MICROWAVE FREQUENCY COUNTER
5342A

DUPLICATE OF SECTIONS I THRU III OF YOUR OPERATING AND SERVICE MANUAL
KEEP WITH INSTRUMENT

Hewlett Packard
CHANGE DATE: April 23, 1982
(This change supersedes all earlier dated changes.)

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

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

<table>
<thead>
<tr>
<th>SERIAL PREFIX OR SERIES NUMBER</th>
<th>MANUAL CHANGE(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1904A, 1916A, 1936A, 1948A</td>
<td>None</td>
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<tr>
<td>2004A, 2008A</td>
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</tr>
<tr>
<td>2014A, 2020A</td>
<td>1, 2</td>
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<tr>
<td>2022A</td>
<td>1 thru 5</td>
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<tr>
<td>2024A, 2030A</td>
<td>1, 2, 3</td>
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<tr>
<td>2034A, 2035A</td>
<td>1, 2, 3, 4</td>
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<td>2036A</td>
<td>1 thru 5</td>
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<td>2037A, 2038A</td>
<td>1 thru 6</td>
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<tr>
<td>2039A</td>
<td>1 thru 6</td>
</tr>
<tr>
<td>2040A</td>
<td>1 thru 7</td>
</tr>
<tr>
<td>2041A, 2042A, 2043A, 2044A</td>
<td>1 thru 7</td>
</tr>
<tr>
<td>2045A, 2046A, 2101A, 2102A</td>
<td>1 thru 8</td>
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<tr>
<td>2103A, 2104A</td>
<td>1 thru 9</td>
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<td>2105A, 2106A, 2107A</td>
<td>1 thru 10</td>
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<td>2108A, 2109A</td>
<td>1 thru 11</td>
</tr>
<tr>
<td>2110A, 2111A, 2112A</td>
<td>1 thru 11</td>
</tr>
</tbody>
</table>

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

(C53420) 8440-8643-8647/9081-8626/9840-9864/9877/9585-9920/9900-9602/2=9542-10265/E=11379/13=12542/14=12544/15=12117-13861

HP HEWLETT PACKARD
NOTE: Refer to MANUAL CHANGES sheet supplied with Operating and Service Manual (HP Part No. 05342-90013) for any changes applicable to this Operating Information Manual. All changes pertaining to Sections I through III of the above Operating and Service Manual apply directly to this Operating Information Manual. Changes affecting the instrument Serial Number Prefix may also apply if instrument Specifications or operating procedures are changed.

ERRATA
Page 1-2, Table 1-1, Specifications:
>Change "INPUT 1 INPUT CHARACTERISTICS" for "Manual Mode of Operation" to read as follows: Manual: Center frequency entered to within +/-40 MHz TYPICAL of true value; +/-25 MHz TYPICAL for frequencies below 825 MHz.

NOTE: This change in specifications applies to all places in this manual where the center frequency for MANUAL operation states "+/−50 MHz".

Page 1-2, Table 1-1, Model 5342A Specifications:
Under TIME BASE

External Time Base:
Change to read, "Requires 10 MHz, 3.0V peak-to-peak (2.4V peak-to-peak TYPICAL) sine wave or square wave into 1 K OHMS via rear panel BNC connector. Switch selects either internal or external time base."

Page 1-5, Table 1-4, Recommended Test Equipment:
> Add Frequency Counter capable of frequency measurements up to at least 350 MHz for troubleshooting A8, A9, and A10 Main Loop Synthesizer. The HP Model 5345 Electronic Counter is recommended. Use Channel A input set for 50 OHMS input impedance.

Page 2-4, Paragraph 2-25, Table of Option Kits:
> Change option number for HP-IB I/O to "011" & Part Number for "HP-IB Assy" from 05342-60019 to 05342-60015.
CHANGE 1
Page 1-2, Table 1-1, Specifications:
>CHANGE "Maximum Input" level for "INPUT 1:" to +7 dBm.

Page 1-3, Table 1-1, Model 5342A Specifications (Cont'd):
> Add the following:

FREQUENCY EXTENSION TO 24 GHz OPTION 005
Option 005 provides the ability to measure frequency up to 24 GHz.
Option 005 is not compatible with Options 002 or 003.

INPUT 1:
Frequency Range: 500 MHz to 24 GHz.
Sensitivity: 18 GHz to 24 GHz -15 dBm.
Maximum Operating Level: +7 dBm.
Dynamic Range: 18 GHz to 24 Gdagger.Em.
Temperature Range: 0dC to 50dC, nominal.
Damage Level: +25 dBm, peak.
SWR: <3:1 TYPICAL.

NOTE — The following Serial Prefix 1936A instruments have Option 005:

1936A02331
1936A02352
1936A02359
1936A02364
1936A02377
1936A02425

Page 3-3, Paragraph 3-37, Maximum Input Signal Powers:
>CHANGE +5 dBm to +7 dBm in lines 2, 5, and 6.

NOTE: The maximum input level should be considered to be +7 dBm anywhere in
the Operating and Service Manuals where +5 dBm is specified.

Page 3-17, Paragraph 3-52, Operator Error Displays:
>Delete Excessive Signal Level Display for "Frequency" and "Amplitude
(Option 002)".
>Delete footnote indicated by dagger.
For "Out of Frequency Limits (Amplitude)"
>Delete "(if frequency <10 MHz of frequency >18.4 GHz)"
>Add the following:
INPUT 1: if frequency displayed is <500 MHz or >18.4 GHz
INPUT 2: if frequency displayed is <10 MHz

CHANGE 2
Page 2-4, Paragraph 2-28, Installation of Option 002:
>Add the following:
The following procedure is basically correct for all 5342A counters with a
Serial Prefix Number of 2014A or below. A more detailed procedure
applicable to all 5342A counters is given in HP Service Note 0-05342-
60200A. If you do not have a copy of this Service Note, contact your local
HP Sales and Service Office.
CHANGE 2 (Cont'd)

Except for instruments with Option 002, the input fuse for BNC connector A1J2 is mounted inside the front panel connector and is user replaceable as shown in the following illustration:

![Diagram showing the front panel and A1 display board connections, with notes on fuse and connector types.]

CHANGES 3 thru 10, and 15

These are electrical changes which do not affect operation or performance of the instrument.

CHANGES 11, 12, and 14

These are mechanical changes which do not affect operation or performance of the instrument.

CHANGE 13

Page 2-4, paragraph 2-25:

> Change the High Stability Time Base Part Number to read "10544-60011 or 10811-60111 (as alternate part)."

NOTE: The 10544-60011 and 10811-60111 oscillators are directly interchangeable. Instruments with Serial numbers 2152A05216 and above may have either oscillator.
SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

1-1. This manual provides operating and service information for the Hewlett-Packard Model 5342A Microwave Frequency Counter, shown in Figure 1-1.

1-3. SPECIFICATIONS

1-4. Specifications of the 5342A are listed in Table 1-1.

Figure 1-1. Model 5342A Microwave Frequency Counter
### INPUT CHARACTERISTICS

**INPUT 1:**
- **Frequency range:** 500 MHz to 18 GHz
- **Sensitivity:**
  - 500 MHz to 12.4 GHz: -25 dBm
  - 12.4 GHz to 18 GHz: -20 dBm
- **Maximum input:** 5 dBm (see Options 002, 003 for higher level).
- **Dynamic range:**
  - 500 MHz to 12.4 GHz: 30 dB
  - 12.4 GHz to 18 GHz: 25 dB
- **Impedance:** 50 ohms, nominal
- **Connector:** Precision Type N female
- **Gain:** +25 dBm, peak
- **Coupling:** dc to load, ac to instrument.
- **SWR:**
  - <2.1, 500 MHz—10 GHz
  - <3.1, 10 GHz—18 GHz
- **FM tolerance:** Switch selectable (rear panel)
  - FM (wide): 50 MHz p-p worst case
  - CW (normal): 20 MHz p-p worst case
- **AM tolerance:** Any modulation index provides the minimum signal level is not less than the sensitivity specification.
- **Automatic amplitude discrimination:** Automatically measures the largest of all signals present, providing that signal is 6 dB above any signal within 500 MHz, 20 dB above any signal, 500 MHz—18 GHz.
- **Modes of operation:**
  - **Automatic:** Counter automatically acquires and displays highest level signal within sensitivity range.
  - **Manual:** Center frequency entered to within ±50 MHz to true value.
- **Acquisition time:**
  - Automatic mode: Normal FM 530 ms worst case; wide FM 2.4 s worst case.
  - Manual mode: 80 ms after frequency entered.

**INPUT 2:**
- **Frequency range:** 10 Hz to 520 MHz Direct Count.
- **Sensitivity:**
  - 5031 10 Hz to 520 MHz 25 mV rms.
  - 1 MHz 10 Hz to 25 MHz 50 mV rms.
- **Impedance:** Selectable: 1 MΩ, <50 pF or 500 Ω nominal.
- **Coupling:** ac
- **Connector:** Type BNC female.
- **Maximum input:** 500 3.5 V rms (±24 dBm) or 5 V dc fuse protected; 1 MΩ 200 V dc ±5.0 V rms.

**TIME BASE**
- **Crystal frequency:** 10 MHz
- **Stability:**
  - Aging rate: <1 x 10^-7 per month.
  - Short term: <1 x 10^-9 for 1 second average time.
  - Temperature: <±1 x 10^-6 over the range 0°C to 50°C.
  - Line variation: <1 x 10^-7 for 10% change from nominal.
- **Output frequency:** 10 MHz ≥2.4 V square wave (TTL compatible); 1.5 V peak-to-peak into 500 Ω available from rear panel BNC.
- **External time base:** Requires 10 MHz, 20V peak-to-peak sine wave or square wave into 1 kΩ via rear panel BNC connector. Switch selects either internal or external time base.

**OPTIONAL TIME BASE**

**OPTION (001)**
- Option 001 provides an oven-controlled crystal oscillator time base, 10544A (see separate data sheet), that results in better accuracy and longer periods between calibration.
- **Crystal frequency:** 10 MHz
- **Stability:**
  - Aging rate: <5 x 10^-10/day after 24-hour warm-up.
  - Temperature: <7 x 10^-9 over the range 0°C to 50°C.
  - Short term: <1 x 10^-11 for 1 second average time.
  - Line variation: <1 x 10^-10 for 1% change from nominal.
  - Warm-up: <5 x 10^-9 of final value 20 minutes after turn-on, at 25°C.

**AMPLITUDE MEASUREMENT**

**OPTION (002)**
- Option 002 provides the capability of measuring the amplitude of the incoming sine wave signal, and simultaneously displaying its frequency (MHz) and level (dBm). The maximum operating level and the top end of dynamic range are increased to +20 dBm. Amplitude offset to 0.1 dB resolution may be selected from front panel pushbuttons.

**INPUT 1:**
- **Frequency range:** 500 MHz—18 GHz.
- **Dynamic range (frequency and level):**
  - -22 dBm to +20 dBm 500 MHz to 12.4 GHz
  - -15 dBm to +20 dBm 12.4 GHz to 18 GHz
- **Maximum operating level:** +20 dBm
- **Gain:** +25 dBm, peak
- **Resolution:** 0.1 dB
- **Accuracy:** ±1.5 dB (excluding mismatch uncertainty).
- **SWR:**
  - <2:1 (amplitude measurement).
  - <5:1 (frequency measurement).
- **Measurement time:** 100 ms + frequency measurement time.
- **Display:** Simultaneously displays frequency to 1 MHz resolution and input level. (Option 011 provides full frequency resolution on HP-18 output.)

