

Agilent U1066A

Acqiris High-Speed cPCI Digitizers

DC440: 12-bit, 2 ch, 100 MHz/300 MHz, 420 MS/s

DC438: 12-bit, 2 ch, 100 MHz, 200 MS/s



Agilent Technologies



HRes SR



HF In



AS bus



Ctrl I/O



Main Features

- High-resolution, high-speed, dual-channel digitizer with exceptional performance
- Up to 420 MS/s sample rate, simultaneous on two channels
- Fine-tunable sample rate (SR) with a resolution better than 0.25% of the SR (U1066A-001 only)
- 50 Ω , 100 MHz mezzanine front end with large full-scale dynamic range and input protection, with optional 300 MHz AC-coupled HF input (U1066A-001 only)
- Large 4 MSample to 8 MSample (optional) acquisition memory
- Multi-module synchronization with auto-synchronous bus system for distribution of trigger and clock signal
- High-speed PCI bus transfers data to host PC at sustained rates up to 100 MB/s

Acqiris High-Speed Digitizers

The proprietary ADC chipsets in the 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 rates at GS/s. 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 200 MS/s, 500 MS/s, 1 GS/s, 2 GS/s, 4 GS/s and 8 GS/s high-speed digitizer cards with 8-, 10- and 12-bit resolution, wide bandwidth and large acquisition memory. These products, in PCI, PXI, cPCI, and VME formats, are used in research, ATE, and OEM applications in industries as wide spread as biotechnology, semiconductors, aerospace, physics, and astronomy.

Unique Tools for Complex Frequency Analysis

Agilent Acqiris high-speed cPCI digitizers (U1066A) set new standards in high-resolution data acquisition. Using the latest SiGe (silicon-germanium) technology, the digitizer features two input channels with fast sample rates up to 420 MS/s and bandwidths up to 300 MHz. The digitizer features long 4 MSample acquisition memory, with an optional extension to 8 MSamples. Waveforms are transferred directly into the digitizers' large acquisition memory so that complex signals can be stored over long time periods. Large memory is essential for maintaining fast sampling rates and timing resolution.

The 12-bit digitizers have their own crystal-controlled precision time base (better than ± 2 ppm). Sampling rates for the DC438 configuration can be chosen among a discrete number of values. These values cover the full range between 100 S/s and 200 MS/s. Sampling rates for the DC440 configuration, however, can be precisely tuned with a resolution better than 0.25% (500 kS/s in the 200-420 MS/s range) of the sampling frequency, up to 420 MS/s. This unusual time base flexibility is ideal for wideband frequency-related measurements. It allows for easy demodulation processing of I/Q modulated carriers, like the ones used in QAM or RF/IF digital receivers. The high resolution sample rate (HRes SR) applications range from IF sampling and wireless communication (and derivative applications) to radar identification. The HRes SR can also be exploited to deliver a fine-grained adjustable distance/sample-period ratio in ranging applications.

The sample rate selection and bandwidth combine to allow high-resolution capture of signals with a superior spurious-free dynamic range (typ. 80 dB into the HF input and 75 dB otherwise) and a high signal-to-noise ratio (typ. 65 dB into the HF input, 62 dB otherwise).

Additional outstanding specifications include typ. total harmonic distortion (THD) of -78 dB and effective bits (ENOB) of more than 10. Such specifications make the digitizer a perfect match for test and measurement for multi-channel based applications in automotive, ultrasound, medical imaging, lidar, NDT, and high-accuracy analytical instruments. The HF input is ideal for wireless communication equipment testing, general QAM or RF/IF digital receivers and radar wideband communication and analysis (SIGINT) applications.

High-Resolution Multi-Channel DAQ System under PC Control

Up to 14 channels in one crate

The U1066A digitizers are dual-channel, CompactPCI (6U) modules that are ideal for use in high-resolution multi-channel applications. For example, a single 8-slot 6U cPCI/PXI crate can house up to 7 modules (plus an interface) to make a 14-channel bench-top data acquisition system (U1056A). The low power consumption of about 25 W/digitizer, results in a 14-channel system that uses less power than most comparable multi-channel systems.

The digitizers include a proprietary high-bandwidth AS bus, an auto-synchronous bus system. In multi-channel applications, AS bus is a vital tool designed to deliver all necessary trigger and clock signals. The system improves trigger flexibility by allowing any module input to be used as the trigger source for all the digitizers. AS bus allows all the digitizers to be synchronously clocked. Synchronous digitizing improves the accuracy of cross-channel measurements and is essential for accurate time correlation. The AS bus can also be used to phase synchronize all the digitizers to an external standard such as a 10 MHz reference.

