

# Keysight Technologies

## U2701A/U2702A

### USB Modular Oscilloscope

Data Sheet





## Introduction

The Keysight Technologies, Inc. U2701A and U2702A USB modular oscilloscopes combine a set of essential features that are ideal for analyzing designs in an affordable way.

The U2701A and U2702A come in two bandwidths: 100 MHz and 200 MHz respectively. These devices are uniquely designed to accommodate your need for flexibility with the dual-play function. This function allows you to use the oscilloscope as a standalone instrument, or to scale up the test system in a cardcage with additional scopes or with other Keysight USB modular product offerings, providing a complete solution for system development.

The U2701A/U2702A USB modular oscilloscopes give you the debugging power you need. Each USB modular oscilloscope comes with standard features such as advanced triggering, automatic measurements, math functions including FFTs and much more.

### Features

- 100 MHz and 200 MHz bandwidths
- Up to 1 GSa/s maximum sample rate
- 32 Mpts of waveform memory
- Compact and portable size
- Advanced triggering, including edge, pulse width and TV
- Four math functions, including FFTs standard
- Dual-play function – standalone and modular capability
- Compatibility with High-Speed USB 2.0 and USBTMC-USB488 standards

## Why do you need deep memory and a high sampling rate?

### To view results over a longer period

A deep memory lets you to store more samples, allowing you to view the signal and results over a longer period of time. A longer capture time gives you better visibility into the cause-effect relationships in your design. This allows you to capture start-up events in a single acquisition, and can significantly simplify your root-cause debugging.

With the U2701A/U2702A USB modular oscilloscopes, you no longer need to stitch together multiple acquisitions or set precise triggering condition, allowing you to spend less time finding events, and more time analyzing them.

### To view signals in greater detail

All oscilloscopes have a “banner” maximum sample rate, but many can only sustain these rates at a few time base settings. The U2701A/U2702A USB modular oscilloscopes have a deep memory depth that is able to store a large amount of data, letting you zoom in on signals for more detail.

### To achieve higher accuracy

By offering a sampling rate more than twice the acquired signal bandwidth, the U2701A/U2702A can prevent aliasing. By capturing more samples, you can obtain higher test and analysis result accuracy.

## Ease of use

The U2701A/U2702A USB modular oscilloscopes are equipped with High-Speed USB 2.0 interface for easy setup and plug-and-play. This ease of use makes the oscilloscopes ideal for the education, design validation and manufacturing industries.



Figure 1. The dual-play capability allows the U2701A/U2702A USB modular oscilloscope to be used as a standalone unit or as part of test system in a cardcage.

## Features you need

The U2701A and U2702A include the following standard features that you need to perform your tasks efficiently:

### Hi-Speed USB Interface

The U2701A and U2702A connect to the computer through Hi-Speed USB 2.0 connectivity.

### Autoscale

Autoscale lets you display any active signals, automatically setting the vertical, horizontal, and trigger controls for the best signal display within the shortest time.

### Advanced triggering

Edge, pulse width, and TV are the triggering modes included to help you isolate the signals you want to see.

### Large memory

With memory depth up to 32 Mpts, you can capture even more data. Larger memory allows you to capture data over a longer time frame.

### Fast Fourier Transfer (FFT) and Waveform Math

The U2701A and U2702A USB modular oscilloscopes offer analysis functions such as addition, subtraction, multiplication, division, and Fast Fourier Transform (FFT). FFT allows you to manipulate the waveform using five types of windows such as Hanning, Hamming, Blackman-Harris, Flattop, and Rectangular.



Figure 2. The U2701A and U2702A connect to the computer or laptop with a USB cable, enabling fast data transfer.

### High sampling rate

A sampling rate up to 500 MSa/s/ch allows you to view and analyze the signal in greater detail. When two channels are interleaved, the sampling rate can rise up to 1 GSa/s. This fast-sampling capability allows you to perform intermittent detections easily.

### Pulse triggering

Pulse triggering allows you to trigger on pulse events.

### Portability

The U2701A and U2701A's compact size makes them portable, and they can be easily carried to and around your work field.

### Three-year warranty

Every U2701A and U2702A comes with a three year warranty.

