Agilent E1438C/D
100 MSa/s Digitizer with DSP and Memory

Product Overview

High resolution sampling for frequency- and time-domain applications

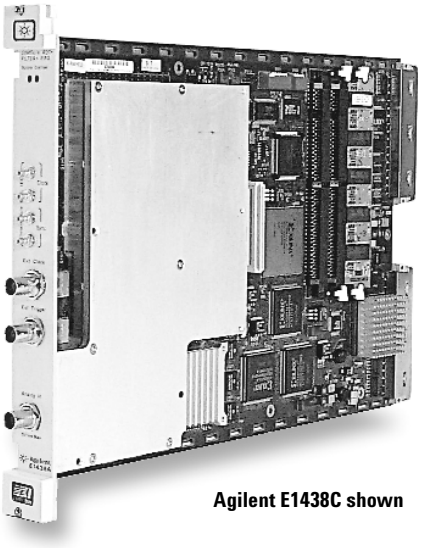
The Agilent E1438C/D is ideal for signal acquisition and analysis, high resolution ATE and radar testing applications. This single-channel 100 MSa/s digitizer combines exceptional spurious-free dynamic range with alias-protected signal conditioning, center-frequency tunable digital filtering, and a large signal capture memory. The only difference between the C and D versions is the E1438D includes a 2.5 Gbit/sec optical front panel data port and support for the VXI local bus. The E1348C/D is a single-slot C-size VXI module.

A new digitizer

The heart of the E1438C/D is a new, Agilent-designed, 100 MSa/s digitizer. This high performance monolithic component provides clean, low-distortion samples at a higher sample rate than offered previously from Agilent.

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.

The E1438C/D delivers high sample linearity. Spurious signal contamination is at least –90 dBfs (below full scale). Harmonic distortion is less than –65 dBc. Noise density is –133 dBfs/Hz.



Agilent E1438C shown

- **0–40 MHz input bandwidth**
- **–90 dBfs spurious-free dynamic range**
- **Anti-alias filter and signal conditioning**
- **Digital decimation filters with tunable center frequency**
- **144 MB RAM FIFO memory (expandable to 1.2 GB)**
- **Local bus (E1438D only)**
- **Optical front panel data port (E1438D only)**
- **Multi-channel compatible**
- **VXI*plug&play* compatible**
- **Single-slot, C-size module**

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Built-in digital filtering and LO
The standard E1438C/D 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 E1438C/D 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. This complex frequency shifter can be used to tune the center frequency of each digital filter anywhere in the 40 MHz input bandwidth of the E1438C/D.

The LO is helpful for processing 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. 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 E1438C/D 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 E1438C/D operating point to the signal amplitude. It also protects the digitizer from harmful voltages. Input bandwidth without alias protection is typically 100 MHz.

Flexible triggering and synchronization
The *immediate trigger* begins sampling automatically. The *external trigger* mode is used when sampling must start coincident with an external event. The *level* mode triggers 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. The external trigger modes support slope selection.

The external synchronization and external clock features of the E1438C/D may be used when an application requires closely coordinated sampling with multiple E1438C/Ds. The user simply connects the ECL synchronization and clock ports between the modules and starts 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 required.

Selection of sample clocks
The E1438C/D provides several crystal-controlled internal sample clocks. The 100 MHz clock offers convenient, decimal compatible, time domain sampling. The 102.4 MHz internal clock option is the optimal choice when downstream signal processing, like the FFT algorithm, needs a binary-compatible sample rate.

It is also possible to run the E1438C/D ADC with an external reference clock. This will 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 E1438C/D has a 144 MByte FIFO memory (288 MB and 1.2 GB available) to assemble data into blocks so the downstream DSP doesn't have to perform that task. The FIFO type design of the E1438C/D ensures that new data will not be lost while a data block is transferred out.

The FIFO also acts as signal capture memory. With the 1.2 GB FIFO option installed the E1438C/D has an eight-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 twelve minutes of data. Using the narrower filters will result in even longer signal capture times.

