Keysight M8290A Optical Modulation Analyzer and High-Speed Digitizer Test Solution

Getting Started Guide

KEYSIGHT TECHNOLOGIES

Notices

Manual Part Number

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Safety Notices

CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Safety Summary

General Safety Precautions

The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. For safe operation, the general safety precautions for the M9502A and M9505A AXIe chassis, must be followed.

See: http://www.keysight.com/find/M9505A

Keysight Technologies Inc. assumes no liability for the customer's failure to comply with these requirements. Before operation, review the instrument and manual for safety markings and instructions. You must follow these to ensure safe operation and to maintain the instrument in safe condition.

Initial Inspection

Inspect the shipping container for damage. If there is damage to the container or cushioning, keep them until you have checked the contents of the shipment for completeness and verified the instrument both mechanically and electrically. The Performance Tests give procedures for checking the operation of the instrument. If the contents are incomplete, mechanical damage or defect is apparent, or if an instrument does not pass the operator's checks, notify the nearest Keysight Technologies Sales/Service Office.

WARNING To avoid hazardous electrical shock, do not perform electrical tests when there are signs of shipping damage to any portion of the outer enclosure (covers, panels, etc.).

General

This product is a Safety Class 3 instrument. The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

Environment Conditions

This instrument is intended for indoor use in an installation category II, pollution degree 2 environment. It is designed to operate within a temperature range of 5 °C – 35 °C (41 °F – 95 °F) at a maximum relative humidity of 80% and at altitudes of up to 2000 meters.

This module can be stored or shipped at temperatures between -40 °C and +70 °C. Protect the module from temperature extremes that may cause condensation within it.

Ground the Instrument

To minimize shock hazard, the instrument chassis and cover must be connected to an electrical protective earth ground. The instrument must be connected to the ac power mains through a grounded power cable, with the ground wire firmly connected to an electrical ground (safety ground) at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

Before Applying Power

Verify that all safety precautions are taken including those defined for the mainframe. The power cable inlet of the instrument serves as a device to disconnect from the mains in case of hazard. The instrument must be positioned so that the operator can easily access the power cable inlet. When the instrument is rack-mounted, the rack must be provided with an easily accessible mains switch.

Line Power Requirements

The Keysight M829xA modules operate when installed in a Keysight AXIe mainframe.

Do Not Operate in an Explosive Atmosphere

Do not operate the instrument in the presence of flammable gases or fumes.

Do Not Remove the Instrument Cover

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made only by qualified personnel.

Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

General Safety Considerations

Intended Use

This instrument is intended to use in an office or laboratory environment, under the environmental conditions listed in the specifications.

Safety Symbols

CAUTION

The caution sign denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in damage to or destruction of the product. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

WARNING

The warning sign denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning sign until the indicated conditions are fully understood and met.

Instrument Markings

Table 1 Instrument Markings

Symbol	Description
	Indicates warning or caution. If you see this symbol on a product, you must refer to the manuals for specific Warning or Caution information to avoid personal injury or damage to the product.
	The laser radiation symbol. This warning symbol is marked on products which have a laser output.
	The electrostatic discharge symbol. This warning symbol is marked on products which have components that can be damaged by an electrostatic discharge.

Symbol	Description
	Indicates the time period during which no hazardous or toxic substance elements are expected to leak or deteriorate during normal use. Forty years is the expected useful life of the product.
	The C-Tick mark is the certification mark of the Australian Communications Authority.
	The RCM Mark is a compliance mark to the ACMA (Australian Spectrum Management Agency). This indicates compliance with all Australian EMC regulatory information.
	CSA is the Canadian certification mark to demonstrate compliance with the Safety requirements.
	The earthing symbol marks a connection that is connected, through the instrument, to the earth of the line power.
	CE compliance marking to the EU Safety and EMC Directives. ISM GRP-1A classification according to the international EMC standard. ICES/NMB-001 compliance marking to the Canadian EMC standard.
	This symbol on all primary and secondary packaging indicates compliance to China standard GB 18455-2001.

Compliance and Environmental Information

Table 2 Compliance and Environmental Information

Safety Symbol	Description
	This product complies with WEEE Directive (2002/96/EC) marking requirements. The affixed label indicates that you must not discard this electrical/electronic product in domestic household waste. Product Category: With reference to the equipment types in WEEE Directive Annex I, this product is classed as a “Monitoring and Control instrumentation” product. Do not dispose in domestic household waste. To return unwanted products, contact your local Keysight office, or see http://about.keysight.com/en/companyinfo/environment/takeback.shtml for more information.

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Keysight M8290A Optical Modulation Analyzer and High-Speed Digitizer Test Solution

Getting Started Guide

1 Introduction

Introduction

The M8290A rack-mountable modular coherent test system for the AXIe platform is designed to address the 400G speed class in a significantly narrower form factor and a more attractive price point than today's oscilloscope-based solutions for this speed class.

For coherent transmitter and receiver testing, the M8292A compact optical modulation analyzer and M8296A high speed digitizer fill the gap between the portable N4392A integrated optical modulation analyzer for 100G and the real-time oscilloscope-based N4391A optical modulation analyzer supporting speed classes of 400G, 600G and 1 Terabit per second.

The compact and modular approach makes the M8290A optical modulation analyzer and high-speed digitizer test solution an ideal system for coherent transmitter signal qualification for EVM and related parameters as well as for component characterization like ICR, PMQ or even fully-assembled CFPx-ACO modules. The modular concept addresses the needs of development teams, new product introduction groups and production test engineers looking for affordable test equipment for 400G. The M8290A modular coherent test solution provides a combination of compactness, affordability and performance that cannot be achieved with current oscilloscope-based solutions in this speed class.

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In the M8290A system configuration, the M8292A optical modulation analyzer module (a 2-slot AXIe module) and a 4-channel single-slot electrical digitizer module are available, both operating at 92 GSa/s sampling rate.

Getting Started

The M829xA is a modular instrument packaged in the AXIe form factor. AXIe is an open standard for high-performance modular instrumentation. Different form factors of AXIe chassis are available: 13-slot, 5-slot and 2-slot AXIe chassis.

The M8290A Coherent Test Solution comprises an M9537A AXIe embedded controller. This controller can control one or multiple M829xA and consumes one module slot of the AXIe chassis. The M8290A Coherent Test Solution comes with all required software pre-installed and configured at the factory. Therefore, the information given in Chapter 2 and Chapter 3 of this guide is only relevant if the user wishes to reinstall a software package or change the system configuration.

Login details for the embedded controller:

- Username: M8290a_admin
- Password: admin!123

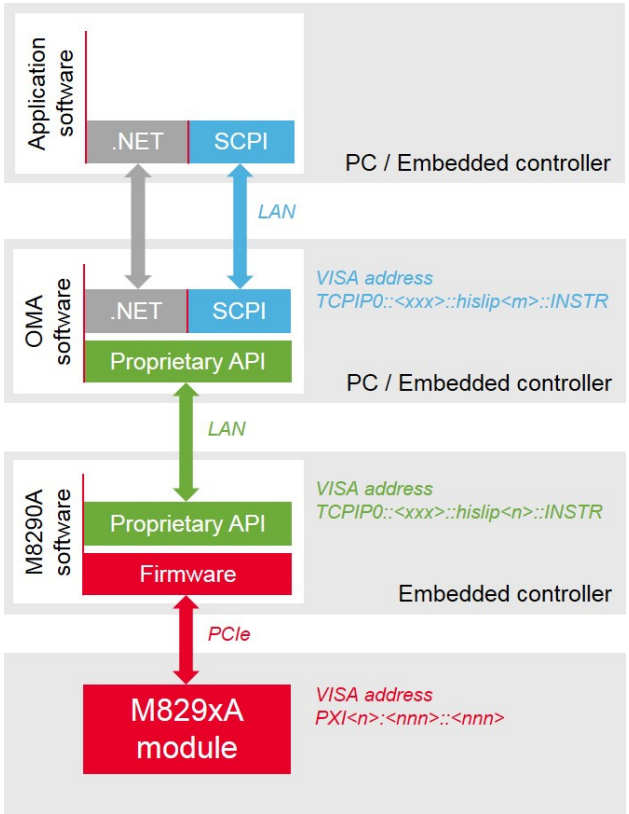
Additional Documents

Additional documentation can be found at:

- http://www.keysight.com/find/M9514A for 14-slot chassis related documentation.
- http://www.keysight.com/find/M9505A for 5-slot chassis related documentation.
- http://www.keysight.com/find/M9502A for 2-slot chassis related documentation.
- http://www.keysight.com/find/M9537A for embedded AXIe controller related documentation.
- http://www.keysight.com/find/M8290A for optical modulation analyzer and high-speed digitizer test solution related documentation
- http://www.keysight.com/find/M8292A for AXIe based modular optical modulation analyzer related documentation
- http://www.keysight.com/find/M8296A for AXIe based electrical high-speed digitizer related documentation

2 Software Installation

The M8290A coherent test solution uses a layered software architecture, which is illustrated below, that requires multiple software packages to be installed. This chapter explains how to install and configure these packages. However, in general, they are pre-installed at the factory. Therefore, the installation process described here only needs to be completed if the user wishes to reconfigure the system.



