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Agilent U1061A

Acqiris High-Speed PXI Digitizers

DC140: 8-bit, 2 ch, up to 1 GHz, 1-2 GS/s
DC135: 8-bit, 2 ch, up to 500 MHz, 0.5-1 GS/s

Agilent Technologies





Main Features

- **Two-channel digitizer with synchronous dual-channel acquisition, independent gain and offset on each channel, and interleaved single-channel mode**
- **Choice of fully-featured mezzanine front-end design with internal calibration and input protection, offering 50 Ω or 1 MΩ input impedance, with up to 1 GHz analog bandwidth in all FS ranges**
- **Up to 2 GS/s sampling rate and 16 MSamples of acquisition memory**
- **Multipurpose I/O connectors (Ctrl I/O) for trigger, clock, reference, and control signals**
- **Compliant to both the PXI and CompactPCI standards with exceptionally low power consumption**
- **Built-in 5 ps trigger time interpolator (TTI) for accurate timing measurements**
- **Low dead-time sequential recording with up to 8,000 time stamp segments**
- **Optional firmware for frequency counter functionality**
- **Device drivers for Windows®, VxWorks, LabViewRT, and Linux, with application code examples for MATLAB®, C/C++, Visual Basic, LabVIEW, and LabWindows/CVI**

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MATLAB is a U.S. registered trademark of The Math Works, Inc.

Acqiris High-Speed Digitizers

The proprietary ADC chipsets in Agilent Technologies Acqiris high-speed digitizers are designed for the specific purpose of optimizing high-speed ADC performance. The analog front-end technology provides the signal conditioning, amplification, and interleaving functions essential to achieving high-speed data acquisition at GS/s rates. The digital data handling components provide vital clock and synchronization signals, to capture and memorize acquired data with maximum data throughput. Together, these ASICS make low-power, high-fidelity data acquisition much more accessible and provide maximum data throughput to the host PC or processor to reduce the time and cost of measurement.

The Acqiris product line provides a range of high-speed digitizer cards[1] with 8-, 10- and 12-bit resolution, wide bandwidths, and large acquisition memory. These products, in PCI, PXI, cPCI, and VME formats, are used in research and in ATE and OEM applications in industries such as biotechnology, semiconductors, aerospace, physics, and astronomy.

Single-Slot High-Speed Data Acquisition

Agilent Acqiris high-speed PXI digitizers (U1061A) use the latest SiGe (silicon-germanium) technology to provide superior data conversion performance in single-slot PXI 3U modules. They can be plugged directly into any PXI or CompactPCI crate and can be quickly integrated into any system.

The DC140 version (Option U1061A-002) is the top of the line. It offers a sampling rate of 1 GS/s on each channel, 1 GHz bandwidth, and 128 kSample/channel acquisition memory (with an optional 8 MSample). In single channel mode these values increase to 2 GS/s and 256 kSample of acquisition memory (with an optional 16 MSample) as the circuits are precisely interleaved.

As a cost effective solution, the DC135 (Option U1061A-001) uses the same SiGe technology and overall architecture as the DC140. It has dual-channel sampling rates up to 500 MS/s (1 GS/s in single-channel mode), 500 MHz bandwidth, and 64 kSample/channel of memory (with an optional 2 MSample).

The digitizers' ultra-fast sampling rates and bandwidths combine to allow the accurate capture of signals up to 1 GHz. Moreover, with long acquisition memories up to 16 MSample, it is possible to record complex signals over long periods of time.

The digitizer is designed to perform outstanding cross-channel timing measurements (I/Q, jitter, phase, propagation delay, etc.) thanks to the combination of synchronously sampling ADCs, well matched front-end electronics, and a precision time base (±2 ppm). The cards' time-base circuit clocks the ADCs of each channel at the same time. The independent SiGe front-end circuitry ensures that timing skew (between channels) is kept to ± 100 ps (typical).

