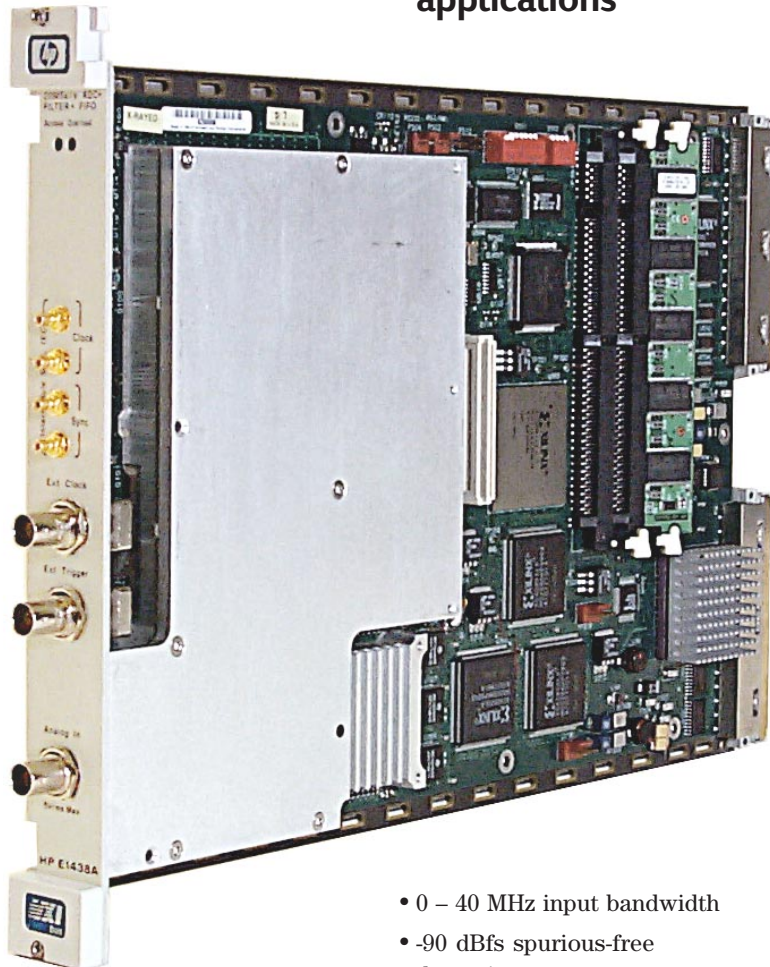


HP

E1438A

100 MSa/s Digitizer with DSP and Memory

High resolution sampling for frequency- and time-domain applications



The HP E1438A is ideal for application in signal acquisition and analysis, high resolution ATE and radar testing. This single-channel 100 MSa/s digitizer combines exceptional spurious-free dynamic range with alias-protected signal conditioning, center frequency tunable digital filtering, and a large signal capture memory, in a single-wide C-size VXI module.

A New Digitizer

The heart of the HP E1438A is a new, HP-designed, 100 MSa/s digitizer. This high performance monolithic component provides clean, low-distortion samples at a higher sample rate than ever before from HP.

Signal analysis algorithms produce better results when supplied with precise samples. The output precision of algorithms such as RMS averaging, the Fast Fourier Transform, and various curve fitting algorithms, is limited by spurs and distortion in the data. Reducing those contaminants ensures more precise results.

Sample linearity and purity are the key and the HP E1438A delivers. Spurious signal contamination is at least -90 dBfs (below full scale), harmonic distortion is down better than -65 dBc and noise density is -133 dBfs/Hz.

- 0 – 40 MHz input bandwidth
- -90 dBfs spurious-free dynamic range
- Anti-alias filter and signal conditioning
- Digital decimation filters with tunable center frequency
- 18MB RAM FIFO memory (expandable to 288 MB)
- Local bus and VXIbus outputs
- Multi-channel compatible
- VXIplug&play compatible
- Single-slot, C-size module

Built-in digital filtering and LO

The standard HP E1438A includes digital decimation filtering and a programmable LO.

Use the real-time filters to reduce noise and improve signal to noise ratio, or to filter out unwanted signals. The 17 filters provided reduce the analysis bandwidth of the HP E1438A from 40 MHz to 305 Hz in octave steps.

These filters also improve data efficiency. The data from each filter is decimated to reduce data rate and data quantity without losing any signal information.

The filter section also includes a digital LO. Use this complex frequency shifter to tune the center frequency of each digital filter anywhere in the 40 MHz input bandwidth of the HP E1438A.

The LO is a big help when you have to process digital modulation formats. The LO action is implemented using quadrature mixing, which produces the I/Q data needed for this task. These digital I and Q results are better matched and, at -90 dBfs, have lower spurious content than I/Q signals produced by analog means. And, the LO's 0.001 Hz resolution is vital for the precise tuning needed to stop a rotating constellation diagram.

Analog signal conditioning includes alias protection

The HP E1438A comes with analog signal conditioning, including a bypassable 40 MHz anti-alias filter. The anti-alias filter ensures the Nyquist-compatible sampling needed by most signal processing algorithms. The signal conditioning makes it easy to match the HP E1438A operating point to your

signal amplitude, and protects the digitizer from harmful voltages. Input bandwidth without alias protection is 100 MHz (typical).