Pre-Requisites

The following are the pre-requisites for installing the Keysight M8290A software:

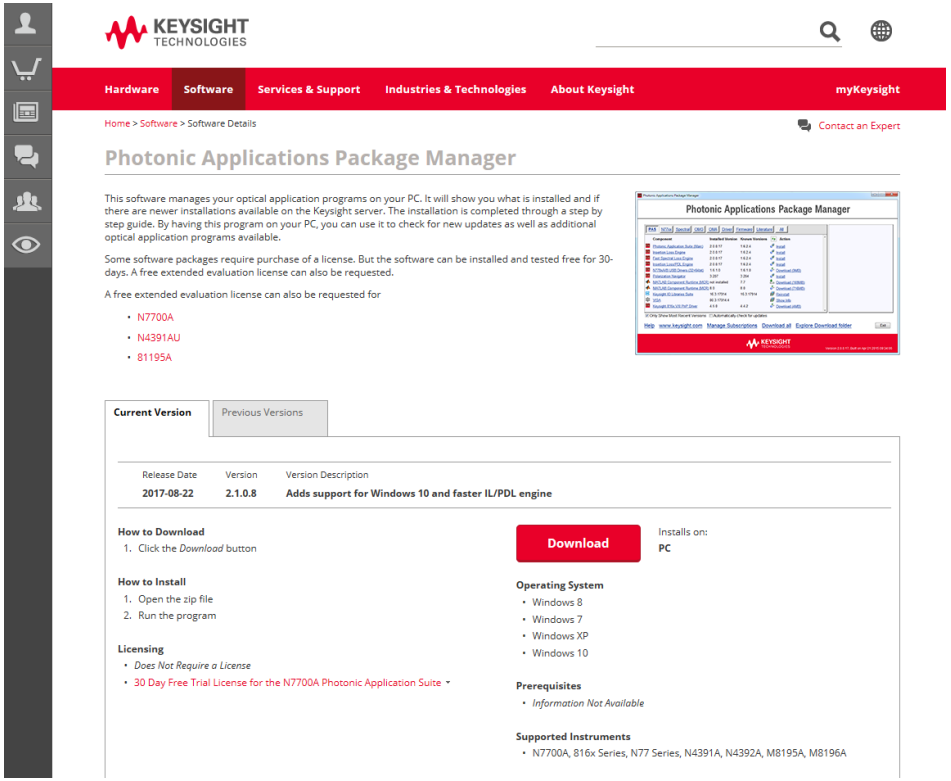
- The supported operating systems are:
  - Windows 10 (32 bit or 64 bit)
  - Windows 8.1 (32 bit or 64 bit)
  - Windows 8 (32 bit or 64 bit)
  - Windows 7 (32 bit or 64 bit)
- Ensure that you have Keysight IO Libraries Suite Version 17.3 or higher installed on your system. The Keysight IO Libraries Suite can be found at http://www.keysight.com/find/iosuite.

NOTE Even if a non-Keysight I/O library is already installed on your PC, it is still necessary to install the Keysight I/O library. The Keysight I/O library will install as "secondary" I/O library in this case. This use case is fully supported.

Downloading the Photonic Application Suite Package Manager

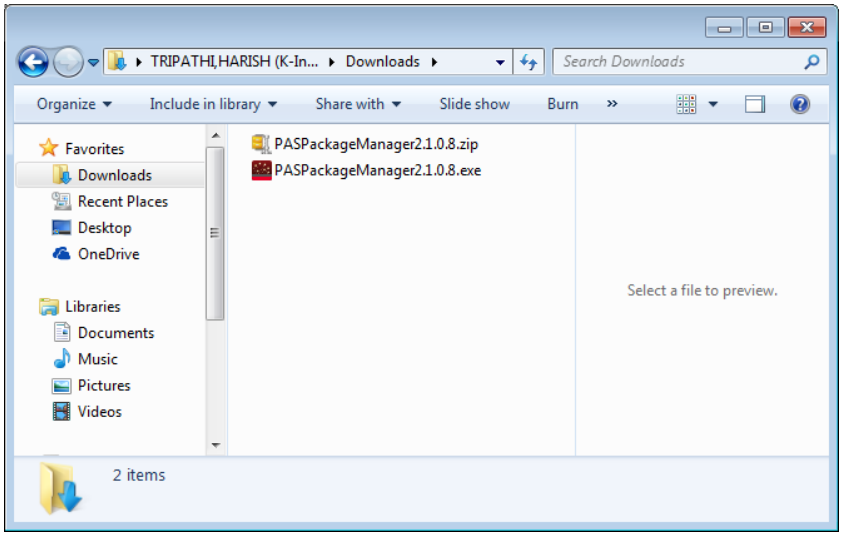
The Photonic Application Suite (PAS) Package Manager is required to select and download software packages for proper operation of the OMA. Skip this section if the PAS Package Manager is already present on the system.

1 Visit the PAS Package Manager web page at www.keysight.com/find/photonic-sw, select the **Current Version** tab, and click on the **Download** button to start the download process.

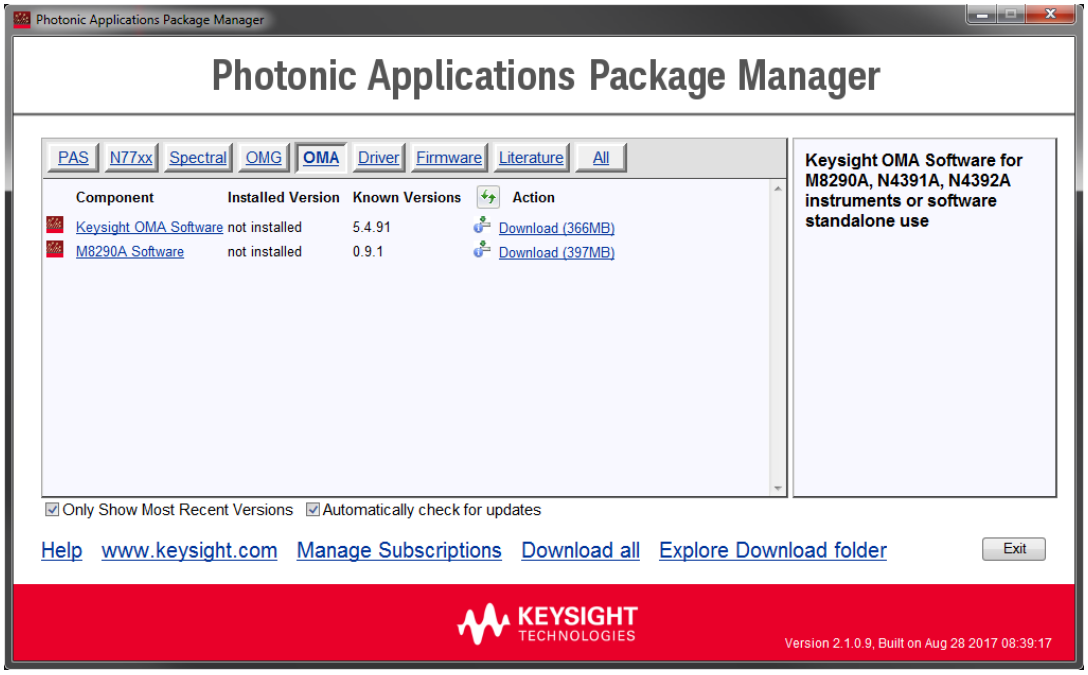


2 Click on the **Open** button to open the zip file.

3 Unzip the file and double-click on the executable file to run the PAS Package Manager.



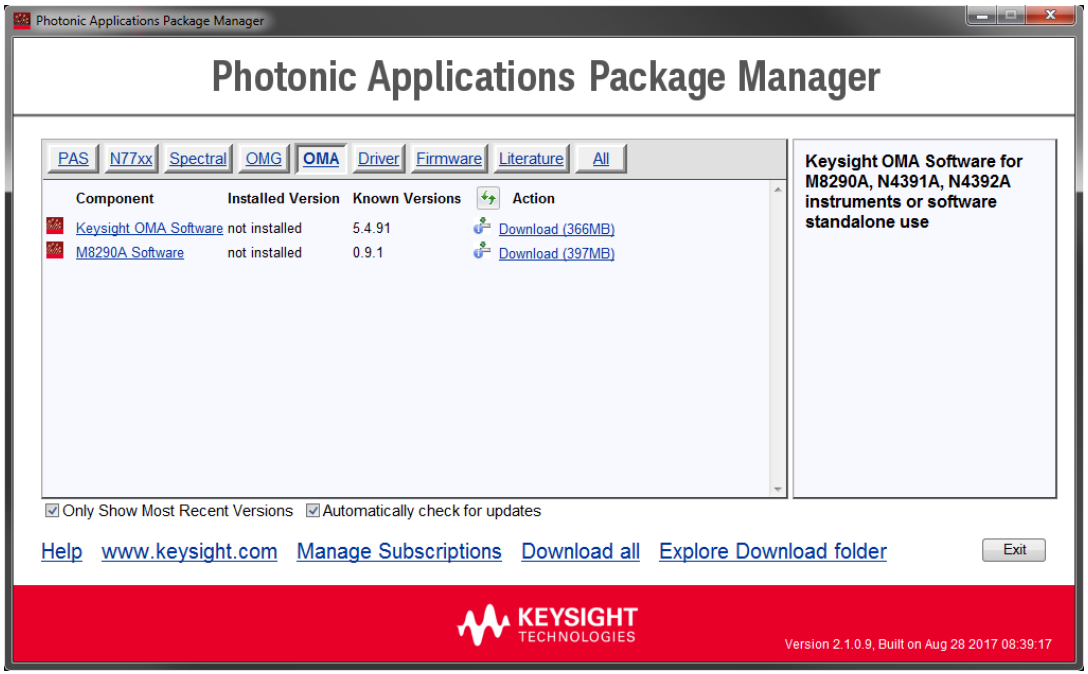
4 Start the **PAS Package Manager** as administrator and select the **OMA** tab to see all possible OMA packages.



