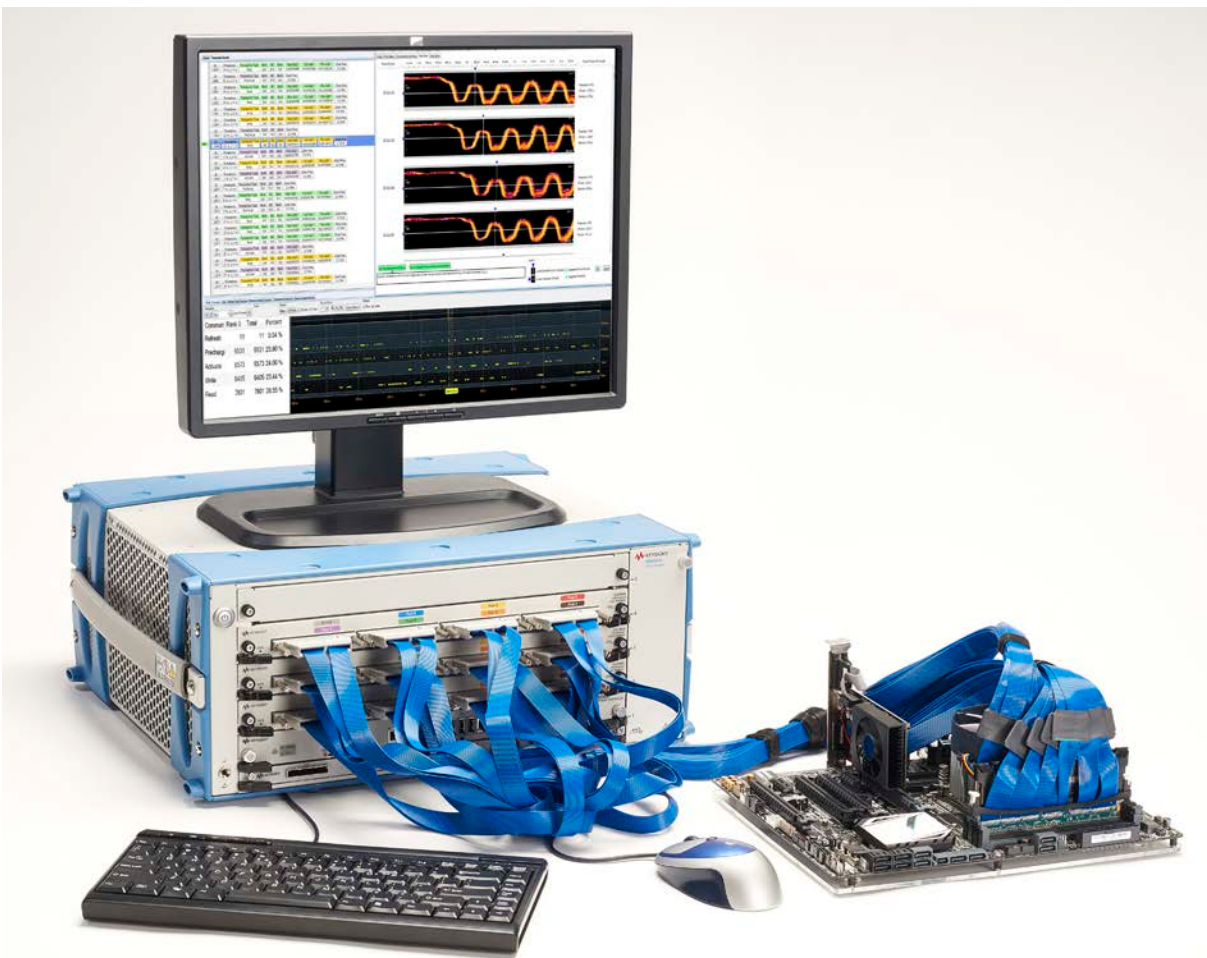


Keysight Technologies

DDR4 Functional/Protocol Debug and Analysis Reference Solution

Configuration Guide



A. Select Options for Probing to Connect to Your System Under Test

Step 1. Select probing specific to your system under test

- | | |
|--|--|
| ☐ PS-X10-750-3PH ¹ | Interposer FS2510AB DDR4 288-pin DIMM interposer for logic with FS1070 conversion kit for operation over 2500 MT/s.

