% 1/8 W MSFD: WAFER MSFD: DETENT 2ND SFD: WAFER 2ND SFD: DETENT LSFD: WAFER LSFD, DETENT MSAD: WAFER MSAD: DETENT 3RD SAD: WAFER 3RD SAD: DETENT 2ND SAD: WAFER 2ND SAD: DETENT LSAD: WAFER LSAD: DETENT RANGE: TOP WAFER RANGE: BOTTOM WAFER RANGE: DETENT | 28480 91637 28480 28480 28480 28480 28480 28480 28480 28480 28480 28480 28480 28480 28480 28480 28480 28480 28480 28480 | 03320-61901 CMF 1/10 32 T-1 obd 3130-0471 3130-0473 3130-0472 3130 0477 3130-0472 3130-0477 3130 0476 3130-0479 3130-0472 3130-0477 3130-0472 3130-0472 3130-0477 3130-0472 3130-0477 3130-0474 3130-0475 3130-0478 |
| A14 (3320B ONLY) | 03320-66514 | 1 | BOARD ASSY. POWER AMPLIFIER | 28480 | 03320-66514 |
| A14C1 A14C2 A14C3 A14C4 A14C5 | 0160-2198 0160-0336 0160-3520 0140-0218 0160-0205 | 1 1 | C:FXD MICA 20 PF 5% C:FXD MICA 100 PF 1% C:FXD MICA 75 PF 1% 100VDCW C:FXD MICA 160 PF 2% C:FXD MICA 10 PF 5% | 72136 28480 72136 28480 28480 | RDM15C200J3C 016C-0336 RDM15E750F1C 014C-0218 0160-0205 |
| A14C6 A14C7 A14C8 A14C9 A14C10 | 0140-0228 0140-0226 0160-2198 0140-0220 0140-0176 | | C:FXD MICA 360 PF 1% 300VDCW C:FXD MICA 320 PF 1% C:FXD MICA 20 PF 5% C:FXD MICA 200 PF 1% 300VDCW C:FXD MICA 100 PF 2% | 28480 28480 72136 28480 28480 | 0140-0228 014C-0226 RDM15C200J3C 0140-0220 0140-0176 |

Table 6-1. Replaceable Parts(Cont'd)

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|-----|-----------------------------------|----------|--------------------|
| A14C11 | 0160-2228 | 1 | C:FXD MICA 2700 PF 5% | 28480 | 0160-2228 |
| A14C12 | 0180-0291 | | C:FXD ELECT 1.0 UF 10% 35VDCW | 56289 | 150D105X9035A2-DYS |
| A14C13 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A14C14 | 0180-1846 | 2 | C:FXD ELECT 2.2 UF 10% 35VDCW | 56289 | 150D225X9035B2-DYS |
| A14C15 | 0180-0291 | | C:FXD ELECT 1.0 UF 10% 35VDCW | 56289 | 150D105X9035A2-DYS |
| A14C16 | 0150-0084 | | C:FXD CER 0.1 UF +80-20% 100VDCW | 56289 | 33C41B5-CDH |
| A14C17 | | | NOT ASSIGNED | | |
| A14C18 | 0180-0291 | | C:FXD ELECT 1.0 UF 10% 35VDCW | 56289 | 150D105X9035A2-DYS |
| A14C19 | 0150-0015 | | C:FXD TI DIOX 2.2 PF 10% 500VDCW | 78488 | TYPE GA |
| A14C20 | 0150-0084 | | C:FXD CER 0.1 UF +80-20% 100VDCW | 56289 | 33C41B5-CDH |
| A14C21 | 0180-0116 | 2 | C:FXD ELECT 6.8 UF 10% 35VDCW | 56289 | 150D685X9035B2-DYS |
| A14C22 | 0150-0084 | | C:FXD CER 0.1 UF +80-20% 100VDCW | 56289 | 33C41B5-CDH |
| A14C23 | 0180-0291 | | C:FXD ELECT 1.0 UF 10% 35VDCW | 56289 | 150D105X9035A2-DYS |
| A14C24 | 0180-0376 | 3 | C:FXD ELECT 0.47 UF 10% 35VDCW | 56289 | 150D474X9035A2-DYS |
| A14C25 | 0180-0376 | | C:FXD ELECT 0.47 UF 10% 35VDCW | 56289 | 150D474X9035A2-DYS |
| A14C26 | 0180-0291 | | C:FXD ELECT 1.0 UF 10% 35VDCW | 56289 | 150D105X9035A2-DYS |
| A14C27 | 0150-0084 | | C:FXD CER 0.1 UF +80-20% 100VDCW | 56289 | 33C41B5-CDH |
| A14C28 | | | NOT ASSIGNED | | |
| A14C29 | 0180-1846 | | C:FXD ELECT 2.2 UF 10% 35VDCW | 56289 | 150D225X9035B2-DYS |
| A14C30 | 0180-0291 | | C:FXD ELECT 1.0 UF 10% 35VDCW | 56289 | 150D105X9035A2-DYS |
| A14C32 | 0150-0022 | | C:FXD TI DIOX 3.3 PF 10% 500VDCW | 78488 | TYPE GA |
| A14C33 | 0150-0084 | | C:FXD CER 0.1 UF +80-20% 100VDCW | 56289 | 33C41B5-CDH |
| A14C34 | 0180-0291 | | C:FXD ELECT 1.0 UF 10% 35VDCW | 56289 | 150D105X9035A2-DYS |
| A14C35 | 0150-0084 | | C:FXD CER 0.1 UF +80-20% 100VDCW | 56289 | 33C41B5-CDH |
| A14C36 | 0180-0116 | | C:FXD ELECT 6.8 UF 10% 35VDCW | 56289 | 150D685X9035B2-DYS |
| A14C37 | 0180-0291 | | C:FXD ELECT 1.0 UF 10% 35VDCW | 56289 | 150D105X9035A2-DYS |
| A14C38 | 0180-0291 | | C:FXD ELECT 1.0 UF 10% 35VDCW | 56289 | 150D105X9035A2-DYS |
| A14C39 | 0180-0291 | | C:FXD ELECT 1.0 UF 10% 35VDCW | 56289 | 150D105X9035A2-DYS |
| A14C40 | 0180-0291 | | C:FXD ELECT 1.0 UF 10% 35VDCW | 56289 | 150D105X9035A2-DYS |
| A14C41 | 0180-0376 | | C:FXD ELECT 0.47 UF 10% 35VDCW | 56289 | 150D474X9035A2-DYS |
| A14C42 | 0180-3077 | | C:FXD MYLAR .027 UF 10% 100VDCW | 56289 | 225P2739WBI-PWM |
| A14CR1 | 1902-3205 | 3 | DIODE BREAKDOWN: 15.0V 5% | 28480 | 1902-3205 |
| A14CR2 | 1902-3205 | | DIODE BREAKDOWN: 15.0V 5% | 28480 | 1902-3205 |
| A14CR3 | 1902-0556 | 2 | DIODE: BREAKDOWN 20.0V 5% 1W | 28480 | 1902-0556 |
| A14CR4 | 1901-0044 | | DIODE: SILICON 20MA/1V | 28480 | 1901-0044 |
| A14CR5 | 1901-0044 | | DIODE: SILICON 20MA/1V | 28480 | 1901-0044 |
| A14CR6 | 1901-0040 | | DIODE: SILICON 30MA 30WV | 07263 | FDG1088 |
| A14CR7 | 1901-0040 | | DIODE: SILICON 30MA 30WV | 07263 | FDG1088 |
| A14CR8 | 1901-0040 | | DIODE: SILICON 30MA 30WV | 07263 | FDG1088 |
| A14CR9 | 1901-0040 | | DIODE: SILICON 30MA 30WV | 07263 | FDG1088 |
| A14CR10 | 1901-0040 | | DIODE: SILICON 30MA 30WV | 07263 | FDG1088 |
| A14CR11 | 1901-0040 | | DIODE: SILICON 30MA 30WV | 07263 | FDG1088 |
| A14CR12 | 1901-0040 | | DIODE: SILICON 30MA 30WV | 07263 | FDG1088 |
| A14CR14 | 1901-0044 | | DIODE: SILICON 20MA/1V | 28480 | 1901-0044 |
| A14CR15 | 1901-0044 | | DIODE: SILICON 20MA/1V | 28480 | 1901-0044 |
| A14CR16 | 1901-0040 | | DIODE: SILICON 30MA 30WV | 07263 | FDG1088 |
| A14CR17 | 1901-0040 | | DIODE: SILICON 30MA 30WV | 07263 | FDG1088 |
| A14CR18 | 1901-0040 | | DIODE: SILICON 30MA 30WV | 07263 | FDG1088 |
| A14CR19 | 1901-0050 | | DIODE: SI 200 MA AT 1V | 07263 | FDA 6308 |
| A14CR20 | 1902-0202 | 2 | DIODE BREAKDOWN: 15.0V 5% 1W | 28480 | 1902-0202 |
| A14CR22 | 1901-0050 | | DIODE: SI 200 MA AT 1V | 07263 | FDA 6308 |
| A14CR23 | 1902-0202 | | DIODE BREAKDOWN: 15.0V 5% 1W | 28480 | 1902-0202 |
| A14CR24 | 1902-0556 | | DIODE: BREAKDOWN 20.0V 5% 1W | 28480 | 1902-0556 |
| A14CR25 | 1901-0044 | | DIODE: SILICON 20MA/1V | 28480 | 1901-0044 |
| A14CR26 | 1901-0044 | | DIODE: SILICON 20MA/1V | 28480 | 1901-0044 |
| A14IC1 | 1820-0203 | 1 | IC: OPERATIONAL AMPLIFIER | 07263 | SL8940 |

1 See Section VIII, Manual Backdating

Table 6-1. Replaceable Parts (cont'd).

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|-----|-------------------------------------|----------|-----------------|
| A14J1 | 1251-2969 | | CONNECTOR: PHONO, SINGLE JACK | 27264 | 15-24-0501 |
| A14J3 | 1251-2969 | | CONNECTOR: PHONO, SINGLE JACK | 27264 | 15-24-0501 |
| A14J4 | 1251-2969 | | CONNECTOR: PHONO, SINGLE JACK | 27264 | 15-24-0501 |
| A14L1 | 9100-3319 | | COIL:FXD 0.74 UH | 28480 | 9100-3319 |
| A14L2 | 9100-3318 | | COIL:FXD 0.58 UH | 28480 | 9100-3318 |
| A14L3 | 9100-3318 | | COIL:FXD 0.58 UH | 28480 | 9100-3318 |
| A14L4 | 9100-1619 | | COIL:MOLDED CHOKE 6.8 UH 10% | 28480 | 9100-1619 |
| A14L5 THRU L8 | 9170 0018 | 1 | BEAD. MAGNETIC SHIELDING | 28480 | 9170 0016 |
| A14L8 | 9170 0016 | | BEAD. MAGNETIC SHIELDING | 28480 | 9170 0016 |
| A14J2 | 1250 1195 | | CONNECTOR RF SUB-MINIATURE SERIES | 98231 | 52 053 0000 |
| † A1401 | 5080 9041 | | TSTR. SELECTED | 28480 | 5080 9041 |
| † A1402 | 5080 9041 | | TSTR. SELECTED | 28480 | 5080 9041 |
| A1403 | 1853 0010 | | TSTR. SI PNP (SELECTED FROM 2N3251) | 28480 | 1853 0010 |
| A1404 | 1853 0312 | 2 | TSTR. SI PNP | 04713 | 2N5160 |
| A1405 | 1854 0531 | 2 | TSTR. SI PNP | 28480 | 1854 0531 |
| A1406 | 1854-0351 | | TSTR. SI PNP | 04713 | 2N3904 |
| A14Q7 | 1854-0039 | 4 | TSTR:SI NPN | 80131 | 2N3053 |
| A14Q8 | 1854-0308 | 1 | TSTR:SI NPN | 80131 | 2N3553 |
| † A1409 | 5080 9042 | 2 | TSTR:SELECTED | 28480 | 5080 9042 |
| A14Q10 | 1854-0351 | | TSTR:SI NPN | 04713 | 2N3904 |
| A14Q11 | 1854-0531 | | TSTR:SI NPN | 28480 | 1854-0531 |
| A14Q12 | 1853-0312 | | TSTR:SI PNP | 04713 | 2N5160 |
| A14Q13 | 1853-0313 | 1 | TSTR:SI PNP | 04713 | MM4019 |
| A14Q14 | 1853-0010 | | TSTR:SI PNP (SELECTED FROM 2N3251) | 28480 | 1853-0010 |
| A14Q15 | 1853-0051 | 2 | TSTR:SI PNP | 80131 | 2N4037 |
| † A14016 | 5080 9042 | | TSTR. SELECTED | 28480 | 5080 9042 |
| A14R1 | 0757 0277 | | R: FXD MET FLM 49.9 OHM 1% 1/8W | 28480 | 0757 0277 |
| A14R2 | 0757-0442 | | R: FXD MET FLM 10.0 K OHM 1% 1/8W | 28480 | 0757 0442 |
| A14R3 | 0757-0442 | | R:FXD MET FLM 10.0K OHM 1% 1/8W | 28480 | 0757-0442 |
| A14R4 | 0757-0270 | | R:FXD MET FLM 249K OHM 1% 1/8W | 28480 | 0757-0270 |
| A14R5 | 0757-0280 | | R:FXD MET FLM 1K OHM 1% 1/8W | 28480 | 0757-0280 |
| A14R6 | 0684-1521 | 2 | R:FXD COMP 1500 OHM 10% 1/4W | 01121 | CB 1521 |
| A14R7 | 0684-1521 | | R:FXD COMP 1500 OHM 10% 1/4W | 01121 | CB 1521 |
| A14R8 | 0698-3518 | | R:FXD FLM 7.32K OHM 1% 1/8W | 28480 | 0698-3518 |
| A14R9 | 0698-4427 | 1 | R:FXD FLM 1650 OHM 1% 1/8W | 28480 | 0698-4427 |
| A14R10 | 0683-0685 | 4 | R:FXD COMP 6.8 OHM 5% 1/4W | 01121 | CB68G5 |
| A14R11 | 0683-0685 | | R:FXD COMP 6.8 OHM 5% 1/4W | 01121 | CB58G5 |
| A14R12 | | | NOT ASSIGNED | | |
| A14R13 | 0757-0394 | 3 | R:FXD MET FLM 51.1 OHM 1% 1/8W | 28480 | 0757-0394 |
| A14R14 | 0757-0283 | | R:FXD MET FLM 2.00K OHM 1% 1/8W | 28480 | 0757-0283 |
| A14R15 | 0757-0442 | | R:FXD MET FLM 10.0K OHM 1% 1/8W | 28480 | 0757-0442 |
| A14R16 | 0757-0384 | | R:FXD FLM 20 OHM 1% 1/8W | 28480 | 0757-0384 |
| A14R17 | 0757-0291 | | R:FXD FLM 24.9 OHM 1% 1/8W | 28480 | 0757-0291 |
| A14R18 | 0757-0747 | 2 | R:FXD FLM 5110 OHM 1% 1/4W | 28480 | 0757-0747 |
| A14R19 | 0757-0428 | | R:FXD MET FLM 1.62K OHM 1% 1/8W | 28480 | 0757-0428 |
| A14R20 | 0698-4135 | 1 | R:FXD MET FLM 8.87K OHM 1.0% 1/2W | 28480 | 0698-4135 |
| A14R21 | 0757-0277 | | R:FXD MET FLM 49.9 OHM 1% 1/8W | 28480 | 0757-0277 |
| † A14R22 | 0757 0277 | | R:FXD FLM 49.9 OHM 1% 1/8W | 28480 | 0757 0277 |
| A14R23 | 0698-4474 | | R:FXD FLM 8450 OHM 1% 1/8W | 28480 | 0698-4474 |
| A14R24 | 0698-3535 | 2 | R:FXD MET FLM 1650 OHM 1.0% 1/2W | 28480 | 0698-3535 |
| A14R25 | 0687-1001 | 2 | R:FXD COMP 10 OHM 10% 1/2W | 01121 | EB 1001 |
| A14R26 | 0698-7985 | 2 | R:FXD FLM 2 OHM 5% 1/4W | 28480 | 0698-7985 |
| A14R27 | 0698-0001 | 2 | R:FXD COMP 4.7 OHM 5% 1/2W | 01121 | EB 47G5 |
| A14R28 | 0698-0001 | | R:FXD COMP 4.7 OHM 5% 1/2W | 01121 | EB 47G5 |
| A14R29 | 0684-3321 | | R:FXD COMP 3300 OHM 10% 1/4W | 01121 | CB 3321 |
| A14R30 | 0757-0338 | | R:FXD MET FLM 1.00K OHM 1% 1/4W | 28480 | 0757-0338 |
| A14R32 | 0698-7990 | 4 | R:FXD MET FLM 200 OHM .01% 1/2W | 28480 | 0698-7990 |
| A14R33 | 0698-7990 | | R:FXD MET FLM 200 OHM .01% 1/2W | 28480 | 0698-7990 |
| A14R34 | 0658-7990 | | R:FXD MET FLM 200 OHM .01% 1/2W | 28480 | 0698-7990 |
| A14R35 | 0698-7990 | | R:FXD MET FLM 200 OHM .01% 1/2W | 28480 | 0698-7990 |
| A14R36 | 0698-8008 | 1 | R:FXD FLM 357 OHM | 28480 | 0698-8008 |
| A14R37 | 0698-4426 | | R:FXD FLM 1580 OHM 1% 1/8W | 28480 | 0698-4426 |
| A14R38 | 0698-8009 | 1 | R:FXD FLM 95 OHM | 28480 | 0698-8009 |
| A14R39 | 0757-0394 | | R:FXD MET FLM 51.1 OHM 1% 1/8W | 28480 | 0757-0394 |
| A14R40 | 0684-3321 | | R:FXD COMP 3300 OHM 10% 1/4W | 01121 | CB 3321 |
| A14R41 | 0757-0283 | | R:FXD MET FLM 2.00K OHM 1% 1/8W | 28480 | 0757-0283 |
| A14R42 | 0757-0442 | | R:FXD MET FLM 10.0K OHM 1% 1/8W | 28480 | 0757-0442 |
| A14R43 | 0757-0394 | | R:FXD MET FLM 51.1 OHM 1% 1/8W | 28480 | 0757-0394 |
| A14R44 | 0683-0685 | | R:FXD COMP 6.8 OHM 5% 1/4W | 01121 | CB68G5 |
| A14R45 | 0683-0685 | | R:FXD COMP 6.8 OHM 5% 1/4W | 01121 | CB68G5 |
| A14R46 | 0757-0384 | | R:FXD FLM 20 OHM 1% 1/8W | 28480 | 0757-0384 |
| A14R47 | 0757-0291 | | R:FXD FLM 24.9 OHM 1% 1/8W | 28480 | 0757-0291 |
| A14R48 | 0757-0747 | | R:FXD FLM 5110 OHM 1% 1/4W | 28480 | 0757-0747 |
| A14R49 | 0757-0283 | | R:FXD MET FLM 2.00K OHM 1% 1/8W | 28480 | 0757-0283 |
| A14R50 | 0757-0442 | | R:FXD MET FLM 10.0K OHM 1% 1/8W | 28480 | 0757-0442 |
| A14R52 | 0757-0428 | | R:FXD MET FLM 1.62K OHM 1% 1/8W | 28480 | 0757-0428 |
| A14R53 | 0757-0277 | | R:FXD MET FLM 49.9 OHM 1% 1/8W | 28480 | 0757-0277 |
| A14R55 | 2100-1984 | 1 | R:VAR FLM 100 OHM 10% LIN 1/2W | 28480 | 2100-1984 |
| † A14R56 | 0757 0277 | | R:FXD FLM 49.9 OHM 1% 1/8W | 28480 | 0757 0277 |
| A14R57 | 0757-0277 | | R:FXD MET FLM 49.9 OHM 1% 1/8W | 28480 | 0757-0277 |
| A14R58 | 0698-7985 | | R:FXD FLM 2 OHM 5% 1/4W | 28480 | 0698-7985 |
| A14R59 | 0698-3535 | | R:FXD MET FLM 1650 OHM 1.0% 1/2W | 28480 | 0698-3535 |
| A14R60 | 0698-4474 | | R:FXD FLM 8450 OHM 1% 1/8W | 28480 | 0698-4474 |

† See Section VIII, Manual Backdating

Table 6-1. Replaceable Parts (cont'd).

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|-----|--|----------|--------------------|
| A14R61 | 0687-1001 | | R:FXD COMP 10 OHM 10% 1/2W | 01121 | E8 1001 |
| A14R62 | 0698-7520 | 2 | R:FXD FLM 3.01 OHM 1% 1/4W | 28480 | 0698-7520 |
| A14R63 | 0698-7520 | | R:FXD FLM 3.01 OHM 1% 1/4W | 28480 | 0698-7520 |
| A14R64 | 0757-0414 | | R:FXD FLM 432 OHM 1% 1/8W | 28480 | 0757-0414 |
| A14R05 | 0698-8070 | 1 | R:FXD FLM 1.3 OHM 5% 1/4W | 28480 | 0698-8070 |
| A15 (3320B ONLY) | 03320-66515 | 1 | BOARD ASSY. ATTENUATOR | 28480 | 03320-66515 |
| A15 (Option 001) | 03320-66556 | 1 | BOARD ASSY. ATTENUATOR | 28480 | 03320-66556 |
| A15C1 | 0180-0229 | 2 | C:FXD ELECT 33 UF 10% 10VDCW | 28480 | 0180-0229 |
| A15C2-C5 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A15C6 | 0160-3622 | | C:FXD MICA 1UF 5% | 72136 | RDM15E102J1C |
| A15CR1 | 1901-0040 | | DIODE:SILICON 30MA 30WV | 07263 | FDG1088 |
| A15CR2 | 1901-0040 | | DIODE:SILICON 30MA 30WV | 07263 | FDG1088 |
| A15CR3 | 1901-0040 | | DIODE:SILICON 30MA 30WV | 07263 | FDG1088 |
| A15CR4 | 1901-0040 | | DIODE:SILICON 30MA 30WV | 07263 | FDG1088 |
| A15IC1 | 1820-0586 | 9 | IC:DIGITAL TTL HEX CONVERTER | 28480 | 1820-0586 |
| A15IC2 | 1820-0256 | 1 | IC:DTL QUAD 2-INPUT POWER GATE | 04713 | MC858P |
| A15J1 | 1250-1195 | | CONNECTOR:RF SUB-MINIATURE SERIES | 98291 | 52-053-0C00 |
| A15J2 | 1250-1338 | | CONNECTOR RF SUB-MINIATURE SERIES | 98291 | 52-051-0000 |
| A15K1, K2 | 0490-0963 | | RELAY:MULTI-REED | 28480 | 0490-0963 |
| A15K3 | 0490-0963 | | RELAY:MULTI-REED | 28480 | 0490-0963 |
| A15K4 | 0490-0963 | | RELAY:MULTI-REED | 28480 | 0490-0963 |
| A15K5 | 0490-0963 | | RELAY:MULTI-REED | 28480 | 0490-0963 |
| A15Q1 | 1854-0354 | | TSTR:SI NPN | 28480 | 1854-0354 |
| A15Q2 | 1854-0354 | | TSTR:SI NPN | 28480 | 1854-0354 |
| A15Q3 | 1854-0354 | | TSTR:SI NPN | 28480 | 1854-0354 |
| A15Q4 | 1854-0354 | | TSTR:SI NPN | 28480 | 1854-0354 |
| A15R1 | 0684-3911 | | R:FXD COMP 390 OHM 10% 1/4W | 01121 | C8 3911 |
| A15R2 | 0684-3911 | | R:FXD COMP 390 OHM 10% 1/4W | 01121 | C8 3911 |
| A15R3 | 0684-3911 | | R:FXD COMP 390 OHM 10% 1/4W | 01121 | C8 3911 |
| A15R4 | 0684-1811 | 1 | R:FXD COMP 180 OHM 10% 1/4W | 01121 | C8 1811 |
| A15R5 | 0698-7984 | 8 | R:FXD FLM 61.1 OHM .01% 1/2W | 28480 | 0698-7984 |
| A15R6 | 0698-8258 | 4 | R:FXD PREC FLM 247.5 OHM 1% 1/4W | 01738 | CMF-60-1,T9 |
| A15R7 | 0698-7984 | | R:FXD FLM 61.1 OHM 0.1% 1/2W | 28480 | 0698-7984 |
| A15R8 | 0698-8390 | 2 | R:FXD FLM 96.25 OHM 0.1% 1/4W | 28480 | 0698-8390 |
| A15R9 | 0698-7982 | 1 | R:FXD FLM 71.16 OHM 0.1% 1/4W | 28480 | 0698-7982 |
| A15R10 | 0698-8390 | | R:FXD FLM 96.25 OHM 0.1% 1/4W | 28480 | 0698-8390 |
| A15R12 | 0698-7984 | | R:FXD FLM 61.1 OHM .01% 1/2W | 28480 | 0698-7984 |
| A15R13 | 0698-8258 | | R:FXD PREC FLM 247.5 OHM 1% 1/4W | 01738 | CMF 60-1, T9 |
| A15R14 | 0698-7984 | | R:FXD FLM 61.1 OHM .01% 1/2W | 28480 | 0698-7984 |
| A15R15 | 0698-7984 | | R:FXD FLM 61.1 OHM .01% 1/2W | 28480 | 0698-7984 |
| A15R16 | 0698-8258 | | R:FXD PREC FLM 247.5 OHM 1% 1/4W | 01738 | CMF 60-1, T9 |
| A15R17, R18 | 0698-7984 | | R:FXD FLM 61.1 OHM 0.1% 1/2W | 28480 | 0698-7984 |
| A15R19 | 0698-8258 | | R:FXD PREC FLM 247.5 OHM 1% 1/4W | 01738 | CMF-60-1, T9 |
| A15R20 | 0698-7984 | | R:FXD FLM 61.1 OHM 0.1% 1/2 W | 28480 | 0698-7984 |
| A15R21(OPTION 001) | 0698-8011 | 1 | R:FXD FLM 25 OHM 0.1% 1/4 W | 28480 | 0698-8011 |
| A16A (3320A ONLY) | 03320-66534 | | PC ASSY: FILTER | 28480 | 03320-66534 |
| A16C1 | 0180-2395 | | C:FXD ELECT 3000 UF 10 + 75% 40 VDCW | 56289 | 390300 |
| A16C2 | 0180-2395 | | C:FXD ELECT 3000 UF 10 + 75% 40 VDCW | 56289 | 390300 |
| A16R1 | 0687-1231 | | R:FXD COMP 12 K OHM 10% 1/2 W | 01121 | E8 1231 |
| A16R2 | 0687-1231 | | R:FXD COMP 12 K OHM 10% 1/2 W | 01121 | E8 1231 |
| A16B (3320B ONLY) | 03320-66516 | 1 | BOARD ASSY: FILTER | 28480 | 03320-66516 |
| A16C1 | 0180-2395 | 2 | C:FXD AL ELECT 3000 UF +75-10% 40VDCW | 56289 | 390300 |
| A16C2 | 0180-2395 | | C:FXD AL ELECT 3000 UF +75-10% 40VDCW | 56289 | 390300 |
| A16C3 | 0180-2396 | 2 | C:FXD AL ELECT 1000 UF +75-10% 75VDCW | 56289 | 39D108G075JP4 |
| A16C4 | 0180-2396 | | C:FXD AL ELECT 1000 UF +75-10% 75VDCW | 56289 | 39D108G075JP4 |
| A16R1 | 0687-1231 | 2 | R:FXD COMP 12K OHM 10% 1/2W | 01121 | E8 1231 |
| A16R2 | 0687-1231 | | R:FXD COMP 12K OHM 10% 1/2W | 01121 | E8 1231 |
| A16R3 | 0687-2231 | 2 | R:FXD COMP 22K OHM 10% 1/2W | 01121 | E8 2231 |
| A16R4 | 0687-2231 | | R:FXD COMP 22K OHM 10% 1/2W | 01121 | E8 2231 |
| A17A (3320A ONLY) | 03320-66535 | 1 | PC ASSY. POWER SUPPLY A17A IS IDENTICAL TO A17B WITH THE FOLLOWING EXCEPTIONS. | 28480 | 03320-66535 |
| A17C4 | | | NOT ASSIGNED | | |
| A17C9 THRU C13 | | | NOT ASSIGNED | | |
| A17IC3 | | | NOT ASSIGNED | | |
| A17Q2 | | | NOT ASSIGNED | | |
| A17D7 THRU Q13 | | | NOT ASSIGNED | | |
| A17R15 THRU R17 | | | NOT ASSIGNED | | |
| A17R33, R34 | | | NOT ASSIGNED | | |
| A17R39 THRU R50 | | | NOT ASSIGNED | | |
| A17B (3320B ONLY) | 03320-66517 | 1 | BOARD ASSY: POWER SUPPLY | 28480 | 03320-66517 |
| A17C1 | 0160-0299 | 1 | C:FXD MY 1800 PF 10% 200VDCW | 56289 | 192P18292-PTS |
| A17C2 | 0180-0374 | | C:FXD TANT. 10 UF 10% 20VDCW | 56289 | 150D106X902082-DYS |
| A17C3 | 0180-0309 | 1 | C:FXD ELECT 4.7 UF 20% 10VDCW | 56289 | 150D475X0010A2-DYS |
| A17C4 | 0180-0374 | | C:FXD TANT. 10 UF 10% 20VDCW | 56289 | 150D106X902082-DYS |
| A17C5 | 0180-0291 | | C:FXD ELECT 1.0 UF 10% 35VDCW | 56289 | 150D105X9035A2-DYS |
| A17C6 | 0180-0229 | 2 | C:FXD ELECT 33 UF 10% 10VDCW | 28480 | 0180-0229 |
| A17C7 | 0180-1974 | | C:FXD TA 10 UF 10% 35VDCW | 56289 | 150D106X9035R2-DYS |
| A17C8 | 0180-1974 | | C:FXD TA 10 UF 10% 35VDCW | 56289 | 150D106X9035R2-DYS |
| A17C9 | 0180-0691 | 2 | C:FXD ELECT 10 UF +50-10% 100VDCW | 56289 | 30D106F100DC2-OSM |
| A17C10 | 0160-2204 | 2 | C:FXD MICA 100PF 5% | 72136 | RDM15F101J3C |

Table 6-1. Replaceable Parts (cont'd)

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|----------------|-----|------------------------------------|----------|-------------------|
| A17C12 | 0160-2204 | | C:FXD MICA 100PF 5% | 72136 | ROM15f101J3C |
| A17C13 | 0180-0091 | | C:FXD ELECT 10 UF +50-10% 100VDCW | 56289 | 30D106F100DC2-DSM |
| A17CR1 | 1901-0040 | | DIODE:SILICON 30MA 30WV | 07263 | FDG10E8 |
| A17CR2 | 1902-3104 | 1 | DIODE:BREAKDOWN 5.62V 5% | 04713 | SZ10939-110 |
| A17CR3 | 1884-0068 | 1 | THRISTOR | 28480 | 1884-C068 |
| A17CR4 | 1901-0040 | | DIODE:SILICON 30MA 30WV | 07263 | FDG10E8 |
| A17CR5 | 1901-0040 | | DIODE:SILICON 30MA 30WV | 07263 | FDG10E8 |
| A17CR6 | 1902-0049 | | DIODE:BREAKDOWN 6.19V 5% | 04713 | SZ10929-122 |
| A17CR7 | 1901-0040 | | DIODE:SILICON 30MA 30WV | 07263 | FDG10E8 |
| A17CR8 | 1901-0040 | | DIODE:SILICON 30MA 30WV | 07263 | FDG10E8 |
| A17CR9 | 1902-0686 | 1 | DIODE BREAKDOWN:6.2V 2% | 04713 | 1N825 |
| A17CR10 | 1902-3205 | | DIODE BREAKDOWN:15.0V 5% | 28480 | 1902-3205 |
| A17CR12 | 1901-0040 | | DIODE:SILICON 30MA 30WV | 07263 | FDG10E8 |
| A17CR13 | 1902-0579 | 1 | DIODE BREAKDOWN:5.11V | 28480 | 1902-C579 |
| A17CR14 | 1901-0527 | 2 | DIODE:CURRENT REGULATOR | 28480 | 1901-C527 |
| A17CR15 | 1902-3114 | 1 | DIODE BREAKDOWN:6.19V 2% | 28480 | 1902-3114 |
| A17CR16 | 1901-0527 | | DIODE:CURRENT REGULATOR | 28480 | 1901-0527 |
| A17IC1 | 1826-0043 | | IC:LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-C043 |
| A17IC2 | 1826-0043 | | IC:LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-C043 |
| A17IC3 | 1826-0043 | | IC:LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-C043 |
| A17IC4 | 1826-0043 | | IC:LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-C043 |
| A17IC5 | 1826-0043 | | IC:LINEAR OPERATIONAL AMPLIFIER | 28480 | 1826-C043 |
| A17Q1 | 1854-0039 | | TSTR:SI NPN | 80131 | 2N3053 |
| A17Q2 | 1854-0039 | | TSTR:SI NPN | 80131 | 2N3053 |
| A17Q3 | 1854-0039 | | TSTR:SI NPN | 80131 | 2N3053 |
| A17Q4 | 1851-0017 | 1 | TSTR:GE NPN | 80131 | 2N1304 |
| A17Q5 | 1853-0051 | | TSTR:SI PNP | 80131 | 2N4037 |
| A17Q6 | 1850-0062 | 1 | TSTR:GE ALLOY JUNCTION | 01295 | GA 287 |
| A17Q7 | 1854-0408 | 2 | TSTR:SI NPN | 28480 | 1854-0408 |
| A17Q8 | 1854-0071 | | TSTR:SI NPN(SELECTED FROM 2N3704) | 28480 | 1854-C071 |
| A17Q9 | 1854-0408 | | TSTR:SI NPN | 28480 | 1854-0408 |
| A17Q10 | 1853-0238 | 3 | TSTR:SI PNP | 28480 | 1853-0238 |
| A17Q11 | 1853-0010 | | TSTR:SI PNPI(SELECTED FROM 2N3251) | 28480 | 1853-0010 |
| A17Q12 | 1853-0238 | | TSTR:SI PNP | 28480 | 1853-0238 |
| A17Q13 | 1853-0238 | | TSTR:SI PNP | 28480 | 1853-0238 |
| A17R1 | 0684-1821 | 2 | R:FXD COMP 1800 OHM 10% 1/4W | C1121 | CB 1821 |
| A17R2 | 0698-3279 | | R:FXD MET FLM 4990 OHM 1% 1/8W | 28480 | 0698-3279 |
| A17R3 | 0757-0429 | 3 | R:FXD MET FLM 1.82K OHM 1% 1/8W | 28480 | 0757-C429 |
| A17R4 | 0698-3279 | | R:FXD MET FLM 4990 OHM 1% 1/8W | 28480 | 0698-3279 |
| A17R5 | 0698-3279 | | R:FXD MET FLM 4990 OHM 1% 1/8W | 28480 | 0698-3279 |
| A17R6 | 0684-1041 | 1 | R:FXD COMP 100K OHM 10% 1/4W | 01121 | CB 1041 |
| A17R7 | 0757-0284 | | R:FXD MET FLM 150 OHM 1% 1/8W | 28480 | 0757-0284 |
| A17R8 | 0811-1200 | 2 | R:FXD WW 0.10 OHM 10% 2W | 28480 | 0811-1200 |
| A17R9 | 0811-1200 | | R:FXD WW 0.10 OHM 10% 2W | 28480 | 0811-1200 |
| A17R10 | 0757-0401 | | R:FXD MET FLM 100 OHM 1% 1/8W | 28480 | 0757-0401 |
| A17R12 | 0757-0429 | | R:FXD MET FLM 1.82K OHM 1% 1/8W | 28480 | 0757-C429 |
| A17R13 | 0698-3154 | 1 | R:FXD MET FLM 4.22K OHM 1% 1/8W | 19701 | MF4C T-3 |
| A17R14 | 0757-0430 | | R:FXD MET FLM 2.21K OHM 1% 1/8W | 28480 | 0757-0430 |
| A17R15 | 0757-0429 | | R:FXD MET FLM 1.82K OHM 1% 1/8W | 28480 | 0757-0429 |
| A17R16 | 0684-1821 | | R:FXD COMP 1800 OHM 10% 1/4W | 01121 | CB 1821 |
| A17R17 | 0683-0275 | 3 | R:FXD COMP 2.7 OHM 5% 1/4W | 01121 | CB 27G5 |
| A17R18 | 0811-3050 | 2 | R:FXD WW 0.75 OHM 5% 1W | 28480 | 0811-3050 |
| A17R19 | 0698-3700 | 2 | R:FXD FLM 715 OHM 1% 1/8W | 28480 | 0698-3700 |
| A17R20 | 0698-4307 | | R:FXD FLM 14.3K OHM 1% 1/8W | 28480 | 0698-4307 |
| A17R21 | 0757-0273 | | R:FXD MET FLM 3.01K OHM 1% 1/8W | 28480 | 0757-0273 |
| A17R22 | 0698-4477 | 1 | R:FXD MET FLM 10.5K OHM 1% 1/8W | 28480 | 0698-4477 |
| A17R23 | 2100-2633 | 1 | R:VAR CERMET 1K OHM 10% LIN 1/2W | 28480 | 2100-2633 |
| A17R24 | 0698-4471 | | R:FXD FLM 7.15K OHM 1% 1/8W | 28480 | 0698-4471 |
| A17R25 | 0698-3279 | | R:FXD MET FLM 4990 OHM 1% 1/8W | 28480 | 0698-3279 |
| A17R26 | 0698-3279 | | R:FXD MET FLM 4990 OHM 1% 1/8W | 28480 | 0698-3279 |
| A17R27 | 0757-0426 | | R:FXD FLM 1.3K OHM 1% 1/8W | 28480 | 0757-0426 |
| A17R28 | 0811-3050 | | R:FXD WW 0.75 OHM 5% 1W | 28480 | 0811-3050 |
| A17R29 | 0698-3700 | | R:FXD FLM 715 OHM 1% 1/8W | 28480 | 0698-3700 |
| A17R30 | 0698-4307 | | R:FXD FLM 14.3K OHM 1% 1/8W | 28480 | 0698-4307 |
| A17R32 | 0757-0273 | | R:FXD MET FLM 3.01K OHM 1% 1/8W | 28480 | 0757-0273 |
| A17R33 | 0698-6678 | 4 | R:FXD MET FLM 15K OHM 0.5% 1/8W | 28480 | 0698-6678 |
| A17R34 | 0698-6678 | | R:FXD MET FLM 15K OHM 0.5% 1/8W | 28480 | 0698-6678 |
| A17R35 | 0683-7525 | | R:FXD COMP 7500 OHM 5% 1/4W | 01121 | CB 7525 |
| A17R36 | 0687-3301 | 1 | R:FXD COMP 33 OHM 10% 1/2W | 01121 | EB 3301 |
| A17R37 | 0687-2701 | 2 | R:FXD COMP 27 OHM 10% 1/2W | 01121 | EB 2701 |
| A17R38 | 0687-2701 | | R:FXD COMP 27 OHM 10% 1/2W | 01121 | EB 2701 |
| A17R39 | 0683-0335 | 2 | R:FXD COMP 3.3 OHM 5% 1/4W | 01121 | CB 0335 |
| A17R40 | 0683-0275 | | R:FXD COMP 2.7 OHM 5% 1/4W | 01121 | CB 27G5 |
| A17R42 | 0698-4157 | 1 | R:FXD FLM 10K OHM 0.1% 1/8W | 28480 | 0698-4157 |
| A17R43 | 0698-3151 | | R:FXD MET FLM 2.87K OHM 1% 1/8W | 28480 | 0698-3151 |
| A17R44 | 0698-4641 | 1 | R:FXD FLM 3240 OHM 1% 1/4W | 28480 | 0698-4641 |
| A17R45 | 0757-0446 | | R:FXD MET FLM 15.0K OHM 1% 1/8W | 28480 | 0757-0446 |
| A17R46 | 0683-7525 | | R:FXD COMP 7500 OHM 5% 1/4W | 01121 | CB 7525 |
| A17R47 | 0698-6678 | | R:FXD MET FLM 15K OHM 0.5% 1/8W | 28480 | 0698-6678 |
| A17R48 | 0698-6678 | | R:FXD MET FLM 15K OHM 0.5% 1/8W | 28480 | 0698-6678 |

Table 6-1. Replaceable Parts (cont'd).

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|---------------------------------------|----------------|-----|---|----------|--------------------|
| A17R49 | 0683-0275 | | R:FXD COMP 2.7 OHM 5% 1/4W | 01121 | CB 27G5 |
| A17R50 | 0683-0335 | | R:FXD COMP 3.3 OHM 5% 1/4W | 01121 | CB 0335 |
| A17TP1 | 08443-00041 | | TEST POINT | 28480 | 08443-00041 |
| A17TP2 | 08443-00041 | | TEST POINT | 28480 | 08443-00041 |
| A18 | | | NOT ASSIGNED | | |
| A19 | 03320-66519 | 1 | BOARD ASSY:MOTHER | 28480 | 03320-66519 |
| A19XA1 | 1251-2035 | 8 | CONN:PC 30(2X15) CONTACTS | 76530 | 65-7160 |
| A19XA2 | 1251-2035 | | CONN:PC 30(2X15) CONTACTS | 76530 | 65-7160 |
| A19XA3 | 1251-2035 | | CONN PC 30(2X15) CONTACTS | 76530 | 65 7160 |
| A19XA4 | 1251-1633 | 4 | CONN:PC (1 x 15) 15 CONTACT | 71785 | 252-15-30-310 |
| A19XA5 | 1251-1633 | | CONNECTOR:PC (1 x 15) 15 CONTACT | 71785 | 252-15-30-310 |
| A19XA7, A8 | 1251-1633 | | CONNECTOR:PC (1 x 15) 15 CONTACT | 717 85 | 252-15-30-310 |
| A19XA8 | 1251-2035 | | CONN:PC 30 (2 x 15) CONTACTS | 76530 | 65 7160 |
| A19XA10 | 1251-1633 | | CONNECTOR:PC (1 x 15) 15 CONTACT | 71785 | 252-15-30 310 |
| A19XA11 | 1251-2035 | | CONN:PC 30(2X15) CONTACTS | 76530 | 65-7160 |
| A19XA12 | 1251-1633 | | CONNECTOR:PC(1 X 15) 15 CONTACT | 71785 | 252-15-30-310 |
| A19XA20 (STD 3320A ONLY) | 1251 1365 | | CONNECTOR PC (2X22) CONTACTS | 71785 | 252 22 30-300 |
| A19XA21 (STD 3320B ONLY) | 1251 1365 | 5 | CONN:PC 44 (2X22) CONTACTS | 71785 | 252 22-30-300 |
| A19XA22 (3320A/B OPT. 003 THRU007) | 1251 1365 | | CONN PC 44 (2X22) CONTACTS | | |
| A20 (STD 3320A ONLY) | 03320 66520 | 1 | BOARD ASSY INTERFACE A | 28480 | 03320-66520 |
| A20IC1 | 1820-0586 | | IC:DIGITAL TTL HEX CONVERTER | 28480 | 1820-0586 |
| A20IC2 | 1820-0598 | 3 | IC:DIGITAL TTL QUAD 2-INPT EXCL OR GATE | 28480 | 1820-0598 |
| A20IC3 | 1820-0587 | 3 | IC:TTL TRIPLE 3-INPT NAND GATE | 28480 | 1820-0587 |
| A20IC4 | 1820-0586 | | IC:DIGITAL TTL HEX CONVERTER | 28480 | 1820-0586 |
| A20IC5 | 1820-0777 | 5 | IC: DIGITAL | 01295 | SN21819 |
| A20R1 | 1810-0041 | 14 | R:NETWORK,8 RES. 2.7K OHM 5% | 28480 | 1810-0041 |
| A20R2 | 1810-0041 | | R:NETWORK,8 RES. 2.7K OHM 5% | 28480 | 1810-0041 |
| A20R3 | 0683-2725 | 6 | R:FXD COMP 2700 OHM 5% 1/4W | 01121 | CB 2725 |
| A20R4 | 0683-2725 | | R:FXD COMP 2700 OHM 5% 1/4W | 01121 | CB 2725 |
| A21 (STD 3320B ONLY) | 03320-66521 | 1 | BOARD ASSY: INTERFACE B | 28480 | 03320-66521 |
| A21IC1 | 1820-0586 | | IC:DIGITAL TTL HEX CONVERTER | 28480 | 1820-0586 |
| A21IC2 | 1820-0586 | | IC:DIGITAL TTL HEX CONVERTER | 28480 | 1820-0586 |
| A21IC3 | 1820-0586 | | IC:DIGITAL TTL HEX CONVERTER | 28480 | 1820-0586 |
| A21IC4 | 1820-0766 | 8 | IC: MOS | 28480 | 1820-0766 |
| A21IC5 | 1820-0766 | | IC: MOS | 28480 | 1820-0766 |
| A21IC6 | 1820-0766 | | IC: MOS | 28480 | 1820-0766 |
| A21IC7 | 1820-0766 | | IC: MOS | 28480 | 1820-0766 |
| A21IC8 | 1820-0598 | | IC:DIGITAL TTL QUAD 2-INPT EXCL OR GATE | 28480 | 1820-0598 |
| A21IC9 | 1820-0584 | | IC:TTL QUAD 2-INPT NCR GATE | 28480 | 1820-0584 |
| A21IC12 | 1820-0587 | | IC:TTL TRIPLE 3-INPT NAND GATE | 28480 | 1820-0587 |
| A21IC13 | 1820-0586 | | IC:DIGITAL TTL HEX CONVERTER | 28480 | 1820-0586 |
| A21IC14 | 1820-0583 | | IC:TTL QUAD 2-INPT NAND GATE | 28480 | 1820-0583 |
| A21IC15 | 1820-0777 | | IC: DIGITAL | 01295 | SN21819 |
| A21Q1 | 1853-0203 | | TSTR:SI PNP | 28480 | 1853-0203 |
| A21Q2 | 1855-0081 | | TSTR:SI FET | 80131 | 2N5245 |
| A21Q3 | 1853-0203 | | TSTR:SI PNP | 28480 | 1853-0203 |
| A21Q4 | 1854-0071 | | TSTR:SI NPN(SELECTED FROM 2N3704) | 28480 | 1854-0071 |
| A21R1 | 1810-0041 | | R:NETWORK,8 RES. 2.7K OHM 5% | 28480 | 1810-0041 |
| A21R2 | 1810-0041 | | R:NETWORK,8 RES. 2.7K OHM 5% | 28480 | 1810-0041 |
| A21R3 | 1810-0041 | | R:NETWORK,8 RES. 2.7K OHM 5% | 28480 | 1810-0041 |
| A21R4 | 1810-0041 | | R:NETWORK,8 RES. 2.7K OHM 5% | 28480 | 1810-0041 |
| A21R5 | 1810-0041 | | R:NETWORK,8 RES. 2.7K OHM 5% | 28480 | 1810-0041 |
| A21R6 | 1810-0041 | | R:NETWORK,8 RES. 2.7K OHM 5% | 28480 | 1810-0041 |
| A21R7 | 0683-1535 | | R:FXD COMP 15K OHM 5% 1/4W | 01121 | CB 1535 |
| A21R8 | 0683-7535 | | R:FXD COMP 75K OHM 5% 1/4W | 01121 | CB 7535 |
| A21R9 | 0683-1125 | | R:FXD COMP 1100 OHM 5% 1/4W | 01121 | CB 1125 |
| A21R10 | 0683-2035 | 3 | R:FXD COMP 20K OHM 5% 1/4W | 01121 | CB 2035 |
| A21R12 | 0683-8215 | | R:FXD COMP 820 OHM 5% 1/4W | 01121 | CB 8215 |
| A21R13 | 0683-2425 | | R:FXD COMP 2400 OHM 5% 1/4W | 01121 | CB 2425 |
| A21R14 | 0683-1325 | 2 | R:FXD COMP 1300 OHM 5% 1/4W | 01121 | CB 1325 |
| A21R15 | 0683-1815 | 3 | R:FXD COMP 180 OHM 5% 1/4W | 01121 | CE 1815 |
| A21R16 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A21R17 | 0683-2025 | | R:FXD COMP 2000 OHM 5% 1/4W | 01121 | CB 2025 |
| A21R18 | 0683-2725 | | R:FXD COMP 2700 OHM 5% 1/4W | 01121 | CB 2725 |
| A21R19 | 0683-2725 | | R:FXD COMP 2700 OHM 5% 1/4W | 01121 | CB 2725 |
| A21R20 | 0683-1545 | | R:FXD COMP 150K OHM 5% 1/4W | 01121 | CB 1545 |
| A21R21 | 0683-5125 | | R:FXD COMP 5100 OHM 5% 1/4W | 01121 | CB 5125 |
| A22 (OPT. 003, 004, 007) | 03320-66522 | | BOARD ASSY: CABLE | 28480 | 03320-66522 |
| A22IC1 | 1820-0777 | | IC: DIGITAL | 01295 | SN21819 |
| A23 (OPT. 003, 004, 007) | 03320-66523 | | BOARD ASSY:FREQUENCY | 28480 | 00320-66523 |
| A23C1 | 0160-0938 | | C:FXD MICA 1000 PF 5% | 72136 | RD15E102J1C |
| A23C2 | 0180-0210 | 1 | C:FXD ELECT 3.3 UF 20% 15VDCW | 56289 | 150D335X0015A2-DYS |
| A23C3 | 0180-0195 | 1 | C:FXD ELECT 0.33 UF 20% 35VDCW | 56289 | 150D334X0035A2-DYS |
| A23C4 | 0150-0093 | | C:FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A23IC1 | 1820-0590 | 17 | IC:DIGITAL TTL DUAL 2-WIDE, INPT AND/OR | 28480 | 1820-0590 |

Table 6-1. Replaceable Parts (Cont'd)

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|------------------------------------|----------------|-----|--|----------|-----------------|
| A23IC2 | 1820-0590 | | IC: DIGITAL TTL DUAL 2-WIDE, INPT AND/OR | 28480 | 1820-0590 |
| A23IC3 | 1820-0590 | | IC: DIGITAL TTL DUAL 2-WIDE, INPT AND/OR | 28480 | 1820-0590 |
| A23IC4 | 1820-0590 | | IC: DIGITAL TTL DUAL 2-WIDE, INPT AND/OR | 28480 | 1820-0590 |
| A23IC5 | 1820-0590 | | IC: DIGITAL TTL DUAL 2-WIDE, INPT AND/OR | 28480 | 1820-0590 |
| A23IC6 | 1820-0590 | | IC: DIGITAL TTL DUAL 2-WIDE, INPT AND/OR | 28480 | 1820-0590 |
| A23IC7 | 1820-0590 | | IC: DIGITAL TTL DUAL 2-WIDE, INPT AND/OR | 28480 | 1820-0590 |
| A23IC8 | 1820-0590 | | IC: DIGITAL TTL DUAL 2-WIDE, INPT AND/OR | 28480 | 1820-0590 |
| A23IC9 | 1820-0590 | | IC: DIGITAL TTL DUAL 2-WIDE, INPT AND/OR | 28480 | 1820-0590 |
| A23IC10 | 1820-0586 | | IC: DIGITAL TTL HEX CONVERTER | 28480 | 1820-0586 |
| A23IC11 | 1820-0598 | | IC: DIGITAL TTL QUAD 2-INPT EXCL OR GATE | 28480 | 1820-0598 |
| A23IC12 | 1820-0584 | | IC: TTL QUAD 2-INPT NOR GATE | 28480 | 1820-0584 |
| A23IC13 | 1820-0584 | | IC: TTL QUAD 2-INPT NOR GATE | 28480 | 1820-0584 |
| A23IC14 | 1820-0600 | 2 | IC: DIGITAL TTL DECADE COUNTER | 28480 | 1820-0600 |
| A23IC15 | 1820-0600 | | IC: DIGITAL TTL DECADE COUNTER | 28480 | 1820-0600 |
| A23IC16 | 1820-0583 | | IC: TTL QUAD 2-INPT NAND GATE | 28480 | 1820-0583 |
| A23IC17 | 1820-0584 | | IC: TTL QUAD 2-INPT NOR GATE | 28480 | 1820-0584 |
| A23IC18 | 1820-0207 | | IC: TTL MONOSTABLE MULTIVIBRATOR | 28480 | 1820-0207 |
| A23IC19 | 1820-0587 | | IC: TTL TRIPLE 3-INPT NAND GATE | 28480 | 1820-0587 |
| A23IC20 | 1820-0583 | | IC: TTL QUAD 2-INPT NAND GATE | 28480 | 1820-0583 |
| A23IC21 | 1820-0585 | | IC: TTL DUAL J-K MASTER SLAVE F/F | 28480 | 1820-0585 |
| A23Q1 | 1854-0071 | | TSTR: SI NPN (SELECTED FROM 2N3704) | 28480 | 1854-0071 |
| A23R1 | 1810-0041 | | R: NETWORK, 8 RES. 2.7K OHM 5% | 28480 | 1810-0041 |
| A23R2 | 1810-0041 | | R: NETWORK, 8 RES. 2.7K OHM 5% | 28480 | 1810-0041 |
| † A23R3, R4 | 0683-2725 | | R: FXD COMP 2700 OHM 5% 1/4 W | 01121 | CB 2725 |
| A23R5 | 0683-3925 | 44 | R: FXD COMP 3900 OHM 5% 1/4 W | 01121 | CB 3925 |
| A23R6 | 2100-3056 | | R: VAR CERMET 5K OHM 10% TYPE P 3/4 W | 28480 | 2100-3056 |
| A23R7 | 0683-1235 | 1 | R: FXD COMP 12K OHM 5% 1/4 W | 01121 | CB 1235 |
| A23R8 | 0683-1025 | | R: FXD COMP 1000 OHM 5% 1/4 W | 01121 | CB 1025 |
| A23R9 | 0683-5125 | | R: FXD COMP 5100 OHM 5% 1/4 W | 01121 | CB 5125 |
| A23R10 | 0683-1825 | 1 | R: FXD COMP 1800 OHM 5% 1/4 W | 01121 | CB 1825 |
| A23R11 | 0683-2025 | | R: FXD COMP 2000 OHM 5% 1/4 W | 01121 | CB 2025 |
| A24A (3320A OPT. 003 ONLY) | 03320-66536 | | PC ASSY INVERTER | 28480 | 00320-66536 |
| A24IC1 | 1820-0471 | | IC TTL HEX INVERTER | 01295 | SN19235 |
| A24R1 | 0683-5115 | | R: FXD COMP 510 OHM 5% 1/4 W | 01121 | CB 5115 |
| A24R2 | 0683-5115 | | R: FXD COMP 510 OHM 5% 1/4 W | 01121 | CB 5115 |
| A24R3 | 0683-1815 | | R: FXD COMP 180 OHM 5% 1/4 W | 01121 | CB 1815 |
| A24R4 | 0683-1535 | | R: FXD COMP 15K OHM 5% 1/4 W | 01121 | CB 1535 |
| A24B (3320B OPT. 004, 007 ONLY) | 03320-66524 | 1 | BOARD ASSY-AMPLITUDE CONTROL | 284800 | 03320-66524 |
| A24C1 | 0150-0093 | | C: FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A24C2 | 0150-0093 | | C: FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A24C3 | 0150-0093 | | C: FXD CER 0.01 UF +80-20% 100VDCW | 72982 | 801-K800011 |
| A24IC1 | 1820-0590 | | IC: DIGITAL TTL DUAL 2-WIDE, INPT AND/OR | 28480 | 1820-0590 |
| A24IC2 | 1820-0590 | | IC: DIGITAL TTL DUAL 2-WIDE, INPT AND/OR | 28480 | 1820-0590 |
| A24IC3 | 1820-0590 | | IC: DIGITAL TTL DUAL 2-WIDE, INPT AND/OR | 28480 | 1820-0590 |
| A24IC4 | 1820-0590 | | IC: DIGITAL TTL DUAL 2-WIDE, INPT AND/OR | 28480 | 1820-0590 |
| A24IC5 | 1820-0590 | | IC: DIGITAL TTL DUAL 2-WIDE, INPT AND/OR | 28480 | 1820-0590 |
| A24IC6 | 1820-0590 | | IC: DIGITAL TTL DUAL 2-WIDE, INPT AND/OR | 28480 | 1820-0590 |
| A24IC7 | 1820-0590 | | IC: DIGITAL TTL DUAL 2-WIDE, INPT AND/OR | 28480 | 1820-0590 |
| A24IC8 | 1820-0590 | | IC: DIGITAL TTL DUAL 2-WIDE, INPT AND/OR | 28480 | 1820-0590 |
| A24IC9 | 1820-0766 | | IC: MOS | 28480 | 1820-0766 |
| A24IC10 | 1820-0766 | | IC: MOS | 28480 | 1820-0766 |
| A24IC11 | 1820-0766 | | IC: MOS | 28480 | 1820-0766 |
| A24IC12 | 1820-0766 | | IC: MOS | 28480 | 1820-0766 |
| A24IC13 | 1820-0583 | | IC: TTL QUAD 2-INPT NAND GATE | 28480 | 1820-0583 |
| A24IC14 | 1820-0584 | | IC: TTL QUAD 2-INPT NOR GATE | 28480 | 1820-0584 |
| A24IC15 | 1820-0471 | 1 | IC: TTL HEX INVERTER | 28480 | 1820-0471 |
| A24Q1 | 1853-0203 | | TSTR: SI PNP | 28480 | 1853-0203 |
| A24Q2 | 1855-0081 | | TSTR: SI FET | 80131 | 2N5245 |
| A24Q3 | 1853-0203 | | TSTR: SI PNP | 28480 | 1853-0203 |
| A24R1 | 1810-0041 | | R: NETWORK, 8 RES. 2.7K OHM 5% | 28480 | 1810-0041 |
| A24R2 | 1810-0041 | | R: NETWORK, 8 RES. 2.7K OHM 5% | 28480 | 1810-0041 |
| A24R3 | 1810-0041 | | R: NETWORK, 8 RES. 2.7K OHM 5% | 28480 | 1810-0041 |
| A24R4 | 1810-0041 | | R: NETWORK, 8 RES. 2.7K OHM 5% | 28480 | 1810-0041 |
| A24R5 | 0683-1535 | | R: FXD COMP 15K OHM 5% 1/4 W | 01121 | CB 1535 |
| A24R6 | 0683-5125 | | R: FXD COMP 5100 OHM 5% 1/4 W | 01121 | CB 5125 |
| A24R7 | 0683-1545 | | R: FXD COMP 150K OHM 5% 1/4 W | 01121 | CB 1545 |
| A24R8 | 0683-7535 | | R: FXD COMP 75K OHM 5% 1/4 W | 01121 | CB 7535 |
| A24R9 | 0683-1125 | | R: FXD COMP 1100 OHM 5% 1/4 W | 01121 | CB 1125 |
| A24R10 | 0683-1815 | | R: FXD COMP 180 OHM 5% 1/4 W | 01121 | CB 1815 |
| A24R12 | 0683-2425 | | R: FXD COMP 2400 OHM 5% 1/4 W | 01121 | CB 2425 |
| A24R13 | 0683-8215 | | R: FXD COMP 820 OHM 5% 1/4 W | 01121 | CB 8215 |
| A24R14 | 0683-2035 | | R: FXD COMP 20K OHM 5% 1/4 W | 01121 | CB 2035 |
| A24R15 | 0683-5115 | | R: FXD COMP 510 OHM 5% 1/4 W | 01121 | CB 5115 |
| A24R16 | 0683-5115 | | R: FXD COMP 510 OHM 5% 1/4 W | 01121 | CB 5115 |
| A24R17 | 0683-1815 | | R: FXD COMP 180 OHM 5% 1/4 W | 01121 | CB 1815 |
| A24R18 | 0683-1025 | | R: FXD COMP 1000 OHM 5% 1/4 W | 01121 | CB 1025 |
| A24R19 | 0683-2025 | | R: FXD COMP 2000 OHM 5% 1/4 W | 01121 | CB 2025 |
| A24R53 | 0683-1535 | | R: FXD COMP 15K OHM 5% 1/4 W | 01121 | CB 1535 |
| A25 (3320B OPT. 007 ONLY) | 03320-66525 | 1 | PC ASSY. LATCH | 28480 | 03320-66525 |
| A25C1 | 0140-0232 | 1 | C: FXD MICA 460 PF 1% 300VDCW | 28480 | 0140-0232 |

† See Section VIII, Manual Backdating.