## Product outlook and dimensions

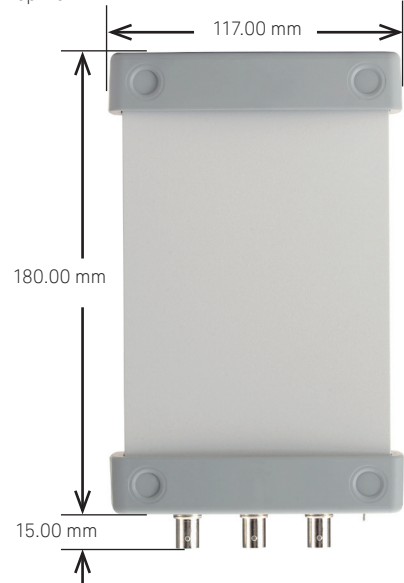
Front view



Rear view



Top view



## Standard shipped accessories

- 12 V, 2 A AC/DC Power adapter
- Power cord
- USB Standard A to Mini-B interface cable
- 2 x 10:1 Passive probe 150 MHz 1.2m, N2862A (only applicable for U2701A)
- 2 x 10:1 Passive probe 300 MHz 1.2m, N2863A (only applicable for U2702A)
- L-Mount kit (used with modular product chassis)
- Keysight Automation-Ready CD-ROM (contains the Keysight IO Libraries Suite)
- Keysight USB Modular Products Quick Start Guide
- Keysight USB Modular Products Reference CD-ROM
- Keysight USB Modular Products Quick Reference Card
- Certificate of Calibration

## Product characteristics and general specifications

### REMOTE INTERFACE

- Hi-Speed USB 2.0
- USBTMC 488.2 Class device<sup>1</sup>

### POWER CONSUMPTION

- +12 VDC, 2 A
- Installation Category III

### OPERATING ENVIRONMENT

- Operating temperature from 0 °C to +50 °C
- Operating humidity at 20% to 85% RH (non-condensing)
- Altitude up to 2000 meters
- Pollution Degree 2
- For indoor use only

### STORAGE COMPLIANCE

- Storage temperature from -20 °C to 70 °C
- Storage humidity at 5% to 90% RH (non-condensing)

### SAFETY COMPLIANCE

Certified with:

- IEC 61010-1:2001/EN 61010-1:2001 (2nd Edition)
- USA: UL61010-1: 2004
- Canada: CSA C22.2 No.61010-1:2004

### EMC COMPLIANCE

- IEC 61326-1:2002/EN 61326-1:1998+A2:2001+A3:2003
- Canada: ICES-001:2004
- Australia/New Zealand: AS/NZS CISPR 11:2004

### SHOCK AND VIBRATION

Tested to IEC/EN 60068-2

### IO CONNECTOR

BNC connector

### DIMENSION (W × D × H)

Module dimension:

- 117.00 mm × 180.00 mm × 41.00 mm (with bumpers)
- 105.00 mm × 175.00 mm × 25.00 mm (without bumpers)

### WEIGHT

- 534 g (with bumpers)
- 482 g (without bumpers)

### WARRANTY

Three years for U2701A/U2702A

Three months for standard shipped accessories

## Optional accessories

- BNC cable, U2921A-100
- USB Secure cable, U2921A-101
- 1:1 Passive probe 20 MHz, 1.5 m, 10070C (Order no.: U2701A-200)
- 10:1 Passive probe 150 MHz 1.2m, N2862A (only applicable for U2701A)
- 10:1 Passive probe 300 MHz 1.2m, N2863A (only applicable for U2702A)

1. Compatible with Microsoft Windows operating systems only. Requires a direct USB connection to the PC so the appropriate driver can be installed in the USB modular instrument.