PC control and convenience

Acqiris software allows adjustment of the key acquisition settings such as time-base, trigger, and sensitivity while state-of-the-art front-end electronics allow high fidelity recording with full control over features such as input coupling, gain, and offset. Data recorded by the digitizers can be transferred directly to a host computer at rates up to 100 Mbytes/s. Combining the fast transfer rates with today's most powerful computer processors makes it possible to perform measurements and calculations significantly faster than with conventional instruments.

You can also store hundreds of waveforms directly on the computer's hard drive. Archiving important waveforms has never been easier. Furthermore, you can interface directly to your desktop PC and use the Internet or a local network to send important information to others anywhere and at anytime. The result is flexibility and performance that can dramatically reduce testing times, increase measurement throughput, and lower overall cost.

Advanced Features for Broadband Signal Capturing

Mezzanine front end

For each channel both the standard and HF inputs (-001 option only) are located on a separate mezzanine hosting the front-end electronics. The standard signal input has programmable front-end electronics that provide a voltage range from 250 mV to 10 V (full scale in a 1, 2, 5 sequence) and variable voltage offsets. The HF input bypasses the input stage and gives direct access to the ADCs. Both the standard and HF inputs have 50 Ω impedance and are protected against over-voltage signals by clamp diodes.

The front-end circuitry features switchable filtering and internal calibration. Many applications can save time by only performing calibration for the configurations that will actually be used. Calibration can usually be performed with signals present at the channel, external, and clock inputs. However, if the calibration is found to be unreliable, as shown by a calibration failure status, it may be necessary to remove such signals. The input buffer amplifier and ADCs are mounted on a removable mezzanine card guaranteeing fast replacement, in the event of accidental damage or component fatigue.

Flexible trigger

The U1066A digitizers include 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 less than 1 μ s dead-time between successive triggers. This low dead-time enables capture and storage of events, that may occur at very high repetition rates, in their correct arrival sequence.

This trigger mode is perfect for "impulse-response" type applications such as radar, lidar, ultrasound, medical and biomedical research. The sequential trigger mode and very low dead-time greatly extend the digitizer timing range and resolution. Each event can be individually time-stamped and relative time measurements (between events) can be made with better than 100 ps accuracy.

Furthermore, a TV trigger capability has been added. This opens the way to wideband video signal applications such as the ones based on fast CCD cameras (charged couple device) for imaging readout. The TV trigger mode is for positive video modulation and allows line and frame selection (odd & even) for common video formats (B/G - 625 lines/50 frames, PAL; L-625 lines/50 frames, SECAM; and M 525 lines/60 frames, NTSC).

Front-panel multi I/O ports

The control over the trigger and time base is made even more flexible by the addition of high-density, high-frequency, front-panel connectors. The four MMCX-type front-panel

connectors enable the use of an external clock (up to 400 MHz) or reference signal (10 MHz), a trigger output and two additional I/O digital control lines.

The latter can be used to monitor or modify the digitizer's status and configuration. An example of the control available is trigger gating. Also, the I/O can be used as a 10 MHz built-in source for autonomous board test purposes.

High Reliability

Low parts count

A very high degree of integration is needed in order to achieve the level of performance obtained with the digitizer. By drastically reducing the number of components, the integration delivers reliability and lowers total power consumption. To maintain quality measurements the digitizer also uses a proprietary 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 variation.

High-Fidelity Frequency-Related Measurements

Quality acquisitions

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

Easy software integration

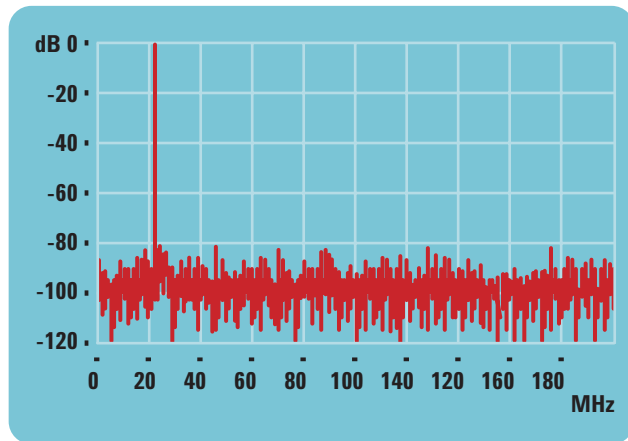
Agilent Technologies' high-speed Acqiris digitizers are supplied with software drivers for Windows[®], Linux, LabVIEW RT and VxWorks, and application code examples for MATLAB[®], C/C++, Visual Basic, LabVIEW, and LabWindows/CVI.

