

# Agilent E1441A Arbitrary Waveform Generator

## Data Sheet

- 12-bit, 40 MSa/s, four 16k-deep arbitrary waveforms
- 15 MHz sine- and square-wave outputs
- Includes sine, square, triangle, ramp, noise, and more
- Internal lin/log sweep plus AM/FM/FSK/Burst modulation
- Isolated output
- Optional high-stability timebase and external phase lock

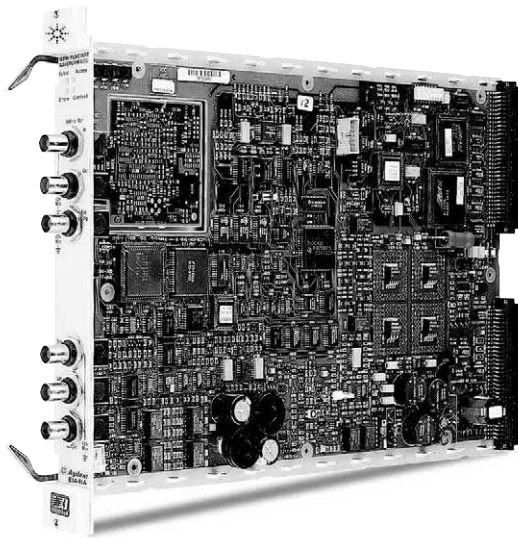
### Description

The Agilent Technologies E1441A Arbitrary Waveform Generator is a **C-size, 1-slot, message-based VXI module**. It uses direct digital synthesis to deliver outstanding functionality at a price far below comparable, rival arbitrary function generators.

Standard built-in waveforms include sine, square, triangle, ramp, noise,  $\sin(x)/x$ , exponential rise & fall, cardiac, and DCV. With the E1441A, you can also design your own arbitrary waveform. Standard features include internal AM/FM/FSK/Burst modulation and both linear and logarithmic sweep. The output from the E1441A is isolated from earth ground so that ground loops or other common mode noise are minimized.

With Option 001, the E1441A provides high-stability timebase and external phase lock. This option adds 0.1 ppm/month frequency stability plus phase lock to an external reference or phase lock two or more E1441A's together.

Refer to the Agilent Technologies Website for instrument driver availability and downloading instructions, as well as for recent product updates, if applicable.



Agilent E1441A



## Product Specifications

### Waveforms

<b>Built-in waveforms:</b>	Sine, square, triangle, ramp, noise, DCV, sine(x)/x, negative ramp, exponential rise, exponential fall, cardiac
<b>Arbitrary waveform:</b>	
Length:	8 to 16,000 points
Resolution:	12 bits (including sign)
Sample rate:	40 MSa/s
Non-volatile memory:	Four (4) 16k waveforms

### Frequency Characteristics

<b>Sine:</b>	100 $\mu$ Hz - 15 MHz
<b>Square:</b>	100 $\mu$ Hz - 15 MHz
<b>Triangle:</b>	100 $\mu$ Hz - 100 kHz
<b>Ramp:</b>	100 $\mu$ Hz - 100 kHz
<b>Noise (Gaussian):</b>	10 MHz bw
<b>Waveforms (points):</b>	
8 to 8,192:	100 $\mu$ Hz - 5 MHz
8,193 to 12,287:	100 $\mu$ Hz - 2.5 MHz
12,288 to 16,000:	100 $\mu$ Hz - 200 kHz 10 $\mu$ Hz or 10 digits

### Resolution accuracy (18 to 28° C):

90 days:	10 ppm
1 year:	20 ppm

<b>Temperature coefficient:</b>	<2 ppm/°C
<b>Aging:</b>	<10 ppm/yr

### Sinewave Spectral Purity

<b>Harmonic distortion:</b>	
dc to 20 kHz:	<-70 dBc
20 kHz to 100 kHz:	<-60 dBc
100 kHz to 1 MHz:	<-45 dBc
1 MHz to 15 MHz:	<-35 dBc
<b>Total harmonic distortion:</b>	
dc to 20 kHz:	<0.04%
<b>Spurious (non-harmonic):</b>	
Output (dc to 1 MHz):	<-65 dBc
Output (>1 MHz):	<-65 dBc + 6dB/octave
<b>Phase noise:</b>	<-52 dBc in a 30 kHz band