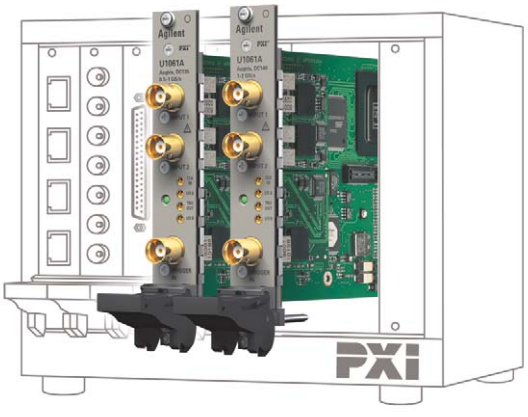
Easily Integrated

In production test environments, the time taken to integrate all the required test modules needs to be kept to a minimum. In semiconductor production testing for example, the addition of high speed functionalities in on-chip design, such as Ethernet, Wi-Fi, and Bluetooth®, have led to a growing requirement for high-speed data conversion tools. It is important that the digitizer module chosen for this task can be easily integrated into the existing component testing system, minimizing down-time.

Agilent's high-speed Acqiris digitizers are supplied with software drivers for Windows, Linux, LabVIEW RT and VxWorks, and application code examples for MATLAB, C/C++, VisualBasic, LabVIEW, and LabWindows/CVI.

These code examples provide digitizer setup and basic acquisition functionality, and are easily modified, so that the card can be quickly integrated into a measurement system.

The flexibility of the driver means that, with minimum software adjustments, any Acqiris digitizer can be swapped out, replaced, or upgraded with the latest high-speed Acqiris digitizer.



1) 500 MS/s, 1 GS/s, 2 GS/s, 4 GS/s and 8 GS/s high-speed digitizer cards

Bluetooth and the Bluetooth logos are trademarks owned by Bluetooth SIG, Inc., U.S.A. and licensed to Agilent Technologies, Inc.

Optional Firmware for Frequency Counting

With the optional frequency counter firmware (U1061A-FC1) the digitizer can be used to perform real-time frequency measurement at up to 400 MHz. For user selectable intervals in the range 1 ms to 1,000 s the module will count the number of triggers generated on the selected input signal, in the range of 1 to more than 4 billion counts. From this measurement, together with a small correction for the actual trigger time, it is possible to extract the average frequency, signal period, or the measured trigger count itself. The option can also be used to total the number of triggers up to 125 MHz, occurring during a user-defined gate interval as given by a hardware signal on a Ctrl I/O input. Frequency measurement accuracy benefits from the high internal clock accuracy of the modules (±2 ppm) with no additional requirement for any external reference. An external reference source can also be used if even higher precision is desired.

Figure 1: Digitizer mezzanine card.