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

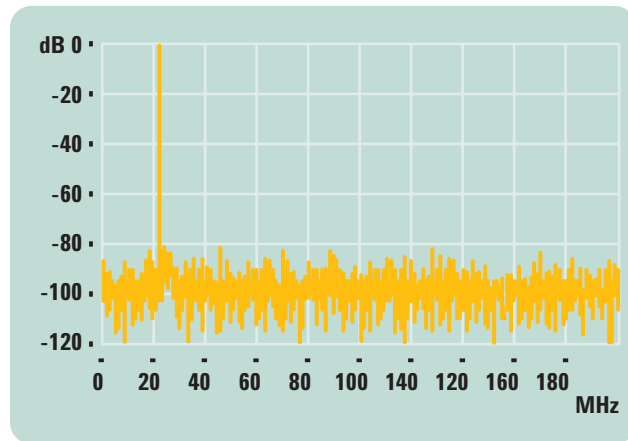
The flexibility of the driver means that, with minimum software adjustments, any Acqiris digitizer can be swapped out, replaced, and upgraded over time, with the latest high-speed Acqiris digitizer.

Windows is a U.S. registered trademark of Microsoft Corporation.
MATLAB is a U.S. registered trademark of The MathWorks, Inc.

FFT analysis: standard input

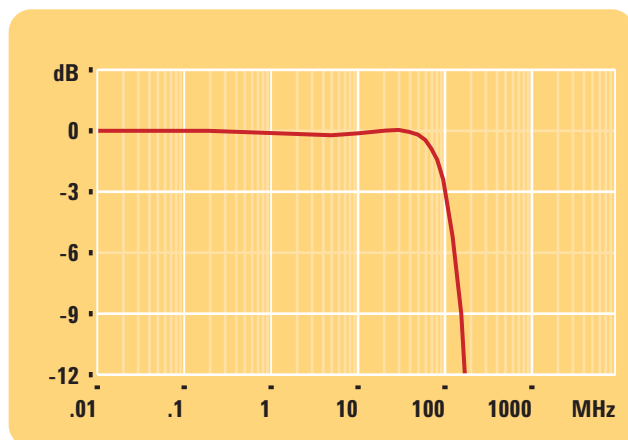


FFT analysis: HF input



Figures 1 and 2: FFT analysis of a pure 25 MHz sinewave at 400 MS/s shows amazingly low noise floor, extremely high SFDR and little harmonic distortion for both the standard and high-frequency inputs (U1066A-001 only).

Frequency response: standard input



Frequency response: HF input

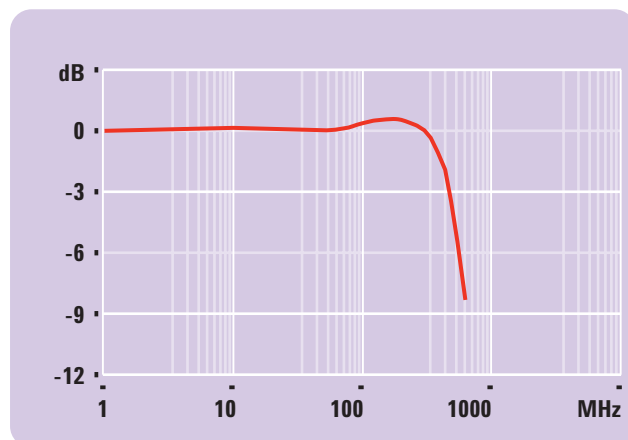
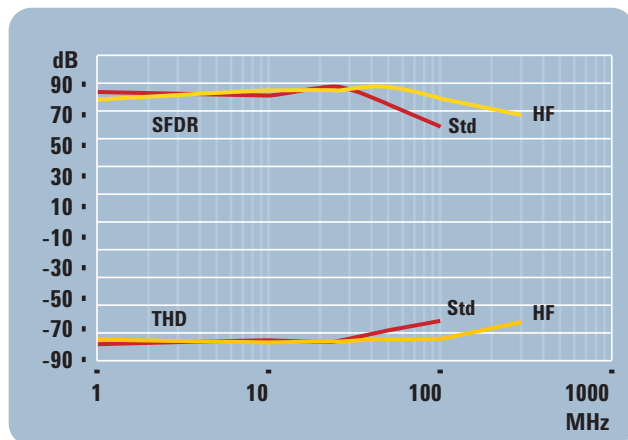


Figure 3: Frequency response for standard input is flat and system bandwidth for 1 V FS exceeds the specified 100 MHz.

