Keysight Technologies
U4611A/B USB 2.0/3.0 Protocol Analyzer
Version 3.7.x with MegaZoom
Data Sheet

Only Keysight delivers the deep and fast analysis tools that you need for tackling today's high-performance SuperSpeed USB designs.

KEYSIGHT
TECHNOLOGIES

High-performance analysis

- – Real-time end-point analysis
- – Real-time link performance
- – Real-time LTSSM
- – Detailed performance logging
- – Customizable triggering, counting, filtering

Instant access to captured data

- – Segmented buffer with multiple event capture
- – Up to 18 GB of data capture
- – Intuitive GUI with one-click data access
- – Clear specification-oriented data decode
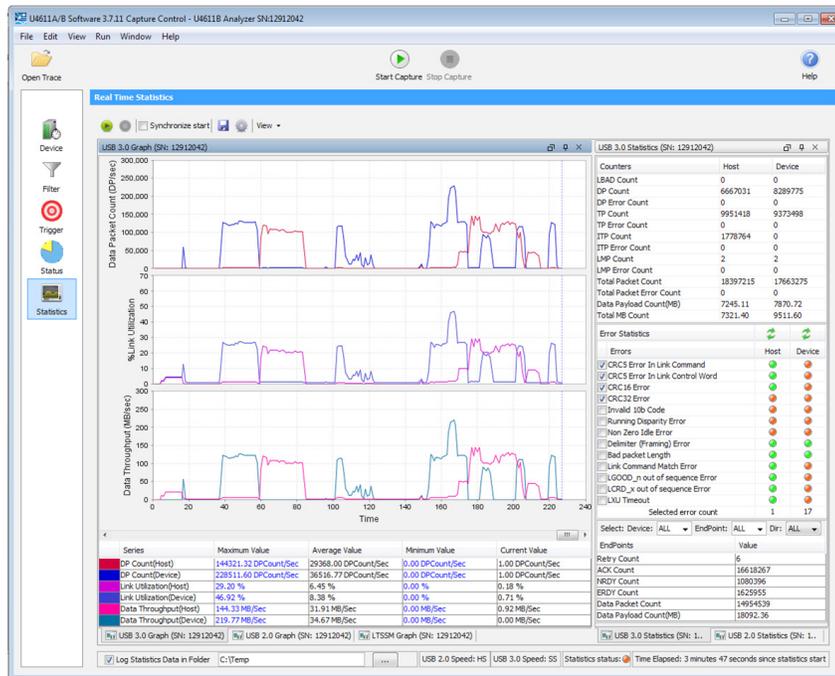
The Keysight Technologies, Inc. U4611A/B USB Protocol Analyzer offers a new level of usability with industry leading real-time performance analysis, LTSSM state following, the most comprehensive triggering system, and customizable data analysis of up to 18 GB.

Protocol Analyzers from Keysight are the right tool for locating intermittent problems in complex SuperSpeed USB systems.

Overview

For today's USB developers and integrators, ensuring that their design is compatible with the ever growing number of USB devices is a difficult task. Traditionally, those needing to capture large amounts of traffic have been faced with limited trace buffers, long waits to view the data, slow searches, and slow saving. With USB 3.0 designs moving past basic functionality, USB designers are working on getting the optimum performance from new and existing USB devices. MegaZoom™ technology analyzes the USB operations in real-time with full operational performance views. The Keysight U4611A/B USB Protocol Analyzer overcomes limitations with its ability to provide an instant display of the captured data, even at the full available trace capture depth of 18 GB. Trace data is transferred to the host computer by either Hardware Accelerated Gigabit Ethernet (up to 70 MB/s) or PCI Express (up to 550 MB/s), making full depth data available for analysis with little or no waiting. For example, a histogram of the full 18-GB trace can be obtained in 15 seconds. Pre-indexed and compressed trace data is displayed and can be analyzed with multiple processors.

Figure 1. The U4611A/B Analyzer is connected in a pass-through mode and records traffic being exchanged between the host and the device under test.