Requires qty (3) U4164A modules each with option U4164A-02G for data rates over 2500MT/s. (Requires qty (2) U4164A modules with option U4164A-01G for operation up to 2500MT/s) |
| ☐ PS-X10-650-3PH | Interposer FS2520 DDR4 4GT/s 288 pin DIMM accessory for logic analyzer.

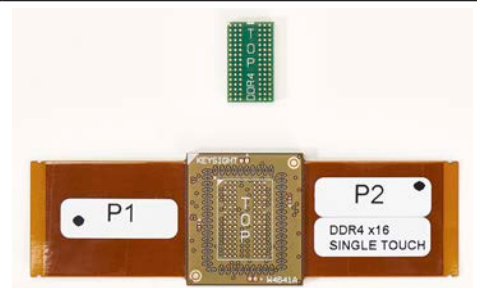
Requires qty (3) U4164A modules for all data rates, each with option U4164A-02G for operation over 2500MT/s. (option U4164A-01G for operation up to 2500MT/s) |
| ☐ PS-X10-740-3PH ¹ | Interposer FS2512 DDR4 260-pin SODIMM interposer for logic configured for operation up to 2500 MT/s.

Requires qty (3) U4164A modules each with option U4164A-02G for data rates over 2500MT/s. (Requires qty (2) U4164A modules with option U4164A-01G for operation up to 2500MT/s) |

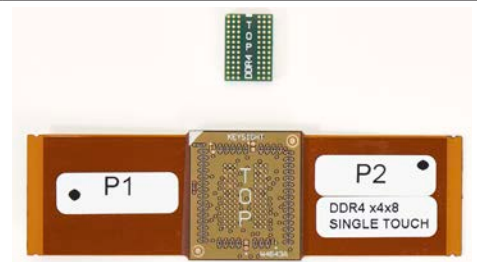


Order with FS1070 cable conversion kit to map headers to three U4164A modules for operation over 2500MT/s.

- | | |
|--|--|
| ☐ W4641A-001 quantity 1 | W4641A DDR4 x16 BGA interposer, 96-ball, 2-wing, for logic analyzers, connects to 61-pin ZIF. Requires 1 each U4208A and U4209A 61-pin ZIF probe/cables. |
| ☐ W4641A-002 quantity 2 | |
| ☐ W4641A-004 quantity 4 | |



- | | |
|--|--|
| ☐ W4643A-001 quantity 1 | W4643A DDR4 x4/x8 BGA interposer, 78-ball, 2-wing, for logic analyzers, connects to 61-pin ZIF. Requires 1 each U4208A and U4209A 61-pin ZIF probe/cables. |
| ☐ W4643A-002 quantity 2 | |
| ☐ W4643A-004 quantity 4 | |



A. Select Options for Probing to Connect to Your System Under Test (Continued)

Step 1. Select probing specific to your system under test		
☐	U4208A probe/cable, 61-pin ZIF, from left wing, no RC, 160-pin direct connect	One each required for either W4641A or W4643A DDR4 BGA interposers. 
☐	U4209A probe/cable, 61-pin ZIF, from right wing, no RC, 160-pin direct connect	One each required for either W4641A or W4643A DDR4 BGA interposers. 

1. PS-X10-xxx-xxx numbers are examples of consulting bundles sold in the United States. For country-specific ordering information and complete order descriptions, please contact Keysight. www.keysight.com/find/contactus.

B. Select Options for U4164A Logic Analyzer Module to Acquire Traces

Step 1. Start with U4164A logic analyzer module base configuration			
☐	Each U4164A logic analyzer module (occupies 1 slot) includes: Return to Keysight warranty – 3 years		
Step 2. Choose speed grade option			
☐		350 MHz state, included in base configuration of U4164A	
☐	U4164A-700	Increase maximum state speed to 700 MHz	
☐	U4164A-01G	Increase maximum speeds: state to 2.8 Gb/s (1.4 GHz) and timing to 10 GHz	
☐	U4164A-02G	Increase maximum speeds: state to 4 Gb/s (2.5 GHz) and timing to 10 GHz	
Step 3. Choose memory depth option			
☐		2M included in base configuration of U4164A	
☐	U4164A-004	Increase acquisition memory depth to 4 Mb	
☐	U4164A-008	Increase acquisition memory depth to 8 Mb	
☐	U4164A-016	Increase acquisition memory depth to 16 Mb	
☐	U4164A-032	Increase acquisition memory depth to 32 Mb	
☐	U4164A-064	Increase acquisition memory depth to 64 Mb	
☐	U4164A-128	Increase acquisition memory depth to 128 Mb	
☐	U4164A-200	Increase acquisition memory depth to 200 Mb	
☐	U4164A-400	Increase acquisition memory depth to 400 Mb	