## Performance specifications<sup>1</sup>

### Vertical system: oscilloscope channels

Bandwidth (-3 dB)	U2701A: DC to 100 MHz U2702A: DC to 200 MHz
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### Scope channel triggering

Trigger sensitivity	< 10 mV/div: greater of 1 div or 5mV; ≥ 10 mV/div: 0.6 div
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## Performance characteristics<sup>2</sup>

### Acquisition: oscilloscope channels

Real time sample rate		
– 2 channels interleaved	1 GSa/s	
– Each channel	500 MSa/s	
Standard memory depth	Normal	Single-shot
– 2 channels interleaved	32 Mpts	64 Mpts
– Each channel	16 Mpts	32 Mpts
Vertical resolution	8 bits	
Peak detection	Yes	
Averaging	Any number from 1 to 999	
Filter	Sin(x)/x interpolation for time base 1 ns to 100 ns	
Sweep modes	Auto, normal, single	

### Vertical system: oscilloscope channels

Scope channels	U2701A/U2702A: Ch 1 and Ch 2 simultaneous acquisition	
AC coupled	U2701A: 3.5 Hz to 100 MHz U2702A: 3.5 Hz to 200 MHz	
Calculated rise time (= 0.35/bandwidth)	U2701A: 3.5 ns U2702A: 1.75 ns	
Single-shot bandwidth	U2701A: 100 MHz U2702A: 200 MHz	
Range	2 mV/div to 5 V/div (1 M $\Omega$ )	
Maximum input <sup>3</sup>	CAT I 30 Vrms, 42 Vpk	
Offset range	±4 div Example: ±8 mV on 2 mV/div; ±20 V on 5 V/div	
Dynamic range	±4 div	
Input impedance	1 M $\Omega$ : ≈ 16 pF	
Coupling	AC, DC, Ground	
BW limit	≈ 25 MHz	
Standard probes	10:1 Passive probe 150 MHz 1.2 m 10:1 Passive probe 300 MHz 1.2 m	
ESD tolerance	±2 kV	
Noise peak-to-peak	3 mVpp	
DC vertical offset accuracy	≤ 200 mV/div: ±0.1 div ±2.0 mV ±0.5% offset value; > 200 mV/div: ±0.1 div ±2.0 mV ±1.5% offset value	
DC vertical gain accuracy	±4.0% of full scale	

1. All specifications are warranted. specifications are valid after a 30-minute warm-up and within ±100 °C of last calibration temperature.
2. All characteristics are typical performance values and are not warranted. Characteristics are valid after a 30-minute warm-up period and within ±10 °C of last calibration temperature.
3. Under standalone use, you are only allowed to measure up to CAT I 30 Vrms. For high-voltage measurement up to CAT I 300 Vrms, you must install the L-Mount kit on the U2701A/U2702A before plugging it into the product chassis. Ensure that the L-Mount kit installed on your modular oscilloscope is screwed to the product chassis to ensure proper chassis grounding. Note that you are required to use the provided 10:1 probes (N2862A/N2863A) for high-voltage measurements to avoid damaging your instrument.

Performance characteristics<sup>1</sup> (continued)

<b>Vertical system: oscilloscope channels (continued)</b>	
Single-cursor accuracy	±{DC vertical gain accuracy + DC vertical offset accuracy + 0.2% full scale (~1/2 LSB)} Example: For 50 mV signal, scope set to 10 mV/div (80 mV full scale), 5 mV offset, Accuracy = ±{4.0% (80 mV) + 0.1(10 mV) + 2.0 mV + 0.5% (5 mV) + 0.2% (80 mV)} = ±6.385 mV
Dual-cursor accuracy	±{DC vertical gain accuracy + 0.4% full scale (~1 LSB)} Example: For 50 mV signal, scope set to 10 mV/div (80 mV full scale), 5 mV offset, Accuracy = ±{4.0% (80 mV) + 0.4% (80 mV)} = ±3.52 mV
<b>Horizontal</b>	
Range	1 ns/div to 50 s/div
Time base accuracy	20 ppm
Delay range	Pre-trigger: -100 % Post-trigger: +100 %
Modes	Main, roll, XY
XY	Yes
Reference position	Center
<b>Trigger System</b>	
Sources	Ch 1, Ch 2, Ext (not applicable for TV trigger)
Modes	Normal, single, auto trigger
Hold off time	60 ns
Selections	Edge, pulse width, TV
– Edge	Triggers on a rising or falling edge, alternating, or either edge of any source
– Pulse width	Triggers on a pulse width greater than, equal to, or less than a specified time limit, with time limits ranging from 16 ns to 10 s Minimum lower limit: 8 ns Minimum upper limit: 16 ns Maximum pulse width setting: 10 s
– TV	Triggers on one of three standard television waveforms: NTSC, PAL, SECAM TV trigger sensitivity: 0.6 division of sync signal. Modes supported include Field 1, Field 2, all fields, or any line within a field
Autoscale	Single-button automatic setup of all channels
<b>Oscilloscope channel triggering</b>	
Range (internal)	±4 div from center screen
Coupling	AC (< 15 Hz) LF reject (~ 35 kHz) HF reject (~ 35 kHz)
<b>External (EXT) triggering</b>	
Input impedance	1 MW: ≈ 16 pF
Maximum input	CAT I 30 Vrms, 42 Vpk
Range	DC coupling: trigger level ±1.25 V and ±2.5 V
EXT trigger pulse width	> 2.5 ns