**INPUT 2:**
- **(50Ω impedance only)**
- **Frequency range:** 10 MHz—520 MHz
- **Dynamic range (frequency and level):**
  - -17 dBm to +20 dBm
- **Damage level:** +24 dBm, peak
- **Resolution:** 0.1 dBm.
- **Accuracy:** 1.5 dB (excluding mismatch uncertainty).
- **SWR:** <1:8:1
- **Measurement time:** 100 ms + frequency measurement time.
- **Display:** Simultaneously displays frequency to 1 MHz resolution and input level.
Table 1-1. Model 5342A Specifications (Continued)

**EXTENDED DYNAMIC RANGE**

**OPTION 003**
Option 003 provides an attenuator that automatically extends the dynamic range of operation for input 1.

**INPUT 1:**
- Frequency range: 500 MHz to 18 GHz
- Sensitivity:
  - 500 MHz to 12.4 GHz: -22 dB
  - 12.4 GHz to 18 GHz: -15 dBm
- Maximum operating level: +20 dBm.
- Dynamic range:
  - 500 MHz to 12.4 GHz: 42 dB
  - 12.4 GHz to 18 GHz: 35 dB
- Damage level: +25 dBm, peak
- SWR: <5:1

**DIGITAL-TO-ANALOG CONVERTER**

**OPTION 004**
Option 004 provides the ability to convert any three consecutive displayed digits into an analog voltage output. A display of 000 produces 0 V output; 999 produces 9.99V full scale.
- Accuracy: ±5 mV, ±0.3 mV/°C (from 25°C)
- Conversion Speed: <50 μs to ±0.01% of full scale reading.
- Resolution: 10 mV
- Output: 5 mA. Impedance <1.0 ohm.
- Connector: Type BNC female on rear panel.

**GENERAL**
- Accuracy: ±1 count ± time base error.
- Resolution: Front panel pushbuttons select 1 Hz to 1 MHz.
- Residual stability: When counter and source use common time base or counter uses external high stability time base, <4 x 10^-11 rms typical.
- Display: 11-digit LED display, sectionalized to read GHz, MHz, kHz, and Hz.
- Self-check: Selected from front panel pushbuttons. Measures 75 MHz for resolution chosen.
- Frequency offset: Selected from front panel pushbuttons. Displayed frequency is offset by entered value to 1 Hz resolution.
- Sample rate: Variable from less than 20 ms between measurements to HOLD which holds display indefinitely.
- IF out: Rear panel BNC connector provides 25 MHz to 125 MHz output of down-converted microwave signal.
- Operating temperature: 0°C to 50°C.
- Power requirements: 100/120/220/240V rms, +5%, -10%, 48–66 Hz; 100 VA max.
- Accessories furnished: Power cord, 229 cm (7½ ft.)
- Size: 133 mm H x 213 mm W x 498 mm D (5¼" x 8½" x 19½").
- Weight: Net 9.1 kg (20 lbs.), shipping 12.7 kg (28 lbs.).

1-5. **SAFETY CONSIDERATIONS**

1-6. This product is a Safety Class I instrument (provided with a protective earth terminal). Safety information pertinent to the operation and servicing of this instrument is included in appropriate sections of this manual.

1-7. **INSTRUMENT IDENTIFICATION**

1-8. Hewlett-Packard instruments have a 2-section, 10-character serial number (0000A00000), which is located on the rear panel. The four-digit serial prefix identifies instrument changes. If the serial prefix of your instrument differs from that listed on the title page of this manual, there are differences between this manual and your instrument. Instruments having higher serial prefixes are covered with a "Manual Changes" sheet included with this manual. If the change sheet is missing, contact the nearest Hewlett-Packard Sales and Service Office listed at the back of this manual. Instruments having a lower serial prefix than that listed on the title page, are covered in Section VII.

1-9. **ACCESSORIES**

1-10. Table 1-2 lists accessory equipment supplied and Table 1-3 lists accessories available.

**Table 1-2. Equipment Supplied**

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>HP PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detachable Power Cord 229 cm (7½ feet long)</td>
<td>8120-1378</td>
</tr>
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</table>
Table 1-3. Accessories Available

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>HP PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bail Handle Kit</td>
<td>5061-2002</td>
</tr>
<tr>
<td>Rack Mounting Adapter Kit (Option 908)</td>
<td>5061-0057</td>
</tr>
<tr>
<td>Rack Mounting Adapter Kit with slot for access to front connectors from rear</td>
<td>K70-59992A</td>
</tr>
<tr>
<td>Transit Case</td>
<td>9211-2682</td>
</tr>
<tr>
<td>Service Accessory Kit (refer to paragraph 1-16)</td>
<td>Model 10842A</td>
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<tr>
<td>Microwave Attenuators</td>
<td>Model 8491B, 8494/5/6H</td>
</tr>
<tr>
<td>Signature Analyzer</td>
<td>Model 5004A</td>
</tr>
</tbody>
</table>

1-11. DESCRIPTION

1-12. The 5342A Microwave Frequency Counter measures the frequency of signals in the range of 10 Hz to 18 GHz, with a basic sensitivity of –25 dBm. Signals in the frequency range of 10 Hz to 500 MHz are measured by the direct count method. Signals in the frequency range of 500 MHz to 18 GHz are down-converted to an IF by a heterodyne conversion technique for application to the counter circuits. The unique conversion technique employed results in high sensitivity and FM tolerance in addition to automatic amplitude discrimination. The counted IF is added to the local oscillator frequency to determine the unknown frequency for display.

1-13. OPTIONS

1-14. Options available with the 5342A are described in Table 1-1 and paragraph 3-57. If an option is included in the initial order, it will be installed at the factory and ready for operation upon receipt. If an option is ordered for field installation it will be supplied as a retrofit kit. Refer to Section II for kit part numbers and installation instructions.

1-15. SERVICE EQUIPMENT AVAILABLE

1-16. Extender boards are available for servicing printed circuit assemblies while extended from the instrument. The extender boards allow assemblies to be extended from their plug-in connectors for monitoring with appropriate test equipment. Extender boards for each assembly are supplied in Service Accessory Kit 10842A as described in paragraph 8-46.

1-17. RECOMMENDED TEST EQUIPMENT

1-18. The test equipment listed in Table 1-4 is recommended for use during performance tests, adjustments, and troubleshooting. Substitute test equipment may be used if it meets the required characteristics listed in the table.
<table>
<thead>
<tr>
<th>INSTRUMENT</th>
<th>REQUIRED CHARACTERISTICS</th>
<th>USE*</th>
<th>RECOMMENDED MODEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oscilloscope</td>
<td>100 MHz bandwidth</td>
<td>T,A,O,V,P</td>
<td>HP 1740A</td>
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<td>Signal Generator</td>
<td>10 Hz—10 MHz</td>
<td>T,A,O,V,P</td>
<td>HP 651B</td>
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<td></td>
<td>10 MHz—2.4 GHz</td>
<td></td>
<td>HP 8620C/86222A</td>
</tr>
<tr>
<td></td>
<td>2 GHz—18 GHz</td>
<td></td>
<td>HP 8620C/86290A</td>
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<td>Spectrum Analyzer</td>
<td>RF inputs from 1 MHz—500 MHz</td>
<td>T,A,P</td>
<td>HP 141T/8552A/8554B</td>
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<td>DC Voltmeter</td>
<td>20V Range, 0.05V Resolution</td>
<td>T,A</td>
<td>HP 3465A</td>
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<td>AC Voltmeter</td>
<td>10 MHz—350 MHz</td>
<td>T,A</td>
<td>HP 3406A</td>
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<tr>
<td>AC Voltmeter</td>
<td>100 kHz, 1% accuracy</td>
<td>A (Opt. 002)</td>
<td>HP 3400A</td>
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<tr>
<td>Logic State Analyzer</td>
<td>HP 1740A compatibility</td>
<td>T</td>
<td>HP 1607A (use with HP 1740A)</td>
</tr>
<tr>
<td>Signature Analyzer</td>
<td>5342A compatibility</td>
<td>T</td>
<td>HP 5004A</td>
</tr>
<tr>
<td>Power Splitter</td>
<td>DC—18 GHz</td>
<td>O,V,P</td>
<td>HP 11667A</td>
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<td>Logic Pulser</td>
<td>TTL compatibility</td>
<td>T</td>
<td>HP 546A</td>
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<td>Current Tracer</td>
<td>1 mA—1 A range</td>
<td>T</td>
<td>HP 547A</td>
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<tr>
<td>Logic Probe</td>
<td>TTL compatibility</td>
<td>T</td>
<td>HP 545A</td>
</tr>
<tr>
<td>Step Attenuator</td>
<td>DC—18 GHz 10 dB steps</td>
<td>O,V,P</td>
<td>HP 8495B</td>
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<td>AP Clips (4)</td>
<td>Clip for 14 pin/16 pin IC's</td>
<td>T</td>
<td>HP P/N 1400-0734</td>
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<td>Isolation Transformer</td>
<td>120V IN — Isolated 120V OUT</td>
<td>T</td>
<td>Allied Electronics P/N 705-0048</td>
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<td>Extender Boards</td>
<td>2 x 10 pin</td>
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<td>HP P/N 05342-60030</td>
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<td>2 x 12 pin</td>
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<td>HP P/N 05342-60031</td>
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<td>2 x 15 pin</td>
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<td>HP P/N 05342-60032</td>
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<td>2 x 18 pin (2)</td>
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<td>HP P/N 05342-60033</td>
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<td>2 x 22 pin (2)</td>
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<td></td>
<td>2 x 24 pin</td>
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<td>A 14 Extender</td>
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<td>HP P/N 05342-60036</td>
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<td>A 15 Extender</td>
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<td>Power Meter</td>
<td>10 MHz—18 GHz</td>
<td>A,O,V,P</td>
<td>HP 436A</td>
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<td>Power Sensor</td>
<td>10 MHz—18 GHz</td>
<td>A,O,V,P</td>
<td>HP 8481A</td>
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<tr>
<td>50Ω Termination</td>
<td>DC—18 GHz</td>
<td>P</td>
<td>HP 909A (Option 012)</td>
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<tr>
<td>Microwave Amplifier</td>
<td>1 GHz, +20 dBm Output</td>
<td>P (Opt. 002)</td>
<td>HP 489A</td>
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<tr>
<td>Signal Generator</td>
<td>100 MHz, +20 dBm</td>
<td>A (Opt. 002)</td>
<td>HP 8601A</td>
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<tr>
<td>Signal Generator</td>
<td>&gt;100 MHz, +20 dBm</td>
<td>P,O,V, (Option 002)</td>
<td>HP 3312A</td>
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<td>Swept Frequency Analyzer</td>
<td>100 MHz—18 GHz</td>
<td>P</td>
<td>HP 8755B</td>
</tr>
<tr>
<td>15 MHz—18 GHz Modulator</td>
<td>HP 8755B compatibility</td>
<td>P</td>
<td>HP 11665B</td>
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<tr>
<td>15 MHz—18 GHz Detectors (2 required)</td>
<td>0.1—18 GHz</td>
<td>P</td>
<td>HP 11664A</td>
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<tr>
<td>Oscilloscope Mainframe</td>
<td>HP 8755B compatibility</td>
<td>P</td>
<td>HP 182T</td>
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<tr>
<td>Directional Coupler</td>
<td>2—18 GHz</td>
<td>P</td>
<td>HP 11692D</td>
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<tr>
<td>Directional Coupler</td>
<td>100—500 MHz</td>
<td>P</td>
<td>HP 778D</td>
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<tr>
<td>Signal Generator Mainframe</td>
<td>(Two Microwave sources needed for automatic amplitude discrimination test — see paragraph 4-35)</td>
<td>P</td>
<td>HP 8620C Mainframe</td>
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<tr>
<td>Bus System Analyzer</td>
<td>Control HP-18 lines</td>
<td>T (Opt. 011)</td>
<td>HP 59401A</td>
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</tbody>
</table>

*T = Troubleshooting  O V = Operational Verification
A = Adjustments             P = Full Performance Testing
SECTION II
INSTALLATION

2-1. INTRODUCTION

2-2. This section contains information for unpacking, inspection, storage, and installation.