Figure 4: Frequency response of HF input shows system bandwidth above the specified 300 MHz (U1066A-001 only).

SFDR & THD: standard input, HF input



Effective bits: standard input, HF input

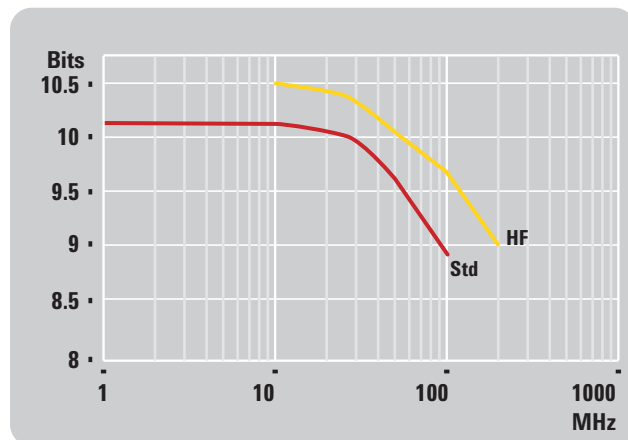


Figure 5: SFDR & THD values at 170 MS/s SR and 80% of 1 V FS are remarkably high for both the standard and HF inputs (U1066A-001 only).

Figure 6: Effective bits at 170 MS/s SR and 80% of 1 V FS are well above 10 for both the standard and HF inputs (U1066A-001 only).

Acqiris High-Speed cPCI Digitizers

Model DC440

Dual-channel, 12-bit, 420 MS/s, 4 MSample or 8 MSample memory

Model DC438

Dual-channel, 12-bit, 200 MS/s, 4 MSample or 8 MSample memory

Signal input – 50 Ω BNC

Channels

U1066A-001: Dual at 420 MS/s
U1066A-002: Dual at 200 MS/s

Bandwidth (-3 dB)

DC to 100 MHz

Bandwidth limit filter

35 MHz 2-pole Bessel filter

Full scale (FS)

250 mV, 500 mV, 1 V, 2 V, 5 V, 10 V

Offset range

± 1 V for 250, 500 mV, 1 V FS
± 2 V for 2 V FS
± 5 V for 5 V FS
± 10 V for 10 V FS

Maximum input voltage

± 10 V DC (2 W) or 10 V RMS at 50 Ω
(Diode clamping at ± 11 V DC)

Coupling

DC into 50 Ω

Impedance

50 Ω ± 1% at DC

Connectors

BNC, gold plated

Signal input – 50 Ω SMA

(-001 only)

Channels

Dual at 420 MS/s

Bandwidth (-3 dB)

1 to 300 MHz

Full scale (FS)

+8.9 dBm (1.75 V FS) typical

Maximum input voltage

± 15 V DC + 2 V RMS (AC component)
at 50 Ω
(Diode clamping at 6 V AC pk-pk)

Coupling

AC

Impedance

50 Ω ± 5%, AC coupled

Connectors

SMA, gold plated

Digital conversion

Sample rate

-001: 100 S/s to 420 MS/s
-002: 100 S/s to 200 MS/s

Sample rate adjustment granularity

-001: < 0.25% of SR; 500 kS/s in
200-420 MS/s range
-002: < 10% of SR

Resolution

-001: 12 bits at SR > 200 MS/s,
13 bits at SR ≤ 200 MS/s
-002: 12 bits at SR > 110 MS/s,
13 bits at SR ≤ 110 MS/s

DNL

In the range [-0.9, 0.5] LSB

Acquisition memory

4 MSamples/channel

Maximum optional memory

8 MSamples/channel

Time base

Clock accuracy

Better than ± 2 ppm

Sampling jitter

< 1 ps rms for 1 ms with internal clock
and reference

Acquisition modes

Single shot
Sequence: 1 to 8000 segments
Dead time: < 1 μs at 200 MS/s and
400 MS/s

