

# The Best Value in High Performance Crystal Oscillators

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The HP 10811D and HP 10811E Crystal Oscillators are oven-controlled, high-performance component oscillators for use in OEM equipment and in a wide variety of communication, navigation, and instrumentation applications. You get the best value in oscillators for these reasons:

- low aging rate means lower maintenance costs
- fast warm-up time reduces downtime - typically six minutes
- low power consumption provides longer backup battery life
- low phase noise
- high reliability results in low cost of ownership
- you get all the above at a competitive price

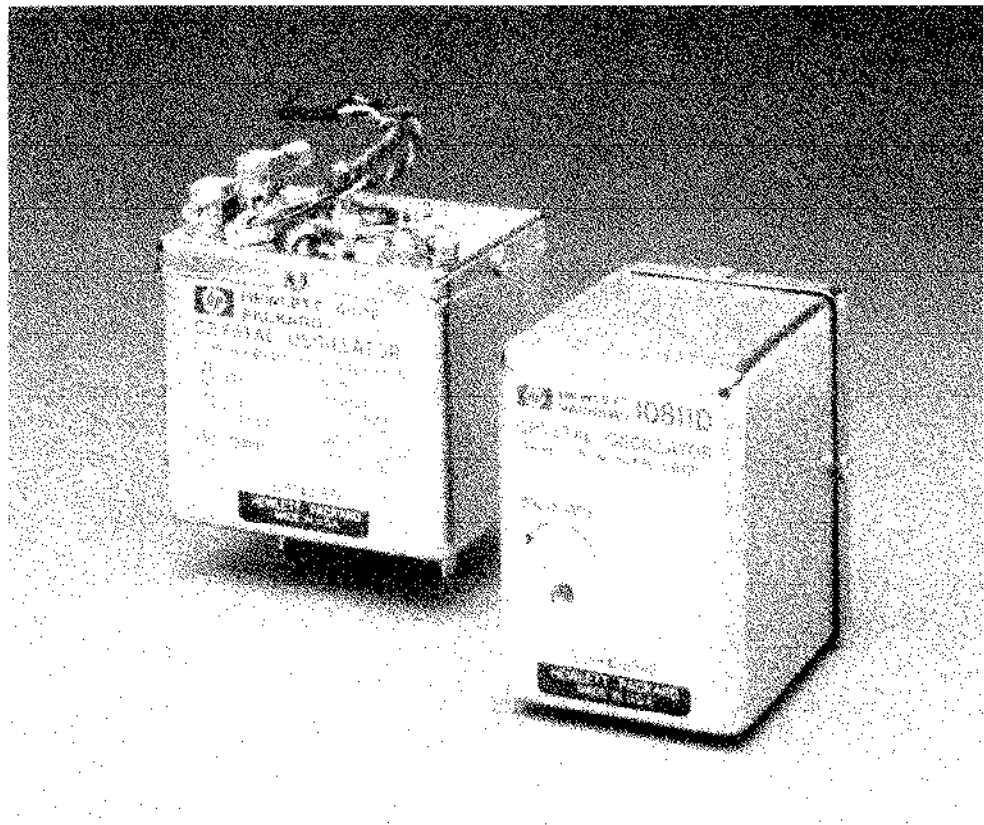
HP quality and attention to every design and manufacturing detail are evident throughout the HP 10811D/E. For example, the oscillators' oven power control transistors, themselves, are the source of oven heat. This simplified design gives you greater reliability.

The HP 10811D/E replace the HP 10811A/B in most applications.

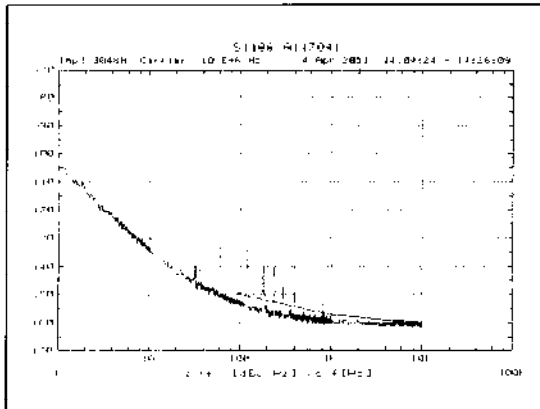
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## HP 10811D/10811E Crystal Oscillators