High-speed data transfer
The E1438C/D generates data at rates up to 200 MB/sec. The simplest way to transfer data is to use the VXI-bus. It can transfer data at 2–4 MB/sec. This can be used for continuous sampling at 500 kHz or less, or for unloading full-bandwidth data saved in the RAM FIFO. The E1438D has two additional ways to transfer data at very high rates. Its VXI local bus transfers data at up to 50 MB/sec, or 25 MSa/sec. For continuous sampling at the E1438C/D maximum sample rate of 100 MSa/sec, use the E1438D. Its optical front panel data port can transfer data continuously at 200 MB/sec.

VXI*plug&play* programming
The E1438C/D is shipped with software and documentation to support a broad set of controllers, I/O interfaces, programming languages and operating systems.

Compiled C libraries (with source code), example programs, on-line help files, and an installation program are included as standard items with the E1438C/D. An executable front panel program allows the E1438C/D to be turned on, verified, and used for simple tasks without the requirement to write user programs.

The E1438C/D is fully VXI*plug&play* compliant and is easily controlled in 32-bit Windows® based VXI*plug&play* frameworks.

If programming is done in C in a non-VXI*plug&play* environment it is recommended to use the E1438C/D C libraries. The source code is shipped with these libraries and can be modified to work with a specific I/O and processor.

Other Agilent VXI ADCs
E1430A
E1437A
E1439C/D

Agilent accessories available
The E1438C/D “sync” and “clk” connectors may be connected to other E1438C/D modules in synchronized multi-channel applications. The following cable and terminator to connect the modules are available from Agilent. (See the Agilent VXI Source Book for additional cables.)

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

Backplane connector shields
The backplane connector shields are required for RFI compliance with the EN55011 and CISPR11 standards. Order optional RFI backplane shields for your VXI mainframe. They are not required for MFRAME1.

Warranty
This product is distributed, warranted, and supported by Agilent Technologies.

The E1438C/D comes with a 3-year warranty. During that period, the unit will either be replaced or repaired, at Agilent Technologies’ option, and returned to the customer without charge.

Ordering Information

E1438C/D	100 MSa/s AD with filter and memory
E1438C/D-001	1.2 GB FIFO memory
E1438C/D-144	144 MB FIFO memory
E1438C/D-288	288 MB FIFO memory

Technical Specification Summary
(refer to Agilent E1438C/D Technical Specification 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 reference	10 MHz for 100 MSa/s, 10.24 MHz for 102.4 MSa/s (10—102.4 MHz clock range)

Trigger

Sources	Immediate, level, external, software
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	144 MB, 288 MB, or 1.2 GB

Optical serial front panel data port (E1438D only)

Standard support	Draft standard VITA 17.1, 1 Gbit/sec and 2.5 Gbit/sec
Connector	Dual LC receptacle
Optical type	Multi-mode fiber, 850 mm wavelength
Maximum length	100 meters

Related Literature

Publication Title	Publication Type	Publication Number
E1437A 20 MSample/Second ADC with Filter and FIFO	Product Overview	5965-6893E
E1437A 20 MSample/Second ADC with Filter and FIFO	Technical Specifications	5965-9774E
E1438C/D 100 MSample/Second Digitizer with DSP and Memory	Data Sheet	5968-8233E
E1439C/D VXI 70 MHz IF ADC with Filters and Memory	Product Overview	5980-1261E
E1439C/D VXI 70 MHz IF ADC with Filters and Memory	Data Sheet	5980-1260E
E9830A Delay Memory Module	Product Overview	5968-7349E
Agilent Test System and VXI	Products Catalog	5980-0307E

Product Web site

For the most up-to-date and complete application and product information, please visit our product Web site at:
www.agilent.com/find/vxi

Agilent Communications Intelligence Information:
www.agilent.com/find/AD

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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. Support is available for at least five years beyond the production life of the product. Two concepts underlie Agilent's overall support policy: "Our Promise" and "Your Advantage."

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