Figure 2. The MegaZoom graph gives instant access to any event in the 18 GB buffer.
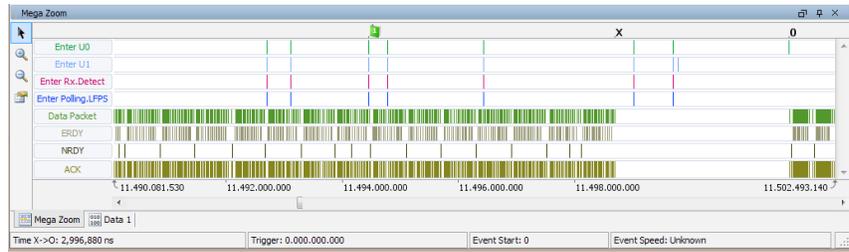
Find USB Problems Faster With MegaZoom

MegaZoom technology in the U4611A and U4611B delivers the tools that you need quickly analyze massive amounts of data and drill into the detail you need.

— MegaZoom delivers up to 18 GB of deep memory data capture, without the sluggish response times and complex user interfaces that users had to tolerate with traditional analyzers.

— Thanks to patented indexing techniques performed in proprietary FPGA designs, MegaZoom is able to fully analyze the 5 Gbps bi-directional data of USB 3.0 in real time.

— Results are displayed in seconds and provide instant access to all of the events in the capture with a single click.

— MegaZoom is not a special mode-it performs at full bandwidth in every capture, regardless of additional triggers and analysis performed by the analyzer.

USB has truly delivered on the promise of being a universal connection for electronic devices. Starting with low-speed human interface devices like mice and keyboards, it has now been adopted as a default connection for external disk drives and adapters for high speed networks. This places greater demand on optimizing the performance of the connection.

Figure 3. Real-time performance graphically shows the throughput as well all major packet counts and endpoint performance.
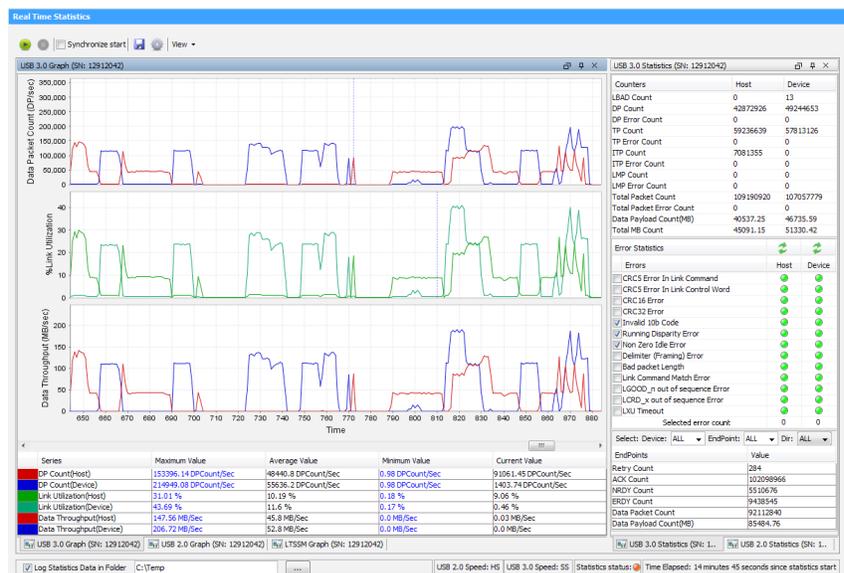
The Keysight U4611A USB protocol analyzer supports complete time correlated analysis to allow you to find those difficult-to-find problems that affect the operation and performance of your USB implementations, starting with graphical displays containing performance and error counters that show exactly what has occurred on the USB link and continuing through to a 18-GB packet capture.
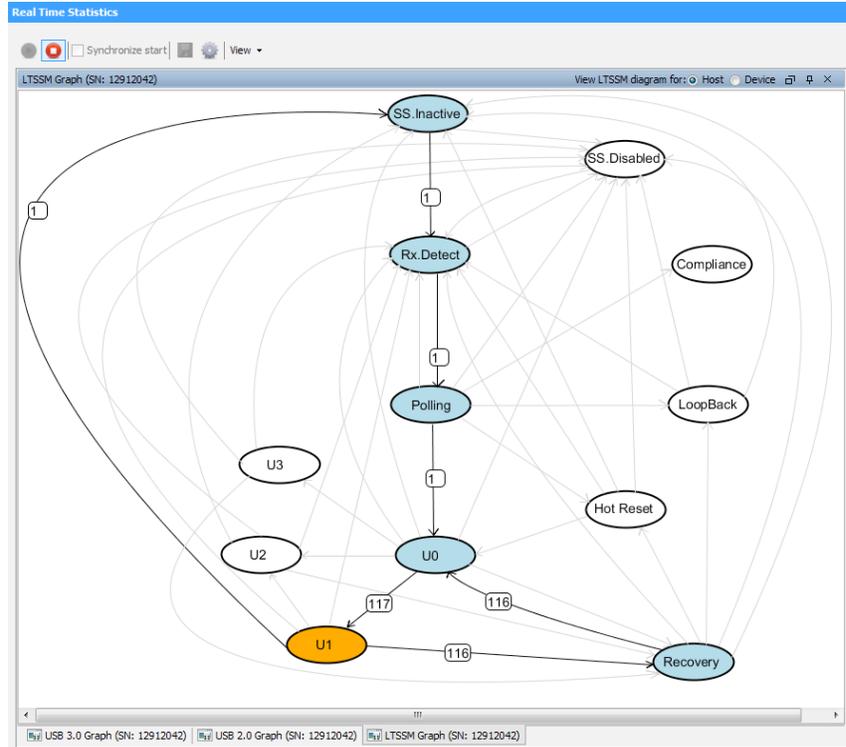