C. Select a Chassis and Accessories

Step 1. Select a chassis - choose chassis based on number of slots required. Remember that embedded controllers fill one slot of a chassis.			
☐	M9505A	AXIe-5 slot chassis	
☐	M9502A	AXIe-2 slot chassis	

D. Select Controller

D1. Either AXIe embedded controller or external PC cable/adaptor)¹

Step 1. Select either M9537A or PCI Express cable and adapter combinations for laptop or desktop hosts

- ☐ The Keysight M9537A is an AXIe embedded controller. It provides a high-performance PCIe Gen2 link to the AXIe backplane and is a powerful one-slot computer that can be used to build compact AXIe systems.



Step 2. Upgrade from standard memory size (recommended)

For M9537A

- ☐ M9537A-M08 Memory standard

For M9537A

- ☐ M9537A-M16 Memory upgrade from 8 to 16 GB RAM

Step 3. Select an operating system

For M9537A

☐	M9537A-WE3	Windows embedded standard 7 (32-bit)
☐	M9537A-WE6	Windows embedded standard 7 (64-bit)

D. Select Controller (Continued)

D2. For an external PC controller, select options for desktop PC below ³

To use your desktop PC as a controller

☐ M9048A PCIe desktop adapter



☐ Y1202A PCIe cable



1. For a list of qualified external controllers, please see *PC Tested Configurations with PXI/AXIe Chassis - Technical Overview*, literature number 5990-7632EN.
2. The M9537A embedded controller occupies the first functional slot.
3. Not all M9502A and M9505A product options are shown above. See www.keysight.com/find/M9502A or www.keysight.com/find/M9505A for more details.

E. Select Software

E1. Download U4164A logic analyzer software

Start with Keysight logic and protocol analyzer software available for free download from www.keysight.com/find/U4164A from the Technical Support page and Drivers, Firmware & Software tab. Version 6.20 or higher is required for basic U4164A logic analyzer operation with B4661A memory analysis software.

☐ Logic and protocol analyzer software (64-bit)

E2. Select software for B4661A memory analysis software

Start with B4661A memory analysis base software available for free download from www.keysight.com/find/B4661A from the Technical Support link

- The B4661A memory analysis base software includes the following required tools:

 - DDR setup assistant for use tuning DDR and LPDDR state mode sample positions
 - Default configurations for standard DDR and LPDDR probes and interposers
 - DDR configuration creator for users with custom DDR and LPDDR configurations
 - DDR eye scan used in eye finder mode by DDR setup assistant for state mode sample position tuning. Allows manual eyefinder or eye scan scans for bus level signal integrity insight across all DDR or LPDDR signals probed by the logic analyser

Add recommended B4661A memory analysis software licensed options		
☐	B4661A-1FP	DDR decoder with physical address trigger tool, fixed perpetual license
☐	B4661A-1NP	DDR decoder with physical address trigger tool, network/floating perpetual license
☐	B4661A-1TP	DDR decoder with physical address trigger tool, transportable perpetual license
☐	B4661A-2FP	LPDDR decoder, fixed perpetual license
☐	B4661A-2NP	LPDDR decoder, network/floating perpetual license
☐	B4661A-2TP	LPDDR decoder, transportable perpetual license
☐	B4661A-3FP	DDR and LPDDR compliance violation analysis, fixed perpetual license
☐	B4661A-3NP	DDR and LPDDR compliance violation analysis, network/floating perpetual license
☐	B4661A-3TP	DDR and LPDDR compliance violation analysis, transportable perpetual license
☐	B4661A-4FP	DDR3/4 and LPDDR2/3/4 performance analysis, fixed perpetual license
☐	B4661A-4NP	DDR3/4 LPDDR2/3/4 performance analysis, network/floating perpetual license
☐	B4661A-4TP	DDR3/4 and LPDDR2/3/4 performance analysis, transportable perpetual license