2-3. UNPACKING AND INSPECTION

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

2-5. INSTALLATION REQUIREMENTS

CAUTION

Before connecting the instrument to ac power lines, be sure that the voltage selector is properly positioned as described below.

2-6. LINE VOLTAGE REQUIREMENTS. The 5342A is equipped with a power module that contains a printed-circuit line voltage selector to select 100-120-, 220-, or 240-volt ac operation. Before applying power, the pc selector must be set to the correct position and the correct fuse must be installed as described below.

2-7. Power line connections are selected by the position of the plug-in circuit card in the module. When the card is plugged into the module, the only visible markings on the card indicate the line voltage to be used. The correct value of line fuse, with a 250-volt rating, must be installed after the card is inserted. This instrument uses a 0.75A fuse (HP Part No. 2110-0360) for 100/120-volt operation; a 0.375A fuse (HP Part No. 2110-0421) for 220/240-volt operation.

2-8. To convert from one line voltage to another, the power cord must be disconnected from the power module before the sliding window covering the fuse and card compartment can be moved to expose the fuse and circuit card. See Figure 2-1.

![Figure 2-1. Line Voltage Selection](image_url)
2-9. Power Cable

2-10. The 5342A is shipped with a three-wire power cable. When the cable is connected to an appropriate ac power source, this cable connects the chassis to earth ground. The type of power cable plug shipped with each instrument depends on the country of destination. Refer to Figure 2-2 for the part numbers of the power cable and plug configurations available.

![Power cable and plug configurations](image)

**Figure 2-2. Power Cable HP Part Numbers versus Mains Plugs Available**

**WARNING**

BEFORE SWITCHING ON THIS INSTRUMENT, THE PROTECTIVE EARTH TERMINALS OF THIS INSTRUMENT MUST BE CONNECTED TO THE PROTECTIVE CONDUCTOR OF THE (MAINS) POWER CORD. THE MAINS PLUG SHALL ONLY BE INSERTED IN A SOCKET OUTLET PROVIDED WITH A PROTECTIVE EARTH CONTACT. THE PROTECTIVE ACTION MUST NOT BE NEGATED BY THE USE OF AN EXTENSION CORD (POWER CABLE) WITHOUT A PROTECTIVE CONDUCTOR (GROUNDING).
2-11. Operating Environment

2-12. TEMPERATURE. The 5342A may be operated in temperatures from 0°C to +55°C.

2-13. HUMIDITY. The 5342A may be operated in environments with humidity up to 95%. However, it should be protected from temperature extremes which cause condensation in the instrument.

2-14. ALTITUDE. The 5342A may be operated at altitudes up to 4,600 metres (15,000 feet).

2-15. STORAGE AND SHIPMENT

2-16. Environment

2-17. The instrument may be stored or shipped in environments within the following limits:

   TEMPERATURE ................. -40°C to +75°C
   HUMIDITY ....................... Up to 95%
   ALTITUDE ...................... 7,620 metres (25,000 feet)

2-18. The instrument should also be protected from temperature extremes which cause condensation within the instrument.

2-19. Packaging

2-20. ORIGINAL PACKAGING. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number. Also, mark the container FRAGILE to ensure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

2-21. OTHER PACKAGING. The following general instructions should be used for repacking with commercially available materials:

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

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

   c. Use a layer of shock-absorbing material 70 to 100 mm (3- to 4-inch) thick around all sides of the instrument to provide firm cushioning and prevent movement inside container. Protect control panel with cardboard.

   d. Seal shipping container securely.

   e. Mark shipping container FRAGILE to ensure careful handling.

   f. In any correspondence, refer to instrument by model number and full serial number.

2-22. FIELD INSTALLATION OF OPTIONS

2-23. Procedures for field installation of Options 001, 002, 003, 004, and 011 are described in the following paragraphs.
2-24. Part Numbers for Ordering Option Kits

2-25. To obtain the necessary parts for installation of an option, order by part number as listed below (refer to Section VI for ordering information):

<table>
<thead>
<tr>
<th>Option</th>
<th>Name</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>High Stability Time Base</td>
<td>HP Model 10544A</td>
</tr>
<tr>
<td>002</td>
<td>Amplitude Measurement</td>
<td>05342-60200 (Kit)</td>
</tr>
<tr>
<td>003</td>
<td>Extended Dynamic Range</td>
<td>05342-60201 (Kit)</td>
</tr>
<tr>
<td>*004</td>
<td>Digital-to-Analog Converter</td>
<td>05342-60202 (Kit)</td>
</tr>
<tr>
<td>001</td>
<td>HP-IB I/O</td>
<td>05342-60015 (HP-IB Assy.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>05342-60029 (HP-IB Input Assy.)</td>
</tr>
</tbody>
</table>

*NOTE*

If the instrument in which Option 004 is to be installed has a series number 1812 or lower, the U7 ROM on A14 Microprocessor will have to be replaced. Order U7 ROM Part Number 1818-0706 to replace the old U7 ROM (1818-0331).

2-26. Installation of 10 MHz Oscillator Option 001

2-27. Option 001 consists of oven-controlled crystal oscillator time base 10544A, which has a pc card connector. Option 001 is installed in the same connector on the motherboard as the standard oscillator (A24). See Figure 8-44. To install Option 001, proceed as follows:

a. Remove the standard oscillator from A24 connector.

b. Install Option 001 oscillator into A24 connector.

c. Attach Option 001 oscillator to the motherboard by means of two 6/32 x 5/16 pan head screws. Install the screws from the bottom of the motherboard using star washers.

d. Perform Option 001 oscillator adjustment as described in paragraph 5-32.

2-28. Installation of Amplitude Measurement Option 002

2-29. Option 002 consists of U2 High Frequency Amplitude assembly and A27 Low Frequency Amplitude Assembly modules and the A16 Amplitude Assembly pc board. U2 is connected to the high frequency input of the 5342A, A27 is connected to the low frequency input and both of the modules are connected to the A16 board by the coax wires supplied. See photo of installed option, Figure 8-22, and schematic diagram, Figure 8-39. To install the components proceed as follows:

NOTE

The parts that comprise this option are listed in Table 6-5.

a. Remove the top and bottom covers and top plate from instrument.

b. Place instrument top down.

c. At inside front panel, disconnect cables from A1J1, J1J3, J25J1 (IF OUT INT), and A25J2 (IF OUT EXT).

d. Solder one end of the white/red/green 14-inch wire (8120-0483) to AT1 feedthrough capacitor terminal on A25 Preamplifier assembly.
e. Install coax assembly 8120-2268 through A22 motherboard from top of instrument at A16 slot. Place the wires through the holes as shown below:

```
BLUE
GREEN
YELLOW
ORANGE
RED
BROWN
FRONT OF 5342A

A22 MOTHER BOARD (BOTTOM)
```

**NOTE**

Prior to installing A27 Low Frequency Amplitude Assembly, connect the wires as described below.

f. Solder one end of the black/white/blue 14-inch wire (8120-0471) to C7 feedthrough capacitor terminal on A27.

g. Place heat shrinkable tubing (0890-0983) over connection at C7.

h. Place heat shrinkable tubing (0890-0983) over three of the coax wires (red, blue, and green) that were installed in step e. and solder these wires to the terminals listed below:

<table>
<thead>
<tr>
<th>Coax</th>
<th>Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>A27C10</td>
</tr>
<tr>
<td>Blue</td>
<td>A27C9</td>
</tr>
<tr>
<td>Green</td>
<td>A27C8</td>
</tr>
</tbody>
</table>

i. Apply heat to shrink the tubing at the connections made in step g and h.

j. Remove attaching nut from front panel N-type input connector and disconnect rigid coax W1 from J1 on U1 Sampler. Remove W1 from instrument.

k. Mount A27 Low Frequency Amplitude Assembly in the recessed angle of the casting behind front frame, see Figure 8-22. Attach A27 to casting with two pan head screws supplied. Place a star washer under the other screw.

l. The wire previously soldered to A27C10 has a black ground wire attached. Solder the end of this black wire to the ground lug installed in preceding step.

m. Solder the free end of white/red/green wire (other end connected to A25AT1 in step d) to A22 motherboard at XA16B, pin 3 (ATT).

**NOTE**

Prior to installing U2 High Frequency Amplitude Assembly, connect the color-coded wires as shown below. Place heat shrinkable tubing (0890-0983 for coax and 0890-0706 for single wires) over all connections to U2.
n. Connect rigid coax (8120-2516) from U2 High Frequency Amplitude Assembly to J1 on Sampler U1. Install U2 input connector through front panel. Fasten with attaching nut.

o. Solder white/black/red wire (from U2) to A22 motherboard XA16B, pin 3.

p. Solder white/brown/red wire (from U2) to A22 motherboard XA16B, pin 4.

q. Harness the coax cables and wires with tie wraps supplied.

r. Connect cable 05342-60119 from A27J1 to A1J3.


t. Reconnect A1J1, J1 (IF OUT INT) and J2 (IF OUT EXT) and harness with tie wrap.

u. Harness the white cables with tie wraps supplied.

**NOTE**

The ROM and U2 High Frequency Amplitude Assembly are supplied as a matched pair and are included under one replaceable part number (05342-80005).

v. Install the ROM (supplied with option) into U3 socket on A16 (05342-60038) board.

w. Replace resistor R2 on A16 board with a resistor of the value labeled on U2 assembly.

x. Insert the plug of 8120-2268 cable into mating socket on A16 board (05342-60038) and install A16 into connector XA16.

y. Perform the Option 002 adjustments listed under paragraph 5-33 through 5-39 of this manual.

z. Perform the operational verification procedures in paragraphs 4-14, 4-15, and 4-17 of this manual.

**NOTE**

If the instrument does not meet the specified accuracy of ±1.5 dB as described in paragraph 4-14, perform the following procedures.

Replace resistor R6 from the A27 Low Frequency Amplitude Assembly and replace with a resistor of a higher or lower value as shown below. For lower power readings increase the value and for higher power readings decrease the value of resistor R6 as follows:

<table>
<thead>
<tr>
<th>dB Change</th>
<th>R6 Changes (ohms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>10</td>
</tr>
<tr>
<td>0.4</td>
<td>20</td>
</tr>
<tr>
<td>0.6</td>
<td>30</td>
</tr>
<tr>
<td>0.8</td>
<td>40</td>
</tr>
<tr>
<td>1.0</td>
<td>50</td>
</tr>
</tbody>
</table>
2-30. Installation of Extended Dynamic Range Option 003

2-31. Option 003 consists of A16 Extended Dynamic Range Assembly (05342-60037) and U2 Attenuator Assembly (5088-7038). See Figure 8-22 for location of U2 (Option 002 or 003).

NOTE
The parts that comprise this option are listed at the end of Table 6-6.

a. Remove the top and bottom covers and top plate from instrument.
b. Place instrument top down.
c. At inside front panel, disconnect cable from A1J1, A1J3, A25J1 (IF OUT INT), and A25J2 (IF OUT EXT).
d. Solder one end of the white/red/green 14-inch wire (8120-0483) to AT1 feedthrough capacitor terminal on A25 Preamplifier Assembly.

NOTE
Prior to installing U2 (5088-7038) assembly, connect the color-coded wires as shown below. Place heat shrinkable tubing (0690-0706) over the connections and apply heat.

e. Solder free end of white/red/green wire (other end connected to A25AT1 in step d) to A22 Motherboard at XA168, pin 3 (ATT).
f. Solder white/black/red wire (from U2) to A22 Motherboard XA168, pin 3.
g. Solder white/brown/red wire (from U2) to A22 Motherboard XA168, pin 4.
h. Remove the N-type input connector from front panel and replace with U2 (5088-7038).
i. Connect rigid coax (supplied) from U2 to J1 on Sampler U1.
j. Install A16 board (05342-60037) into XA16 connector.
k. Perform the operational verification procedures in paragraphs 4-13 and 4-16 of this manual.