### Signal Specifications

<b>Square wave:</b>	
Rise/fall time:	<20 ns
Overshoot:	<4%
Asymmetry:	<1% + 5 ns
Duty cycle:	20% to 80% (to 5 MHz), 40% to 60% (to 15 MHz)
<b>Triangle, ramp, arbitrary:</b>	
Rise/fall time:	<100 ns (typical)
Linearity:	<0.1% of peak output
Settling time:	<250 ns to 0.5% of final value
Jitter:	<25 ns

### Output Characteristics

**Note:** Add 1/10th of output amplitude and offset specification per ° C for operation outside of 18° C to 28° C range.

<b>Amplitude (into 50 <math>\Omega</math>):</b>	50 mVp-p to 10 Vp-p, 100 mVp-p to 20 Vp-p into open-circuit load
<b>Accuracy (at 1 kHz):</b>	$\pm$ 1% of specified output

### Flatness (sine wave relative to 1 kHz):

<100 kHz:	$\pm$ 1% (0.1 dB)
100 kHz to 1 MHz:	$\pm$ 1.5% (0.15 dB)
1 MHz to 15 MHz:	$\pm$ 2% (0.2 dB)

### Offset (into 50 $\Omega$ ):

**(Note:** Offset  $\leq$ 2X peak-to-peak amplitude)

Accuracy (For square wave outputs, add 2% of output amplitude additional error):	$\pm$ 5 Vpk ac + dc
--	---------------------

<b>Output impedance:</b>	50 $\Omega$ fixed
<b>Resolution:</b>	3 digits, amplitude and offset
<b>Output units:</b>	Vp-p, Vrms, dBm
<b>Isolation:</b>	42 Vpk maximum to earth
<b>Protection:</b>	Short-circuit protection, $\pm$ 15 Vpk overdrive <1 minute

### Modulation Specifications

<b>AM modulation:</b>	
Carrier (3 dB frequency):	15 MHz (typical)
<b>Modulation:</b>	Any internal waveform plus arbitrary
Frequency:	10 mHz to 20 kHz ( $\pm$ 0.05% to 2.5 kHz, then decreases linearly to $\pm$ 0.4% at upper limit)
<b>FM modulation:</b>	
Modulation:	Any internal waveform plus arbitrary
Frequency:	10 mHz to 10 kHz ( $\pm$ 0.05% to 600 Hz, then decreases linearly to $\pm$ 0.8% at upper limit)
Peak deviation:	10 mHz to 15 MHz
Source:	Internal only
<b>Burst modulation:</b>	
Carrier frequency:	5 MHz max.
Count:	1 to 50,000 cycles, or infinite
Start phase:	-360° to + 360°
Internal rate:	10 mHz to 50 kHz $\pm$ 1%
Gate source:	Internal or external gate
Trigger source:	Single, external, or internal rate
<b>FSK modulation:</b>	
Frequency range:	10 mHz to 15 MHz ( $\pm$ 0.05% to 600 Hz, then decreases linearly to $\pm$ 4% at upper limit)
Internal rate:	10 mHz to 50 kHz
Source:	Internal/external (1 MHz max.)
Internal rate:	10 mHz to 50 kHz $\pm$ 1%

---

## Auxiliary Inputs

<b>External AM modulation:</b>	± 5 Vpk = 100% modulation
<b>Input resistance:</b>	5 k Ω nominal
<b>Ext. trigger/FSK/Burst rate (Trigger source ignored when External Gate is selected):</b>	TTL (high true)
Latency:	1.3 μs
Jitter:	25 ns
<b>VXI TTL Trigger/FSK/Burst rate:</b>	TTL (low true)
Latency:	1.15 μs
Jitter:	25 ns

---

## General Characteristics

<b>Configuration times:</b>	Time to change parameter and output the new signal
Function change (Modulation or sweep off):	80 mS
Frequency change (Modulation or sweep off):	30 mS
Amplitude change:	30 mS
Offset change:	20 mS
Modulation parameter change:	<350 mS
Select user arbitrary:	550 mS
<b>Warm-up time:</b>	30 min
<b>Arbitrary waveforms:</b>	Stored separately
<b>User-configurable stored states:</b>	4