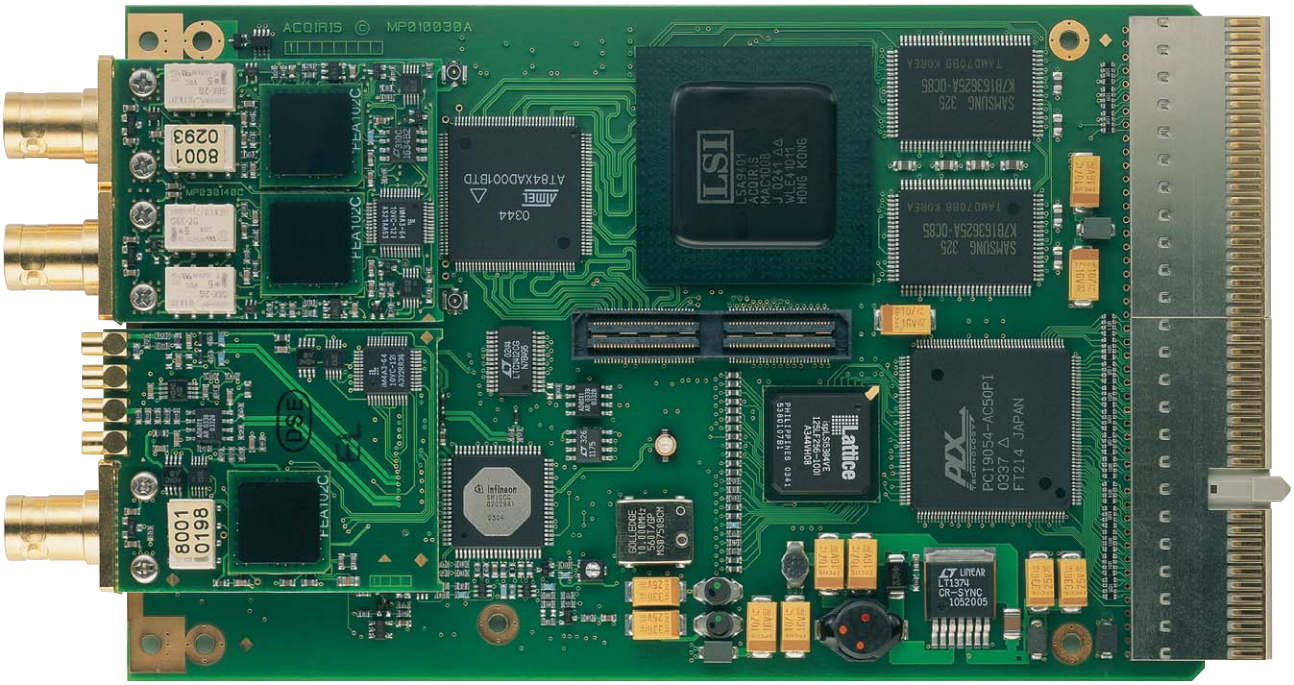


Figure 2: The U1061A digitizer uses large-scale integrated circuit technology to reduce size and power requirements. This essential technology allows the digitizer to deliver fast sampling rates and high bandwidths in a 3U PXI/CompactPCI package.

High-Performance Front-End Electronics, Trigger, and Time Base

Mezzanine front end
The channel inputs of the digitizer have programmable front-end electronics with a complete set of input voltage ranges (from 50 mV to 5 V full scale into 50 Ω, and to 50 V full scale into 1 MΩ, in a 1, 2, 5 sequence) and variable voltage offset. The front-ends are fully protected against overvoltage signals. The amplifiers feature internal calibration and very fast recovery from out-of-range signals. The input buffer and amplifier are mounted on a removable mezzanine card so that replacement is fast and efficient in the event of accidental damage or as components fatigue over time (e.g. relays in high duty cycle automated testing applications).

Multipurpose I/O Ports
Control over the trigger and time base is made even more flexible by the provision of high-frequency I/O ports. The four MMCX-type front-panel connectors enable the use of an external clock (up to 2 GHz), or reference signal (10 MHz), and provide a trigger output and two additional I/O digital control lines, for monitoring or modifying the digitizer's status and configuration.

Precision Time Base
The digitizer has its own crystal-controlled precision time base. Sample rates can be selected in a 1, 2, 2.5, 4, 5 sequence, from 100 S/s to 2 GS/s. An internal time-to-digital converter (TDC) with high timing resolution allows accurate positioning of the trigger signal with respect to the internal clock (sampling time). The sample rate can also be generated externally, using the dedicated MMCX CLK IN connector.

Flexible Trigger
The digitizer includes a precision trigger system with full pre- and post-trigger adjustment. User-selectable coupling is combined with internal or external trigger sources for maximum flexibility. The digitizers also provide a sophisticated sequential trigger mode with extremely low dead time, enabling events, which may occur at very high repetition rates, to be captured and stored. This greatly extends the digitizer's timing range and resolution. Each event can be individually time-stamped and relative time measurements, between events, made with <1 ns resolution.

Quality Acquisitions
Agilent Acqiris digitizers are designed to provide superior measurement precision and accuracy. Key acquisition specifications (such as DC accuracy, channel timing skew, integral and differential linearity) are optimized to deliver maximum measurement fidelity. Careful circuit layout, custom ICs, and special packaging techniques are all used to reduce overall system noise.

Low Parts Count
A high degree of integration is needed in order to achieve the level of performance obtained with the U1061A digitizer. By drastically reducing the number of components, the integration has clear benefits in terms of reliability and lower total power consumption. To maintain quality measurements, the digitizer uses a patented cooling scheme. This cooling method allows components to run at safe and stable operating temperatures. It helps to extend component life as well as minimize measurement errors caused by temperature variations.