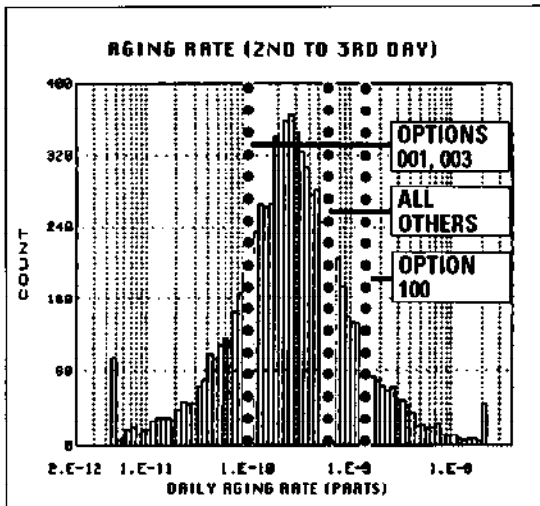
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**Proven performance and reliability in the HP 10811D/E continue to give you the highest value in crystal oscillators.**



Phase noise plot



Aging rate histogram

## Low Oscillator Phase Noise Means Low System Phase Noise

The graph on the left shows a typical HP 10811D/E noise floor and power line spur plot. As local oscillator frequencies for communication and navigation receivers go higher, low phase noise becomes a much more important oscillator characteristic. Many of these applications require multiplication of base frequency to useable local oscillator frequencies.

## Extensive Analysis in Manufacturing Ensures Your Oscillator Will Meet or Exceed Spec

The histogram on the left plots aging rates measured during a recent HP 10811D/E manufacturing cycle. Many other histograms are generated so that phase noise, short-term stability, temperature and other specifications are continuously monitored. HP quality and reliability translates to reduced downtime for you.

## Low Acceleration Sensitivity

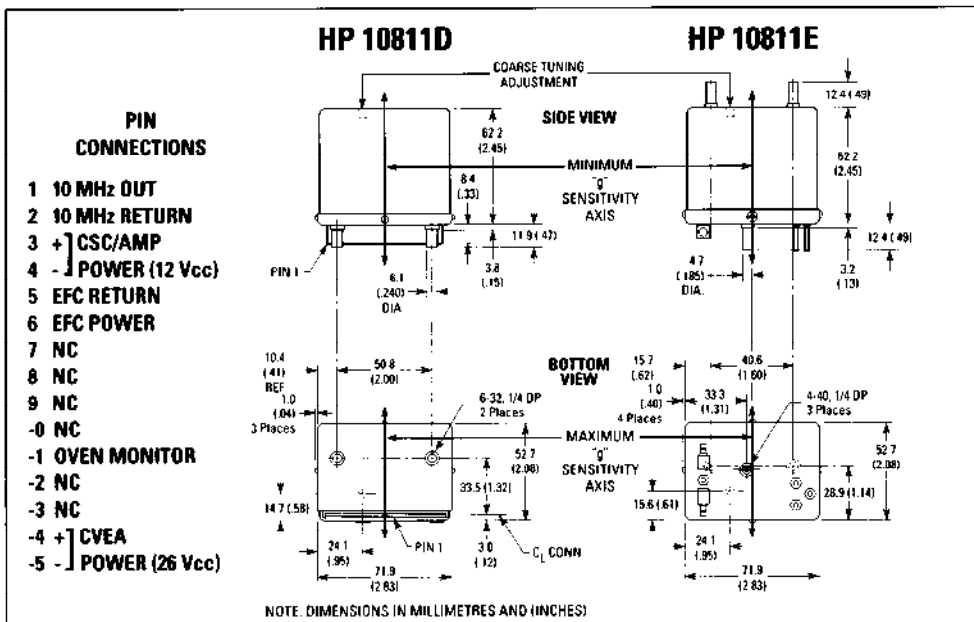
Both vibration and gravity acceleration can cause frequency shifts larger than those caused by aging or temperature. The maximum frequency shift is less than  $\pm 4 \times 10^{-9}$  for any reorientation of the HP 10811D/E. Typically, the acceleration frequency shift along the most sensitive axis of rotation is  $< 5 \times 10^{-10}$  for 2 g turn-over.

Gravitational and vibrational stress can be minimized by mounting the oscillator so that the stress will be along the minimum g sensitivity axis (see "Dimensions" below).