2-32. Installation of Digital-to-Analog Conversion (DAC) Option 004

2-33. Option 004 consists of an A2 Display Driver Assembly (05342-60028) that contains DAC circuitry added to the standard A2 circuit. Interconnecting wires are included with the Option 004 retrofit kit (05342-60202). Procedures for installation of Option 004 are as follows:
a. Remove top and bottom covers, front frame and A1–A2 assemblies. Refer to disassembly procedures, paragraph 8-22.

b. Replace the original A2 board (05342–60002) with Option 004 A2 board (05342–60028) and reassemble unit.

c. If the series number of the instrument is 1812 or lower, the U7 ROM, 1818-0331 on the A14 Microprocessor board will have to be replaced with U7 ROM, 1818-0706 as described in step d. If instrument has the 1818-0706 ROM, proceed to step e.

CAUTION

ROM U7 is a large-scale MOS IC. Its inputs are susceptible to damage by high voltage and by static charges. Particular care should be exercised when servicing this IC or handling it under conditions where static charges can build up.

d. Remove top plate from 5342A. Remove A14 Microprocessor and replace ROM U7 part number 1818-0331 with part number 1818-0706. Install A14.

e. At bottom of 5342A connect coax cable to the connector at the bottom rear of A2 board labeled D/A OUTP. Solder the other end of this cable to the DAC OUT connector on the rear panel.

f. Connect the white/gray wire to the pin (push-on) labeled LDA at bottom rear of A2 Display Driver board. Solder other end of wire to LDA terminal on A22 Motherboard as shown in figure below.

g. Connect red wire (+15V) and violet wire (-15V) to the proper terminals (push-on pins) on A2 Display Driver board (see Figure 8-25, component locator for location). Connect other end of these wires to terminals on A22 Motherboard as shown in figure below.

h. Reassemble instrument and perform operational verification procedures in paragraph 4-27 of this manual.

2-34. Installation of HP-IB Option 011

2-35. Option 011 consist of printed-circuit assembly A15 and interconnection board A29. The interconnection board mounts inside the 5342A rear panel and is connected to A22 Motherboard via a cable strap. Procedures for installation of Option 011 are as follows (see photo of installed option, Figure 8-22):

a. Remove top and bottom covers and top panel from the 5342A.

b. Insert A15 assembly into A15 slot. See Figure 8-21 for location.
c. If Model 342A is equipped with Option 001 Oscillator, remove oscillator assembly by removing two attaching screws from A22 Motherboard.

**NOTE**

In the following step, make sure that the address switch (A29S1) is located as shown in Figure 8-20.

d. Insert the A29 Interconnection board (05342-60019) into the rear panel slots provided (from inside). Screw the two mounting studs (0380-0644) and washers (2100-3171) into the HP-IB connector to attach the board to the rear panel.

e. Connect the plug of the cable strap from A29 to J2 on A22 Motherboard with arrow on installed plug pointing toward front panel.

f. Perform the Option 011 HP-IB Verification in paragraph 4-19 of this manual.

g. Refer to paragraph 2-36 for HP-IB interconnection data and to paragraph 3-69 for programming information.

2-36. HP-IB Interconnections

2-37. HEWLETT-PACKARD INTERFACE BUS. Interconnection data concerning the rear panel HP-IB connector is provided in Figure 2-3. This connector is compatible with the HP 10631A/B/C/D HP-IB cables. The HP-IB system allows interconnection of up to 15 (including the controller) HP-IB compatible instruments. The HP-IB cables have identical “piggy back” connectors on both ends so that several cables can be connected to a single source without special adapters or switch boxes. System components and devices may be connected in virtually any configuration desired. There must, of course, be a path from the calculator (or other controller) to every device operating on the bus. As a practical matter, avoid stacking more than three or four cables on any one connector. If the stack gets too large, the force on the stack produces great leverage which can damage the connector mounting. Be sure each connector is firmly (finger tight) screwed in place to keep it from working loose during use.

2-38. CABLE LENGTH RESTRICTIONS. To achieve design performance with the HP-IB, proper voltage levels and timing relationship must be maintained. If the system cable is too long, the lines cannot be driven properly and the system will fail to perform properly. Therefore, when interconnecting an HP-IB system, it is important to observe the following rules:

a. The total cable length for the system must be less than or equal to 20 metres (65 feet).

b. The total cable length for the system must be equal to or less than 2 metres (6.6 feet) times the total number of devices connected to the bus.

c. The total number of instruments connected to the bus must not exceed 15.

2-39. 5342A Listen Address

2-40. The 5342A contains a rear panel HP-IB Instrument address selection switch. There are five switches designated (A6, A5, A4, A3, A2, A1) which are used to select the address. Instructions for setting and changing the listen address are provided in Section III of this manual along with programming codes.

2-41. HP-IB Descriptions

2-42. A description of the HP-IB is provided in Section III of this manual. A study of this information is necessary if the user is not familiar with the HP-IB concept. Additional information concerning the design criteria and operation of the bus is available in IEEE Standard 488-1975, titled "IEEE Standard Digital Interface for Programmable Instrumentation".
The 5342A contains metric threaded HP-IB cable mounting studs as opposed to English threads. Metric threaded HP 10831A, B, C, or D HP-IB cable lockscrews must be used to secure the cable to the instrument. Identification of the two types of mounting studs and lockscrews is made by their color. English threaded fasteners are colored silver and metric threaded fasteners are colored black. DO NOT mate silver and black fasteners to each other or the threads of either or both will be destroyed. Metric threaded HP-IB cable hardware illustrations and part numbers follow.

Logic Levels
The Hewlett-Packard Interface Bus logic levels are TTL compatible, i.e., the true (1) state is 0.0 V dc to 0.4 V dc and the false (0) state is +2.5 V dc to +5.0 V dc.

Programming and Output Data Format
Refer to Section III, Operation

Mating Connector
HP 1251-0293; Amphenol 57-30240.

Mating Cables Available
HP 10831A, 0.9 metres (3 ft.), HP 10831B, 1.8 metres (6 ft.)
HP 10831C, 3.7 metres (12 ft.)
HP 10831D, 0.5 metres (1.5 ft.)

Cabling Restrictions
1. A Hewlett-Packard Interface Bus System may contain no more than 1.8 metres (6 ft.) of connecting cable per instrument.
2. The maximum accumulative length of connecting cable for any Hewlett-Packard Interface Bus System is 20.0 metres (66.6 ft.).

Figure 2-3. Hewlett-Packard Interface Bus Connection
SECTION III
OPERATION

3-1. INTRODUCTION

3-2. This section contains operating information including operating characteristics, descriptions of controls and indicators, and operating procedures.

3-3. OPERATING CHARACTERISTICS

3-4. The following paragraphs describe the operating ranges and modes, resolution, sample rate, AM and FM characteristics, and auto-amplitude discrimination. Front panel controls and indicators are described in Figure 3-1, rear panel controls and connectors are described in Figure 3-2. Operating procedures are explained in Figure 3-3. Amplitude measurements (Option 002) are described in Figure 3-4. DAC operation (Option 004) is described in Figure 3-5.

3-5. Operating Ranges

3-6. There are two basic operating ranges: 10 Hz to 500 MHz and 500 MHz to 18 GHz. Frequencies in the lower range are measured direct while measurements in the 500 MHz to 18 GHz range are made indirectly by a harmonic heterodyne down-conversion technique. Provision is made to select either range by a front-panel slide switch. A separate input connector is provided for each range. When the range switch is in the 10 Hz—500 MHz position, the signal at the BNC connector is routed to the direct count circuits of the 5342A. In this range, input impedance is selectable via the 50Ω—1 MΩ switch. When the range switch is in the 500 MHz—18 GHz range, the input signal is applied via the front-panel type N connector to the down-conversion circuits of the 5342A.

3-7. Resolution Keys

3-8. The best case resolution is the value represented by the least significant digit (LSD) in the display. In the 5342A, a maximum resolution of 1 Hz can be selected (by the pushbutton keys on the front panel labeled in blue, preceded by the blue key being pressed). The display is divided into four sections for ease of determining GHz, MHz, kHz, and Hz resolution. Half-sized 0’s are used as space fillers within a section to improve interpretation of the display. For example, a signal measured to 100 kHz resolution will be displayed thus:

\[
\begin{array}{cccc}
1 & 2 & 2 & 4 \\
G & H & z & -
\end{array}
\begin{array}{cccc}
B & o & o & l
\end{array}
\begin{array}{cccc}
H & z
\end{array}
\begin{array}{cccc}
- & k & H & z
\end{array}
\begin{array}{cccc}
- & M & H & z
\end{array}
\begin{array}{cccc}
- & G & H & z
\end{array}
\]

The two filler 0’s in the kHz section indicate immediately that the 0 represents hundreds of kilohertz. The Hz section is blanked.

3-9. The pushbutton keys on the front panel under the RESOLUTION label are used for other purposes when the blue key is not in effect (has not been pressed). When the blue key has not been pressed, the keys are defined by the black number on the keys and are used to enter frequency offsets, manual center frequencies, and amplitude offsets as described in Figure 3-1.
3-10. CHECK, DAC, and ENTER keys

3-11. The CHECK, DAC, and ENTER keys are used as described in Figure 3-1.

3-12. FREQ Keys

3-13. Two of the pushbutton keys on the front panel under the FREQ label are used to select the automatic or manual mode of operation. The other keys in this section of the keyboard control the use of the RESOLUTION keys. Use of these keys is described in detail in Figure 3-1.

3-14. Automatic Mode

3-15. The automatic mode of operation is selected by pressing the AUTO key. Input signals in the 500 MHz—18 GHz range are acquired, measured, and displayed automatically. When power is initially turned on, the 5342A goes into this mode automatically.

3-16. Manual Mode

3-17. The manual mode of operation is selected by pressing the MAN (MHz) key. To operate in this mode, input signals in the 500 MHz—18 GHz range must be known to within 50 MHz and this frequency (called the manual center frequency) must be entered into the display prior to the measurement. Use of the manual mode is described in detail in Figure 3-3.

3-18. Offset Frequencies

3-19. It is sometimes desirable to add or subtract a constant to/from a frequency measurement. For example, by measuring a radio IF and knowing the LO, the counter can display the RF input when the LO frequency is entered as a positive offset. It may be easier to tune an oscillator to a specific frequency if the desired frequency is entered as a negative offset and the oscillator tuned until the counter reads zero. Frequency offsets are described in Figure 3-3.

3-20. Amplitude and Offset Measurements

3-21. When Amplitude Option 002 is installed, the amplitude is displayed in addition to the frequency of the input signal. The frequency is displayed to 1 MHz resolution in the five leftmost digits and the amplitude is displayed to 0.1 dB resolution in the four rightmost digits of the display. An arbitrary value can be selected as an amplitude offset and can be added to or subtracted from the measured value as described in Figure 3-4.

3-22. Digital-to-Analog Converter (DAC) Operation

3-23. When DAC Option 004 is installed, any three consecutive digits of the display can be selected and converted to a corresponding analog voltage output. The voltage is available at the BNC connector on the rear panel (labeled DAC OUT) and is between 0 and 9.99 volts dc. For example, if the selected digits are 000 the output is 0 volts and if the selected digits are 999 the output is 9.99 volts dc. Operating procedures are listed in Figure 3-5.

3-24. SET, RESET, RECALL, and CHS Keys

3-25. The SET, RESET, RECALL, and CHS keys allow offsets and center frequencies to be entered, reset the measurement process, recall previous values, and change the sign of offsets as described in Figure 3-3.

3-26. SAMPLE RATE, GATE, and REMOTE

3-27. The SAMPLE RATE control adjusts the downtime between the end of one measurement and the start of the next measurement. The duration of the measurement is determined by the
resolution selected. The SAMPLE RATE is variable between <20 ns and HOLD. In HOLD position
the display will hold the measurement displayed indefinitely.