Figure 4. Real-time LTSSM status shows all of the transitions as well as the current state of the link.

Data throughput is supported by the operation of the lower levels of the protocol to maintain link integrity and reduce power consumption. The ability to find and zero in on these events is critical to understanding the link operations.

The high-speed trace capture and display capabilities of the U4611A/B Protocol Analyzer are the product of a total system development process that encompasses all elements of USB testing, starting with the analyzer's memory and extending to the communication link to the computer hosting the application.
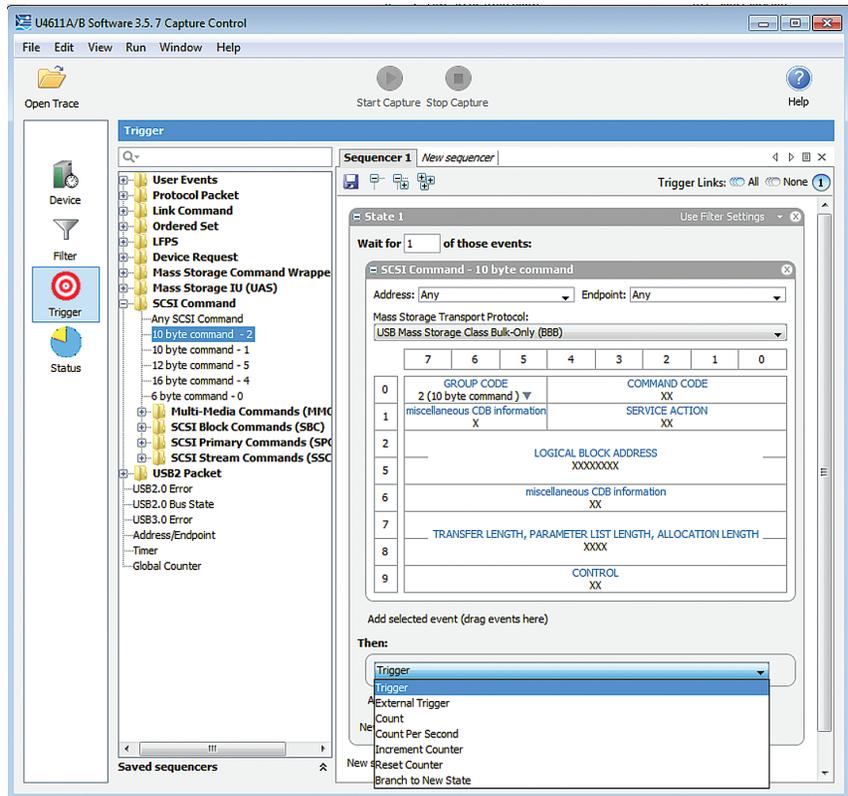
Figure 5. Trigger configuration is through an intuitive menu drive system that supports complex measurements.