## Differences Between the "D" and "E"

The difference between the HP 10811D and HP 10811E is in the method of making electrical connections. The "D" uses a printed circuit connector board. The "E" uses filter feed-thru terminals for the power connections, oven monitor and SMB snap-on type rf connectors for the 10 MHz output and EFC input.

Mechanically the "D" has two internally-threaded mounting studs on the bottom cover. The "E" has one stud on its bottom cover and two on the top, so vibration isolators, such as the LORD #J2924-2-1 (HP P/N 1520-0094) can further isolate the "E" from shock or vibration.



Dimensions

# HP 10811D/E Specifications\*

Averaging Time (seconds) $\tau$	Stability (parts) $\sigma_y \tau$	Offset from Signal (Hz) Frequency	Phase Noise (dBc) Relative Power	
			Std, Opt 001,023	Opt 002,003
Standard and all options except Option 100				
0.001	$<1.5 \times 10^{-10}$	1	$<-100$	$<-103$
0.01	$<1.5 \times 10^{-11}$	10	$<-130$	$<-133$
0.1	$<5 \times 10^{-12}$	100	$<-150$	$<-153$
1	$<5 \times 10^{-12}$ (see opt note A)	1,000	$<-157$ (see opt note B)	$<-162$
10	$<5 \times 10^{-12}$	10,000	$<-160$	$<-162$
100	$<1 \times 10^{-11}$			
1,000 (typical)	$<1 \times 10^{-11}$			

## Frequency Stability

### Long Term (Aging Rate):

$<5 \times 10^{-10}$ /day after 24 hour warm-up. See Notes 1 and 2, and Option Note C.

### Continuous Operation:

$<1 \times 10^{-7}$  per year. (Typical  $1 \times 10^{-8}$  per year after 1 year.) See Option Note D.

### Short Term:

refer to tables above.

**Warm-up:**  $<5 \times 10^{-9}$  of final value\*\* 10 minutes after turn-on. See Notes 1 and 3, and Option Note E.

## Environmental Sensitivity:

**Temperature:**  $<4.5 \times 10^{-9}$  from 0°C to +71°C.

See Option Note F.

**Operating Range:** 0°C to +71°C.

**Storage Range:** -55°C to +85°C.

**Load:**  $<5 \times 10^{-10}$  for  $\pm 10\%$  change in 50  $\Omega$  load.  $<5 \times 10^{-10}$  for  $\pm 25\%$  change in 1K  $\Omega$  load.

**Oscillator Power Supply:**  $<2 \times 10^{-10}$  for a 1% change in oscillator supply voltage. See Option Note G.

**Ripple:**  $<-90$  dBc spurs from 10 mV rms ripple on oscillator supply voltage at 100 Hz.

### Oven Power Supply:

$<2.5 \times 10^{-10}$  for 10% change in oven supply voltage ( $<1 \times 10^{-10}$  typical)

See Option Note G.

**Gravitational Field:**  $<4 \times 10^{-9}$  for 2g static shift (turn-over). See Option Note H.

**Magnetic Field:**  $<-90$  dBc sidebands due to 0.1 mT (1 Gauss) rms at 100 Hz. See Option Note H.

**Humidity (typical):**  $1 \times 10^{-9}$  for 95% RH @ 40°C.

**Shock (survival):** 30 g, 11 ms, 1/2 sinewave.

**Altitude (typical):**  $<2 \times 10^{-9}$  for 0 to 50,000 ft.

## Adjustment

### Coarse Frequency Range:

$>\pm 1 \times 10^{-6}$  ( $\pm 10$  Hz) with 18-turn control. See Option Note I.

**Electronic Frequency Control (EFC):**  $\geq 1 \times 10^{-7}$  (1 Hz) total, control range -5 Vdc to +5 Vdc. See Option Note J.

## Power Requirements

**Oscillator Circuit:** +11.0 to +13.5 Vdc. I =  $<40$ mA (30mA typical). Ripple  $<100\mu$ V rms.

**Oven Circuit:** 20 to 30 Vdc; Ripple  $<30$  mV rms. Turn-on load is 42  $\Omega$  minimum.

Steady-state power drops to a typical value of 2.0W at 25°C in still air with 20 Vdc applied.

(Specifications cont. on back page)

## Notes:

- For oscillator off-time less than 24 hours and aging rate was  $<5 \times 10^{-10}$  per day before turnoff.
- If off-time is greater than 24 hours, specified aging rate will be met in less than 30 days (typically 3 days).
- With  $>20$  Vdc on oven, at 25°C ambient.

