HP 5061B
- Improved **accuracy ±3x10^-12**
- **Primary standard**
- **Proven reliability**

HP 5061B, Opt 004
- Accuracy ±2 x 10^{-12}
- **Settability ±1x10^{-13}**
- Time domain stability 5 x 10^{-12} (1 s avg)

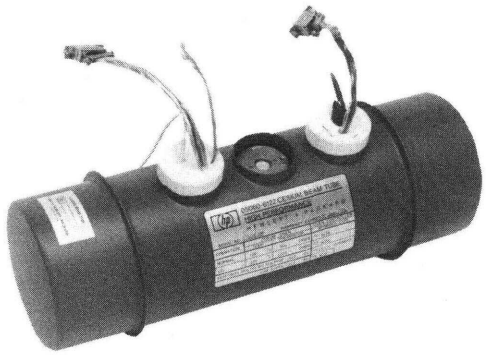
HP 5061B

HP 5061B Cesium **Beam Standard**

The first Hewlett-Packard Cesium Beam Standard, the HP 5060A, was introduced in 1964. This was followed in 1967 with the improved HP 5061A, in 1973 with the high performance beam tube option for the HP 5061A and in 1986 with the 5061B. Since this time the accuracy and reliability of Hewlett-Packard cesium beam standards continues to be demonstrated and these standards have become the world-wide standard for frequency and time keeping. The HP 5061B has provision for an optional digital divider and reliable, easy-to-read LCD clock (Option 003) and for a battery with 3/4 hour standby power capacity with automatic charging.

Reliability and warranty: over 100 million operation hours have proven the performance and reliability of Hewlett-Packard cesium beam standards in various world-wide applications. The units have provided dependable microsecond accuracy in aircraft, ship and fixed environments.

A five-year warranty on the HP 5061B standard cesium beam tube is provided as a result of proven field reliability. This warranty includes replacement of the cesium beam tube if it should fail within the warranty period.



Option 004, High Performance Cesium Beam Tube with three-year warranty

HP [illegible] with Opt 004, High Performance CesiumBeamTube

The Hewlett-Packard 5061B primary frequency standard with the Option 004 Cesium Beam Tube offers increased stability and accuracy in the instrument which has become the worldwide standard of frequency and time keeping since its introduction in 1967. Improvements in magnetic shielding, ruggedization and environmental performance permit improved performance and expansion of navigation and communication systems.

The design concept of the high-performance beam tube includes unique HP designed dual-beam optics with higher beam intensity to accomplish better short-term stability and greater immunity to effects of shock and vibration. A 50 percent increase in resonance cavity length without change in the overall beam tube size contributes to better accuracy and settability because of the high Q of the narrower resonant line width. This tube retains the unique cesium standard feature of virtually no long term instability or aging.

The intrinsic accuracy is improved to ±2 X 10^{-12} which provides an excellent reference standard without need of calibration. If desired, as in many timekeeping applications, two or more units may be calibrated to determine the difference in rate or may be adjusted to the same frequency. With the improved settability specifications of 1 X 10^{-13} small changes in frequency are accomplished rapidly and accurately. A provision for degaussing the tube without adversely affecting the instrument operation allows removal of any residual magnetic field in the tube. This is important in achieving the settability performance.

The short term stability specification is improved by a factor of ten with this tube. The 5 X 10^{-12} (1 s avg.) performance compares very favorably with that of rubidium type standards which are noted for their excellent short term stability. An important advantage from the better short term stability is the capability to make measurements to 1 sigma precision of 1 X 10^{-12} in about one minute compared to the two hours required previously. The HP 5061B with the Option 004 High Performance Tube has the same high reliability as the HP 5061B with the standard tube. The new high performance tube is warranted for three years, but is designed to have the same long life as the standard tube.*

HP E21-5061B Flying Clock

The HP E21-5061B consists of a HP 5061B Cesium Beam Standard with Option 003 LCD Clock and Special Option E21, all fastened to an HP 5089A Standby to form a portable unit. The power supply, which can be operated from 11 to 30 V dc, 85 to 255 V ac, will provide approximately 10 hours standby power (from sealed immobilized electrolyte lead calcium batteries) for the HP 5061B Cesium Beam Standard.

This wide range of operating power capabilities enable the HP E21-5061B to operate on local power in virtually any country in the world. The 10 hours standby capability makes it possible to travel where there is no power available and, of course, allows the HP E21-5061B to conveniently be transported between power sources and operated in almost any air or surface vehicle as a "flying clock" (see Hewlett-Packard Journal, August 1966 and December 1967).

The Option 004 tube, because of the improved shielding, offers a significant increase in accuracy under the varying earth's magnetic field conditions experienced by flying clocks and is a desirable addition to the HP E21-5061B. In addition, the better short term stability permits more accurate and rapid comparison of standards.

*See page 492 for ordering information.

