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Agilent U1071A

Acqiris DP1400 High-Speed PCI Digitizer

Targeting Embedded OEM Applications

U1071A-001: 8-bit, 2 ch, 1 GHz, 2 GS/s

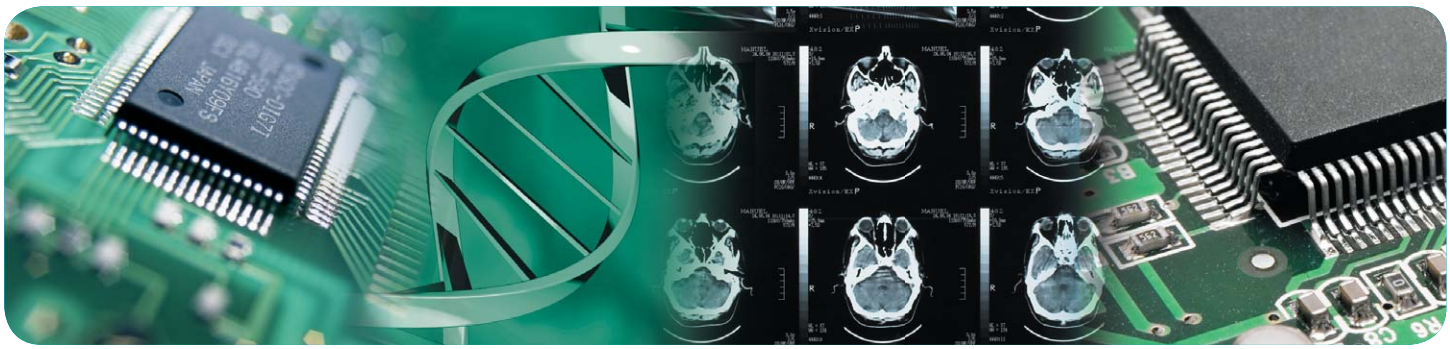
U1071A-002: 8-bit, 2 ch, 500 MHz, 2 GS/s

U1071A-004: 8-bit, 2 ch, 150 MHz, 1 GS/s

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Agilent Technologies

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Ctrl I/O



AS bus 2



SAR Mode



Main Features

- **Configurable 8-bit digitizer**
- **Up to 2 GS/s real-time sampling rate**
- **Optional 50 Ω input with up to 1 GHz bandwidth guaranteed over 50 mV to 5 V full scale ranges**
- **Optional 1 MΩ input with up to 300 MHz bandwidth over 50 mV to 50 V full scale ranges**
- **Configurable acquisition memory, offering 256 kS, 16 MS, 64 MS, 128 MS, or 256 MS**
- **Optional simultaneous multibuffer acquisition and readout mode for increased measurement throughput**
- **Support for multi-module synchronization, with auto-synchronous bus system for trigger and clock signal distribution**
- **Power requirements < 16 W, < 20 W with full optional memory**
- **Device drivers for Windows®, VxWorks, LabViewRT, and Linux, with application code examples for MATLAB®, C/C++, Visual Basic, LabVIEW, and LabWindows/CVI**

Exceptional Performance Embedded in Your System

The Agilent Acqiris U1071A high-speed PCI digitizer is designed to provide optimized data conversion performance and maximum data throughput that is easily integrated into complex OEM systems. Though a highly configurable digitizer, it uses proprietary Agilent ASIC technology to offer a very high level of integration, and features exceptional low power consumption in a compact package.

The digitizer's front-end includes both signal conditioning ASICs and high-speed analog to digital converter (ADC) components. As with other Acqiris products, the entire front end is mounted on a removable mezzanine card so, in the event of accidental damage, replacement is fast and efficient.

The digitizer is designed to obtain maximum data throughput from this mezzanine ADC to the host PC. The card features a PCI 32-bit/66 MHz interface that allows PCI bus data transfers to the host PC at sustained rates of up to 220 MB/s.