The Keysight U4611A/B also features easy triggering with the Keysight USB SuperSpeed Protocol Analysis software. In addition, pre- and post-filtering, textual search and sequence search, and many different displays of the captured traffic to bring specific points of interest into focus with this software interface.
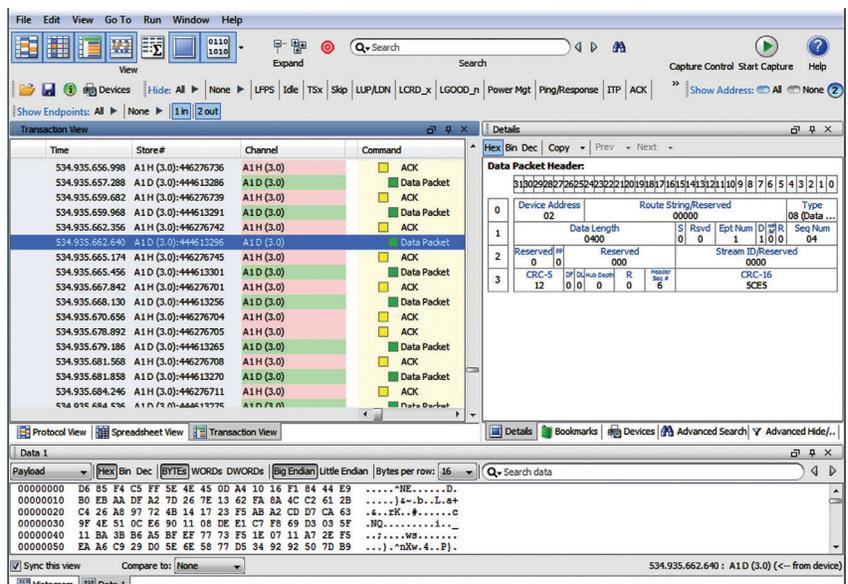

Figure 6. The USB transaction view of the Keysight USB SuperSpeed analyzer system illustrates the operation of the system under test with three easily understood views. The highlighted row in the transaction view window is presented in the details screen.

Powerful application software

The U4611A/B comes with Keysight's USB SuperSpeed Protocol Analysis software. An intuitive user interface allows the user to configure the analyzer's acquisition and triggering functions to perform the analysis of the SuperSpeed USB bus. This enhanced usability, coupled with the high-speed data capture and display technology, results in increased project throughput and reduced time to market. Product testing is quickly configured and data analysis is enhanced.

The Keysight USB SuperSpeed USB Protocol Analysis software, with its multiple levels of abstraction, provides clear, instant insight into the system under test.

Advanced software automates test

— Multiple buffer segments, enabling controlled captures during a single run, greatly enhances the effectiveness of a test run.

— Multi-state triggering creates complex if-then decision making in the runtime capture to control data capture triggering, counting, and timing.

— Multiple trigger sequences enable simultaneous execution of multiple test scenarios.

The USB transaction view of the Keysight USB SuperSpeed analyzer system presents the operation of the system under test with three easily understood views, as shown in Figure 2. The histogram view, shown in Figure 3, provides an overview of the operation of the system under test. The red target symbol is the location of the trigger event.

Powerful triggering brings events of interest into focus for detailed analysis. In addition to the ability to trigger on USB data, the analyzer can be triggered by an external instrument or command an external instrument to be triggered on a specific USB event. This greatly expands problem solving as events in the overall system under test are easily linked to specific events captured in the USB protocol analyzer. Figure 4 is an example of the trigger setup menu.