Acqiris High-Speed PXI Digitizers

Model DC140

Dual-channel, 8-bit, 1-2 GS/s, 1 GHz bandwidth

Model DC135

Dual-channel, 8-bit, 0.5-1 GS/s, 500 MHz bandwidth

Signal input (-F50 option)

Channels
U1061A-001: Two at 500 MS/s
U1061A-002: Two at 1 GS/s

Bandwidth (-3 dB)
-001: DC to 500 MHz
-002: DC to 1 GHz

Full scale (FS)
50 mV, 100 mV, 200 mV, 500 mV, 1 V, 2 V, and 5 V

Offset range
±2 V for 50 mV to 500 mV FS
±5 V for 1 V to 5 V FS

Bandwidth limit filters
700 MHz (-002 ONLY), 200 MHz, 20 MHz

Maximum input voltage
±5 V DC

Impedance
50 Ω ± 1% at DC

Coupling
DC, AC

SFDR (typ. at 1 GS/s, 50 Ω)
53 dB at 10.9 MHz
-001: 52 dB at 97.7 MHz
-002: 45 dB at 400 MHz

SNR (50 Ω and 1 MΩ)
> 37 dB at 50 mV FS
> 38 dB at 100 mV, 500 mV, 1 V, and 5 V FS
> 39 dB at 200 mV and 2 V FS

DC accuracy
± 2.5% FS at 50 mV FS
± 2% FS at ≥ 100 mV FS

Effective bits (at maximum dual channel sampling rate)
50 Ω: > 6.5 at 10.7 MHz, 200 MHz BWL
1 MΩ: > 6.5 at 10.7 MHz, 200 MHz BWL
50 Ω: > 6.0 at 99.5 MHz, (with 700 MHz BWL in -002)
50 Ω: > 5.0 at 407 MHz, (with 700 MHz BWL in -002)

Connectors
BNC or SMA, gold plated

High-impedance input: 50 Ω/1 MΩ (-FHZ front-end option)

Channels
U1061A-001: Two at 500 MS/s
U1061A-002: Two at 1 GS/s

Bandwidth (-3 dB)
-001 50 Ω: DC to 500 MHz
-002 50 Ω: DC to 1000 MHz

1 MΩ: DC to >300 MHz (typ.)

Full scale (FS)
50 Ω: 50 mV to 5 V
1 MΩ: 50 mV to 50 V

Offset range
50 Ω: ± 2 V for 50 to 500 mV FS
50 Ω: ± 5 V for 1 to 5 V FS
1 MΩ: ± 2 V for 50 to 500 mV FS
1 MΩ: ± 20 V for 1 to 5 V FS
1 MΩ: ± 200 V for 10 to 50 V FS

Bandwidth limit filters
50 Ω: 700 MHz (-002 ONLY), 200 MHz, 20 MHz
1 MΩ: 20 MHz, 200 MHz at ≤ 5 V FS
1 MΩ: 20 MHz at > 5 V FS

Maximum input voltage
50 Ω: ±5 V DC
1 MΩ: ±300 V DC

Impedance
50 Ω ± 1.0 % at DC
1 MΩ ± 1.0 % at DC // 18 ± 3 pF

Coupling
DC, AC

SFDR (typ. at 1 GS/s, 50 Ω)
52 dB at 10.9 MHz
45 dB at 400 MHz

SNR (50 Ω and 1 MΩ)
> 37 dB at 50 mV FS
> 39 dB at other FS

DC accuracy
± 2.5% FS at 50 mV FS
± 2% FS at ≥ 100 mV FS

Effective bits (at maximum dual channel sampling rate)
50 Ω: > 6.7 at 10.7 MHz, 200 MHz BWL
1 MΩ: > 6.5 at 10.7 MHz, 200 MHz BWL
50 Ω: > 6.4 at 99.5 MHz, (with 700 MHz BWL in -002)
50 Ω: > 6.0 at 407 MHz, (with 700 MHz BWL in -002)

Connectors
BNC or SMA, gold plated

Digital conversion

Sample rate
-001: 100 S/s to 1 GS/s
-002: 100 S/s to 2 GS/s

Resolution
8 bits

DNL
<0.9 LSB

INL
< ± 1% FS

Acquisition memory
-001: 64 kSamples/channel
-002: 128 kSamples/channel

Optional memory
-001: 2 MSamples/channel
-002: 16 MSamples/channel

Time base

Clock accuracy
Better than ±2 ppm

Sampling jitter
< 1 ps rms for 10 ms with internal clock and reference

Acquisition modes
Single shot

Sequence: 1 to 200 segments (optional 8000)
Dead time:
-001: < 1.1 µs
-002: < 800 ns