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The card offers on-board storage memory of 256 ksamples, and optional 16, 64, 128, or 256 Msample memory extensions. This acquisition memory can be segmented for burst mode acquisitions (sequence mode). In this configuration, each triggered event is stored in its own memory segment until the entire memory is filled. All triggers are time-stamped with a 13 ps resolution counter, stored along with each waveform. At readout, all recorded segments can be retrieved at once with a single efficient DMA transfer.

The card also features an optional simultaneous multi-buffer acquisition and readout (SAR) mode. This allows an acquired buffer of data, stored in the 256-ksample standard memory, to be read out through the PCI bus while another buffer is filled with new data, drastically increasing data throughput and increasing the maximum trigger rate for lossless acquisition.

Superior Measurement

The Acqiris high-speed digitizer features front-end mezzanines that can be configured to your requirements. The AC- and DC-coupled digitizing channels of the 50 Ω mezzanine include programmable front-end electronics that provide a complete set of input voltage ranges from 50 mV to 5 V full scale, the selectable 50 Ω/1 MΩ from 50 mV to 50 V, in a 1, 2, 5 sequence, with variable voltage offset.

Amplifier response (flatness, overshoot, and accuracy) are optimized to ensure that high-frequency measurements can be made with the greatest precision and confidence, with a -3 dB bandwidth of, 1 GHz, 500 MHz, or 150 MHz (200 MHz typical). The proprietary front end amplifier ASIC features internal calibration, switchable filtering, at 700 MHz, 200 MHz, and 20 MHz, and very fast recovery from out-of-range signals.

The on-board clock ASIC provides timebase stability of ± 2 ppm (parts per million) essential for any frequency based measurements. The low clock jitter (typically < 2 ps RMS for 10 µs record length) helps maintain the high effective number of bits over the full frequency range.

The mechanical design of the card features a common heat sink/shielding that helps reduce the operating temperature of the card and with careful grounding, also helps shield the components against any stray electromagnetic interference from the PC environment.

Maximum Measurement Throughput

The optional simultaneous multibuffer acquisition and readout mode of the digitizer includes a high-speed 32-bit/66 MHz PCI interface, providing up to 220 MB/s of data throughput.

The optional simultaneous multibuffer acquisition and readout mode of the digitizer allows users to acquire smaller blocks of data and pass these to the host PC, while acquisition continues. This option is only available with the standard 256 ksample acquisition memory. In many applications data can be split into multiple pieces and, up to certain data rates, the digitizer can stream these pieces continually, providing a virtual infinite memory bank.

This data handling and readout mode will not allow acquired data to be overwritten with new data until the bank has been released. If the PC cannot keep up with the data flow, the acquisition will automatically be suspended and resumed on a space available basis.

At 2 GS/s, a 5 µs event can be acquired into a 10-ksample segment. If the repetition rate of this event is 15 kHz, the Acqiris DP1400 high-speed digitizer can acquire continuously, missing zero events. Total data rate is 150 MB/s, well within the theoretical 250 MB/s of the 32-bit/66-MHz PCI bus.