Increase project confidence with the U4612A Jammer

Add the Keysight U4612A Jammer to the U4611A/B Protocol Analyzer to provide a complete USB 3.0 validation test solution. The U4612A Jammer can inject a variety of errors into live data so that real-time error handling, system recovery, and duplication of issues can be tested. Used in conjunction with the U4611A/B Protocol Analyzer, it is easy to verify the system under test's ability to respond to and recover from errors. The U4612A Jammer can be used to create random and defined line errors such as CRC or 8b10b encoding errors, and modifies link commands, protocol packets, packet data, and ordered sets.
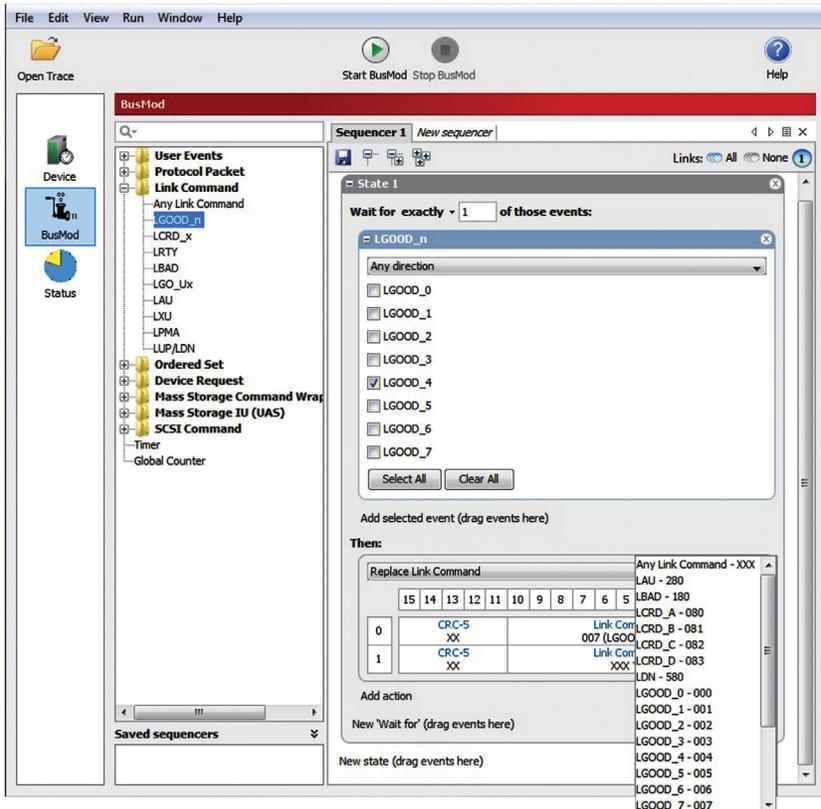
Figure 7. The U4612A USB 3.0 Jammer enables packet modification with a simple-to-configure, menu-driven user interface.

The jammer is controlled with the Keysight USB SuperSpeed Protocol Analysis software provided with the U4611A/B USB 3.0 USB Protocol Analyzer, shown in Figure 6. The Jammer's GUI enables easy definition of frames, random or interval error generation, and creation of logical branching and arguments.

The U4612A USB Jammer and U4611A/B USB Protocol Analyzer connected in pass-through mode between a USB host and device is shown in Figure 7. The Jammer injects programmed errors on the link while the analyzer non-intrusively records any traffic exchanged between the host and the device.
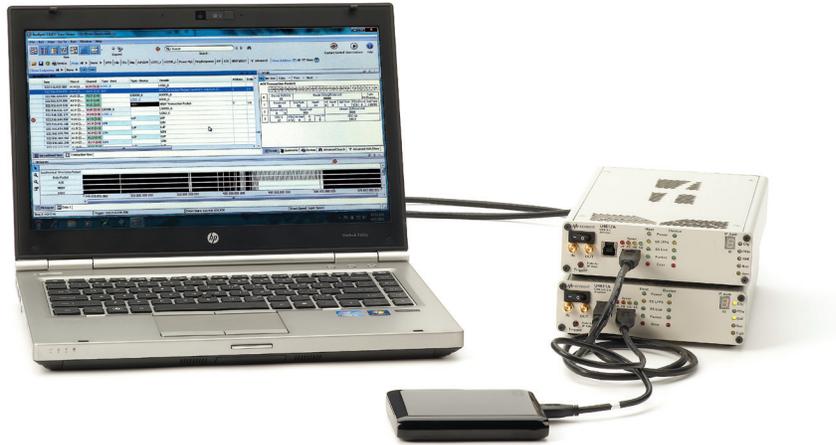
Figure 8. The U4611A and U4612A in a cascaded configuration operate as a single system with one UI to control the entire test setup.

Configuration options

– The U4611A is designed for specialized, limited testing requirements. These applications are ideally suited to a smaller buffer size (2, 4, or 9 GB) and choice of speeds (2.0, 3.0, or both).

– The U4611B supports an 18-GB trace buffer to meet the needs of developing the highest performance products. The powerful U4611B breaks free of past analyzer limitations and lets users spend more time on development.