M8290A Software Installation

Follow the steps below to install the Keysight M8290A software on your system:

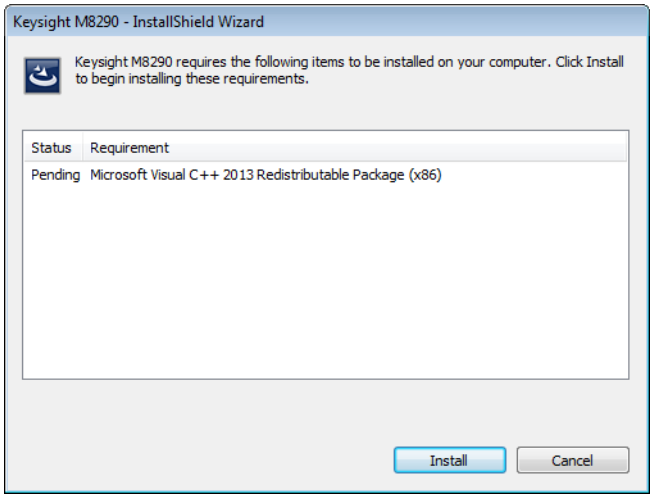
1 Start the **PAS Package Manager** as administrator, if it is not already open and select the **OMA** tab to see all possible OMA packages.



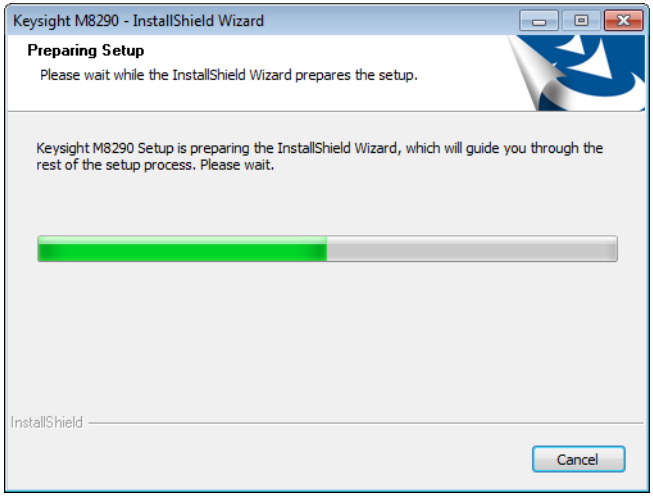
2 Select the "**M8290A Software**".

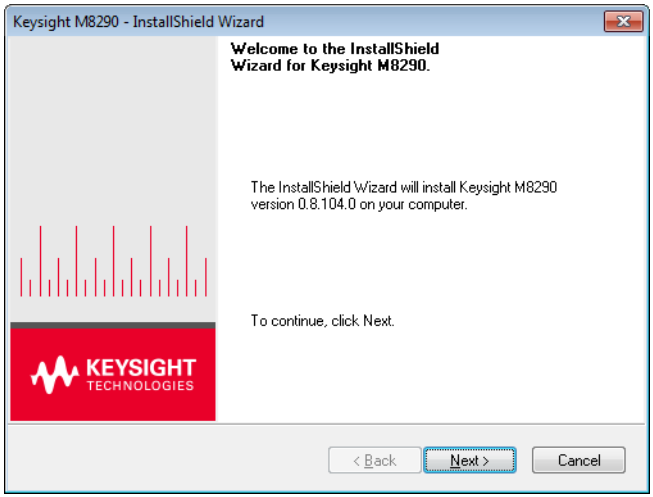
3 Click on the **Download** link.

4 Continue following the installation instructions. The installer will first check for and list some pre-requisites. Click **Install** to install them. If the embedded controller requests you to reboot, please do so immediately.

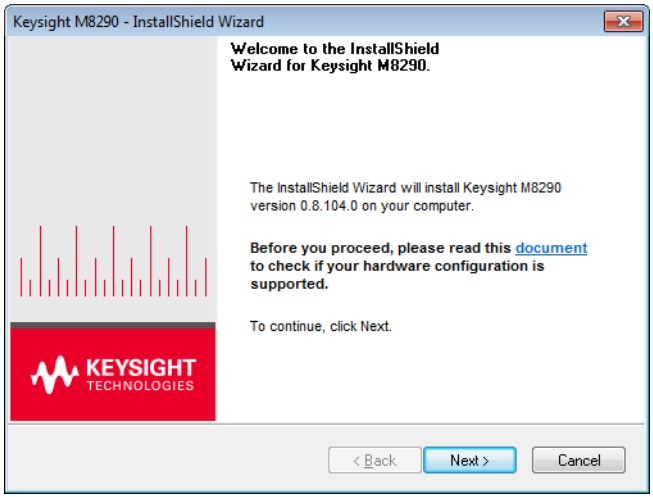


5 The Keysight **M8290A Setup** will prepare the **InstallShield Wizard** for the installation process. The following screen will appear.

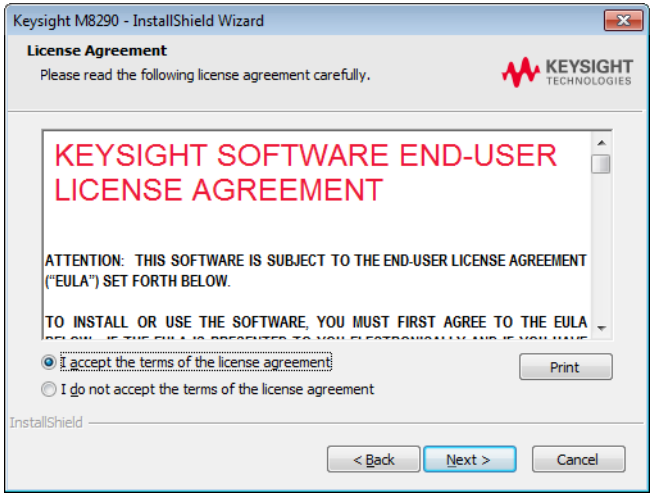




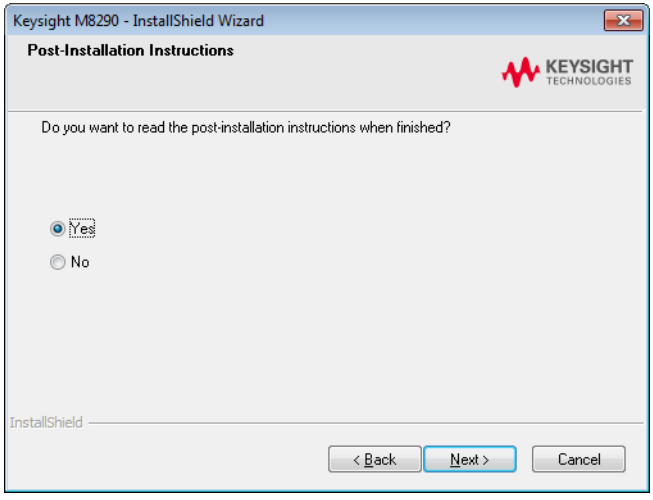
6 Click **Next**. The following screen will appear:



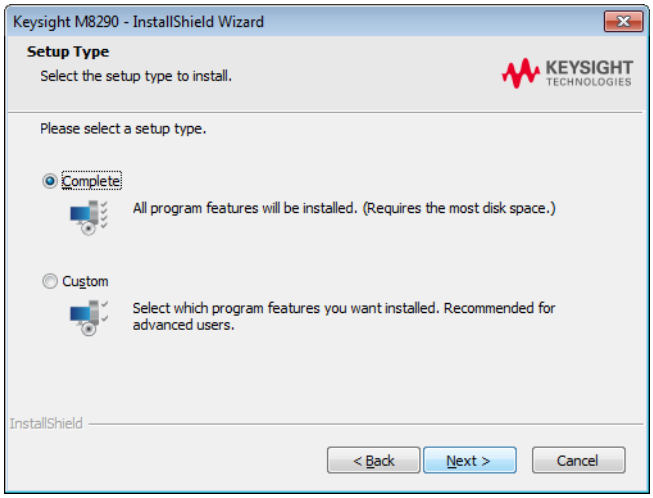
7 Click **Next** to proceed to the license agreements.