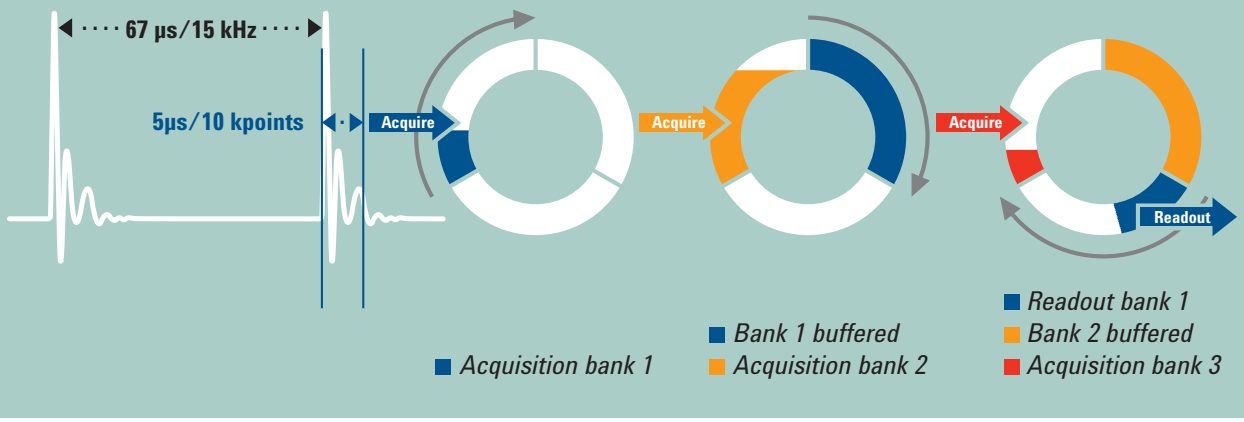


Figure 1. Simultaneous multibuffer acquisition and readout mode example

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Extended Functionality

Reference clock and synchronization

The clock distribution circuit includes trigger functions to facilitate high performance triggering on specific signal waveforms. Its low jitter (< 2 ps typ.) and high stability performance (accurate to ± 2 ppm) are essential to the high performance data conversion provided by the Acqiris high-speed digitizer.

GHz bandwidth front end

The front-end mezzanine includes two front-end amplifier ASICs. This circuit includes a programmable gain amplifier (PGA) with on-chip filtering and trigger circuitry. It provides pre-ADC signal conditioning and amplification, necessary for high performance high-speed data conversion systems.

The channel inputs of the digitizers have programmable front-end electronics with a complete set of input voltage ranges (from 50 mV to 50 V full scale in a 1, 2, 5 sequence) and variable voltage offset. The filter section, which is useful for signal noise reduction, allows 2-pole Bessel bandwidth limiting of the full bandwidth to 700 MHz or 200 MHz and a single-pole filtering at 20 MHz.