3-28. The GATE indicator is lit during the measurement interval (gate time) when the counter’s
gate is open and accumulating counts.

3-29. The REMOTE indicator is lit when the 5342A is in remote operation (Option 011 installed).

3-30. AM Tolerance

3-31. The 5342A will measure carrier frequencies containing amplitude modulation to any
modulation index provided the minimum voltage of the signal is not less than the sensitivity
specification of the 5342A.

3-32. FM Tolerance

3-33. The 5342A will measure carrier frequencies which are modulated in frequency such as a
microwave radio carrier. The FM tolerance is the worst case FM deviation which can be present
without affecting the counters ability to acquire the signal. If the deviations about the carrier are
symmetrical, then the counter averages out the deviations to measure the actual carrier fre-
quency. The FM tolerance is determined by the position of the CW-FM switch on the rear panel.
The CW position provides FM tolerance of 20 MHz peak-to-peak. The FM position provides a
tolerance of 50 MHz peak-to-peak but results in slower acquisition time (2.4 seconds compared
to 530 milliseconds for CW position).

NOTE

Most measurements should be made with the rear
panel FM/CW switch in CW position. The FM
position should be used only when the input signal
has significant amounts of FM (>20 MHz p-p). In-
correct measurements may result if the FM position is
used with a stable input (non-FM) signal which has
been locked to the counter’s time base.

3-34. Automatic Amplitude Discrimination

3-35. The automatic amplitude discrimination feature allows the 5342A to acquire and display
the highest level signal within its sensitivity range. The highest level signal must be 20 dB greater
in amplitude than any other signal present. Typical operation is approximately 10 dB. This feature
is useful for discriminating against spurious signals and harmonics.

3-36. MAXIMUM INPUT SIGNAL POWER

CAUTION

Do not exceed +25 dBm (peak) of input power at the
type N connector (500 MHz—18 GHz). Damage to the
internal sampler may occur. Refer to paragraph 3-37
for detailed explanation.

3-37. The 5342A will function within specifications for 500 MHz—18 GHz signal inputs up to
+15 dBm (standard unit). For measuring higher level inputs, refer to the options described in par-
agraphs 3-61 and 3-63. Under no circumstances should the input level to the 5342A exceed
+25 dBm. If the input power exceeds this level, damage to the internal sampler may occur and the
sampler is expensive to replace. Measurements from +15 to +25 dBm are not recommended as
false readings may occur. When signal levels exceed +15dBm external attenuators should be used
to attenuate the signal. Options 002 and 003 can extend the range to +20 dBm.
3-38. The 10 Hz—500 MHz direct count input BNC connector is fuse-protected for a maximum input level of 3.5V rms (+24 dBm).

3-39. INPUT CABLE CONSIDERATIONS

3-40. Consideration should be given to input cable losses at higher frequencies. For example, a 6-foot section of RG-214/U coaxial cable has about 15 dB loss at 18 GHz. Such losses must be taken into consideration along with the sensitivity specifications given in Table 1-1.

3-41. CONTROLS, INDICATORS, AND CONNECTORS

3-42. Figure 3-1 describes the front panel controls, indicators, and connectors. Figure 3-2 describes the rear panel connectors and controls.

WARNING

BEFORE THE INSTRUMENT IS SWITCHED ON, ALL PROTECTIVE EARTH TERMINALS, EXTENSION CORDS, AUTOTRANSFORMERS AND DEVICES CONNECTED TO IT SHOULD BE CONNECTED TO A PROTECTIVE EARTH GROUNDED SOCKET. ANY INTERRUPTION OF THE PROTECTIVE EARTH GROUNDING WILL CAUSE A POTENTIAL SHOCK HAZARD THAT COULD RESULT IN PERSONAL INJURY.

ONLY FUSES WITH THE REQUIRED RATED CURRENT AND SPECIFIED TYPE SHOULD BE USED. DO NOT USE REPAIRED FUSES OR SHORT CIRCUITED FUSEHOLDERS. TO DO SO COULD CAUSE A SHOCK OR FIRE HAZARD.

CAUTION

Before the instrument is switched on, it must be set to the voltage of the power source, or damage to the instrument may result. (Refer to paragraph 2-6.)

3-43. OPERATING PROCEDURES

3-44. Figure 3-3 illustrates operating procedures for the standard 5342A. Self-check procedures are also given in Figure 3-3. An operators keyboard check is given in paragraph 3-45. Operating procedures for Amplitude Option 002 are listed in Figure 3-4, and for DAC Option 004 in Figure 3-5.
DISPLAY

Digits:
The display contains 11 digit positions, two digits for frequencies in GHz and three digits each for MHz, kHz, and Hz. (The Hz digits position is used to display dBm when Amplitude Option 002 is installed.)

Annunciators:
- Sign 1 When lighted, indicates a negative frequency offset has been entered into display (MHz).
- OVN indicator 2 Oven monitor indicates when crystal oscillator oven is on (warming). When warmed-up, light goes out (Option 001 only).
- dBm indicator 3 When lighted, indicates amplitude of input signal is being measured (Option 002 installed). Selected by pressing AMPL key and displayed in Hz portion of display. The fourth digit from the right displays a — sign for signals below 0 dBm.
- * Indicator 4 When lighted, indicates the rear panel CW-FM switch is in FM position. This selects the wide-band mode which provides wider FM (50 MHz p-p) tolerance.

FREQ Keys
The FREQ keys select the mode of operation and control the display.

NOTE
Some keys are equipped with center indicator lights that serve as "promters" to the user. A blinking indicator light states a "ready" condition for the key function that was selected and the instrument is waiting for a mode or number to be entered. A steady indicator light states that the key function that was selected is in operation.

AUTO key. Selects the automatic mode of operation to acquire and display input signal frequencies in the 500 MHz—18 GHz range. The instrument goes into this mode when power is turned on.
MAN (MHz) key. Selects manual mode for input signal frequencies in the 500 MHz—18 GHz range. Input signal frequency must be known (within 50 MHz) and entered into display via the black-numbered keys.

Figure 3-1. Front Panel Controls and Indicators
Blue key. Pressing this key activates the blue-labeled functions of the RESOLUTION keys.

RESET key. Clears the display and restarts a measurement. Clears any blinking lights in key center indicators.

SET key. Must be pressed prior to selecting OFF dB, OFS MHz or MAN (MHz). The SET condition is indicated by lighted segments or in the GHz digits of the display. This indicates that a center frequency, offset frequency, or amplitude offset may be entered into the display.

RECALL key. Recalls stored memory information into display. The MAN (MHz), OFF dB, or OFS MHz keys, if held in after RECALL is pressed, will result in a display of previously entered or computed information.

NOTE
Information stored in memory (by digit keys) after MAN (MHz) key is pressed is available for display until AUTO mode is selected. Then the center frequency determined by the automatic measurement overrides the manual information.

AMPL key. Selects amplitude mode (when Option 002 is installed). The amplitude of the input signal is displayed in the four rightmost digits of the display to a resolution of 0.1 dBm. The frequency of the input signal is displayed in the five leftmost digits of the display.

OFF dB key. After pressing the SET key, the OFF dB key is pressed prior to entering an offset value in dB via the digit keys. (Digit keys are labeled in black numbers under RESOLUTION.) Indicates selection of amplitude offset mode when lighted and adds amplitude offset to measured amplitude (Option 002).

NOTE
An offset value is an arbitrary value selected for entry into the display to be added or subtracted from a measured value.

OFFS MHz key. After pressing the SET key, the OFFS MHz key is pressed prior to entering an offset value via the digit keys. (Digit keys are labeled in black numbers under RESOLUTION.) Indicates selection of frequency offset mode when lighted and adds frequency offset to measured frequency.

RESOLUTION keys:
The resolution keys select the display resolution (according to the blue labeling above each key) after the blue key is pressed. The keys are defined by the black number labeled on the key when entering offsets and manual center frequencies.

CHECK key. After pressing the blue key, the CHECK key is pressed to perform a self-check of the instrument. The display will indicate 75 MHz for proper operation. Press RESET to exit self-check.

NOTE
The instrument must not have an input signal connected at the 500 MHz—18 GHz input to perform the self-check.

ENTER key. Used to enter digits for manual center frequencies or offsets into memory via black-numbered keys. After the digits have been selected, ENTER key is pressed to signal the end of the digit sequence.

LINE switch. In ON position, applies power to all circuits except the crystal oven (Option 001 installed). The crystal oven connects through a separate transformer, a thermal circuit breaker and fuse directly to the ac line. This allows the oven to maintain its operating temperature and accuracy when the LINE switch is in STBY position, thereby eliminating warmup delays.

SAMPLE RATE control. Adjusts the interval between measurements from 20 ms to HOLD. When rotated to HOLD will hold display indefinitely.

GATE indicator. Indicates when counters main gate is open and a measurement is in progress.

REMOTE indicator. Illuminates when counter is in remote operation.

50Ω—1 MΩ switch. Selects input impedance for adjacent 10 Hz—500 MHz input connector.

10 Hz—500 MHz, 500 MHz—18 GHz switch. Selects either low or high frequency range input connector.

BNC Input Connector. Accepts 10 Hz—500 MHz input for direct count measurements. Measurements made at this input require that the range switch is set to the 10 Hz—500 MHz position. Sensitivity is listed in Table 1-1.

Type N Input Connector. Input for measurements in the 500 MHz—18 GHz range. Measurements made at this input require that the range switch is set to the 500 MHz—18 GHz position. Sensitivity is listed in Table 1-1.

Figure 3-1. Front Panel Controls and Indicators (Continued)
1. PROCESSOR INTERFACE connector A22W4/1. Not used. This connector is part of cable W4 which is connected to A22 motherboard as an interface to the A14 Microprocessor address and data lines. This interface is provided for future use with companion instruments.

2. Position of digital input/output connector when instrument is equipped with Hewlett-Packard Interface Bus (HP-IB) Option 011. Refer to paragraph 3-69 for details.

3. Position of ADDRESS switch when instrument is equipped with Hewlett-Packard Interface Bus (HP-IB) Option 011. Refer to paragraph 3-72 for details.

4. AC Power Module. Input power module consisting of an IEC approved connector, a fuse (0.75 amp for 100/200-volt operation, 0.375 for 220/240-volt operation) and a pc card line voltage selector. Refer to paragraph 2-6 for details.

5. CW-FM selector switch. Selects a short or long pseudorandom sequence (prs). The CW position provides a short prs (narrow mode) with FM tolerance of 20 MHz p-p. The FM position provides a long prs (wide mode) with FM tolerance of 50 MHz p-p.

**NOTE**

Most measurements should be made with the rear panel FM/CW switch in the CW position. The FM position should be used only when the input signal has significant amounts of FM (>20 MHz p-p).

6. INT/EXT selector switch. Selects the internal 10 MHz crystal oscillator signal or an external 10 MHz source for the time base circuit. The external source must be connected to the adjacent connector (7).

**NOTE**

If the INT/EXT switch is switched and causes momentary loss of clock, the microprocessor may hang up and cause the display to stop counting. To recover, press LINE switch to STBY then to ON.

7. EXT FREQ STD connector. Accepts 10 MHz external time base signal when INT/EXT switch is in EXT position.

8. FREQ STD OUT connector. Supplies a 10 MHz squarewave output at 1.5 volts peak-to-peak.

9. IF OUT connector. Provides the intermediate frequency (IF) output of the Preampifier circuit for test or monitor of the IF.

10. DAC connector. Provides the output voltage of the digital to analog converter when the Option 004 is installed.

*Figure 3-2. Rear Panel Controls and Connectors*
PRELIMINARY PROCEDURES

1. On rear panel:
   a. Set INT/EXT to INT position.
   b. Set CW/FM switch to CW. Refer to paragraph 3-33 for detailed description.
   c. On ac power module, check for proper fuse (0.75 amp for 100/120-volt operation, 0.375 amp for 220/240-volt operation) and check position of pc line voltage selector (refer to paragraph 2-6 for detailed description).
   d. For remote operation, refer to paragraph 3-69 for explanation of HP-IB programming and address switch settings on rear panel (for 5342A's equipped with Option 011).