Flexible triggering and synchronization

Select one of five ways to trigger the HP E1438A. Use *immediate* to begin sampling automatically. Select the *external trigger* mode when sampling must start coincident with an external event. Use the *level* mode to trigger on the level of the input signal itself. A *software trigger* command is also provided.

Large pre- and post-trigger delays (> 100 MSamples with the memory option) are standard and the external trigger modes support slope selection.

Use the external synchronization and external clock features of the HP E1438A when your application requires closely coordinated sampling with multiple HP E1438As. Simply connect the ECL synchronization and clock ports between the modules and start sampling. All sampling and digital filter timing will be coordinated between modules, providing less than 10 ns timing skew within a VXI mainframe. This skew is a constant and can be measured and compensated if more precise timing is needed.

Selection of sample clocks

You have a choice of sample clocks with the HP E1438A. The module has two crystal-controlled internal sample clocks. Select the 100 MHz clock for convenient, decimal compatible, time domain sampling. Use the 102.4 MHz internal clock option when downstream signal processing, like the FFT algorithm, needs a binary-compatible sample rate.

You can also run the HP E1438A ADC with an external reference clock to lock sampling to a master 10 MHz timing reference for single-channel sample timing accuracy or phase-coherent multi-channel sampling.

Large built-in memory

Many digital signal processing algorithms use blocks of data. The HP E1438A has an 18 MByte FIFO memory (144 MB and 288 MB options available) to assemble data into blocks so downstream DSP doesn't have to. The FIFO type design of the HP E1438A ensures that new data will not be lost while a data block is being transferred out.

The FIFO also acts as signal capture memory. With the 288 MB FIFO option installed the HP E1438A has a two-second time capture buffer (100 MSa/s, 12-bit real data format). With the lower data-rate 1 MHz decimating filter selected, the FIFO will store three minutes of data. Using the narrower filters will result in even longer signal capture times.

VXI plug&play programming

The HP E1438A is shipped with software and documentation to support a broad set of controllers, I/O interfaces, programming languages and operating systems.

Included standard with the HP E1438A are: compiled C libraries (with source code), example programs, on-line help files, and an installation program. An executable front panel program allows the HP E1438A to be turned on, verified, and used for simple tasks without writing any user programs.

The HP E1438A is fully *VXIplug&play* compliant and is easily controlled in 32-bit Windows® based *VXIplug&play* frameworks.

For those preferring the UNIX® operating system, a *VXIplug&play* C API function library is provided for HP-UX* running on HP Series 700 workstations.

If you are programming in C in a non-*VXIplug&play* environment you will want to use the HP E1438A C libraries. The source code is shipped with these libraries so you can modified them to work with your specific I/O and processor.

High-speed data transfer

Sample linearity and signal processing features are wasted if the data stream has gaps because the module output circuits can not keep up with the data generation processes. The HP E1438A provides two ways to move data to other VXI modules. The VXIbus port on the P1 connector will move data at 2-4 MB/s (typical). This is sufficient for continuous sampling of signals with bandwidths below 500 kHz. For wider signal bandwidths, or multi-channel applications, the Local Bus is key. Using this port, the HP E1438A can move data at >50 MB/s continuously.

Data transfer is further aided by a selection of data output formats. Select from four choices:

Component/Sample	Format
Real only (I)	16 bit
Real & imaginary (I/Q)	16 bit
real only (I)	32 bit
real & imaginary (I/Q)	32 bit

Other HP VXI ADCs

HP E1430
HP E1437A

Technical Specification Summary

(refer to HP E1438A technical data sheet for more data)

Standard Input

Ranges:	+30 dBm to -21 dBm, 3 dB steps
Impedance:	50 Ω
Bandwidth:	40 MHz (alias filter in), 100 MHz (alias filter out)
Distortion products:	<-65 dBc or -90 dBfs, whichever is greater (for fin < 30 MHz)
Spurious:	-90 dBfs
Noise density:	-133 dBfs/Hz

Accuracy

Raw resolution:	12 bits
Absolute accuracy:	±0.7 dB

Clock

Internal:	100 MHz or 102.4 MHz
External:	10 MHz for 100 MSa/s, 10.24 MHz for 102.4 MSa/s (10 MHz to 102.4 MHz clock range)

Trigger

Sources:	Immediate, level, external, software
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Filter

One analog anti-alias filter (40 MHz), 17 digital decimation filters (40 MHz to 305 Hz, octave steps) with digital LO (0.023 mHz tuning resolution)

Memory

Type:	FIFO
Capacity:	18 MB, or 144 MB or 288 MB

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Accessories Available

The HP E1438A “sync” and “clk” connectors may be connected to other HP E1438A modules in synchronized multi-channel applications. The following cable and terminator are available from HP to connect the modules. (See the HP VXI Source Book for additional cables.)

1250-0676	SMB 50W load
8120-5623	175 mm cable with SMB connectors

Backplane Connector Shields

Required for RFI compliance specified in standards EN55011 and CISPR11; specify quantity one Opt 918 with purchase of an HP VXI mainframe: HP E1401B or HP E1421A; specify this kit for retrofitting an existing HP mainframe (E1400-80920 or E1421-80920).

Ordering Information

HP E1438A	100 MSa/s AD with filter and memory
opt 144	144 MB FIFO memory
opt 288	288 MB FIFO memory

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