Table 6-1. Replaceable Parts(Cont'd)

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|----------------------------|----------------|-----|------------------------------------|----------|-----------------|
| A25C2 | 0140-0199 | 1 | C:FXD MICA 240 PF 5% | 28480 | 0140-0199 |
| A25C3 | 0160-0363 | 1 | C:FXD MICA 620PF 5% | 28480 | 0160-0363 |
| A25IC1 | 1820-0584 | | IC:TTL QUAD 2-INPT NOR GATE | 28480 | 1820-0584 |
| A25IC2 | 1820-0584 | | IC:TTL QUAD 2-INPT NOR GATE | 28480 | 1820-0584 |
| A25IC3 | 1820-0595 | | IC:TTL DUAL J-K MASTER SLAVE F/F | 28480 | 1820-0595 |
| A25IC4 | 1820-0595 | | IC:TTL DUAL J-K MASTER SLAVE F/F | 28480 | 1820-0595 |
| A25IC5 | 1820-0595 | | IC:TTL DUAL J-K MASTER SLAVE F/F | 28480 | 1820-0595 |
| A25IC6 | 1820-0583 | | IC:TTL QUAD 2-INPT NAND GATE | 28480 | 1820-0583 |
| A25IC7 | 1820-0584 | | IC: TTL QUAD NOR GATE | 28480 | 1820-0584 |
| A25IC8, C9 | 1820-0497 | 4 | IC:DIGITAL 4-BIT RIGHT/LEFT | 01295 | SN19995 |
| A25IC10 | 1820-0497 | | IC:DIGITAL 4-BIT RIGHT/LEFT | 01295 | SN19995 |
| A25IC11 | 1820-0497 | | IC:DIGITAL 4-BIT RIGHT/LEFT | 01295 | SN19995 |
| A25IC12 | 1820-0595 | | IC:TTL DUAL J-K MASTER SLAVE F/F | 28480 | 1820-0595 |
| A25IC13 | 1820-0583 | | IC:TTL QUAD 2-INPT NAND GATE | 28480 | 1820-0583 |
| A25IC14 | 1820-0583 | | IC:TTL QUAD 2-INPT NAND GATE | 28480 | 1820-0583 |
| A25IC15 | 1820-0583 | | IC:TTL QUAD 2-INPT NAND GATE | 28480 | 1820-0583 |
| A25IC17 | 1820-0584 | | IC:TTL QUAD 2-INPT NOR GATE | 28480 | 1820-0584 |
| A25IC18 | 1820-0656 | 10 | IC:DIGITAL TTL 4-BIT DATA SELECTOR | 01295 | SN14266 |
| A25IC19 | 1820-0656 | | IC:DIGITAL TTL 4-BIT DATA SELECTOR | 01295 | SN14266 |
| A25IC20 | 1820-0656 | | IC:DIGITAL TTL 4-BIT DATA SELECTOR | 01295 | SN14266 |
| A25IC21 | 1820-0656 | | IC:DIGITAL TTL 4-BIT DATA SELECTOR | 01295 | SN14266 |
| A25IC22 | 1820-0656 | | IC:DIGITAL TTL 4-BIT DATA SELECTOR | 01295 | SN14266 |
| A25IC23 | 1820-0656 | | IC:DIGITAL TTL 4-BIT DATA SELECTOR | 01295 | SN14266 |
| A25IC25 | 1820-0656 | | IC:DIGITAL TTL 4-BIT DATA SELECTOR | 01295 | SN14266 |
| A25IC26 | 1820-0656 | | IC:DIGITAL TTL 4-BIT DATA SELECTOR | 01295 | SN14266 |
| A25IC27 | 1820-0656 | | IC:DIGITAL TTL 4-BIT DATA SELECTOR | 01295 | SN14266 |
| A25IC28 | 1820-0656 | | IC:DIGITAL TTL 4-BIT DATA SELECTOR | 01295 | SN14266 |
| A25R1 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A25R2 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A25R3 | 0683-1025 | | R:FXD COMP 1000 OHM 5% 1/4W | 01121 | CB 1025 |
| A28 (OPT 003, 004 ONLY) | C3320-66528 | 1 | BGARD ASSY:PAR LGC | 28480 | 03320-66528 |
| A28Q1 | 1854-0071 | | TSTR:SI NPN(SELECTED FROM 2N3704) | 28480 | 1854-0071 |
| A28R1 | 0683-1525 | | R:FXD COMP 1500 OHM 5% 1/4W | 01121 | CB 1525 |
| A28R2 | 0683-1525 | | R:FXD COMP 1500 OHM 5% 1/4W | 01121 | CB 1525 |
| A28R3 | 0683-3925 | | R:FXD COMP 3900 OHM 5% 1/4W | 01121 | CB3925 |
| A28R4 | 0683-3925 | | R:FXD COMP 3900 OHM 5% 1/4W | 01121 | CB3925 |
| A28R5 | 0683-1525 | | R:FXD COMP 1500 OHM 5% 1/4W | 01121 | CB1525 |
| A28R6 | 0683-1525 | | R:FXD COMP 1500 OHM 5% 1/4W | 01121 | CB1525 |
| A28R7 | 0683-3925 | | R:FXD COMP 3900 OHM 5% 1/4W | 01121 | CB3925 |
| A28R8 | 0683-3925 | | R:FXD COMP 3900 OHM 5% 1/4W | 01121 | CB3925 |
| A28R9 | 0683-1525 | | R:FXD COMP 1500 OHM 5% 1/4W | 01121 | CB1525 |
| A28R10 | 0683-1525 | | R:FXD COMP 1500 OHM 5% 1/4W | 01121 | CB1525 |
| A28R11 | 0683-3925 | | R:FXD COMP 3900 OHM 5% 1/4W | 01121 | CB3925 |
| A28R12 | 0683-3925 | | R:FXD COMP 3900 OHM 5% 1/4W | 01121 | CB3925 |
| A28R13 | 0683-1525 | | R:FXD COMP 1500 OHM 5% 1/4W | 01121 | CB1525 |
| A28R14 | 0683-1525 | | R:FXD COMP 1500 OHM 5% 1/4W | 01121 | CB1525 |
| A28R15 | 0683-3925 | | R:FXD COMP 3900 OHM 5% 1/4W | 01121 | CB3925 |
| A28R16 | 0683-3925 | | R:FXD COMP 3900 OHM 5% 1/4W | 01121 | CB3925 |
| A28R17 | 0683-1525 | | R:FXD COMP 1500 OHM 5% 1/4W | 01121 | CB1525 |
| A28R18 | 0683-1525 | | R:FXD COMP 1500 OHM 5% 1/4W | 01121 | CB1525 |
| A28R19 | 0683-3925 | | R:FXD COMP 3900 OHM 5% 1/4W | 01121 | CB3925 |
| A28R20 | 0683-3925 | | R:FXD COMP 3900 OHM 5% 1/4W | 01121 | CB3925 |
| A28R21 | 0683-1525 | | R:FXD COMP 1500 OHM 5% 1/4W | 01121 | CB1525 |
| A28R22 | 0683-1525 | | R:FXD COMP 1500 OHM 5% 1/4W | 01121 | CB1525 |
| A28R23 | 0683-3925 | | R:FXD COMP 3900 OHM 5% 1/4W | 01121 | CB3925 |
| A28R24 | 0683-3925 | | R:FXD COMP 3900 OHM 5% 1/4W | 01121 | CB3925 |
| A28R27 | 0683-1525 | | R:FXD COMP 1500 OHM 5% 1/4W | 01121 | CB1525 |
| A28R28 | 0683-1525 | | R:FXD COMP 1500 OHM 5% 1/4W | 01121 | CB1525 |
| A28R29 | 0683-3925 | | R:FXD COMP 3900 OHM 5% 1/4W | 01121 | CB3925 |
| A28R30 | 0683-3925 | | R:FXD COMP 3900 OHM 5% 1/4W | 01121 | CB3925 |
| A28R31 | 0683-1525 | | R:FXD COMP 1500 OHM 5% 1/4W | 01121 | CB1525 |
| A28R32 | 0683-1525 | | R:FXD COMP 1500 OHM 5% 1/4W | 01121 | CB1525 |
| A28R33 | 0683-3925 | | R:FXD COMP 3900 OHM 5% 1/4W | 01121 | CB3925 |
| A28R34 | 0683-3925 | | R:FXD COMP 3900 OHM 5% 1/4W | 01121 | CB3925 |
| A28R35 | 0683-1525 | | R:FXD COMP 1500 OHM 5% 1/4W | 01121 | CB1525 |
| A28R36 | 0683-3925 | | R:FXD COMP 3900 OHM 5% 1/4W | 01121 | CB3925 |
| A28R37 | 0683-1525 | | R:FXD COMP 1500 OHM 5% 1/4W | 01121 | CB1525 |
| A28R38 | 0683-1525 | | R:FXD COMP 1500 OHM 5% 1/4W | 01121 | CB1525 |
| A28R39 | 0683-3925 | | R:FXD COMP 3900 OHM 5% 1/4W | 01121 | CB3925 |
| A28R40 | 0683-3925 | | R:FXD COMP 3900 OHM 5% 1/4W | 01121 | CB3925 |
| A28R41 | 0683-1525 | | R:FXD COMP 1500 OHM 5% 1/4W | 01121 | CB1525 |
| A28R42 | 0683-1525 | | R:FXD COMP 1500 OHM 5% 1/4W | 01121 | CB1525 |
| A28R43 | 0683-3925 | | R:FXD COMP 3900 OHM 5% 1/4W | 01121 | CB3925 |
| A28R44 | 0683-3925 | | R:FXD COMP 3900 OHM 5% 1/4W | 01121 | CB3925 |
| A28R45 | 0683-1525 | | R:FXD COMP 1500 OHM 5% 1/4W | 01121 | CB1525 |
| A28R46 | 0683-1525 | | R:FXD COMP 1500 OHM 5% 1/4W | 01121 | CB1525 |
| A28R47 | 0683-3925 | | R:FXD COMP 3900 OHM 5% 1/4W | 01121 | CB3925 |
| A28R48 | 0683-3925 | | R:FXD COMP 3900 OHM 5% 1/4W | 01121 | CB3925 |
| A28R49 | 0683-1525 | | R:FXD COMP 1500 OHM 5% 1/4W | 01121 | CB1525 |

Table 6-1. Replaceable Parts(Cont'd)

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|------------------------------|----------------|-----|---|----------|----------------------|
| A28R50 | 0683-1525 | | R: FXD COMP 1500 OHM 5% 1/4 W | 01121 | CB1525 |
| A28R51 | 0683-3925 | | R: FXD COMP 3900 OHM 5% 1/4 W | 01121 | CB3925 |
| A28R52 | 0683-3925 | | R: FXD COMP 3900 OHM 5% 1/4 W | 01121 | CB3925 |
| A28R53 | 0683-1525 | | R: FXD COMP 1500 OHM 5% 1/4 W | 01121 | CB1525 |
| A28R54 | 0683-1525 | | R: FXD COMP 1500 OHM 5% 1/4 W | 01121 | CB1525 |
| A28R55 | 0683-3925 | | R: FXD COMP 3900 OHM 5% 1/4 W | 01121 | CB3925 |
| A28R56 | 0683-3925 | | R: FXD COMP 3900 OHM 5% 1/4 W | 01121 | CB3925 |
| A28R58 | 0683-1525 | | R: FXD COMP 1500 OHM 5% 1/4 W | 01121 | CB1525 |
| A28R59 | 0683-1525 | | R: FXD COMP 1500 OHM 5% 1/4 W | 01121 | CB1525 |
| A28R60 | 0683-3925 | | R: FXD COMP 3900 OHM 5% 1/4 W | 01121 | CB3925 |
| A28R61 | 0683-3925 | | R: FXD COMP 3900 OHM 5% 1/4 W | 01121 | CB3925 |
| A28R62 | 0683-1525 | | R: FXD COMP 1500 OHM 5% 1/4 W | 01121 | CB1525 |
| A28R63 | 0683-1525 | | R: FXD COMP 1500 OHM 5% 1/4 W | 01121 | CB1525 |
| A28R64 | 0683-3925 | | R: FXD COMP 3900 OHM 5% 1/4 W | 01121 | CB3925 |
| A28R65 | 0683-3925 | | R: FXD COMP 3900 OHM 5% 1/4 W | 01121 | CB3925 |
| A28R66 | 0683-1525 | | R: FXD COMP 1500 OHM 5% 1/4 W | 01121 | CB1525 |
| A28R67 | 0683-1525 | | R: FXD COMP 1500 OHM 5% 1/4 W | 01121 | CB1525 |
| A28R68 | 0683-3925 | | R: FXD COMP 3900 OHM 5% 1/4 W | 01121 | CB3925 |
| A28R69 | 0683-3925 | | R: FXD COMP 3900 OHM 5% 1/4 W | 01121 | CB3925 |
| A28R70 | 0683-1525 | | R: FXD COMP 1500 OHM 5% 1/4 W | 01121 | CB1525 |
| A28R71 | 0683-1525 | | R: FXD COMP 1500 OHM 5% 1/4 W | 01121 | CB1525 |
| A28R72 | 0683-3925 | | R: FXD COMP 3900 OHM 5% 1/4 W | 01121 | CB3925 |
| A28R73 | 0683-3925 | | R: FXD COMP 3900 OHM 5% 1/4 W | 01121 | CB3925 |
| A28R74 | 0683-1525 | | R: FXD COMP 1500 OHM 5% 1/4 W | 01121 | CB1525 |
| A28R75 | 0683-3925 | | R: FXD COMP 3900 OHM 5% 1/4 W | 01121 | CB3925 |
| A28R76 | 0683-1525 | | R: FXD COMP 1500 OHM 5% 1/4 W | 01121 | CB1525 |
| A28R77 | 0683-3925 | | R: FXD COMP 3900 OHM 5% 1/4 W | 01121 | CB3925 |
| A28R78 | 0683-1525 | | R: FXD COMP 1500 OHM 5% 1/4 W | 01121 | CB1525 |
| A28R79 | 0683-3925 | | R: FXD COMP 3900 OHM 5% 1/4 W | 01121 | CB3925 |
| A28R80 | 0683-3925 | | R: FXD COMP 3900 OHM 5% 1/4 W | 01121 | CB3925 |
| A28R81 | 0683-1325 | | R: FXD COMP 1300 OHM 5% 1/4 W | 01121 | CB1325 |
| A28R82 | 0683-1525 | | R: FXD COMP 1500 OHM 5% 1/4 W | 01121 | CB1525 |
| A28R83 | 0683-3925 | | R: FXD COMP 3900 OHM 5% 1/4 W | 01121 | CB3925 |
| A28R84 | 0683-1525 | | R: FXD COMP 1500 OHM 5% 1/4 W | 01121 | CB1525 |
| A28R85 | 0683-3925 | | R: FXD COMP 3900 OHM 5% 1/4 W | 01121 | CB3925 |
| A28R86 | 0683-1525 | | R: FXD COMP 1500 OHM 5% 1/4 W | 01121 | CB1525 |
| A28R87 | 0683-3925 | | R: FXD COMP 3900 OHM 5% 1/4 W | 01121 | CB3925 |
| A28R88 | 0683-1525 | | R: FXD COMP 1500 OHM 5% 1/4 W | 01121 | CB1525 |
| A28R89 | 0683-3925 | | R: FXD COMP 3900 OHM 5% 1/4 W | 01121 | CB3925 |
| A28R91 | 0683-7515 | | R: FXD COMP 750 OHM 5% 1/4 W | 01121 | CB7515 |
| A28XA23 | 1251-1365 | | CONN. PC 4 (2X22) CONTACTS | 71785 | 252-22-31-300 |
| A28XA24 | 1251-1365 | | CONN. PC 44 (2X22) CONTACTS | 71785 | 252-22-31-300 |
| A37 (3320B OPT. 007 ONLY) | 03320-66537 | | GPIO INPUT | 28480 | 03320-66537 |
| A37C1 | 0160-0990 | | C: FXD MICA 100 pF 2% 300 VDCW | 72136 | 080 |
| A37C2 | 0160-0363 | | C: FXD MICA 620 pF 5% 300 VDCW | 72136 | 080 |
| A37C3 | 0160-0938 | | C: FXD MICA 1000 pF 5% 300 VDCW | 72136 | 080 |
| A37C4 | 0160-0938 | | C: FXD MICA 1000 pF 5% 300 VDCW | 72136 | 080 |
| A37C5 | 0140-0198 | | C: FXD MICA 200 pF 5% | 72136 | 080 |
| A37C6 | 0180-0104 | | C: FXD AL ELECT 200 UF -10% +75% 16 VDCW | 56289 | 300207G016DF2-0SM |
| A37C7 | 0180-0104 | | C: FXD AL ELECT 200 UF -10% +75% 16 VDCW | 56289 | 300207G016DF2-0SM |
| A37C8 | 0150-0012 | | C: FXD CER 0.01 UF 20% 1000 VDCW | 56289 | C023A102J103MS36-CDR |
| A37CR1 | 1910-0016 | | DIODE: GE 100 MA | 14433 | G718 |
| A37CR2 | 1910-0016 | | DIODE: GE 100 MA | 14433 | G718 |
| A37CR3 | 1910-0016 | | DIODE: GE 100 MA | 14433 | G718 |
| A37CR4 | 1910-0016 | | DIODE: GE 100 MA | 14433 | G718 |
| A37CR5 | 1910-0016 | | DIODE: GE 100 MA | 14433 | G718 |
| A37CR6 | 1910-0016 | | DIODE: GE 100 MA | 14433 | G718 |
| A37CR7 | 1910-0016 | | DIODE: GE 100 MA | 14433 | G718 |
| A37CR8 | 1910-0016 | | DIODE: GE 100 MA | 14433 | G718 |
| A37CR9 | 1901-0158 | | DIODE: SI .75 A 200 V | 04713 | SR 1356-3 |
| A37CR10 | 1901-0158 | | DIODE: SI .75 A 200 V | 04713 | SR 1356-3 |
| A37CR11 | 1901-0158 | | DIODE: SI .75 A 200 V | 04713 | SR 1356-3 |
| A37CR12 | 1901-0158 | | DIODE: SI .75 A 200 V | 04713 | SR 1356-3 |
| A37IC1 | 1820-0583 | | INTEGRATED CIRCUIT: DIGITAL QUAD 2-INPUT GATE | 12040 | SD12955 |
| A37IC2 | 1820-0583 | | INTEGRATED CIRCUIT: DIGITAL QUAD 2-INPUT GATE | 12040 | SD12955 |
| A37IC3 | 1820-0588 | | INTEGRATED CIRCUIT: DIGITAL DUAL 4-INPUT GATE | 12040 | SD12981 |
| A37IC4 | 1820-0588 | | INTEGRATED CIRCUIT: DIGITAL DUAL 4-INPUT GATE | 12040 | SD12981 |
| A37IC5 | 1820-0584 | | INTEGRATED CIRCUIT: DIGITAL QUAD 2-INPUT NOR GATE | 12040 | DM74L02N |
| A37IC6 | 1820-0584 | | INTEGRATED CIRCUIT: DIGITAL QUAD 2-INPUT NOR GATE | 12040 | DM74L02N |

Table 6-1. Replaceable Parts(Cont'd)

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|------------------------------|----------------|-----|--|----------|--------------------|
| A371C7 | 1820-0584 | | INTEGRATED CIRCUIT: DIGITAL QUAD 2-INPUT NOR GATE | 12040 | DM74L02N |
| A371C8 | 1820-0583 | | INTEGRATED CIRCUIT: DIGITAL QUAD 2-INPUT NAND GATE | 12040 | SD12955 |
| A371C9 | 1820-0586 | | INTEGRATED CIRCUIT: DIGITAL HEX INVERTER | 12040 | DM74L04N |
| A371C10 | 1990 0312 | | PHOTO ISOLATOR | 01295 | 08D |
| A371C11 | 1990 0312 | | PHOTO ISOLATOR | 01295 | 08D |
| A37Q1 | 1854-0354 | | TSTR: SI NPN | 04713 | SS2077 |
| A37Q2 | 1854-0354 | | TSTR: SI NPN | 04713 | SS2077 |
| A37Q3 | 1854 0009 | | TSTR: SI NPN 2N709 | 04713 | SS376K |
| A37Q4 | 1853-0203 | | TSTR: SI PNP | 04713 | SS5651 |
| A37Q5 | 1854 0354 | | TSTR: SI NPN | 04713 | SS2077 |
| A37R1 | 1810 0136 | | R NETWORK FLM | 91637 | 08D |
| A37R2 | 0683 5115 | | R: FXD COMP 510 OHM 5% 1/4 W | 01121 | CB 5115 |
| A37R3 | 0683 5115 | | R: FXD COMP 510 OHM 5% 1/4 W | 01121 | CB 5115 |
| A37R4 | 0683 5115 | | R: FXD COMP 510 OHM 5% 1/4 W | 01121 | CB 5115 |
| A37R5 | 0683-5115 | | R: FXD COMP 510 OHM 5% 1/4 W | 01121 | CB 5115 |
| A37R6 | 0683-5115 | | R: FXD COMP 510 OHM 5% 1/4 W | 01121 | CB 5115 |
| A37R7 | 0683-5115 | | R: FXD COMP 510 OHM 5% 1/4 W | 01121 | CB 5115 |
| A37R8 | 0683 5115 | | R: FXD COMP 510 OHM 5% 1/4 W | 01121 | CB 5115 |
| A37R9 | 0683-3025 | | R: FXD COMP 3 K OHM 5% 1/4 W | 01121 | CB 3025 |
| A37R10 | 0683 6225 | | R: FXD COMP 6200 OHM 5% 1/4 W | 01121 | CB 6225 |
| A37R11 | | | NOT ASSIGNED | | |
| A37R12 | 0683 3025 | | R: FXD COMP 3 K OHM 5% 1/4 W | 01121 | CB 3025 |
| A37R13 | 0683 6225 | | R: FXD COMP 6200 OHM 5% 1/4 W | 01121 | CB 6225 |
| A37R14 | 0683 9115 | | R: FXD COMP 910 OHM 5% 1/4 W | 01121 | CB 9115 |
| A37R15 | 0683-6215 | | R: FXD COMP 620 OHM 5% 1/4 W | 01121 | CB 6215 |
| A37R16 | 0683-1025 | | R: FXD COMP 1 K OHM 5% 1/4 W | 01121 | CB 1025 |
| A37R17 | 0683 6215 | | R: FXD COMP 620 OHM 5% 1/4 W | 01121 | CB 6215 |
| A37R18 | 0683-5115 | | R: FXD COMP 510 OHM 5% 1/4 W | 01121 | CB 5115 |
| A37R19 | 0683 1325 | | R: FXD COMP 1300 OHM 5% 1/4 W | 01121 | CB 1325 |
| A37R20 | 0683-1325 | | R: FXD COMP 1300 OHM 5% 1/4 W | 01121 | CB 1325 |
| A37R21 | 0683 1025 | | R: FXD COMP 1 K OHM 5% 1/4 W | 01121 | CB 1025 |
| A37R22 | 0683 1535 | | R: FXD COMP 15 K OHM 5% 1/4 W | 01121 | CB 1535 |
| A37R23 | | | NOT ASSIGNED | | |
| A37R24 | 0683 1025 | | R: FXD COMP 1 K OHM 5% 1/4 W | 01121 | CB 1025 |
| A37R25 | 0683-1535 | | R: FXD COMP 15 K 5% 1/4 W | 01121 | CB 1535 |
| A37R26 | 0683 3615 | | R: FXD COMP 360 OHM 5% 1/4 W | 01121 | CB 3615 |
| A37R27 | 0683 1025 | | R: FXD COMP 1 K OHM 5% 1/4 W | 01121 | CB 1025 |
| A37R28 | 0683 1035 | | R: FXD COMP 10 K OHM 5% 1/4 W | 01121 | CB 1035 |
| A37R29 | 0683-1025 | | R: FXD COMP 1 K OHM 5% 1/4 W | 01121 | CB 1025 |
| A37R30 | 0683-1535 | | R: FXD COMP 15 K 5% 1/4 W | 01121 | CB 1535 |
| A37R31 | 0683 3025 | | R: FXD COMP 3 K OHM 5% 1/4 W | 01121 | CB 3025 |
| A37R32 | 0683-6225 | | R: FXD COMP 6200 OHM 5% 1/4 W | 01121 | CB 6225 |
| A37R33 | 0683 3615 | | R: FXD COMP 360 OHM 5% 1/4 W | 01121 | CB 3615 |
| A37R34 | 0683-1035 | | R: FXD COMP 10 K OHM 5% 1/4 W | 01121 | CB 1035 |
| A37R35 | 0683 1025 | | R: FXD COMP 1 K OHM 5% 1/4 W | 01121 | CB 1025 |
| A37R36 | 0683 3005 | | R: FXD COMP 30 OHM 5% 1/4 W | 01121 | CB 3005 |
| A37T1 | 9100 1238 | | XFMR PULSE | 90095 | 2 WEMA |
| A37T2 | 9100 1238 | | XFMR PULSE | 90095 | 2 WEMA |
| A37T3 | 9100-1238 | | XFMR PULSE | 90095 | 2 WEMA |
| A37T4 | 9100-1238 | | XFMR PULSE | 90095 | 2 WEMA |
| A37T5 | 9100-1238 | | XFMR PULSE | 90095 | 2 WEMA |
| A37T6 | 9100 1238 | | XFMR PULSE | 90095 | 2 WEMA |
| A37T7 | 9100 1238 | | XFMR PULSE | 90095 | 2 WEMA |
| A37T8 | 9100-1238 | | XFMR PULSE | 90095 | 2 WEMA |
| A38 (3320B OPT. 007 ONLY) | 03320-66538 | | GP1B CONTROL | 28480 | 03320 66538 |
| A38C1 | 0160-0938 | | C: FXD MICA 1000 pF 5% 300 VDCW | 72136 | 08D |
| A38C2 | 0180-0291 | | C: FXD TA 1 UF 10% 35 VDCW | 56289 | 150D105X9035A2-DYS |
| A38C3 | 0160-0938 | | C: FXD MICA 1000 pF 5% 300 VDCW | 72136 | 08D |
| A38C4 | 0160-2207 | | C: FXD MICA 300 pF 5% 300 VDCW | 72136 | 08D |
| A38C5 | 0180-1746 | | C: FXD TA 15 UF 10% 20 VDCW | 56289 | 150D155X9020B2 DYS |
| A38C6 | 0160-2207 | | C: FXD MICA 300 pF 5% 300 VDCW | 72136 | 08D |
| A38CR1 | 1910-0016 | | DIODE: GE 100 MA | 14433 | G718 |
| A38CR2 | 1910-0016 | | DIODE: GE 100 MA | 14433 | G718 |
| A38IC1 | 1820-0584 | | INTEGRATED CIRCUIT: DIGITAL QUAD 2-INPUT NOR GATE | 12040 | DM74L02N |
| A38IC2 | 1820 0584 | | INTEGRATED CIRCUIT DIGITAL QUAD 2-INPUT NOR GATE | 12040 | DM74L02N |
| A38IC3 | 1820-0584 | | INTEGRATED CIRCUIT: DIGITAL QUAD 2-INPUT NOR GATE | 12040 | DM74L02N |
| A38IC4 | 1820 0584 | | INTEGRATED CIRCUIT: DIGITAL QUAD 2-INPUT NOR GATE | 12040 | DM74L02N |
| A38IC5 | | | NOT ASSIGNED | | |
| A38IC6 | 1820-0584 | | INTEGRATED CIRCUIT: DIGITAL QUAD 2-INPUT NOR GATE | 12040 | DM74L02N |
| A38IC7 | 1820-0584 | | INTEGRATED CIRCUIT: DIGITAL QUAD 2 INPUT NOR GATE | 12040 | DM74L02N |
| A38IC8 | 1820-0584 | | INTEGRATED CIRCUIT: DIGITAL QUAD 2-INPUT NOR GATE | 12040 | DM74L02N |

Table 6-1. Replaceable Parts(Cont'd)

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-------------------------------------|----------------|-----|--|----------|-----------------|
| A38IC9 | 1820 0583 | | INTEGRATED CIRCUIT· DIGITAL QUAD 2 INPUT NAND GATE | 12040 | SO12955 |
| A38IC10 | 1820 0595 | | INTEGRATED CIRCUIT DIGITAL DUAL FLIP FLOP | 12040 | DM74L73N |
| A38IC11 | 1820-0584 | | INTEGRATED CIRCUIT· DIGITAL QUAD 2-INPUT NOR GATE | 12040 | DM74L02N |
| A38IC12 | 1820 0777 | | INTEGRATED CIRCUIT: DIGITAL | 01295 | SN21819 |
| A38IC13 | 1820 0777 | | INTEGRATED CIRCUIT DIGITAL | 01295 | SN21819 |
| A38IC14 | 1820-0777 | | INTEGRATED CIRCUIT, DIGITAL | 01295 | SN21819 |
| A38IC15 | 1820-0586 | | INTEGRATED CIRCUIT· DIGITAL HEX INVERTER | 12040 | DM74L04N |
| A38IC16 | 1820 0584 | | INTEGRATED CIRCUIT, DIGITAL QUAD 2 INPUT NOR GATE | 12040 | DM74L02N |
| A38IC17 | 1820 0586 | | INTEGRATED CIRCUIT DIGITAL HEX INVERTER | 12040 | DM74L04N |
| A38Q1 | 1853 0086 | | TSTR SI PNP | 04713 | SPS3322 |
| A38R1 | 0683-9115 | | R FXD COMP 910 OHM 5% 1/4 W | 01121 | CB 9115 |
| A38R2 | 0683-6215 | | R FXD COMP 620 OHM 5% 1/4 W | 01121 | CB 6215 |
| A38R3 | 0683 1025 | | R FXD COMP 1 K OHM 5% 1/4 W | 01121 | CB 1025 |
| A38R4 | 0683 2035 | | R FXD COMP 20 K 5% 1/4 W | 01121 | CB 2035 |
| A38R5 | 0683-1025 | | R FXD COMP 1 K OHM 5% 1/4 W | 01121 | CB 1025 |
| A38R6 | 0683 9115 | | R FXD COMP 910 OHM 5% 1/4 W | 01121 | CB 9115 |
| A38R7 | 0683-6215 | | R FXD COMP 620 OHM 5% 1/4 W | 01121 | CB 6215 |
| A38R8 | 0683 1025 | | R FXD COMP 1 K OHM 5% 1/4 W | 01121 | CB 1025 |
| A38R9 | 0683-1025 | | R FXD COMP 1 K OHM 5% 1/4 W | 01121 | CB 1025 |
| A38R10 | 0683 1025 | | R FXD COMP 1 K OHM 5% 1/4 W | 01121 | CB 1025 |
| A39 (3320B OPT. 007 ONLY) | 03320-66539 | 1 | PC ASSY MOTHER | 28480 | 03320 66539 |
| A39XA23 | 1251-1385 | | CONN PC 44 (2X22) CONTACTS | 71785 | 252 22 30-300 |
| A39XA24 | 1251 1385 | | CONN PC 44 (2X22) CONTACTS | 71785 | 252-22 30 300 |
| A39XA25 | 1251 2035 | | CONN PC 30 (2X15) CONTACTS | 76530 | 65 7160 |
| A39XA37 | 1251 2035 | | CONN PC 30 (2X15) CONTACTS | 76530 | 65 7160 |
| A39XA38 | 1251 2035 | | CONN PC 30 (2X15) CONTACTS | 76530 | 65 7160 |
| CHASSIS MOUNTED COMPONENTS | | | | | |
| C1 | 0180-2397 | 1 | C FXD 18000 UF | | |
| CR1, CR2 | 1901-0526 | 3 | ASSY. DIODE BRIDGE SI 100 PIV 5A | | |
| CR3* | 1901-0526 | | ASSY. DIODE BRIDGE SI 100 PIV 5A | | |
| F1 (110 V ac) | 2110-0312 | 1 | FUSE 1A 250 V SLO BLO | | |
| F1 (230 V ac) | 2110-0202 | 1 | FUSE: 0.50A 250 V SLO BLO | 75915 | 313.5035 |
| F2 | 2110-0055 | 1 | FUSE 4A 250 V NORMAL BLO | | |
| J1 THRU J5 | 1250-1194 | | CONNECTOR RF (SUBMIN) | | |
| J6 | 1250-0252 | | CONNECTOR RF | | |
| J7 (3320A ONLY) | 1250-0102 | | CONNECTOR RF | | |
| J8 | 1250-0252 | | CONNECTOR RF | | |
| J9 | 1250-1194 | | CONNECTOR RF (SUBMIN) | | |
| J10 (3320B ONLY) | 1250-0102 | | CONNECTOR RF | | |
| J11 | | | P/O 03320-61618 CABLE ASSY | | |
| J12, J13 | 1250-0252 | | | | |
| J14 | | | | | |
| J15 | 1250-0118 | | REM. I/O, (A28, OPT. 003, 004) (A39, OPT. 007) | | |
| LED1 THRU LED4 | 03320-68101 | | CONNECTOR RF | | |
| M1 | 3160 0248 | 1 | DECIMAL INDICATOR ASSEMBLY | | |
| O1 | 1854-0063 | 1 | FAN, TUB AXIAL | | |
| O2 | 1854-0072 | 2 | TSTR: SI NPN 2N3055 | | |
| O3 | 1853-0052 | 2 | TSTR: SI NPN 2N3054 | | |
| O4* | 1854-0072 | | TSTR: SI PNP 2N3740 | | |
| O5* | 1853-0052 | | TSTR: SI NPN 2N3054 | | |
| R1 | 0684-4711 | | R: FXD COMP 470 OHM 10% 1/4 W | | |
| R2 | 2100-2217 | 1 | R: VAR WW LIN 10 K OHM 5% 3W | | |
| R3 | 2100-3167 | 1 | R: VAR 25 K OHM (3320A ONLY) | | |
| S1 | 3101-0896 | 1 | SWITCH: TOGGLE (POWER) | | |
| S2 | 3100-2725 | 1 | SWITCH: ROTARY (VERNIER) | | |
| S3* | 3101 1179 | 1 | SWITCH, TOGGLE (LEVELING) | | |
| T1 | 9100-2234 | 1 | TRANSFORMER: POWER | | |
| CABLE ASSEMBLIES | | | | | |
| W1 | 03320-61601 | 1 | FLAT CABLE ASSEMBLY (3320A/B STD AND OPTIONS: 001, 002, 006) | | |
| W2 | 03320-61602 | 1 | FLAT CABLE ASSEMBLY (3320A/B OPTIONS 003 THRU 007 ONLY) | | |
| | 03320-61603 | 1 | CABLE ASSEMBLY A (BROWN) | | |
| | 03320-61604 | 1 | CABLE ASSEMBLY B (RED) | | |
| | 03320-61605 | 1 | CABLE ASSEMBLY C (A12 TO A14 B MODEL ONLY) | | |
| | 03320-61606 | 1 | CABLE ASSEMBLY D (4-COND. TO POWER SWITCH) | | |
| | 03320-61607 | 1 | CABLE ASSEMBLY E (TO FRONT PANEL OUTPUT) | | |
| | 03320-61608 | 1 | CABLE ASSEMBLY F (ORANGE) | | |
| | 03320-61610 | 1 | CABLE ASSEMBLY H (GREEN) | | |
| | 03320-61611 | 1 | CABLE ASSEMBLY I (BLUE) | | |
| | 03320-61612 | 1 | CABLE ASSEMBLY J (VIOLET) | | |
| | 03320-61613 | 1 | CABLE ASSEMBLY K (WHITE) | | |
| | 03320-61614 | 1 | CABLE ASSEMBLY L (FROM A15) | | |
| (*) INDICATES PART ON 8 MODEL ONLY. | 03320-61618 | 1 | CABLE ASSEMBLY (ALTERNATE OUTPUT) | 28480 | 03320-61618 |

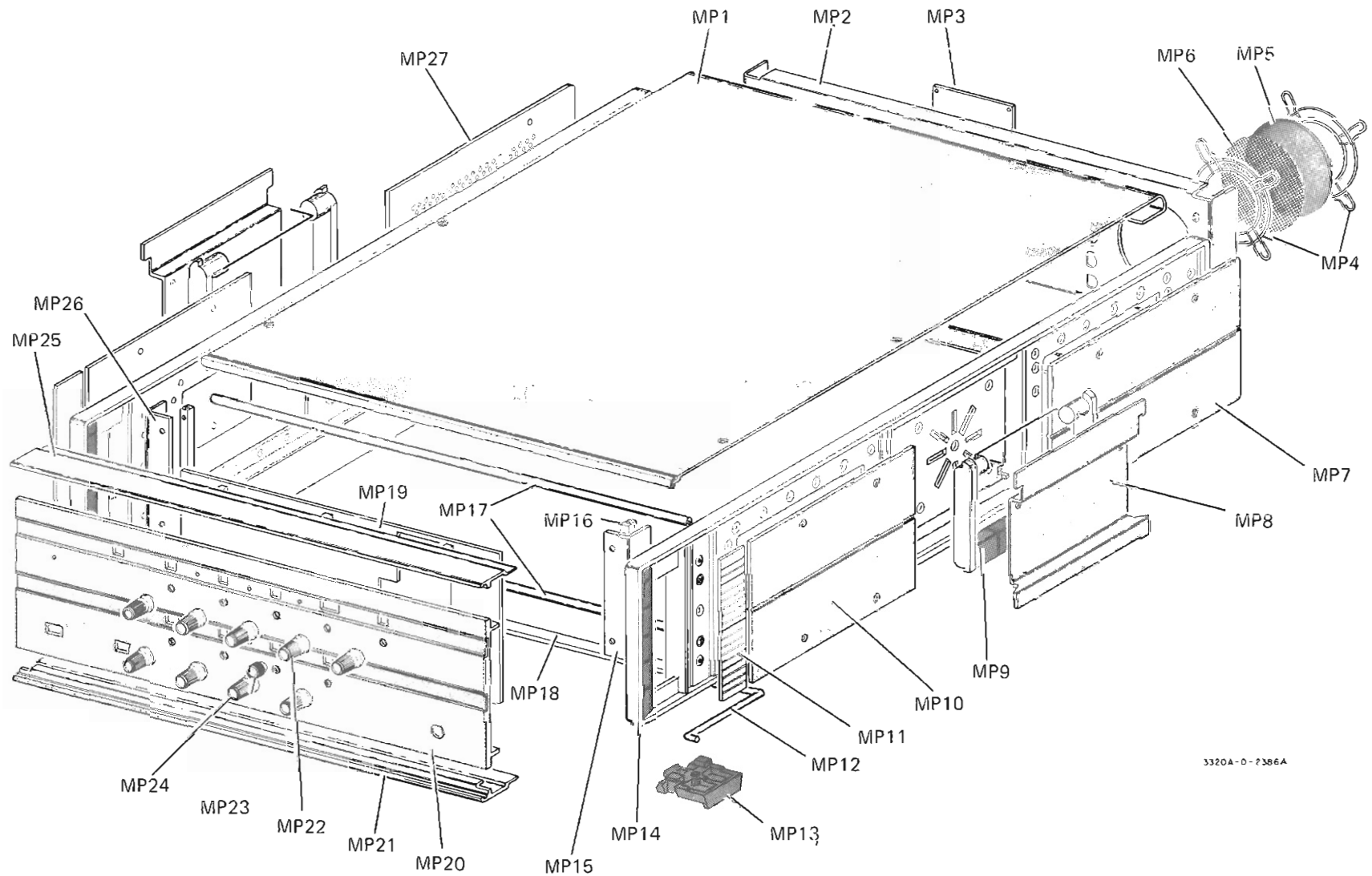
Table 6-1. Replaceable Parts(Cont'd)

| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|-----------------------|---------------------|-----|--|----------|-----------------|
| | | | MISCELLANEOUS | | |
| | 5040-5932 | 1 | COVER, MAIN POWER SWITCH | | |
| | 10513-4001 | 1 | COVER, 18 PIN CONNECTOR (OPTION 003) | | |
| | 05216-4008 | 1 | GUARD SOCKET (REMOTE CONTROL) | | |
| | 5040-1449 | 1 | HINGE | | |
| | 1400-0008 | 1 | HOLDER FUSE (F2) | | |
| | 05216-4007 | 1 | HOUSING CONNECTOR (REMOTE CONTROL) | | |
| | 5040-0702 | 2 | INSULATOR CONNECTOR (FOR J3) | | |
| | 03320-84401 | 1 | KIT ACCESSORY INCLUDES THE FOLLOWING: | | |
| | 5020-7621 | 1 | BRACKET | | |
| | 5020-7622 | 1 | BRACKET | | |
| | 03320-66530 | 1 | EXTENDER PC | | |
| | 5040-6676 | 1 | FILLER STRIP | | |
| | 03320-67703 | 1 | FILTER ASSY FAN | | |
| | 03320-90000 | 1 | MANUAL, OPERATING AND SERVICE | | |
| | Option 002 only | | | | |
| | 03320-61501 | 1 | BRKT ASSY TERM CONSISTS OF | | |
| | 03320-01209 | 1 | BRKT TERM | hp- | |
| | 0757-0442 | 2 | R: FXD FLM 10K OHM 1% 1/2 W | 19701 | MF4CT-0 obd |
| | 2100-2488 | 1 | R: VAR COMP 10K OHM 20% 1/2 W | 01121 | Type W |
| | 0960-0164 | 1 | CRYSTAL OVEN OSCILLATOR | 75378 | |
| | 10502-6001 | 1 | CABLE EXTERNAL PULSE | hp | |
| | 1251-3056 | 1 | 56 PIN CONNECTOR (OPT. 003, 004) | | |
| | | | MECHANICAL PARTS (REFER TO FIGURES 61 THRU 63) | | |
| MP1 | 5050-8505 | 1 | COVER TOP | | |
| MP2 | 03320-00202 (3320A) | 1 | PANEL REAR | | |
| | 03320-00201 (3320B) | 1 | PANEL REAR | | |
| MP3 | 03320-04115 | 1 | COVER OVEN | | |
| MP4 | 3160-0249 | 1 | GRILLE FAN | | |
| MP5 | 3150-0227 | 1 | FILTER FAN | | |
| MP6 | 3150-0228 | 1 | SCREEN FILTER | | |
| MP7 | 5000-8527 | 1 | COVER REAR (RIGHT SIDE) | | |
| MP8 | 5060-8737 | 2 | RETAINER HANDLE | | |
| MP9 | 5060-0222 | 2 | ASSY HANDLE | | |
| MP10 | 5000-8525 | 2 | COVER FRONT SIDE | | |
| MP11 | 5000-0051 | 2 | PLATE FLUTED | | |
| MP12 | 0490-0030 | 1 | STAND TILT | | |
| MP13 | 5060-0767 | 5 | ASSY FOOT | | |
| MP14 | 03320-24901 | 2 | FRAME SIDE | | |
| MP15 | 03320-01202 | 1 | BRACKET: PANEL (RIGHT SIDE) | | |
| MP16 | 03320-24707 | 2 | SPACER BAR | | |
| MP17 | 03320-24708 | 2 | SPACER ROD | | |
| MP18 | 5060-8513 | 1 | COVER, BOTTOM | | |
| MP19 | 03320-04301 | 1 | PLATE SWITCH | | |
| MP20 | | | MP20, Front Panel Assembly Includes A13 Switch Assembly. | | |
| | 03320-60302 | 1 | PANEL FRONT 3320A | | |
| | 03320-60304 | 1 | PANEL FRONT 3320A (OPTION 001) | | |
| | 03320-60301 | 1 | PANEL FRONT 3320B* | | |
| | 03320-60303 | 1 | PANEL FRONT 3320B (OPTION 001)* | | |
| MP21 | 5020-6866 | 1 | TRIM: BOTTOM | | |
| MP22 | 0370-2257 | 8 | KNOB RND | | |
| MP23 | 0370-1092 | 1 | KNOB 1/2 RND | | |
| MP24 | 0370-1126 | 1 | KNOB CONCENTRIC | | |
| MP25 | 5020-6865 | 1 | TRIM TOP | | |
| MP26 | 03320-01203 | 1 | BRACKET PANEL (LEFT SIDE) | | |
| MP27 | 5000-8531 | 1 | COVER, REAR (LEFT SIDE) | | |
| MP28 | 03320-01206 | 1 | BRACKET RECTIFIER | | |
| † MP29 | 03320-61205 | 1 | BRACKET: POWER SUPPLY | | |
| MP30 | 03320-01208 | 1 | STRAP RETAINER | | |
| † MP31 | 03320-69536 | 1 | REAR DECK ASSEMBLY INCLUDES. | | |
| | 03320-60112 | 1 | DECK, POWER SUPPLY | | |
| | 03320-61204 | 1 | BRACKET RIGHT | | |
| | 03320-61210 | 1 | BRACKET: CONTROL FRONT | | |
| | 03320-61211 | 1 | BRACKET, CONTROL REAR | | |
| MP32 | 03320-00104 | 1 | DECK AMP AND AITEN | | |
| MP33 | 03320-60101 | 1 | ASSY GUSSET | | |
| MP34 | 03320-00101 | 1 | DECK: CARD NEST | | |
| MP35 | 03320-00601 | 1 | SHIELD | | |
| MP36 | 03320-25501 | 11 | EXTRU. CARD NEST (A1THRU A11) | | |
| MP37 | 03320-61201 (3320A) | 1 | ASSY TSTR BRACKET | | |
| | 03320-61202 (3320B) | 1 | ASSY TSTR BRACKET | | |
| MP38 | 03320-04101 | 1 | COVER CARD NEST (A1) | | |
| MP39 | 03320-04102 | 1 | COVER CARD NEST (A2) | | |
| MP40 | 03320-04103 | 1 | COVER CARD NEST (A3) | | |
| MP41 | 03320-04104 | 1 | COVER CARD NEST (A4) | | |
| MP42 | 03320-04105 | 1 | COVER CARD NEST (A5) | | |
| MP43 | 03320-04106 | 1 | COVER CARD NEST (A6) | | |
| MP44 | 03320-04107 | 1 | COVER CARD NEST (A7) | | |
| MP45 | 03320-04108 | 1 | COVER CARD NEST (A8) | | |
| MP46 | 03320-04109 | 1 | COVER CARD NEST (A9) | | |
| MP47 | 03320-04110 | 1 | COVER CARD NEST (A10) | | |
| MP48 | 03320-04111 (3320B) | 1 | COVER CARD NEST (A11) | | |
| MP49 | 03320-04119 (3320A) | 1 | COVER CARD NEST (A11) | | |
| MP50 | 03320-42301 | 1 | EXTRU. CARD NEST (A12) | | |
| MP51 | 03320-24705 | 1 | SUPPORT: FLAG | | |
| MP52 | 5040-5882 | 1 | ASSY: FLAG | | |

† See Section VIII, Manual Backdating.

MECHANICAL PARTS (cont'd)

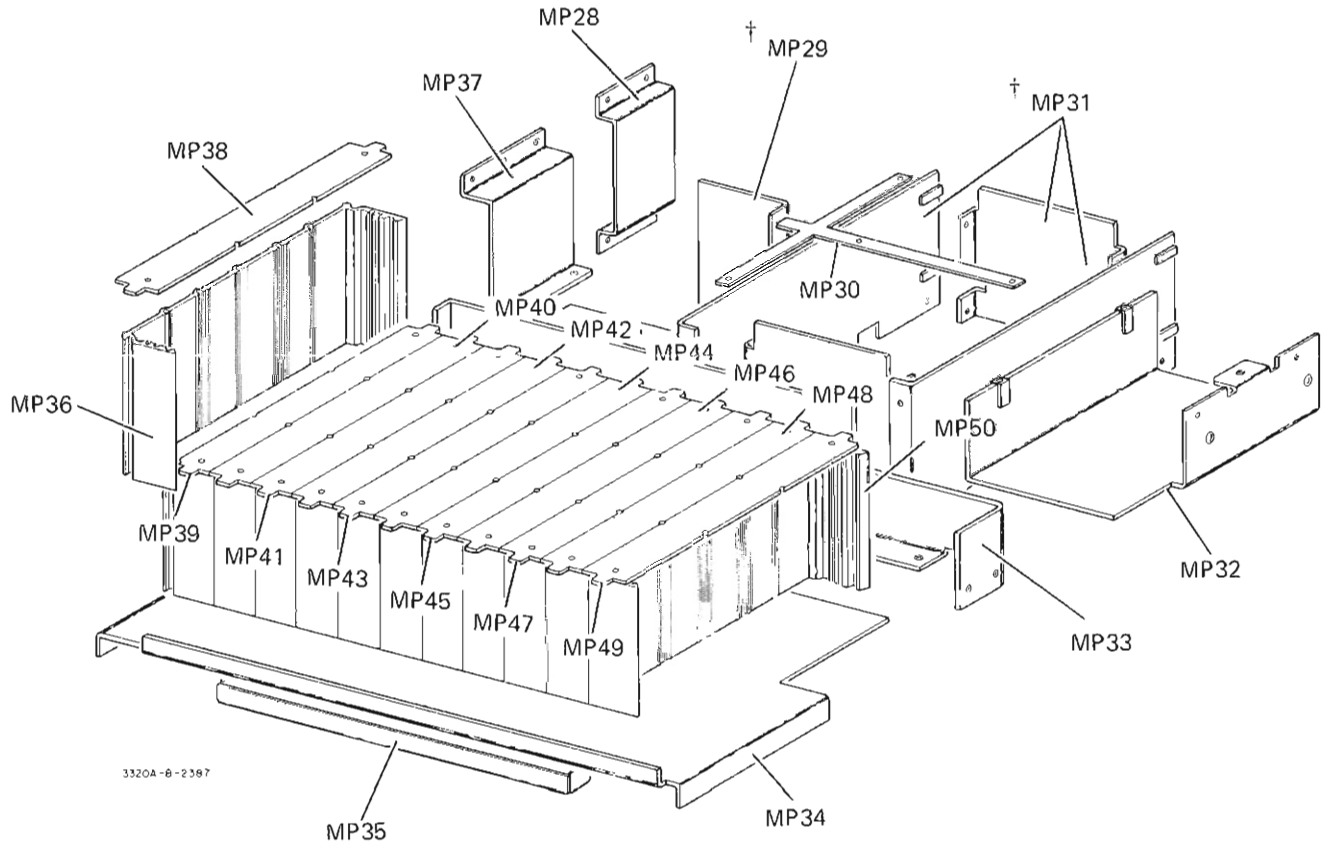
| Reference Designation | HP Part Number | Qty | Description | Mfr Code | Mfr Part Number |
|---------------------------|----------------|-----|---|----------|-----------------|
| MP53 | 03320-29101 | 1 | SPRING | | |
| MP54 | 5040-5885 | 1 | DISK FEADOUT | | |
| MP55 | 5040-5886 | 1 | DISK FEADOUT* | | |
| MP56 | 03320-24704 | 6 | SPACER | | |
| MP57 | | | NOT ASSIGNED | | |
| MP58 | 5040-5884 | 2 | DISK: FEADOUT | | |
| MP59, MP60 | 5040-5887 | 3 | DISK FEADOUT* | | |
| MP61 | 5040-5883 | 1 | DISK. FEADOUT | | |
| MP62 | 03320-61401 | 1 | ASSY: VERNIER DRIVE (SEE FIGURE 6-3) | | |
| 1 | 03320-23501 | 1 | SUPPORT GEAR | | |
| 2 | 3100-2725 | 1 | SWITCH ROTARY | | |
| 3 | 03320-23702 | 1 | SHAFT DRIVE GEAR | | |
| 4 | 1430-0757 | 1 | GEAR DRIVE | | |
| 5 | 5060-5991 | 1 | GEAR POT | | |
| 6 | 2950-0001 | 1 | NUT. HEX 3/8 BRS | | |
| 7 | 2190-0016 | 1 | WASHER: LOCK INT | | |
| 8 | 03320-22401 | 2 | GEAR BEVEL | | |
| 9 | 2100-2217 | 1 | R. VAR WW LIN 10 K OHM 5/ 3W | | |
| 10 | 1140-0053 | 1 | COUNTER | | |
| 11 | 1530-1638 | 1 | POINTER | | |
| 12 | 1430-0741 | 1 | GEAR CENTER SPUR | | |
| 13 | 03320-24706 | 1 | SPACER: GEAR | | |
| 14 | 2190-0378 | 2 | WASHER: S.S | | |
| 15 | 03320-23701 | 1 | SHAFT BEVEL GEAR | | |
| 16 | 2190-0879 | 2 | WASHER: NYLON | | |
| 17 | 5040-5878 | 1 | CAM | 28480 | 5040-5878 |
| 18 | 03320-26202 | 1 | COLLAR | 28480 | 03320-26202 |
| 19 | 5040-5946 | 1 | CAM | 28480 | 5040-5946 |
| 20 | 03320-26201 | 1 | COLLAR | 28480 | 03320-26201 |
| REBUILT ASSEMBLIES | | | | | |
| A1 | 03320-69501 | | | | |
| A2 | 03320-69502 | | | | |
| A3 | 03320-69503 | | | | |
| A4 | 03320-69504 | | | | |
| A5 | 03320-69505 | | | | |
| A7 | 03320-69507 | | | | |
| A8 | 03320-69508 | | | | |
| A9B | 03320-69509 | | | | |
| A10 | 03320-69510 | | | | |
| A11 | 03320-69511 | | | | |
| A12B | 03320-69512 | | | | |
| A14 | 03320-69514 | | | | |
| A15 | 03320-69515 | | | | |
| A17B | 03320-69517 | | | | |
| A12A | 03320-69518 | | | | |
| A21 | 03320-69521 | | | | |
| A23 | 03320-69523 | | | | |
| A24 | 03320-69524 | | | | |
| A25 | 03320-69525 | | | | |
| A26 | 03320-69526 | | | | |
| A27 | 03320-69527 | | | | |
| ASA | 03320-69533 | | | | |
| A17A | 03320-69535 | | | | |



3320A-0-2386A

Figure 6-1. External Mechanical Parts.