F. Select Services, Warranty, Calibration, Startup Assistance

	Description
☐ PS-S10	Remote scheduled productivity assistance. Select 1 to 999 hours
☐ PS-S20	Startup assistance
☐ R-50C-011-3	Calibration assurance plan - Return to Keysight - 3 years
☐ R-50C-011-5	Calibration assurance plan - Return to Keysight - 5 years
☐ R-50C-021-3	ANSI Z540-1-1994 calibration - 3 years
☐ R-50C-021-5	ANSI Z540-1-1994 calibration - 5 years
☐ R-51B-001-5Z	Warranty assurance plan - Return to Keysight - 5 years

Note: Warranty and calibration options must be ordered for each individual component ordered for this solution. For example, if your solution includes an M9505A chassis, a M9037A controller, and three U4164A logic analyzers, and you want a five year warranty and Z540 calibration, you would order R-51B-001-5Z and R-50C-021-5 for each main item. Warranty extensions are not available for accessories such as the M9048A PCIe adapter, Y1202A PCIe cable, and BGA probes.

Global warranty

Keysight Technologies provides the peace of mind that today's high tech industry requires. Your investment is protected by Keysight's global reach in more than 100 countries (either directly or through distributors). The warranty gives you convenient standard coverage for the country in which the product is used, eliminating the need to ship equipment back to the country of purchase. Keysight's warranty service provides:

- All parts and labor necessary to return your investment to full specified performance
- Recalibration for products supplied originally with a calibration certificate
- Return shipment

Express warranty

Reduce downtime with the faster repair service in the industry. The express warranty upgrades the global warranty to provide:

- 5 day typical turnaround repair service in the US, Japan, China and many EU countries or up to a 10-day improvement in turnaround time in the rest of the world
- Priority return shipment

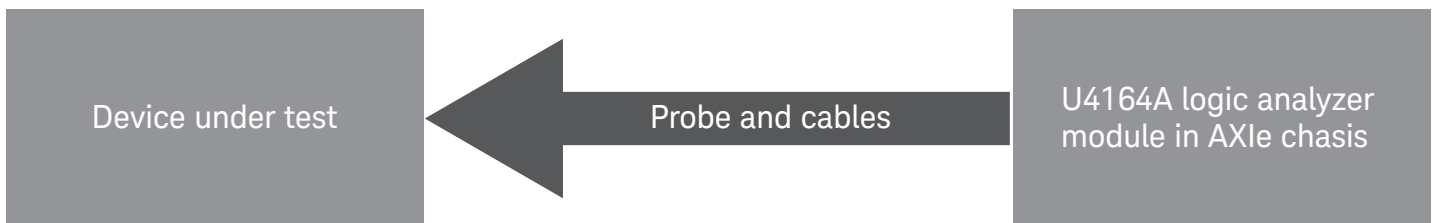
One day start-up assistance

A Keysight applications engineer will get you started quickly by helping you install the modules in a chassis, configure the controller, load software and start making measurements.