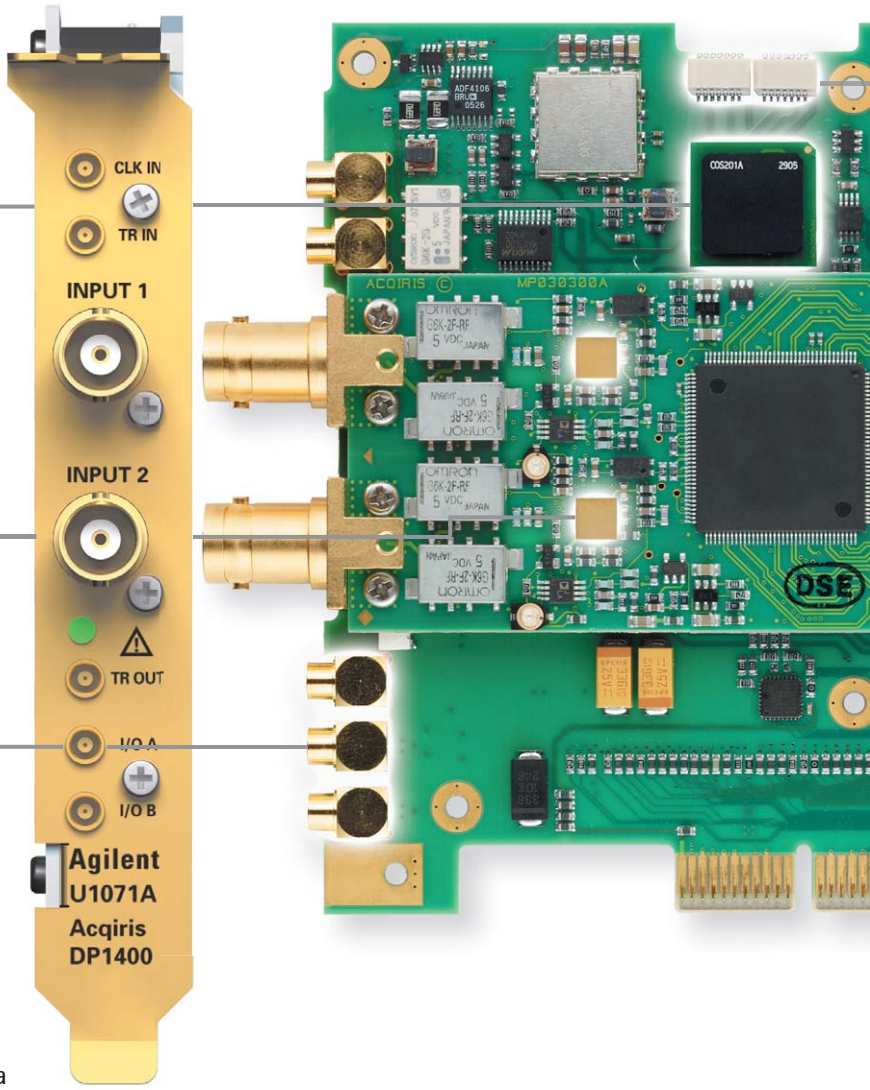
Additional ports



Ctrl I/O

The trigger source for an acquisition can be a signal applied to either of the input channels and/or to the external trigger input, accessible through a front-panel MCX connector.

Five front-panel 50 Ω or 1 MΩ terminated MCX connectors make up the control I/O ports (Ctrl I/O) for the for the digitizer. These connectors provide access for the external trigger input and output, an external clock, or 10 MHz reference signal. Two additional I/O digital control lines (I/O A & B) can be used for monitoring or modifying the digitizer's status and configuration, or to extract the 10 MHz clock signal.



Small size and low power

Due to the extensive use of ASIC's and the high level of integration, the Agilent Acqiris high-speed digitizer provides exceptional performance, with a minimal footprint.

Integrated into the standard short PCI card format, the card can be used in almost all PCI bus slots. The low component count means that the power consumption, even when running at 2 GS/s sampling rate, is as low as 15 W. This lower power consumption reduces both the generation of heat and thermal stress on the card, and improves its performance.

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Figure 2. High-speed U1071A dual channel PCI digitizer



EDN Hot 100 Products of 2007

Auto-synchronous bus system



AS bus 2

If more than two synchronous data acquisition channels are required, several Acqiris digitizers of the same configuration can be combined using the 2nd generation of an auto-synchronous bus system (AS bus 2).

The AS bus 2 distributes both the clock and trigger signals between all the digitizers that participate in the system. It allows any digitizer to generate the trigger while the central digitizer acts as the common synchronous clock source.

Fast digital data handling



SAR Mode

The memory and acquisition controller of the Acqiris digitizer is a digital CMOS integrated circuit.

A high-speed data demultiplexer with on-board memory, it is designed for the capture and memorization of digital data (up to 10-bit), at speeds of up to 2 GS/s. It has large internal static RAMs, high clock frequencies, and is able to accept and generate LVDS (low-voltage differential signal, 100 mV - 600 mV range) levels for fast input/output signals.

The circuit allows storage of the input data stream to a self-addressed, 256 ksamples, internal memory, and provides high throughput operation with the optional SAR mode. It also provides data handling for the 16, 64, 128, and 256 Msample optional memory extensions.

Custom configurations

The U1071A is designed to offer the flexibility you need for your embedded application. Contact us for more custom performance capabilities.

Easy integration

Agilent Acqiris high-speed digitizer is supplied with software drivers for Windows®, Linux, LabViewRT, and VxWorks, and application code examples for MATLAB®, C/C++, VisualBasic, LabView, and LabWindows.

These code examples provide card 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.

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Acqiris DP1400 High-Speed PCI Digitizers

U1071A-001, dual-channel, 8-bit, 1 GHz, 1 to 2 GS/s
U1071A-002, dual-channel, 8-bit, 500 MHz, 1 to 2 GS/s
U1071A-004, dual-channel, 8-bit, 150 MHz, 0.5 to 1 GS/s

Signal input: 50 Ω

(-F50 front-end option)

Bandwidth (-3 dB)
-001: DC to 1 GHz
-002: DC to 500 MHz
-004: DC to 150 MHz (guaranteed)
DC to 200 MHz (typ.)