Figure 6-2. Internal Mechanical Parts.



† See Appendix C, Manual Backdating.

Rev. A - For Instrument Serial Numbers: 3320A - 1121A - 00111 and above.
3320B - 1122A - 00121 and above.

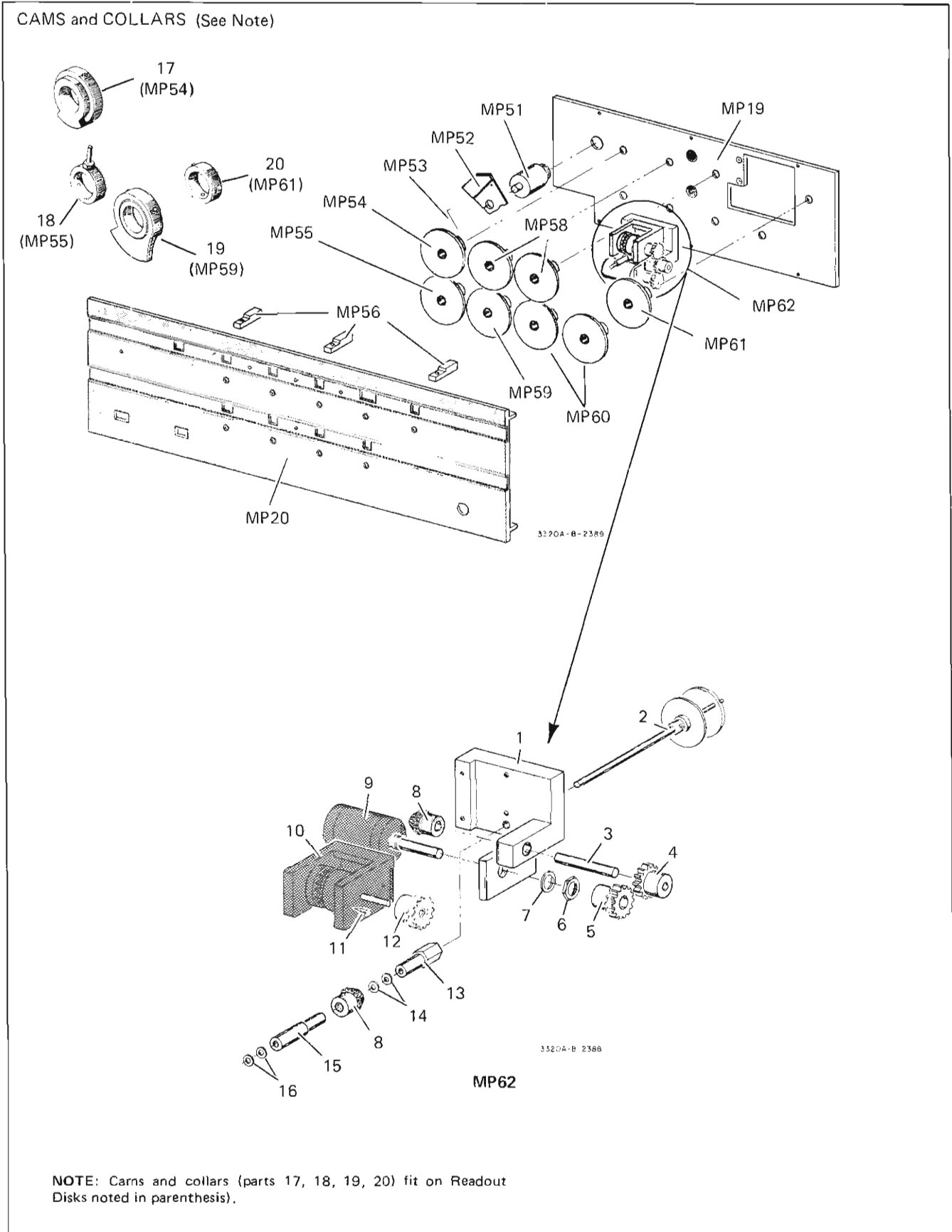


Figure 6-3. Front Panel and Vernier Control Mechanical Parts.

SECTION VII CIRCUIT DIAGRAMS

7-1. INTRODUCTION.

7-2. This section of the manual contains troubleshooting information and circuit diagrams for the 3320A/B Automatic Synthesizer. Included are troubleshooting trees, functional block diagrams, schematic diagrams and component location diagrams.

7-3. TROUBLESHOOTING.

7-4. The following troubleshooting information is designed to eliminate needless unrelated checks in locating instrument malfunctions. It should first be determined that a malfunction does exist and that it does not exist external to the 3320A/B. Before troubleshooting the 3320A/B, become familiar with the principles of operation (Section III) and the functional composition (Section IV) of the instrument.

7-5. To isolate the malfunction to an assembly, use the Block Diagrams (Figures 7-5, 7-6, 7-7) and/or the troubleshooting trees (Figures 7-1 through 7-4). To further isolate the malfunction to a component, use the schematic diagrams (Figures 7-9 through 7-32).

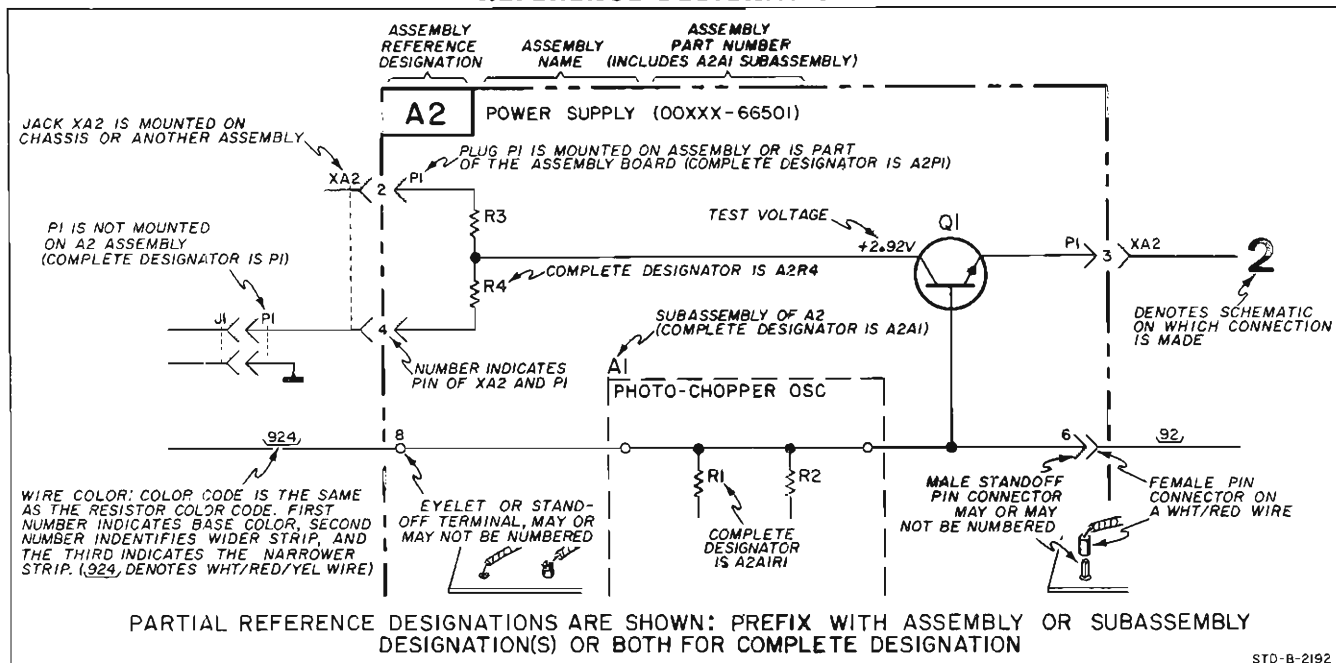
NOTE

Use the troubleshooting trees in the sequence in which they appear in the manual with one exception. The first troubleshooting tree, (Figure 7-1, System Component Isolation and GPIB Troubleshooting Tree) should be used for Option 007 (GPIB) 3320B instruments only. For standard instruments start the troubleshooting with Figure 7-2, Reference Frequency Troubleshooting Tree.

7-6. SCHEMATIC DIAGRAMS.

7-7. The schematic diagrams (Figure 7-9 through Figure 7-32) contained in this section show the detailed circuits of the 3320A/B. Components marked with an asterisk are those that are critical in value. The value of these components may vary from one instrument to another. The optimum value is selected at the factory. All options available with the 3320A/B are shown.

REFERENCE DESIGNATIONS



STD-B-2192

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.

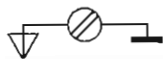
RESISTANCE IN OHMS
CAPACITANCE IN MICROFARADS
INDUCTANCE IN MICROHENRYS

3.  DENOTES FLOATABLE CIRCUIT GROUND.

4.  DENOTES ASSEMBLY CIRCUIT GROUND.

5.  DENOTES CHASSIS CIRCUIT GROUND.

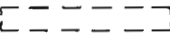
6.  DENOTES POWER LINE GROUND.

7.  DENOTES SCREWDRIVER GROUND.


8.  DENOTES ASSEMBLY.


9. **2** DENOTES SIGNAL DESTINATION.

10.  DENOTES FRONT PANEL MARKING.

11.  DENOTES SIDE AND REAR PANEL MARKING.

12.  DENOTES SCREWDRIVER ADJUST.

13.  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.  = WHITE, RED, YELLOW.)

14. * AVERAGE VALUE SHOWN, OPTIMUM VALUE SELECTED AT FACTORY.

15. SCHEMATIC DIAGRAMS INCLUDE ALL OPTIONS.

PROGRAM CARD
CARD NO. 1 OF 6
TITLE Diagnostic Card 1

| NO. | STEP | CODE | 200 | 100 | 40 | 20 | 10 | 4 | 2 | 1 |
|-----|------|------|-----|-----|----|----|----|---|---|---|
| 1 | | | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | * | 267 | | | | | | | | |
| 5 | A | 101 | | | | | | | | |
| 6 | + | 053 | | | | | | | | |
| 7 | 2 | 082 | | | | | | | | |
| 8 | 6 | 066 | | | | | | | | |
| 9 | 9 | 071 | | | | | | | | |
| 10 | 9 | 071 | | | | | | | | |
| 11 | | 054 | | | | | | | | |
| 12 | R | 122 | | | | | | | | |
| 13 | 3 | 063 | | | | | | | | |
| 14 | | 054 | | | | | | | | |
| 15 | F | 106 | | | | | | | | |
| 16 | 1 | 061 | | | | | | | | |
| 17 | 0 | 060 | | | | | | | | |
| 18 | 9 | 071 | | | | | | | | |
| 19 | 9 | 071 | | | | | | | | |
| 20 | | 054 | | | | | | | | |
| 21 | M | 115 | | | | | | | | |
| 22 | | 054 | | | | | | | | |
| 23 | D | 104 | | | | | | | | |
| 24 | 3 | 063 | | | | | | | | |
| 25 | | 054 | | | | | | | | |
| 26 | C | 103 | | | | | | | | |
| 27 | | | | | | | | | | |
| 28 | | | | | | | | | | |
| 29 | | | | | | | | | | |
| 30 | | | | | | | | | | |
| 31 | | | | | | | | | | |
| 32 | | | | | | | | | | |

1. USE SOFT PENCIL
2. DO NOT MARK IN SHADED AREA (TOP)
3. ERASE COMPLETELY
4. INSERT THIS SIDE UP

HP 91238-0001 HP PART NO. 91238-0004 312200-0001

PROGRAM CARD
CARD NO. 2 OF 6
TITLE Diagnostic Card 2

| NO. | STEP | CODE | 200 | 100 | 40 | 20 | 10 | 4 | 2 | 1 |
|-----|------|------|-----|-----|----|----|----|---|---|---|
| 1 | | | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | * | 267 | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | A | 101 | | | | | | | | |
| 7 | + | 055 | | | | | | | | |
| 8 | 5 | 065 | | | | | | | | |
| 9 | 9 | 071 | | | | | | | | |
| 10 | 6 | 066 | | | | | | | | |
| 11 | 6 | 066 | | | | | | | | |
| 12 | | 054 | | | | | | | | |
| 13 | R | 122 | | | | | | | | |
| 14 | 4 | 064 | | | | | | | | |
| 15 | | 054 | | | | | | | | |
| 16 | F | 106 | | | | | | | | |
| 17 | 7 | 067 | | | | | | | | |
| 18 | 6 | 066 | | | | | | | | |
| 19 | 6 | 066 | | | | | | | | |
| 20 | | 054 | | | | | | | | |
| 21 | K | 113 | | | | | | | | |
| 22 | V | 126 | | | | | | | | |
| 23 | 8 | 070 | | | | | | | | |
| 24 | | 054 | | | | | | | | |
| 25 | D | 104 | | | | | | | | |
| 26 | 4 | 064 | | | | | | | | |
| 27 | | 054 | | | | | | | | |
| 28 | C | 103 | | | | | | | | |
| 29 | | | | | | | | | | |
| 30 | | | | | | | | | | |
| 31 | | | | | | | | | | |
| 32 | | | | | | | | | | |

1. USE SOFT PENCIL
2. DO NOT MARK IN SHADED AREA (TOP)
3. ERASE COMPLETELY
4. INSERT THIS SIDE UP

HP 91238-0001 HP PART NO. 91238-0004 312200-0001

PROGRAM CARD
CARD NO. 3 OF 6
TITLE Diagnostic Card 3

| NO. | STEP | CODE | 200 | 100 | 40 | 20 | 10 | 4 | 2 | 1 |
|-----|------|------|-----|-----|----|----|----|---|---|---|
| 1 | | | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | * | 267 | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |
| 10 | | | | | | | | | | |
| 11 | | | | | | | | | | |
| 12 | | | | | | | | | | |
| 13 | | | | | | | | | | |
| 14 | K | 113 | | | | | | | | |
| 15 | | | | | | | | | | |
| 16 | | | | | | | | | | |
| 17 | | | | | | | | | | |
| 18 | | | | | | | | | | |
| 19 | | | | | | | | | | |
| 20 | | | | | | | | | | |
| 21 | | | | | | | | | | |
| 22 | | | | | | | | | | |
| 23 | | | | | | | | | | |
| 24 | V | 126 | | | | | | | | |
| 25 | 7 | 067 | | | | | | | | |
| 26 | | | | | | | | | | |
| 27 | | 054 | | | | | | | | |
| 28 | | | | | | | | | | |
| 29 | | | | | | | | | | |
| 30 | | 065 | | | | | | | | |
| 31 | | | | | | | | | | |
| 32 | | | | | | | | | | |

1. USE SOFT PENCIL
2. DO NOT MARK IN SHADED AREA (TOP)
3. ERASE COMPLETELY
4. INSERT THIS SIDE UP

HP 91238-0001 HP PART NO. 91238-0004 312200-0001

PROGRAM CARD
CARD NO. 4 OF 6
TITLE Diagnostic Card 4

| NO. | STEP | CODE | 200 | 100 | 40 | 20 | 10 | 4 | 2 | 1 |
|-----|------|------|-----|-----|----|----|----|---|---|---|
| 1 | | | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |
| 10 | | | | | | | | | | |
| 11 | | | | | | | | | | |
| 12 | | | | | | | | | | |
| 13 | | | | | | | | | | |
| 14 | | | | | | | | | | |
| 15 | | | | | | | | | | |
| 16 | | | | | | | | | | |
| 17 | | | | | | | | | | |
| 18 | | | | | | | | | | |
| 19 | | | | | | | | | | |
| 20 | | | | | | | | | | |
| 21 | | | | | | | | | | |
| 22 | | | | | | | | | | |
| 23 | | | | | | | | | | |
| 24 | | | | | | | | | | |
| 25 | | | | | | | | | | |
| 26 | | | | | | | | | | |
| 27 | | | | | | | | | | |
| 28 | | | | | | | | | | |
| 29 | | | | | | | | | | |
| 30 | | | | | | | | | | |
| 31 | | | | | | | | | | |
| 32 | | | | | | | | | | |

1. USE SOFT PENCIL
2. DO NOT MARK IN SHADED AREA (TOP)
3. ERASE COMPLETELY
4. INSERT THIS SIDE UP

HP 91238-0001 HP PART NO. 91238-0004 312200-0001

PROGRAM CARD
CARD NO. 5 OF 6
TITLE Diagnostic Card 5

| NO. | STEP | CODE | 200 | 100 | 40 | 20 | 10 | 4 | 2 | 1 |
|-----|------|------|-----|-----|----|----|----|---|---|---|
| 1 | | | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | * | 267 | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | A | 101 | | | | | | | | |
| 9 | + | 063 | | | | | | | | |
| 10 | 2 | 062 | | | | | | | | |
| 11 | 6 | 066 | | | | | | | | |
| 12 | 6 | 066 | | | | | | | | |
| 13 | 6 | 066 | | | | | | | | |
| 14 | | 054 | | | | | | | | |
| 15 | F | 106 | | | | | | | | |
| 16 | 8 | 070 | | | | | | | | |
| 17 | 0 | 060 | | | | | | | | |
| 18 | 0 | 060 | | | | | | | | |
| 19 | | 054 | | | | | | | | |
| 20 | R | 122 | | | | | | | | |
| 21 | 3 | 063 | | | | | | | | |
| 22 | | 054 | | | | | | | | |
| 23 | K | 113 | | | | | | | | |
| 24 | V | 126 | | | | | | | | |
| 25 | 7 | 067 | | | | | | | | |
| 26 | | 054 | | | | | | | | |
| 27 | D | 104 | | | | | | | | |
| 28 | 4 | 064 | | | | | | | | |
| 29 | | 054 | | | | | | | | |
| 30 | C | 103 | | | | | | | | |
| 31 | | | | | | | | | | |
| 32 | | | | | | | | | | |

1. USE SOFT PENCIL
2. DO NOT MARK IN SHADED AREA (TOP)
3. ERASE COMPLETELY
4. INSERT THIS SIDE UP

HP 91238-0001 HP PART NO. 91238-0004 312200-0001

PROGRAM CARD
CARD NO. 6 OF 6
TITLE Diagnostic Card 6

| NO. | STEP | CODE | 200 | 100 | 40 | 20 | 10 | 4 | 2 | 1 |
|-----|------|------|-----|-----|----|----|----|---|---|---|
| 1 | | | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |
| 10 | | | | | | | | | | |
| 11 | | | | | | | | | | |
| 12 | | | | | | | | | | |
| 13 | | | | | | | | | | |
| 14 | | | | | | | | | | |
| 15 | | | | | | | | | | |
| 16 | | | | | | | | | | |
| 17 | | | | | | | | | | |
| 18 | | | | | | | | | | |
| 19 | | | | | | | | | | |
| 20 | | | | | | | | | | |
| 21 | | | | | | | | | | |
| 22 | | | | | | | | | | |
| 23 | | | | | | | | | | |
| 24 | | | | | | | | | | |
| 25 | | | | | | | | | | |
| 26 | | | | | | | | | | |
| 27 | | | | | | | | | | |
| 28 | | | | | | | | | | |
| 29 | | | | | | | | | | |
| 30 | | | | | | | | | | |
| 31 | | | | | | | | | | |
| 32 | | | | | | | | | | |

1. USE SOFT PENCIL
2. DO NOT MARK IN SHADED AREA (TOP)
3. ERASE COMPLETELY
4. INSERT THIS SIDE UP

HP 91238-0001 HP PART NO. 91238-0004 312200-0001

* This card is marked for addressing an instrument of address 67. If the address of your instrument is different, you should change the address on the cards to match your instrument's internal address.

TABLE 1: PIN STATES ON XA25A AND XA25B AFTER INSERTING DIAGNOSTIC CARD NO. 1.

| PIN NUMBERS ON XA25A | A | B | C | D | E | F | H | J | K | L | M | N | P | R | S | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|----------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|
| STATE | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 |

| PIN NUMBERS ON XA25B | P | R | S | 13 | 14 | 15 |
|----------------------|---|---|---|----|----|----|
| STATE | 1 | 1 | 0 | 1 | 0 | 1 |

1 HIGH VOLTAGE - LIGHT ON
0 LOW VOLTAGE - LIGHT OFF

TABLE 2: PIN STATES ON XA25A AND XA25B AFTER INSERTING DIAGNOSTIC CARD NO. 2

| PIN NUMBERS ON XA25A | A | B | C | D | E | F | H | J | K | L | M | N | P | R | S | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|----------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|
| STATE | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |

| PIN NUMBERS ON XA25B | M | N | P | R | S | 11 | 12 | 13 | 14 | 15 |
|----------------------|---|---|---|---|---|----|----|----|----|----|
| STATE | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 |

1 HIGH VOLTAGE - LIGHT ON
0 LOW VOLTAGE - LIGHT OFF

LOGIC DEFINITIONS (For Tables 3 thru 5)

- 1 = Light ON (high voltage)
- 0 = Light OFF (low voltage)
- b = Burst of pulses (light blinking rapidly)

EXAMPLE

Code 1 0 1

- 1) 1 Means that before card is inserted logic probe light is ON.
- 2) 0 Means that sometime during the time the Card Reader is running the light goes OFF
- 3) -1 The light comes back ON This may occur before or after the Card Reader stops running.

LOGIC TROUBLESHOOTING PROCEDURE

- A) Connect logic probe to connector pin designated in Logic Troubleshooting Table (Tables 3 thru 5) being used
- B) Using the Logic Definitions listed above note the initial logic state indicated by the logic probe. This state should correspond with the first digit of the 3-digit code to be checked.
- C) While observing the logic probe indication, insert the appropriate test card in the Card Reader.
- D) While the Card Reader is running, the logic probe indication should correspond with the second digit of the code being checked.
- E) When the Card Reader has stopped running, the logic probe indication should correspond with the third digit of the code being checked.
- F) If the logic probe indication is incorrect for any or all digits of a given code replace the board indicated in the Logic Troubleshooting Table

TABLE 5: PIN STATES ON X38 AFTER INSERTING DIAGNOSTIC CARD NO. 1.

| PIN NUMBERS | 3 | 4 | 5 | C | E | S | SHOULD THIS TEST FAIL REPLACE A36 |
|-------------|-------|-------|-------|-------|-------|-------|-----------------------------------|
| STATE | 1-0-1 | 0-1-0 | 1-0-1 | 1-0-1 | 1-0-1 | 1-0-1 | |

TABLE 6. ALL PINS ARE ON XA37.

Connect logic probe to XA37 pin 9. Insert Diagnostic Card No. 6 and note the number of times the probe light blinks after the card is inserted. Repeat this sequence with the logic probe connected to each of the other pins listed in the table. In each case, the light should be ON initially and blink three times after the card is inserted. The only exceptions are pin 10 which should blink rapidly during the test and pin 11 which is always low when the card reader power switch is ON.

| PINS TO BE CHECKED AS INDICATED ABOVE | | | | | | | | | | |
|---------------------------------------|---|---|---|---|---|---|----|----|---|--|
| 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | R | |
| | | | | | | | | | | |

TABLE 3: PIN STATES ON XA37 BEFORE, DURING AND AFTER INSERTING DIAGNOSTIC CARD NO. 4.

| PIN NUMBERS | C | D | E | F | H | J | K | SHOULD THIS TEST FAIL REPLACE A37 |
|-------------|-------|-------|-------|-------|-------|-------|-------|-----------------------------------|
| STATE | 0-b-0 | 0-b-0 | 0-b-0 | 0-b-0 | 0-b-0 | 0-b-0 | 0-b-0 | |

TABLE 4: PIN STATES ON X38 BEFORE, DURING AND AFTER INSERTING DIAGNOSTIC CARD NO. 3

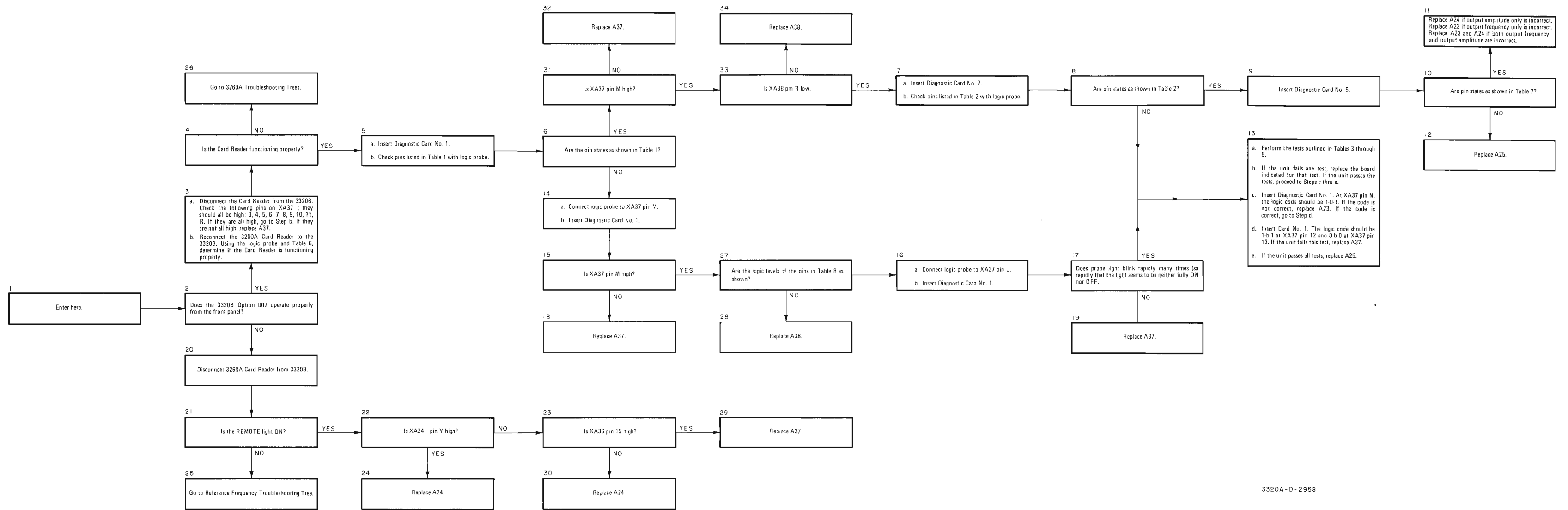
| PIN NUMBERS | 2 | 6 | 7 | B | D | F | SHOULD THIS TEST FAIL REPLACE A38 |
|-------------|-------|-------|-------|-------|-------|-------|-----------------------------------|
| STATE | 0-1-0 | 0-1-0 | 0-1-0 | 1-0-1 | 0-1-0 | 0-b-0 | |

TABLE 7. PIN STATES ON XA25 AFTER INSERTING DIAGNOSTIC CARD NO. 5.

| PIN NUMBERS ON XA25A | R | S | 13 | 14 | PIN NUMBERS ON XA25B | 11 | 12 | M | N |
|----------------------|---|---|----|----|----------------------|----|----|---|---|
| STATES | 1 | 0 | 1 | 1 | STATES | 0 | 0 | 0 | 1 |

TABLE 8: PIN STATES ON XA38 AFTER INSERTING DIAGNOSTIC CARD NO. 1.

| PIN NUMBERS ON XA38 | 8 | H | R |
|---------------------|---|---|---|
| STATES | 1 | 1 | 0 |



3320A - D - 2958

Figure 7-1. System Component Isolation And GPIB Troubleshooting Tree.

TABLE 1 RANGE SWITCH LOGIC.
(AVAILABLE ON MOTHER BOARD)

| FREQUENCY SETTING | R2 | R3 | R4 | R5 | R6 |
|---|----------|------------|------------|------------|------------|
| 1222 Hz on 1000 Hz Range | 0 0 V | 1 3.5 V | 1 3.5 V | 1 3.5 V | 1 3.5 V |
| 111 kHz on 10 kHz Range | 1 | 0 | 1 | 1 | 1 |
| 111 kHz or 122.2 kHz on 100 kHz Range | 1 | 1 | 0 | 1 | 1 |
| 111.00 kHz on 1000 kHz Range | 1 | 1 | 1 | 0 | 1 |

TABLE 2. PRETUNE D/A AND COUNTER INPUTS
(AVAILABLE ON MOTHER BOARD)

| Front Panel Frequency Setting | USED ON A2 AND A3 | | | | | | | | | | USED ONLY ON A2 | | | |
|-------------------------------------|-------------------|------------|----------|----------|-----|----|----|----|----|---|-----------------|---|---|--|
| | 1000 | 800 | 400 | 200 | 100 | 80 | 40 | 20 | 10 | 8 | 4 | 2 | 1 | |
| 0111 Any Range | 1 3.5 V | 1 3.5 V | 0 0 V | 0 0 V | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | |
| 1222 Any Range | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | |

TABLE 3: FREQUENCY SWITCH LOGIC
(ALL PIN NUMBERS ARE LOCATED ON W2)

| FREQUENCY SETTING | PINS ON W2 | | | | | | | | | | | | | | | |
|-------------------|------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | 12 | 14 | 16 | 18 | 20 | 3 | 5 | 7 | 9 | 11 | 13 | 15 | 17 | 21 | 19 | 23 |
| 77.7 kHz | open | gnd | open | gnd | gnd | open | gnd | gnd | gnd | gnd | gnd | gnd | open | open | open | gnd |
| 888 kHz | open | open | gnd | open | open | gnd | open | open | open | open | open | open | gnd | gnd | gnd | open |
| 12.00 MHz | gnd | | | | | | | | | | | | | | | |

TABLE 4

INSTRUCTIONS:

- A. If you are Troubleshooting the 3320B Option 007, you do not have A21 in the unit.
- B. If you arrived at this point via path ①, replace A23 with a new board.
- C. If you arrived at this point via path ②, check the pin numbers in Table after setting the appropriate frequencies.

| Frequency | Pins on XA23A | | |
|------------|---------------|---|---|
| | L | 8 | 9 |
| 10.00 kHz | 1 | 1 | 0 |
| 100.00 kHz | 0 | 0 | 1 |

If the unit passes these tests, replace A22.

If the unit fails these tests, replace A23.

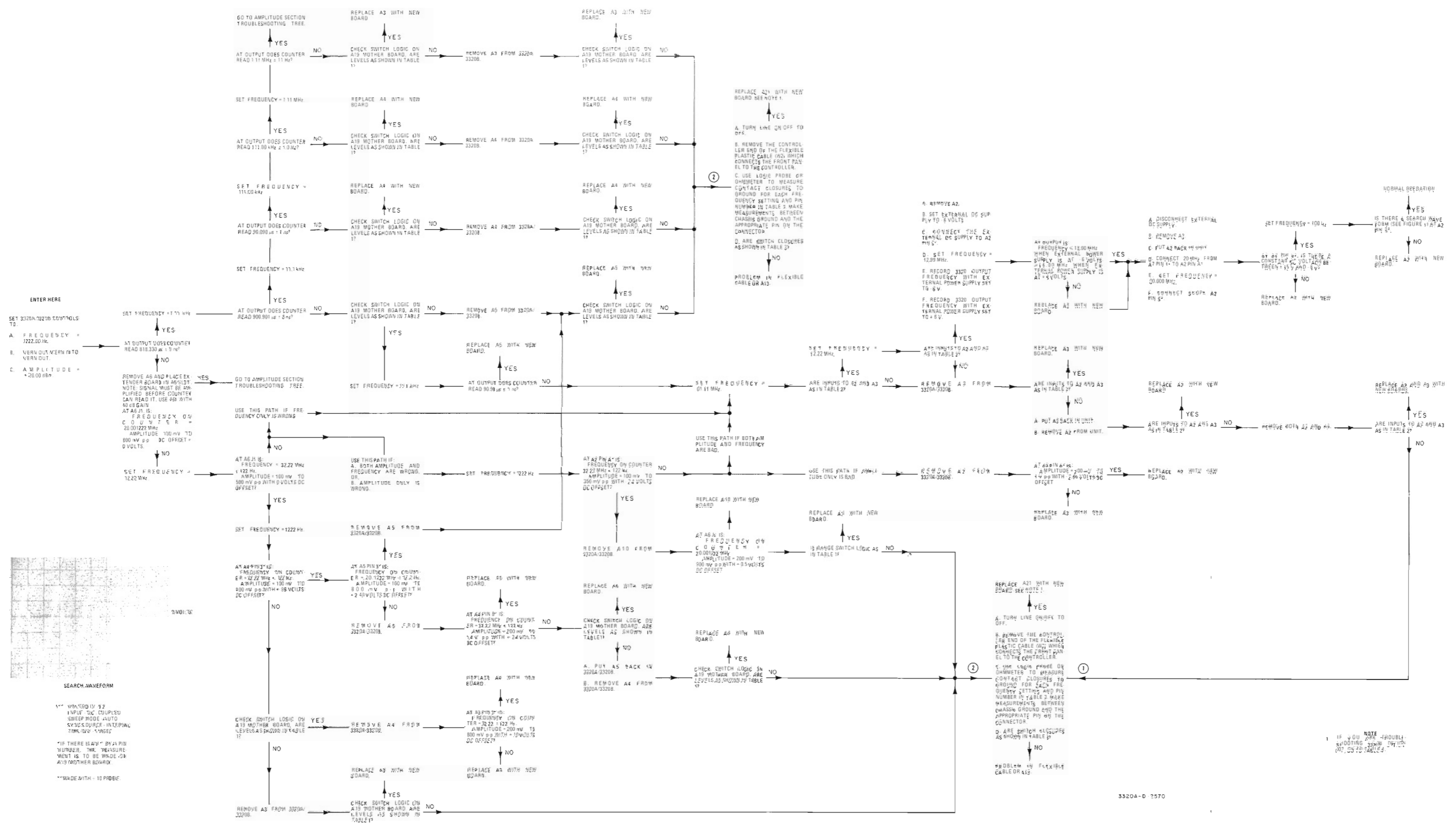


Figure 7-3. Frequency Generating Section Troubleshooting Tree.

TABLE 1 LOGIC WEIGHTS FOR A11 ON MOTHER BOARD

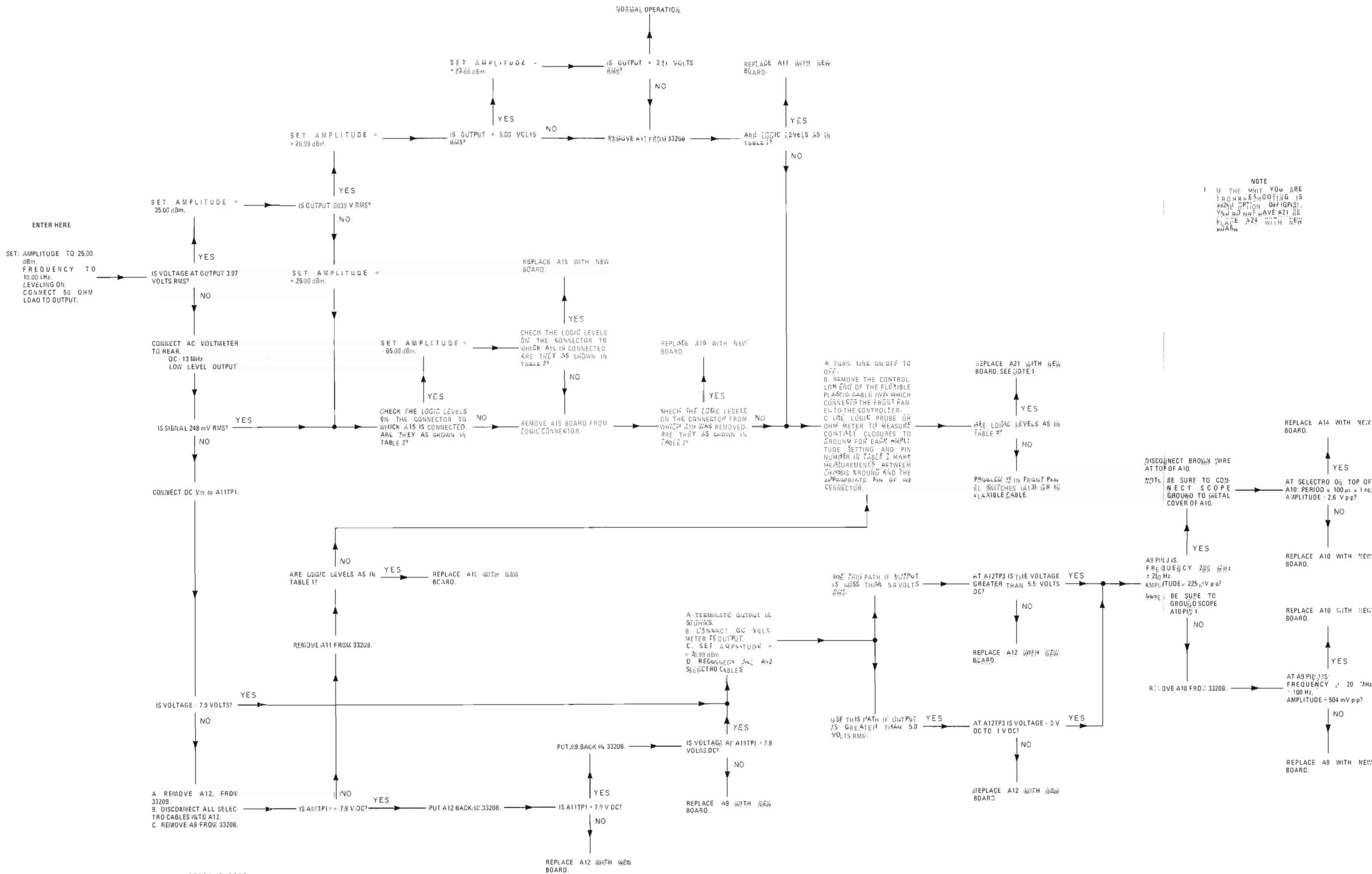
| AMPLITUDE SETTING | LOGIC WEIGHTS | | | | | | | | | | | |
|-------------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| | 800 | 400 | 200 | 100 | 80 | 40 | 20 | 10 | 8 | 4 | 2 | 1 |
| + 25.00 dBm | 5 V 1 | 25 V 0 | 25 V 0 | 25 V 0 | 25 V 0 | 25 V 0 | 25 V 0 | 25 V 0 | 25 V 0 | 25 V 0 | 25 V 0 | 25 V 0 |
| + 26.99 dBm | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| + 23.66 dBm | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 |

TABLE 2. LOGIC FOR A15 LOGIC CONNECTOR

| AMPLITUDE SETTING | LOGIC WEIGHTS | | | |
|-------------------|---------------------|---------------------|---------------------|---------------------|
| | 4 | 2 | 2 | 1 |
| + 25.00 dBm | - 3 V to - 5 V 1 | - 3 V to - 5 V 1 | - 3 V to - 5 V 1 | - 3 V to + 5 V 1 |
| 65.00 dBm | 0 V to + .6 V 0 | 0 V to + .6 V 0 | 0 V to + .6 V 0 | 0 V to + 0.6 V 0 |

TABLE 3. AMPLITUDE SWITCH LOGIC.
(ALL PIN NUMBERS ARE LOCATED ON W2)

| AMPLITUDE SETTING | PINS ON W2 | | | | | | | | | | | | | | | |
|-------------------|------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 |
| + 17.77 dBm | open | open | gnd | open | gnd | gnd | open | gnd | gnd | gnd | open | gnd | gnd | gnd | open | gnd |
| - 68.88 | gnd | gnd | open | gnd | open | open | gnd | open | open | open | gnd | open | open | open | gnd | open |



NOTE
 IF THE UNIT YOU ARE TROUBLESHOOTING IS 3520 OPTION 007 (GPIB), YOU DO NOT HAVE A21 RE-PLACE A24 WITH NEW BOARD

3320A-D-2568

*IF THERE IS AN ASTERISK BY A PIN NUMBER, THE MEASUREMENT IS TO BE MADE ON THE OTHER BOARD (A98)

Figure 7-4. Amplitude Section Troubleshooting Tree.

Table 1. Data Bit Decoder.

| ASCII Character | INPUT* | | | | | | | OUTPUT or Preface Commands |
|--------------------|--------|----|----|-----|----|----|----|---------------------------------------|
| | b7 | b6 | b5 | b4 | b3 | b2 | b1 | |
| 0 | 0 | 1 | 1 | X** | X | X | X | H Numerical No. Enable (IC8 pin 1) |
| 1 | 0 | 1 | 1 | - | - | - | - | |
| 2 | 0 | 1 | 1 | - | - | - | - | |
| 3 | 0 | 1 | 1 | - | - | - | - | |
| 4 | 0 | 1 | 1 | - | - | - | - | |
| 5 | 0 | 1 | 1 | - | - | - | - | |
| 6 | 0 | 1 | 1 | - | - | - | - | |
| 7 | 0 | 1 | 1 | - | - | - | - | |
| 8 | 0 | 1 | 1 | - | - | - | - | |
| 9 | 0 | 1 | 1 | - | - | - | - | |
| . | 0 | 1 | 0 | 1 | 1 | 0 | 0 | H Function Execute (XA 38 pin 6) |
| - | 0 | 1 | 0 | 1 | 1 | 0 | 1 | H - dBm (XA38 pin 7) |
| A | 1 | 0 | 0 | 0 | 0 | 0 | 1 | L Amplitude (XA38 pin C) |
| C | 1 | 0 | 0 | 0 | 0 | 1 | 1 | L Delay Initiate (XA38 pin S) |
| D | 1 | 0 | 0 | 0 | 1 | 0 | 0 | L Delay (XA38 pin 5) |
| F | 1 | 0 | 0 | 0 | 1 | 1 | 0 | L Frequency (XA38 pin 3) |
| I | 1 | 0 | 0 | 1 | 0 | 0 | 1 | H Local Enable (IC11 pin 10) |
| K | 1 | 0 | 0 | 0 | 0 | 1 | 1 | H Vernier In (XA38 pin D) |
| M | 1 | 0 | 0 | 1 | 1 | 0 | 1 | H Vernier Out (XA38 pin 4) |
| R | 1 | 0 | 1 | 0 | 0 | 1 | 0 | L RANGE (XA38 pin E) |
| V | 1 | 0 | 1 | 0 | 1 | 1 | 0 | L Vernier Digit (XA38 pin B) |

* Positive True.
** X = Don't Care.

NOTE

This is a Functional Block Diagram of the GPIB and BCD Controller. The logic symbology shown is functional and may not agree with the conventional Logic shown on schematics. Two or more Logic gates may be combined into one gate on this diagram. The circle(s) on the inputs of the IC's indicates the logic level required not necessarily inversion. The circle "O" indicates a low logic level (0 V) required to perform the gate function.

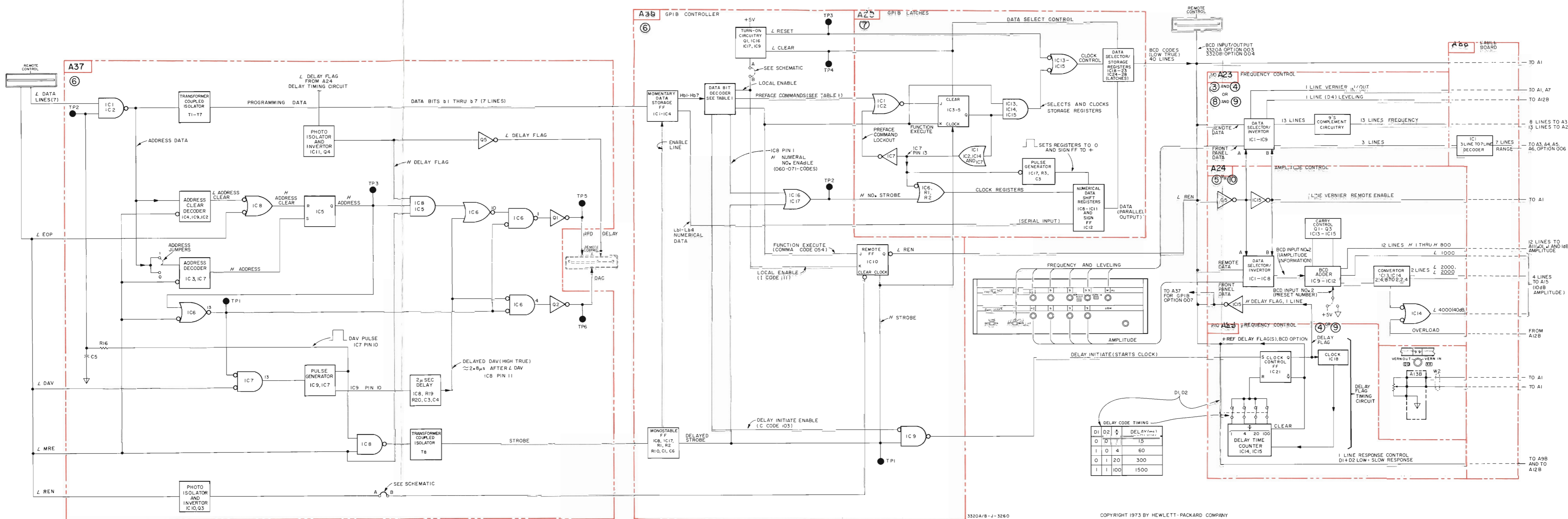
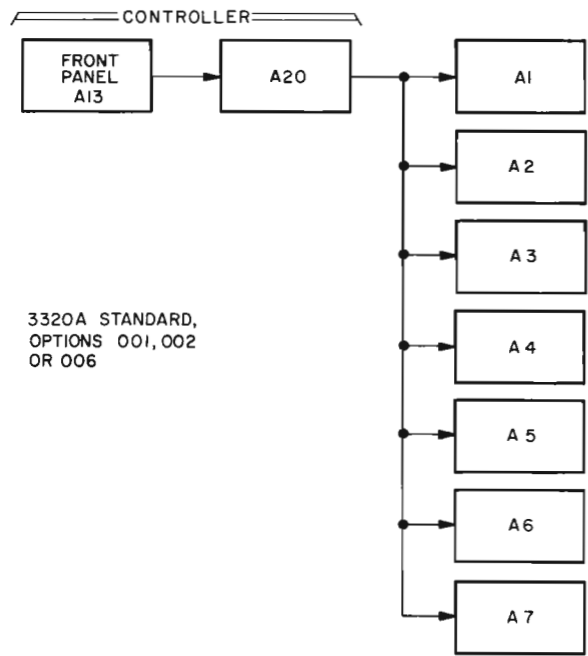
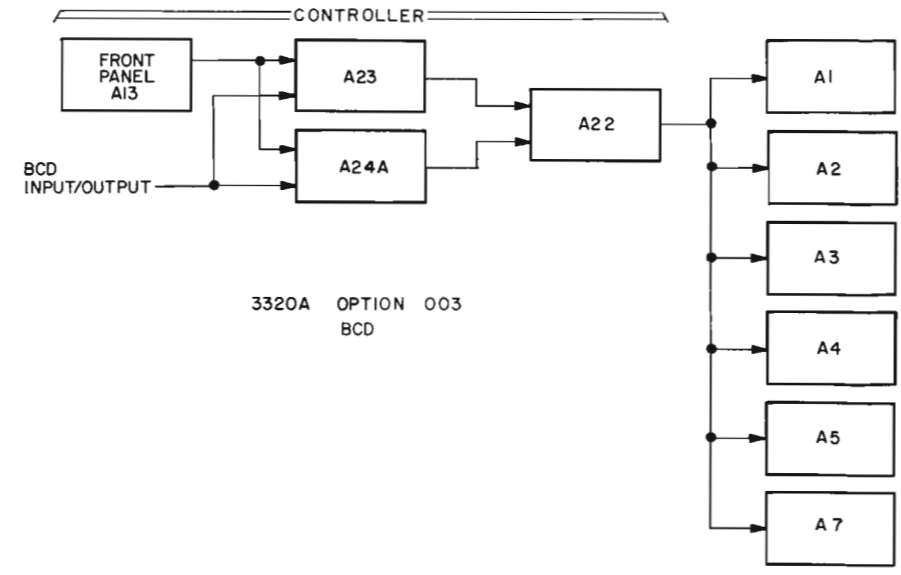


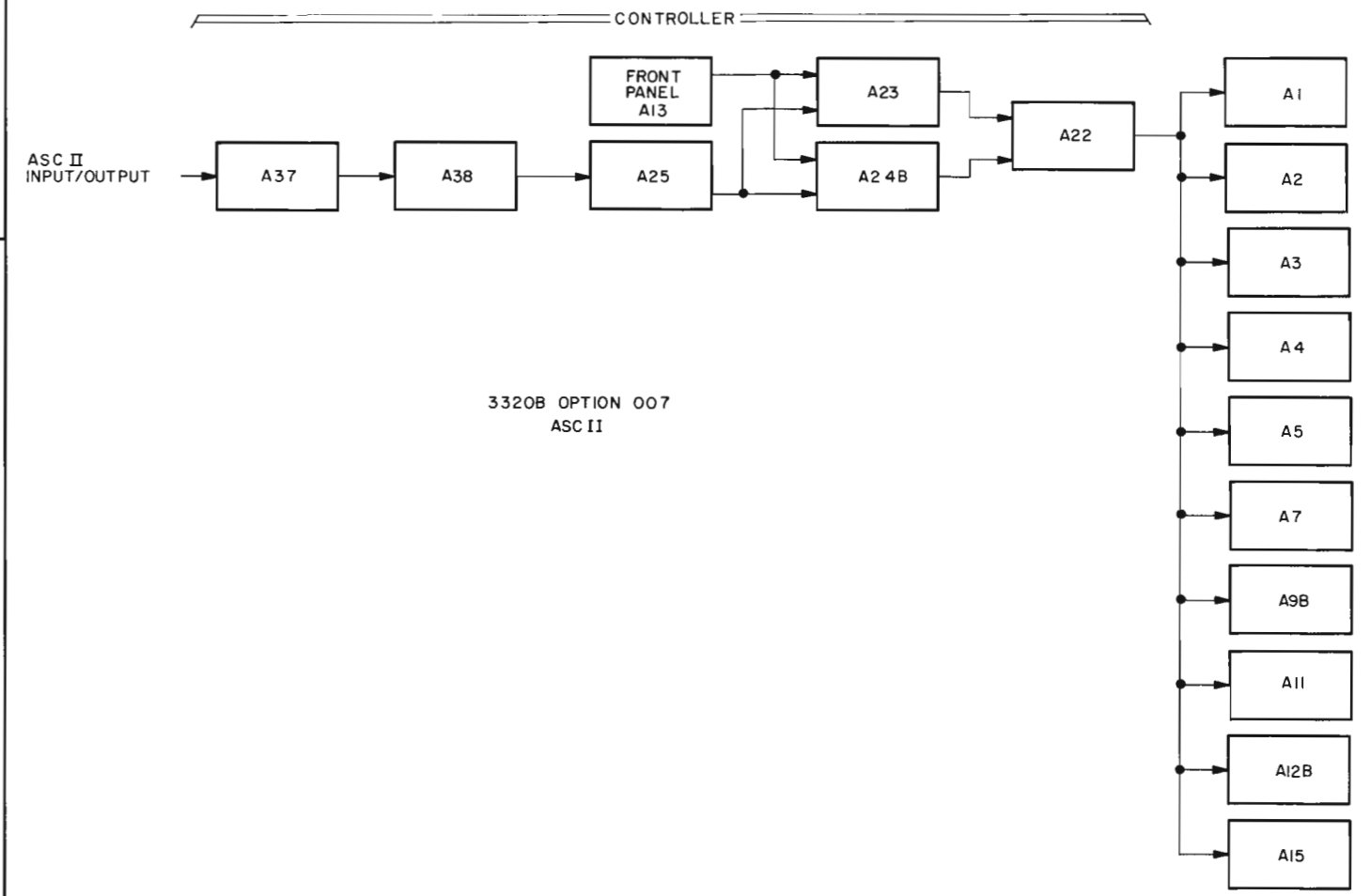
Figure 7-5. Controller Functional Block Diagram.



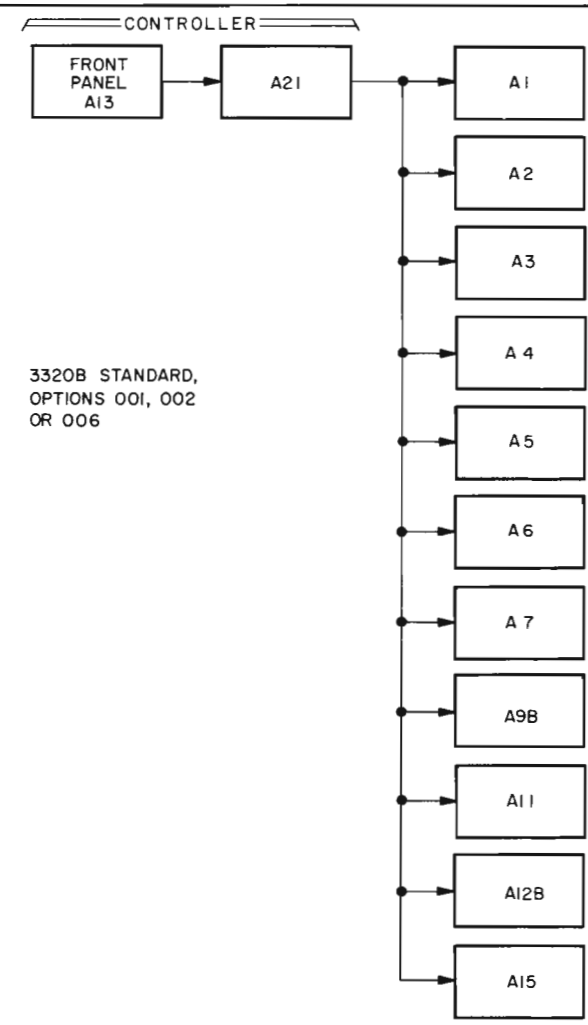
3320A STANDARD,
OPTIONS 001, 002
OR 006



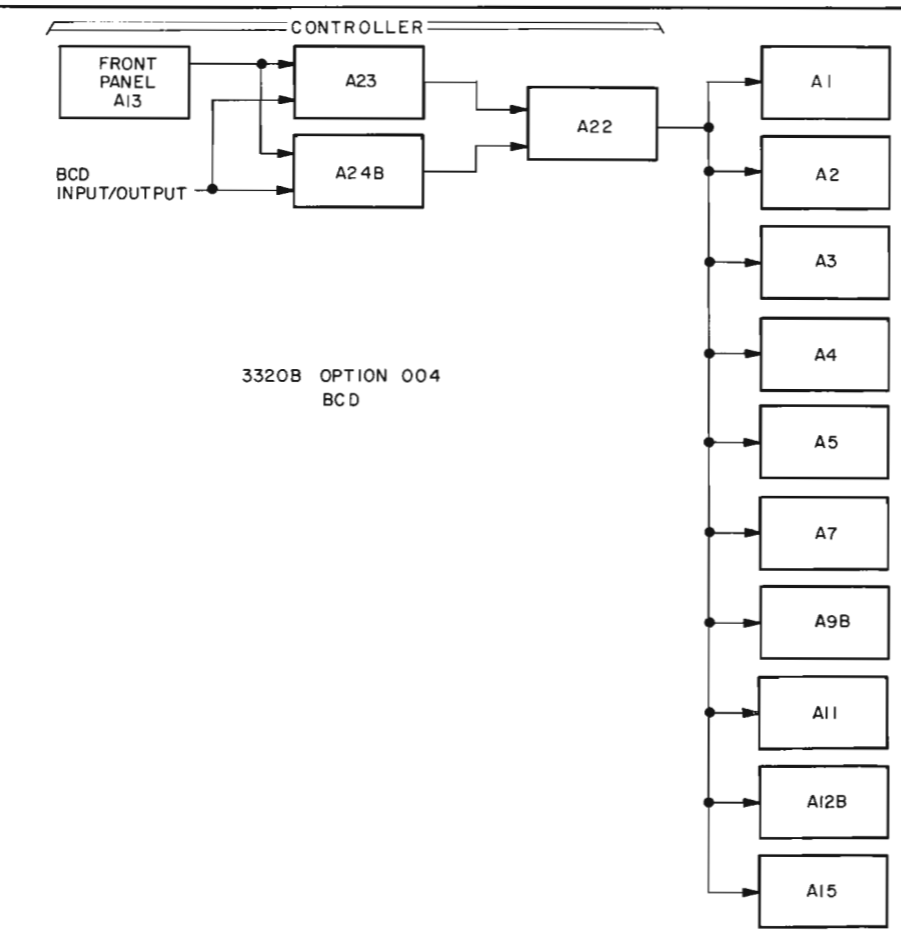
3320A OPTION 003
BCD



3320B OPTION 007
ASC II



3320B STANDARD,
OPTIONS 001, 002
OR 006



3320B OPTION 004
BCD

Figure 7-6. Controller Configurations.