Calibration services

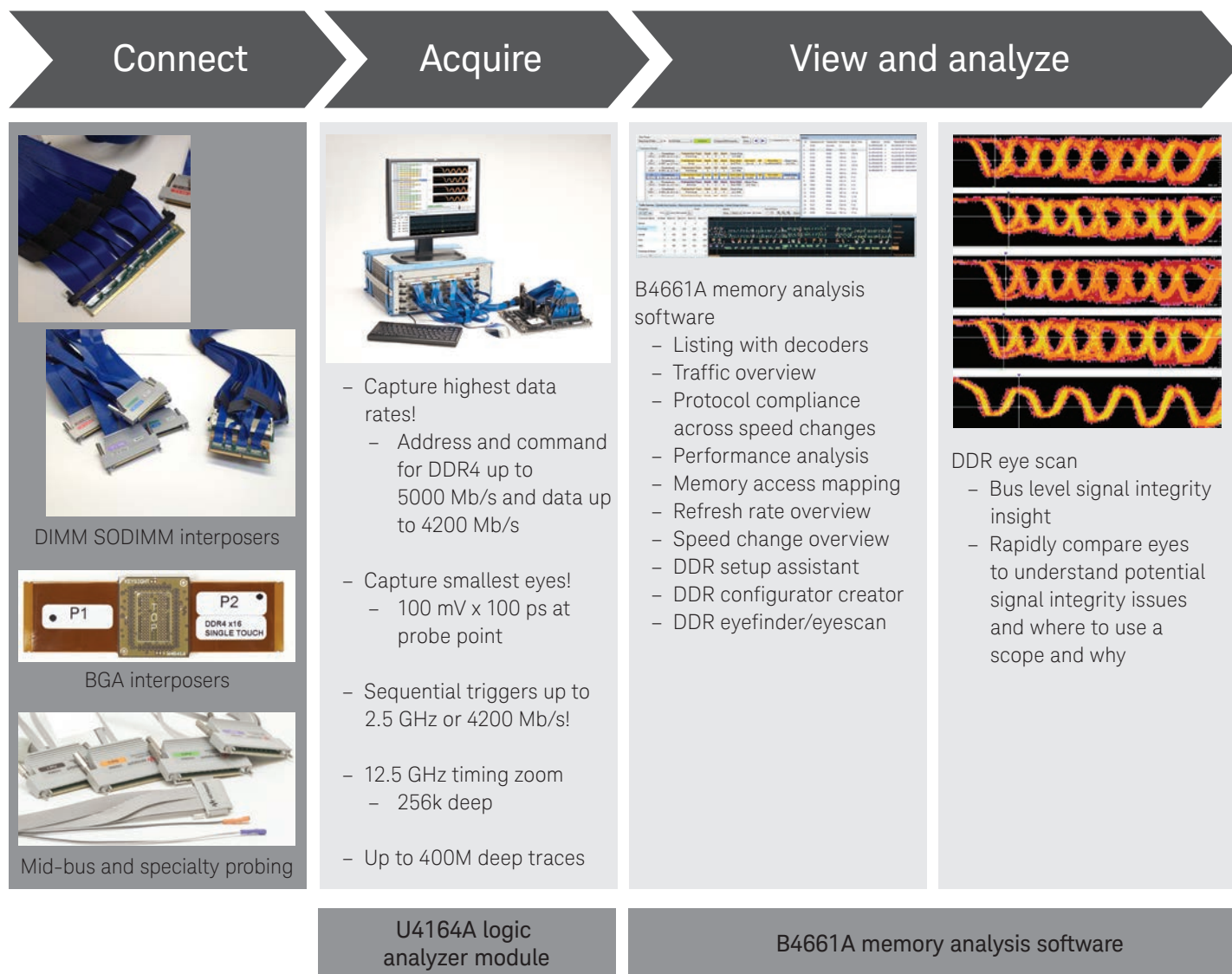
The modular products are factory calibrated and shipped with an ISO-9002, NIST-traceable calibration certificate. A two year calibration cycle is recommended for the U4164A logic analyzer module.