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

VSWR (typ.)
< 1.15 DC to 500 MHz
< 1.5 500 MHz to 1 GHz

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

Bandwidth limit filters
700 MHz 2-pole Bessel filter
(U1071A-001 only)
200 MHz 2-pole Bessel filter
(-001 and -002 only)
20 MHz single-pole filter

Maximum input voltage
± 5 V DC

Connectors
BNC or SMA, gold-plated

Impedance
50 Ω ± 1% at DC

Coupling
DC, AC (32 Hz LF limit, 50 Ω)

Signal input: 50 Ω/1 MΩ

(-HZ front-end option)

Bandwidth (-3 dB)
50 Ω: -001: DC to 1 GHz
-002: DC to 500 MHz
-004: DC to 150 MHz (guaranteed)
DC to 200 MHz (typ.)
1 MΩ: -001: DC to 300 MHz (typ.)
-002: DC to 300 MHz (typ.)
-004: DC to 200 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 mV to 500 mV
± 5 V for 1 V to 5 V
1 MΩ: ± 2 V for 50 to 500 mV FS
± 20 V for 1 to 5 V FS
± 200 V for 10 to 50 V FS

Bandwidth limit filters
700 MHz 2-pole Bessel filter
(-001 only)
200 MHz 2-pole Bessel filter
(-001 and -002 only)
20 MHz single-pole filter

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

Connectors
BNC or SMA, gold-plated

Impedance
50 Ω: ± 1.0 % at DC for 1 V to 5V
± 2.5 V DC for 50 mV to 500 mV
1 MΩ: ± 1.0 % at DC // 18 pF (typ.)

Coupling
DC, AC (8 Hz LF limit, 50 Ω)

Digital conversion

Sample rate
-001, -002: 10 MS/s to 2 GS/s in
1, 2, 5 sequence
-004: 10 MS/s to 1 GS/s in 1, 2, 5
sequence

Resolution
8 bits (1:256)

Acquisition memory
256 kS
128 kS/channel

Optional memory
M16 : 16 MS or 8 MS/channel
M64 : 64 MS or 32 MS/channel
128 : 128 MS or 64 MS/channel
256 : 256 MS or 128 MS/channel

Clock or reference input

Input amplitude
> 500 mV pk-pk into 50 Ω

Connector
MCX, gold-plated

Maximum input voltage
±1 V AC

Ext. reference frequency
10 MHz ± 0.3 %

Ext. clock frequency
-001, -002: From 200 MHz to 2 GHz
-004: From 200 MHz to 1 GHz

A high-speed auto-synchronous bus (AS bus 2) distributes clock and trigger to synchronize up to 3 modules.

Time base

Clock accuracy
Better than ±2 ppm

Sampling jitter
< 2 ps RMS (typ.)
(for 10 µs record length)

Acquisition modes
Single shot and Sequence with the following characteristics

Standard 256 kS memory:
1 to 1000 segments, dead time < 350 ns at full sample rate

With memory option:
-001, -002: dead time < 1.8 µs at 2 GS/s
-004: dead time < 2.8 µs at 1 GS/s

-256: 1 to 64,000 segments
-128: 1 to 32,000 segments
-M64: 1 to 16,000 segments
-M16: 1 to 4,000 segments

Trigger (channel and external)

Channel trigger input
Threshold adjust range: FS of channel
Sensitivity: DC to 1 GHz > 15% FS

Pretrigger
Adjustable to 100% of horizontal full scale

External trigger input
MCX, gold-plated
Impedance: 50 Ω and 1 MΩ ±1%

Modes
Edge (positive and negative)
Window[1], HF divide by 4[1],
spike stretcher[1], dual-source pattern[2]
(OR, AND, NOR, NAND)

Coupling
DC, AC[1], HFReject[1]

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Control I/O (A & B)

Connectors
MCX, gold-plated

Signals
CMOS compatible (3.3 V)

Input
Trigger enable

Output
10 MHz reference clock
Acquisition skipping to next segment
Acquisition active
Trigger ready

Trigger output

Output level
Adjustable in range ±2.5 V (no load)
Amplitude ±0.8 V (no load) ±15 mA max

Connector
MCX, gold-plated

Rise/fall time
2.5 ns

Coupling
DC

Output impedance
50 Ω

System performance

DC accuracy
± (2 % × FS + 0.4% × offset)

Integral linearity
< ±1 % FS

SNR (typ.)
> 40 dB full bandwidth
> 44 dB with BWL at 200 MHz
> 45 dB with BWL at 20 MHz