NOTE 1: Circled number indicates schematic number for circuit shown.

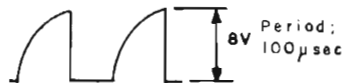
NOTE 2: RESPONSE CONTROL: In local mode of operation, response is always in "slow" mode (switches closed). In remote mode response is in "fast" mode (switches open) unless programmed for "slow" mode. See Section III.



Troubleshooting Points For Functional Block Diagram

A1TP2 10 to 10.004 MHz; VERN at "00" (full ccw) \approx 9999.9 MHz; VERN at "99" \approx 10003.0 MHz.

A2TP1 10 kHz; see waveform:



A3TP3 The VTO frequency varies between 20 MHz and 32.99 MHz depending on frequency setting.

| FREQUENCY RANGE/SETTING | | | | | A3TP3 |
|-------------------------|----------|---------|--------|---------|--------|
| 10 MHz | 1000 kHz | 100 kHz | 10 kHz | 1000 Hz | |
| 0 Hz | 0 Hz | 0 Hz | 0 Hz | 0 Hz | 20 MHz |
| 5 MHz | 500 kHz | 50 kHz | 5 kHz | 500 Hz | 25 MHz |
| 10 MHz | 1000 kHz | 100 kHz | 10 kHz | 1000 Hz | 30 MHz |

NOTE

Use a 10:1 probe and a counter with high sensitivity (-hp- 5245L with 5261A) when measuring frequency at A3TP3.

A7TP1 > 6 V p-p when unlocked, see Reference Oscillator Adjustment procedure, Section V.

A8TP1 20 MHz, 1.7 V p-p.

A8TP5 18 MHz, 2 V p-p.

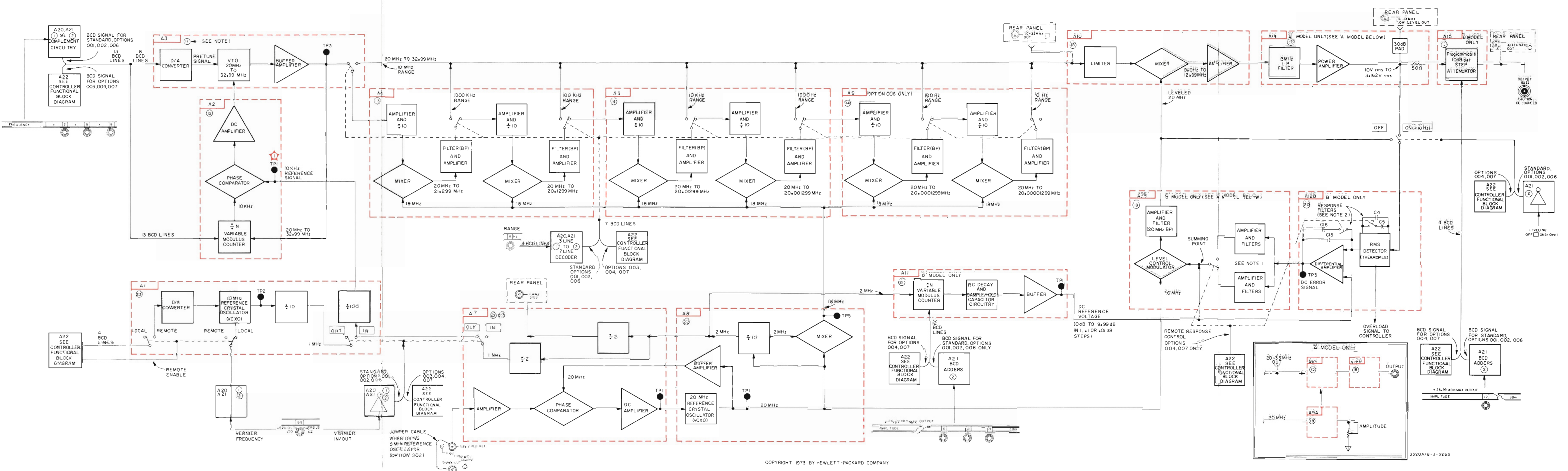
A11TP1 + 10.000 V dc at +16.99 dBm setting. + 3.1659 V dc at +17.00 dBm setting. For 3320B with 50 Ω output only.

A12TP3 On properly adjusted unit, typically +2 V dc but must remain within \pm .2 V with any amplitude change with LEVELING ON.

20-33 MHz Out (Rear Panel) Tracks output frequency, 20 MHz plus front panel frequency setting. > 100 mV rms into 50 Ω .

Low Level Out (Rear Panel) Same frequency as main output, between 50 mV and 158 mV rms into 50 Ω depending on amplitude level setting.

1 MHz Out (Rear Panel) > 220 mV rms into 50 Ω .

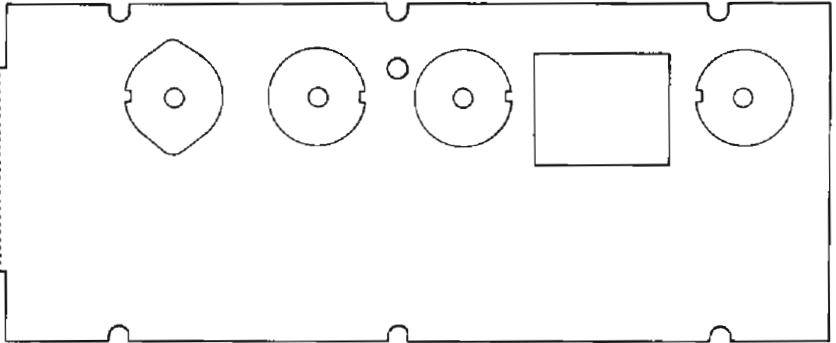


COPYRIGHT 1973 BY HEWLETT-PACKARD COMPANY

Figure 7-7. Analog Functional Block Diagram.

TO WIJ2
(STD OPT 001,002)
TO W2J3
(OPT 003)

58 47 49
CIRCUIT
COMPONENT



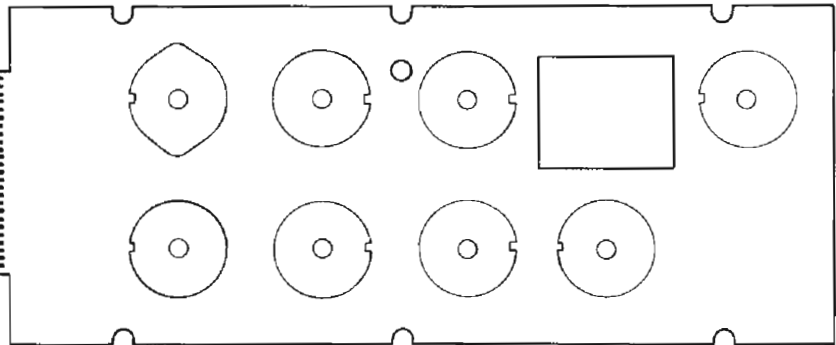
A13A

3320A/E-B-3257

hp Part No. 03320-61902
FRONT PANEL SWITCH ASSEMBLY

TO WIJ2
(STD OPT 001,002)
TO W2J3
(OPTS 004,007)

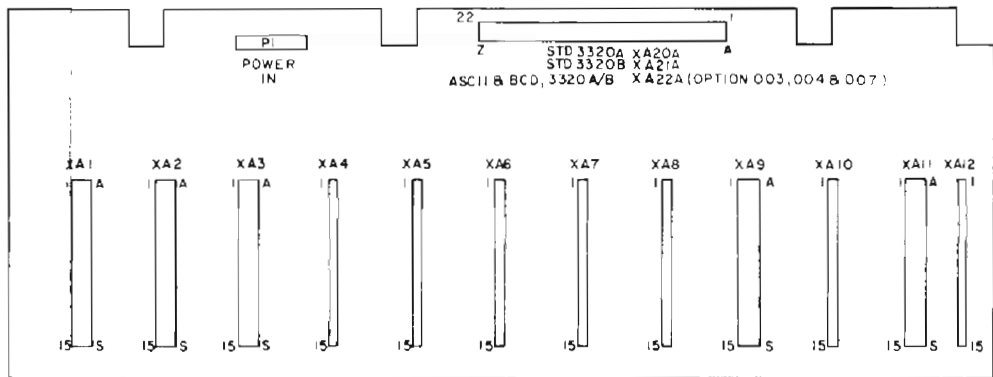
58 47 49
CIRCUIT
COMPONENT



A13B

3320A/B-B-2356

hp Part No. 03320-61901
FRONT PANEL SWITCH ASSEMBLY



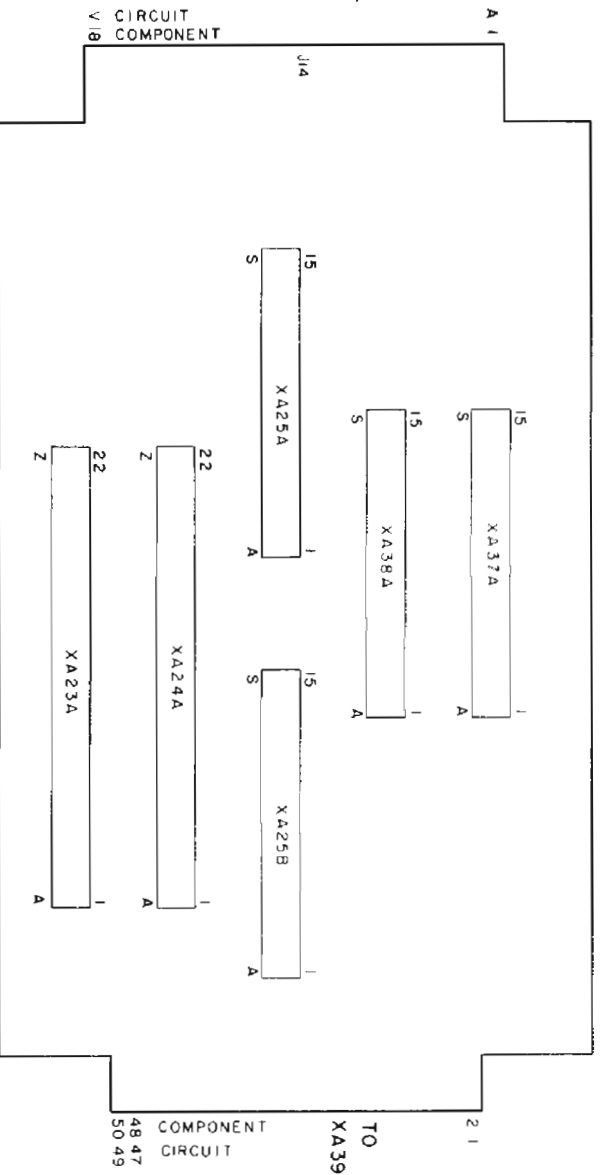
A19

3320A/B-B-3259

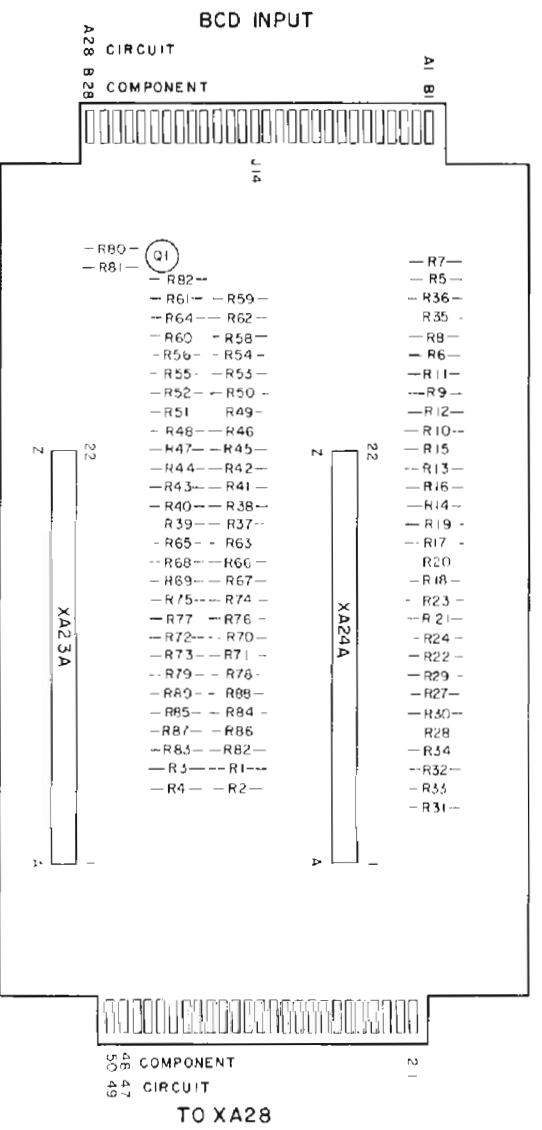
hp Part No. 03320-66519

Rev B

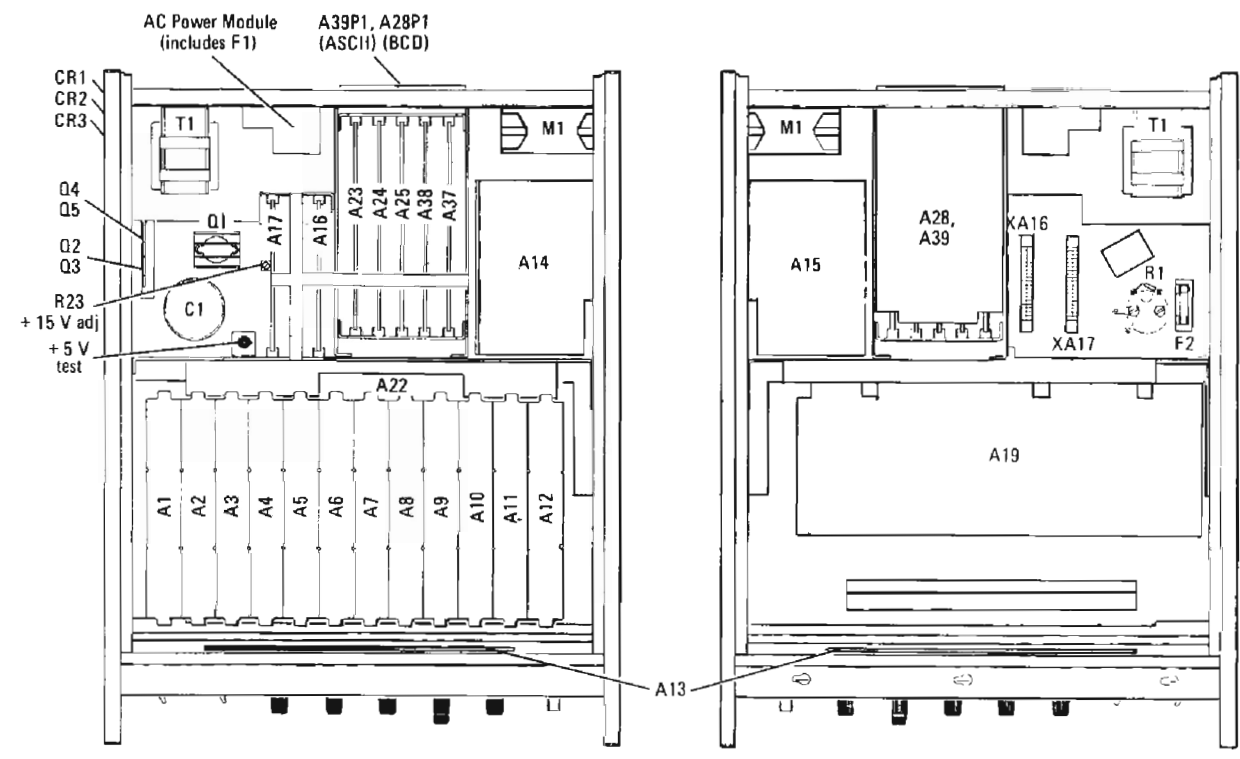
MOTHER BOARD



A39
 hp Part No. 03320-66539
 Rev A
 MOTHER BOARD, OPTION 007



A28
 hp Part No. 03320-66528
 Rev A
 BCD MOTHER BOARD, OPTION 003 or 004

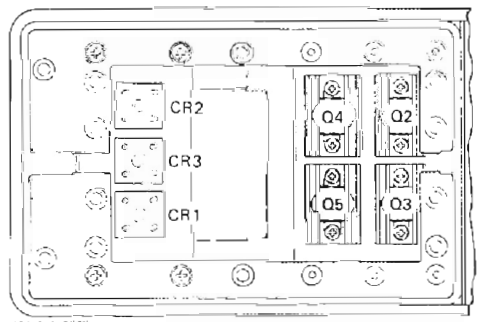


Rev. A

TOP VIEW

BOTTOM VIEW

O4, O5, CR3 Deleted for 3320A



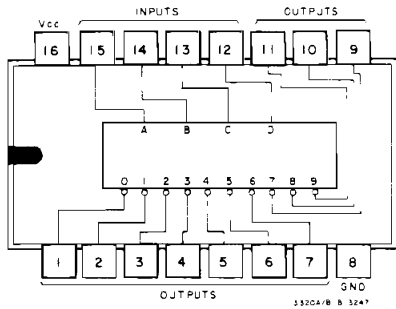
RIGHT SIDE VIEW

Figure 7-8. Common Assemblies, Top And Bottom View.

NOTE 1: 9's Complement Circuitry:

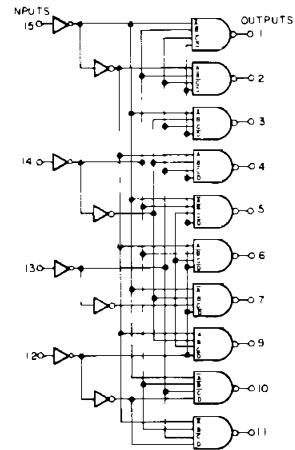
| Digit | INPUT | | | | 9's COMPLEMENT | | | |
|-------|-------|---|---|---|----------------|---|---|---|
| | 1 | 2 | 4 | 8 | 1 | 2 | 4 | 8 |
| 0 | H | H | H | H | H | L | L | H |
| 1 | L | H | H | H | L | H | L | L |
| 2 | H | L | H | H | H | H | L | L |
| 3 | L | L | H | H | L | H | H | L |
| 4 | H | H | L | H | H | L | H | L |
| 5 | L | H | L | H | L | H | H | L |
| 6 | H | L | L | H | L | H | L | L |
| 7 | L | L | L | H | L | H | L | L |
| 8 | H | H | H | L | H | L | L | L |
| 9 | L | H | H | L | L | L | L | L |

NOTE 2: On A20IC5, input at pin 12 is hard wired low, and output pins 9, 10, and 11 are not used (N/C).



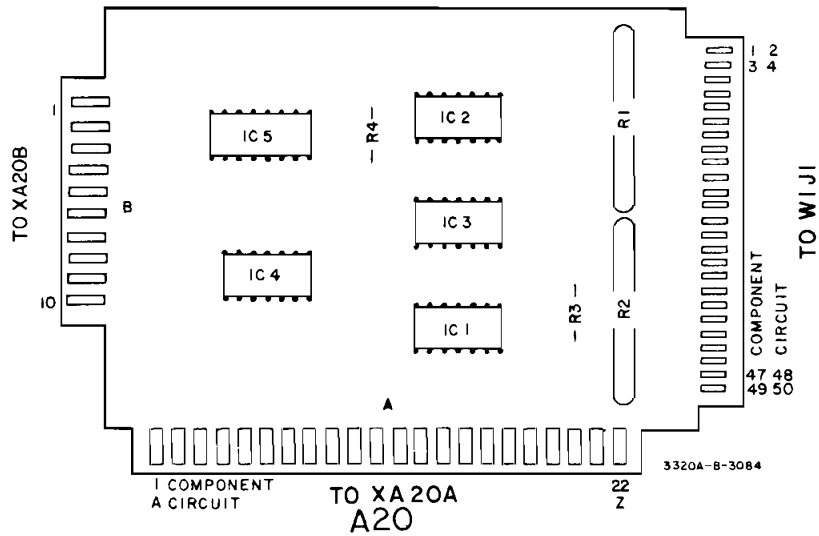
| INPUT | | | | DECIMAL OUTPUT | | | | | | | | | |
|-------|----|----|----|----------------|---|---|---|---|---|---|---|----|----|
| 12 | 13 | 14 | 15 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 9 | 10 | 11 |
| L | L | L | L | L | H | H | H | H | H | H | H | H | H |
| L | L | L | H | H | L | H | H | H | H | H | H | H | H |
| L | L | H | L | H | H | L | H | H | H | H | H | H | H |
| L | L | H | H | H | H | H | L | H | H | H | H | H | H |
| L | H | L | L | H | H | H | H | L | H | H | H | H | H |
| L | H | L | H | H | H | H | H | H | L | H | H | H | H |
| L | H | H | L | H | H | H | H | H | L | H | H | H | H |
| L | H | H | H | H | H | H | H | H | H | L | H | H | H |
| H | L | L | L | H | H | H | H | H | H | H | L | L | L |
| H | L | L | H | H | H | H | H | H | H | H | H | L | L |
| H | L | H | L | H | H | H | H | H | H | H | H | L | L |
| H | L | H | H | H | H | H | H | H | H | H | H | L | L |
| H | H | L | L | H | H | H | H | H | H | H | H | H | H |
| H | H | L | H | H | H | H | H | H | H | H | H | H | H |
| H | H | H | L | H | H | H | H | H | H | H | H | H | H |
| H | H | H | H | H | H | H | H | H | H | H | H | H | H |

NOTE 2: (Cont'd)



NOTE 3: BCD Low true logic, switch contact(s) to Ground is true state.

| Digit | CODE | | | |
|-------|------|---|---|---|
| | 1 | 2 | 4 | 8 |
| 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 |
| 2 | 0 | 1 | 0 | 0 |
| 3 | 1 | 1 | 0 | 0 |
| 4 | 0 | 0 | 1 | 0 |
| 5 | 1 | 0 | 1 | 0 |
| 6 | 0 | 1 | 1 | 0 |
| 7 | 1 | 1 | 1 | 0 |
| 8 | 0 | 0 | 0 | 1 |
| 9 | 1 | 0 | 0 | 1 |



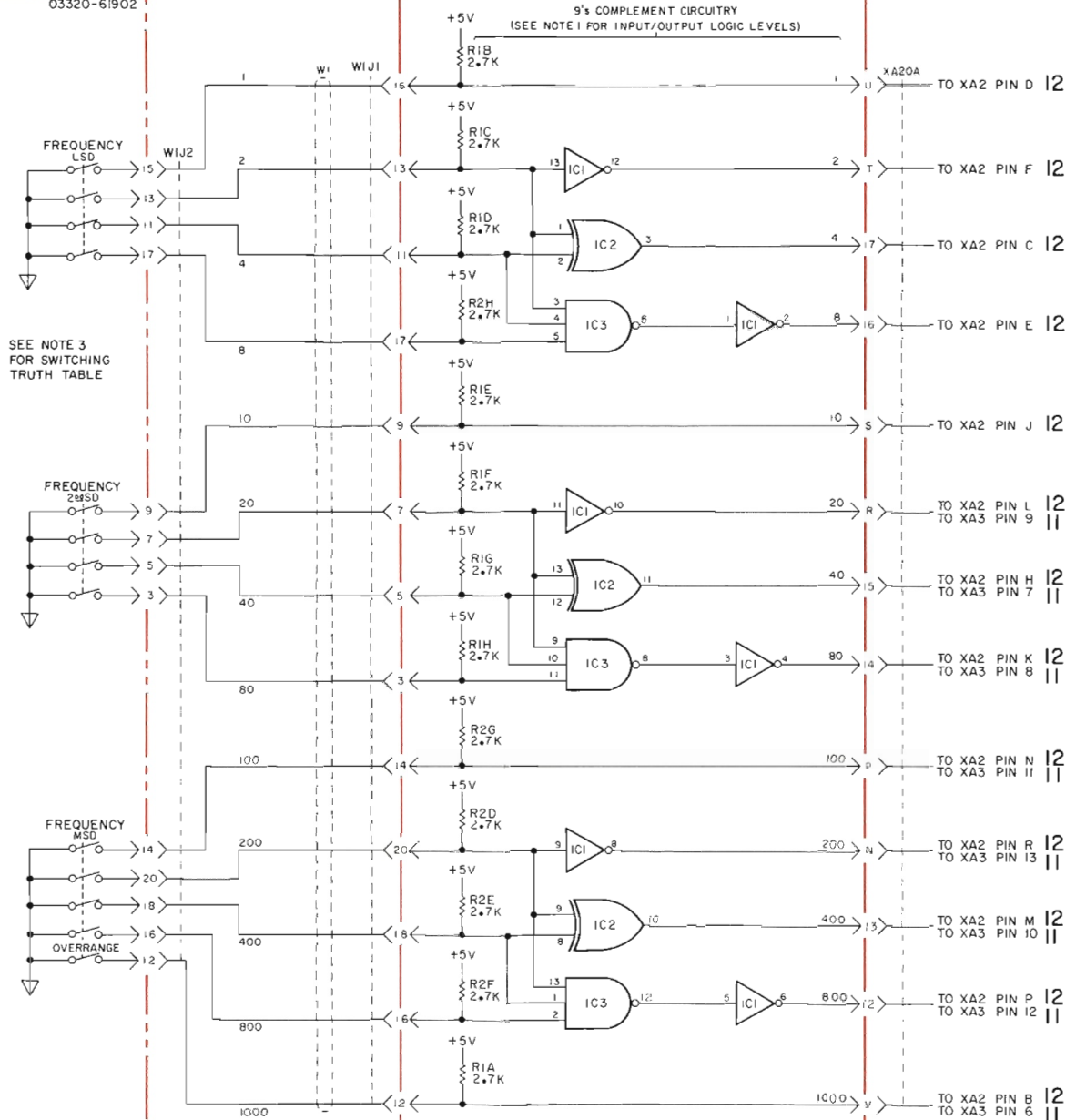
P/O A13A

FRONT
PANEL
03320-61902

P/O A20

PANEL INTERFACE "A" 03320-66520
(STANDARD, OPTIONS 001, 002 AND 006, "A" MODEL ONLY)

A19

MOTHER
BOARD
03320-66519

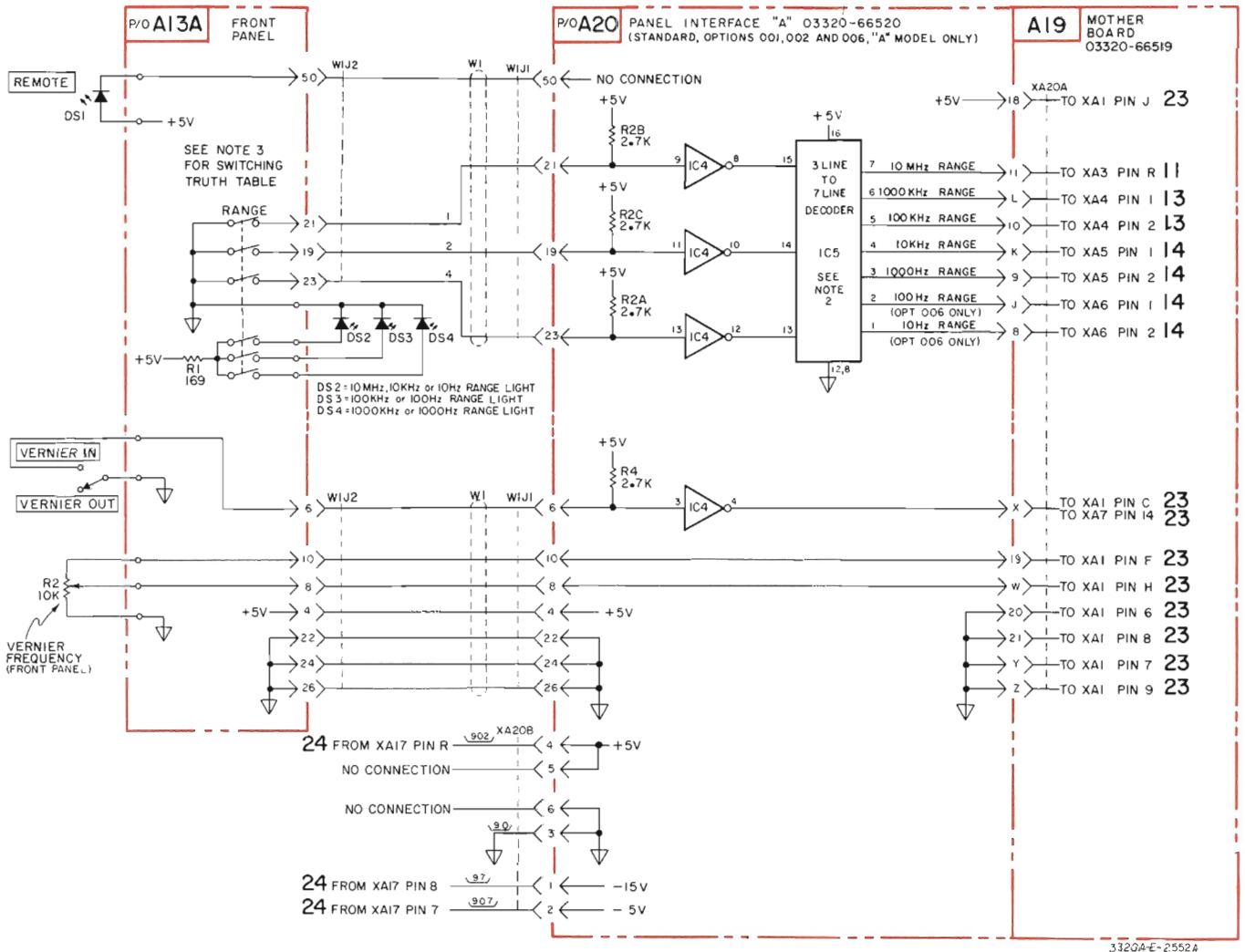


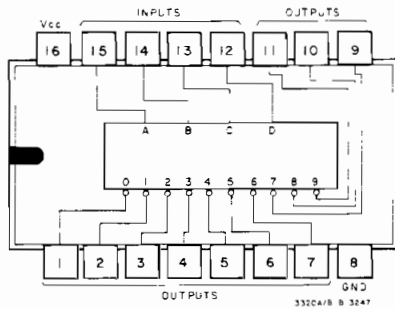
Figure 7-9. Panel Interface A20; 3320A Standard, Options 001, 002, 006.

7-19/7-20

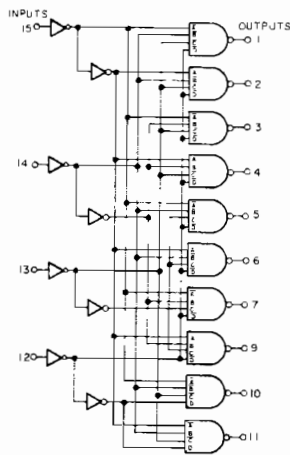
NOTE 1: 9's Complement Circuitry:

| Digit | INPUT | | | | 9's COMPLEMENT | | | |
|-------|-------|---|---|---|----------------|---|---|---|
| | 1 | 2 | 4 | 8 | 1 | 2 | 4 | 8 |
| 0 | H | H | H | H | H | L | L | H |
| 1 | L | H | H | H | L | L | L | H |
| 2 | H | L | H | H | H | H | H | L |
| 3 | L | L | H | H | L | H | H | L |
| 4 | H | H | L | H | H | L | H | L |
| 5 | L | H | L | H | L | L | H | L |
| 6 | H | L | L | H | H | H | L | L |
| 7 | L | L | L | H | L | H | L | L |
| 8 | H | H | H | L | H | L | L | L |
| 9 | L | H | H | L | L | L | L | L |

NOTE 2: On A21IC15, input at pin 12 is hard wired low, and output pins 9, 10, and 11 are not used (N/C).



| INPUT | | | | DECIMAL OUTPUT | | | | | | | | | |
|-------|----|----|----|----------------|---|---|---|---|---|---|---|----|----|
| 12 | 13 | 14 | 15 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 9 | 10 | 11 |
| L | L | L | L | L | H | H | H | H | H | H | H | H | H |
| L | L | L | H | H | L | H | H | H | H | H | H | H | H |
| L | L | H | L | H | H | L | H | H | H | H | H | H | H |
| L | L | H | H | H | H | H | L | H | H | H | H | H | H |
| L | H | L | L | H | H | H | H | L | H | H | H | H | H |
| L | H | L | H | H | H | H | H | L | H | H | H | H | H |
| L | H | H | L | H | H | H | H | H | L | H | H | H | H |
| L | H | H | H | H | H | H | H | H | H | L | H | H | H |
| H | L | L | L | H | H | H | H | H | H | H | L | H | H |
| H | L | L | H | H | H | H | H | H | H | H | H | L | H |
| H | L | H | L | H | H | H | H | H | H | H | H | H | L |
| H | L | H | H | H | H | H | H | H | H | H | H | H | H |
| H | H | L | L | H | H | H | H | H | H | H | H | H | H |
| H | H | L | H | H | H | H | H | H | H | H | H | H | H |
| H | H | H | L | H | H | H | H | H | H | H | H | H | H |
| H | H | H | H | H | H | H | H | H | H | H | H | H | H |



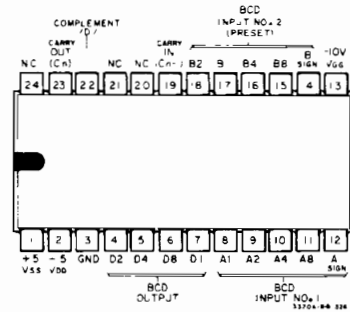
NOTE 3: BCD Low true logic, switch contact(s) to Ground is true state.

| Digit | CODE | | | |
|-------|------|---|---|---|
| | 1 | 2 | 4 | 8 |
| 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 |
| 2 | 0 | 1 | 0 | 0 |
| 3 | 1 | 1 | 0 | 0 |
| 4 | 0 | 0 | 1 | 0 |
| 5 | 1 | 0 | 1 | 0 |
| 6 | 0 | 1 | 1 | 0 |
| 7 | 1 | 1 | 1 | 0 |
| 8 | 0 | 0 | 0 | 1 |
| 9 | 1 | 0 | 0 | 1 |

NOTE 4: IC4, 5, 6, or 7 operate as a BCD Adder. The two BCD Inputs (#1 and #2) are summed together and applied to the BCD Output. The BCD inputs and output lines are high true logic. A true signal on the A Sign input indicates a negative amplitude number (i.e., -10.00 dBm). The BCD Input #2 is a "hard wired" input, preset by means of jumper wires on the pc assembly. See Note 5.

The Complement /D/ input controls the BCD output (D1, D2, D4, D8). With the Complement /D/ input high ($\approx +5$ V) the direct BCD sum of inputs #1 and #2 are applied to the BCD Output. With the Complement /D/ input low (≈ -5 V) the 9's complement of the two inputs is applied to the BCD Output. The BCD Output lines have internal pull-up resistors.

Transistor Q1 inhibits a Carry-In signal to IC4 when the Amplitude Sign is positive. Transistors Q2, Q3 and IC8 control the level of the Complement /D/ input.



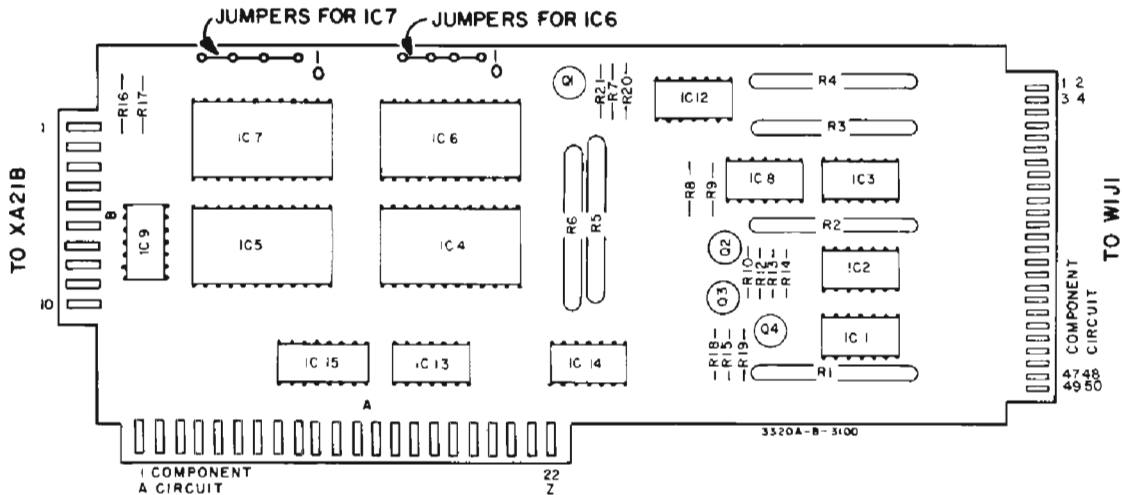
NOTE 5: Jumpers on the A21 Assembly for IC6 and IC7 are preset at the factory:

3320B STANDARD, 50Ω Impedance

IC7 Jumpered for BCD 7
IC6 Jumpered for BCD 3

3320B OPTION 001, 75Ω Impedance

IC7 Jumpered for BCD 7
IC6 Jumpered for BCD 5



3320A-B-3100

TO XA21A

A21

hp Part No. 03320-66521

Rev B

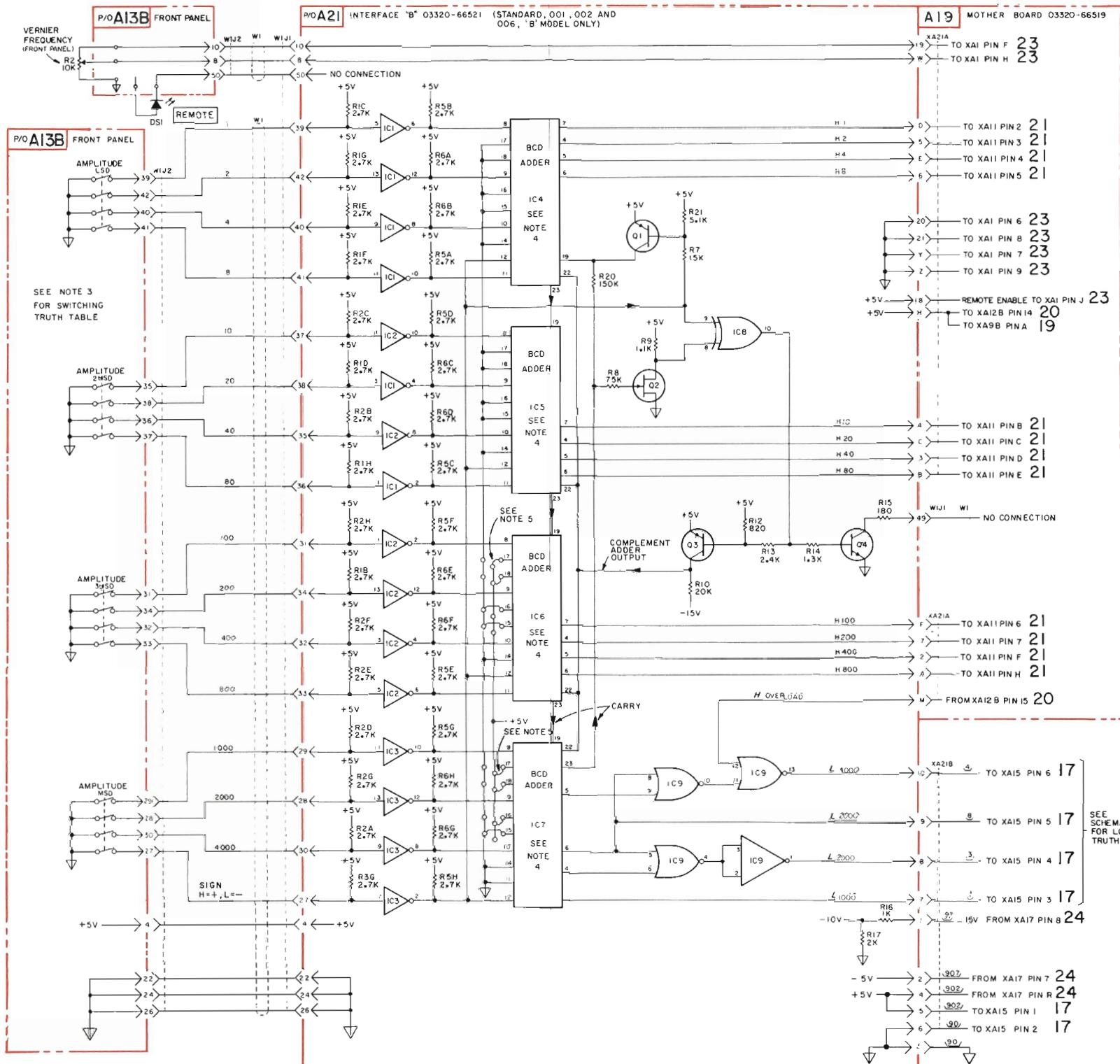


Figure 7-10. Panel Interface A21; 3320B Standard, Options 001, 002, 006.

NOTE 1: Logic signal levels are shown by the letters H or L preceding the name of the line. The H and L indicates the true state (signal present). Voltage levels for the H and L are:

H = +5 V
L = 0 V

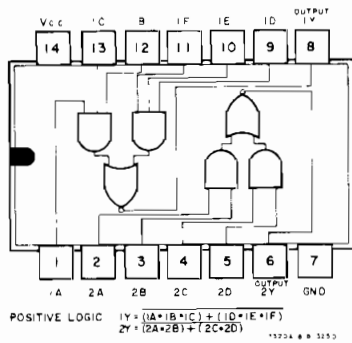
Example:

H Delay Flag — indicates the delay flag line should be +5 V when a delay flag signal is present.

L Data Valid — indicates the data valid line should be 0 V when a data valid signal is present.

NOTE 2: In Remote Mode (A High, B Low) the input on pins 12 and 13 is inverted and applied to pin 8. The input on pin 3 is inverted and applied to pin 6.

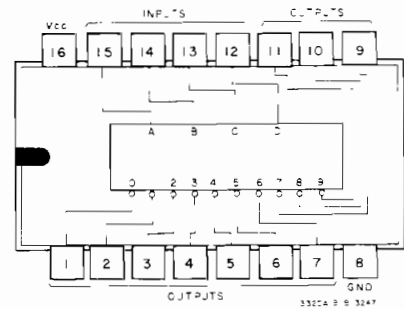
In Local Mode (A Low, B High) the input on pins 9 and 10 is inverted and applied to pin 8. The input on pin 5 is inverted and applied to pin 6.



NOTE 4: 9's Complement Circuitry:

| Digit | INPUT | | | | 9's COMPLEMENT | | | |
|-------|-------|---|---|---|----------------|---|---|---|
| | 1 | 2 | 4 | 8 | 1 | 2 | 4 | 8 |
| 0 | L | L | L | L | H | L | L | H |
| 1 | H | L | L | L | L | L | L | H |
| 2 | L | H | L | L | H | H | H | L |
| 3 | H | H | L | L | L | H | H | L |
| 4 | L | L | H | L | H | L | H | L |
| 5 | H | L | H | L | L | L | H | L |
| 6 | L | H | H | L | H | H | L | L |
| 7 | H | H | H | L | L | H | L | L |
| 8 | L | L | L | H | H | L | L | L |
| 9 | H | L | L | H | L | L | L | L |

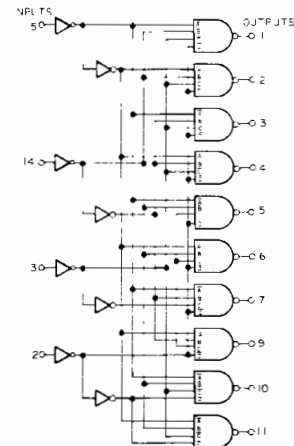
NOTE 5: On A221C1, input at pin 12 is hard wired low, and output pins 9, 10, and 11 are not used (N/C).

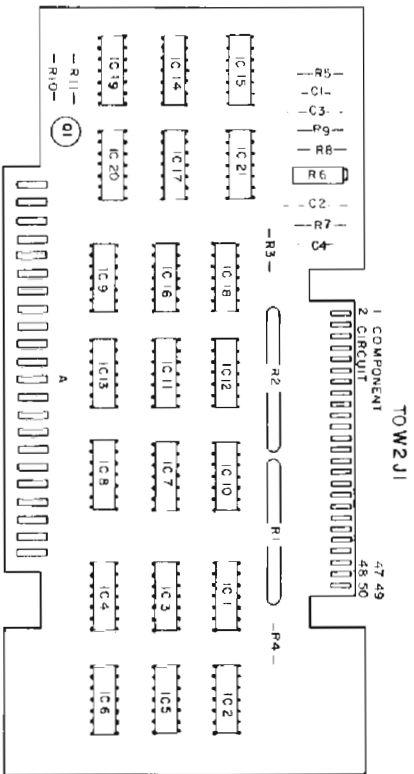


| INPUT | | | | DECIMAL OUTPUT | | | | | | | | | |
|-------|----|----|----|----------------|---|---|---|---|---|---|---|----|----|
| 12 | 13 | 14 | 15 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 9 | 10 | 11 |
| L | L | L | L | L | H | H | H | H | H | H | H | H | H |
| L | L | L | H | H | L | H | H | H | H | H | H | H | H |
| L | L | H | L | H | H | L | H | H | H | H | H | H | H |
| L | L | H | H | H | H | H | L | H | H | H | H | H | H |
| L | H | L | L | H | H | H | H | L | H | H | H | H | H |
| L | H | L | H | H | H | H | H | L | H | H | H | H | H |
| L | H | H | L | H | H | H | H | H | L | H | H | H | H |
| L | H | H | H | H | H | H | H | H | H | L | H | H | H |
| H | L | L | L | H | H | H | H | H | H | H | H | L | H |
| H | L | L | H | H | H | H | H | H | H | H | H | H | L |
| H | L | H | L | H | H | H | H | H | H | H | H | H | H |
| H | L | H | H | H | H | H | H | H | H | H | H | H | H |
| H | H | L | L | H | H | H | H | H | H | H | H | H | H |
| H | H | L | H | H | H | H | H | H | H | H | H | H | H |
| H | H | H | L | H | H | H | H | H | H | H | H | H | H |
| H | H | H | H | H | H | H | H | H | H | H | H | H | H |

NOTE 3: BCD Low true logic, switch contact(s) to ground is true state.

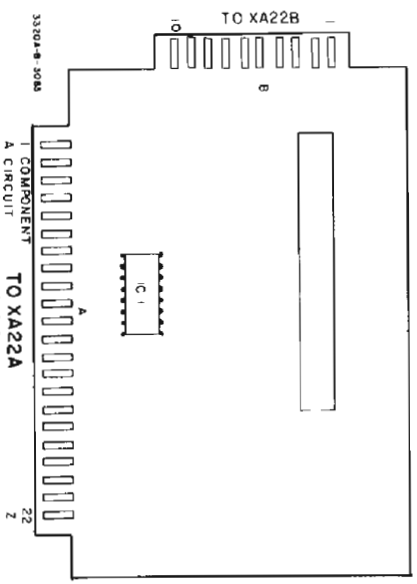
| Digit | CODE | | | |
|-------|------|---|---|---|
| | 1 | 2 | 4 | 8 |
| 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 |
| 2 | 0 | 1 | 0 | 0 |
| 3 | 1 | 1 | 0 | 0 |
| 4 | 0 | 0 | 1 | 0 |
| 5 | 1 | 0 | 1 | 0 |
| 6 | 0 | 1 | 1 | 0 |
| 7 | 1 | 1 | 1 | 0 |
| 8 | 0 | 0 | 0 | 1 |
| 9 | 1 | 0 | 0 | 1 |





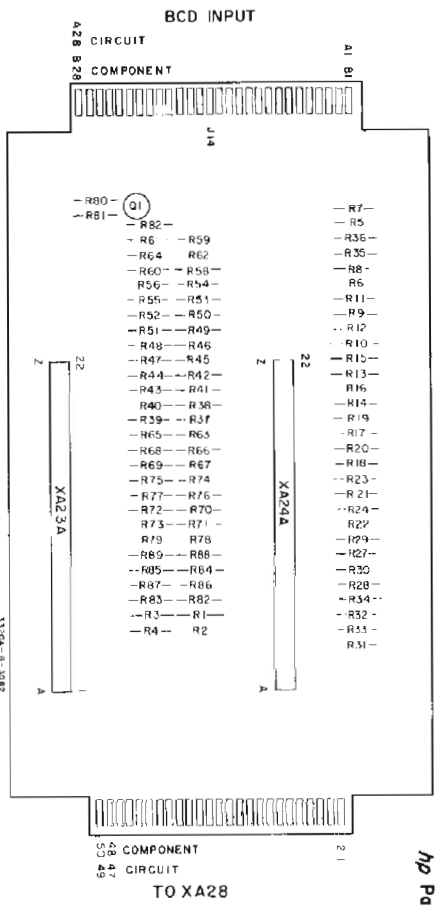
33204-B-247MS

A23
 hp Part No. 03320-66523
 Rev B



33204-B-208B

A22
 hp Part No. 03320-66522
 Rev A



BCD INPUT
 CIRCUIT
 COMPONENT

TO XA28
 CIRCUIT
 COMPONENT

33204-B-208Z

A28
 hp Part No. 03320-66528
 Rev A
 BCD MOTHER BOARD, OPTION 003 or 004

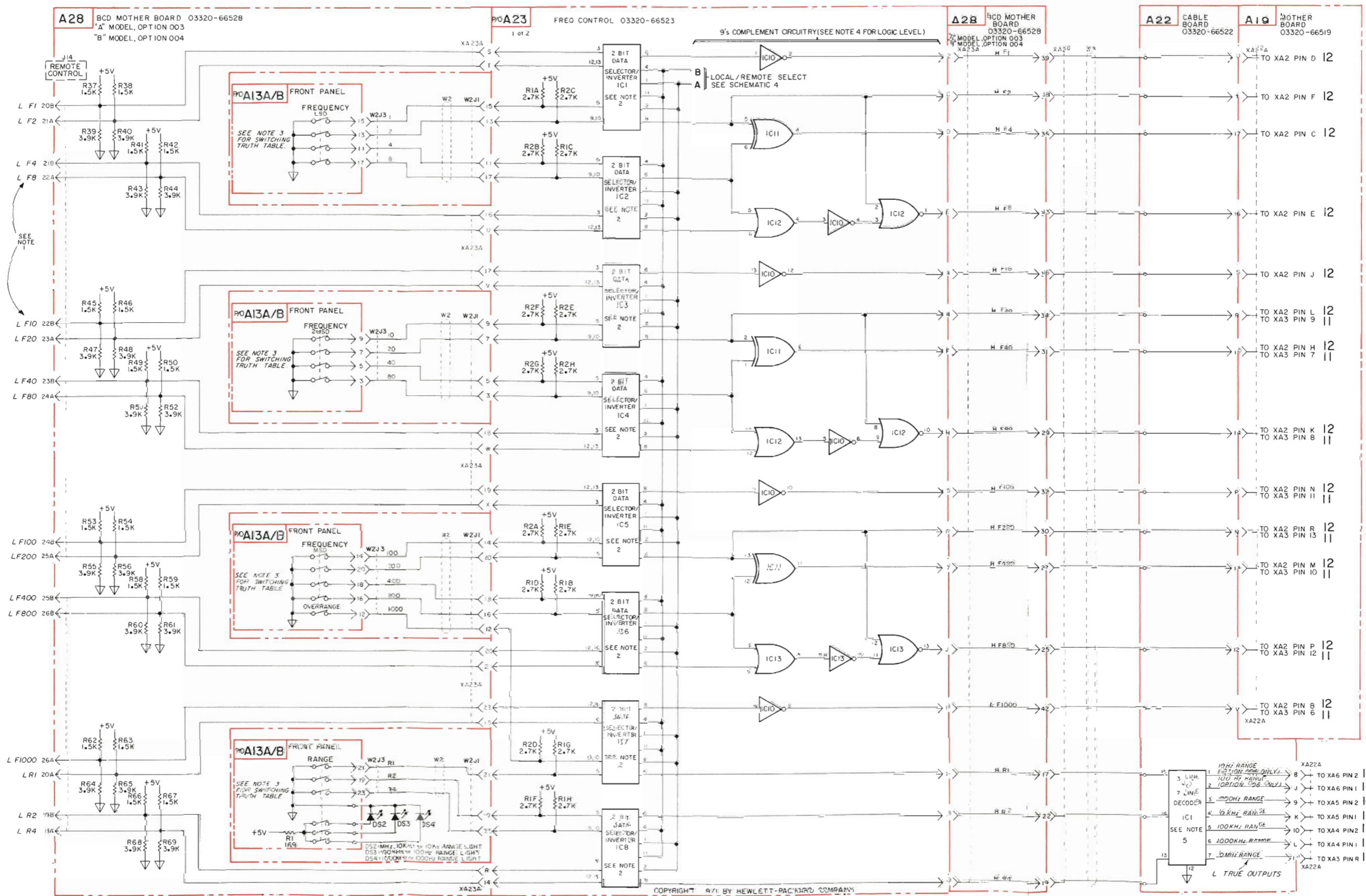
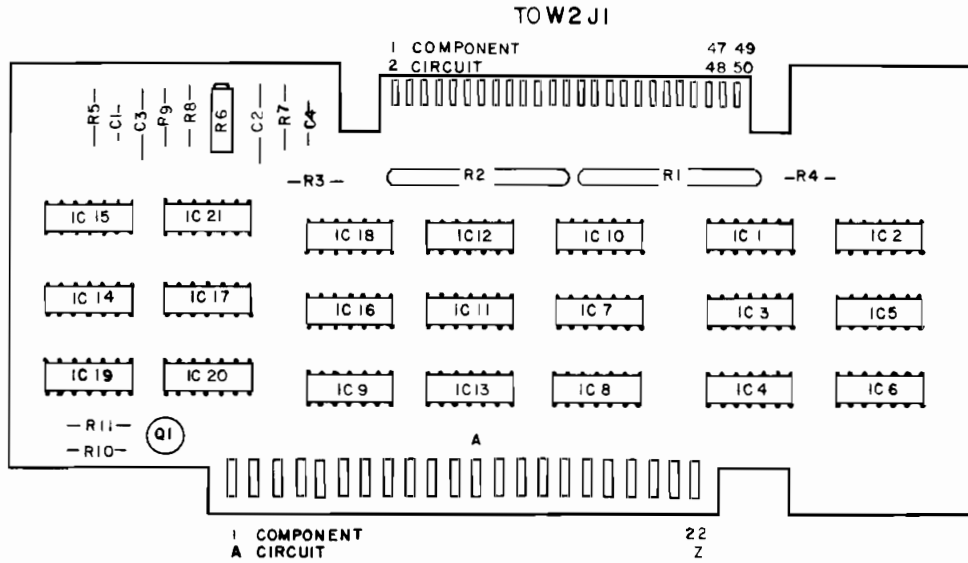


Figure 7-11. BCD Frequency Control P/O A23; 3320A Option 003, 3320B Option 004.



3320A-B-2875

TO XA23A
A23
hp Part No. 03320-66523
Rev B

NOTE 1: Logic signal levels are shown by the letters H or L preceding the name of the line. The H and L indicates the true state (signal present). Voltage levels for the H and L are:

H = +5 V
L = 0 V

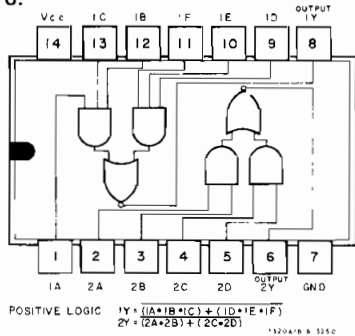
Example:

H Delay Flag — indicates the delay flag line should be +5 V when a delay flag signal is present.

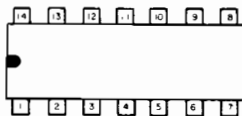
L Data Valid — indicates the data valid line should be 0 V when a data valid signal is present.

NOTE 2: In Remote Mode (A High, B Low) the input on pins 12 and 13 is inverted and applied to pin 8. The input on pin 3 is inverted and applied to pin 6.

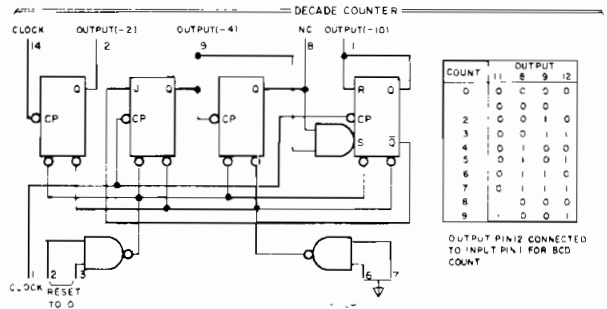
In Local Mode (A Low, B High) the input on pins 9 and 10 is inverted and applied to pin 8. The input on pin 5 is inverted and applied to pin 6.