8 Accept the terms of '**Keysight Software End-User License Agreement**' and click **Next**. The following screen will appear:

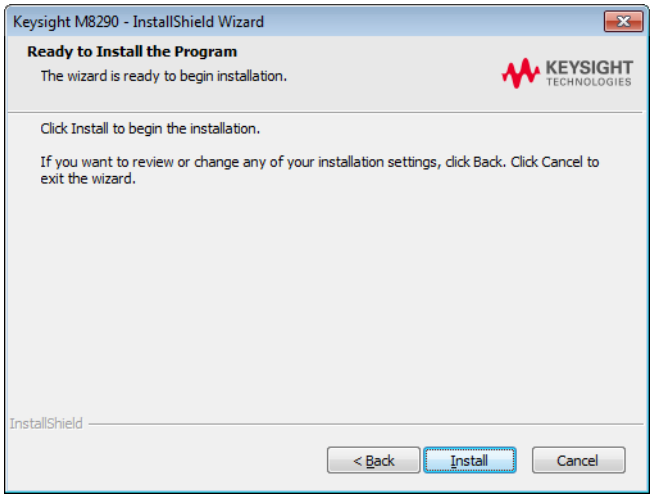


9 Select **Yes** if you want to read the post-installation instructions and click **Next**. The following screen will appear:

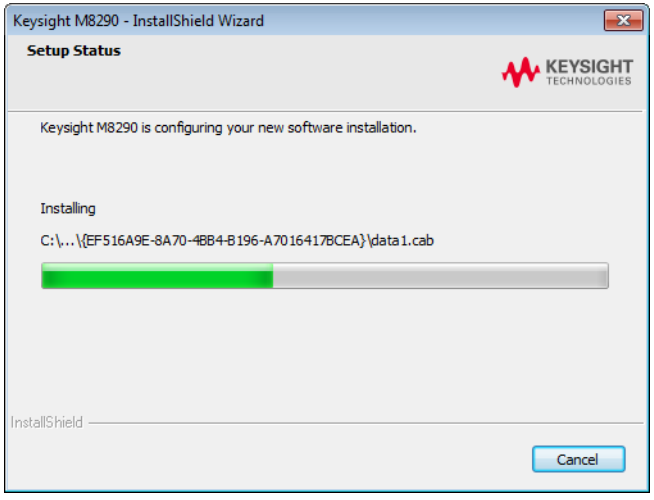


10 Select a setup type of either **Complete** or **Custom**. If you select **Complete**, the M8290A documentation will be installed along with the M8290A software and a shortcut to the PAS Package Manager will be added to the Start menu. If you select **Custom** instead, you can specify which of the optional features to install.

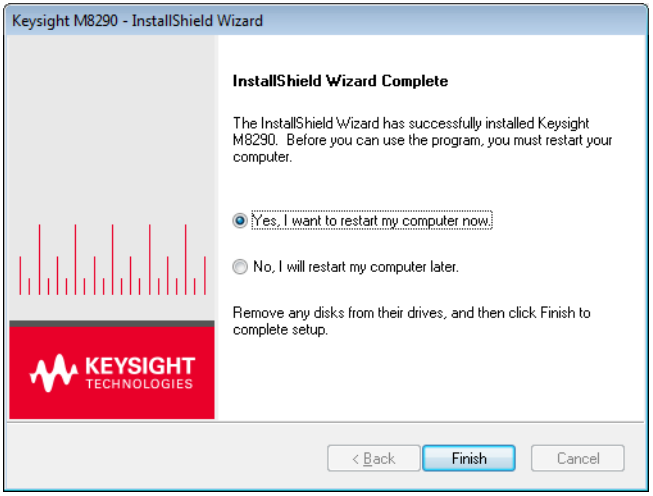
11 Click **Next**. The following screen will appear:



12 Click **Install** to begin the software installation. The **Setup Wizard** will now install the M8290A software.



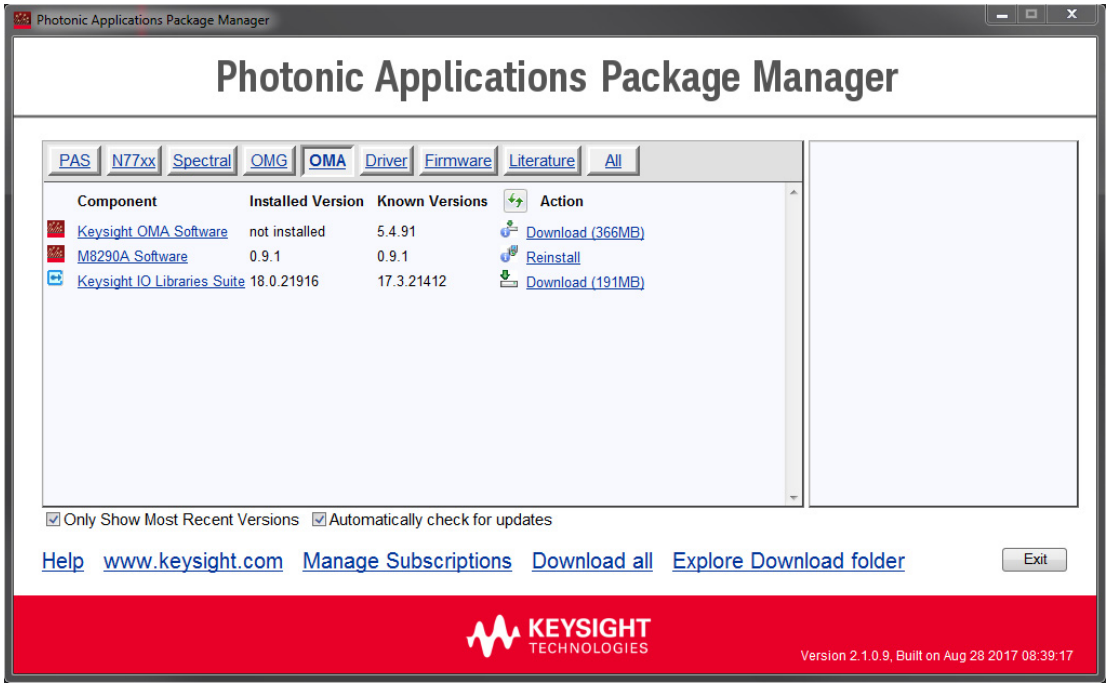
13 The following screen will appear once the Keysight M8290A software is successfully installed on your system.



14 Click **Finish** to restart your system. This completes the Keysight M8290A software installation.

Installing the Keysight OMA Software

1 Start the **PAS Package Manager** as administrator, if it is not already open and select the **OMA** tab to see all possible OMA packages.

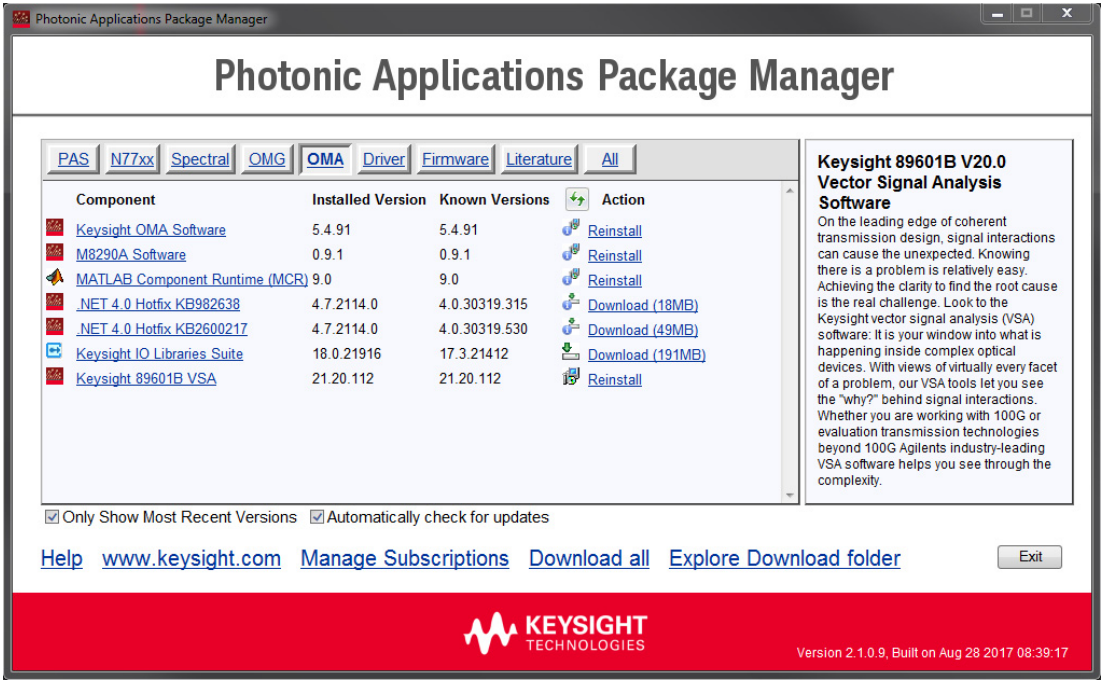


2 Select the "**Keysight OMA Software**".

3 Click on the **Download** link.

4 Continue following the installation instructions and always select the default settings. The **PAS Package Manager** will install additional drivers and software required to install the OMA software. During the OMA installation, select **M8290A Hardware** as setup type. You may postpone all system restarts until the installation has been completed.

5 When the installation has been completed, verify that the **PAS Package Manager** lists all installed components with an "Installed Version". If any of them is not listed, please launch the installation of the missing package again.