---

## Option 001 Phase Lock/TCXO Timebase

<b>Description:</b>	Adds high stability reference, phase lock to second E1441A and control phase offset
<b>Stability:</b>	± 1 ppm, 0 to 50° C
<b>Aging:</b>	<2 ppm/month in first 30 days, 0.1 ppm/month after 30 days
<b>Ext. ref. input lock range:</b>	10 MHz ± 50 Hz
<b>Phase offset:</b>	–360° to + 360°, 0.001° resolution

---

## General Specifications

### VXI Characteristics

<b>VXI device type:</b>	Message based
<b>Data transfer bus:</b>	A16, slave only
<b>Size:</b>	C
<b>Slots:</b>	1
<b>Connectors:</b>	P1/P2
<b>Shared memory:</b>	No
<b>VXI buses:</b>	No

---

**Instrument Drivers** - See the Agilent Technologies Website ([http://www.agilent.com/find/inst\\_drivers](http://www.agilent.com/find/inst_drivers)) for driver availability and downloading.

<b>Command module firmware:</b>	Not required, message based
<b>Command module firmware rev:</b>	Not required, message based
<b>I-SCPI Win 3.1:</b>	Not required, message based
<b>I-SCPI Series 700:</b>	Not required, message based
<b>C-SCPI LynxOS:</b>	Not required, message based
<b>C-SCPI Series 700:</b>	Not required, message based
<b>Panel Drivers:</b>	No
<b>VXIplug&amp;play Win Framework:</b>	No
<b>VXIplug&amp;play Win 95/NT Framework:</b>	Yes
<b>VXIplug&amp;play HP-UX Framework:</b>	No

---

## Module Current

	I <sub>PM</sub>	I <sub>DM</sub>
<b>+5 V:</b>	0.5 A	0.10 A
<b>+12 V:</b>	2.5 A	0.12 A
<b>–12 V:</b>	0	0
<b>+24 V:</b>	0	0
<b>–24 V:</b>	0	0
<b>–5.2 V:</b>	0	0
<b>–2 V:</b>	0	0

---

## Cooling/Slot

<b>Watts/slot:</b>	25.0
<b>ΔP mm H<sub>2</sub>O:</b>	0.1
<b>Air Flow liter/s:</b>	2.0

---

## Ordering Information

Description	Product No.
Arbitrary Waveform Generator	E1441A
Phase Lock/TCXO Timebase	E1441A 001
ANSI Z540 Compliant Calibration	E1441A A6J

## **Agilent Technologies' Test and Measurement Support, Services, and Assistance**

Agilent Technologies aims to maximize the value you receive, while minimizing your risk and problems. We strive to ensure that you get the test and measurement capabilities you paid for and obtain the support you need. Our extensive support resources and services can help you choose the right Agilent products for your applications and apply them successfully. Every instrument and system we sell has a global warranty. Two concepts underlie Agilent's overall support policy: "Our Promise" and "Your Advantage."

### **Our Promise**

Our Promise means your Agilent test and measurement equipment will meet its advertised performance and functionality. When you are choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you receive your new Agilent equipment, we can help verify that it works properly, and help with initial product operation.

### **Your Advantage**

Your Advantage means that Agilent offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra-cost upgrades, out-of-warranty repairs, and onsite education and training, as well as design, system integration, project management, and other professional engineering services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.



### **Agilent Email Updates**

[www.agilent.com/find/emailupdates](http://www.agilent.com/find/emailupdates)

Get the latest information on the products and applications you select.

### **Agilent T&M Software and Connectivity**

Agilent's Test and Measurement software and connectivity products, solutions and developer network allows you to take time out of connecting your instruments to your computer with tools based on PC standards, so you can focus on your tasks, not on your connections.

Visit [www.agilent.com/find/connectivity](http://www.agilent.com/find/connectivity) for more information.

For more assistance with all your test and measurement needs or to find your local Agilent office go to [www.agilent.com/find/assist](http://www.agilent.com/find/assist)

Product specifications and descriptions in this document subject to change without notice.

© Agilent Technologies, Inc. 2005  
Printed in the USA May 1, 2005  
5965-8830E



**Agilent Technologies**