NOTE 3: Logic diagram of IC is shown below.



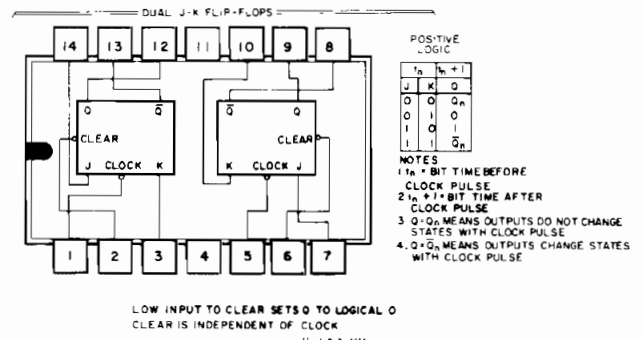
NOTE 3: (CONT'D)



NOTE 4: Local/Remote select lines from A24 Assembly:

Local mode A Low, B High
Remote mode A High, B Low

NOTE 5: Logic Diagram of IC is shown below.



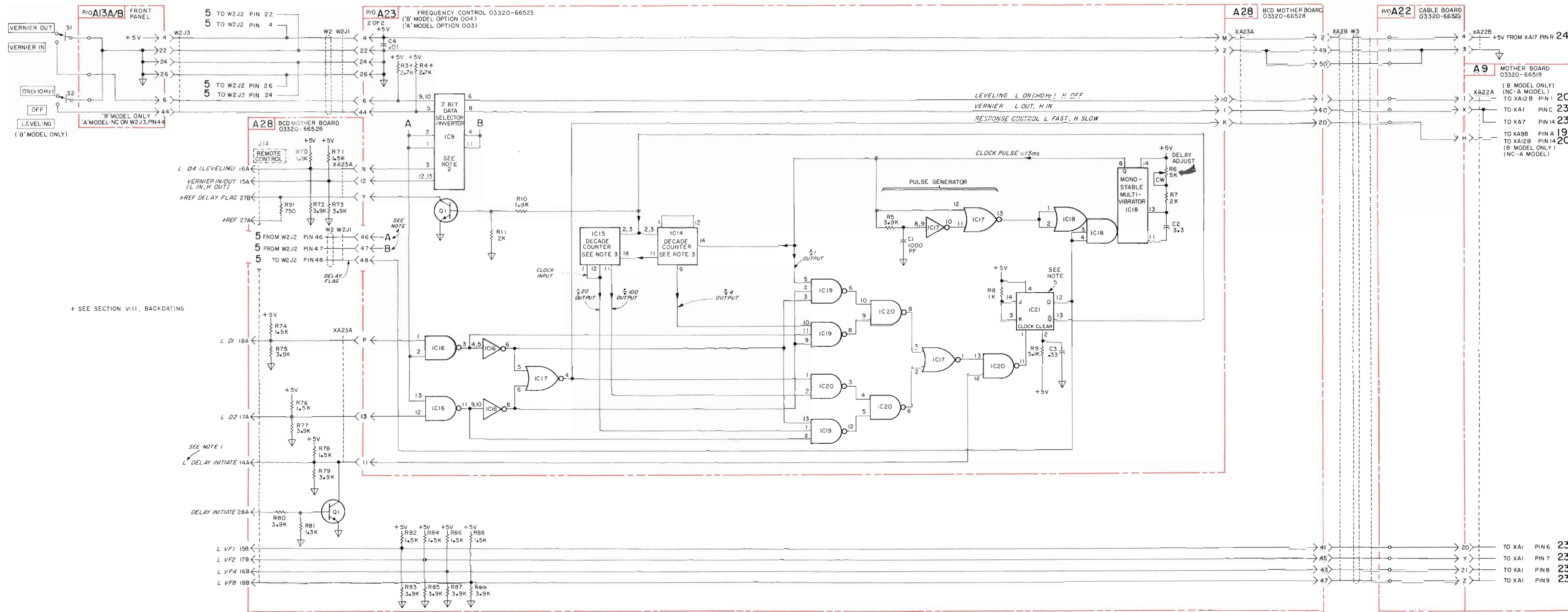


Figure 7-12. BCD Frequency Control P/O A23; 3320A Option 003, 3320B Option 004.

NOTE 1: Logic signal levels are shown by the letters H or L preceding the name of the line. The H and L indicates the true state (signal present). Voltage levels for the H and L are:

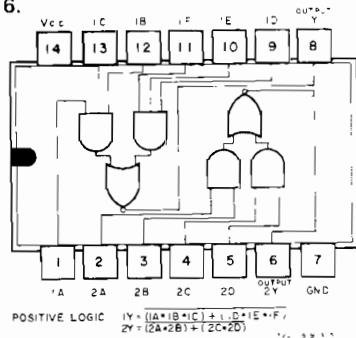
H = +5 V
L = 0 V

Example:

- H Delay Flag — indicates the delay flag line should be +5 V when a delay flag signal is present.
- L Data Valid — indicates the data valid line should be 0 V when a data valid signal is present.

NOTE 2: In Remote Mode (A High, B Low) the input on pins 12 and 13 is inverted and applied to pin 8. The input on pin 3 is inverted and applied to pin 6.

In Local Mode (A Low, B High) the input on pins 9 and 10 is inverted and applied to pin 8. The input on pin 5 is inverted and applied to pin 6.



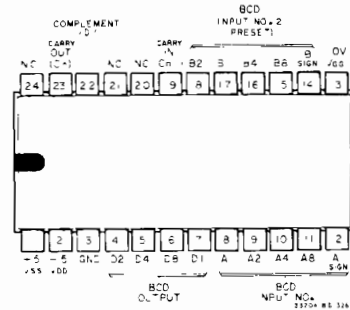
NOTE 3: BCD Low true logic, switch contact(s) to ground is true state.

| Digit | CODE | | | |
|-------|------|---|---|---|
| | 1 | 2 | 4 | 8 |
| 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 |
| 2 | 0 | 1 | 0 | 0 |
| 3 | 1 | 1 | 0 | 0 |
| 4 | 0 | 0 | 1 | 0 |
| 5 | 1 | 0 | 1 | 0 |
| 6 | 0 | 1 | 1 | 0 |
| 7 | 1 | 1 | 1 | 0 |
| 8 | 0 | 0 | 0 | 1 |
| 9 | 1 | 0 | 0 | 1 |

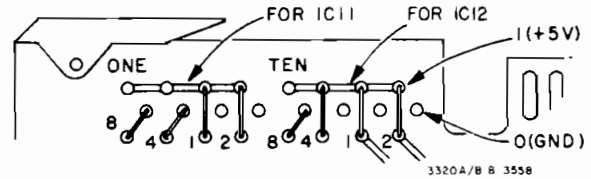
NOTE 4: IC9, 10, 11 or 12 operate as a BCD Adder. The two BCD Inputs (#1 and #2) are summed together and applied to the BCD Output. The BCD inputs and output lines are high true logic. A true signal on the A Sign input indicates a negative amplitude number (i.e., -10.00 dBm). The BCD Input #2 is a "hard wired" input, preset by means of jumper wires on the pc assembly. See Note 5.

The Complement /D/ input controls the BCD output (D1, D2, D4, D8). With the Complement /D/ input high ($\approx +5$ V), the direct BCD sum of inputs #1 and #2 are applied to the BCD Output. With the Complement /D/ input low (≈ -5 V), the 9's complement of the two inputs is applied to the BCD Output. The BCD Output lines have internal pull-up resistors.

Transistor Q1 inhibits a Carry-In signal to IC9 when the Amplitude Sign is positive. Transistors Q2, Q3 and associated circuits (IC13, 14 and 15) control the level of the Complement /D/ input.



NOTE 5: Jumpers on the A24B Assembly for IC11 and IC12 are preset at the factory:



3320B STANDARD, 50 Ω Impedance
(Preset No. 73)

IC12 Jumpered for BCD 7
IC11 Jumpered for BCD 3

3320B OPTION 001, 75 Ω Impedance
(Preset No. 75)

IC12 Jumpered for BCD 7
IC11 Jumpered for BCD 5

two BCD
the BCD
ic. A true
e number
'd' input,
ote 5.

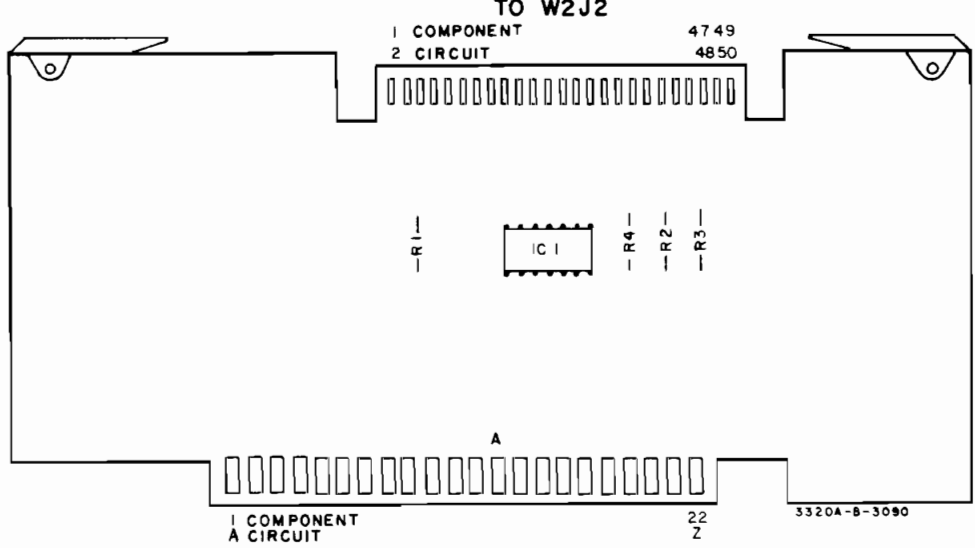
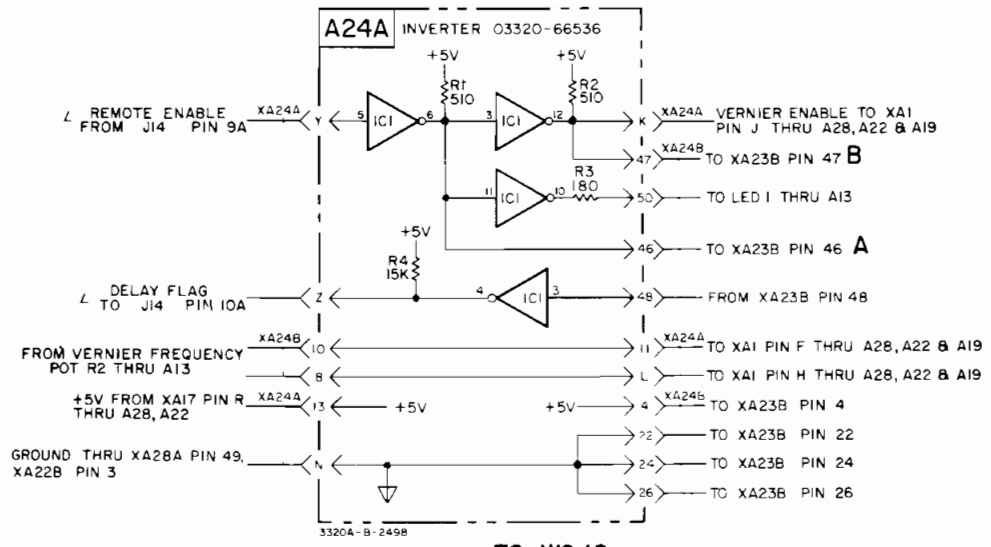
, D2, D4,
rect BCD
With the
f the two
ines have

plitude
(IC13, 14

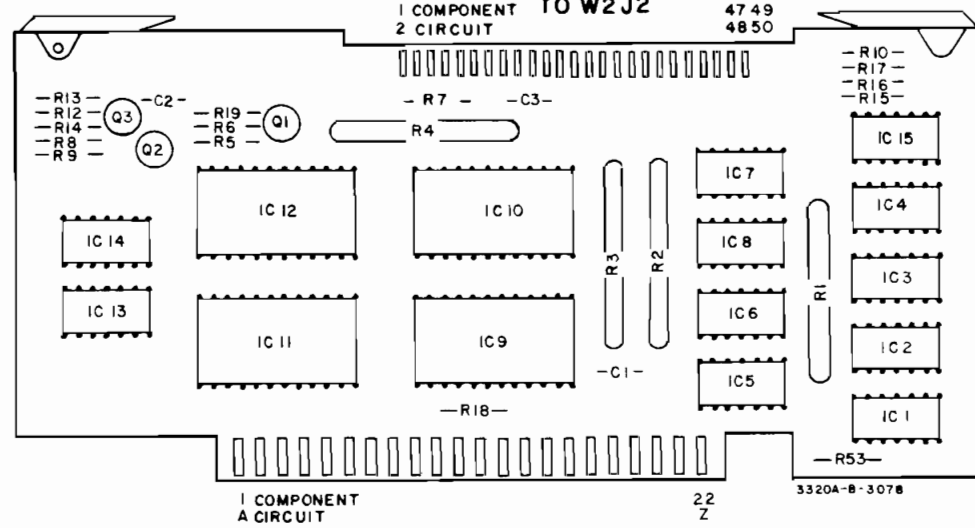
IC12 are

(+5V)

(GND)



TO XA24A A24A
hp Part No. 03320-66536
Rev A



TOXA24A A24B
hp Part No. 03320-66524
Rev A

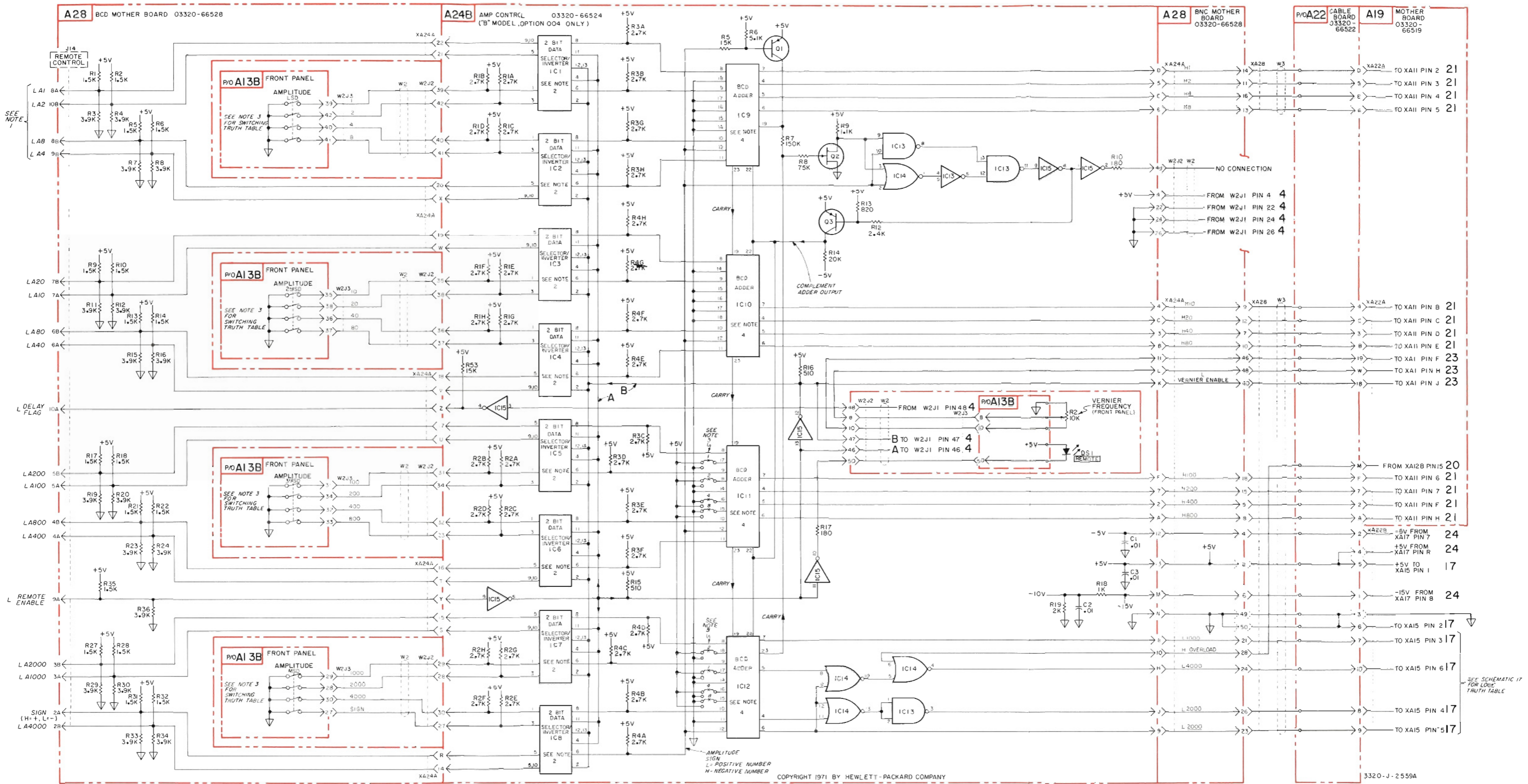


Figure 7-13. BCD Amplitude Control A24B, 3320B Option 004; Inverter A24A, 3320A Option 003.

NOTE 1: Logic signal levels are shown by the letters H or L preceding the name of the line. The H and L indicates the true state (signal present). Voltage levels for the H and L are:

H = +5 V
L = 0 V

Example:

H Delay Flag – indicates the delay flag line should be +5 V when a delay flag signal is present.

L Data Valid – indicates the data valid line should be 0 V when a data valid signal is present.

NOTE 2: Location of jumpers on A37 Assembly indicates GPIB Address of instrument. Instruments are shipped from factory with Address 63, jumpered in as shown on schematic. To change Address, move jumpers to desired number according to the following table:

| BIT | WEIGHT |
|-----|--------|
| b1 | 1 |
| b2 | 2 |
| b3 | 4 |
| b4 | 10 |
| b5 | 20 |

Note: b6 (40 weight) is "hard-wired".
b7 (80 weight) is "hard-wired".

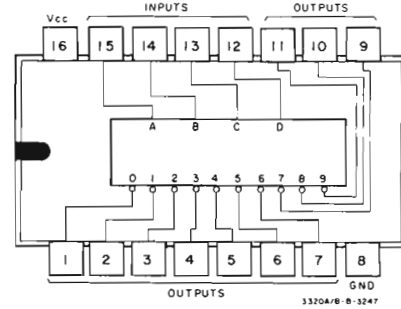
NOTE 3: Instruments are shipped from factory with jumper A-B on A37 Assembly connected. The jumper wire can be removed and a ground connected to B to inhibit remote enable.

If it is desired to control local or remote mode of the instrument with a switch, connect the switch to the S.W. REMOTE ENABLE point on the A39 Assembly. Grounding the S.W. REMOTE ENABLE point forces local mode. No connection (switch open) to the S.W. REMOTE ENABLE point will allow the instrument to be remotely programmed, as outlined in Section III, if jumper A-B is connected.

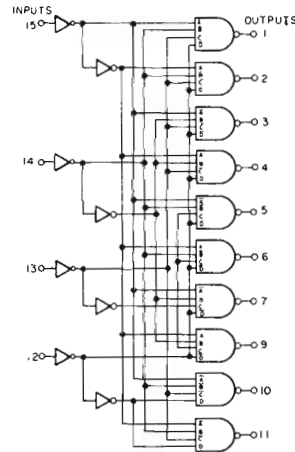
NOTE 4: Instruments are shipped from factory with jumper A-B on A38 Assembly removed (disconnected). With the jumper disconnected, the last remote program for amplitude, frequency, etc., is retained when changing from remote to local and then back to remote. If it is not desired to retain the last remote program, connect a jumper between points A and B. This will enable the Data Selector/Storage Registers on the A25 Assembly to be reset by the Local Enable Command to the initial remote turn-on condition listed below.

Frequency 800 Hz
Range 1000 Hz
Amplitude -69.00 dBm
Vernierout/0 Hz
Delay 1500 ms
Leveling ON (>10 Hz)

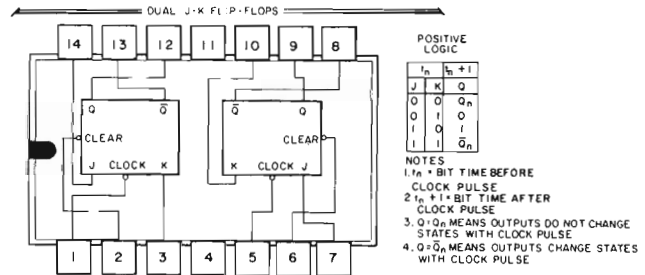
NOTE 5: The Logic diagram for a 4 Line to 10 Line Decoder is shown below. IC12, 13, 14 along with NOR gates IC6, 7, 11 and Inverter IC15 constitute a "data bit decoder". See Figure 7-5 for truth table.



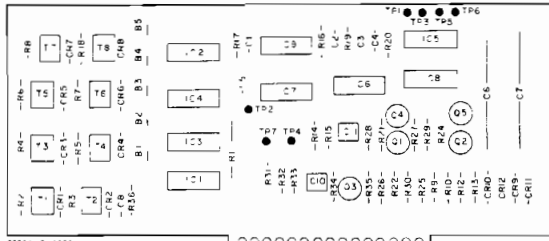
| INPUT | | | | DECIMAL OUTPUT | | | | | | | | | | |
|-------|----|----|----|----------------|---|---|---|---|---|---|---|----|----|--|
| 12 | 13 | 14 | 15 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 9 | 10 | 11 | |
| L | L | L | L | L | H | H | H | H | H | H | H | H | H | |
| L | L | L | H | H | L | H | H | H | H | H | H | H | H | |
| L | L | H | L | H | H | L | H | H | H | H | H | H | H | |
| L | L | H | H | H | H | H | L | H | H | H | H | H | H | |
| L | H | L | L | H | H | H | H | L | H | H | H | H | H | |
| L | H | L | H | H | H | H | H | H | L | H | H | H | H | |
| L | H | H | L | H | H | H | H | H | L | H | H | H | H | |
| L | H | H | H | H | H | H | H | H | H | L | H | H | H | |
| H | L | L | L | H | H | H | H | H | H | H | L | H | H | |
| H | L | L | H | H | H | H | H | H | H | H | H | L | H | |
| H | L | H | L | H | H | H | H | H | H | H | H | H | L | |
| H | L | H | H | H | H | H | H | H | H | H | H | H | H | |
| H | H | L | L | H | H | H | H | H | H | H | H | H | H | |
| H | H | L | H | H | H | H | H | H | H | H | H | H | H | |
| H | H | H | L | H | H | H | H | H | H | H | H | H | H | |
| H | H | H | H | H | H | H | H | H | H | H | H | H | H | |



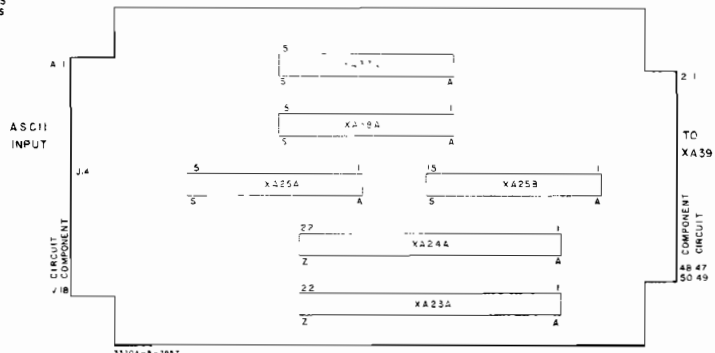
NOTE 6: Logic diagram of IC is shown below.



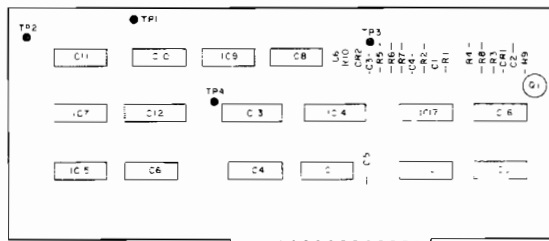
Low input to Clear sets Q to logical 0.
Clear is independent of Clock.



A37 TO XA37A
 hp Part No. 03320-66537
 Rev A



A39
 hp Part No. 03320-66539
 Rev A
 ASCII MOTHER BOARD, OPTION 007



A38 TO XA38A
 hp Part No. 03320-66538
 Rev A

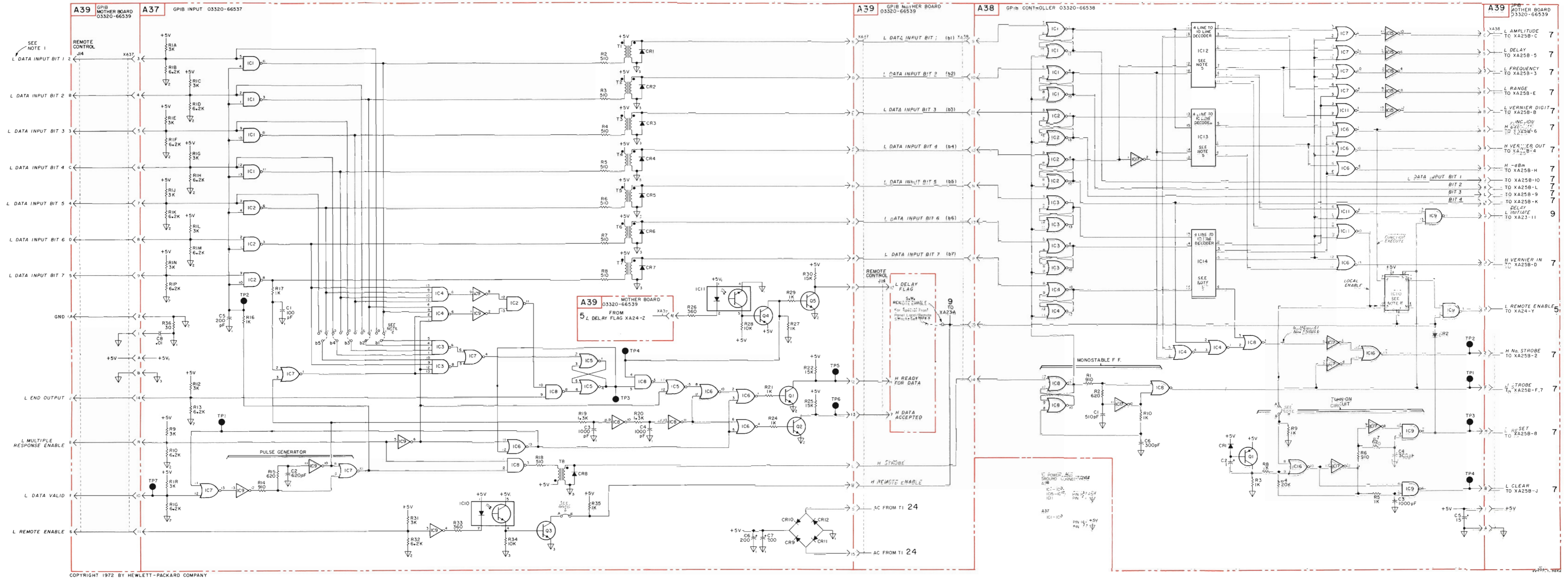


Figure 7-14. GPIB Input A37 And GPIB Controller A38, 3320B Option 007.

NOTE 1: Logic signal levels are shown by the letters H or L preceding the name of the line. The H and L indicates the true state (signal present). Voltage levels for the H and L are:

H = +5 V
L = 0 V

Example:

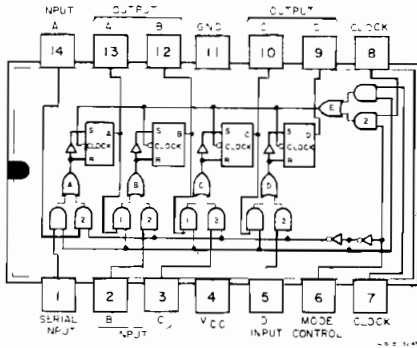
H Delay Flag — indicates the delay flag line should be +5 V when a delay flag signal is present.

L Data Valid — indicates the data valid line should be 0 V when a data valid signal is present.

NOTE 2: IC8–IC11 are 4-bit Shift Registers. The mode of operation is controlled by the voltage level on mode control line, pin 6. When the mode control line is high ($\approx +5$ V), the registers are reset by parallel loading of Inputs A, B, C and D. Inputs A, B, C and D are hard-wired to +5 V. When the mode control line is low (≈ 0 V) the Serial Input, pin 1, is enabled. These IC's are connected for serial-to-parallel conversion of the numerical data bits, b_1 – b_4 .

The "A" output of each IC represents the least significant digit. The "D" output of each IC represents the most significant digit.

All inputs and outputs are low true.



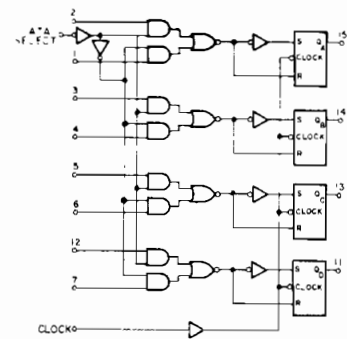
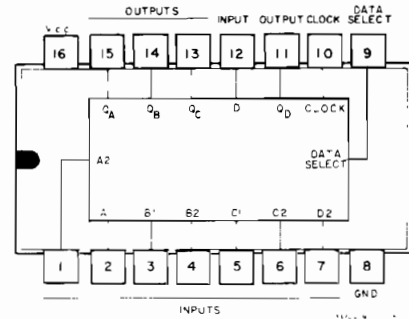
NOTE 3: IC18–IC23, and IC25–IC28 are 4-bit Data Selectors/Storage Registers (latches). All inputs and outputs are BCD, low true. When L Clear (Data Select) input is low (≈ 0 V), input data A1, B1, C1, and D1 is applied to the respective outputs Q_A , Q_B , Q_C , and Q_D . When Data Select input is high, input data A2, B2, C2 and D2 is applied to the respective outputs. The selected input data is shifted to the output terminals on the negative-going edge of clock pulse.

Input data A1, B1, C1, and D1 is hardwired, as listed below, for the "initial turn on conditions" listed in Section III.

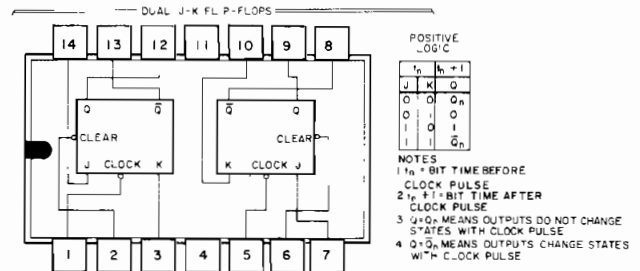
| IC | PINS | WIRED | BCD OUTPUT |
|-----------|---------------|-----------|------------|
| IC18 | 5, 12 2, 3 | +5 V ↓ | 3 |
| IC19 | 2, 5, 12 3 | +5 V ↓ | 2 |
| IC20–IC22 | 2, 3, 5, 12 | +5 V | 0 |
| IC23 | 2, 3, 5 12 | +5 V ↓ | 8 |
| IC25–IC26 | 2, 3, 5, 12 | +5 V | 0 |
| IC27 | 3, 5 2, 12 | +5 V ↓ | 9 |

| IC | PINS | WIRED | BCD OUTPUT |
|------|---------------|-----------|------------|
| IC28 | 2 3, 5, 12 | +5 V ↓ | -6 |
| IC4 | Clear | | VERN OUT |

Input Data A2, B2, C2, and D2 is numerical data from shift registers IC8–IC11.



NOTE 4: Logic diagram of IC is shown below.



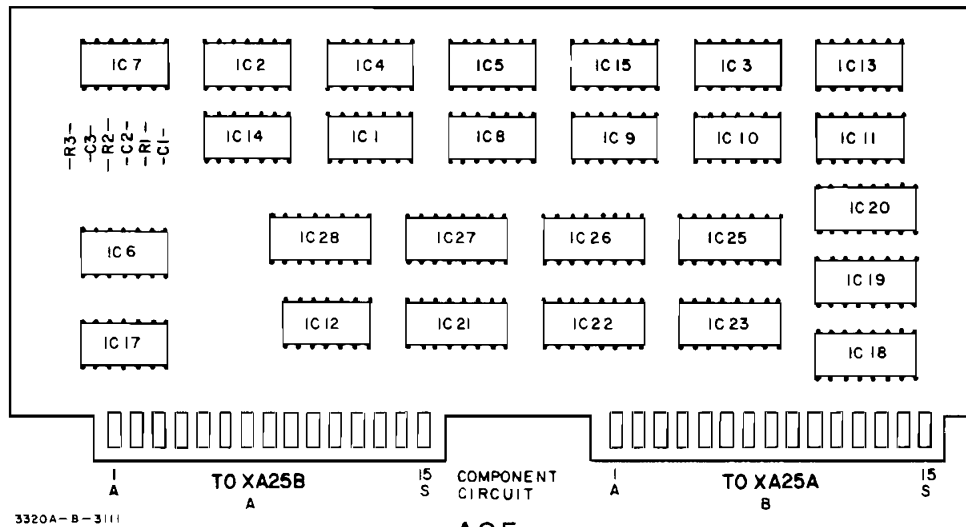
Low input to Clear sets Q to logical 0.
Clear is independent of Clock

BCD
OUTPUT

- 6

ERN OUT

m shift registers



3320A-B-3111

A25

hp Part No. 03320-66525

Rev A

ORE
AFTER
PUTS DO NOT CHANGE
LOCK PULSE
PUTS CHANGE STATES
SE

A25 GPIB LATCHES 03320-66525

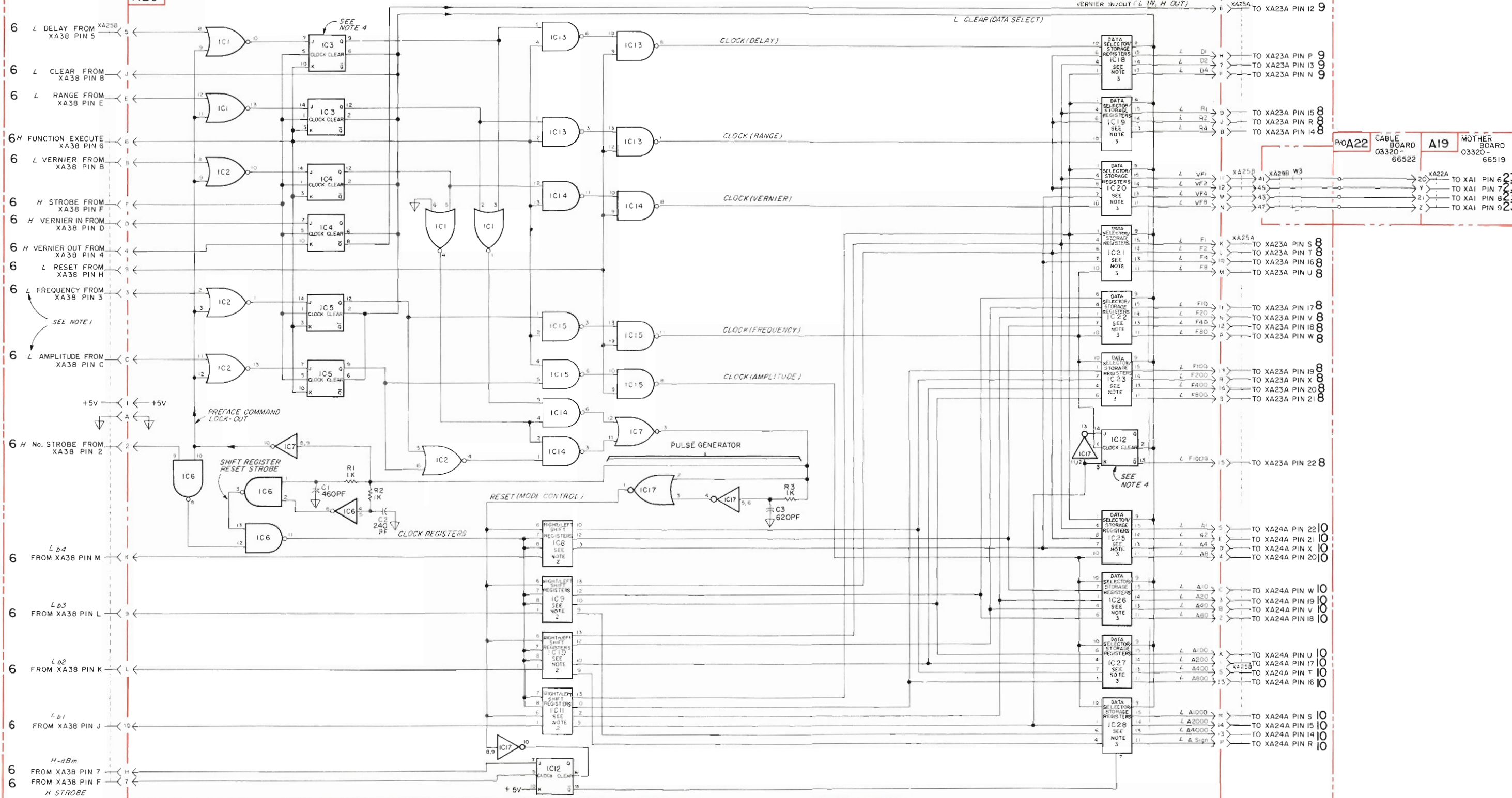


Figure 7-15. GPIB Latches A25, 3320B Option 007.

NOTE 1: Logic signal levels are shown by the letters H or L preceding the name of the line. The H and L indicates the true state (signal present). Voltage levels for the H and L are:

H = +5 V
L = 0 V

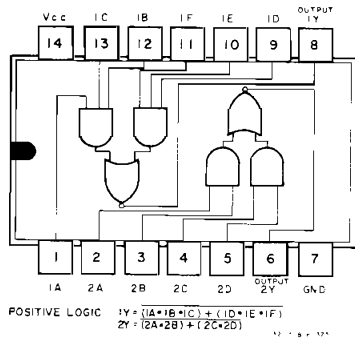
Example:

H Delay Flag – indicates the delay flag line should be +5 V when a delay flag signal is present.

L Data Valid – indicates the data valid line should be 0 V when a data valid signal is present.

NOTE 2: In Remote Mode (A High, B Low) the input on pins 12 and 13 is inverted and applied to pin 8. The input on pin 3 is inverted and applied to pin 6.

In Local Mode (A Low, B High) the input on pins 9 and 10 is inverted and applied to pin 8. The input on pin 5 is inverted and applied to pin 6.



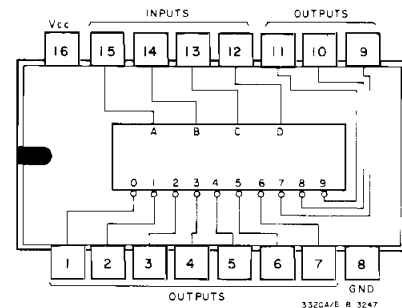
NOTE 3: BCD Low true logic, switch contact(s) to ground is true state.

| Digit | CODE | | | |
|-------|------|---|---|---|
| | 1 | 2 | 4 | 8 |
| 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 |
| 2 | 0 | 1 | 0 | 0 |
| 3 | 1 | 1 | 0 | 0 |
| 4 | 0 | 0 | 1 | 0 |
| 5 | 1 | 0 | 1 | 0 |
| 6 | 0 | 1 | 1 | 0 |
| 7 | 1 | 1 | 1 | 0 |
| 8 | 0 | 0 | 0 | 1 |
| 9 | 1 | 0 | 0 | 1 |

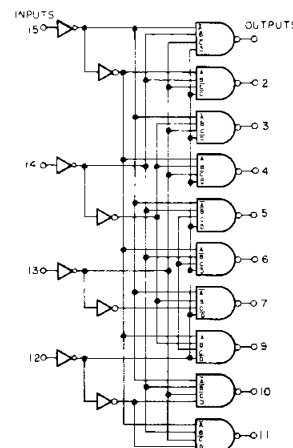
NOTE 4: 9's Complement Circuitry:

| Digit | INPUT | | | | 9's COMPLEMENT | | | |
|-------|-------|---|---|---|----------------|---|---|---|
| | 1 | 2 | 4 | 8 | 1 | 2 | 4 | 8 |
| 0 | L | L | L | L | H | L | L | H |
| 1 | H | L | L | L | L | L | L | H |
| 2 | L | H | L | L | H | H | H | L |
| 3 | H | H | L | L | L | H | H | L |
| 4 | L | L | H | L | H | L | H | L |
| 5 | H | L | H | L | L | L | H | L |
| 6 | L | H | H | L | H | H | L | L |
| 7 | H | H | H | L | L | H | L | L |
| 8 | L | L | L | H | H | L | L | L |
| 9 | H | L | L | H | L | L | L | L |

NOTE 5: On A221C1, input at pin 12 is hard wired low, and output pins 9, 10, and 11 are not used (N/C).

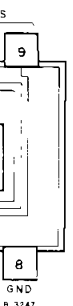


| INPUT | | | | DECIMAL OUTPUT | | | | | | | | | |
|-------|----|----|----|----------------|---|---|---|---|---|---|---|----|----|
| 12 | 13 | 14 | 15 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 9 | 10 | 11 |
| L | L | L | L | L | H | H | H | H | H | H | H | H | H |
| L | L | L | H | H | L | H | H | H | H | H | H | H | H |
| L | L | H | L | H | H | L | H | H | H | H | H | H | H |
| L | L | H | H | H | H | H | L | H | H | H | H | H | H |
| L | H | L | L | H | H | H | H | L | H | H | H | H | H |
| L | H | L | H | H | H | H | H | L | H | H | H | H | H |
| L | H | H | L | H | H | H | H | H | H | L | H | H | H |
| L | H | H | H | H | H | H | H | H | H | H | L | H | H |
| H | L | L | L | H | H | H | H | H | H | H | H | L | L |
| H | L | L | H | H | H | H | H | H | H | H | H | H | L |
| H | L | H | L | H | H | H | H | H | H | H | H | H | H |
| H | L | H | H | H | H | H | H | H | H | H | H | H | H |
| H | H | L | L | H | H | H | H | H | H | H | H | H | H |
| H | H | L | H | H | H | H | H | H | H | H | H | H | H |
| H | H | H | L | H | H | H | H | H | H | H | H | H | H |
| H | H | H | H | H | H | H | H | H | H | H | H | H | H |

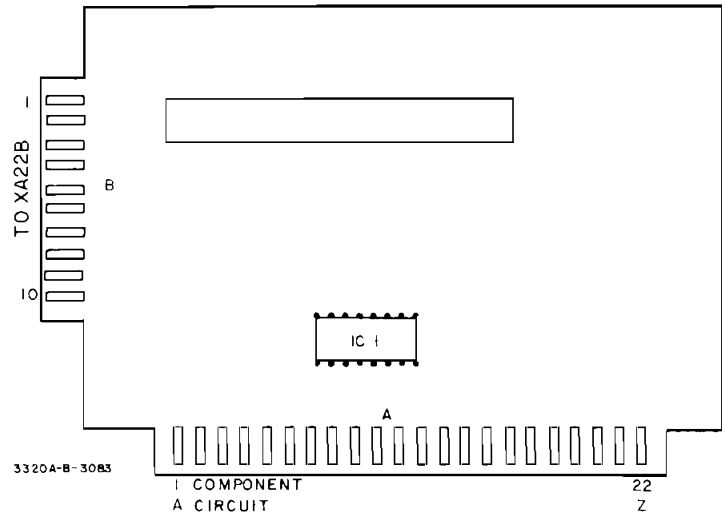


| IMPLEMENT | | |
|-----------|---|---|
| 2 | 4 | 8 |
| L | L | H |
| L | L | H |
| H | H | L |
| H | H | L |
| L | H | L |
| L | H | L |
| L | L | L |
| L | L | L |
| L | L | L |
| L | L | L |

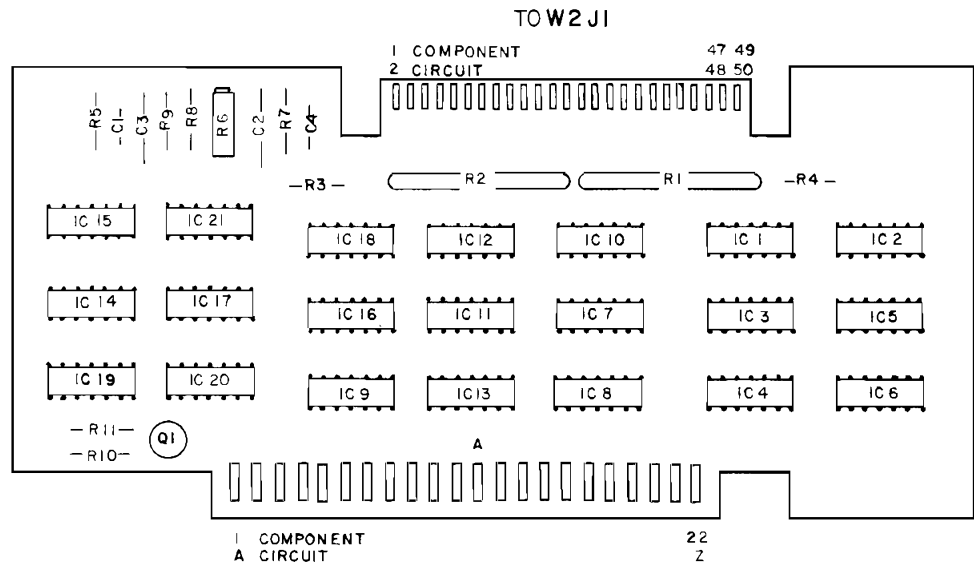
ed low, and output



| T | 7 | 9 | 10 | 11 |
|---|---|---|----|----|
| H | H | H | H | H |
| H | H | H | H | H |
| H | H | H | H | H |
| H | H | H | H | H |
| H | L | H | H | H |
| H | H | L | H | H |
| H | H | H | H | H |
| H | H | H | H | H |
| H | H | H | H | H |
| H | H | H | H | H |

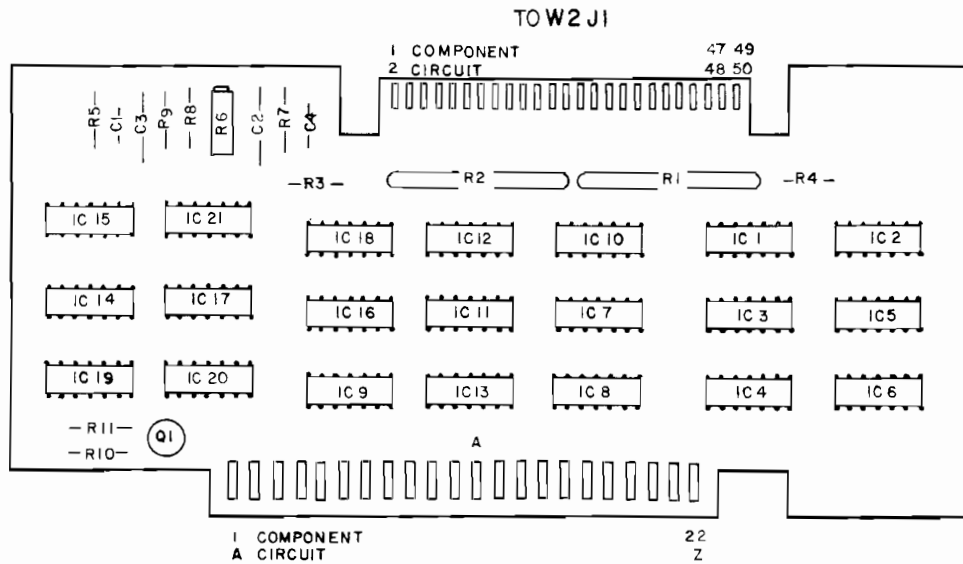


TO XA22A
A22
hp Part No. 03320-66522
Rev A



TO XA23A
A23
hp Part No. 03320-66523
Rev B

3320A-B-2875



3320A-B-28/5

TO XA23A
A23
hp Part No. 03320-66523
Rev B

NOTE 1: Logic signal levels are shown by the letters H or L preceding the name of the line. The H and L indicates the true state (signal present). Voltage levels for the H and L are:

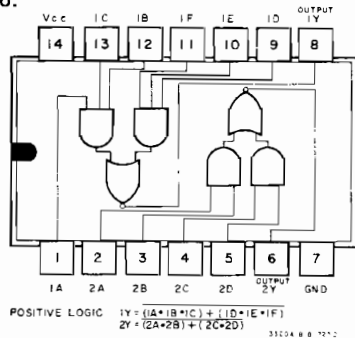
H = +5 V
L = 0 V

Example:

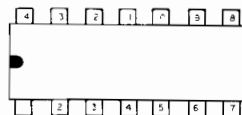
- H Delay Flag — indicates the delay flag line should be +5 V when a delay flag signal is present.
- L Data Valid — indicates the data valid line should be 0 V when a data valid signal is present.

NOTE 2: In Remote Mode (A High, B Low) the input on pins 12 and 13 is inverted and applied to pin 8. The input on pin 3 is inverted and applied to pin 6.

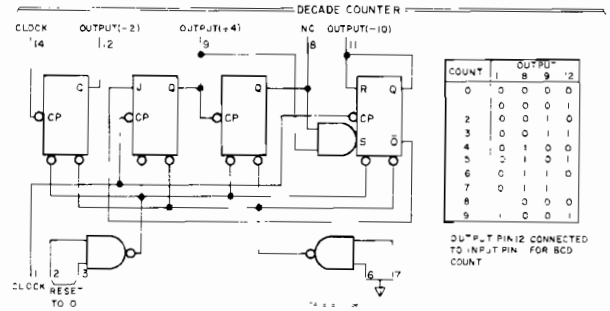
In Local Mode (A Low, B High) the input on pins 9 and 10 is inverted and applied to pin 8. The input on pin 5 is inverted and applied to pin 6.



NOTE 3: Logic diagram of IC is shown below.



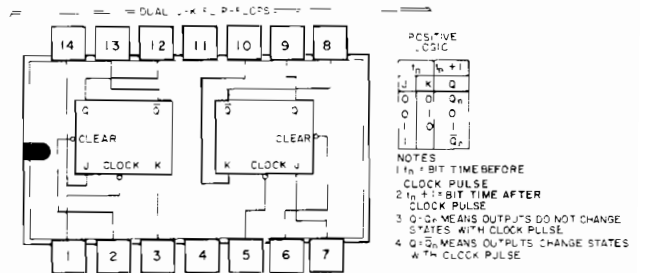
NOTE 3: (CONT'D.)



NOTE 4: Local/Remote select lines from A24 Assembly:

Local mode A Low, B High
Remote mode A High, B Low

NOTE 5: Logic Diagram of IC is shown below.



Low input to Clear sets Q to logical 0.
Clear is independent of Clock

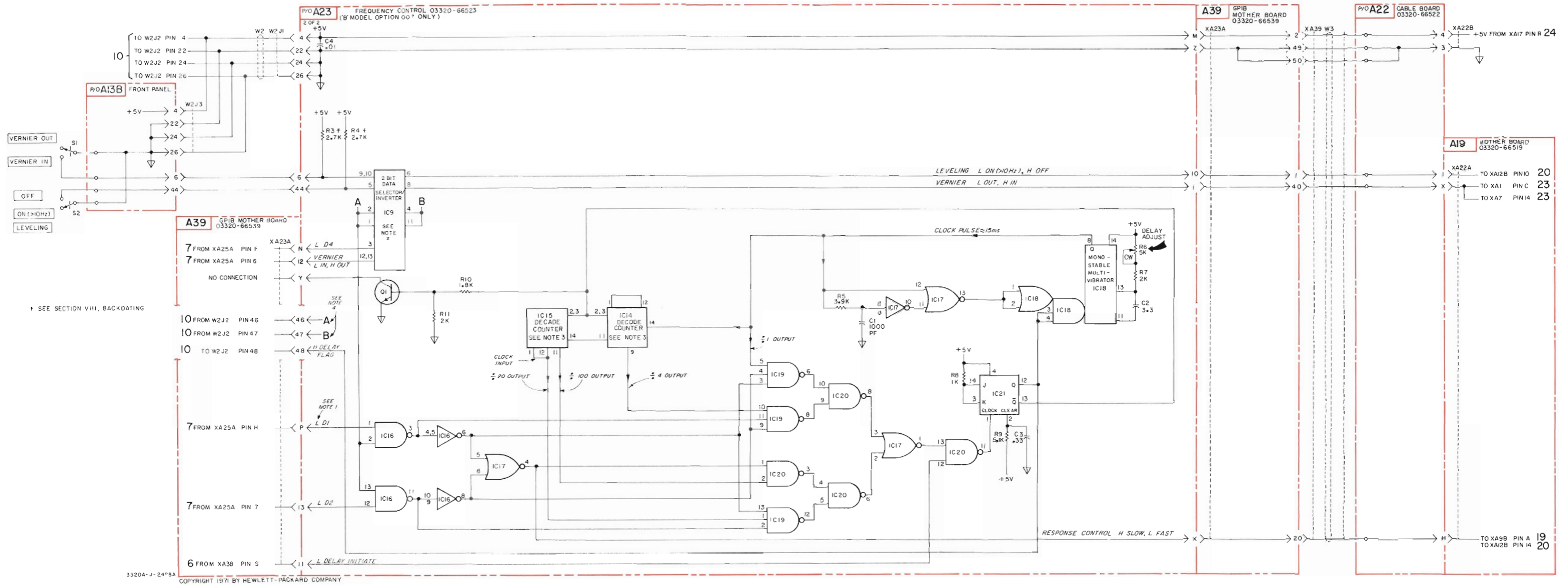


Figure 7-17. GPIB Frequency Control P/O A23, 3320B Option 007.

NOTE 1: Logic signal levels are shown by the letters H or L preceding the name of the line. The H and L indicates the true state (signal present). Voltage levels for the H and L are:

H = +5 V
L = 0 V

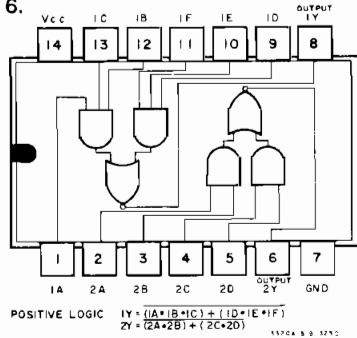
Example:

H Delay Flag – indicates the delay flag line should be +5 V when a delay flag signal is present.

L Data Valid – indicates the data valid line should be 0 V when a data valid signal is present.

NOTE 2: In Remote Mode (A High, B Low) the input on pins 12 and 13 is inverted and applied to pin 8. The input on pin 3 is inverted and applied to pin 6.

In Local Mode (A Low, B High) the input on pins 9 and 10 is inverted and applied to pin 8. The input on pin 5 is inverted and applied to pin 6.



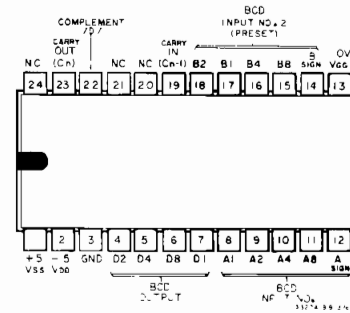
NOTE 3: BCD Low true logic, switch contact(s) to ground is true state.

| Digit | CODE | | | |
|-------|------|---|---|---|
| | 1 | 2 | 4 | 8 |
| 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 |
| 2 | 0 | 1 | 0 | 0 |
| 3 | 1 | 1 | 0 | 0 |
| 4 | 0 | 0 | 1 | 0 |
| 5 | 1 | 0 | 1 | 0 |
| 6 | 0 | 1 | 1 | 0 |
| 7 | 1 | 1 | 1 | 0 |
| 8 | 0 | 0 | 0 | 1 |
| 9 | 1 | 0 | 0 | 1 |

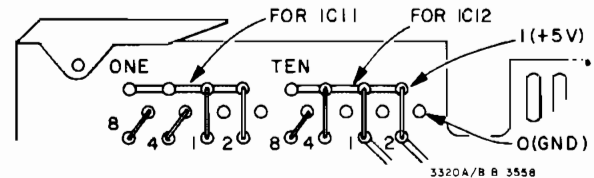
NOTE 4: IC9, 10, 11 or 12 operate as a BCD Adder. The two BCD Inputs (#1 and #2) are summed together and applied to the BCD Output. The BCD inputs and output lines are high true logic. A true signal on the A Sign input indicates a negative amplitude number (i.e., -10.00 dBm). The BCD Input #2 is a "hard wired" input, preset by means of jumper wires on the pc assembly. See Note 5.