Photonic Applications Package Manager
Photonic Applications Package Manager
PAS
N77xx
Spectral
OMG
OMA
Driver
Firmware
Literature
All
Component
Installed Version
Known Versions
Action
Keysight OMA Software
5.4.91
5.4.91
Reinstall
M8290A Software
0.9.1
0.9.1
Reinstall
MATLAB Component Runtime (MCR)
9.0
9.0
Reinstall
.NET 4.0 Hotfix KB982638
4.7.2114.0
4.0.30319.315
Download (18MB)
.NET 4.0 Hotfix KB2600217
4.7.2114.0
4.0.30319.530
Download (49MB)
Keysight IO Libraries Suite
18.0.21916
17.3.21412
Download (191MB)
Keysight 89601B VSA
21.20.112
21.20.112
Reinstall
Keysight 89601B V20.0 Vector Signal Analysis Software
On the leading edge of coherent transmission design, signal interactions can cause the unexpected. Knowing there is a problem is relatively easy. Achieving the clarity to find the root cause is the real challenge. Look to the Keysight vector signal analysis (VSA) software: It is your window into what is happening inside complex optical devices. With views of virtually every facet of a problem, our VSA tools let you see the "why?" behind signal interactions. Whether you are working with 100G or evaluation transmission technologies beyond 100G Agilents industry-leading VSA software helps you see through the complexity.
Only Show Most Recent Versions
Automatically check for updates
Help
www.keysight.com
Manage Subscriptions
Download all
Explore Download folder
Exit
KEYSIGHT TECHNOLOGIES
Version 2.1.0.9, Built on Aug 28 2017 08:39:17

Post Installation Steps

Follow the post installation steps as shown below:

1 Shut down the embedded controller.

2 Reboot the AXIe chassis.

3 The embedded controller should automatically recognize all available M829xA modules. You may check this in the device manager; e.g. via **Start** > **Control Panel** > **Device Manager**, or right-click **Computer** > **Manage** > **Device Manager**.

   The instruments should be visible in the device tree as **Keysight Technologies Modular Devices** > **M8296A** or **M8292A** respectively.

4 Check if all installed M829xA modules are visible in the **Connection Expert**. The connection expert can be opened by clicking its icon in the system tray.

   If something went wrong and any of the instruments does not appear in the PXI section, it may be necessary to reboot the embedded controller once more.

NOTE To successfully connect the M829xA to the PC, the post installation steps mentioned above must be strictly followed.

NOTE Reboot your PC immediately, if requested to do so.

3 Using the Instrument

How to use the Instrument

In order to use the instrument:

1 Turn on the AXIe chassis.

2 Start a separate instance of the M8290A Software (**Start** > **All Programs** > **Keysight M8290** > **Keysight M8290 Software**) for each M829xA module installed in the system. The user interface will display the VISA resource details required to set up the instrument in the **Connection Expert**.

3 Add the M829xA to the **Connection Expert** as described in section Adding the M829xA to the Connection Expert on page 30. This step is required to access the instrument from the Keysight OMA software.

4 Start the Keysight OMA software and set up the instrument connection as described in the section Setting up the M829xA in the Keysight OMA Software on page 32.

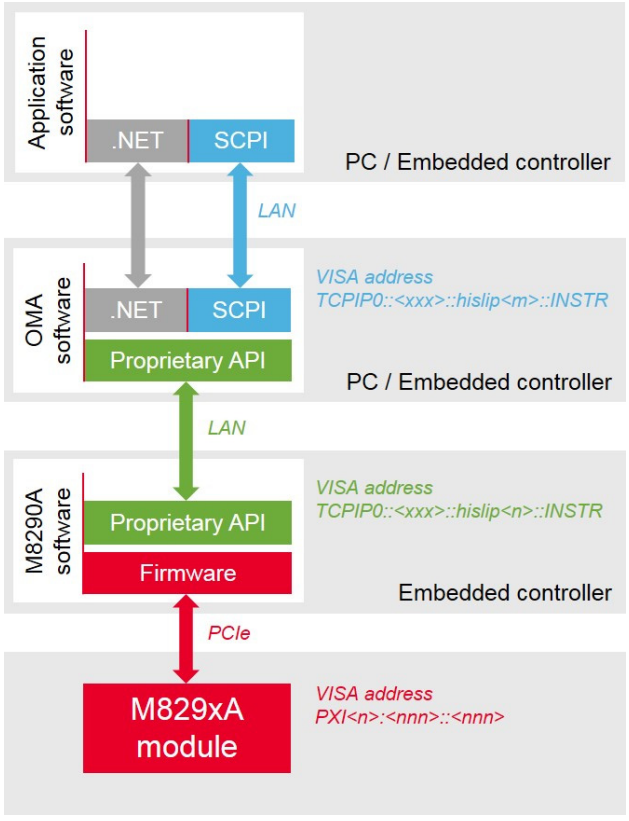
NOTE To show in the Keysight OMA Software, the module must have been added to the Connection Expert as a LAN instrument. Socket connections are not supported.

NOTE Always close the M8290A Software and shut down the embedded controller prior to switching off the AXIe chassis.

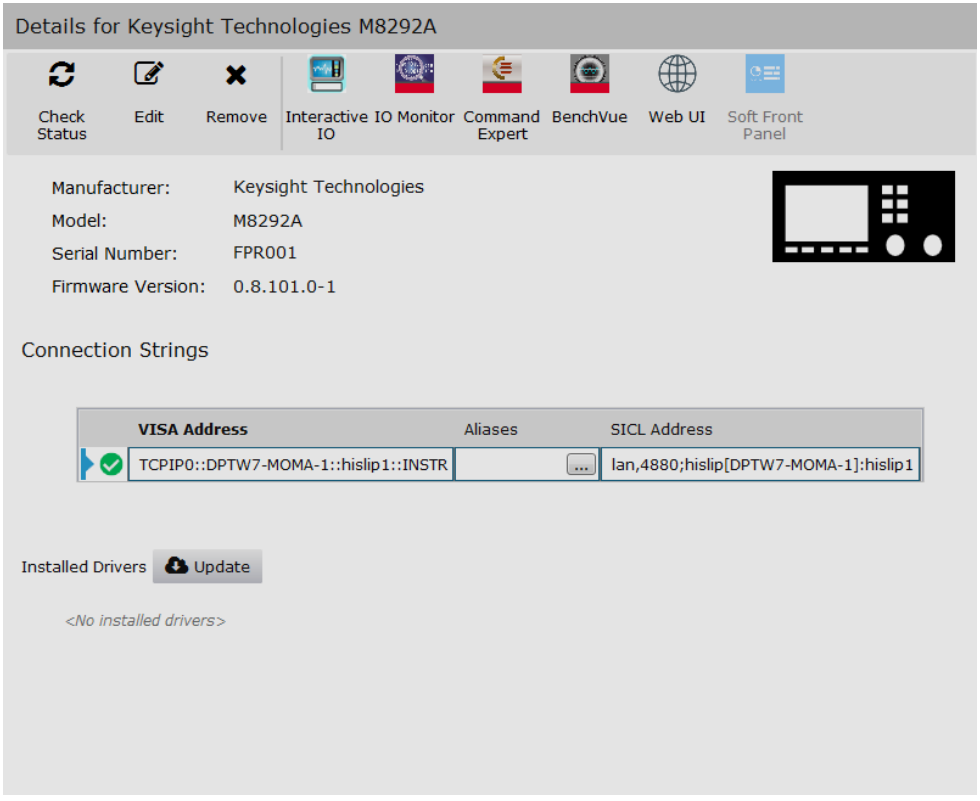
Adding the M829xA to the Connection Expert

A standard M8290A system is pre-configured at the factory. This section shows how to modify the factory configuration or to configure a stand-alone module.

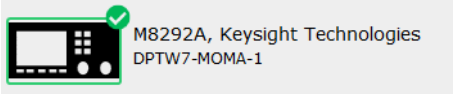
1. Open the **Connection Expert** by clicking its icon ( ) in the system tray and selecting the corresponding item from the context menu.
2. Click on the **Add** (Add) button in the "**My Instruments**" section and select **LAN instrument** from the drop-down list.
3. Go to the 'Enter Address' tab.
4. Enter the hostname or the IP address of the embedded controller running the M8290A software. Then set the Protocol to HiSlip and enter the remote name as displayed on the M8290A Software user interface.



5 Hit the **OK** button. You should now be able to view the instrument details within the **Connection Expert** as indicated below.



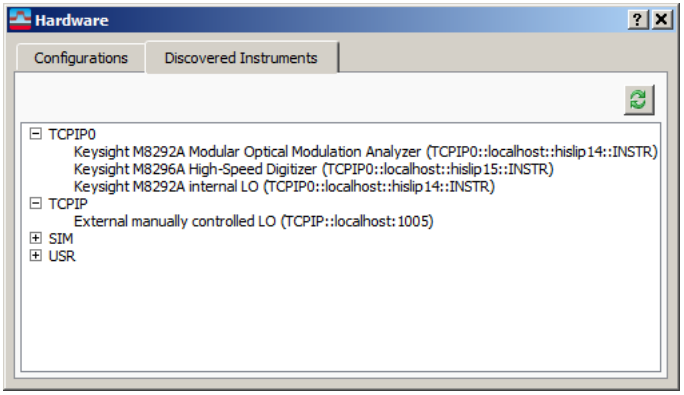
6 Verify that the instrument details shown in the **Connection Expert** are correct and that the instrument is listed with a green check mark in the "**My Instruments**" section. If so, the instrument is ready to be connected to the Keysight OMA Software as described in the following section.