## Option Notes:

- Option 100  $<5 \times 10^{-11}$  @ 1 second only
- Option 100  $<-155$  dBc @ 1000 Hz only
- Option 001, 003,  $<1 \times 10^{-10}$ ; Option 100,  $1.5 \times 10^{-9}$
- Option 001, 003,  $<3.6 \times 10^{-8}$  per year; Option 100 ( $5.5 \times 10^{-7}$  per year)
- Option 100  $<6 \times 10^{-9}$
- Option 100  $<7 \times 10^{-9}$  from 0°C to +71°C
- Option 100  $<1 \times 10^{-8}$
- Option 100 not specified
- Option 100  $>\pm 8 \times 10^{-7}$
- Opt 100 not specified
- Opt 023 10.23 MHz
- Opt 100 .5V (typical) into 50  $\Omega$

\* Specifications describe the oscillator's warranted performance. Supplemental characteristics are intended to provide information useful in applying the oscillator by giving TYPICAL or NOMINAL, but non-warranted performance parameters. Definition of terms is provided at the end of the specification section. See "NBS-Monograph 140" for measurement definitions.

\*\*Final frequency value is the oscillator frequency 24 hours after turn-on.

# Specifications (continued)

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## Connectors

**HP 10811D:** mates with CINCH 250-15-30-210 (HP# 1251-0160) or equivalent (not supplied).

**HP 10811E:** solder terminals and SMB Snap-on connectors. Mates with Cablewave Systems, Inc. #700156 or equivalent (not supplied).

## Output

**Frequency:** 10.000000 MHz. See Option Note K (previous page).

**Voltage:** 0.55V  $\pm$ 50 mV rms into 50  $\Omega$ . 1V rms  $\pm$ 200mV into 1K  $\Omega$ . See Option Note L (previous page).

**Harmonic Distortion:** <25 dB down from output.

**Spurious Phase Modulation:** < 100 dB down from output (discrete sidebands 10 Hz to 25 kHz).

## General

**Size:** See "Dimensions" drawing inside.

**Weight:** 0.31 kg (11 oz.)

## Ordering Information:

**HP 10811D Standard**

**HP 10811E Standard**

### Options

001 (Lower Aging Rate)

002 (Lower Phase Noise)

003 (001 plus 002)

023 (10.23 MHz Output)

100 (Reduced Specs)

Consult HP Sales Office for quantity discounts.

Requests for special connectors, mounting, and for special frequencies within 500 kHz will be considered. Contact your local HP Sales Office for details about S01-59991A.

## Warranty

Hewlett-Packard warrants the HP 10811D/E Oscillators against defects in materials and workmanship for a period of 90 days from date of shipment. The oscillators will be repaired or replaced at no charge during the warranty period.

**United States:** Hewlett-Packard Company, 4 Choke Cherry Road, Rockville, MD 20850, Tel. (301) 670-4300. Hewlett-Packard Company, 5201 Tollview Drive, Rolling Meadows, IL 60008, Tel. (708) 255-9800. Hewlett-Packard Company, 5161 Lankershim Boulevard, No. Hollywood, CA 91601, Tel. (818) 505-5600. Hewlett-Packard Company, 2015 South Park Place, Atlanta, GA 30339, Tel. (404) 955-1500. **Canada:** Hewlett-Packard Ltd. 6877 Goreway Drive, Mississauga, Ontario L4V 1M8, Tel. (416) 678-9430. **Europe:** Hewlett-Packard S.A., Marcom Operations Europe, P.O. Box 529, 1180 Amstelveen, The Netherlands, Tel. (31) 20 547 9999. **Japan:** Yokogawa-Hewlett-Packard Ltd., 15-7 Nishi Shinjuku 4 Chome, Shinjuku-ku, Tokyo, Japan, (03) 5371 1315. **Latin America:** Latin American Region Headquarters, Monte Pelvoux No. 11, Lomas de Chapultepec, 11000 Mexico, D.F., Tel. (525) 202 0155. **Australia/New Zealand:** Hewlett-Packard Australia Ltd., 31-41 Joseph Street, Blackburn, Victoria 3130, Australia (A.C.N. 004 394 763), Tel. (03) 895 2895. **Far East:** Hewlett-Packard Asia Ltd., 22/F Bond Centre, West Tower, 89 Queensway, Central, Hong Kong, Tel. (852) 848 7777.



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