1. All characteristics are typical performance values and are not warranted. Characteristics are valid after a 30-minute warm-up period and within ±10 °C of last calibration temperature.

Performance characteristics<sup>1</sup> (continued)**External (EXT) triggering (continued)**

Trigger level sensitivity	For $\pm 1.25$ V range setting: DC to 100 MHz: 100 $\mu$ V > 100 MHz: 200 $\mu$ V For $\pm 2.5$ V range setting: DC to 100 MHz: 250 $\mu$ V > 100 MHz: 500 $\mu$ V
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**Display**

Interpolation	Sin(x)/x
Display types	Dots and vectors
Persistence	Off, infinite
Format	XY, roll

**Measurement features**

Automatic measurements	Measurements are continuously updated. Cursors track last selected measurement.
Voltage	Peak-to-peak, maximum, minimum, average, amplitude, top, base, Vrms, overshoot, preshoot, crest, standard deviation, cycle RMS, RMS AC
Time	Frequency, period, +width, -width, +duty cycle, -duty cycle, rise time, fall time, delay, phase
Frequency	Maximum peak
Cursors	<ul style="list-style-type: none"> <li>- Modes: Manual</li> <li>- Type: Time, voltage and frequency (FFT)</li> <li>- Measurements: DT, DV, frequency, Peak Scan (FFT), DPeak</li> </ul>
Math functions	Add, subtract, multiply, FFT, divide

**FFT**

Points	1250 points (for 500 ns and above)
Source of FFT	Source channels 1 or 2
Window	Hanning, Hamming, Blackman-Harris, Rectangular, Flattop
Noise floor	-50 dB to -90 dB depending on averaging
Amplitude	Display in dBV
Maximum frequency	250 MHz

1. All specifications are warranted. specifications are valid after a 30-minute warm-up and within  $\pm 100$  °C of last calibration temperature.



## Keysight Measurement Manager

The Keysight Measurement Manager (KMM) is an application data viewer software that comes with the standard purchase of the U2700A Series USB modular instruments. This software is designed to help you perform quick device configuration, data logging and data acquisition using the products.

Supported features found in the U2701A/ U2702A USB modular oscilloscope:

- Averaging
- Command logger to allow the capture of configuration commands that can be easily converted to snippets of VEE, VB, C++ and C# code
- Self-test
- Self-calibration
- Option to save the current instrument configuration to a file
- Data logging and export feature to CSV, HTML and text only format files that can be printed
- Trigger settings between modules in the instrument chassis with Star trigger and Master/Slave trigger

## Keysight Measurement Manager prerequisites

Prior to installing the Keysight Measurement Manager software, ensure that your PC meets the following minimum system requirements for installation and operation.

Requirement	Windows XP operating systems	Windows Vista operating systems	Windows 7 operating systems
Operating system	Windows XP Service Pack 3 (or later) <sup>1</sup>	Windows Vista (32-bit) Service Pack 1 and 2 <sup>2</sup>	Windows 7 (32-bit and 64-bit) <sup>3,4</sup>
Processor speed	600 MHz or higher required, 800 MHz recommended	1 GHz 32-bit (x86)	3 GHz 32-bit (x86)
Memory	256 MB minimum (1 GB or greater recommended)	1 GB minimum	2 GB minimum
Hard-disk space	1.5 GB minimum	1.5 GB minimum	1.5 GB minimum
Video	Super VGA (800 × 600) 256 colors or more	Support for DirectX 9 graphics with 128 MB graphics memory recommended <sup>5</sup>	Support for DirectX 9 graphics with 128 MB graphics memory recommended <sup>5</sup>
CD-ROM drive or DVD-ROM drive <sup>6</sup>	Required	Required	Required
Browser	Microsoft Internet Explorer 5.01 or greater	Microsoft Internet Explorer 7 or greater	Microsoft Internet Explorer 7 or greater