Setting up the M829xA in the Keysight OMA Software

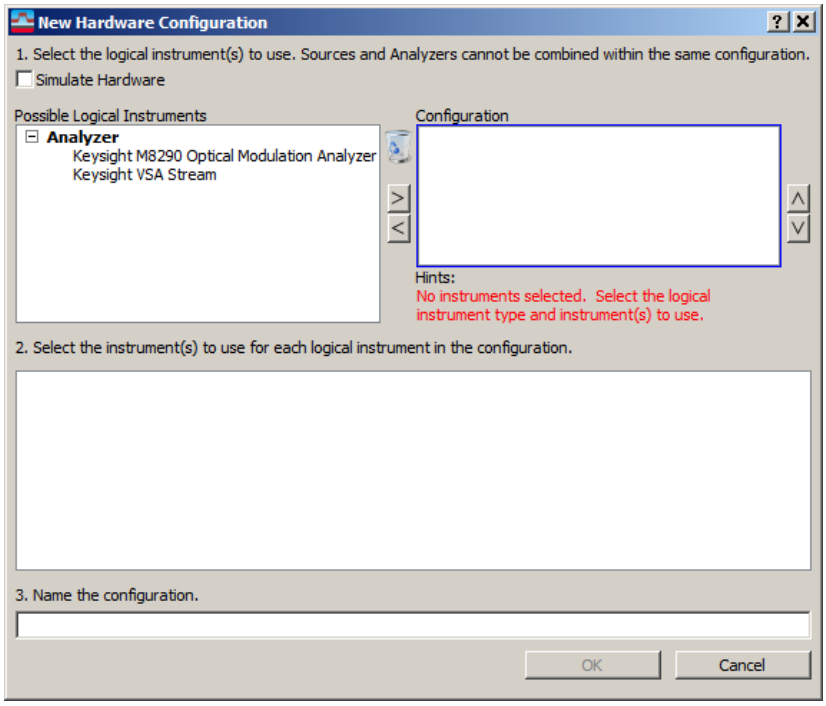
A standard M8290A system is pre-configured at the factory. This section shows how to modify the factory configuration or to configure a stand-alone module.

1 In the Keysight 89600 VSA Software interface, select **Utilities** > **Hardware** > **Discovered Instruments** to view a list of all available instruments. A screen similar to the following is displayed.

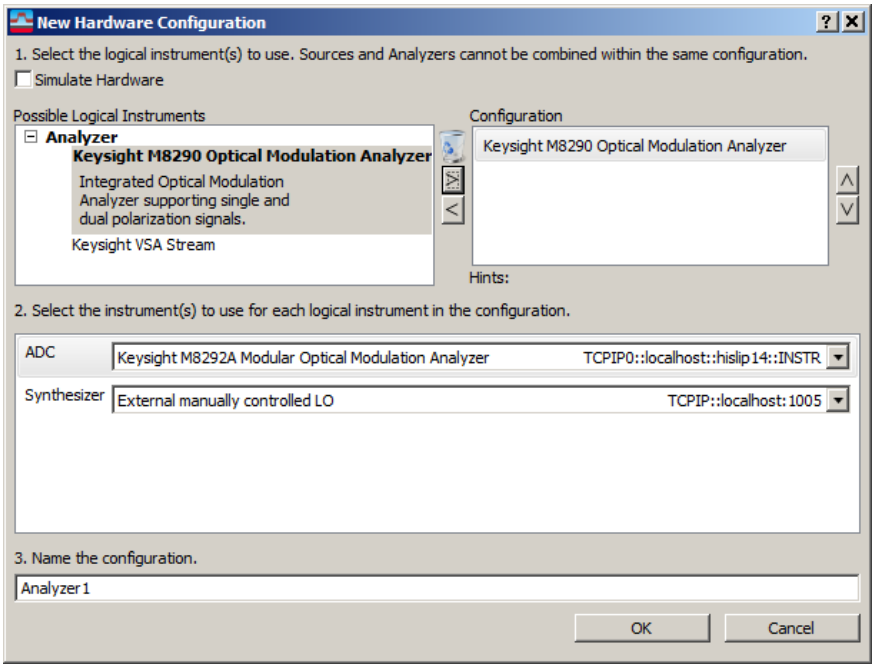


However, if your module is not listed, please add it to the Connection Expert as described in section Adding the M829xA to the Connection Expert on page 30 and hit the refresh button ( ).

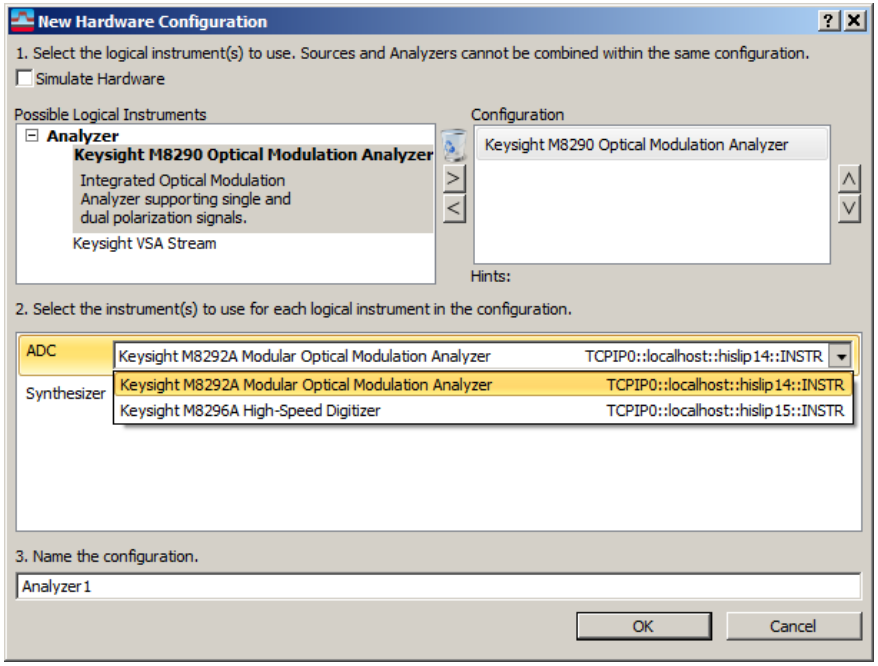
2 Switch to the **Configurations** tab and click on the plus ( ) button.



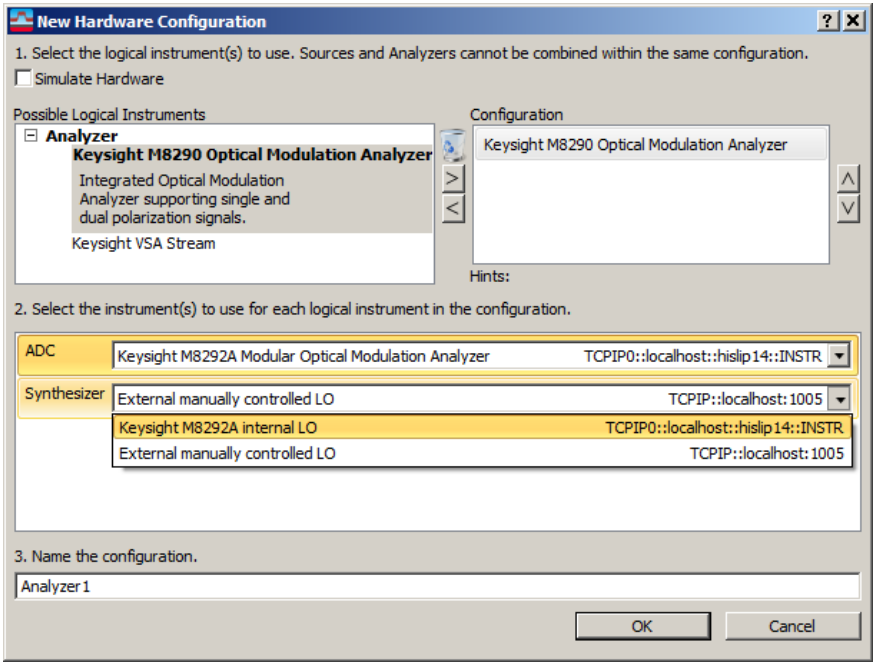
3 From the **Possible Logical Instruments** list, select **Keysight M8290 Optical Modulation Analyzer** then click on the > button to add it to the **Configuration** list.



4 In the ADC selection, click on the down arrow and select the desired instrument.



5 In the **Synthesizer** selection, click on the down arrow and select the LO configuration (internal or external LO). With the **M8296A** only an **external manually controlled LO** is supported. This setting can also be used if the test setup does not actually include an LO.