G. Physical Connections



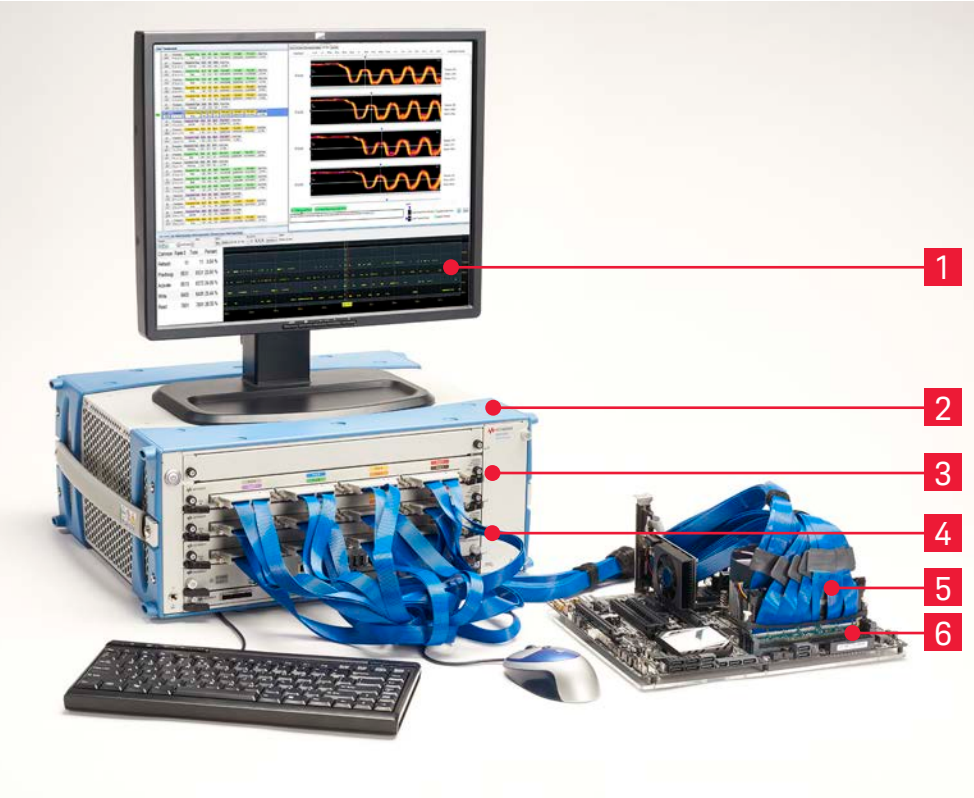
H. Configurations

Solution architecture



- Connect to your system by selecting probing specific for your device under test.¹
- Acquire trace captures using the U4164A module(s) in an M9502A/05A chassis with a host controller. The number of U4164A modules varies depending on the probing and data rate required.
- View and analyze your traces using the B4661A memory analysis software.

Recommended configuration for DDR4 DIMM ADD/CMD/DQ capture for data rates up to and including 4200 Mb/s



- 1. User-supplied monitor
- 2. M9505A five-slot chassis (qty 1)
- 3. U4164A module (qty 3)
- 4. M9537A (qty 1)
- 5. FS2520 DDR4 DIMM interposer or FS2510AB DDR4 DIMM interposer with FS1070 conversion for use with three modules (qty 1)
- 6. Device under test

Hardware

Model	Quantity	Description
U4164A	3	136-channel logic analyzer module
U4164A-02G	3	Speed grade option for 2.5 GHz clocking and 4 Gb/s data capture
U4164A-008	3	Increase acquisition memory depth to 8 Mb
PS-X10-650-3PH	1	Interposer FS2520 DDR4 4Gb/s 288 pin DIMM accessory for logic analyzer
M9505A	1	5-slot AXIe-based chassis
M9537A	1	Embedded controller

Software

Model	Quantity	Description
Version 6.20 or higher	1	Logic and protocol analyzer software (64-bit)
B4661A	1	Memory analysis software
B4661A-1FP	1	DDR decoder with physical address trigger tool, fixed perpetual license
B4661A-3FP	1	DDR and LPDDR compliance violation analysis, fixed perpetual license
B4661A-4FP	1	DDR3/4 and LPDDR2/3/4 performance analysis, fixed perpetual license

Recommended configuration for DDR4 x4/x8 DRAM ADD/CMD/DQ capture for data rates up to and including 3200 Mb/s