The Complement /D/ input controls the BCD output (D1, D2, D4, D8). With the Complement /D/ input high ($\approx +5$ V), the direct BCD sum of inputs #1 and #2 are applied to the BCD Output. With the Complement /D/ input low (≈ -5 V), the 9's complement of the two inputs is applied to the BCD Output. The BCD Output lines have internal pull-up resistors.

Transistor Q1 inhibits a Carry-In signal to IC9 when the Amplitude Sign is positive. Transistors Q2, Q3 and associated circuits (IC13, 14 and 15) control the level of the Complement /D/ input.



NOTE 5: Jumpers on the A24B Assembly for IC11 and IC12 are preset at the factory:



3320B STANDARD, 50 Ω Impedance
(Preset No. 73)

IC12 Jumpered for BCD 7
IC11 Jumpered for BCD 3

3320B OPTION 001, 75 Ω Impedance
(Preset No. 75)

IC12 Jumpered for BCD 7
IC11 Jumpered for BCD 5

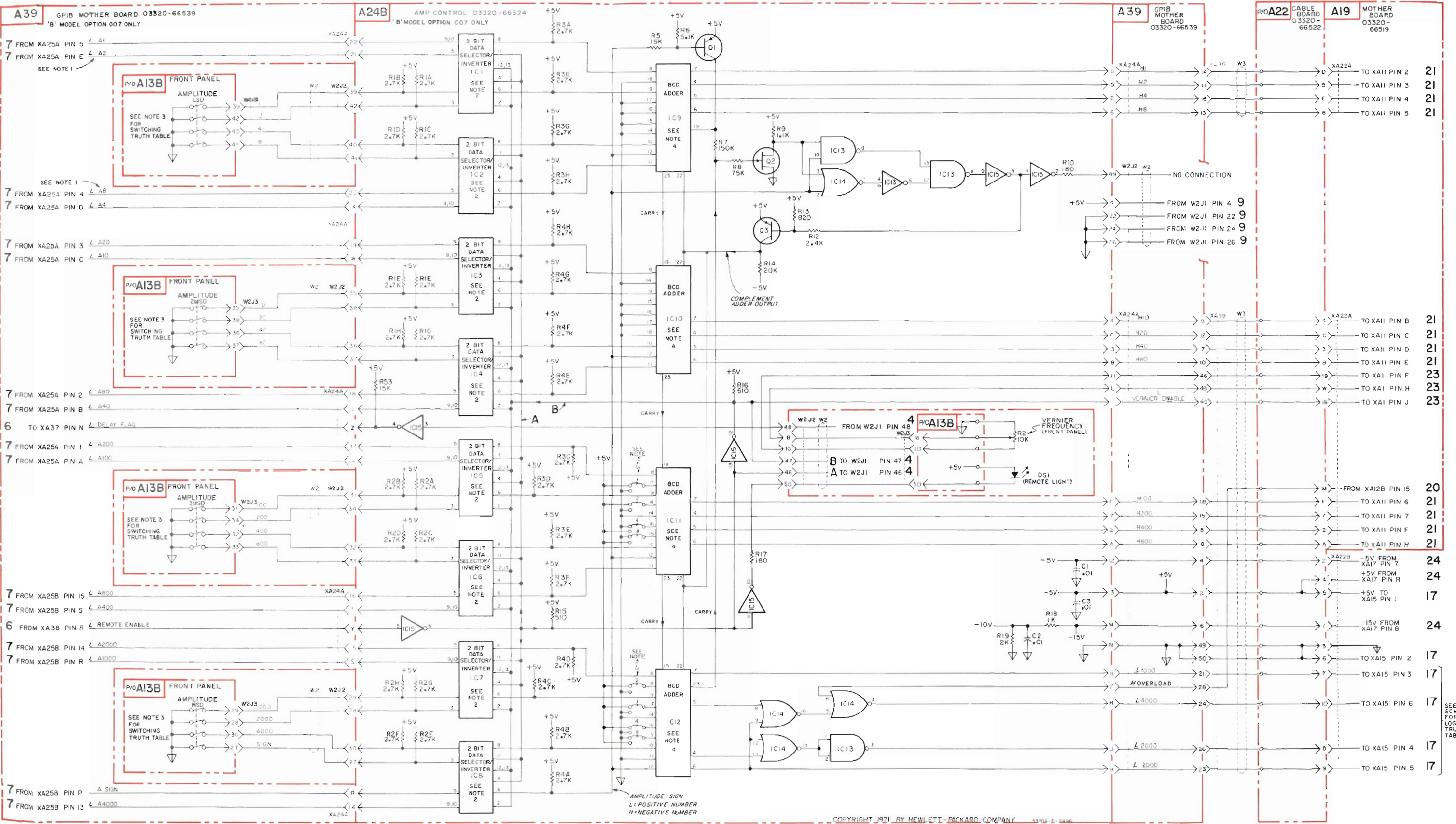
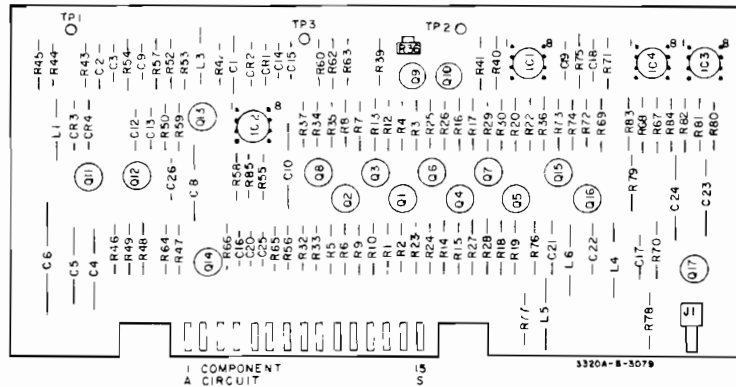


Figure 7-18. GPIB Amplitude Control A24B, 3320B Option 007.



TOXA3 A3
 hp Part No. 03320-66503
 Rev C

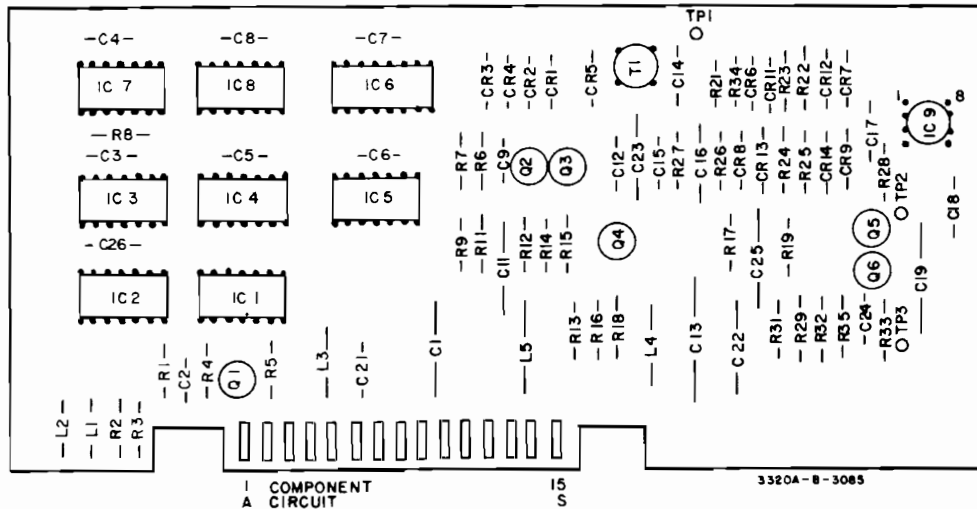
NOTE 1: The following table lists the schematic number and connector number versus instrument type for controller board interfacing:

| SCHEMATIC NUMBER | CONNECTOR NUMBER | INSTRUMENT TYPE |
|------------------|------------------|--|
| 1 | XA20A | "A" Model - Standard, Options 001, 002, 006 |
| 2 | XA21A | "B" Model - Standard, Options 001, 002, 006 |
| 3 | XA22A | "A" Model - Option 003 "B" Model - Option 004 |
| 8 | XA22A | "B" Model - Option 007 |

NOTE 2: Logic levels are high true (+ 5 V)
 (9's complement of front panel settings)

NOTE 3: DC voltage levels on the base and collector of transistors Q1 thru Q8 depend on logic level of base signal. Voltage levels versus logic levels are as follows:

- Logic level high (true) Base = 0.64 Vdc
 Collector = 2.64 Vdc
- Logic level low (false) Base = -1.19 Vdc
 Collector = -5.93 Vdc



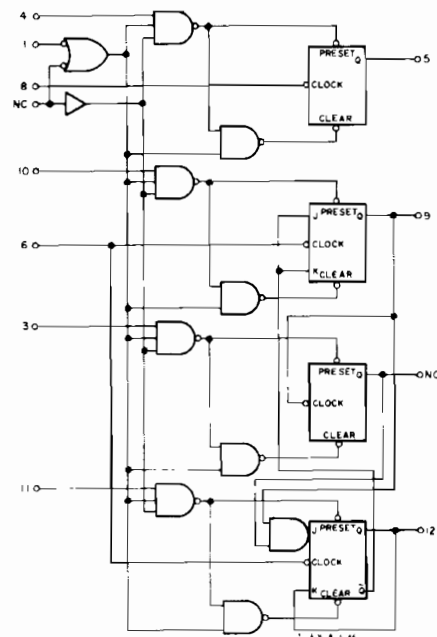
TO XA2 A2
 hp Part No. 03320-66502
 Rev C

NOTE 1: The following table lists the schematic number and connector number versus instrument type for controller board interfacing:

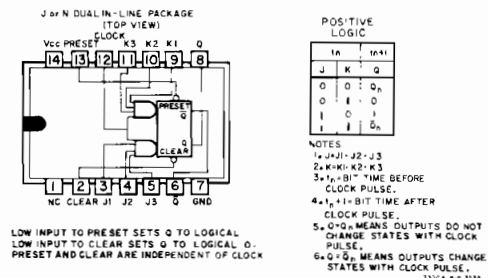
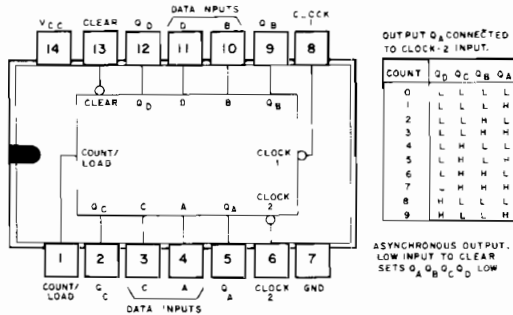
| SCHEMATIC NUMBER | CONNECTOR NUMBER | INSTRUMENT TYPE |
|------------------|------------------|--|
| 1 | XA20A | "A" Model - Standard, Options 001, 002, 006 |
| 2 | XA21A | "B" Model - Standard, Options 001, 002, 006 |
| 3 | XA22A | "A" Model - Option 003 "B" Model - Option 004 |
| 8 | XA22A | "B" Model - Option 007 |

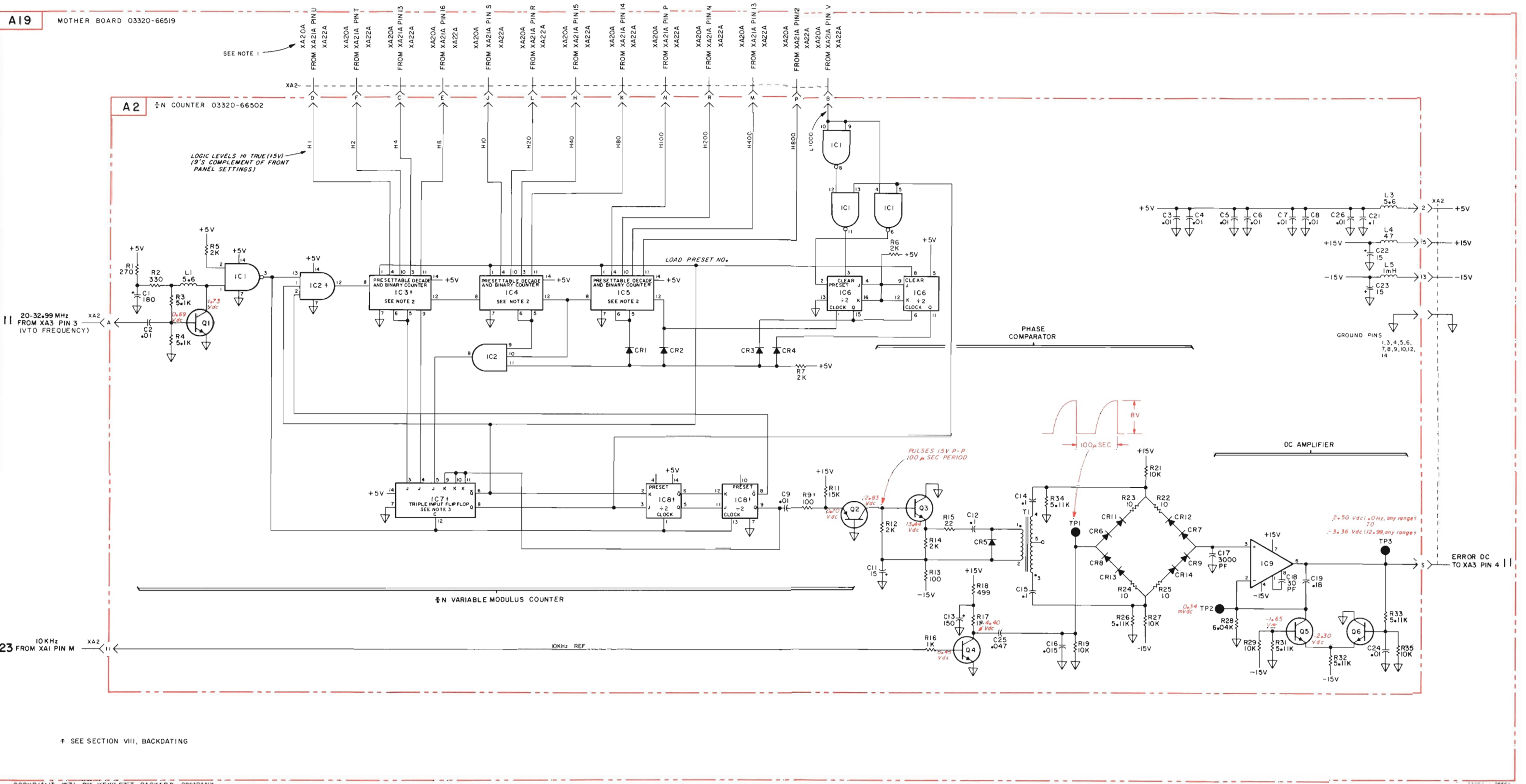
NOTE 2: IC3, IC4 and IC5 are programmable decade counters. The outputs are preset to any state (number) by placing a low on the Count/Load input and parallel loading the desired data (number) on the Data Inputs. The outputs will change to agree with the Data Inputs independently of the state of the clocks.

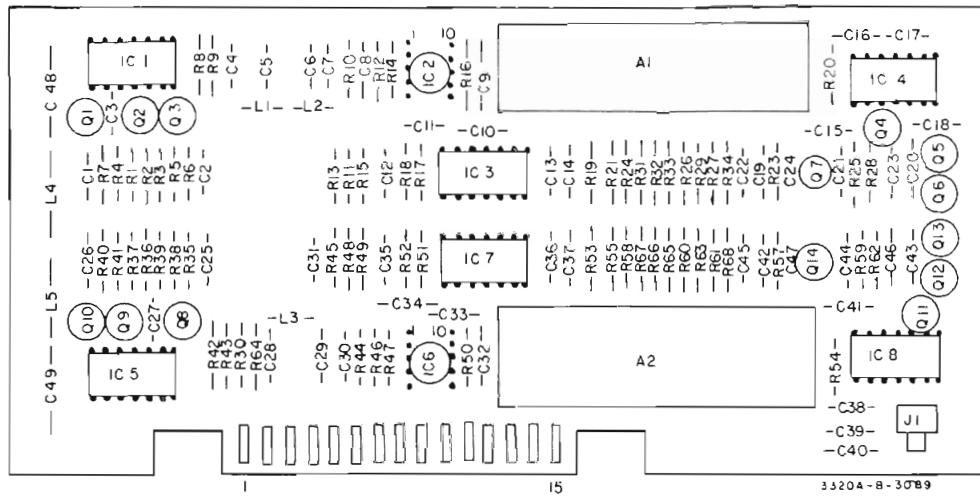
NOTE 2: (CONT'D.)



NOTE 3: Logic diagram of IC is shown below.







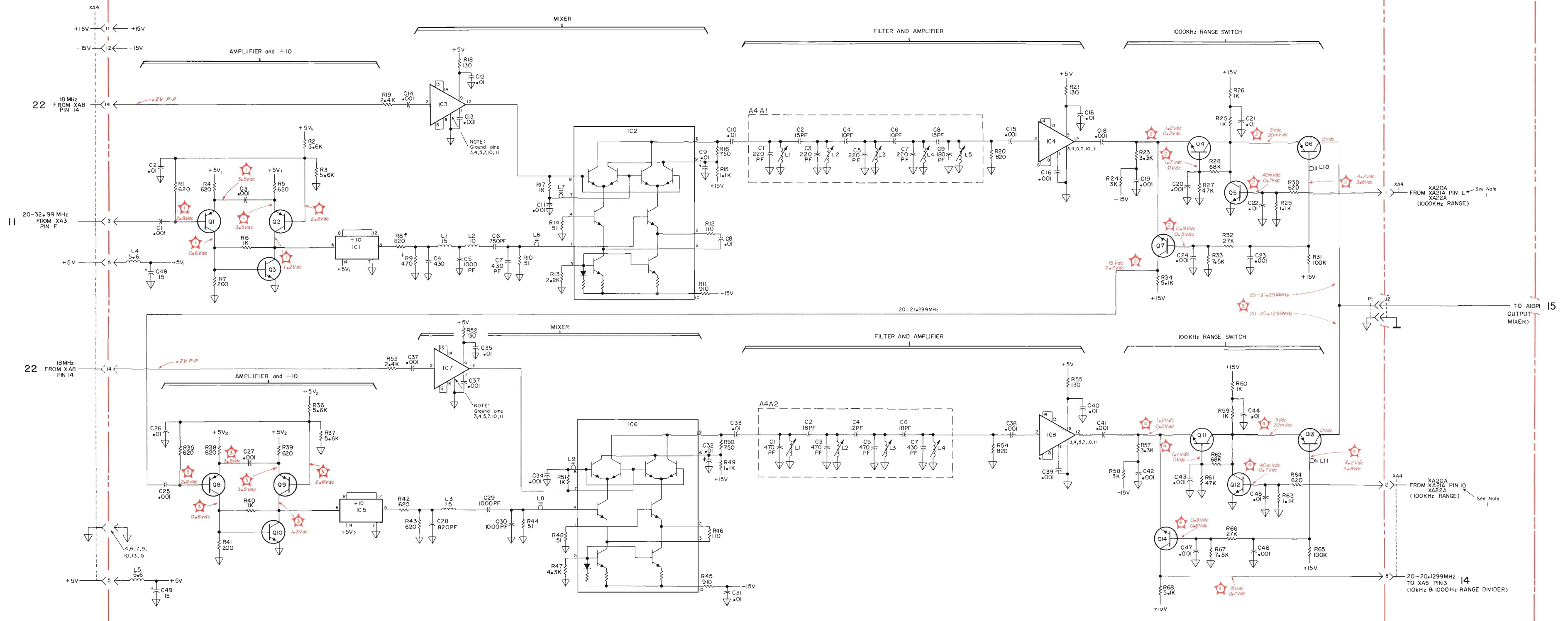
TOXA4 A4
 hp Part No. 03320-66504
 Rev A

NOTE 1: The following table lists the schematic number and connector number versus instrument type for controller board interfacing:

| SCHEMATIC NUMBER | CONNECTOR NUMBER | INSTRUMENT TYPE |
|------------------|------------------|--|
| 1 | XA20A | "A" Model - Standard, Options 001, 002, 006 |
| 2 | XA21A | "B" Model - Standard, Options 001, 002, 006 |
| 3 | XA22A | "A" Model - Option 003 "B" Model - Option 004 |
| 8 | XA22A | "B" Model - Option 007 |

- 1 DC voltages on Q1, Q2, Q3 measured with 3320A/B in 1000 kHz range position using high input resistance, low capacitance voltmeter (-hp- 412A).
- 2 Top voltage measured with 3320A/B in 1000 kHz range position.
Bottom voltage measured with 3320A/B in any other range position.
- 3 DC voltages on Q8, Q9, Q10 measured with 3320A/B in 100 kHz range position using high input resistance, low capacitance voltmeter (-hp- 412A).
- 4 Top voltage measured with 3320A/B in 100 kHz range position.
Bottom voltage measured with 3320A/B in any other range position.
- 5 .7 to .9 V p-p on 1000 kHz or 100 kHz range position.

A4 RANGE DIVIDER 03320-66504

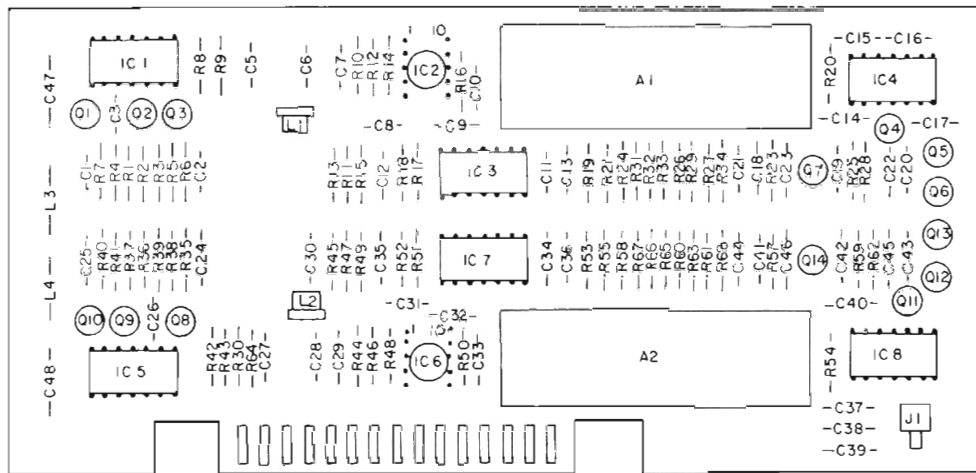


* SEE SECTION VIII, BACKDATING

COPYRIGHT 1971 BY HEWLETT-PACKARD COMPANY

5380A-j-255

Figure 7-21. Range Divider A4. 13
7-43/7-44



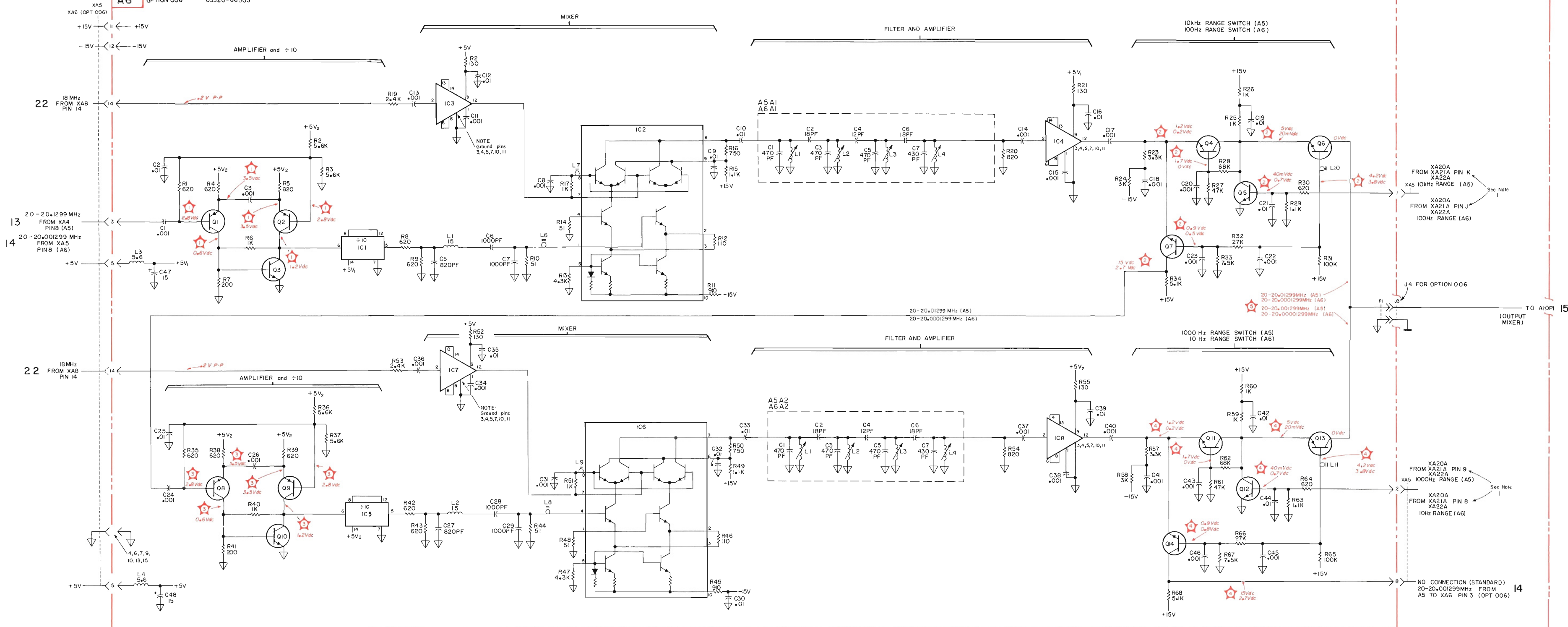
TO XA5/XA6 A5 or A6
 hp Part No. 03320-66505
 Rev A

NOTE 1: The following table lists the schematic number and connector number versus instrument type for controller board interfacing:

| SCHEMATIC NUMBER | CONNECTOR NUMBER | INSTRUMENT TYPE |
|------------------|------------------|--|
| 1 | XA20A | "A" Model - Standard, Options 001, 002, 006 |
| 2 | XA21A | "B" Model - Standard, Options 001, 002, 006 |
| 3 | XA22A | "A" Model - Option 003 "B" Model - Option 004 |
| 8 | XA22A | "B" Model - Option 007 |

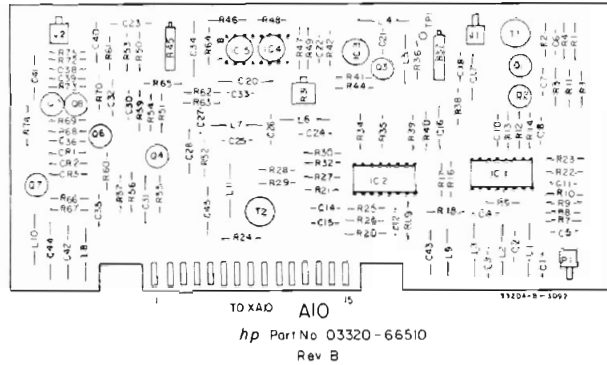
- 1** DC voltages on Q1, Q2, Q3 measured with 3320A/B in 10 kHz (100 Hz for A6, Option 006) range position using high input resistance, low capacitance voltmeter (-hp-412A).
- 2** Top voltage measured with 3320A/B in 10 kHz range (100 Hz range for A6, Option 006) position. Bottom voltage measured with 3320A/B in any other range.
- 3** DC voltages on Q8, Q9, Q10 measured with 3320A/B in 1000 Hz (10 Hz for A6, Option 006) range position using high input resistance, low capacitance voltmeter (-hp-412A).
- 4** Top voltage measured with 3320A/B in 1000 Hz range (10 Hz range for A6, Option 006) position. Bottom voltage measured with 3320A/B in any other range position.
- 5** .7 to .9 V p-p on 10 kHz and 1000 Hz ranges (100 Hz and 10 Hz ranges for A6, Option 006).

| | | |
|----|---------------|-------------|
| A5 | RANGE DIVIDER | 03320-66505 |
| A6 | OPTION 006 | 03320-66505 |

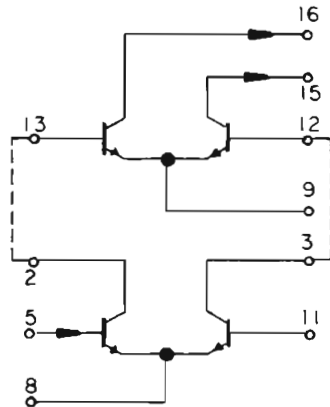


COPYRIGHT 1971 BY HEWLETT-PACKARD COMPANY

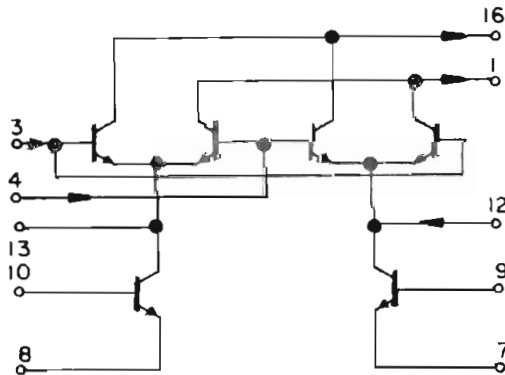
Figure 7-22. Range Divider A5, 3320A/B Standard; Range Divider A6, 3320A/B Option 006.



NOTE 1: IC1 is a high frequency transistor array consisting of 4 transistors for use as a limiter. Circuit diagram is shown below.



NOTE 2: IC2 is a high frequency transistor array consisting of 6 transistors for use as a mixer. Circuit diagram is shown below.

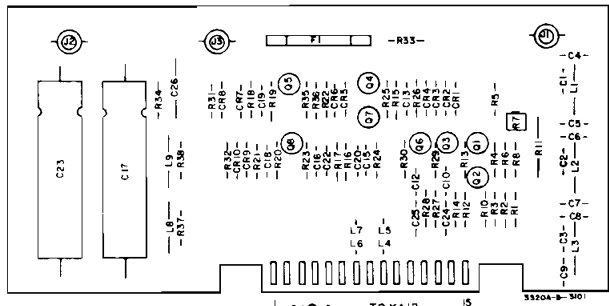


- 1
- 2
- 3

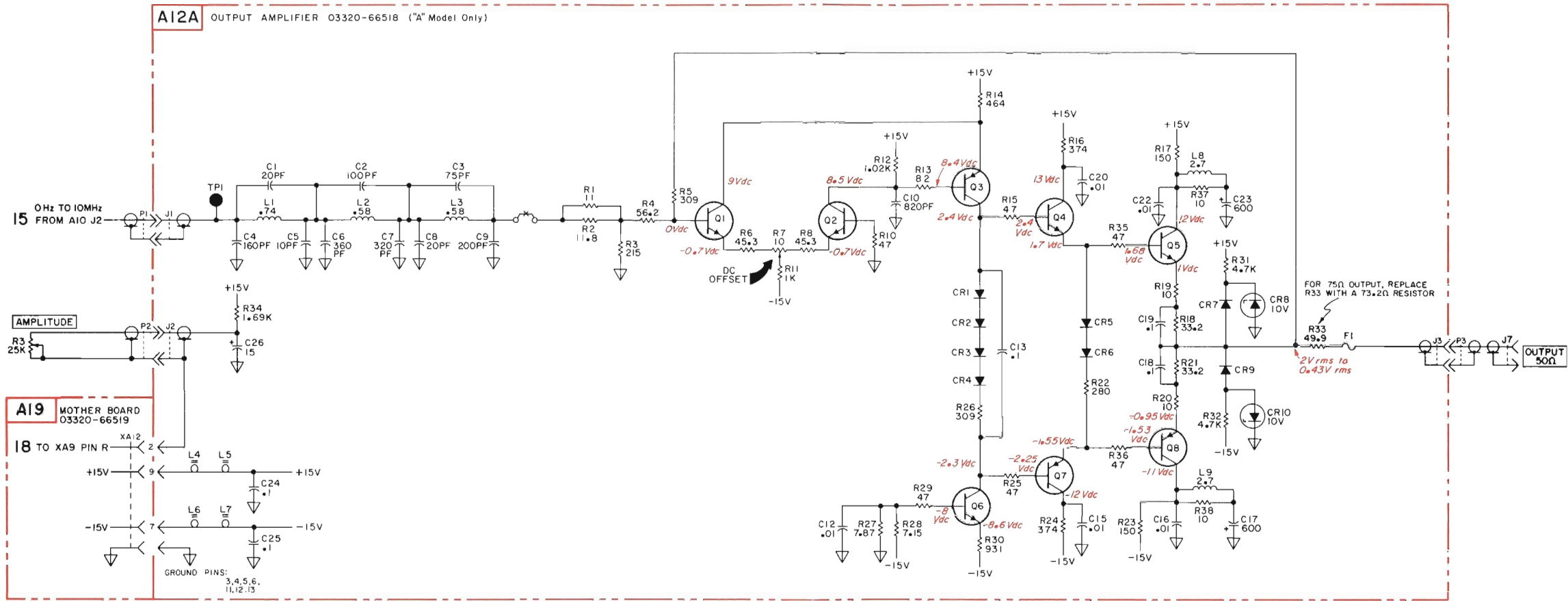
.3 to .9 V p-p varies with range setting.

For 3320B with 50 Ω output voltage varies from $\approx .1$ V p-p at +17.00 dBm to $\approx .3$ V p-p at +16.99 dBm. NOTE: to prevent oscillations, make measure on bottom side of mother board with A10 in place.

0 Hz to 12.99 MHz. For 3320B with 50 Ω output, 3 V p-p at +17.00 dBm. 5 V p-p at +16.99 dBm. NOTE: with BRN (PRE AMP OUT) cable disconnected.



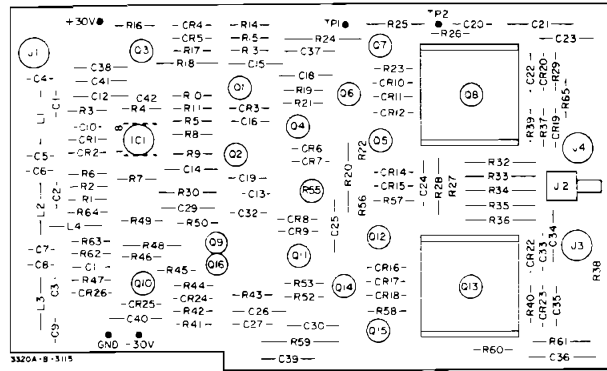
A12 A TO XA12
 hp Part No 03320-66518
 Rev A



COPYRIGHT 1971 BY HEWLETT-PACKARD COMPANY

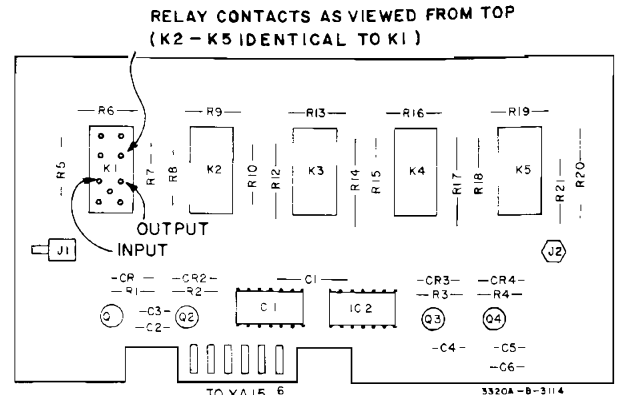
3320A-0-2555

16
Figure 7-24. Power Amplifier A12A, 3320A.



A14

hp Part No. 03320-66514
Rev. A



A15

hp Part No. 03320-66515 (STANDARD)
03320-66556 (OPTION 001)
Rev D

NOTE 1: The following table lists the schematic number and connector number versus instrument type for controller board interfacing:

| SCHEMATIC NUMBER | CONNECTOR NUMBER | INSTRUMENT TYPE |
|------------------|------------------|---|
| 2 | XA21A | "B" Model - Standard, Options 001, 002, 006 |
| 5 | XA22B | "B" Model - Option 004 |
| 10 | XA22B | "B" Model - Option 007 |

NOTE 2: The Low Level Out varies with settings of amplitude controls. At maximum output (+ 26.99 dBm for 50 Ω, + 24.99 dBm for 75 Ω), the output is 158 mV. At all levels in 10 dB steps down from maximum output, the Low Level Out is 158 mV. See output level for standard (50 Ω) unit listed below.

NOTE 2: (CONT'D.)

| AMPLITUDE | LOW LEVEL OUT |
|-----------|---------------|
| + 26.99 | 158 mV |
| + 17.00 | 50 mV |
| + 16.99 | 158 mV |
| + 7.00 | 50 mV |
| + 6.99 | 158 mV |
| - 3.00 | 50 mV |
| - 3.01 | 158 mV |
| - 13.00 | 50 mV |
| - 13.01 | 158 mV |
| . | . |
| . | . |

NOTE 3: To prevent oscillations on A14 Assembly, measure dc voltage levels with high input resistance, low capacitance voltmeter (-hp-412A).

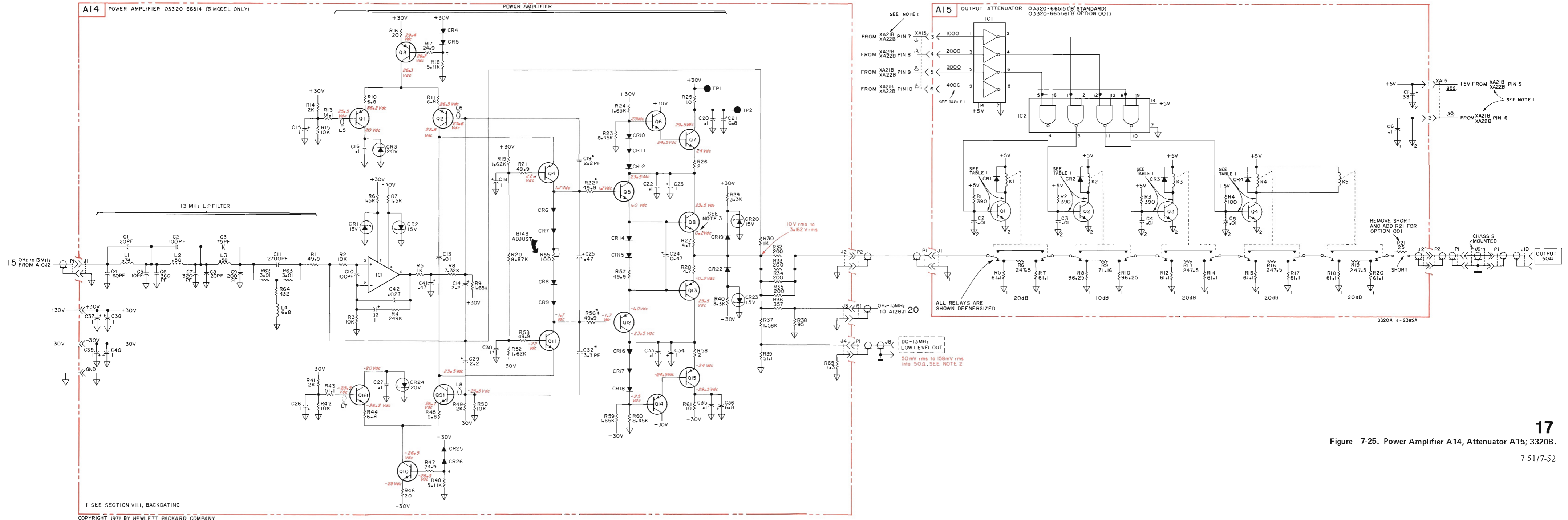
Table 1. Output Attenuator.

LOW signals (0 V) at inputs (pins 3, 4, 5, and 6) puts in attenuation by de-energizing respective reed relay(s). This attenuator provides 0dB of attenuation when amplitude is set for maximum output (+ 26.99 for 50 Ω, + 24.99 for 75 Ω). Switching occurs in 10 dB steps down from maximum output. A truth table for various amplitude settings is listed below:

| AMPLITUDE* SETTING | INPUT LINES (LOW true) | | | | ATTENUATION (thru A15) | TRANSISTORS | | | |
|-----------------------|------------------------|------|------|------|---------------------------|-------------|----|----|----|
| | 4000 | 2000 | 2000 | 1000 | | Q1 | Q2 | Q3 | Q4 |
| + 26.99 | H | H | H | H | 0 dB | - | - | - | - |
| + 16.99 | H | H | H | L | 10 dB | - | X | - | - |
| + 6.99 | H | L | H | H | 20 dB | X | - | - | - |
| - 3.01 | H | L | H | L | 30 dB | X | X | - | - |
| - 13.01 | H | L | L | H | 40 dB | X | - | X | - |
| - 23.01 | H | L | L | L | 50 dB | X | X | X | - |
| - 33.01 | L | L | H | H | 60 dB | X | - | - | X |
| - 43.01 | L | L | H | L | 70 dB | X | X | - | X |
| - 53.01 | L | L | L | H | 80 dB | X | - | X | X |
| - 63.01 | L | L | L | L | 90 dB | X | X | X | X |

*For Standard 3320B (50 Ω output)

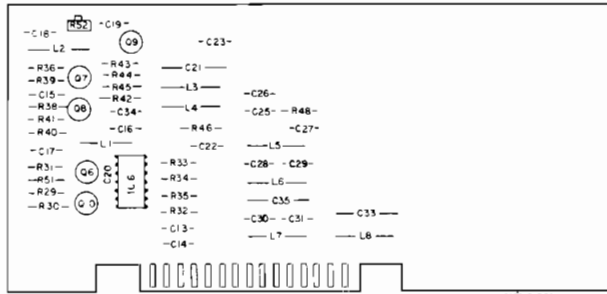
H = + 5 V, L = 0 V, - = transistor(s) ON, X = transistor(s) OFF



17

Figure 7-25. Power Amplifier A14, Attenuator A15; 3320B.

7-51/7-52



COMPONENT
A S

330A-B-1094

TOXA9 A9A
hp Part No. 03320-66533
Rev A

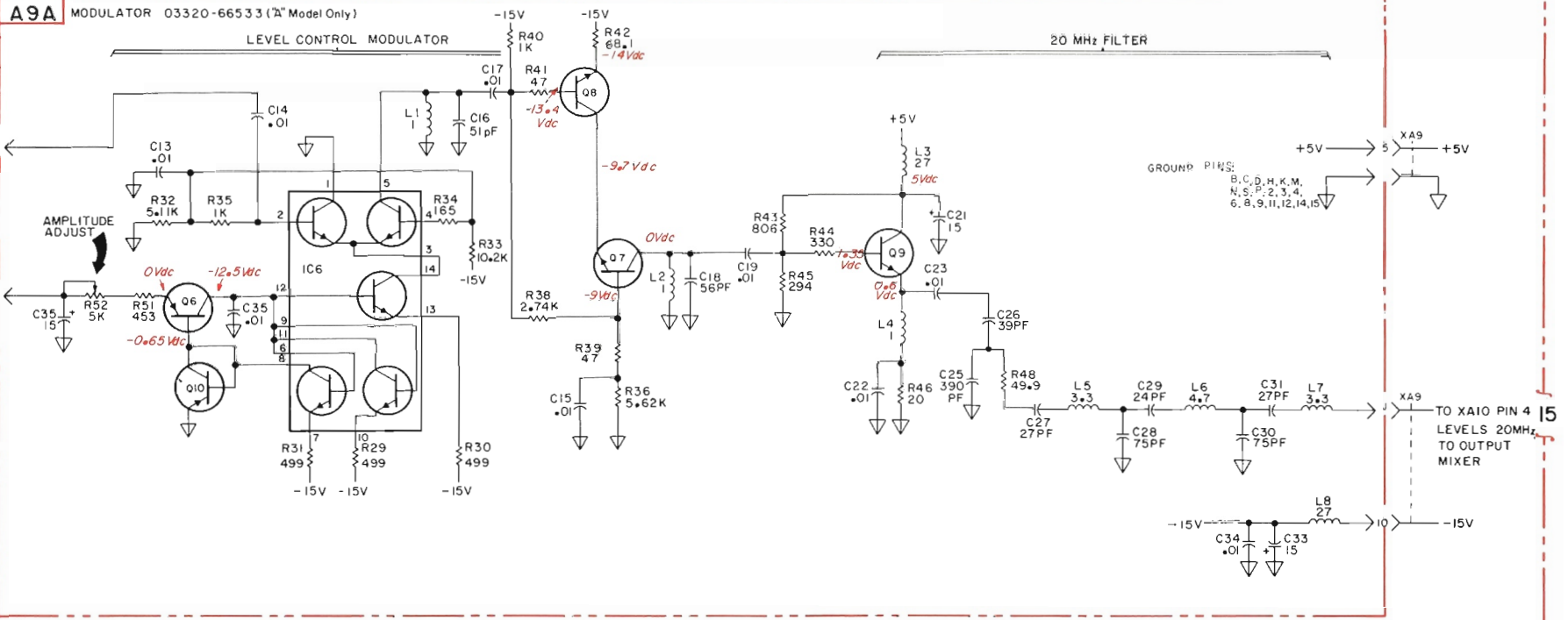
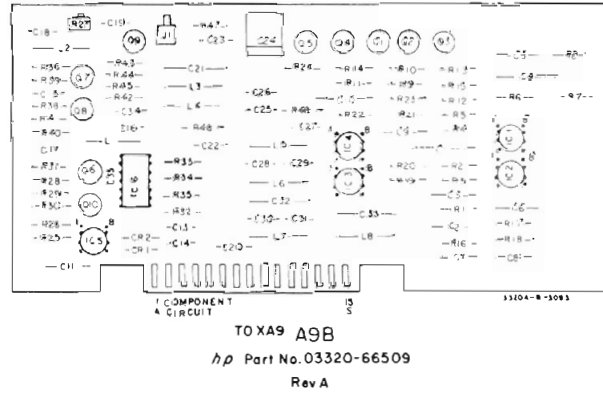


Figure 7-26. Modulator A9A, 3320A.



NOTE 1: Logic signal levels are shown by the letters H or L preceding the name of the line. The H and L indicates the true state (signal present). Voltage levels for the H and L are:

H = + 5 V
L = 0 V

Example:

H Delay Flag — indicates the delay flag line should be + 5 V when a delay flag signal is present.

L Data Valid — indicates the data valid line should be 0 V when a data valid signal is present.

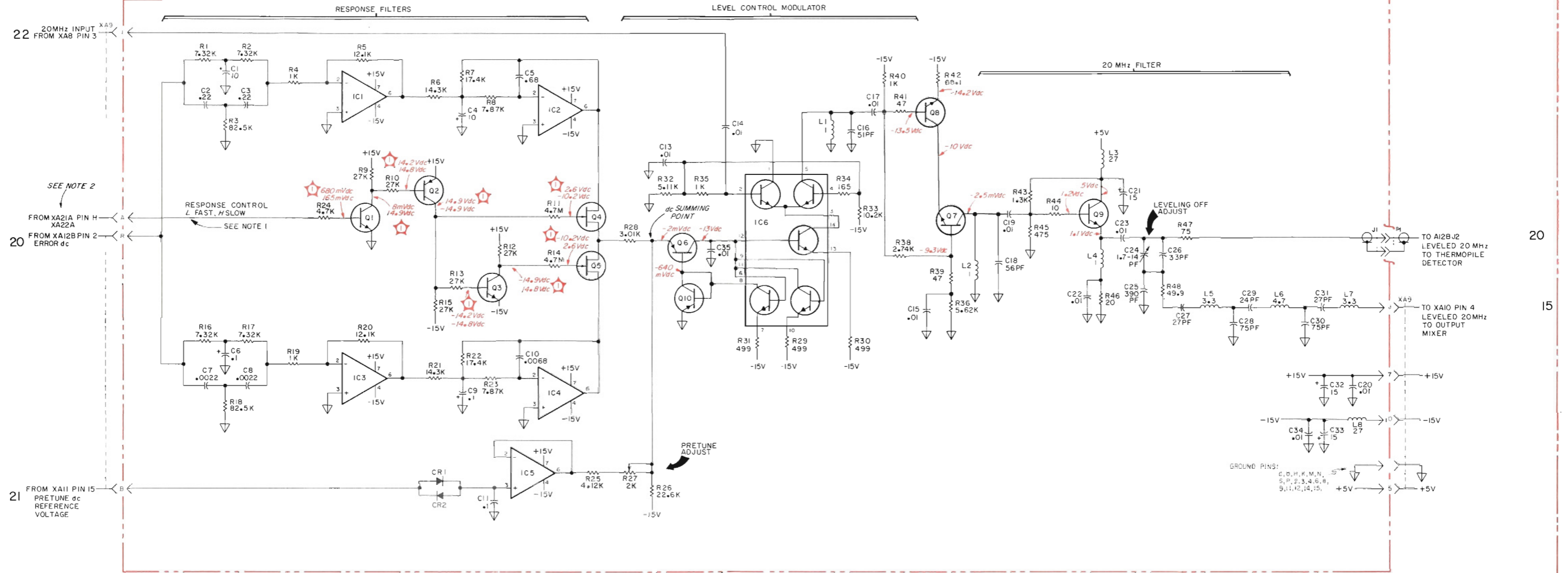
NOTE 2: The following table lists the schematic number and connector number versus instrument type for controller board interfacing:

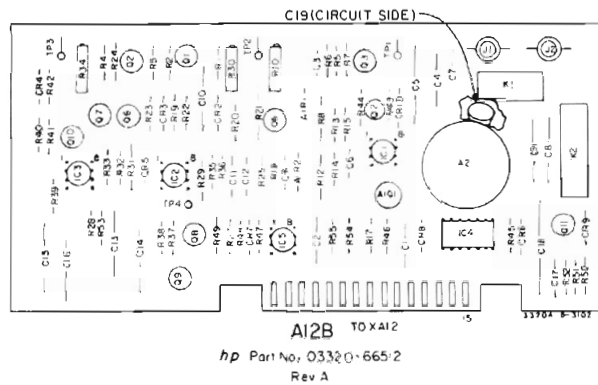
| SCHEMATIC NUMBER | CONNECTOR NUMBER | INSTRUMENT TYPE |
|------------------|------------------|---|
| 2 | XA21A | "B" Model — Standard, Options 001, 002, 006 |
| 4 | XA22A | "B" Model — Option 004 |
| 9 | XA22A | "B" Model — Option 007 |



Top voltage for Response Slow.
Bottom voltage for Response Fast.
NOTE: In local mode response is always slow.

A9B MODULATOR 03320-66509 ("B" Model Only)





NOTE 1: The following table lists the schematic number and connector number versus instrument type for controller board interfacing:

| SCHEMATIC NUMBER | CONNECTOR NUMBER | INSTRUMENT TYPE |
|------------------|------------------|---|
| 2 | XA21A | "B" Model — Standard, Options 001, 002, 006 |
| 4,5 | XA22A | "B" Model — Option 004 |
| 9,10 | XA22A | "B" Model — Option 007 |

NOTE 2: Logic signal levels are shown by the letters H or L preceding the name of the line. The H and L indicate the true state (signal present). Voltage levels for the H and L are:

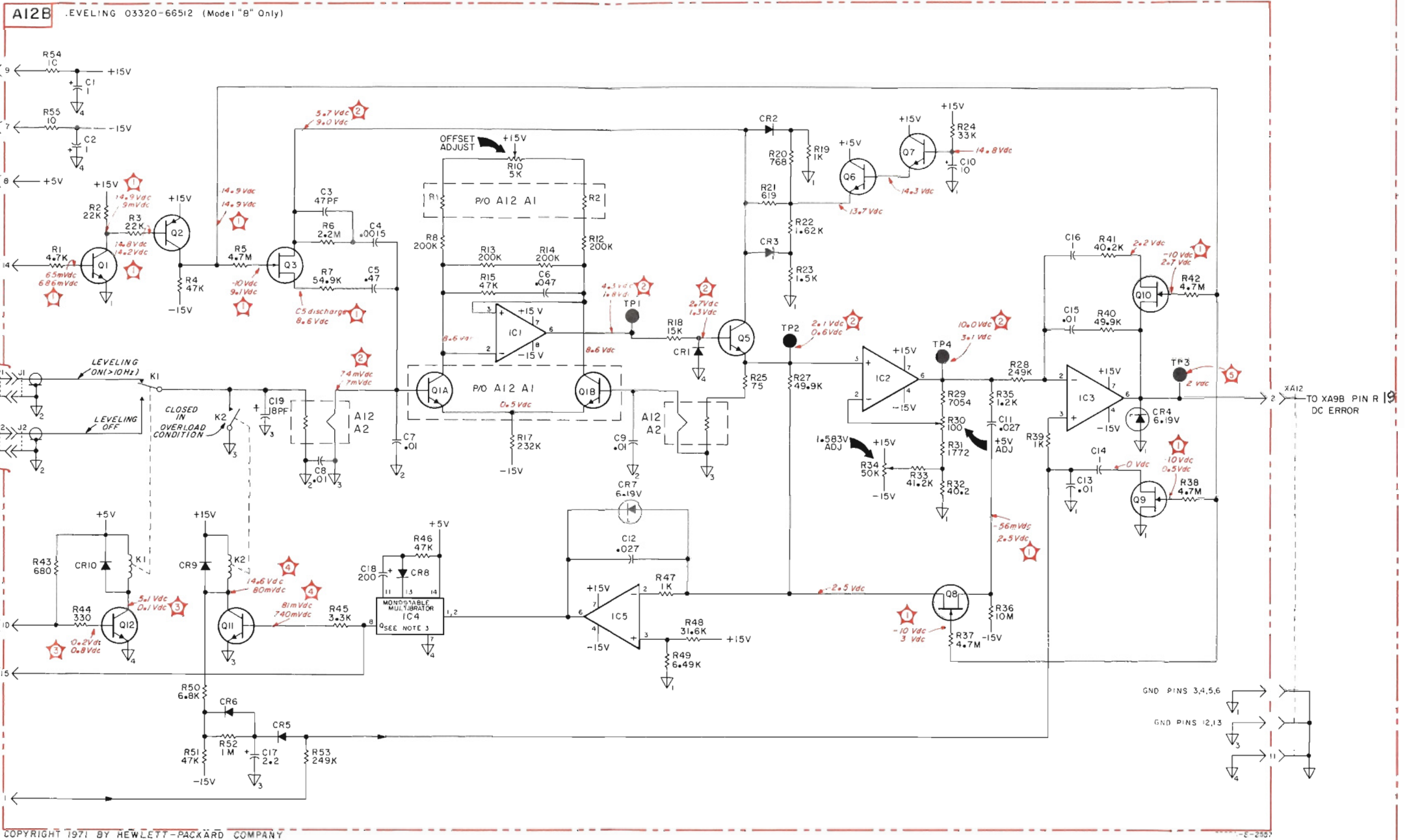
H = +5V
L = 0 V

Example:

- H Delay Flag — indicates the delay flag line should be +5V when a delay flag signal is present.
- L Data Valid — indicates the data valid line should be 0 V when a data valid signal is present.

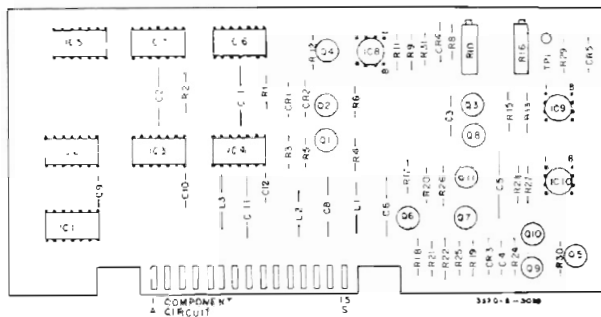
NOTE 3: IC4 is connected to function as a Monostable Flip-flop with negative edge triggering. The Q output will remain high for approximately 5 seconds. This IC is identical to Fairchild 9601.

- 1** Top voltage for Response Slow.
Bottom voltage for Response Fast
Note: in local mode response is always slow
- 2** Top voltage measured with BCD Inputs on A11 Assembly (Schematic 21) at 999%
Bottom voltage measured with BCD Inputs on A11 Assembly at 000.
See Schematic 21, Note 2.
- 3** Top voltage, Leveling ON.
Bottom voltage, Leveling OFF.
- 4** Top voltage, normal operation.
Bottom voltage, overload condition.
- 5** Typically +2 V dc but must remain within $\pm .2$ V dc with any change in amplitude setting with Leveling ON.



† SEE SECTION VIII, BACKDATING

20
Figure 7-28. Detector A12B, 3320B.



TO XA11 A11
hp Part No 03320-66511
Rev A

NOTE 1: The following table lists the schematic number and connector number versus instrument type for controller board interfacing:

| SCHEMATIC NUMBER | CONNECTOR NUMBER | INSTRUMENT TYPE |
|------------------|------------------|---|
| 2 | XA21A | "B" Model - Standard, Options 001, 002, 006 |
| 5 | XA22A | "B" Model - Option 004 |
| 10 | XA22A | "B" Model - Option 007 |

NOTE 2: Logic Signal levels for BCD INPUTS are indicated by the H preceding the BCD weighting. The H indicates the true state (signal present).