1. Supported Windows XP editions – Home or Professional
2. Supported Windows Vista (32-bit) editions – Home Basic, Home Premium, Business, or Ultimate
3. Supported Windows 7 (32-bit and 64-bit) editions – Home Basic, Home Premium, Professional, Enterprise, or Ultimate
4. Keysight Measurement Manager for Windows 7 64-bit support is a 32-bit application running on a WOW64 (Windows-on-Windows 64-bit) emulator.
5. Super VGA graphics is supported for Windows Vista and Windows 7.
6. The type of media provided with the product determines whether a CD-ROM drive or DVD-ROM drive is required.

### Software requirements

Keysight IO Libraries Suite 15.1 and above <sup>1</sup>

Keysight T&M Toolkit Runtime version 2.12

Keysight T&M Toolkit Redistributable Package 2.1 patch <sup>2</sup>

Microsoft .NET Framework version 2.02

1. Available on the Keysight Automation-Ready CD-ROM
2. Bundled with Keysight Measurement Manager software application installer



## Other products in the Keysight USB Modular Test Instruments Family

### U2722A/U2723A USB Modular Source Measure Unit

#### Features:

- Three-channel SMU with four-quadrant source/measure operation
- High measurement sensitivity of 100 pA with 16-bit resolution for all voltage and current ranges
- 0.1% basic accuracy
- Embedded test scripts (for U2723A)

For more information: <http://www.keysight.com/find/U2722A>  
<http://www.keysight.com/find/U2723A>



### U2741A USB Modular Digital Multimeter (DMM)

#### Features:

- Fast reading speed (up to 100 Sa/s)
- Wide range of basic measurement functions, including frequency and temperature measurements

For more information: <http://www.keysight.com/find/U2741A>



### U2751A USB Modular Switch Matrix

#### Features:

- Minimal cross-talk of -30 dB at 45 MHz wide bandwidth
- High bandwidth at 45 MHz without terminal block
- Capability to test up to four devices-under-test (DUTs)
- Works with other Keysight instruments for multi-point testing

For more information: <http://www.keysight.com/find/U2751A>



### U2761A USB Modular Function/Arbitrary Waveform Generator

#### Features:

- Direct digital synthesis (DDS) waveform generator
- Pulse generator that can generate pulse signal as stimulus
- Easy customization with Arbitrary Waveform Editor
- Internal modulation capability simplifies test setup

For more information: <http://www.keysight.com/find/U2761A>



### U2781A USB Modular Product Chassis

#### Features:

- Expansion of channels for each modular product
- Multiple instrument synchronization
- Internal and external 10 MHz reference clock
- High-speed USB 2.0
- SSI/Star trigger bus synchronization between external trigger source and modules

For more information: <http://www.keysight.com/find/U2781A>



## Ordering Information

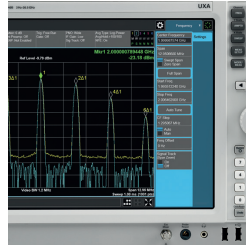
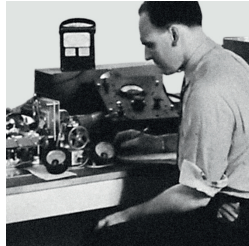
Model	Description
U2701A	USB modular oscilloscope (100 MHz)
U2702A	USB modular oscilloscope (200 MHz)

## Optional accessories

Model	Description
N2862A	10:1 pas sive probe, 150 MHz, 1.2 m (for U2701A)
N2863A	10:1 passive probe, 300 MHz, 1.2 m (for U2702A)
U2701A-200	10070C 1:1 passive probe, 20 MHz, 1.5 m
U2921A-100	BNC cable, 1.2 m
U2921A-101	USB secure cable, 2 m

## From Hewlett-Packard through Agilent to Keysight

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Keysight's committed to superior product quality and lower total cost of ownership. Keysight is the only test and measurement company with a three-year warranty standard on all instruments, worldwide. And, we provide a one-year warranty on many accessories, calibration devices, systems and custom products.



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