2. On front panel, set LINE switch to ON position.

   **CAUTION**

   Do not exceed +25 dBm peak of input power at the type N connector (500 MHz—18 GHz). Damage to the internal sampler may occur.

   **NOTE**

   When the input signal level to the type N connector exceeds approximately +5 dBm, each digit in the display becomes a minus sign (−) to indicate overload. For Options 002, 003, this threshold is approximately +20 dBm.

   **CAUTION**

   The 10 Hz—500 MHz direct count input BNC connector is fuse-protected for a maximum input level of 3.5V rms (+24 dBm).

   **NOTE**

   The fuse for the 10 Hz—500 MHz input is located on the A3 Direct Count Amplifier assembly.

Figure 3-3. Operating Procedures
3. Connect input signal to appropriate input connector according to frequency requirements (BNC for 10—500 MHz, type N for 500 MHz—18 GHz) and set frequency range switch accordingly.

4. For input signals connected to BNC connector (10—500 MHz): set the 500Ω—1 MΩ switch as required. This switch has no effect on input signals connected to the type N connector (500 MHz—18 GHz).

5. Press blue key, then press blue-labeled RESOLUTION key for desired resolution.

**NOTE**
Half-sized 7’s are used as fillers in the display to facilitate display interpretation.

6. Adjust SAMPLE RATE control for desired interval between measurements.

**KEY INDICATORS**
Indicator LED’s in the center of some keys are used as “prompters” by the operator, as follows:

**Blinking Indicator**
A blinking LED in a key is a “ready” condition for that key function. It indicates it is waiting for an entry via the keyboard. To clear the condition, press RESET.

**Steady Indicator**
A steady “on” LED in a key is an indication that the key function is in effect. To clear the condition, press the key. (The AUTO Key is cleared by pressing MAN (MHz) and vice versa.)

**SELF-CHECK PROCEDURE**
Perform the self-check as follows (no input signal connected and SAMPLE RATE full ccw):

```
Press | Blue key | CHECK | 
--- | --- | --- |
```

Counter Display:
```

gHz - MHz - kHz - Hz
```
(To exit from CHECK mode, press RESET)

**TO SET MANUAL CENTER FREQUENCY**
Example — To measure a 4.125 (±0.050) GHz signal in manual mode, connect signal to type N connector and:

```
Press | SET | MAN (MHz) | 4 | 1 | 2 | 5 | ENTER |
--- | --- | --- | --- | --- | --- | --- |
```

```

gHz - MHz - kHz - Hz
```

**NOTE**
The manual center frequency is entered (and displayed) with 1 MHz resolution and must be within 50 MHz of the input signal frequency (connected to 500 MHz—18 GHz connector).

*Figure 3-3. Operating Procedures (Continued)*
TO ENTER OFFSET FREQUENCY
Example — To add 12.5 MHz to the measured frequency:

Press SET OFS MHz 1 2 · 5 ENTER

Example — To subtract 12.5 MHz from the measured frequency:

Press SET OFS MHz 1 2 · 5 CHS ENTER

TO RECALL OFFSETS OR CENTER FREQUENCY
Example — To recall a center frequency:

Press RECALL Press and hold MAN (MHz)

(Displayed center frequency to 1 MHz resolution)

Example — To recall an offset frequency:

Press RECALL Press and hold OFS MHz

(Displayed offset)

TO REMOVE OFFSETS
Example — To remove offset from display:

Press OFS MHz

LED in key goes out, function is off and display shows actual measured frequency. (Offset is still stored in memory and can be added to the measurement by pressing OFS MHz again.)
AUTOMATIC OFFSETS

Example — To “hold” a measurement and use it as a negative offset in subsequent measurements:

Rotate SAMPLE RATE cw to HOLD

Press [ ] [ ] [ ]

Rotate SAMPLE RATE ccw to normal

NOTE

The measured frequency will now be negatively offset by the frequency captured when in HOLD.

RESET

Pressing [ ] key clears the display and initiates a new measurement without clearing stored values of offset or center frequencies. Clears any blinking (ready state) key indicators, but does not clear steady state indicators. 5342A maintains current operating modes.
TO MEASURE AMPLITUDE

Example — To simultaneously display frequency to 1 MHz resolution (5 leftmost digits) and amplitude to 0.1 dB resolution (4 rightmost digits):

Press [AMPL]

TO SET AMPLITUDE OFFSET

Example — To add 4.3 dB to the measured amplitude:

Press [SET] [OFS dB] 4 3 [ENTER]

Example — To subtract 4.3 dB from the measured amplitude:

Press [SET] [OFS dB] 4 3 [CHS] [ENTER]

Figure 3-4. Amplitude Measurements (Option 002)
The DAC key is effective only when DAC Option 004 is installed. Selects any three consecutive displayed digits to convert to voltage. The position of the most significant digit of selected digits is determined by the black numbered key. For example:

```
SET  Blue key  DAC  5
```

To select digits as follows:

```
1 2 3 4 5 6 7 8 9
--- --- --- --- --- --- --- ---
GHz MHz kHz Hz
```

A dc voltage of 8 to 10 volts, corresponding to the selected digits, will be present at the DAC OUT connector on the rear panel. Selected digits 000 produces 8V output, 999 produces 9.99V output.

**NOTE**

Use the manual mode, minimum required resolution (1 MHz is lowest) and as fast a sample rate as possible to obtain the smoothest output.

*Figure 3-5. DAC Operation (Option 004)*
### 3-45. OPERATOR KEYBOARD CHECK

3-46. Check for proper operation of the keyboard and display by pressing the keys listed and observing display. To exit from keyboard check mode, press RESET.

<table>
<thead>
<tr>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>SET SET 8</td>
<td><img src="image" alt="Display Image" /></td>
</tr>
</tbody>
</table>

**AUTO**

![Display Image](image)

**MAN (MHz)**

![Display Image](image)

**Blue key**

![Display Image](image)

#### NOTE

Do not press RESET key or procedure will need to be started over.

<table>
<thead>
<tr>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>SET</td>
<td><img src="image" alt="Display Image" /></td>
</tr>
</tbody>
</table>

| RECALL   | ![Display Image](image) |

| AMPL     | ![Display Image](image) |

| OFS dB   | ![Display Image](image) |

| OFS MHz  | ![Display Image](image) |

<p>| CHS      | <img src="image" alt="Display Image" /> |</p>
<table>
<thead>
<tr>
<th>Press</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>77777777</td>
</tr>
<tr>
<td>8</td>
<td>88888888</td>
</tr>
<tr>
<td>9</td>
<td>99999999</td>
</tr>
<tr>
<td>4</td>
<td>44444444</td>
</tr>
<tr>
<td>5</td>
<td>55555555</td>
</tr>
<tr>
<td>6</td>
<td>66666666</td>
</tr>
<tr>
<td>1</td>
<td>11111111</td>
</tr>
<tr>
<td>2</td>
<td>22222222</td>
</tr>
<tr>
<td>3</td>
<td>33333333</td>
</tr>
<tr>
<td>0</td>
<td>00000000</td>
</tr>
<tr>
<td>.</td>
<td>. . . . . .</td>
</tr>
<tr>
<td>ENTER</td>
<td>r r r r r r</td>
</tr>
</tbody>
</table>
3-47. ERROR CODE DISPLAYS

3-48. Error codes are displayed by the 5342A to indicate circuit malfunctions in the instrument and to indicate operator (procedure) errors.

3-49. Instrument Error Displays

3-50. When power is applied to the 5342A, check-sum routines are automatically performed. If a routine fails, an error code is displayed to indicate the circuit fault area as follows:

<table>
<thead>
<tr>
<th>Display</th>
<th>Fault Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE EEE EEE EEE</td>
<td>RAM A14U12</td>
</tr>
<tr>
<td>GHz - MHz - kHz - Hz</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>ROM A14U7</td>
</tr>
<tr>
<td>2</td>
<td>ROM A14U4</td>
</tr>
<tr>
<td>3</td>
<td>ROM A14U1</td>
</tr>
<tr>
<td>E16.0</td>
<td>PROM A16U3</td>
</tr>
<tr>
<td>E16.1</td>
<td>No Conversion complete signal from A16U8(36)</td>
</tr>
</tbody>
</table>

NOTE

If any of the above codes are displayed, refer to the troubleshooting procedures in Table 8-5.
3-51. **Operator Error Displays**

3-52. The display indicates when the applied signal is insufficient or excessive in level or limits, as follows:

<table>
<thead>
<tr>
<th>Operating Mode</th>
<th>Range Switch</th>
<th>Insufficient Signal Level Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Frequency</td>
<td>10 Hz—500 MHz</td>
<td>![Insufficient Display]</td>
</tr>
<tr>
<td>*Frequency</td>
<td>500 MHz—18 GHz</td>
<td>![Insufficient Display]</td>
</tr>
<tr>
<td>Amplitude (Option 002)</td>
<td>10 Hz—500 MHz</td>
<td>![Excessive Display]</td>
</tr>
<tr>
<td>Amplitude (Option 002)</td>
<td>500 MHz—18 GHz</td>
<td>![Excessive Display]</td>
</tr>
<tr>
<td>Frequency</td>
<td>500 MHz—18 GHz</td>
<td>![Excessive Display]</td>
</tr>
<tr>
<td>†Amplitude (Option 002)</td>
<td>10 Hz—500 MHz and</td>
<td>![Excessive Display]</td>
</tr>
<tr>
<td>500 MHz—18 GHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>10 Hz—500 MHz and</td>
<td>![Excessive Display]</td>
</tr>
<tr>
<td>500 MHz—18 GHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amplitude (Option 002)</td>
<td>10 Hz—500 MHz and</td>
<td>![Excessive Display]</td>
</tr>
<tr>
<td>500 MHz—18 GHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amplitude (Option 002)</td>
<td>10 Hz—500 MHz and</td>
<td>![Excessive Display]</td>
</tr>
<tr>
<td>500 MHz—18 GHz</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Excessive Signal Level Display**

**Overrange (due to offset)**

**Frequency measurement. In presence of excessive frequency offset, will be all 9's.**

**Out of Frequency Limits (Amplitude)**

**NOTES:**

*Shown for 1 Hz resolution. Digit shifts one position to left for each step decrease in resolution.

†For input signal levels greater than 22.9 dBm, it is possible for the IF detector not to indicate an excessive level condition so that frequency will be displayed (five leftmost digits). However, the amplitude option will cause dashes in the amplitude portion of the display because of excessive level.
3-53. Limit Errors and Sequence Errors

3-54. A limit error (for example, setting a manual center frequency less than 500 MHz) will be displayed as:

```
L-Error
- GHz - MHz - kHz - Hz-
```

3-55. A sequence error (for example, pressing a digit key before pressing a function key) will be displayed as:

```
S-Error
- GHz - MHz - kHz - Hz-
```

3-56. For detailed descriptions of error codes, refer to Table 8-5.

3-57. OPTIONS

3-58. The operating characteristics of the 5342A are affected by the addition of any of the options described in the following paragraphs.

3-59. Time Base Option 001

3-60. Option 001 provides an oven-controlled crystal oscillator time base (Model 10544A) that results in higher accuracy and longer periods between calibration (refer to Table 1-7). The oven temperature is maintained when the 5342A LINE switch is in either the ON or the STBY position (provided the instrument is connected to the power mains). When the OVN indicator in the display is lit, the oven is ON (warming). When the oven is at the proper temperature, the OVN indicator goes out.