SFDR (typ.)
> 55 dB at 10 MHz
> 45 dB at 400 MHz

Transfer speed
High-speed PCI bus transfers data at sustained rates up to 220 Mbytes/sec to host PC

Effective bits (typ.)
DC to 10 MHz, with BWL 200 MHz, 1 GS/s: 7.1
10 – 100 MHz, with BWL 700 MHz, 1 GS/s: 6.8
100 MHz – 400 MHz, full 1 GHz BW (U1071A-001), 2 GS/s: 6.5

PC system requirements

PC compatible (x86) systems running Microsoft Windows 7, Windows Vista, Windows XP, 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.

General

Power consumption
Without memory option
< 16 W
With memory option
< 20 W

Current requirements (typ.)[3]

+12 V	90 mA
+5 V	1.4 A
+3.3 V	1.9 A
-12 V	40 mA

Warranty
1 year

Front-panel LEDs indicate digitizer status
green: ready for trigger
yellow: module identification
red: trigger

Environmental and physical

Operating temperature
0° to 50° C

Relative humidity
5 to 95% (non-condensing)

Safety
Complies with EN61010-1

EMC immunity
Complies with EN61326-1
Industrial Environment

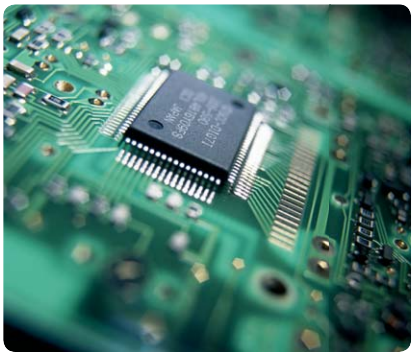
EMC emissions
Complies with EN61326-1 Class A for radiated emissions

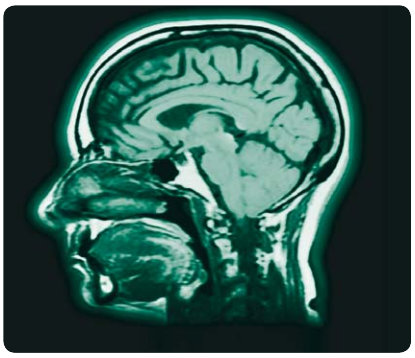
Dimensions
PCI standard
170 mm x 107 mm x 16 mm

Front panel complies with IEEE1101.10

CE Certification and Compliance

1) Channel trigger only.
2) Between either one of the input channels and the external trigger.
3) Sampling at 2 GS/s.







Contact Agilent for custom performance requirements for embedded OEM applications.

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Contacts

Agilent Acqiris Product Information

USA	**(800) 829-4444**
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Canada	(877) 894 4414
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Ordering Information

Model	Description
U1071A	Acqiris OEM DP1400 high-speed PCI digitizer
U1071A-001	Dual channel, 1 GHz, 1 to 2 GS/s
U1071A-002	Dual channel, 500 MHz, 1 to 2 GS/s
U1071A-004	Dual channel, 150 MHz, 0.5 to 1 GS/s
U1071A-BNC	BNC connectors
U1071A-SMA	SMA connectors
U1071A-F50	Dual channel 50 Ω front end
U1071A-FHZ	Dual channel 50 Ω / 1 MΩ front end
U1071A-STD	256 kSample standard memory
U1071A-M16	16 MSample acquisition memory
U1071A-M64	64 MSample acquisition memory
U1071A-128	128 MSample acquisition memory
U1071A-256	256 MSample acquisition memory
U1071A-SAR	Simultaneous multibuffer acquisition and readout firmware
U1071A-UK6	Calibration certificate
Accessories	
U1092A-CB5	MCX to BNC, 1 m cable
U1093A-AS6	AS Bus 2 connector for PCI
U1071A-XP5	Fan unit for DP1400
U1071A-XP4	Fan unit for two adjacent DP1400 units

For more information on the Acqiris product line, sales or services, see our website at:

www.agilent.com/find/acqiris
www.agilent.com/find/u1071a

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