

SECTION I GENERAL INFORMATION

1-1. INTRODUCTION.

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

1-3. SPECIFICATIONS.

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

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

1-6. DESCRIPTION.

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

Table 1-1. Specifications.

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

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

Table 1-2. General Information.

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

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

<p>GPIO Remote Control* Option 007 3320B Only</p> <p>Allows bit-parallel word-serial digital remote control of all functions. ① A 3320B with this option will recognize an address and then accept instructions in a serial fashion. Instructions are in a 7-bit parallel ASCII code. Due to the addressing feature, up to ten 3320B's (with this option) may be programmed from one programmer. The HP 3260A Marked Card Programmer may be used as a programmer for this option.</p> <p>This option requires 8 digital input lines for full control. ① Seven of the eight are programming input lines and one is a data command line.</p> <p>Full digital isolation is standard with this option.</p> <p>Timing: max of 5 μs per word required to input program data.</p> <p>Logic level requirements: (same as parallel BCD remote). Switching and settling times for frequency and amplitude are the same as with the parallel BCD remote option. For field installation, order accessory kit HP 11239B.</p>	<p>Logic Level Requirements for All Digital Remote Control Options.</p> <table border="1"> <thead> <tr> <th>State</th> <th>Requirements</th> </tr> </thead> <tbody> <tr> <td>"Low" (logical "1")</td> <td>0 V to 0.4 V (5 mA max.) or contact closure to ground through < 80 ohms.</td> </tr> <tr> <td>"High" (logical "0")</td> <td>+ 2.4 V to + 5 V or removal of contact closure to ground.</td> </tr> </tbody> </table> <p>100 Hz and 10 Hz Ranges* Option 006 3320A/B</p> <p>Adds two lower frequency ranges, 100.0 Hz and 10.00 Hz, yielding greater resolution for low frequency outputs (see resolution section of specifications). These two ranges are fully programmable if digital remote options are installed. For field installation order accessory kit HP 11240A.</p> <p>*Field installable.</p> <p>① Except last vernier digit and line switch.</p>	State	Requirements	"Low" (logical "1")	0 V to 0.4 V (5 mA max.) or contact closure to ground through < 80 ohms.	"High" (logical "0")	+ 2.4 V to + 5 V or removal of contact closure to ground.
State	Requirements						
"Low" (logical "1")	0 V to 0.4 V (5 mA max.) or contact closure to ground through < 80 ohms.						
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overrange digit, and a vernier control that provides two digits of resolution. A range control provides five ranges of 1000 Hz, 10 kHz, 100 kHz, 1000 kHz, and 10 MHz. The output frequencies are derived from a precision single frequency source by an indirect synthesis technique.

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

1-9. OPTIONS.

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

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

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

1-12. ACCESSORIES SUPPLIED.

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

Table 1-3. Accessories Supplied.

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

1-14. ACCESSORIES AVAILABLE.

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

Table 1-4. Accessories Available.

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

1-16. INSTRUMENT AND MANUAL IDENTIFICATION.

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