HP E1441A

Arbitrary Waveform Generator

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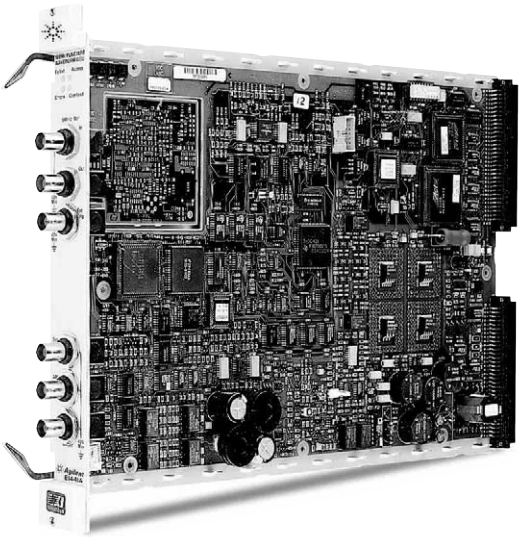
Agilent E1441A
Arbitrary Waveform Generator

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**



Agilent E1441A

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 Technologies

Product Specifications

Waveforms

Built-in waveforms:	Sine, square, triangle, ramp, noise, DCV, sine(x)/x, negative ramp, exponential rise, exponential fall, cardiac
Arbitrary waveform:	
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

Sine:	100 µHz - 15 MHz
Square:	100 µHz - 15 MHz
Triangle:	100 µHz - 100 kHz
Ramp:	100 µHz - 100 kHz
Noise (Gaussian):	10 MHz bw
Waveforms (points):	
8 to 8,192:	100 µHz - 5 MHz
8,193 to 12,287:	100 µHz - 2.5 MHz
12,288 to 16,000:	100 µHz - 200 kHz 10 µHz or 10 digits
Resolution accuracy (18 to 28° C):	
90 days:	10 ppm
1 year:	20 ppm
Temperature coefficient:	<2 ppm/°C
Aging:	<10 ppm/yr

Sinewave Spectral Purity

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

Signal Specifications

Square wave:	
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)
Triangle, ramp, arbitrary:	
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.

Amplitude (into 50 Ω):	50 mVp-p to 10 Vp-p,100 mVp-p to 20 Vp-p into open-circuit load
Accuracy (at 1 kHz):	± 1% of specified output
Flatness (sine wave relative to 1 kHz):	
<100 kHz:	± 1% (0.1 dB)
100 kHz to 1 MHz:	± 1.5% (0.15 dB)
1 MHz to 15 MHz:	± 2% (0.2 dB)
Offset (into 50 Ω):	
(Note: Offset ≤2X peak-to-peak amplitude**)**	± 5 Vpk ac + dc
Accuracy (For square wave outputs, add 2% of output amplitude additional error):	± 2% of setting + 2 mV
Output impedance:	50 Ω fixed
Resolution:	3 digits, amplitude and offset
Output units:	Vp-p, Vrms, dBm
Isolation:	42 Vpk maximum to earth
Protection:	Short-circuit protection, ± 15 Vpk overdrive <1 minute

Modulation Specifications

AM modulation:	
Carrier (3 dB frequency):	15 MHz (typical)
Modulation:	Any internal waveform plus arbitrary
Frequency:	10 mHz to 20 kHz (± 0.05% to 2.5 kHz, then decreases linearly to ± 0.4% at upper limit)
FM modulation:	
Modulation:	Any internal waveform plus arbitrary
Frequency:	10 mHz to 10 kHz (± 0.05% to 600 Hz, then decreases linearly to ± 0.8% at upper limit)
Peak deviation:	10 mHz to 15 MHz
Source:	Internal only
Burst modulation:	
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 ± 1%
Gate source:	Internal or external gate
Trigger source:	Single, external, or internal rate
FSK modulation:	
Frequency range:	10 mHz to 15 MHz (± 0.05% to 600 Hz, then decreases linearly to ± 4% at upper limit)
Internal rate:	10 mHz to 50 kHz
Source:	Internal/external (1 MHz max.)
Internal rate:	10 mHz to 50 kHz ± 1%

Auxiliary Inputs

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

General Characteristics

Configuration times:	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
Warm-up time:	30 min
Arbitrary waveforms:	Stored separately
User-configurable stored states:	4

Option 001 Phase Lock/TCXO Timebase

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

General Specifications

VXI Characteristics

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

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

Command module firmware:	Not required, message based
Command module firmware rev:	Not required, message based
I-SCPI Win 3.1:	Not required, message based
I-SCPI Series 700:	Not required, message based
C-SCPI LynxOS:	Not required, message based
C-SCPI Series 700:	Not required, message based
Panel Drivers:	No
VXI*plug&play* Win Framework:	No
VXI*plug&play* Win 95/NT Framework:	Yes
VXI*plug&play* HP-UX Framework:	No

Module Current

	I_{PM}	I_{DM}
+5 V:	0.5 A	0.10 A
+12 V:	2.5 A	0.12 A
–12 V:	0	0
+24 V:	0	0
–24 V:	0	0
–5.2 V:	0	0
–2 V:	0	0

Cooling/Slot

Watts/slot:	25.0
ΔP mm H_2O:	0.1
Air Flow liter/s:	2.0

Ordering Information

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

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

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