Voltage levels are:
H = +5 V
L = 0 V

The BCD INPUTS to the A11 Assembly varies with amplitude setting. The BCD INPUTS may be determined by subtracting the maximum amplitude setting (+26.99 for 50 Ω output) from the amplitude setting and then taking the 9's complement of the last three digits.

Example with + dBm setting:

$$\begin{array}{r}
 \text{max. amplitude} \quad +26.99 \\
 \text{subtract amplitude setting} \quad -(+16.99) \\
 \hline
 \quad \quad \quad \quad \quad \quad 1000 \\
 \text{9's complement of} \quad \quad \quad 999 \\
 \text{last 3 digits.} \\
 \hline
 999 = \text{BCD inputs to A11}
 \end{array}$$

The first digit (1 in these examples) controls the 10 dB step attenuator on the A15 assembly (Schematic 17).

Example with - dBm setting:

$$\begin{array}{r}
 \text{max. amplitude} \quad +26.99 \\
 \text{subtract amplitude setting} \quad -(-12.00) \\
 \hline
 \quad \quad \quad \quad \quad \quad 3899 \\
 \text{9's complement} \quad \quad \quad 200 \\
 \hline
 200 = \text{BCD inputs to A11}
 \end{array}$$

NOTE 3: IC2, IC3 and IC4 are programmable decade counters. The outputs are preset to any state (number) by placing a low on the Count/Load input and parallel loading the desired data (BCD INPUT number) on the Data Inputs. The outputs will change to agree with the Data Inputs independently of the state of the clocks.

NOTE 4: IC6 and IC7 are connected to function as Monostable Flip-Flops with positive edge triggering. The Q output on IC6 will remain high for approximately 25 μsec. The Q output on IC7 will remain high for approximately 50 μsec. Identical to Fairchild Retriggerable Monostable Multivibrator 9601.

1. Top voltage with BCD INPUTS = 999. amplitude setting of +16.99 dBm for 3320B with 50 Ω output.

Bottom voltage with BCD INPUTS = 000 amplitude setting of +17.00 dBm for 3320B with 50 Ω output.

2. Amount of capacitor, C3, discharge (Delay) varies with amplitude setting and may be observed with an oscilloscope:

- At maximum amplitude setting and at all levels 10 dB down from maximum amplitude, there is no discharge and the capacitor remains at +10 V. Examples for 3320B with 50 Ω output:

| Amplitude Setting | BCD INPUTS | Capacitor Discharge |
|-------------------|------------|---------------------|
| + 26.99 | 999 | + 10 V |
| + 16.99 | 999 | + 10 V |
| + 6.99 | 999 | + 10 V |
| - 3.01 | 999 | + 10 V |
| - 13.01 | . | . |
| . | . | . |
| . | . | . |
| . | . | . |

- Capacitor, C3, discharges from +10 V to +3.165 V at 9.99 dB down from maximum output. Or, any time the BCD INPUTS to A11 = 000.

3. For 3320B with 50 Ω output:
+10.000 V dc ± .002 V at +16.99 dBm
+3.1659 V dc ± .0006 V at +17.00 dBm

A11 D/A 03320-66511 (3320B STANDARD)
03320-66540 (3320B OPTION 001)

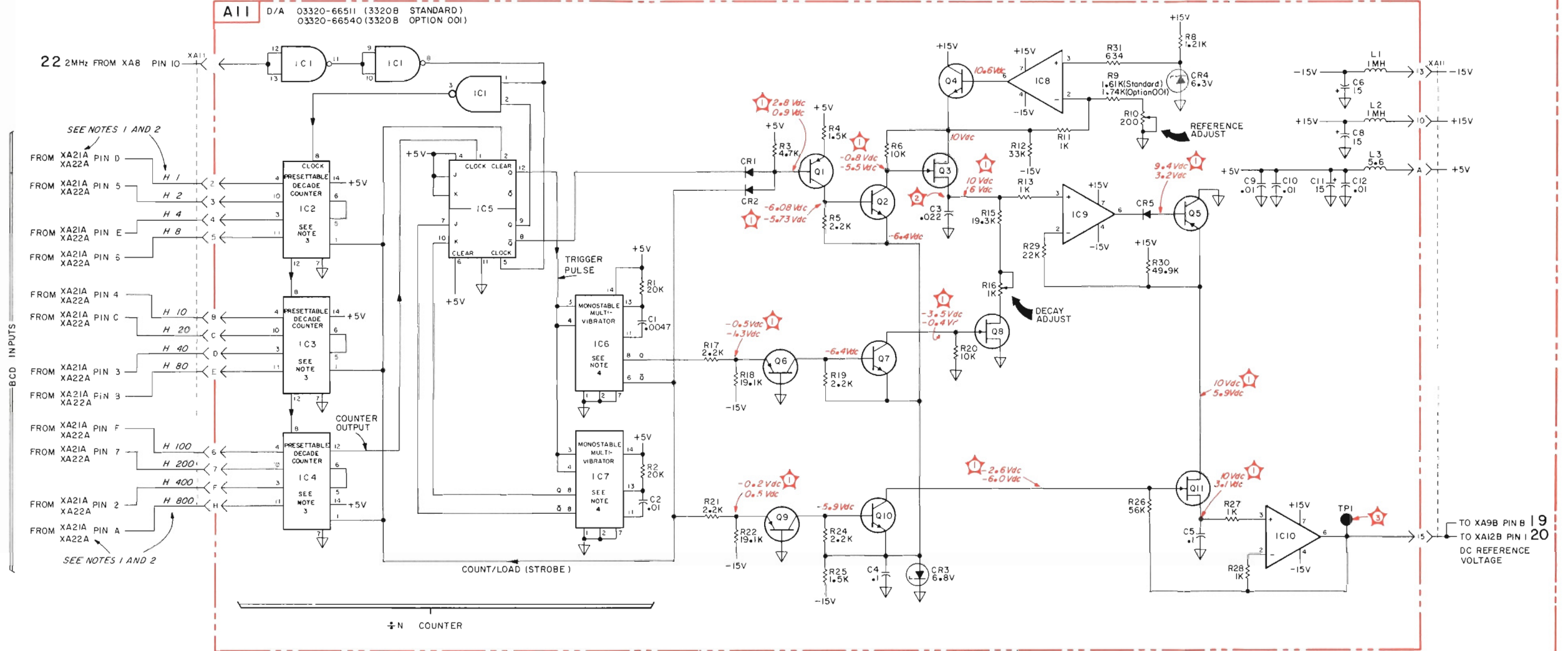
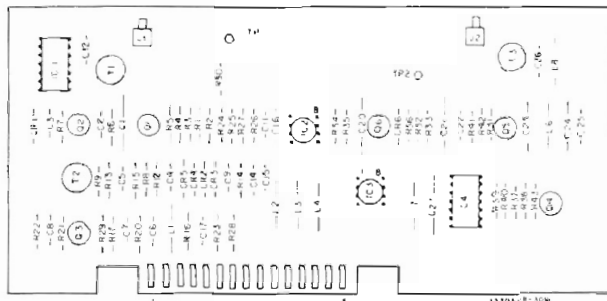
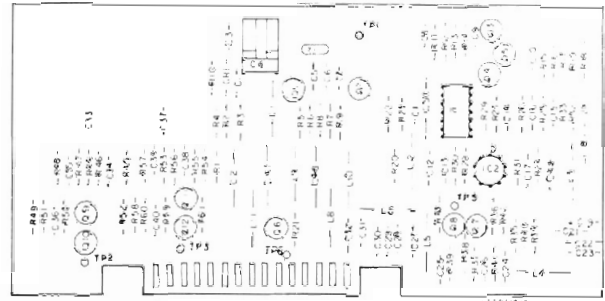


Figure 7-29. Amplitude Reference A11, 3320B.



TO XA7 A7
 hp Part No. 03320-66507
 Rev B



TO XA8 A8
 hp Part No. 03320-66508
 Rev B

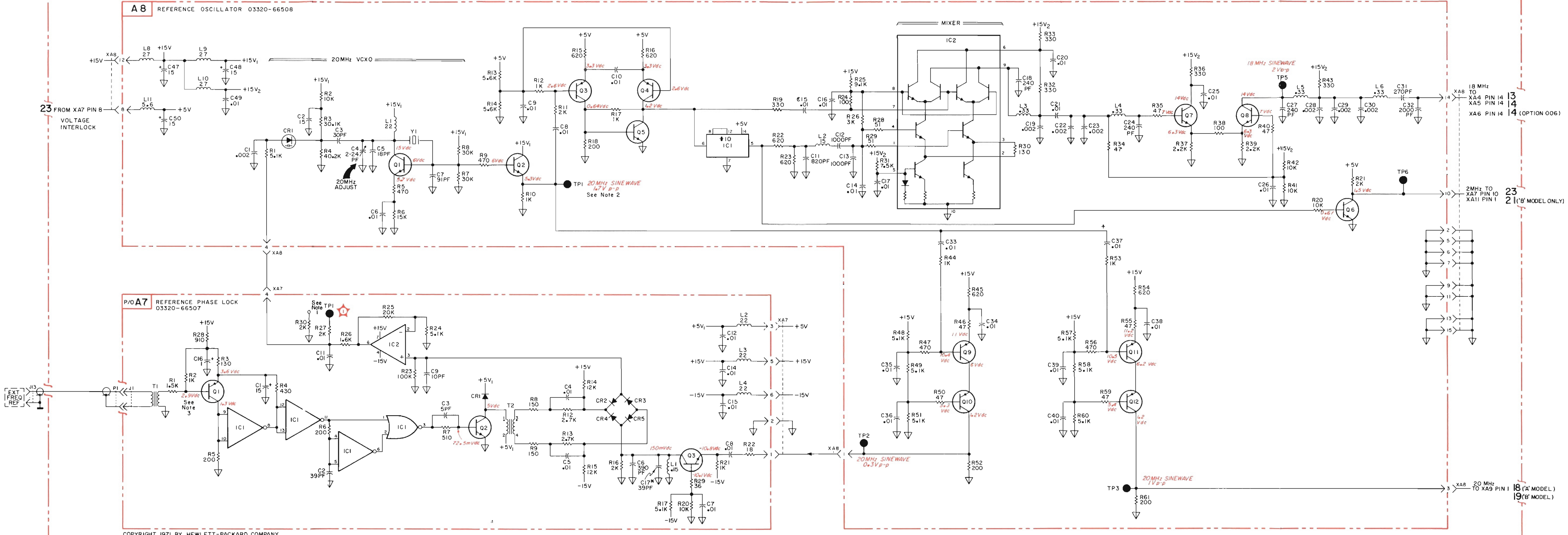
NOTE 1: TP may be removed and a jack (-hp- Part No. 1250-1195) mounted in its place. A cable can be routed from this jack to the 3320A/B rear panel. This will provide an input to the varicaps for a dc voltage to control the frequency of the 20 MHz reference oscillator.

NOTE 2: Test point voltages measured with -hp- 180A Oscilloscope using 10:1 probe.
 DC voltages measured with high input resistance, low capacitance voltmeter (-hp- 412A).

NOTE 3: DC voltages measured with no EXT. FREQ REF applied.

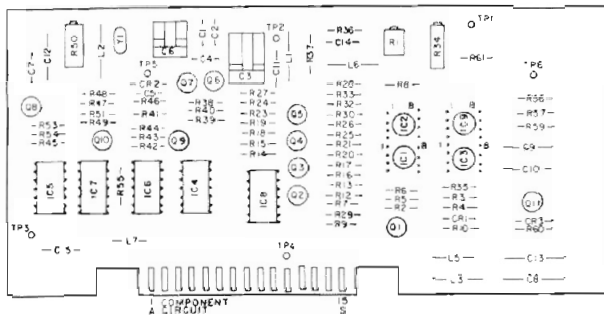


A7TP1, > 6 V p-p when unlocked, see Reference Oscillator Adjustment procedure, Section V.



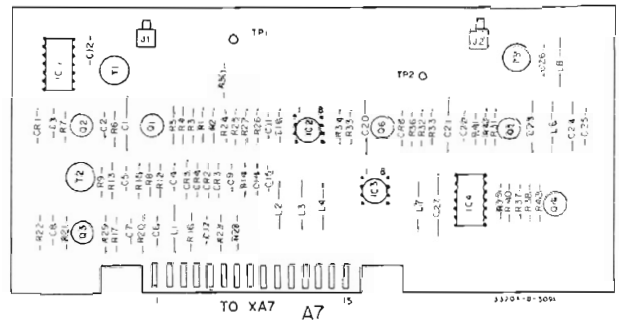
↑ SEE SECTION VIII, BACKDATING

Figure 7-30. 20 MHz Reference Oscillator A8, Reference Phase Lock P/O A7.



TO XAI A1
hp Part No. 03320-66501
Rev B

3320A-B-3074



TO XA7 A7
hp Part No. 03320-66507
Rev B

NOTE 1: The following table lists the schematic number and connector number versus instrument type for controller board interfacing:

| SCHEMATIC NUMBER | CONNECTOR NUMBER | INSTRUMENT TYPE |
|------------------|------------------|--|
| 1 | XA20A | "A" Model — Standard, Options 001, 002, 006 |
| 2 | XA21A | "B" Model — Standard, Options 001, 002, 006 |
| 4,5 | XA22A | "A" Model — Option 003 "B" Model — Option 004 |
| 7,9,10 | XA22A | "B" Model — Option 007 |

NOTE 2: Logic signal levels are shown by the letters H or L preceding the name of the line. The H and L indicates the true state (signal present). Voltage levels for the H and L are:

H = +5 V
L = 0 V

Example:

H Delay Flag — indicates the delay flag line should be +5 V when a delay flag signal is present.

L Data Valid — indicates the data valid line should be 0 V when a data valid signal is present.



Top voltage measured with 3320A/B in remote mode.
Bottom voltage measured in local mode.



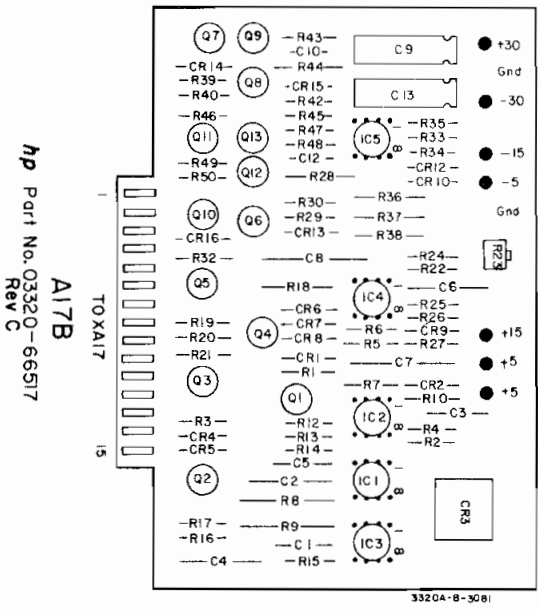
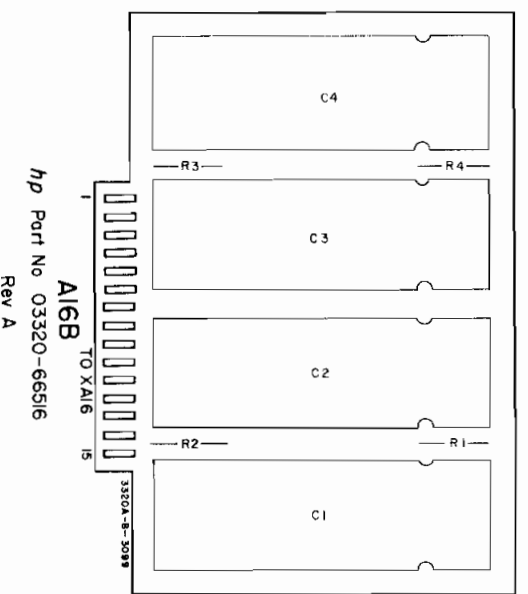
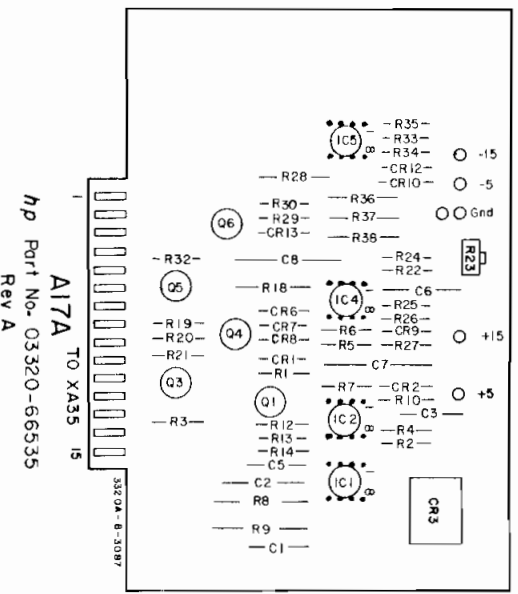
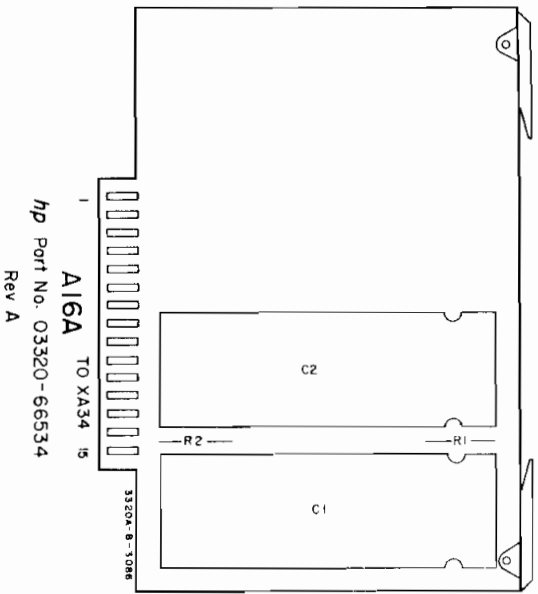
Top voltage measured with frequency controls set to 0000.
Bottom voltage measured with frequency controls set to 1299.



Top voltage measured with respective VF input H.
Bottom voltage measured with respective VF input L.

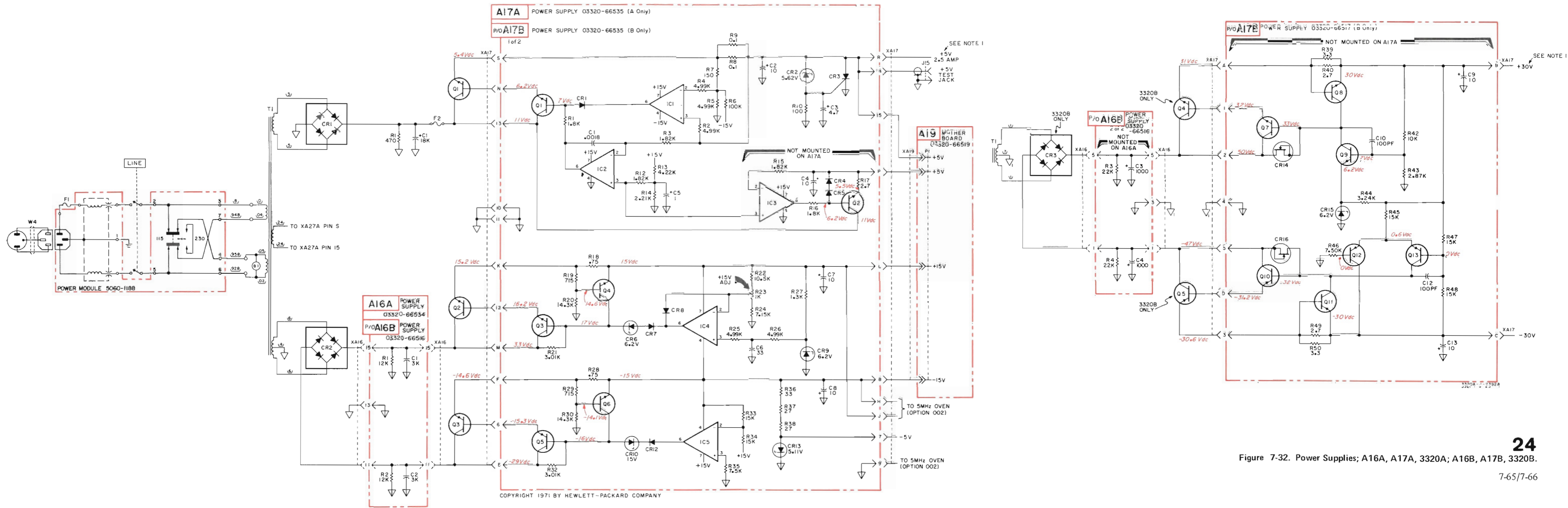


Top voltage measured with VERN IN (front panel)
Bottom voltage measured with VERN OUT.



NOTE 1: Tolerances for power supply output voltages are as follows:

- A17A/B pin 14 5.000 V dc to 5.300 V dc
- A17A/B pin p 5.000 V dc to 5.300 V dc
- A17A/B pin L 14.950 V dc to 15.050 V dc
- A17A/B pin 8 14.8 V dc to 15.2 V dc
- A17A/B pin 7 4.850 V dc to 5.370 V dc
- A17B pin B 29.125 V dc to 30.875 V dc
- A17B pin C 28.800 V dc to 31.200 V dc



24
 Figure 7-32. Power Supplies; A16A, A17A, 3320A; A16B, A17B, 3320B.
 7-65/7-66

SECTION VIII BACKDATING

8-1. INTRODUCTION.

8-2. This section contains backdating material which makes this manual applicable to instruments with serial numbers lower than the serial number listed on the title page. Each change has been keyed in the text or illustration with a dagger (†). This alerts the user to a change which may apply to his instrument. If this manual is to be used with an earlier instrument only, the changes which apply to that instrument may be entered into the text where applicable. Where component values in an instrument differ from the Replaceable Parts List, yet are not listed in the backdating section, the components should be replaced using the part number in this manual.

8-3. INSTRUMENT SERIAL NUMBER SEQUENCE.

8-4. Changes are listed in instrument serial number order (lower serial numbers first). However, when referring to the changes for a particular instrument, begin with the latest change and progress to the earliest change that applies to the serial number in question. Table 8-1 lists the serial numbers versus the changes.

8-5. CHANGE 1, FOR SERIAL NUMBERS 1121A-00110 AND BELOW (3320A), 1122A-00120 AND BELOW (3320B).

8-6. Make the following changes:

a. In table 6-1 and Figures 7-12 and 7-17 delete A23R3 and A23R4.

b. In Table 6-1 add the following components to the A8 assembly:

| Designator | Description | Part Number |
|----------------------|-------------------------|-------------|
| A8C41, C42, C43, C44 | C: 0.01 μ F 100 V | 0150-0093 |
| A8C45 | C: 230 pF 500 V | 0160-2005 |
| A8C46 | C: 680 pF 300 V | 0140-0208 |
| A8R62 | R: fxd 1000 Ω 5% | 0683-1025 |
| A8R63 | R: fxd 620 Ω 5% | 0683-6215 |
| A8R64, R68 | R: fxd 47 Ω 5% | 0683-4705 |
| A8R65 | R: fxd 470 Ω 5% | 0683-4715 |
| A8R66, R67, R69 | R: fxd 5100 Ω 5% | 0683-5125 |
| A8R70 | R: fxd 560 Ω 5% | 0683-5615 |
| A8R71 | R: fxd 51 Ω 5% | 0683-5105 |
| A8Q13, Q14 | TSTR: Si PNP | 1853-0203 |
| A8L7 | Coil: RF | 9140-0088 |
| A8P1 | Conn: RF | 1250-1195 |
| A8T1 | TFMR: Toroid | 9100-1362 |

c. In Table 6-1 make the following component changes:

Delete: A1C11, MP29

Add: A1R58, R: fxd 10 k Ω 1% 1/8 W 0757-0442

Change: A1R59 to R: fxd 10 k Ω 1% 1/8 W 0757-0442

MP31 to 03320-60102 1 each Assy: rear deck

d. In Figure 7-30 add the following circuitry to the A8 assembly:

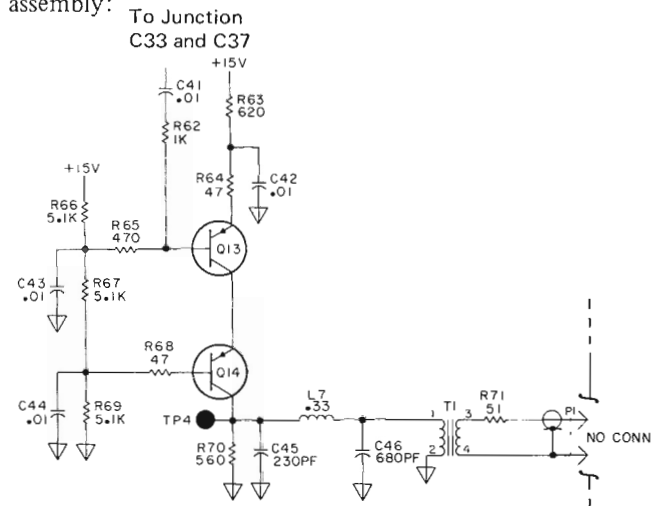


Table 8-1. Serial Number Index.

| 3320A | | 3320B | |
|--------------------------|---------|--------------------------|---------|
| Instrument Serial Number | Changes | Instrument Serial Number | Changes |
| 1121A-00110 and below | 1 | 1122A-00120 and below | 1 |
| 1138A-00135 and below | 4, 5 | See Paragraph 8-7 | 2 |
| 1138A-00185 and below | 7 | See Paragraph 8-9 | 3 |
| 1138A-00275 and below | 9 | 1139A-00200 and below | 4 |
| | | 1139A-00250 and below | 5 |
| | | 1139A-00340 and below | 6 |
| | | 1139A-00540 and below | 7 |
| | | 1139A-00590 and below | 8 |
| | | 1319A-00690 and below | 9 |

e. In Figure 7-31 make the following circuit changes on the A1 assembly:

Delete: A1C11, A1R59

Add: A1R58 and A1R59, 10 kΩ, from pin 2 and pin 3 respectively of IC9 to ground

8-7. CHANGE 2, 3320B.

8-8. Prior to the 15 line GPIB, Option 007, the 3320B contained a 10 line GPIB, Option 005. This manual includes information for the Option 007. For information concerning the Option 005, order the Manual Insert Sheet 3320B-H18 or contact your local Sales and Service Office.

8-9. CHANGE 3, 3320B.

8-10. Change 3 is designed to improve the 3320B harmonic distortion and should be incorporated in all 3320B's.

a. In Table 6-1 the following component changes have been made:

Delete: A14C17, A14C28, C: fxd cer 0.1 μF, 0150-0084

b. In Figure 7-25 the following circuitry changes have been made:

Delete: A14C17, A14C28

Change: A15Q9A and A14Q9B to A14Q16 and A14Q9 respectfully.

A14R22 to 49.9 Ω

A14R56 to 49.9 Ω

8-11. CHANGE 4, FOR SERIAL NUMBERS 1138A-00135 AND BELOW (3320A), 1139A-00200 AND BELOW (3320B).

8-12. Make the following changes:

a. In Table 6-1 make the following component changes:

Add: A2L2, coil/choke: 0.82 μH, 9100-1614

A2R8, R: fxd comp 2000 ohm, 0683-2025

Change: A2CR1, A2CR2, A2CR3, A2CR4 to

Diode: Si 50 mA 30 wv, 1901-0040.

A2IC2 to IC: TTL Triple 3-input AND Gate, 1820-0372.

A2IC8 to IC: Digital TTL Dual J-K FF, 1820-0451

A2R9 to R: fxd comp, 51 Ω, 0683-5105

b. In Figure 7-20 make the following circuitry changes:

8-13. CHANGE 5, FOR SERIAL NUMBERS 1138A-00135 AND BELOW (3320A), 1139A-00250 AND BELOW (3320B).

8-14. In Table 6-1 and Figure 7-21 make the following component changes:

Change:

A4R8 to 820 Ω, 0683-8215

A4R9 to 470 Ω, 0683-4715

A7IC1 to 1820-0923

8-15. CHANGE 6, FOR SERIAL NUMBERS 1139A-00340 AND BELOW (3320B).

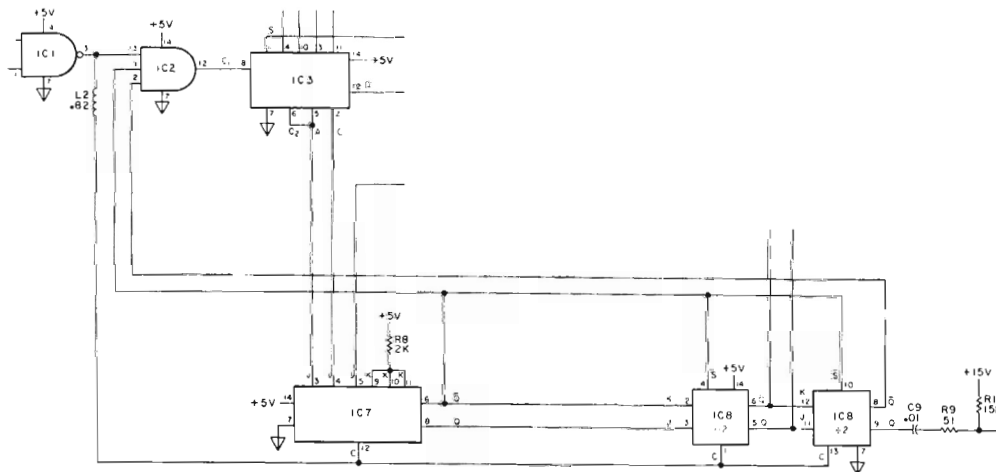
8-16. In Table 6-1 and Figure 7-28 A12BC19 C: fxd 18 pF 100 V 0160-2322 has been added. This increases the output amplitude accuracy and stabilization. See Figure 7-28 for location.

8-17. CHANGE 7, FOR SERIAL NUMBERS 1138A-00185 AND BELOW (3320A), 1139A-00540 AND BELOW (3320B).

8-18. The A13A/B Switch Assembly in these instruments are not designed for the replacement of individual switch wafers and detents. If the A13A/B assembly fails in these instruments it is necessary to replace the front panel assembly with the new front panel assembly (MP20) listed in Table 6-1. The front panel assembly listed in Table 6-1 contains the latest A13A/B Switch Assembly. This assembly is designed for replacement of individual switch components. A disassembly/assembly procedure for the front panel assembly is outlined in Section V, Paragraph 5-49.

8-19. CHANGE 8, FOR SERIAL NUMBERS 1139A-00590 AND BELOW (3320B).

8-20. In Table 6-1 delete Cable Assembly 03320-61618.

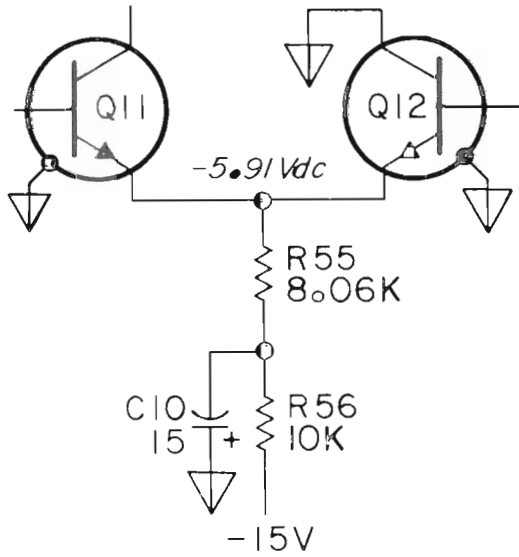


8-21. CHANGE 9, FOR SERIAL NUMBERS 1138A-00275 AND BELOW (3320A), 1319A-00690 AND BELOW (3320B).

8-22. Make the following changes:

a. In Table 6-1 delete A3C26 and A3R85. Change A3R55 to R: fxd 8060 Ω 1% 0698-4473.

b. In Figure 7-19 Change A3Q11 and A3Q12 circuitry as follows:



CODE LIST OF MANUFACTURERS

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name) and their latest supplements. The date of revision and the date of the supplements used appear at the bottom of each page. Alphabetical codes have been arbitrarily assigned to suppliers not appearing in the H4 Handbooks.

| Code No. | Manufacturer | Address | Code No. | Manufacturer | Address | Code No. | Manufacturer | Address |
|----------|--|--------------------------|----------|--|------------------------------------|----------|---|---------------------------------|
| 00000 | U. S. A Common | Any supplier of U.S. | 05347 | Ultronix, Inc. | San Mateo, Cal. | 11236 | CTS of Berne, Inc. | Berne, Ind. |
| 00136 | McCoy Electronics | Mount Holly Springs, Pa. | 05397 | Union Carbine Corp., Elect. | Div. New York, N. Y. | 11237 | Chicago Telephone of California, Inc. | So. Pasadena, Cal. |
| 00213 | Sage Electronics Corp. | Rochester, N. Y. | 05574 | Viking Ind. Inc. | Canoga Park, Cal. | 11242 | Bay State Electronics Corp. | Waltham, Mass. |
| 00287 | Cemco, Inc. | Danielson, Conn. | 05593 | Icore Electro-Plastics Inc. | Sunnyvale, Cal. | 11312 | Teledyne Inc., Microwave Div. | Palo Alto, Cal. |
| 00334 | Humidial | Colton, Calif. | 05616 | Cosmo Plastic (c/o Electrical Spec. Co.) | Cleveland, Ohio | 11314 | National Seal | Downey, Cal. |
| 00348 | Mictron, Co., Inc. | Valley Stream, N. Y. | 05624 | Barber Colman Co. | Rockford, Ill. | 11453 | Precision Connector Corp. | Jamaica, N. Y. |
| 00373 | Garlock Inc. | Cherry Hill, N. J. | 05728 | Tiffen Optical Co. | Roslyn Heights, Long Island, N. Y. | 11534 | Duncan Electronics Inc. | Costa Mesa, Cal. |
| 00656 | Aerovox Corp. | New Bedford, Mass. | 05729 | Metro-Tel Corp. | Westbury, N. Y. | 11711 | General Instrument Corp., Semiconductor Division Products Group | Newark, N. J. |
| 00779 | Amp. Inc. | Harrisburg, Pa. | 05783 | Stewart Engineering Co. | Santa Cruz, Cal. | 11717 | Imperial Electronic, Inc. | Buena Park, Cal. |
| 00781 | Aircraft Radio Corp. | Boonton, N. J. | 05820 | Wakefield Engineering Inc. | Wakefield, Mass. | 11870 | Melabs, Inc. | Palo Alto, Cal. |
| 00809 | Croven, Ltd. | Whitby, Ontario, Canada | 06004 | Bassick Co., Div. of Stewart Warner Corp. | Bridgeport, Conn. | 12136 | Philadelphia Handle Co. | Camden, N. J. |
| 00815 | Northern Engineering Laboratories, Inc. | Burlington, Wis. | 06090 | Raychem Corp. | Redwood City, Cal. | 12361 | Grove Mfg. Co., Inc. | Shady Grove, Pa. |
| 00853 | Sangamo Electric Co., Pickens Div. | Pickens, S. C. | 06175 | Bausch and Lomb Optical Co. | Rochester, N. Y. | 12574 | Gulton Ind. Inc., Data System Div. | Albuquerque, N. M. |
| 00866 | Goe Engineering Co. | City of Industry, Cal. | 06402 | E. T. A. Products Co. of America | Chicago, Ill. | 12697 | Clarostat Mfg. Co. | Dover, N. H. |
| 00891 | Carl E. Holmes Corp. | Los Angeles, Cal. | 06540 | Amatonic Electronic Hardware Co., Inc. | New Rochelle, N. Y. | 12728 | Elmar Filter Corp. | W. Haven, Conn. |
| 00929 | MicroLab Inc. | Livingston, N. J. | 06555 | Beede Electrical Instrument Co., Inc. | Penacook, N. H. | 12859 | Nippon Electric Co., Ltd. | Tokyo, Japan |
| 01002 | General Electric Co., Capacitor Dept. | Hudson Falls, N. Y. | 06666 | General Devices Co., Inc. | Indianapolis, Ind. | 12881 | Metex Electronics Corp. | Clark, N. J. |
| 01009 | Alden Products Co. | Brockton, Mass. | 06751 | Components Inc., Ariz. Div. | Phoenix, Arizona | 12930 | Delta Semiconductor Inc. | Newport Beach, Cal. |
| 01121 | Allen Bradley Co. | Milwaukee, Wis. | 06812 | Torrington Mfg. Co., West Div. | Van Nuys, Cal. | 12954 | Dickson Electronics Corp. | Scottsdale, Arizona |
| 01255 | Litton Industries, Inc. | Beverly Hills, Cal. | 06980 | Varian Assoc. Etmac Div. | San Carlos, Cal. | 13019 | Airco Supply Co., Inc. | Wichita, Kansas |
| 01281 | TRW Semiconductors, Inc. | Lawndale, Cal. | 07088 | Kelvin Electric Co. | Van Nuys, Cal. | 13061 | Wilco Products | Detroit, Mich. |
| 01295 | Texas Instruments, Inc., Transistor Products Div. | Dallas, Texas | 07126 | Digitran Co. | Pasadena, Cal. | 13103 | Thermolloy | Dallas, Texas |
| 01349 | The Alliance Mfg. Co. | Alliance, Ohio | 07137 | Transistor Electronics Corp. | Minneapolis, Minn. | 13327 | Solitron Devices Inc. | Tappan, N. Y. |
| 01538 | Small Parts Inc. | Los Angeles, Cal. | 07138 | Westinghouse Electric Corp., Electronic Tube Div. | Elmira, N. Y. | 13396 | Telefunken (GmbH) | Hanover, Germany |
| 01589 | Pacific Relays, Inc. | Van Nuys, Cal. | 07149 | Filmohm Corp. | New York, N. Y. | 13835 | Midland-Wright Div. of Pacific Industries, Inc. | Kansas City, Kansas |
| 01670 | Gudebrod Bros. Silk Co. | New York, N. Y. | 07233 | Cinch-Graphik Co. | City of Industry, Cal. | 14099 | Sem-Tech | Newbury Park, Cal. |
| 01930 | Amerock Corp. | Rockford, Ill. | 07256 | Silicon Transistor Corp. | Carle Place, N. Y. | 14193 | Calif. Resistor Corp. | Santa Monica, Cal. |
| 01960 | Pulse Engineering Co. | Santa Clara, Cal. | 07261 | Avnet Corp. | Culver City, Cal. | 14298 | American Components, Inc. | Conshohocken, Pa. |
| 02114 | Ferroxcube Corp. of America | Saugerties, N. Y. | 07263 | Fairchild Camera & Inst. Corp., Semiconductor Div. | Mountain View, Cal. | 14433 | ITT Semiconductor, a Div. of Int. Telephone and Telegraph Corporation | West Palm Beach, Fla. |
| 02116 | Wheelock Signals, Inc. | Long Branch, N. J. | 07322 | Minnesota Rubber Co. | Minneapolis, Minn. | 14493 | Hewlett-Packard Company | Loveland, Colo. |
| 02286 | Cole Rubber and Plastics Inc. | Sunnyvale, Cal. | 07387 | Birtcher Corp, The | Monterey Park, Cal. | 14655 | Cornell Dublier Electric Corp. | Newark, N. J. |
| 02660 | Amphenol-Borg Electronics Corp. | Broadview, Ill. | 07397 | Sylvania Elect. Prod. Inc., Mt. View Operations | Mountain View, Cal. | 14674 | Corning Glass Works | Corning, N. Y. |
| 02735 | Radio Corp. of America, Semiconductor and Materials Division | Somerville, N. J. | 07700 | Technical Wire Products Inc. | Cranford, N. J. | 14752 | Electro Cube Inc. | San Gabriel, Cal. |
| 02771 | Vocaline Co. of America, Inc. | Old Saybrook, Conn. | 07829 | Bodine Elect. Co. | Chicago, Ill. | 14960 | Williams Mfg. Co. | San Jose, Cal. |
| 02777 | Hopkins Engineering Co. | San Fernando, Cal. | 07910 | Continental Device Corp. | Hawthorne, Cal. | 15106 | The Sphere Co., Inc. | Little Falls, N. J. |
| 02875 | Hudson Tool & Die | Newark, N. J. | 07933 | Raytheon Mfg. Co., Semiconductor Div. | Mountain View, Cal. | 15203 | Webster Electronics Co. | New York, N. Y. |
| 03296 | Nylon Molding Corp. | Springfield, N. J. | 07980 | Hewlett-Packard Co., New Jersey Division | Rockaway, N. J. | 15287 | Scionics Corp. | Northridge, Cal. |
| 03508 | G. E. Semiconductor Prod. Dept. | Syracuse, N. Y. | 08145 | U. S. Engineering Co. | Los Angeles, Cal. | 15291 | Adjustable Bushing Co. | N. Hollywood, Cal. |
| 03705 | Apex Machine & Tool Co. | Dayton, Ohio | 08289 | Blinn, Delbert Co. | Pomona, Cal. | 15558 | Micron Electronics | Garden City, Long Island, N. Y. |
| 03797 | Eldema Corp. | Compton, Calif. | 08358 | Burgess Battery Co. | Niagara Falls, Ontario, Canada | 15566 | Amprobe Inst. Corp. | Lynbrook, N. Y. |
| 03818 | Parker Seal Co. | Los Angeles, Cal. | 08524 | Deutsch Fastener Corp. | Los Angeles, Cal. | 15631 | Cabletronics | Costa Mesa, Cal. |
| 03877 | Transitron Electric Corp. | Wakefield, Mass. | 08664 | Bristol Co., The | Waterbury, Conn. | 15772 | Twentieth Century Coil Spring Co. | Santa Clara, Cal. |
| 03888 | Pyrofilm Resistor Co., Inc. | Cedar Knolls, N. J. | 08717 | Sloan Company | Sun Valley, Cal. | 15801 | Fenwal Elect. Inc. | Framingham, Mass. |
| 03954 | Singer Co., Diehl Div., FINDERNE Plant | Sumerville, N. J. | 08718 | ITT Cannon Electric Inc., Phoenix Div. | Phoenix, Arizona | 15818 | Amelco Inc. | Mountain View, Cal. |
| 04009 | Arrow, Hart and Hegeman Elect. Co. | Hartford, Conn. | 08727 | National Radio Lab. Inc. | Paramus, N. J. | 16037 | Spruce Pine Mica Co. | Spruce Pine, N. C. |
| 04013 | Taruus Corp. | Lambertville, N. J. | 08792 | CBS Electronics Semiconductor Operations, Div. of CBS Inc. | Lowell, Mass. | 16179 | Omni-Spectra Inc. | Detroit, Ill. |
| 04062 | Arco Electronic Inc. | Great Neck, N. Y. | 08806 | General Electric Co., Miniature Lamp Dept. | Cleveland, Ohio | 16352 | Computer Diode Corp. | Lodi, N. J. |
| 04217 | Essex Wire | Los Angeles, Cal. | 08984 | Mel-Rain | Indianapolis, Ind. | 16554 | Electrold Co. | Union, N. J. |
| 04222 | Hi-Q Division of Aerovox | Myrtle Beach, S. C. | 09026 | Babcock Relays Div. | Costa Mesa, Cal. | 16585 | Boots Aircraft Nut Corp. | Pasadena, Cal. |
| 04354 | Precision Paper Tube Co. | Wheeling, Ill. | 09097 | Electronic Enclosures Inc. | Los Angeles, Calif. | 16688 | Ideal Prec. Meter Co., Inc., De Jur Meter Div. | Brooklyn, N. Y. |
| 04404 | Palo Alto Division of Hewlett-Packard Co. | Palo Alto, Cal. | 09134 | Texas Capacitor Co. | Houston, Texas | 16758 | Delco Radio Div. of G. M. Corp. | Kokomo, Ind. |
| 04651 | Sylvania Electric Products, Microwave Device Div. | Mountain View, Cal. | 09145 | Tech. Ind. Inc. Atohm Elect. | Burbank, Cal. | 17109 | Thermonetics Inc. | Canoga Park, Cal. |
| 04673 | Dakota Engr. Inc. | Culver City, Cal. | 09250 | Electro Assemblies, Inc. | Chicago, Ill. | 17474 | Tranex Company | Mountain View, Cal. |
| 04713 | Motorola Inc. Semiconductor Prod. Div. | Phoenix, Arizona | 09353 | C & K Components Inc. | Newton, Mass. | 17675 | Hamlin Metal Products Corp. | Akron, Ohio |
| 04732 | Filteron Co., Inc. Western Div. | Culver City, Cal. | 09569 | Mallory Battery Co. of Canada, Ltd. | Toronto, Ontario, Canada | 17745 | Angstromm Prec. Inc. | No. Hollywood, Cal. |
| 04773 | Automatic Electric Co. | Northlake, Ill. | 09795 | Pennsylvania Florocarbon | Clifton Heights, Penn. | 17856 | Siliconix Inc. | Sunnyvale, Cal. |
| 04796 | Sequoia Wire Co. | Redwood City, Cal. | 09922 | Burndy Corp. | Norwalk, Conn. | 17870 | McGraw-Edison Co. | Manchester, N. H. |
| 04811 | Precision Coil Spring Co. | El Monte, Cal. | 10214 | General Transistor Western Corp. | Los Angeles, Cal. | 18042 | Power Design Pacific Inc. | Palo Alto, Cal. |
| 04870 | P. M. Motor Company | Westchester, Ill. | 10411 | Ti-Tal, Inc. | Berkeley, Cal. | 18083 | Clevite Corp. Semiconductor Div. | Palo Alto, Cal. |
| 04919 | Component Mfg. Service Co. | W. Bridgewater, Mass. | 10646 | Carborundum Co. | Niagara Falls, N. Y. | 18324 | Signetics Corp. | Sunnyvale, Cal. |
| 05006 | Twentieth Century Plastics, Inc. | Los Angeles, Cal. | | | | 18476 | Ty-Car Mfg. Co., Inc. | Holliston, Mass. |
| 05277 | Westinghouse Electric Corp. Semiconductor Dept. | Youngwood, Pa. | | | | 18486 | TRW Elect. Comp. Div. | Des Plaines, Ill. |

CODE LIST OF MANUFACTURERS (Continued)

| Code No. | Manufacturer | Address | Code No. | Manufacturer | Address | Code No. | Manufacturer | Address |
|----------|------------------------------------|------------------------------|----------|--------------------------------------|--------------------------|----------|---|------------------------------|
| 19644 | LRC Electronics | Horseheads, N. Y. | 71482 | C. P. Clare & Co. | Chicago, Ill. | 78452 | Thompson-Bremer & Co. | Chicago, Ill. |
| 19701 | Electra Mfg. Co. | Independence, Kansas | 71590 | Centralab Div. of | | 78471 | Tilley Mfg. Co. | San Francisco, Cal. |
| 20183 | General Atomics Corp. | Philadelphia, Pa. | | Globe Union Inc. | Milwaukee, Wis. | 78488 | Stackpole Carbon Co. | St. Marys, Pa. |
| 21226 | Executone, Inc. | Long Island City, N. Y. | 71616 | Commercial Plastics Co. | Chicago, Ill. | 78493 | Standard Thomson Corp. | Waltham, Mass. |
| 21355 | Fafnir Bearing Co., The | New Britain, Conn. | 71700 | Cornish Wire Co., The | New York, N. Y. | 78553 | Tinnerman Products, Inc. | Cleveland, Ohio |
| 21520 | Fansteel Metallurgical Corp. | N. Chicago, Ill. | 71707 | Coto Coil Co., Inc. | Providence, R. I. | 78790 | Transformer Engineers | San Gabriel, Cal. |
| 23020 | General Reed Co. | Metuchen, N. J. | 71744 | Chicago Miniature Lamp Works | Chicago, Ill. | 78947 | Ucinite Co. | Newtonville, Mass. |
| 23042 | Texscan Corp. | Indianapolis, Ind. | 71785 | Cinch Mfg. Co. | | 79136 | Waldes Kohinoor Inc. | Long Island City, N. Y. |
| 23783 | British Radio Electronics Ltd. | Washington, D.C. | | Howard B. Jones Div. | Chicago, Ill. | 79142 | Veeder Root, Inc. | Hartford, Conn. |
| 24455 | G. E. Lamp Division, Nela Park | Cleveland, Ohio | 71984 | Dow Corning Corp. | Midland, Mich. | 79251 | Wenco Mfg. Co. | Chicago, Ill. |
| 24655 | General Radio Co. | West Concord, Mass. | 72136 | Electro Motive Mfg. Co., Inc. | | 79727 | Continental-Wirt Electronics Corp. | |
| 24681 | Memcor Inc., Comp. Div. | Huntington, Ind. | | | Willimantic, Conn. | | | Philadelphia, Pa. |
| 26365 | Gries Reproducer Corp. | New Rochelle, N. Y. | 72619 | Dialight Corp. | Brooklyn, N. Y. | 79963 | Zierick Mfg. Corp. | New Rochelle, N. Y. |
| 26462 | Grobert File Co. of America, Inc. | Carlstadt, N. J. | 72656 | Indiana General Corp. | | 80031 | Mepeco Division of Sessions Clock Co. | |
| 26851 | Compac/Hollister Co. | Hollister, Cal. | | Electronics Div. | Keasby, N. J. | | | Morristown, N. J. |
| 26992 | Hamilton Watch Co. | Lancaster, Pa. | 72699 | General Instrument Corp., | | 80033 | Prestole Corp. | Toledo, Ohio |
| 28480 | Hewlett-Packard Co. | Palo Alto, Cal. | | Cap Division | Newark, N. J. | 80120 | Schnitzer Alloy Products Co. | Elizabeth, N. J. |
| 28520 | Heyman Mfg. Co. | Kenilworth, N. J. | 72765 | Drake Mfg. Co. | Harwood Heights, Ill. | 80131 | Electronic Industries Association. | |
| 30817 | Instrument Specialties Co., | | 72825 | Hugh H. Eby Inc. | Philadelphia, Pa. | | Standard tube or semi-conductor device, | |
| | Inc. | Little Falls, N. J. | 72928 | Gudeman Co. | Chicago, Ill. | | any manufacturer. | |
| 33173 | G. E. Receiving Tube Dept. | Owensboro, Ky. | 72962 | Elastic Stop Nut Corp. | Union, N. J. | 80207 | Unimax Switch, Div. Maxon Electronics | |
| 35434 | Lectrohm Inc. | Chicago, Ill. | 72964 | Robert M. Hadley Co. | Los Angeles, Cal. | | Corp. | Wallingford, Conn. |
| 36196 | Stanwyck Coil Products. | | 72982 | Erie Technological Products, Inc. | Erie, Pa. | 80223 | United Transformer Corp. | New York, N. Y. |
| | Ltd. | Hawkesbury, Ontario, Canada | 73061 | Hansen Mfg. Co., Inc. | Princeton, Ind. | 80248 | Oxford Electric Corp. | Chicago, Ill. |
| 36287 | Cunningham, W. H. & Hill, | | 73076 | H. M. Harper Co. | Chicago, Ill. | 80294 | Bourns Inc. | Riverside, Cal. |
| | Ltd. | Toronto, Ontario, Canada | 73138 | Helipot Div. of Beckman Inst., Inc. | | 80411 | Arco Div. of Robertshaw Controls Co. | |
| | | | | | Fullerton, Cal. | | | Columbus, Ohio |
| 37942 | P. R. Mallory & Co., Inc. | Indianapolis, Ind. | 73293 | Hughes Products Division of | | 80486 | All Star Products Inc. | Defiance, Ohio |
| 39543 | Mechanical Industries Prod. Co. | Akron, Ohio | | Hughes Aircraft Co. | Newport Beach, Cal. | 80509 | Avery Label Co. | Monrovia, Cal. |
| 40920 | Miniature Precision Bearings, Inc. | Keene, N. H. | 73445 | Amperex Elect. Co. | Hicksville, L. I., N. Y. | 80583 | Hammariund Co., Inc. | Mars Hill, N. C. |
| 40931 | Honeywell Inc. | Minneapolis, Minn. | 73506 | Bradley Semiconductor Corp. | | 80640 | Stevens, Arnold, Co., Inc. | Boston, Mass. |
| 42190 | Muter Co. | Chicago, Ill. | | | New Haven, Conn. | 80813 | Dimco Gray Co. | Dayton, Ohio |
| 43990 | C. A. Norgren Co. | Englewood, Colo. | 73559 | Carling Electric, Inc. | Hartford, Conn. | 81030 | International Inst. Inc. | Orange, Conn. |
| 44655 | Ohmite Mfg. Co. | Skokie, Ill. | 73586 | Circle F Mfg. Co. | Trenton, N. J. | 81073 | Grayhill Co. | LaGrange, Ill. |
| 46384 | Penn Eng. & Mfg. Corp. | Doylestown, Pa. | 73682 | George K. Garrett Co. | | 81095 | Triad Transformer Corp. | Venice, Cal. |
| 47904 | Polaroid Corp. | Cambridge, Mass. | | Div. MSL Industries, Inc. | Philadelphia, Pa. | 81312 | Winchester Elec. Div. Litton Ind., Inc. | |
| 48620 | Precision Thermometer & | | 73734 | Federal Screw Products, Inc. | Chicago, Ill. | | | Oakville, Conn. |
| | Inst. Co. | Southampton, Pa. | 73743 | Fischer Special Mfg. Co. | Cincinnati, Ohio | 81349 | Military Specification | |
| 49956 | Microwave & Power Tube Div. | Waltham, Mass. | 73793 | General Industries Co., The | Elyria, Ohio | 81483 | International Rectifier Corp. | El Segundo, Cal. |
| 52090 | Rowan Controller Co. | Westminster, Md. | 73846 | Goshen Stamping & Tool Co. | Goshen, Ind. | 81541 | Airpax Electronics, Inc. | Cambridge, Maryland |
| 52983 | HP Co. Med. Elec. Div. | Waltham, Mass. | 73899 | JFD Electronics Corp. | Brooklyn, N. Y. | 81860 | Barry Controls, Div. Barry Wright Corp. | |
| 54294 | Shallcross Mfg. Co. | Selma, N. C. | 73905 | Jennings Radio Mfg. Corp. | San Jose, Cal. | | | Watertown, Mass. |
| 55026 | Simpson Electric Co. | Chicago, Ill. | 73957 | Groove-Pin Corp. | Ridgefield, N. J. | 82042 | Carter Precision Electric Co. | Skokie, Ill. |
| 55933 | Sonotone Corp. | Elmsford, N. Y. | 74276 | Signalite Inc. | Neptune, N. J. | 82047 | Sperth Faraday Inc. | Copper Hewitt |
| 55938 | Raytheon Co. Commercial Apparatus | | 74455 | J. H. Winns, and Sons | Winchester, Mass. | | Electric Div. | Hoboken, N. J. |
| | & System Div. | So. Norwalk, Conn. | 74861 | Industrial Condenser Corp. | Chicago, Ill. | 82116 | Electric Regulator Corp. | Norwalk, Conn. |
| 56137 | Spaulding Fibre Co., Inc. | Tonawanda, N. Y. | 74868 | R. F. Products Division of | | 82142 | Jeffers Electronics Division of | |
| 56289 | Sprague Electric Co. | North Adams, Mass. | | Amphenol-Borg Electronic Corp. | | | Speer Carbon Co. | Du Bois, Pa. |
| 58474 | Superior Elect. Co. | Bristol, Conn. | 74970 | E. F. Johnson Co. | Danbury, Conn. | 82170 | Fairchild Camera & Inst. Corp., | |
| 59446 | Telex Corp. | Tulsa, Okla. | 75042 | International Resistance Co. | Philadelphia, Pa. | | Space & Defense Systems Div. | Paramus, N. J. |
| 59730 | Thomas & Betts Co. | Elizabeth, N. J. | 75263 | Keystone Carbon Co., Inc. | St. Marys, Pa. | 82209 | Magurie Industries, Inc. | Greenwich, Conn. |
| 60741 | Triplet Electrical Inst. Co. | Bluffton, Ohio | 75378 | CTS Knights, Inc. | Sandwich, Ill. | 82219 | Sylvania Electric Prod., Inc. | |
| 61775 | Union Switch and Signal Div. of | | 75382 | Kulka Electric Corp. | Mt. Vernon, N. Y. | | Electronic Tube Division | Emporium, Pa. |
| | Westinghouse Air Brake Co. | Pittsburgh, Pa. | 75818 | Lenz Electric Mfg. Co. | Chicago, Ill. | 82376 | Astron Corp. | East Newark, Harrison, N. J. |
| 62119 | Universal Electric Co. | Owosso, Mich. | 75915 | Littlefuse, Inc. | Des Plaines, Ill. | 82389 | Switchcraft, Inc. | Chicago, Ill. |
| 63743 | Ward-Leonard Electric Co. | Mt. Vernon, N. Y. | 76005 | Lord Mfg. Co. | Erie, Pa. | 82647 | Metals & Controls Inc., | |
| 64959 | Western Electric Co., Inc. | New York, N. Y. | 76210 | C. W. Marwedel | San Francisco, Cal. | | Spencer Products | Attleboro, Mass. |
| 65092 | Weston Inst. Inc. | Weston-Newark, Newark, N. J. | 76433 | General Instrument Corp., | | 82768 | Phillips-Advance Control Co. | Joliet, Ill. |
| 66295 | Witteck Mfg. Co. | Chicago, Ill. | | Micamod Division | Newark, N. J. | 82866 | Research Products Corp. | Madison, Wis. |
| 66346 | Minnesota Mining & Mfg. Co. | | 76487 | James Millen Mfg. Co., Inc. | Malden, Mass. | 82877 | Rolton Mfg. Co., Inc. | Woodstock, N. Y. |
| | Revere Mincom Div. | St. Paul, Minn. | 76493 | J. W. Miller Co. | Los Angeles, Cal. | 82893 | Vector Electronic Co. | Glendale, Cal. |
| 70276 | Allen Mfg. Co. | Hartford, Conn. | 76530 | Cinch-Monadnock, Div. of United Carr | | 83058 | Carr Fastener Co. | Cambridge, Mass. |
| 70309 | Allied Control | New York, N. Y. | | Fastener Corp. | San Leandro, Cal. | 83086 | New Hampshire Ball | |
| 70318 | Allmetal Screw Product Co., Inc. | | | | | | Bearing, Inc. | Peterborough, N. H. |
| | | Garden City, N. Y. | 76545 | Mueller Electric Co. | Cleveland, Ohio | 83125 | General Instrument Corp., | |
| 70417 | Amplex, Div. of Chrysler Corp. | Detroit, Mich. | 76703 | National Union | Newark, N. J. | | Capacitor Div. | Darlington, S. C. |
| 70485 | Atlantic India Rubber Works, Inc. | Chicago, Ill. | 76854 | Oak Manufacturing Co. | Crystal Lake, Ill. | 83148 | ITT Wire and Cable Div. | Los Angeles, Cal. |
| 70563 | Amperite Co., Inc. | Union City, N. J. | 77068 | The Bendix Corp., | | 83186 | Victory Eng. Corp. | Springfield, N. J. |
| 70674 | ADC Products Inc. | Minneapolis, Minn. | | Electrodynamics Div. | N. Hollywood, Cal. | 83298 | Bendix Corp., Red Bank Div. | Red Bank, N. J. |
| 70903 | Belden Mfg. Co. | Chicago, Ill. | 77075 | Pacific Metals Co. | San Francisco, Cal. | 83315 | Hubbell Corp. | Mundelein, Ill. |
| 70998 | Bird Electric Corp. | Cleveland, Ohio | 77221 | Phaostran Instrument and | | 83324 | Rosan Inc. | Newport Beach, Cal. |
| 71002 | Birnbach Radio Co. | New York, N. Y. | | Electronic Co. | So. Pasadena, Cal. | 83330 | Smith, Herman H., Inc. | Brooklyn, N. Y. |
| 71034 | Bliley Electric Co., Inc. | Erie, Pa. | 77252 | Philadelphia Steel and | | 83332 | Tech Labs | Palisades Park, N. J. |
| 71041 | Boston Gear Works Div. of | | | Wire Corp. | Philadelphia, Pa. | 83385 | Central Screw Co. | Chicago, Ill. |
| | Murray Co. of Texas | Quincey, Mass. | 77342 | American Machine & Foundry Co. | | 83501 | Gavitt Wire and Cable Co., Div. of | |
| 71218 | Bud Radio, Inc. | Willoughby, Ohio | | Potter & Brumfield Div. | Princeton, Ind. | | Amerace Corp. | Brookfield, Mass. |
| 71279 | Cambridge Thermionics Corp. | Cambridge, Mass. | 77630 | TRW Electronic Components Div. | Camden, N. J. | 83594 | Burroughs Corp., Electronic | |
| 71286 | Camloc Fastener Corp. | Paramus, N. J. | 77638 | General Instrument Corp., | | | Tube Div. | Plainfield, N. J. |
| 71313 | Cardwell Condenser Corp. | | | Rectifier Division | Brooklyn, N. Y. | 83740 | Union Carbide Corp., Consumer | |
| | | Lindenhurst, L. I., N. Y. | 77764 | Resistance Products Co. | Harrisburg, Pa. | | Prod. Div. | New York, N. Y. |
| 71400 | Bussmann Mfg. Div. of | | 77969 | Rubbercraft Corp. of Calif. | Torrance, Cal. | 83777 | Model Eng. and Mfg., Inc. | Huntington, Ind. |
| | McGraw-Edison Co. | St. Louis, Mo. | 78189 | Shakeproof Division of | | 83821 | Loyd Scruggs Co. | Festus, Mo. |
| 71436 | Chicago Condenser Corp. | Chicago, Ill. | | Illinois Tool Works | Elgin, Ill. | 83942 | Aeronautical Inst. & Radio Co. | Lodi, N. J. |
| 71447 | Calif. Spring Co., Inc. | Pico-Rivera, Cal. | 78277 | Sigma | So. Braintree, Mass. | 84171 | Arco Electronics Inc. | Great Neck, N. Y. |
| 71450 | CTS Corp. | Eikhardt, Ind. | 78283 | Signal Indicator Corp. | New York, N. Y. | 84396 | A. J. Glesener Co., Inc. | San Francisco, Cal. |
| 71468 | ITT Cannon Electric Inc. | Los Angeles, Cal. | 78290 | Struthers-Dunn Inc. | Pitman, N. J. | 84411 | TRW Capacitor Div. | Ogallala, Neb. |
| 71471 | Cinema, Div. Aerovox Corp. | Burbank, Cal. | | | | | | |