Additional test equipment such as Keysight logic analyzers and mixed-signal oscilloscopes expand the view of the total system under test by means of the U4611A/B trigger capabilities. For example, the U4611A/B analyzer can be instructed to capture USB data at a specific point in the operation of the DUT by either the logic analyzer or oscilloscope, giving the user the ability to link system operation across many phases of the DUT operation.
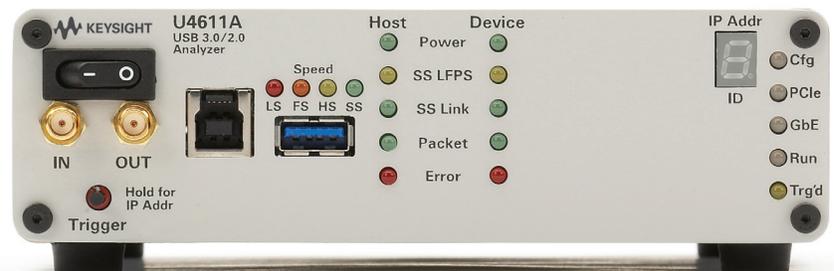
System Requirements

To take full advantage of the U4611A/B's high speed trace processing technology the host computer must be able to receive the deep trace record with minimum delay. Therefore, a high-speed interface to the instrument is required.

Operating system	Windows XP, Vista, Server 2003/2008
	Win7 32 bit or Win7 64-bit platforms
Processor	2.8 GHz or greater dual-core
Memory	3 GB or greater of 1.3 GHz FSB memory
Graphics	Capable of supporting 1920x1200 or greater
Interface	PCIe x4 (550 MB/s) recommended or Express Card Slot (70 MB/s)
Free disk space for installation	100 MB

Specifications

Protocol(s) supported	USB 1.0, 2.0, and 3.0.
	Note: USB 1.0 and 2.0 support supplied as standard with the product.
	Optional software license required for 3.0 operation.
Power	19 Vdc 90 watts maximum
Keysight U4611A-1PS power supply	Input: 50/60 Hz, 100 to 240 Vac ±10%
	Output: 19 Vdc, 4.47 A
Triggering	
Trigger input	Input impedance: ~1 K Ω
	Trigger level: Rising or falling edge ~1.5 V
	Maximum input: 5.5
Trigger output	Source impedance: 50 Ω
	Modes: Pulse high, pulse low, and toggle
Environmental and safety	
This instrument is intended for indoor use in an installation category II, pollution degree 2 environment.	
Temperature	Temperature operating: 20 to 30° C
	Non-operating: –40 to +70° C
Humidity (non-condensing)	Operating: 50% to 80% at 30° C
	Non-operating: 90% for 12 hours at 65° C
Altitude	2000 m (6500 feet)
Temperature operating: 20 to 30° C	Temperature operating: 20 to 30° C
Non-operating: –40 to +70° C	Non-operating: -40 to +70° C
Humidity (non-condensing) operating: 50% to 80% at 30° C	Humidity (non-condensing) operating: 50% to 80% at 30° C
Non-operating: 90% for 12 hours at 65° C	Non-operating: 90% for 12 hours at 65° C
Altitude 2000 m (6500 feet)	Altitude 2000 m (6500 feet)

Specifications (continued)

Environmental and safety (continued)		
Electromagnetic compatibility	IEC 61326-1:2005/EN 61326-1:2006	
	CISPR 11/EN 55011	Group 1 class A
	IEC 61000-4-2/N 61000-4-2	4 kV CD, 8 kV AD
	IEC61000-4-3/EN 61000-4-3	3 V/m, 80 to 1000 MHz & 1.4 to 2 GH, 1 V/m 2 to 2.7 GHz
	IEC61000-4-4/EN 61000-4-4	0.5 kV signal, 1 kV power lines
	IEC61000-4-5/EN 61000-4-5	0.5 kV line-line, 1 kV line-ground
	IEC61000-4-6/EN 61000-4-6 3 V, 0.15 to 80 MHz	3 V, 0.15 to 80 MHz
	IEC61000-4-11/EN 61000-4-11	0% for 1/0.5 (0 degree, 180 degree) cycle 0% for 250/300 cycles 70% for 25/30 cycles
	Canada: ICES-001:2004	
	Australia/New Zealand; AS/NZS CISPR 11:2004	
Safety	IEC 61010-1:2001/EN 61010-1:2001	
	Canada: CAN/CSA C22.2. No 61010-1-04	
	USA: ANSI/UL 61010-1:2004	