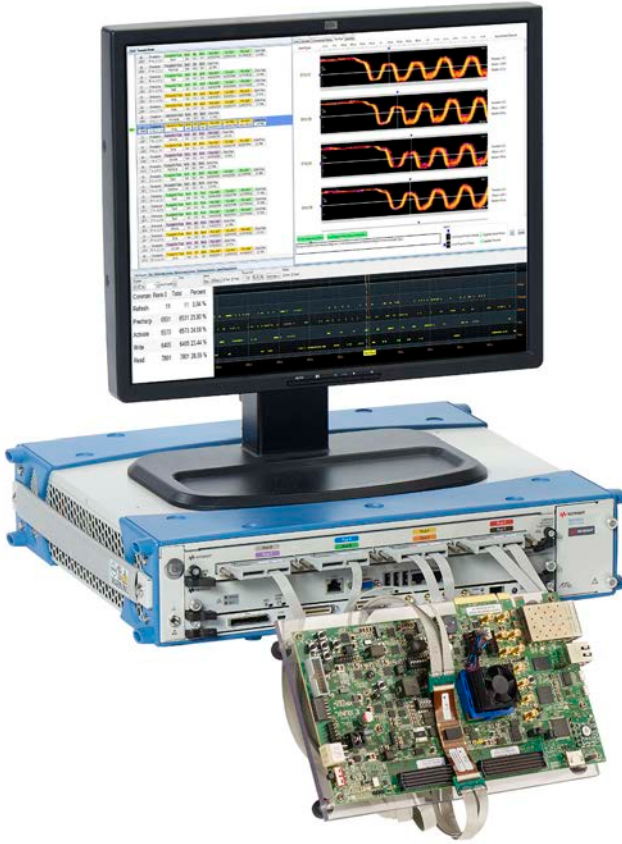
Hardware

Model	Quantity	Description
U4164A	1	136-channel logic analyzer module
U4164A-02G	1	Speed grade option for 2.5 GHz clocking and 4 Gb/s data capture
U4164A-008	1	Increase acquisition memory depth to 8 Mb
W4643A-001	1	W4643A DDR4 x4/x8 BGA interposer for logic analyzer, connects to 61-pin ZIF, quantity 1
U4208A	1	U4208A probe/cable, 61-pin ZIF, from left wing, no RC, 160-pin direct connect
U4209A	1	U4209A probe/cable, 61-pin ZIF, from right wing, no RC, 160-pin direct connect
M9502A	1	2-slot AXIe-based chassis
M9537A	1	Embedded controller

Software

Model	Quantity	Description
Version 6.20 or higher	1	Logic and protocol analyzer software (64-bit)
B4661A	1	Memory analysis software
B4661A-1FP	1	DDR decoder with physical address trigger tool, fixed perpetual license
B4661A-3FP	1	DDR and LPDDR compliance violation analysis, fixed perpetual license
B4661A-4FP	1	DDR3/4 and LPDDR2/3/4 performance analysis, fixed perpetual license

Recommended configuration for DDR4 x16 DRAM ADD/CMD/DQ capture for data rates up to and including 3200 Mb/s



Hardware

Model	Quantity	Description
U4164A	1	136-channel logic analyzer module
U4164A-02G	1	Speed grade option for 2.5 GHz clocking and 4 Gb/s data capture
U4164A-008	1	Increase acquisition memory depth to 8 Mb
W4641A-001	1	W4641A DDR4 x16 BGA interposer for logic analyzer, connects to 61-pin ZIF, quantity 1
U4208A	1	U4208A probe/cable, 61-pin ZIF, from left wing, no RC, 160-pin direct connect
U4209A	1	U4209A probe/cable, 61pin ZIF, from right wing, no RC, 160-pin direct connect
M9502A	1	2-slot AXIe-based chassis
M9537A	1	Embedded controller

Software

Model	Quantity	Description
Version 6.20 or higher	1	Logic and protocol analyzer software (64-bit)
B4661A	1	Memory analysis software
B4661A-1FP	1	DDR decoder with physical address trigger tool, fixed perpetual license
B4661A-3FP	1	DDR and LPDDR compliance violation analysis, fixed perpetual license
B4661A-4FP	1	DDR3/4 and LPDDR2/3/4 performance analysis, fixed perpetual license

I. PC Requirements

Please refer to the *PC Tested Configurations with PXI/AXIe Chassis - Technical Overview*, document number 5990-7632EN, for PC compatibility and requirements when hosting the M9502A or M9505A chassis from an external PC.

J. Related Literature

Publication title	Publication number
<i>Probing Solutions for Logic Analyzers - Data Sheet</i>	5968-4632E
<i>Infiniium 90000 X-Series Oscilloscopes - Data Sheet</i>	5990-5271EN
<i>PC Tested Configurations with PXI/AXIe Chassis - Technical Overview</i>	5990-7632EN
<i>Capture Highest DDR3 Data Rates Using Advanced Probe Settings on Logic Analyzers - Technical Brief</i>	5991-0799EN
<i>W4640A and W4630A Series DDR4 BGA Interposers for Logic Analyzers - Data Sheet</i>	5991-4258EN
<i>B4661A Memory Analysis Software for Logic Analyzers - Data Sheet</i>	5992-0984EN
<i>U4164A Logic Analyzer Module - Data Sheet</i>	5992-1057EN
<i>Keysight U4200A-Series Probes and Cables User Guide</i>	U4200-97000



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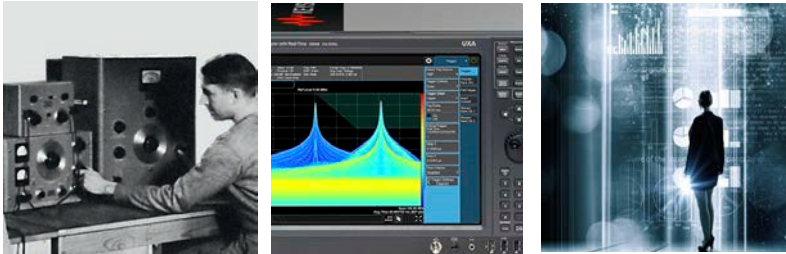
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