FREQUENCY & TIME STANDARDS

Frequency Standards

Models 5061B, 5065A, 105B

Specifications — Frequency Standards

Instrument:	HP 5061B Option 004	HP 5061B	HP 5065A	HP 105B
Type of Standard:	**Cesium**	**Cesium**	**Rubidium**	**Quartz**
Accuracy: maintained in a dc magnetic field to 2 gauss over a temperature range of 0-50°C	$\pm 3 \times 10^{-12}$	$\pm 5 \times 10^{-12}$		
Accuracy: limited temp. range (1)	$\pm 2 \times 10^{-12}$	$\pm 3 \times 10^{-12}$		5×10^{-10}/day
Reproducibility	$\pm 1.5 \times 10^{-12}$	$\pm 3 \times 10^{-12}$		
Retrace	$\pm 5 \times 10^{-13}$	$\pm 3 \times 10^{-12}$		
Settability (frequency)	$\pm 1 \times 10^{-13}$	$\pm 7 \times 10^{-13}$	$\pm 2 \times 10^{-12}$	1×10^{-10}
Long-term Stability	$\pm 2 \times 10^{-12}$ (4)	$\pm 2 \times 10^{-12}$ (4)	$\pm 1 \times 10^{-11}$/month	
DC Magnetic Field Stability, freq. change, any orientation in a 2 gauss field	$< \pm 2 \times 10^{-13}$	$< \pm 2 \times 10^{-12}$	$< \pm 5 \times 10^{-12}$ (1 gauss field)	
Time Constant, quartz OSC. control loop	1s	1s		
Warm-up Time at 25°C	30 min	45 min	5×10^{-11} 4 hrs(2)	5×10^{-9}/15 min
Tube Warranty	3 yrs.	5 yrs.	3 yrs.	
Sinusodial Outputs	10 MHz, 5 MHz, 1 MHz, 100 kHz		5 MHz, 1 MHz, 100 KHz	5M, 1M, 100k, Clock (1M)
Output Voltage	1 volt into 50 Ω			
Harmonic Distortion	>40 dB (from rated output)			
Non-Harmonic Distortion	>80 dB (from rated output)			
Temperature, Operating	0-50°C			
Temperature, Non-operating	–40 to 70°C(3)			–40 to 50°C
Power, AC	50, 60 or 400 Hz ±10%, 115/230V ±10%, 44W (Cesium), 49W (Rb),			19W(71W Warm-up)
Power, DC	22 to 30V, 30W		23 to 30V, 35W	8W (16W Warm-up)
Power, AC/DC with options - add	5 to 16W		0 to 16W	
Dimensions (HxWxD): mm: inches:	221x425x416 8.7x16.7x16.4		133x425x416 5.2x16.7x16.4	88.2x425x286 $3^{15}/_{32}$x$16^{3}/_{4}$x$11^{1}/_{4}$
Weight (lb/kg) **Option 002** **Option 003**	68/30.9 6/2.7	64/29.1 6/2.7	34/15.4 **2/0.9** 3.5/1.6	24/10.9
Time Standard (Clock)				
1 PPS Outputs: Master: **Clock:**	Front and Rear BNC		Front BNC	
Amplitude	10V Peak into 50 Ω load			
Width **Rise Time** **Fall Time**	20 μs min. <50 ns <50 ns			
Jitter, pulse-to-pulse	<1 ns, rms			
Synchronization	Automatic, 100 ± 100 ns delay			
Clock Pulse Adjustment Range:	.1 μs to 1s			
Clock Display:	LCD	LCD	LED	
Standby Power Supply-Capacity at 25°C w/clk	45 min.	45 min.	10 min.	6 hrs
Recharge	Automatic		switch	fast/float

(1) Static mechanical and atmospheric and electromagnetic environment ±2.5°C range at any temperature between 15 and 35°C.
(2) After 24 hours off @ 25°C.
(3) If options installed in HP 5065A, Non-Op. Temp –40°C to +50°C.
(4) For life of Cesium Beam tube.
NOTE: Tubes are intrinsically capable of meeting these specifications when installed in HP 5061B's currently in production.

Ordering Information — Price

HP 5061B Cesium Frequency Standard $35,200
Opt 003 Clock and Standby Power Supply $4,300
Opt 004 High Performance Beam Tube $6,200
Opt 908 Rack Flange Kit $80
Special Option HP E21-5061B Flying Clock +$7,950
Consists of: HP5061B, Opt 003, E21, + 5089A. (The 5061B, + Opt 003 are not included in the E21 price.)
Weight: 64 kg (141 lb).
Size: 425 H x 405 W x 546 mm D (16.7 in. x 15.9 x 21.5 inches) includes handles.
HP 10638A Degausser $2,200

Special Option K34-59991A Phase Comparator $1.925
HP 5065A Rubidium Frequency Standard $33,000
Opt 001 Clock $3,800
Opt 002 Standby Power Supply $1,600
Opt 003 Clock and Standby Power Supply $5, 200
Opt 908 Rack Flange Kit $90
Special Option HP E21-5065A Portable Standard +$g, 375
Consists of: HP 5065A, E21, Opt 001 + 5089A Standby power supply. (The 5065A, + Opt 001 are not included in the E21 price.)
Weight: 50 kg (110 lb).
Size: 314 H x 425 W x 546 mm D (8.4 x 16.7 x 21.5 inches) includes handles.