Instrument		
Dimensions	cm	inches
Width	15.24	6.0
Height	4.45	1.75
Depth	22.9	9.0
Weight	Kg	Lb
Instrument only	1.36	3.0
Shipping	2.95	6.5

Ordering Information

Option	Description
U4611A	**Analyzer for USB 3.0/2.0, up to 9 GB**
USB speed options	
U4611A-600	USB 2.0 speed only
U4611A-601	USB 3.0 speed only
U4611A-602	Both USB 3.0 and USB 2.0 speeds
Software options	
U4611A-800	Software license for basic analyzer features
	1 buffer segment
	1 trigger state
	1 trigger sequence
U4611A-801	Software license for advanced analyzer features
	Up to 256 buffer segments
	Up to 26 trigger states
	Up to 4 trigger sequences
Capture memory	
U4611A-M02	Capture memory, 2.25 GB
U4611A-M04	Capture memory, 4.5 GB
U4611A-M09	Capture memory, 9 GB
U4611B	**Analyzer for USB 3.0/2.0, 18 GB**
USB speed options	
U4611B-600	USB 2.0 speed only
U4611B-601	USB 3.0 speed only
U4611B-602	Both USB 3.0 and USB 2.0 speeds
Software options	
U4611B-800	Software license for basic analyzer features
	1 buffer segment
	1 trigger state
	1 trigger sequence
U4611B-801	Software license for advanced analyzer features
	Up to 256 buffer segments
	Up to 26 trigger states
	Up to 4 trigger sequences
USB 3.0 Jammer	
U4612A	**Jammer for USB 3.0**
U4611A upgrade options	
U4611U-602	Upgrade from USB 2.0 to both USB 3.0 and USB 2.0 speeds
U4611U-603	Upgrade from USB 3.0 to both USB 3.0 and USB 2.0 speeds
U4611U-801	Software license, advanced analyzer for USB 3.0/2.0
U4611U-M04	Capture memory, upgrade from 2.25 GB to 4.5 GB
U4611U-M09	Capture memory, upgrade from 2.25 GB to 9 GB
U4611U-M49	Capture memory, upgrade from 4.5 GB to 9 GB
U4611B upgrade options	
U4611BU-602	Upgrade from USB 2.0 to both USB 3.0 and USB 2.0 speeds, 18 GB
U4611BU-603	Upgrade from USB 3.0 to both USB 3.0 and USB 2.0 speeds, 18 GB
U4611BU-801	Software license, advanced analyzer for USB 3.0/2.0, 18 GB

Ordering Information (continued)

Option	Description
USB 3.0 Jammer	
U4612A	**Jammer for USB 3.0**
U4611A upgrade options	
U4611U-602	Upgrade from USB 2.0 to both USB 3.0 and USB 2.0 speeds
U4611U-603	Upgrade from USB 3.0 to both USB 3.0 and USB 2.0 speeds
U4611U-801	Software license, advanced analyzer for USB 3.0/2.0
U4611U-M04	Capture memory, upgrade from 2.25 GB to 4.5 GB
U4611U-M09	Capture memory, upgrade from 2.25 GB to 9 GB
U4611U-M49	Capture memory, upgrade from 4.5 GB to 9 GB
U4611B upgrade options	
U4611BU-602	Upgrade from USB 2.0 to both USB 3.0 and USB 2.0 speeds, 18 GB
U4611BU-603	Upgrade from USB 3.0 to both USB 3.0 and USB 2.0 speeds, 18 GB
U4611BU-801	Software license, advanced analyzer for USB 3.0/2.0, 18 GB
Refurbished products	
U4611A-RMKT	Keysight Refurbished Product
U4612A-RMKT	Keysight Refurbished Product
Host connection accessories [1]	**Alternative PC connection (Ethernet PC connection is standard)**
U4601A PCIe XpressCard for laptops [1]	XpressCard for laptop based systems
U4602A PCIe XpressCard for desktop [1]	PCIe XpressCard for desktop based systems
U4603A PCIe X4 cable, 2 m long	
U4604A PCIe X4 cable, 3 m long	

1. Using a PCIe connection is optional and not required.

Related literature

Publication title	Publication type	Publication number
Keysight U7243A USB 3.0 Superspeed Electrical Performance Validation	Data Sheet	5990-4115EN
USB Design and Test - A Better Way	Brochure	5990-4640EN
U4612A USB 3.0 Jammer	Data Sheet	5990-9002EN

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