3-61. Amplitude Option 002

3-62. The amplitude option provides the capability of measuring the amplitude of the input signal and simultaneously displaying the frequency (5 leftmost digits) and the amplitude level in dBm (4 rightmost digits). The maximum operating level of +5 dBm for the standard 5342A is extended to +20 dBm for Option 002. The frequency is displayed to a resolution of 1 MHz and the level is displayed to a resolution of 0.1 dBm. The sensitivity of the 5342A with Option 002 is approximately 3 to 5 dB less than the standard 5342A, depending on frequency.

3-63. Extended Dynamic Range Option 003

3-64. The extended dynamic range option extends the maximum operating level of +5 dBm for the standard 5342A to +20 dBm for Option 003 by insertion of an attenuator at the input (ahead of the sampler). The insertion loss of the attenuator results in a sensitivity decrease of approximately 3 to 5 dB, depending upon the frequency of the signal.

3-65. HP-IB Interface Option 011

3-66. The Hewlett-Packard Interface Bus (HP-IB) Option 011 allows the functions of the 5342A to be controlled remotely and allows measurement data to be output to the bus. Programming information for Option 011 is given in paragraphs 3-69 through 3-80.
3-67. Digital-to-Analog Converter (DAC) Option 004

3-68. The DAC option allows selection of any three consecutive digits in the display and conversion of these digits to an analog voltage. The analog voltage is available at a rear panel connector. The digits are converted to a voltage of from 0 to 10 volts, corresponding to the digits selected. Digits 000 produce 0 volts, digits 999 produce 9.99 volts, fullscale into 15 kilohms.

3-69. HP-IB PROGRAMMING (OPTION 011)

3-70. The capability of a device connected to the HP-IB is specified by its interface functions. Table 3-1 lists the interface functions of the 5342A using the terminology of IEEE Standard 488-1975 (Appendix C). Interface functions provide the means for a device to receive, process, and send messages over the HP-IB. Procedures for verification of proper operation of Option 011 HP-IB are contained in paragraphs 4-19 through 4-26.

<table>
<thead>
<tr>
<th>Interface Function Subset Identifier</th>
<th>Interface Function Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SH1</td>
<td>Complete source handshake capability.</td>
</tr>
<tr>
<td>AH1</td>
<td>Complete acceptor handshake capability.</td>
</tr>
<tr>
<td>T1</td>
<td>Talker (basic talker, serial poll, talk only mode, does not unaddress to talk if addressed to listen).</td>
</tr>
<tr>
<td>L2</td>
<td>Listener (basic listener, no listen only mode, does not unaddress to listen if addressed to talk).</td>
</tr>
<tr>
<td>SR1</td>
<td>Service request capability.</td>
</tr>
<tr>
<td>RL1</td>
<td>Complete remote/local capability.</td>
</tr>
<tr>
<td>PP0</td>
<td>No parallel poll capability.</td>
</tr>
<tr>
<td>DC1</td>
<td>Device clear capability.</td>
</tr>
<tr>
<td>DT1</td>
<td>Device Trigger capability.</td>
</tr>
<tr>
<td>C0</td>
<td>No controller capability.</td>
</tr>
<tr>
<td>E1</td>
<td>One unit load.</td>
</tr>
</tbody>
</table>

3-71. There are 12 basic messages which can be sent over the interface. Table 3-2 lists each bus message, a description of the message, how the 5342A uses that message, and examples of 9825A implementation of the messages.

3-72. The 5342A must be assigned a bus address. Table 3-3 gives the allowable address switch settings.

3-73. Table 3-4 gives the program code set for the 5342A. Frequency and amplitude mode selection, manual center frequency setting, frequency and amplitude offset mode selection, frequency and amplitude offset setting, resolution selection, range selection, FM/CW mode selection, and automatic offsets are all analogous to the corresponding front panel operations described previously.

3-74. There are four sample rate modes T0–T3. In T0, the sample rate is determined by the setting of the front panel SAMPLE RATE control. In T1, the counter is in hold. To trigger a measurement, a trigger message must be sent. In T2, the counter ignores any sample rate run-down and initiates a new measurement as soon as the previous measurement is over. In T3, the counter takes a measurement and holds until the next T3 or trigger message.
## Table 3-2. 5342A Bus Message Usage

<table>
<thead>
<tr>
<th>Message</th>
<th>Description</th>
<th>5342A Use</th>
<th>Sample 9825 Statements (5342A set to Address 02)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data</td>
<td>Transfers device-dependent information from one device to one or more devices on the bus.</td>
<td>Sends measurement data. See paragraph 3-77 for output format. Accepts program codes. See Table 3-4 for code set.</td>
<td>red 702, A wrt 702, &quot;AUSR4&quot;</td>
</tr>
<tr>
<td>Trigger</td>
<td>Causes a group of selected devices to simultaneously initiate a set of device-dependent actions</td>
<td>Starts a new measurement.</td>
<td>trg 7 or trg 702</td>
</tr>
<tr>
<td>Clear</td>
<td>Causes an instrument to be set to a predefined state (a certain range, function, etc.).</td>
<td>Same as front panel RESET. Clears internal count and starts new measurement.</td>
<td>clr 7 or clr 702</td>
</tr>
<tr>
<td>Remote</td>
<td>Permits selected devices to be set to remote operation, allowing parameters and device characteristics to be controlled by Bus Messages.</td>
<td>5342A goes to remote if REN is true and addressed to listen. In absence of program data, remote operation is according to the state of the front panel settings just prior to going to remote.</td>
<td>rem 702</td>
</tr>
<tr>
<td>Local</td>
<td>Causes selected devices to return to local (front panel) operation.</td>
<td>Goes to local front panel control. In absence of front panel data, local operation is according to the state of the remote data just prior to going to local.</td>
<td>lcl 702</td>
</tr>
<tr>
<td>Local Lockout</td>
<td>Disables local (front panel) controls of selected devices.</td>
<td>Disables front panel RESET. 5342A remains in remote.</td>
<td>llo 7</td>
</tr>
<tr>
<td>Clear Lockout and local</td>
<td>Returns all devices to local (front panel) control and simultaneously clears the Local Lockout Message.</td>
<td>Local lockout cleared and returns to local front panel control.</td>
<td>lcl 7</td>
</tr>
<tr>
<td>Require Service</td>
<td>Indicates a device's need for interaction with the controller.</td>
<td>Pulls on SRQ to indicate end of a measurement.</td>
<td>rds(7)→A</td>
</tr>
<tr>
<td>Status Byte</td>
<td>Presents status information of a particular device; one bit indicates whether or not the device currently requires service, the other 7 bits (optional) are used to indicate the type of service required.</td>
<td>In serial poll mode, 5342A outputs decimal 80 (01010000) to indicate end of measurement.</td>
<td>rds(702)→A</td>
</tr>
<tr>
<td>Status Bit</td>
<td>A single bit of device-dependent status information which may be logically combined with status bit information from other devices by the controller.</td>
<td>Does not use</td>
<td></td>
</tr>
<tr>
<td>Pass Control</td>
<td>Passes bus controller responsibilities from the current controller to a device which can assume the Bus supervisory role.</td>
<td>Does not use</td>
<td></td>
</tr>
<tr>
<td>Abort</td>
<td>Unconditionally terminates Bus communications and returns control to the system controller.</td>
<td>Clears Talk, Listen, Serial Poll Enable registers on 5342A HP-IB interface. Front panel annunciators do not change, however.</td>
<td>cli 7</td>
</tr>
</tbody>
</table>
Table 3-3. Address Selection

Rear panel address switch:

![Address Switch Diagram](image)

(Shown in addressable mode, and address 02)

*If the 5342A is in TALK ONLY mode and it is desired to return to the addressable mode, set TALK ONLY switch to 0 and press RESET on front panel.

<table>
<thead>
<tr>
<th>ASCII CODE CHARACTER</th>
<th>ADDRESS SWITCHES</th>
<th>5-BIT DECIMAL CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>LISTEN</td>
<td>TALK</td>
<td>A₂</td>
</tr>
<tr>
<td>SP</td>
<td>⊗</td>
<td>0</td>
</tr>
<tr>
<td>!</td>
<td>％</td>
<td>0</td>
</tr>
<tr>
<td>&quot;</td>
<td>＆</td>
<td>0</td>
</tr>
<tr>
<td>#</td>
<td>＋</td>
<td>0</td>
</tr>
<tr>
<td>$</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>%</td>
<td>)</td>
<td>0</td>
</tr>
<tr>
<td>&amp;</td>
<td>(</td>
<td>0</td>
</tr>
<tr>
<td>'</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>&quot;</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>'</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>'</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>'</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>'</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>'</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>'</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>'</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>'</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>'</td>
<td>P</td>
<td>1</td>
</tr>
<tr>
<td>'</td>
<td>Q</td>
<td>1</td>
</tr>
<tr>
<td>'</td>
<td>R</td>
<td>1</td>
</tr>
<tr>
<td>'</td>
<td>S</td>
<td>1</td>
</tr>
<tr>
<td>'</td>
<td>T</td>
<td>1</td>
</tr>
<tr>
<td>'</td>
<td>U</td>
<td>1</td>
</tr>
<tr>
<td>'</td>
<td>V</td>
<td>1</td>
</tr>
<tr>
<td>'</td>
<td>W</td>
<td>1</td>
</tr>
<tr>
<td>'</td>
<td>X</td>
<td>1</td>
</tr>
<tr>
<td>'</td>
<td>Y</td>
<td>1</td>
</tr>
<tr>
<td>'</td>
<td>Z</td>
<td>1</td>
</tr>
<tr>
<td>'</td>
<td>＞</td>
<td>1</td>
</tr>
<tr>
<td>'</td>
<td>＞</td>
<td>1</td>
</tr>
<tr>
<td>'</td>
<td>＞</td>
<td>1</td>
</tr>
</tbody>
</table>
**Table 3-4. Option 011 HP-IB Program Code Set**

1. **FREQUENCY MODE SELECT**
   - AUTO ........................................ AU
   - MANUAL ........................................ M

2. **SET MANUAL CENTER FREQUENCY**
   - SMXXXXX (X's represent nonfixed length data string of up to 5 characters. Decimal points cause entire string to be ignored. + signs and spaces are allowable. Number is in MHz and must be less than 18 GHz or will be ignored.)
     - Example: SM10000E for 10 GHz center frequency
     - SM775E for 775 MHz center frequency
     - SM+5250E for 5.25 GHz center frequency

3. **AMPLITUDE MODE SELECT**
   - Amplitude off ................................ AM0
   - Amplitude on ................................ AM1

4. **FREQUENCY OFFSET MODE SELECT**
   - Frequency Offset off ...................... OM0
   - Frequency Offset on ....................... OM1

5. **SET FREQUENCY OFFSET**
   - SOM±XXXX.XXXXXX (X's represent nonfixed length data string representing offset frequency in MHz. Spaces are ignored.)
     - Example: SOM10.7E for 10.7 MHz positive offset
     - SOM-4000.25E for 4.00025 GHz negative offset.

6. **AMPLITUDE OFFSET MODE**
   - Amplitude Offset off ...................... OB0
   - Amplitude Offset on ....................... OB1

7. **SET AMPLITUDE OFFSET**
   - SOB±XX.XE (X's represent nonfixed length data string representing offset amplitude in dB. Spaces are ignored.)
     - Example: SOB-10.1E for 10.1 dB negative offset
     - SOB3.5E for 3.5 dB positive offset
     - SOB10E for 10 dB positive offset.

8. **RESOLUTION**
   - 1 Hz ........................................... SR3
   - 10 Hz ......................................... SR4
   - 100 Hz ........................................ SR5
   - 1 kHz ......................................... SR6
   - 10 kHz ........................................ SR7
   - 100 kHz ...................................... SR8
   - 1 MHz ......................................... SR9

9. **RANGE**
   - 10 Hz—500 MHz ............................... L
   - 500 MHz—18 GHz ............................. H

10. **FM/CW MODE**
    - CW mode ..................................... C
    - FM mode ..................................... F
Table 3-4. Option 011 HP-IB Program Code Set (Continued)

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>Sample rate</td>
</tr>
<tr>
<td>T1*</td>
<td>Hold</td>
</tr>
<tr>
<td>T2</td>
<td>Fast sample (no delay)</td>
</tr>
<tr>
<td>T3</td>
<td>Sample then hold</td>
</tr>
</tbody>
</table>

*Send trigger command (trg 7 or trg 702) to start measurement. If 5342A is in remote and addressed to listen and other than Hold (T1), the trigger command causes the 5342A to automatically go to Sample then Hold (T3).