CODE LIST OF MANUFACTURERS (Continued)

| Code No. | Manufacturer | Address | Code No. | Manufacturer | Address | Code No. | Manufacturer | Address |
|----------|---|----------------------|----------|--|------------------------|----------|---|---------------------|
| 94870 | Sarkes Tarzian, Inc. | Bloomington, Ind. | 91929 | Honeywell Inc., Micro Switch Division | Freeport, Ill. | 96095 | Hi-Q Div. of Aerovox Corp. | Olean, N. Y. |
| 85454 | Boonton Molding Company | Boonton, N. J. | 91961 | Nahm-Bros. Spring Co. | Oakland, Cal. | 96256 | Thordarson-Meissner Inc. | Mt. Carmel, Ill. |
| 85471 | A. B. Boyd Co. | San Francisco, Cal. | 92180 | Tru-Connector Corp. | Peabody, Mass. | 96296 | Solar Mfg. Co. | Los Angeles, Cal. |
| 85474 | R. M. Bracamonte & Co. | San Francisco, Cal. | 92367 | Elgeet Optical Co., Inc. | Rochester, N. Y. | 96396 | Microswitch, Div. of | |
| 85660 | Koiled Kords, Inc. | Hamden, Conn. | 92607 | Tensolite Insulated Wire Co., Inc. | Tarrytown, N. Y. | 96330 | Minn.-Honeywell | Freeport, Ill. |
| 85911 | Seamless Rubber Co. | Chicago, Ill. | 92702 | IMC Magnetics Corp. | Westbury, L. I., N. Y. | 96330 | Carlton Screw Co. | Chicago, Ill. |
| 86174 | Fafnir Bearing Co. | Los Angeles, Calif. | 92966 | Hudson Lamp Co. | Kearney, N. J. | 96341 | Microwave Associates, Inc. | Burlington, Mass. |
| 86197 | Clifton Precision Products Co., Inc. | Clifton Heights, Pa. | 93332 | Sylvania Electric Prod. Inc., Semiconductor Div. | Woburn, Mass. | 96501 | Excel Transformer Co. | Oakland, Cal. |
| 86579 | Precision Rubber Products Corp. | Dayton, Ohio | 93369 | Robbins & Myers Inc. | Pallisades Park, N. J. | 96508 | Xcelite, Inc. | Orchard Park, N. Y. |
| 86684 | Radio Corp. of America, Electronic Comp. & Devices Division | Harrison, N. J. | 93410 | Stemco Controls, Div. of Essex Wire Corp. | Mansfield, Ohio | 96733 | San Fernando Elec. Mfg. Co. | San Fernando, Cal. |
| 86928 | Seastrom Mfg. Co. | Glendale, Cal. | 93632 | Waters Mfg. Co. | Culver City, Cal. | 96881 | Thomson Ind. Inc. | Long Island, N. Y. |
| 87034 | Marco Industries | Anaheim, Cal. | 93929 | G. V. Controls | Livingston, N. J. | 97464 | Industrial Retaining Ring Co. | Irvington, N. J. |
| 87216 | Philco Corporation (Lansdale Division) | Lansdale, Pa. | 94137 | General Cable Corp. | Bayonne, N. J. | 97539 | Automatic & Precision Mfg. | Englewood, N. J. |
| 87473 | Western Fibrous Glass Products Co. | San Francisco, Cal. | 94144 | Raytheon Co., Comp. Div., Ind. Comp. Operations | Quincy, Mass. | 97979 | Reon Resistor Corp. | Yonkers, N. Y. |
| 87664 | Van Waters & Rogers Inc. | San Francisco, Cal. | 94148 | Scientific Electronics Products, Inc. | Loveland, Colo. | 97983 | Litton System Inc., Adler-Westrex Commun. Div. | New Rochelle, N. Y. |
| 87930 | Tower Mfg. Corp. | Providence, R. I. | 94154 | Wagner Elect. Corp., Tung-Sol Div. | Newark, N. J. | 98141 | R-Tronics, Inc. | Jamaica, N. Y. |
| 88140 | Cutler-Hammer, Inc. | Lincoln, Ill. | 94197 | Curtiss-Wright Corp., Electronics Div. | East Patterson, N. J. | 98159 | Rubber Teck, Inc. | Gardena, Cal. |
| 88220 | Gould-National Batteries, Inc. | St. Paul, Minn. | 94222 | South Chester Corp. | Chester, Pa. | 98220 | Hewlett-Packard Co., Medical Elec. Div. | Pasadena, Cal. |
| 88698 | General Mills, Inc. | Buffalo, N. Y. | 94330 | Wyer Cloth Products, Inc. | Bellwood, Ill. | 98278 | Microdot, Inc. | So. Pasadena, Cal. |
| 89231 | Graybar Electric Co. | Oakland, Cal. | 94375 | Automatic Metal Products Co. | Brooklyn, N. Y. | 98291 | Sealectro Corp. | Mamaronech, N. Y. |
| 89473 | G. E. Distributing Corp. | Schenectady, N. Y. | 94682 | Worcester Pressed Aluminum Corp. | Worcester, Mass. | 98376 | Zero Mfg. Co. | Burbank, Cal. |
| 89479 | Security Co. | Detroit, Mich. | 94696 | Magnecraft Electric Co. | Chicago, Ill. | 98410 | Etc Inc. | Cleveland, Ohio |
| 89665 | United Transformer Co. | Chicago, Ill. | 95023 | George A. Philbrick Researchers, Inc. | Boston, Mass. | 98731 | General Mills Inc., Electronics Div. | Minneapolis, Minn. |
| 90030 | United Shoe Machinery Corp. | Beverly, Mass. | 95146 | Alco Elect. Mfg. Co. | Lawrence, Mass. | 98734 | Paeco Division of Hewlett-Packard Co. | Palo Alto, Cal. |
| 90179 | U. S. Rubber Co., Consumer Ind. & Plastics Prod. Div. | Passaic, N. J. | 95236 | Allies Products Corp. | Dania, Fla. | 98821 | North Hills Electronics, Inc. | Glen Cove, N. Y. |
| 90365 | Belleville Speciality Tool Mfg., Inc. | Belleville, Ill. | 95238 | Continental Connector Corp. | Woodside, N. Y. | 98978 | International Electronic Research Corp. | Burbank, Cal. |
| 90763 | United Carr Fastener Corp. | Chicago, Ill. | 95263 | Leecraft Mfg. Co., Inc. | Long Island, N. Y. | 99109 | Columbia Technical Corp. | New York, N. Y. |
| 90970 | Bearing Engineering Co. | San Francisco, Cal. | 95265 | National Coil Co. | Sheridan, Wyo. | 99313 | Varian Associates | Palo Alto, Cal. |
| 91146 | ITT Cannon Elect. Inc., Salem Div. | Salem, Mass. | 95275 | Vitramon, Inc. | Bridgeport, Conn. | 99378 | Atlee Corp. | Winchester, Mass. |
| 91260 | Connor Spring Mfg. Co. | San Francisco, Cal. | 95348 | Gordos Corp. | Bloomfield, N. J. | 99515 | Marshall Ind., Capacitor Div. | Monrovia, Cal. |
| 91345 | Miller Dial & Nameplate Co. | El Monte, Cal. | 95354 | Methodie Mfg. Co. | Rolling Meadows, Ill. | 99707 | Control Switch Division, Controls Co. of America | El Segundo, Cal. |
| 91418 | Radio Materials Co. | Chicago, Ill. | 95566 | Arnold Engineering Co. | Marengo, Ill. | 99800 | Delevan Electronics Corp. | East Aurora, N. Y. |
| 91506 | Augat Inc. | Attleboro, Mass. | 95712 | Dage Electric Co., Inc. | Franklin, Ind. | 99848 | Wilco Corporation | Indianapolis, Ind. |
| 91637 | Dale Electronics, Inc. | Columbus, Nebr. | 95984 | Siemon Mfg. Co. | Wayne, Ill. | 99928 | Branson Corp. | Whippany, N. J. |
| 91662 | Elco Corp. | Willow Grove, Pa. | 95987 | Weckesser Co. | Chicago, Ill. | 99934 | Rembrandt, Inc. | Boston, Mass. |
| 91673 | Epiphone Inc. | New York, N. Y. | 96067 | Microwave Assoc. West, Inc. | Sunnyvale, Cal. | 99942 | Hoffman Electronics Corp., Semiconductor Division | El Monte, Cal. |
| 91737 | Gremar Mfg. Co., Inc. | Wakefield, Mass. | | | | 99957 | Technology-Instrument Corp. of California | Newbury Park, Cal. |
| 91827 | K F Development Co. | Redwood City, Cal. | | | | | | |
| 91886 | Malco Mfg., Inc. | Chicago, Ill. | | | | | | |

The following HP Vendors have no number assigned in the latest supplement to the Federal Supply Code for Manufacturers Handbook.

| | | | | | | | | |
|-------|--------------------------------|---------------------|-------|--|----------------------------|-------|------------------------|-------------------|
| 0000F | Malco Tool and Die | Los Angeles, Calif. | 000CS | Hewlett-Packard Co., Colorado Springs Div. | Colorado Springs, Colorado | 000QQ | Cooltron | Oakland, Cal. |
| 0000Z | Willow Leather Products Corp. | Newark, N. J. | 000MM | Rubber Eng. & Development | Hayward, Cal. | 000WW | California Eastern Lab | Burlington, Cal. |
| 000AB | ETA | England | 000NN | A "N" D Mfg. Co. | San Jose, Cal. | 000YY | S. K. Smith Co. | Los Angeles, Cal. |
| 000BB | Precision Instrument Comp. Co. | Van Nuys, Cal. | | | | | | |

ELECTRONIC

SALES & SERVICE OFFICES

UNITED STATES

ALABAMA

P.O. Box 4207
2003 Byrd Spring Road S.W.
Huntsville 35802
Tel: (205) 881-4591
TWX: 810-726-2204

ARIZONA

2336 E. Magnolia St.
Phoenix 85034
Tel: (602) 244-1361
TWX: 910-951-1330

5737 East Broadway
Tucson 85711
Tel: (602) 298-2313
TWX: 910-952-1162

CALIFORNIA

1430 East Orangethorpe Ave.
Fullerton 92631
Tel: (714) 870-1000
TWX: 910-592-1288

3939 Lankershim Boulevard
North Hollywood 91604
Tel: (213) 877-1282
TWX: 910-499-2170

6305 Arizona Place
Los Angeles 90045
Tel: (213) 649-2511
TWX: 910-328-6148

1101 Embarcadero Road
Palo Alto 94303
Tel: (415) 327-6500
TWX: 910-373-1280

2220 Watt Ave.
Sacramento 95825
Tel: (916) 482-1463
TWX: 910-367-2092

9606 Aero Drive
San Diego 92123
Tel: (714) 279-3200
TWX: 910-335-2000

COLORADO

7965 East Prentice
Englewood 80110
Tel: (303) 771-3455
TWX: 910-935-0705

CONNECTICUT

12 Lunar Drive
New Haven 06525
Tel: (203) 389-6551
TWX: 710-465-2029

FLORIDA

P.O. Box 24210
2806 W. Oakland Park Blvd.
Ft. Lauderdale 33307
Tel: (305) 731-2020
TWX: 510-955-4099

P.O. Box 13910
6177 Lake Ellenor Dr.
Orlando, 32809
Tel: (305) 859-2900
TWX: 810-850-0113

GEORGIA

P.O. Box 28234
450 Interstate North
Atlanta 30328
Tel: (404) 436-6181
TWX: 810-766-4890

HAWAII

2875 So. King Street
Honolulu 96814
Tel: (808) 955-4455

ILLINOIS

5500 Howard Street
Skokie 60076
Tel: (312) 677-0400
TWX: 910-373-3613

INDIANA

3839 Meadows Drive
Indianapolis 46205
Tel: (317) 546-4891
TWX: 810-341-3263

LOUISIANA

P.O. Box 856
3239 Williams Boulevard
Kenner 70062
Tel: (504) 721-6201
TWX: 810-955-5524

MARYLAND

6707 Whitestone Road
Baltimore 21207
Tel: (301) 944-5400
TWX: 710-862-9157

P.O. Box 1648
2 Choke Cherry Road
Rockville 20850
Tel: (301) 948-6370
TWX: 710-828-9684

MASSACHUSETTS

32 Hartwell Ave.
Lexington 02173
Tel: (617) 861-8960
TWX: 710-326-6904

MICHIGAN

21840 West Nine Mile Road
Southfield 48075
Tel: (313) 353-9100
TWX: 810-224-4882

MINNESOTA

2459 University Avenue
St. Paul 55114
Tel: (612) 645-9461
TWX: 910-563-3734

MISSOURI

11131 Colorado Ave.
Kansas City 64137
Tel: (816) 763-8000
TWX: 910-771-2087

148 Weldon Parkway
Maryland Heights 63043
Tel: (314) 567-1455
TWX: 910-764-0830

*NEVADA

Las Vegas
Tel: (702) 382-5777

NEW JERSEY

W. 120 Century Road
Paramus 07652
Tel: (201) 265-5000
TWX: 710-990-4951

1060 N. Kings Highway
Cherry Hill 08034
Tel: (609) 667-4000
TWX: 710-892-4945

NEW MEXICO

P.O. Box 8366
Station C
6501 Lomas Boulevard N.E.
Albuquerque 87108
Tel: (505) 265-3713
TWX: 910-989-1665

156 Wyatt Drive
Las Cruces 88001
Tel: (505) 526-2485
TWX: 910-983-0550

NEW YORK

6 Automation Lane
Computer Park
Albany 12205
Tel: (518) 458-1550
TWX: 710-441-8270

1219 Campville Road
Endicott 13760
Tel: (607) 754-0050
TWX: 510-252-0890

New York City
Manhattan, Bronx
Contact Paramus, NJ Office
Tel: (201) 265-5000
Brooklyn, Queens, Richmond
Contact Woodbury, NY Office
Tel: (516) 921-0300

82 Washington Street
Poughkeepsie 12601
Tel: (914) 454-7330
TWX: 510-248-0012

39 Saginaw Drive
Rochester 14623
Tel: (716) 473-9500
TWX: 510-253-5981

5858 East Mollay Road
Syracuse 13211
Tel: (315) 454-2486
TWX: 710-541-0482

1 Crossways Park West
Woodbury 11797
Tel: (516) 921-0300
TWX: 510-221-2168

NORTH CAROLINA

P.O. Box 5188
1923 North Main Street
High Point 27622
Tel: (919) 885-8101
TWX: 510-926-1516

OHIO

25575 Center Ridge Road
Cleveland 44145
Tel: (216) 835-0300
TWX: 810-427-9129

3460 South Dixie Drive
Dayton 45439
Tel: (513) 298-0351
TWX: 810-459-1925

1120 Morse Road
Columbus 43229
Tel: (614) 846-1300

OKLAHOMA

P.O. Box 32008
Oklahoma City 73132
Tel: (405) 721-0200
TWX: 910-830-6862

OREGON

17890 SW Boones Ferry Road
Tualatin 97062
Tel: (503) 620-3350
TWX: 910-467-8714

PENNSYLVANIA

2500 Moss Side Boulevard
Monroeville 15146
Tel: (412) 271-0724
TWX: 710-797-3650

1021 8th Avenue
King of Prussia Industrial Park
King of Prussia 19406
Tel: (215) 265-7000
TWX: 510-660-2670

RHODE ISLAND

873 Waterman Ave.
East Providence 02914
Tel: (401) 434-5535
TWX: 710-381-7573

*TENNESSEE

Memphis
Tel: (901) 274-7472

TEXAS

P.O. Box 1270
201 E. Arapaho Rd.
Richardson 75080
Tel: (214) 231-6101
TWX: 910-867-4723

P.O. Box 27409
6300 Westpark Drive
Suite 100
Houston 77027
Tel: (713) 781-6000
TWX: 910-881-2645

231 Billy Mitchell Road
San Antonio 78226
Tel: (512) 434-4171
TWX: 910-871-1170

UTAH

2890 South Main Street
Salt Lake City 84115
Tel: (801) 487-0715
TWX: 910-925-5681

VIRGINIA

P.O. Box 6514
2111 Spencer Road
Richmond 23230
Tel: (703) 285-3431
TWX: 710-956-0157

WASHINGTON

433-108th N.E.
Bellevue 98004
Tel: (206) 454-3971
TWX: 910-443-2303

*WEST VIRGINIA

Charleston
Tel: (304) 768-1232

WISCONSIN

9431 W. Beloit Road
Suite 117
Milwaukee 53227
Tel: (414) 541-0550

FOR U.S. AREAS NOT LISTED:

Contact the regional office nearest you: Atlanta, Georgia . . . North Hollywood, California . . . Paramus, New Jersey . . . Skokie, Illinois. Their complete addresses are listed above.
*Service Only

CANADA

ALBERTA

Hewlett-Packard (Canada) Ltd.
11748 Kingsway Ave.
Edmonton
Tel: (403) 452-3670
TWX: 610-831-2431

BRITISH COLUMBIA

Hewlett-Packard (Canada) Ltd.
4519 Canada Way
West Burnaby 2
Tel: (604) 433-8213
TWX: 610-922-5059

MANITOBA

Hewlett-Packard (Canada) Ltd.
513 Century St.
Winnipeg
Tel: (204) 786-7581
TWX: 610-671-3531

NOVA SCOTIA

Hewlett-Packard (Canada) Ltd.
2745 Dutch Village Rd.
Suite 206
Halifax
Tel: (902) 455-0511
TWX: 610-271-4482

ONTARIO

Hewlett-Packard (Canada) Ltd.
1785 Woodward Dr.
Ottawa 3
Tel: (613) 255-6180, 255-6530
TWX: 610-562-8968

Hewlett-Packard (Canada) Ltd.
50 Galaxie Blvd.
Rexdale
Tel: (416) 677-9611
TWX: 610-492-4246

QUEBEC

Hewlett-Packard (Canada) Ltd.
275 Hymus Boulevard
Pointe Claire
Tel: (514) 697-4232
TWX: 610-422-3022
Telex: 01-20607

FOR CANADIAN AREAS NOT LISTED:

Contact Hewlett-Packard (Canada) Ltd. in Pointe Claire, at the complete address listed above.

CENTRAL AND SOUTH AMERICA

ARGENTINA

Hewlett-Packard Argentina
S.A.C.e.I
Lavalle 1171 - 3°
Buenos Aires
Tel: 35-0436, 35-0627, 35-0341
Telex: 012-1009
Cable: HEWPACK ARG

BRAZIL

Hewlett-Packard Do Brasil
I.E.C. LTDA.
Rua Frei Caneca 1119
01307-Sao Paulo - 3, SP
Tel: 288-7111, 287-5858
Cable: HEWPACK Sao Paulo

Hewlett-Packard Do Brasil
I.E.C. LTDA.
Praca Dom Feliciano 78
Salas 806/808
9000-Porto Alegre RS
Rio Grande do Sul (RS)-Brasil
Tel: 25-8470
Cable: HEWPACK Porto Alegre

Hewlett-Packard Do Brasil
I.E.C. LTDA.
Rua da Matriz 29
2000-Rio de Janeiro, GB
Tel: 266-2643
Cable: HEWPACK Rio de Janeiro

BOLIVIA

Stambuk & Mark (Bolivia) LTDA.
Av. Mariscal, Santa Cruz 1342
La Paz
Tel: 40626, 53163, 52421
Telex: 3560014
Cable: BUKMAR

CHILE

Héctor Calcagni y Cia, Ltda.
Casilla 16.475
Santiago
Tel: 423 96
Cable: CALCAGNI Santiago

COLOMBIA

Instrumentación
Henrik A. Langebaek & Kier S.A.
Carrera 7 No. 48-59
Apartado Aéreo 6287
Bogotá, I. D. C.
Tel: 45-78-06, 45-55-46
Cable: AARIS Bogota
Telex: 44400INSTCO

COSTA RICA

Lic. Alfredo Gallegos Gurdán
Apartado 10159
San José
Tel: 21-86-13
Cable: GALGUR San José

ECUADOR

Laboratorios de Radio-Ingeniería
Calle Guayaquil 1246
Post Office Box 3199
Quito
Tel: 212-496; 219-185
Cable: HORVATH Quito

EL SALVADOR

Electronic Associates
Apartado Postal 1682
Centro Comercial Gigante
San Salvador, El Salvador C.A.
Paseo Escalon 4649-4° Piso
Tel: 23-44-60, 23-32-37
Cable: ELECCAS

GUATEMALA

IPESA
5a via 2-01, Zona 4
Guatemala City
Tel: 63-6-27 & 64-7-86
Telex: 4192 TELTRO GU

MEXICO

Hewlett-Packard Mexicana, S.A.
de C.V.
Adolfo Prieto 622
Col. del Valle
Mexico 12, D.F.
Tel: 543-4232; 523-1874
Telex: 017-74-507

NICARAGUA

Roberto Terán G.
Apartado Postal 689
Edificio Terán
Managua
Tel: 3451, 3452
Cable: ROTERAN Managua

PANAMA

Electrónica Balboa, S.A.
P.O. Box 4929
Ave. Manuel Espinosa No. 13-50
Bldg. Alina
Panama City
Tel: 230833
Telex: 3481003, Curundu.
Canal Zone
Cable: ELECTRON Panama City

PARAGUAY

Z.J. Melamed S.R.L.
Division: Aparatos y Equipos
Médicos
Salón de Exposición y Escritorio:
Chile 482
Edificio Victoria—Planta Baja
Asunción, Paraguay
Tel: 4-5069, 4-6272
Cable: RAMEL

PERU

Compañía Electro Médica S.A.
Ave. Enrique Canauai 312
San Isidro
Casilla 1030
Lima
Tel: 22-3900
Cable: ELMED Lima

PUERTO RICO

San Juan Electronics, Inc.
P.O. Box 5167
Ponce de Leon 154
Pda. 3-PTA de Tierra
San Juan 00906
Tel: (809) 725-3342, 722-3342
Cable: SATRONICS San Juan
Telex: SATRON 3450 332

URUGUAY

Pablo Ferrando S.A.
Comercial e Industrial
Avenida Italia 2877
Casilla de Correo 370
Montevideo
Tel: 40-3102
Cable: RADIUM Montevideo

VENEZUELA

Hewlett-Packard De Venezuela
C.A.
Apartado 50933
Caracas
Tel: 71.88.05, 71.88.69, 71.99.30
Cable: HEWPACK Caracas
Telex: 21146 HEWPACK

FOR AREAS NOT LISTED,

CONTACT:
Hewlett-Packard
Inter-Americas
3200 Hillview Ave.
Palo Alto, California 94304
Tel: (415) 493-1501
TWX: 910-373-1267
Cable: HEWPACK Palo Alto
Telex: 034-8300, 034-8493

EUROPE

AUSTRIA
Hewlett-Packard Ges.m.b.H
Handelskai 52/3
P.O. Box 7
A-1205 Vienna
Tel: (0222) 33 66 06 to 09
Cable: HEWPAK Vienna
Telex: 75923 hewpak a

BELGIUM
Hewlett-Packard Benelux
S.A./N.V.
Avenue du Col-Vert, 1
B-1170 Brussels
Tel: (02) 72 22 40
Cable: PALOEN Brussels
Telex: 23 494 paloben br

DENMARK
Hewlett-Packard A/S
Datavej 38
DK-3460 Birkerød
Tel: (01) 81 66 40
Cable: HEWPAK AS
Telex: 166 40 hp as
Hewlett-Packard A/S
Torvet 9
DK-8600 Silkeborg
Tel: (06) 82-71-66
Telex: 166 40 hp as
Cable: HEWPAK AS

FINLAND
Hewlett-Packard Oy
Bulevardi 26
P.O. Box 12185
SF-00120 Helsinki 12
Tel: (90) 13730
Cable: HEWPAK OY Helsinki
Telex: 12-15363 hel

FRANCE
Hewlett-Packard France
Quartier de Courtaouef
Boite Postale No. 6
F-91401 Orsay
Tel: (1) 907 78 25
Cable: HEWPAK Orsay
Telex: 60048

Hewlett-Packard France
4 Quai des Etoiles
F-93221 Lyon Cedex 1
Tel: (78) 42 63 45
Cable: HEWPAK Lyon
Telex: 31617
Hewlett-Packard France
29 rue de la Gare
F-31700 Blagnac
Tel: (61) 85 82 29
Telex: 51957

**GERMAN FEDERAL
REPUBLIC**
Hewlett-Packard GmbH
Vertriebszentrale Frankfurt
Bernerstrasse 117
Postfach 560 140
D-6000 Frankfurt 56
Tel: (0611) 50 04-1
Cable: HEWPAKSA Frankfurt
Telex: 41 32 49 fra

Hewlett-Packard GmbH
Vertriebsbüro Böblingen
Herrenbergerstrasse 110
D-7030 Böblingen, Württemberg
Tel: (07031) 66 72 87
Cable: HEPAK Böblingen
Telex: 72 65 739 bbn
Hewlett-Packard GmbH
Vertriebsbüro Düsseldorf
Vogelsanger Weg 38
D-4000 Düsseldorf
Tel: (0211) 63 80 31/35
Telex: 85/86 533 hppd d

Hewlett-Packard Ltd.
The Graftons
Stamford New Road
Altrincham, Cheshire, England
Tel: (061) 928-8626
Telex: 668068

ITALY
Hewlett-Packard Italiana S.p.A.
Via Amerigo Vesputici 2
I-20124 Milan
Tel: (2) 6251 (10 lines)
Cable: HEWPAK I T Milan
Telex: 32046
Hewlett-Packard Italiana S.p.A.
Piazza Marconi
I-00144 Rome - Eur
Tel: (6) 5912544/5, 5915947
Cable: HEWPAKIT Rome
Telex: 61514

Hewlett-Packard GmbH
Vertriebsbüro München
Unterhacherger Strasse 28
ISAR Center
D-8012 Ottobrunn
Tel: (0811) 601 30 61/7
Telex: 52 49 85
Cable: HEWPAKSA München
(West Berlin)
Hewlett-Packard GmbH
Vertriebsbüro Berlin
Wilmersdorfer Strasse 113/114
D-1000 Berlin W. 12
Tel: (0311) 3137046
Telex: 18 34 05 hpbml d

GREECE
Kostas Karayannis
18, Ermou Street
GR-Athens 126
Tel: 3230-303
Cable: RAKAR Athens
Telex: 21 59 62 rkar gr

IRELAND
Hewlett-Packard Ltd.
224 Bath Road
GB-Slough, SL1 4 DS, Bucks
Tel: Slough (0753) 33341
Cable: HEWPIE Slough
Telex: 84413

Hewlett-Packard Ltd.
The Graftons
Stamford New Road
Altrincham, Cheshire, England
Tel: (061) 928-8626
Telex: 668068

NETHERLANDS
Hewlett-Packard Benelux, N.V.
Weerdestein 117
P.O. Box 7825
NL-Amsterdam, 2 11
Tel: (020) 42 77 77
Cable: PALOEN Amsterdam
Telex: 13 216 hepa nl
NORWAY
Hewlett-Packard Norge A/S
Nesveien 13
Box 149
N-1344 Haslum
Tel: (02) 53 83 60
Telex: 16621 hpnas n
PORTUGAL
Telegra-Empresa Técnica de
Eléctricos S.a.r.l.
Rua Rodrigo da Fonseca 103
P.O. Box 2531
P-Lisbon 1
Tel: (19) 68 60 72
Cable: TELETRA Lisbon
Telex: 1598

Hewlett-Packard Italiana S.p.A.
Vicolo Pastori, 3
I-35100 Padova
Tel: (49) 66 40 62
Telex: 32046 via Milan

Hewlett-Packard Italiana S.p.A.
Via Colli, 24
I-10129 Turin
Tel: (11) 53 82 64
Telex: 32046 via Milan

LUXEMBURG
Hewlett-Packard Benelux
S.A./N.V.
Avenue du Col-Vert, 1
B-1170 Brussels
Tel: (03/02) 72 22 40
Cable: PALOEN Brussels
Telex: 23 494

NETHERLANDS
Hewlett-Packard Benelux, N.V.
Weerdestein 117
P.O. Box 7825
NL-Amsterdam, 2 11
Tel: (020) 42 77 77
Cable: PALOEN Amsterdam
Telex: 13 216 hepa nl

NORWAY
Hewlett-Packard Norge A/S
Nesveien 13
Box 149
N-1344 Haslum
Tel: (02) 53 83 60
Telex: 16621 hpnas n

PORTUGAL
Telegra-Empresa Técnica de
Eléctricos S.a.r.l.
Rua Rodrigo da Fonseca 103
P.O. Box 2531
P-Lisbon 1
Tel: (19) 68 60 72
Cable: TELETRA Lisbon
Telex: 1598

SPAIN
Hewlett-Packard Española, S.A.
Jerez No 8
E-Madrid 16
Tel: 458 26 00
Telex: 23515 hpe
Hewlett-Packard Española, S.A.
Milanesado 21-23
E-Barcelona 17
Tel: (3) 203 62 00
Telex: 52603 hpbe e

SWEDEN
Hewlett-Packard Sverige AB
Enighetsvägen 1-3
Fack
S-161 20 Bromma 20
Tel: (08) 98 12 50
Cable: MEASUREMENTS
Stockholm
Telex: 10721

Hewlett-Packard Sverige AB
Hagakersgatan 9C
S-431 41 Mölndal
Tel: (031) 27 68 00/01
Telex: 21 312 hmöndi s
SWITZERLAND
Hewlett Packard (Schweiz) AG
Zürcherstrasse 20
P.O. Box 64
CH-8952 Schlieren Zurich
Tel: (01) 98 18 21/24
Cable: HPAG CH
Telex: 53933 hpag ch
Hewlett-Packard (Schweiz) AG
9, Chemin Louis-Pictet
CH-1214 Vernier—Geneva
Tel: (022) 41 4950
Cable: HEWPAKSA Geneva
Telex: 27 333 hpsa ch

SWITZERLAND
Hewlett Packard (Schweiz) AG
Zürcherstrasse 20
P.O. Box 64
CH-8952 Schlieren Zurich
Tel: (01) 98 18 21/24
Cable: HPAG CH
Telex: 53933 hpag ch
Hewlett-Packard (Schweiz) AG
9, Chemin Louis-Pictet
CH-1214 Vernier—Geneva
Tel: (022) 41 4950
Cable: HEWPAKSA Geneva
Telex: 27 333 hpsa ch

SWITZERLAND
Hewlett Packard (Schweiz) AG
Zürcherstrasse 20
P.O. Box 64
CH-8952 Schlieren Zurich
Tel: (01) 98 18 21/24
Cable: HPAG CH
Telex: 53933 hpag ch
Hewlett-Packard (Schweiz) AG
9, Chemin Louis-Pictet
CH-1214 Vernier—Geneva
Tel: (022) 41 4950
Cable: HEWPAKSA Geneva
Telex: 27 333 hpsa ch

TURKEY
Telekom Engineering Bureau
Saglik Sok No. 15/1
Ayaspa-Beyoglu
P.O. Box 437 Beyoglu
TR-Istanbul
Tel: 49 40 40
Cable: TELEMAN Istanbul

UNITED KINGDOM
Hewlett-Packard Ltd.
224 Bath Road
GB-Slough, SL1 4 DS, Bucks
Tel: Slough (0753) 33341
Cable: HEWPIE Slough
Telex: 84413

Hewlett-Packard Ltd.
"The Graftons"
Stamford New Road
GB-Altrincham, Cheshire
Tel: (061) 928-8626
Telex: 668068

Hewlett-Packard Ltd's registered
address for V.A.T. purposes
only:
70, Finsbury Pavement
London, EC2A1SX
Registered No: 69057

**SOCIALIST COUNTRIES
PLEASE CONTACT:**
Hewlett-Packard Ges.m.b.H.
Handelskai 52/3
P.O. Box 7
A-1205 Vienna
Ph: (0222) 33 66 06 to 09
Cable: HEWPAK Vienna
Telex: 75923 hewpak a

**ALL OTHER EUROPEAN
COUNTRIES CONTACT:**
Hewlett-Packard S.A.
Rue du Bois-du-Lan 7
P.O. Box 85
CH-1217 Meyrin 2 Geneva
Switzerland
Tel: (022) 41 54 00
Cable: HEWPAKSA Geneva
Telex: 2 24 86

AFRICA, ASIA, AUSTRALIA

ANGOLA
Telectra Empresa Técnica
de Equipamentos Eléctricos
SAR
Rua de Barbosa Rodrigues
421-A
Box 6487
Luanda
Cable: TELETRA Luanda

AUSTRALIA
Hewlett-Packard Australia
Pty. Ltd.
22-26 Weir Street
Blen Iris, 3146
Victoria
Tel: 20-1371 (6 lines)
Cable: HEWPAK Melbourne
Telex: 31 024
Hewlett-Packard Australia
Pty. Ltd.
Corner Bridge & West Streets
Pymble, New South Wales, 2073
Tel: 449 6-16
Cable: HEWPAK Sydney
Telex: 21561
Hewlett-Packard Australia
Pty. Ltd.
97 Churchhill Road
Prospect 5082
South Australia
Tel: 65-2366
Cable: HEWPAK Adelaide

Hewlett-Packard Australia
Pty. Ltd.
2nd Floor, Suite 13
Casablanca Buildings
196 Adelaide Terrace
Perth, W.A. 6000
Tel: 25-6800
Cable: HEWPAK Perth
Hewlett-Packard Australia
Pty. Ltd.
10 Woolley Street
P.O. Box 191
Dickson A.C.T. 2602
Tel: 49-8194
Cable: HEWPAK Canberra ACT
Hewlett-Packard Australia
Pty. Ltd.
2nd Floor, 49 Gregory Terrace
Brisbane, Queensland, 4000
Tel: 29 1544

CEYLON
United Electricals Ltd.
P.O. Box 681
60 Park St
Colombo 2
Tel: 26696
Cable: HOTPOINT Colombo

CYPRUS
Kypronics
19 Gregorios & Xenopoulos Road
P.O. Box 1152
CY-Nicosia
Tel: 45628/29
Cable: KYPFRONKS PANDEHIS

ETHIOPIA
African Salespower & Agency
Private Ltd., Co.
P.O. Box 718
58/59 Cunningham St.
Addis Ababa
Tel: 12285
Cable: ASACO Addisababa

HONG KONG
Schmidt & Co. (Hong Kong) Ltd.
P.O. Box 297
1511, Prince's Building 15th Floor
10, Chater Road
Hong Kong
Tel: 240168, 232735
Cable: SCHMIDT CO Hong Kong

INDIA
Blue Star Ltd.
Kasturi Buildings
Jamsheji Tata Rd.
Bombay 400 020
Tel: 29 50 21
Telex: 3751
Cable: BLUEFROST
Blue Star Ltd.
Band Box House
Prabhadevi
Bombay 400 025
Tel: 45 73 01
Telex: 3751
Cable: BLUESTAR
Blue Star Ltd.
14/40 Civil Lines
Kampur 208 001
Tel: 6 88 82
Cable: BLUESTAR
Blue Star, Ltd.
7 Hare Street
P.O. Box 506
Calcutta 700 001
Tel: 23-0131
Telex: 655
Cable: BLUESTAR
Blue Star Ltd.
Blue Star House,
34 Ring Road
Lajpat Nagar
New Delhi 110 024
Tel: 62 32 76
Telex: 463
Cable: BLUESTAR
Blue Star, Ltd.
Blue Star House
11/11A Magarath Road
Bangalore 560 025
Tel: 51473
Telex: 430
Cable: BLUESTAR

INDONESIA
Bah Bolon Trading Coy. N.V.
Dajah Merdeka 29
Bandung
Tel: 4915; 51560
Cable: ILMU
Tel: 08-809
IRAN
Multicorp International Ltd.
Avenue Soraya 130
P.O. Box 1212
IR-Teheran
Tel: 83 10 35-39
Cable: MULTICORP Teheran
Telex: 2893 MCI TN
ISRAEL
Electronics & Engineering
Div. of Motorola Israel Ltd.
17 Aminadav Street
Tel-Aviv
Tel: 36941 (3 lines)
Cable: BASTEL Tel-Aviv
Telex: 33569

JAPAN
Yokogawa-Hewlett-Packard Ltd.
Ohashi Building
1-59-1 Yoyogi
Shibuya-ku, Tokyo
Tel: 03-370-2281/92
Telex: 232-2024YHP
Cable: YHPMARKET TOK 23-724
Yokogawa-Hewlett-Packard Ltd.
Nisei Ibaragi Bldg.
2-2-8 Kasuga
Ibaragi-Shi
Osaka
Tel: (0726) 23-1641
Telex: 5332-385 YHP OSAKA
Yokogawa-Hewlett-Packard Ltd.
Nakamo Building
No. 24 Kamissazima-cho
Nakamura-ku, Nagoya City
Tel: (052) 571-5171

KOREA
Amtraco Corporation
Industrial Products Div.
Seoul P.O. Box 1103
8th floor, Daekyung Bldg.
107 Sejong Ro
Chongro-Ku, Seoul
Tel: 73-8924-7
Cable: AMTRACO Seoul
LEBANON
Constantin E. Macridis
P.O. Box 7213
RL-Beirut
Tel: 220846
Cable: ELECTRONUCLEAR Beirut
MALAYSIA
MECOMB Malaysia Ltd.
2 Lorong 13/6A
Section 13
Petaling Jaya, Selangor
Cable: MECOMB Kuala Lumpur
MOZAMBIQUE
A. N. Goncalves, LDA.
41 Apt. 14 Av. D. Luis
P.O. Box 107
Lourenco Marques
Tel: 6-203 NEGON MO
Cable: NEGON
NEW ZEALAND
Hewlett-Packard (N.Z.) Ltd.
94-96 Dixon St.
P.O. Box 9443
Courtenay Place
Wellington, N.Z.
Tel: 56-559
Telex: 6-203 NEGON MU
Cable: HEWPAK Wellington
Hewlett-Packard (N.Z.) Ltd.
Pukuranga
Tel: 56-9837
Cable: HEWPAK Auckland
NIGERIA
Teil (MesaCom Division)
25 Moronll St, Suru-Lere,
P.O. Box 5705
Lagos
Cable: THEITEIL LAGOS

Blue Star, Ltd.
1-1-117/1
Sarojini Devi Road
Secunderabad 500 003
Tel: 7 63 91, 7 73 93
Cable: BLUEFROST
Telex: 459
Blue Star, Ltd.
23/24 Second Line Beach
Madras 600 001
Tel: 2 39 55
Telex: 379
Cable: BLUESTAR
Blue Star, Ltd.
1B Kaiser Bungalow
Dindli Road
Jamshejpur 831 001
Tel: 38 04
Cable: BLUESTAR
Telex: 240

PAKISTAN
Mushko & Company, Ltd.
Oosman Chambers
Abdullah Haroon Road
Karachi 3
Tel: 511027, 512927
Cable: COOPERATOR Karachi
Mushko & Company, Ltd.
388, Satellite Town
Rawalpindi
Tel: 41924
Cable: FEMUS Rawalpindi

PHILIPPINES
Electromex Inc.
5th Floor, Architects
Center Bldg.
Ayala Ave., Makati, Rizal
C.C.P.O. Box 1028
Makati, Rizal
Tel: 86-18-87, 87-76-77
Cable: ELEMEX Manila
SINGAPORE
Mechanical and Combustion
Engineering Company Ltd.
9, Jalan Kilang
Red Hill Industrial Estate
Singapore, 3
Tel: 642361-3; 632611
Cable: MECOMB Singapore
Hewlett-Packard Far East
Area Office
P.O. Box 87
Alexandra Post Office
Singapore 3
Tel: 633022
Cable: HEWPAK SINGAPORE
SOUTH AFRICA
Hewlett Packard South Africa
(Pty.), Ltd.
P.O. Box 31716
Braamfontein Transvaal
Milnerston
30 De Beer Street
Johannesburg
Tel: 725-2080, 725-2030
Telex: 0226 JH
Cable: HEWPAK Johannesburg
Hewlett Packard South Africa
(Pty.), Ltd.
Breecham House
Bree Street
Cape Town
Tel: 3-6019, 3-6545
Cable: HEWPAK Cape Town
Telex: 5-0006
Hewlett Packard South Africa
(Pty.), Ltd.
641 Rideau Road, Durban
P.O. Box 69
Overport, Natal
Tel: 88-6102
Telex: 567954
Cable: HEWPAK

TAIWAN
Hewlett Packard Taiwan
39 Chung Shiao West Road
Sec. 1
Overseas Insurance
Corp. Bldg. 7th Floor
Taipei
Tel: 389160, 1-2, 375121,
Ext. 240-249
Telex: TP824 HEWPAK
Cable: HEWPAK Taipei
THAILAND
UNIMESA Co., Ltd.
Chongkoinee Building
56 Suriwongse Road
Bangkok
Tel: 37956, 31300, 31307,
37540
Cable: UNIMESA Bangkok
UGANDA
Uganda Teie-Electric Co., Ltd.
P.O. Box 4449
Kampala
Tel: 57279
Cable: COMCO Kampala
VIETNAM
Peninsular Trading Inc.
P.O. Box H-3
216 Hien-Vuong
Saigon
Tel: 20-805, 93398
Cable: PENTRA, SAIGON 242
ZAMBIA
R. J. Tilbury (Zambia) Ltd.
P.O. Box 2792
Lusaka
Zambia, Central Africa
Tel: 73793
Cable: ARJAYTEE, Lusaka

AFRICA, ASIA, AUSTRALIA
Blue Star, Ltd.
1-1-117/1
Sarojini Devi Road
Secunderabad 500 003
Tel: 7 63 91, 7 73 93
Cable: BLUEFROST
Telex: 459
Blue Star, Ltd.
23/24 Second Line Beach
Madras 600 001
Tel: 2 39 55
Telex: 379
Cable: BLUESTAR
Blue Star, Ltd.
1B Kaiser Bungalow
Dindli Road
Jamshejpur 831 001
Tel: 38 04
Cable: BLUESTAR
Telex: 240
INDONESIA
Bah Bolon Trading Coy. N.V.
Dajah Merdeka 29
Bandung
Tel: 4915; 51560
Cable: ILMU
Tel: 08-809
IRAN
Multicorp International Ltd.
Avenue Soraya 130
P.O. Box 1212
IR-Teheran
Tel: 83 10 35-39
Cable: MULTICORP Teheran
Telex: 2893 MCI TN
ISRAEL
Electronics & Engineering
Div. of Motorola Israel Ltd.
17 Aminadav Street
Tel-Aviv
Tel: 36941 (3 lines)
Cable: BASTEL Tel-Aviv
Telex: 33569
JAPAN
Yokogawa-Hewlett-Packard Ltd.
Ohashi Building
1-59-1 Yoyogi
Shibuya-ku, Tokyo
Tel: 03-370-2281/92
Telex: 232-2024YHP
Cable: YHPMARKET TOK 23-724
Yokogawa-Hewlett-Packard Ltd.
Nisei Ibaragi Bldg.
2-2-8 Kasuga
Ibaragi-Shi
Osaka
Tel: (0726) 23-1641
Telex: 5332-385 YHP OSAKA
Yokogawa-Hewlett-Packard Ltd.
Nakamo Building
No. 24 Kamissazima-cho
Nakamura-ku, Nagoya City
Tel: (052) 571-5171

NETHERLANDS
Hewlett-Packard Benelux, N.V.
Weerdestein 117
P.O. Box 7825
NL-Amsterdam, 2 11
Tel: (020) 42 77 77
Cable: PALOEN Amsterdam
Telex: 13 216 hepa nl
NORWAY
Hewlett-Packard Norge A/S
Nesveien 13
Box 149
N-1344 Haslum
Tel: (02) 53 83 60
Telex: 16621 hpnas n
PORTUGAL
Telegra-Empresa Técnica de
Eléctricos S.a.r.l.
Rua Rodrigo da Fonseca 103
P.O. Box 2531
P-Lisbon 1
Tel: (19) 68 60 72
Cable: TELETRA Lisbon
Telex: 1598

SPAIN
Hewlett-Packard Española, S.A.
Jerez No 8
E-Madrid 16
Tel: 458 26 00
Telex: 23515 hpe
Hewlett-Packard Española, S.A.
Milanesado 21-23
E-Barcelona 17
Tel: (3) 203 62 00
Telex: 52603 hpbe e
SWEDEN
Hewlett-Packard Sverige AB
Enighetsvägen 1-3
Fack
S-161 20 Bromma 20
Tel: (08) 98 12 50
Cable: MEASUREMENTS
Stockholm
Telex: 10721
Hewlett-Packard Sverige AB
Hagakersgatan 9C
S-431 41 Mölndal
Tel: (031) 27 68 00/01
Telex: 21 312 hmöndi s
SWITZERLAND
Hewlett Packard (Schweiz) AG
Zürcherstrasse 20
P.O. Box 64
CH-8952 Schlieren Zurich
Tel: (01) 98 18 21/24
Cable: HPAG CH
Telex: 53933 hpag ch
Hewlett-Packard (Schweiz) AG
9, Chemin Louis-Pictet
CH-1214 Vernier—Geneva
Tel: (022) 41 4950
Cable: HEWPAKSA Geneva
Telex: 27 333 hpsa ch

TURKEY
Telekom Engineering Bureau
Saglik Sok No. 15/1
Ayaspa-Beyoglu
P.O. Box 437 Beyoglu
TR-Istanbul
Tel: 49 40 40
Cable: TELEMAN Istanbul

UNITED KINGDOM
Hewlett-Packard Ltd.
224 Bath Road
GB-Slough, SL1 4 DS, Bucks
Tel: Slough (0753) 33341
Cable: HEWPIE Slough
Telex: 84413
Hewlett-Packard Ltd.
"The Graftons"
Stamford New Road
GB-Altrincham, Cheshire
Tel: (061) 928-8626
Telex: 668068
Hewlett-Packard Ltd's registered
address for V.A.T. purposes
only:
70, Finsbury Pavement
London, EC2A1SX
Registered No: 69057
**SOCIALIST COUNTRIES
PLEASE CONTACT:**
Hewlett-Packard Ges.m.b.H.
Handelskai 52/3
P.O. Box 7
A-1205 Vienna
Ph: (0222) 33 66 06 to 09
Cable: HEWPAK Vienna
Telex: 75923 hewpak a
**ALL OTHER EUROPEAN
COUNTRIES CONTACT:**
Hewlett-Packard S.A.
Rue du Bois-du-Lan 7
P.O. Box 85
CH-1217 Meyrin 2 Geneva
Switzerland
Tel: (022) 41 54 00
Cable: HEWPAKSA Geneva
Telex: 2 24 86

AFRICA, ASIA, AUSTRALIA
Blue Star, Ltd.
1-1-117/1
Sarojini Devi Road
Secunderabad 500 003
Tel: 7 63 91, 7 73 93
Cable: BLUEFROST
Telex: 459
Blue Star, Ltd.
23/24 Second Line Beach
Madras 600 001
Tel: 2 39 55
Telex: 379
Cable: BLUESTAR
Blue Star, Ltd.
1B Kaiser Bungalow
Dindli Road
Jamshejpur 831 001
Tel: 38 04
Cable: BLUESTAR
Telex: 240
INDONESIA
Bah Bolon Trading Coy. N.V.
Dajah Merdeka 29
Bandung
Tel: 4915; 51560
Cable: ILMU
Tel: 08-809
IRAN
Multicorp International Ltd.
Avenue Soraya 130
P.O. Box 1212
IR-Teheran
Tel: 83 10 35-39
Cable: MULTICORP Teheran
Telex: 2893 MCI TN
ISRAEL
Electronics & Engineering
Div. of Motorola Israel Ltd.
17 Aminadav Street
Tel-Aviv
Tel: 36941 (3 lines)
Cable: BASTEL Tel-Aviv
Telex: 33569
JAPAN
Yokogawa-Hewlett-Packard Ltd.
Ohashi Building
1-59-1 Yoyogi
Shibuya-ku, Tokyo
Tel: 03-370-2281/92
Telex: 232-2024YHP
Cable: YHPMARKET TOK 23-724
Yokogawa-Hewlett-Packard Ltd.
Nisei Ibaragi Bldg.
2-2-8 Kasuga
Ibaragi-Shi
Osaka
Tel: (0726) 23-1641
Telex: 5332-385 YHP OSAKA
Yokogawa-Hewlett-Packard Ltd.
Nakamo Building
No. 24 Kamissazima-cho
Nakamura-ku, Nagoya City
Tel: (052) 571-5171

NETHERLANDS
Hewlett-Packard Benelux, N.V.
Weerdestein 117
P.O. Box 7825
NL-Amsterdam, 2 11
Tel: (020) 42 77 77
Cable: PALOEN Amsterdam
Telex: 13 216 hepa nl
NORWAY
Hewlett-Packard Norge A/S
Nesveien 13
Box 149
N-1344 Haslum
Tel: (02) 53 83 60
Telex: 16621 hpnas n
PORTUGAL
Telegra-Empresa Técnica de
Eléctricos S.a.r.l.
Rua Rodrigo da Fonseca 103
P.O. Box 2531
P-Lisbon 1
Tel: (19) 68 60 72
Cable: TELETRA Lisbon
Telex: 1598

SPAIN
Hewlett-Packard Española, S.A.
Jerez No 8
E-Madrid 16
Tel: 458 26 00
Telex: 23515 hpe
Hewlett-Packard Española, S.A.
Milanesado 21-23
E-Barcelona 17
Tel: (3) 203 62 00
Telex: 52603 hpbe e
SWEDEN
Hewlett-Packard Sverige AB
Enighetsvägen 1-3
Fack
S-161 20 Bromma 20
Tel: (08) 98 12 50
Cable: MEASUREMENTS
Stockholm
Telex: 10721
Hewlett-Packard Sverige AB
Hagakersgatan 9C
S-431 41 Mölndal
Tel: (031) 27 68 00/01
Telex: 21 312 hmöndi s
SWITZERLAND
Hewlett Packard (Schweiz) AG
Zürcherstrasse 20
P.O. Box 64
CH-8952 Schlieren Zurich
Tel: (01) 98 18 21/24
Cable: HPAG CH
Telex: 53933 hpag ch
Hewlett-Packard (Schweiz) AG
9, Chemin Louis-Pictet
CH-1214 Vernier—Geneva
Tel: (022) 41 4950
Cable: HEWPAKSA Geneva
Telex: 27 333 hpsa ch

TURKEY
Telekom Engineering Bureau
Saglik Sok No. 15/1
Ayaspa-Beyoglu
P.O. Box 437 Beyoglu
TR-Istanbul
Tel: 49 40 40
Cable: TELEMAN Istanbul

UNITED KINGDOM
Hewlett-Packard Ltd.
224 Bath Road
GB-Slough, SL1 4 DS, Bucks
Tel: Slough (0753) 33341
Cable: HEWPIE Slough
Telex: 84413
Hewlett-Packard Ltd.
"The Graftons"
Stamford New Road
GB-Altrincham, Cheshire
Tel: (061) 928-8626
Telex: 668068
Hewlett-Packard Ltd's registered
address for V.A.T. purposes
only:
70, Finsbury Pavement
London, EC2A1SX
Registered No: 69057
**SOCIALIST COUNTRIES
PLEASE CONTACT:**
Hewlett-Packard Ges.m.b.H.
Handelskai 52/3
P.O. Box 7
A-1205 Vienna
Ph: (0222) 33 66 06 to 09
Cable: HEWPAK Vienna
Telex: 75923 hewpak a
**ALL OTHER EUROPEAN
COUN**