Trigger time interpolator
5 ps resolution

Internal and external trigger

Internal trigger input
Threshold adjust range: same as vertical FSR
Sensitivity: > 15% FSR
Frequency range:
-001: DC to 500 MHz
-002: DC to 1 GHz

External trigger input
Threshold adjust range: (-FS/2, FS/2) for FS = 500 mV, 1 V, 2 V, and 5 V
Impedance: 50 Ω
Maximum input voltage: ±5 V DC
Sensitivity: > 15% FS
Frequency range: DC to 1 GHz

Coupling
DC, AC (50 Hz LF reject), 50 kHz HF reject

Modes
Edge, positive and negative
Window
HF divide by 4

Pre-trigger
Adjustable to 100% of horizontal full scale

Post-trigger
Adjustable up to 200 MSamples

Control I/O (MMCX)

Ctrl I/O A and B signals
TTL & CMOS compatible (3.3 V)

Ctrl I/O A and B output
10 MHz reference clock out with 50 Ω impedance
Acquisition active
Acquisition skipping to next segment
Trigger ready

Ctrl I/O A and B input
Trigger enable

Trigger OUT
Offset: ± 2.5 V (no load)
Amplitude ± 0.8 V (no load), ±15 mA max
Rise/fall time: 2.5 ns into 50 Ω
Coupling: DC
Output impedance: 50 Ω

CLK IN ext. clock/ref
Amplitude: > 500 mV pk-pk into 50 Ω
Threshold: variable between -2 V and +2 V
Maximum input voltage: ±2 V DC

CLK IN ext. clock input
10 MHz to 2 GHz
SR may be refined with sparsing

CLK IN ext. reference frequency
9-10.2 MHz

General

Host computer and operating system:
PC compatible (x86) systems running Microsoft Windows XP, Windows 2003 Server, Windows 2000, Wind River VxWorks, National Instruments LabVIEW RT, or Linux.
PowerPC systems running Wind River VxWorks.
For more information on which specific processors and operating system versions are supported, please contact us.

Transfer speed:
High-speed PCI bus transfers data at sustained rates to host computer:
Up to 100 Mbytes/s for 32-bit/33 MHz operation

Power consumption
With standard memory
-001: <13 W
-002: <14 W

With maximum memory option
-001: <14 W
-002: <16 W

Current requirements
U1061A-001:

12 V	0.46 A
5 V	0.46 A
3.3 V	1.1 A
-12 V	40 mA

With maximum memory option

3.3 V	1.5 A

U1061A-002:

12 V	0.46 A
5 V	0.46 A
3.3 V	1.4 A
-12 V	40 mA

With maximum memory option

3.3 V	2.2 A

Warranty
1 year

Environmental and Physical

Operating temperature
0° to 40°C

Relative humidity
5 to 95% (non-condensing)

Dimensions
3U PXI/CompactPCI® standard
100 mm x 160 mm x 20 mm

Safety
Complies with EN61010-1

EMC immunity
Complies with EN61326-1
Industrial Environment

EMC emissions
Complies with EN61326-1 Class A for radiated emissions

Required airflow
> 2 m/s in situ



Contacts

Acqiris Product Information

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Ordering Information

Model	Description
U1061A	Acqiris DC140 and DC135 high-speed 8-bit PXI digitizers
U1061A-001	Dual-channel, 500 MHz, 0.5-1 GS/s, 64-128 kSample, DC135
U1061A-002	Dual-channel, 1 GHz, 1-2 GS/s, 128-256 kSample, DC140
U1061A-M16	16 MSample acquisition memory for U1061A-002
U1061A-M4M	4 MSample acquisition memory for U1061A-001
U1061A-FC1	Frequency counter firmware U1061A-F50 50 Ω, 1 GHz front-end
U1061A-FHZ	50 Ω/1 MΩ, 1 GHz/300 MHz front-end
U1061A- F50	50 Ω, 1 GHz front-end
U1061A-CPC	Compact PCI slot-compatible connector
U1061A-PXH	PXI hybrid slot-compatible connectors
U1061A-PXI	PXI Standard connectors
Accessories	
U1061A-UK6	Calibration Certificate and Cal Data

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For more information on Acqiris product line, sales or services, see our website at:
www.agilent.com/find/pxi-digitizers
www.agilent.com/find/u1061a

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