6 In the name field, enter the desired name for this configuration then click on the **OK** button.

7 Repeat this procedure to add more configurations.

4 AXIe Chassis

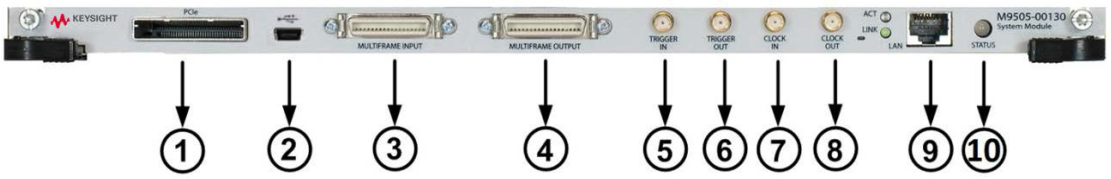
This chapter describes the usage of the AXIe chassis in combination with the M829xA.

The detailed documentation for the AXIe chassis can be found at:

- http://www.keysight.com/find/M9514A for 14-slot chassis
- http://www.keysight.com/find/M9505A for 5-slot chassis
- http://www.keysight.com/find/M9502A for 2-slot chassis

ESM Front Panel Connector

The ESM Front Panel Connector is shown in the figure below:

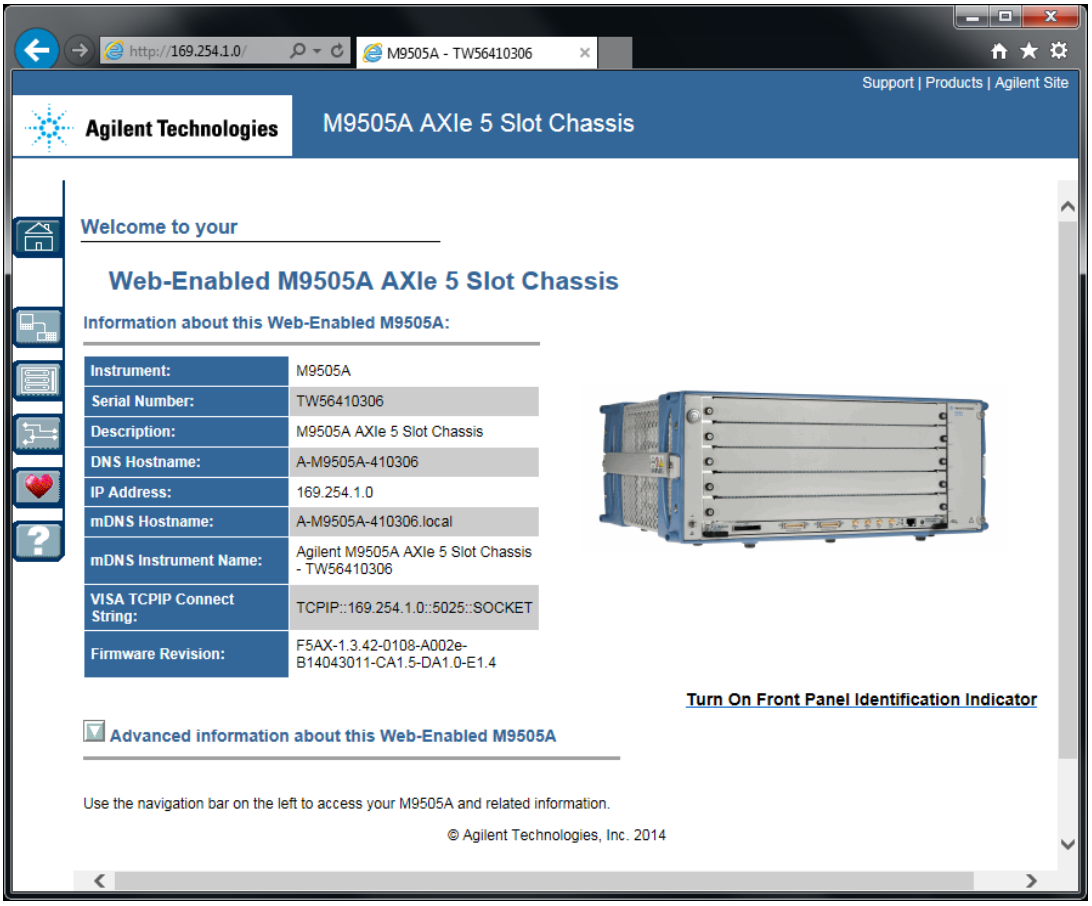


1	PCIe	Connects a host PC to the chassis via PCIe.
2	USB	Connects a host PC to the chassis via USB 2.0. The USB 2.0 port is only available for AXIe chassis with option -U20. Using USB to connect to the M8290A is **not supported**.
3	Multiframe Input	Synchronizes timing signals with multiple daisy-chained chassis.
4	Multiframe Output	
5	Trigger In	External Trigger connections. The Trigger In of the AXIe ESM cannot be used to trigger the M829xA. The Trigger Out of the AXIe ESM cannot be controlled by the M829xA.
6	Trigger Out	
7	Clock In	External clock connections.
8	Clock Out	
9	LAN	Connects the host PC to the chassis, via 10/100/1000 Ethernet. In particular, the LAN connector is used for ESM configuration, but NOT to communicate to the M829xA.
10	Status Light	Indicates the chassis status.

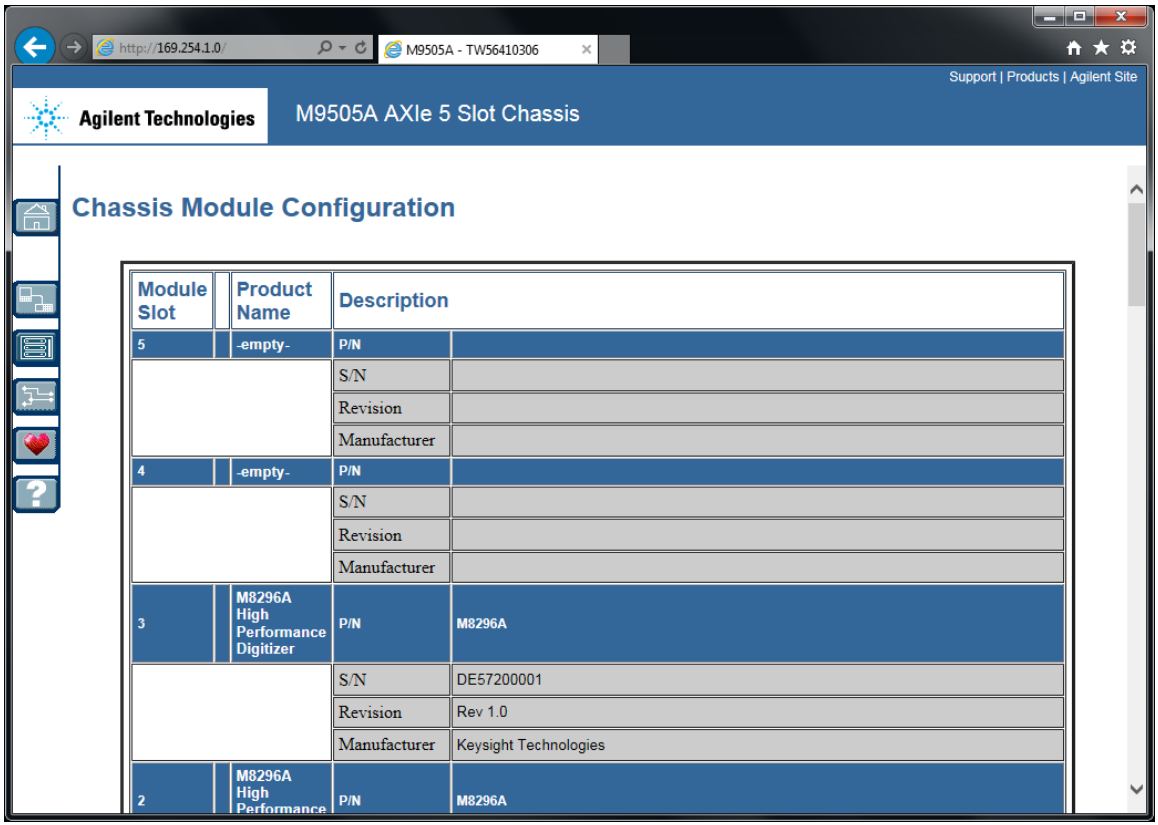
Setting the Startup Delay for the Embedded Controller

For the PCIe connection between the embedded controller and the M829xA module to work properly, the AXIe modules must boot in a certain order. To assure that this order is maintained at all times, a startup delay needs to be configured on the AXIe chassis' system module. All M8290A systems are pre-configured accordingly at the factory. However, if a different AXIe chassis is used with any M829xA module, it may be necessary to set the startup delay manually. To do this, please complete the process described below.