Residual phase modulation

0.3° RMS (typ.) at 400 MS/s (-001)
0.2° RMS (typ.) at 200 MS/s
From 10 Hz to 10 MHz

Trigger time interpolator

5 ps resolution

AS bus

Synchronized clock and trigger distribution for up to 7 adjacent modules of the same type in a crate

AS bus sampling skew

± 100 ps

Internal and external trigger

Internal trigger input

(Standard input only)

Threshold adjust range: ± 0.6 FS about
mid-point voltage
Sensitivity:
Frequency range: DC to 100 MHz
Amplitude range: > 15% FS

External trigger input (BNC)

Threshold adjust range: ± 3 V
Impedance: 50 Ω/1 MΩ
Maximum input voltage: ±5 V DC

Sensitivity:

Frequency range: DC to 300 MHz

Amplitude range: > 15% FS

TV trigger

Trigger for positive modulation

Line and frame selection: (odd and even)

Standards:

- B/G (625 lines/50 frames, PAL)

- L (625 lines/50 frames, SECAM)

- M (525 lines/60 frames, NTSC)

Coupling

DC, AC (50 kHz LF Reject)

Modes

Edge, positive and negative

Pre-trigger

Adjustable to 100% of horizontal full scale

Post-trigger

Adjustable up to 100 MSamples

Control I/O (MMCX)

Ctrl I/O A and B signals

TTL and 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

TRG 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: > 1 V pk-pk into 50 Ω

Threshold: variable between -2 V and +2 V

Maximum input voltage: ± 5 DC into

50 Ω

CLK IN ext. clock input

-001: 10 MHz to 400 MHz

-002: 50 MHz to 200 MHz

SR may be refined with sparsing

CLK IN ext. reference frequency

10 MHz $\pm 10\%$

System performance

DC accuracy

$\pm 0.5\%$ of FS at ≥ 1 V FS

$\pm 1.0\%$ of FS at < 1 V FS

Effective bits (200 MS/s, 400 MS/s)

> 9.0 at DC-25 MHz (typ. 10 for HF input)

INL

$< \pm 0.04\%$ FS at 25 $^{\circ}\text{C}$

SFDR typ. (< 25 MHz signal)

Standard input: > 78 dB at FS ≥ 1 V

Standard input: > 73 dB at FS < 1 V

HF input: > 80 dB

RMS noise (200 MS/s / 400 MS/s)

Standard input: > 57 dB (typ. 60 dB) at 250 mV, 500 mV FS

Standard input: > 61 dB (typ. 63 dB) at 1 V, 2 V, 5 V, 10 V FS

HF input: > 64 dB

THD typ. (< 25 MHz signal, 200 MS/s / 400 MS/s)

Standard input: < -77 dB at 1 V FS

HF input: < -78 dB

General

Host computer and operating system:

PC compatible (x86) systems running Microsoft Windows Vista, 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

< 25 W with 4MSamples memory

Current requirements (max., 4MSamples)

+12 V < 0.6 A

+5 V < 1.5 A

+3.3 V < 2.2 A

-12V < 0.2 A

Battery backup (optional)

2 days retention without external power with 4 MSample memory

Warranty

1 year

Front Panel LED indicates digitizer status

Green: ready for trigger

Yellow: module identification

Red: trigger

Environmental and physical

Operating temperature

0 $^{\circ}$ to 40 $^{\circ}\text{C}$

Relative humidity¹

5 to 95% (non-condensing)

Dimensions

6U CompactPCI standard

233 mm x 160 mm x 20 mm

Shock¹

30 G, half-sine pulse

Vibration¹

5-500 Hz, random

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

Front panel complies with IEEE1101.10

CE Certification and Compliance

1) As defined by MIL-T-28800E Class3



Contacts

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	German - Option 1
	French - Option 2
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Ordering Information

Model	Description
U1066A-001	Dual channel, 12-bit, 100/300 MHz, 420 MS/s, 4 MSample CompactPCI digitizer
U1066A-002	Dual channel, 12-bit 100 MHz, 200 MS/s, 4 MSample CompactPCI digitizer
U1066A-M8M	8 MSample acquisition memory option
U1066A-UK6	Calibration certificate
U1066A-BB1	Battery back-up

Accessories

U1092A-CB1	MMCX to BNC cable (1 m)
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For more information on Acqiris product line, sales or services, see our website at:

www.agilent.com/find/acqiris

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