12. OUTPUT MODE

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ST1</td>
<td>Output only when addressed</td>
</tr>
<tr>
<td>ST2</td>
<td>Wait until addressed</td>
</tr>
</tbody>
</table>

13. RESET

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE</td>
<td>(Display is blanked and new measurement initiated. If in Hold (T1), then measurement is not completed but stays in Hold. Does not return control to local.)</td>
</tr>
</tbody>
</table>

14. AUTOMATIC OFFSETS

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOMB</td>
<td>Automatic frequency offset</td>
</tr>
<tr>
<td>SOBB</td>
<td>Automatic amplitude offset</td>
</tr>
</tbody>
</table>

15. CHECK MODE

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR1</td>
<td>(No input can be present at RF connector. Counter must be in SAMPLE RATE full ccw. Be sure to send RESET command (RE) before making other measurements.)</td>
</tr>
</tbody>
</table>

3-75. In the “output only when addressed” mode, the counter pulls SRQ at the end of a measurement and then checks to see if it has been addressed to talk. If not, SRQ is cleared and it starts the next measurement. If it has been addressed to talk, it outputs the measurement, clears SRQ, and starts the next measurement. In the “wait until addressed” output mode, the counter pulls SRQ at the end of a measurement and waits in a loop until it has been addressed to talk. When it is addressed to talk, it outputs the measurement, clears SRQ and starts the next measurement.

**NOTE**

If the counter is placed in the HOLD (T1) mode, triggered, then addressed to talk, be sure to use the Wait Until Addressed (ST2) output mode. If not, then for short gate times the measurement may be completed before the controller addresses the counter to talk and the counter will discard the measurement result and hang up the bus.

3-76. The 5342A executes each complete program code as it is received just as if the microprocessor were receiving the data from the front panel keyboard. Program code strings should be in the same order as they would be if being entered from the front panel. When a data byte is sent to the 5342A HP-IB Option 011, the HP-IB interface stores the byte and sends an interrupt to the microprocessor which reads in the byte. If the byte does not complete a program code, then the microprocessor waits for the next byte(s) until a complete code is sent (for example, SRS5 is a complete code but SR is not). After a complete code is received, the microprocessor executes the code and begins the measurement. If more codes are in the string, another interrupt is generated. For example, if the string “SRS5AU” is sent by the controller, the “S” is the first byte received and stored by the 5342A HP-IB interface. The interface generates an interrupt to the microprocessor and the “S” is read by the MPU. Since S is not a complete code, the microprocessor
- waits until the complete code is sent and received. After "R" and then "S" are sent, the microprocessor sets the resolution accordingly and then goes to the beginning of the measurement. When the controller sends "A", an interrupt is generated and "A" is read by the microprocessor. It then waits for the complete code to be sent which in this case is "AU". The microprocessor again goes to the start of the measurement cycle.

**NOTE**

The following output formats pertain to input signals of specified sensitivity (Table 1-1). For less sensitive input signals, refer to paragraph 3-82.

3-77. The 5342A outputs measurement data in the following fixed length formats:

a. **NO OFFSET, FREQUENCY ONLY**
   
   `SP F SP SP XXXX.XXXXXX E + 06 CR LF`

   - frequency
   - space
   - carriage return
   - line feed

b. **NO OFFSET, FREQUENCY, AND AMPLITUDE**
   
   `SP F SP SP XXXX.XXXXXX E + 06, A SP ±XX.X E + 0 CR LF`

   - amplitude

  
c. **OFFSET in both FREQUENCY and AMPLITUDE**
   
   `SP FS ±XXXX.XXXXXX E + 06, AS ±XX.X E + 0 CR LF`

   - offset
   - offset

  
d. **OVERLOAD (Amplitude off)**

   `SP F SP SP 99999.999999 E + 09 CR LF`

   (caused by excessive input level)

  
e. **DISPLAY OVERFLOW (Amplitude off)**

   `SP F SP SP 99999.999999 E + 06 CR LF`

   (caused by offset which makes display overflow)

  
f. **OVERLOAD (Amplitude on)**

   `SP F SP SP 99999.999999 E + 09, A SP SP 99.9 E + 0 CR LF`

   (caused by excessive input level)

  
g. **DISPLAY OVERFLOW (Amplitude on)**

   `SP F SP SP XXXX.XXXXXX E + 06, A SP SP 99.9 E + 0 CR LF`

   (caused by offset which makes display overflow)

  
h. **INSUFFICIENT SIGNAL (Amplitude off)**

   `SP F SP SP 00000.000000 E + 06, CR LF`

  
i. **INSUFFICIENT SIGNAL (Amplitude on)**

   `SP F SP SP 00000.000000 E + 06, A SP + 99.9 E + CR LF`

3-78. When the 5342A is in remote, the front panel REMOTE annunciator lights. When the 5342A is addressed to talk, the front panel RECALL pushbutton lamp will light.
3-79. 9825A PROGRAM EXAMPLES

3-80. The following 9825A program examples are illustrative of 5342A programming:

**EXAMPLE 1**
This program assumes the range switch was set to 0.5—18 GHz before the program was executed. The program puts the 5342A in AUTO, 10 kHz resolution, HOLD, and “wait until addressed” output mode. Program takes a measurement (trg 702) and reads it into the A register. After waiting 500 ms, the program loops back to the next trigger, then read statement.

```
0: wrt 702,"AUSR 7T1ST2"
1: trg 702;red 702;"Hidsp A"
wait 500
2: sto 1
3: end
```

**EXAMPLE 2**
This program also assumes the range switch was previously set to the 0.5—18 GHz position. The program puts the counter in AUTO mode, 10 Hz resolution, fast sample, and “only if addressed” output mode. The program takes a measurement, unaddresses the 5342A as a talker (cmd 7, “—”) so that the counter will continue making measurements at a fast rate, and waits 500 ms until reading the next measurement.

```
0: wrt 702,"AUSR 4T2ST1"
1: red 702;A;
cmd 7;"Hidsp A"wait 500
2: sto 1
3: end
```

**EXAMPLE 3**
This program sets a manual center frequency of 10 GHz (input frequency = 10.03 GHz), 1 Hz resolution, 0.5—18 GHz range, FM mode, front panel sample rate control, and “output only if addressed”. Each reading is printed on the 9825A printer.

```
0: wrt 702,"SM10 006S5R3HFT0ST1"
1: red 702;A;
pri A
2: sto 1
3: end
```

10030069548.00
10030069544.00
10030069539.00
10030069529.00
10030069524.00
10030069514.00
10030069512.00
EXAMPLE 4
This program selects AUTO mode, 1 Hz resolution, fast sample, "output only if addressed", and amplitude "on". The frequency is read into the A register and the amplitude is read into the B register. Notice that although the frequency is displayed only to 1 MHz resolution on the counter, the full 1 Hz resolution is output to the calculator.

```
0: \text{u}rt \, 702; \text{"AUSR}
\text{3T2ST1AM1\"}
1: \text{red} \, 702; A, B;
\text{prt} \, A; \text{prt} \, B
2: \text{sto} \, 1
3: \text{end}
\text{*32729}
```

```
4230028373.00
-5.30
4230028373.00
-5.30
4230028367.00
-5.30
4230028370.00
-5.30
```

EXAMPLE 5
This program measures the same signal as in (4) but enters a \text{-10 dB} offset in the amplitude measurement.

```
0: \text{u}rt \, 702; \text{"AUSR}
\text{3T2ST1AM1S0B-}
\text{10.0E\"}
1: \text{red} \, 702; A, B;
\text{prt} \, A; \text{prt} \, B
2: \text{sto} \, 1
3: \text{end}
\text{*20921}
```

```
4230028349.00
-15.30
4230028349.00
-15.30
4230028350.00
-15.30
4230028342.00
-15.30
```
EXAMPLE 6

This is the same program as (5) but with a +10 GHz offset.

0: wri $702; "AUSR
3T2ST1AM1S0B-
10.6ESOM10000EO
M1"
1: red $702; A,B:
pri A;pri B
2: sto 1
3: end
*6961

14230028337.00
-15.30
14230028335.00
-15.30
14230028338.00
-15.30
14230028332.00
-15.30
3-81. HP-IB PROGRAMMING NOTES

3-82. The HP-IB output is affected by input signal level as follows:
   a. For input signal levels greater than or equal to specified sensitivity, the 5342A outputs measurement data as described in paragraph 3-77.
   b. For input signal levels less than the actual sensitivity by 0.1 dB or more (or for no input), the counter outputs zeros when addressed to talk.
   c. For input signal levels just on the edge of the counter's actual sensitivity (approximately a 0.1 dB band) the detectors which indicate sufficient signal level for counting may become intermittent resulting in very long acquisition times. The counter's display holds the previous reading during the prolonged acquisition but the counter will not output any data when addressed to talk. This will hang up the program at the read statement.
   d. With the 9825A, use the “time” statement and “on err” statement to branch around the read statement if it takes longer than a specified number of milliseconds to complete an I/O operation. The following example program can be used when there is more than one read statement in the program. If there is only one read statement, then statement 2 could be deleted and the end of statement 7 could simply cause the program to go to the statement after the read (in this case, “goto 6”):

```
EXAMPLE
0:  dsv "ctr",702
1:  goto "begin"
2:  "err ret": jmp erl-1
3:  "begin": time 1000: on err "er" "err"
4:  ert "ctrl";
    "AUSR4HC71"
5:  tra "ctrl";
    red "ctr";a
6:  wait 500+pr
    jmp -1
7:  "err": if err=4
    time 1000;
    on err "err" "err"
    goto "err ret"
8:  end
#29627
```

Since this statement is in line 2, the program jumps to the statement after the read statement.

Error 4 is time out error. Reset time and error jump.

When the 5342A took more time than 1 second to make the measurement, zeroes are output.
NOTE
For any controller, check SRQ to see if a measurement has been completed. Allow an adequate number of iterations on the SRQ check to permit the counter to complete the measurement and pull SRQ.

A flow diagram of such an algorithm is:

```
TRIGGER 5342A
O → N

SRQ?
N → 1 + N → N

N ≥ 1000?
Y → O → A

THIS LOOP SHOULD TAKE MORE TIME THAN MAXIMUM EXPECTED MEASUREMENT TIME.

READ COUNTER → A
```
3-83. REMOTE PROGRAMMING OF DIAGNOSTIC MODE 6
(OPTION 002, 011 ONLY)

3-84. In some system applications, it may be desirable to program the 5342A to diagnostic mode
6 so that the counter will constantly present a low SWR and not switch to frequency measure-
ments (higher SWR). The following example shows how this may be done:

```
0: dev "ctr", 702
1: wtr "ctr", "RUNITR5T1"
2: wtb "ctr", 15,
   2:0,140,1
3: rdb("ctr")=Z;
   ilor(2:1)=Z
4: wtb "ctr", 1,
   6:140:1:2:5
5: trn "ctr";
   wait 5000
6: wtb "ctr", 15,
   2:0,140,1
7: rdb("ctr")=Z;
   band(2,254)=Z
8: wtb "ctr", 1,
   6:140:1:2:5
9: end
```

- **Program counter for AMPL mode**
- **This sets the counter to diagnostic mode 6**
- **Counter must be triggered to enter diagnostic mode 6. For 5 seconds, counter does not switch to frequency.**
- **This resets the counter to amplitude and frequency measurements**