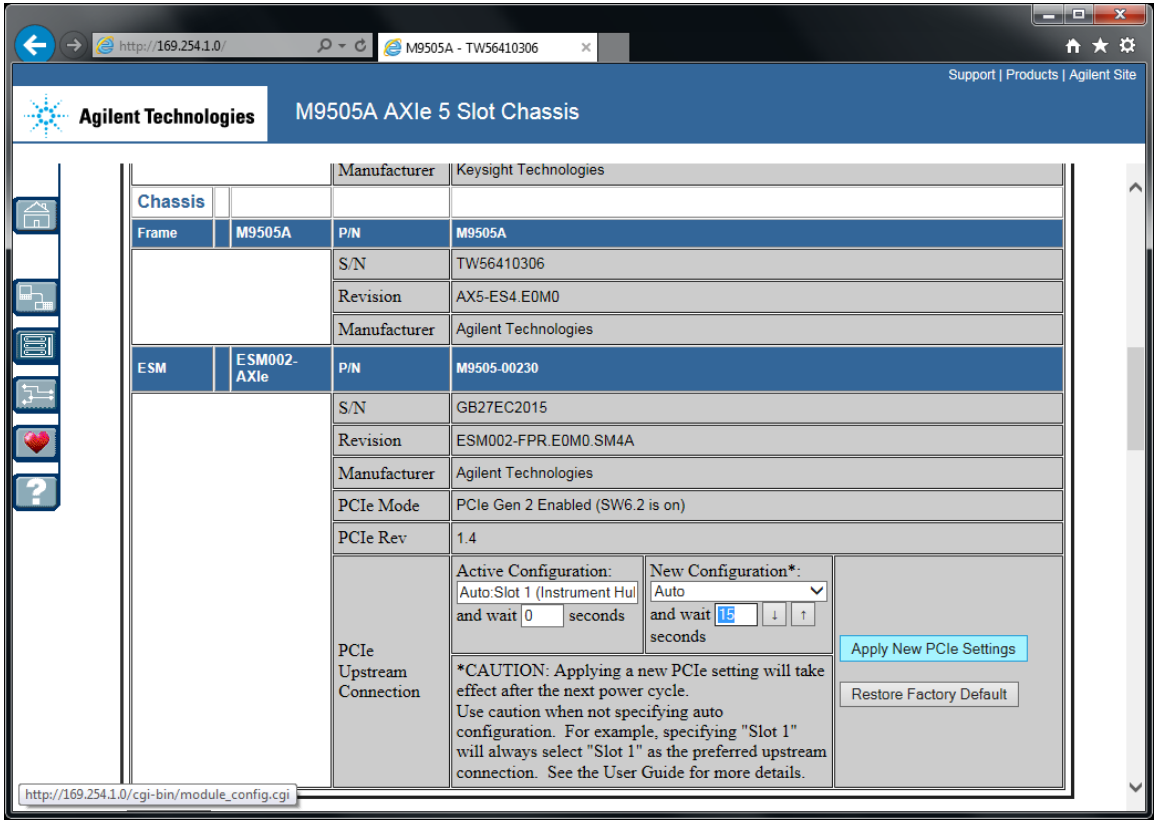
1 On the embedded controller, go to the AXIe chassis' web interface (e.g. by typing "169.254.1.0" into the address bar of a web browser):



2 Click on the "**Modules**" button ( ) on the left side:

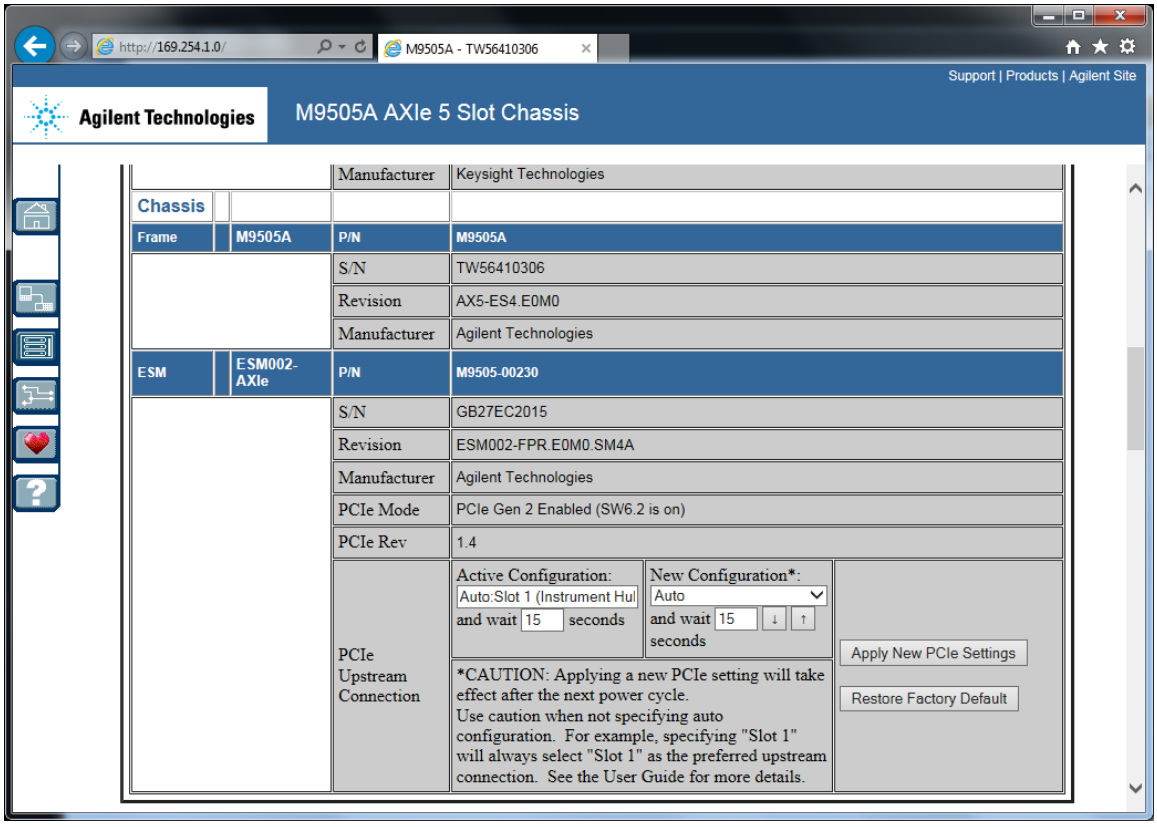


3 Browse to the bottom of the "**Chassis Module Configuration**" box:



4 If the "**Active Configuration**" shows a wait time below 15 seconds, select "**Auto**" in the "**New Configuration**" list and enter 15 seconds as the wait time. Then press "**Apply New PCIe Settings**".

5 Shutdown the embedded controller and power cycle the AXIe chassis. This setting is now shown as the "**Active Configuration**":



Keysight M8290A Optical Modulation Analyzer and High-Speed Digitizer Test Solution

Getting Started Guide

5 M829xA Maintenance

Introduction

This chapter explains how to install and maintain the M829xA. It covers the following topics:

- Laser Safety
- ESD Protection
- Power & Ventilation Requirements
- Thermal Protection
- Battery
- Operating Environment
- Cleaning Recommendation

KEYSIGHT TECHNOLOGIES

Initial Safety Information

The laser sources classified by this guide are classified as Class 1M according to IEC 60825-1 (2014).

All laser sources comply with 21 CFR 1040.10 except for deviations pursuant to Laser Notice No. 50, dated 2007-June-24.

Table 3 Initial Safety Information

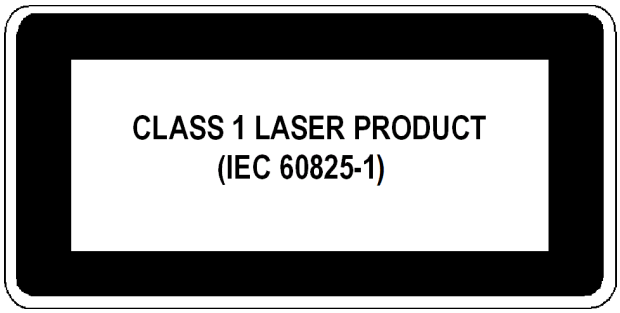
M8292A	Options C92+800	Options C92
Max. CW output power*	< 100 mW	- (internal Laser only)
Beam waist diameter	< 10 µm	-
Numerical aperture	0.1	-
Laser class according to IEC 60825-1 (2014)	Class 1M	Class 1
Max. permissible CW output power†	163 mW	10 mW

* *Max. CW output power is defined as the highest possible optical CW power that the laser source can produce at its output.*

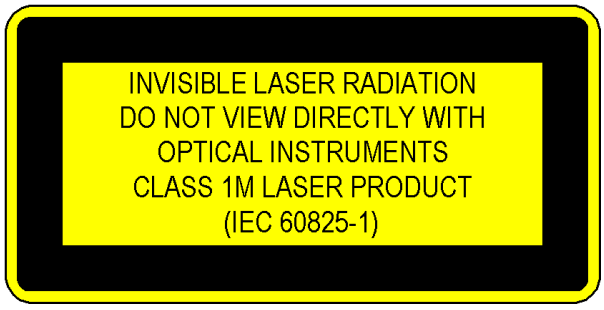
† *Max. permissible CW output power is defined as the highest optical power that is permitted within the appropriate IEC laser class.*

Laser Safety Labels

Laser Class 1 Label



Laser Class 1M Label



A sheet of laser safety labels is included. In order to meet the requirements of IEC 60825-1 we recommend that you stick the laser safety labels, in your language, onto a suitable location on the outside of the instrument where they are clearly visible to anyone using the instrument.

WARNING

Please pay attention to the following laser safety warnings:

- Under no circumstances look into the end of an optical cable attached to the optical output when the device is operational. The laser radiation can seriously damage your eyesight.
- Do not enable the laser when there is no fiber attached to the optical output connector.
- The laser is enabled by the software. The laser is on when the green LED above the LO Output connector is lit.
- The use of the instruments, such as microscopes or spectacles, with this product will increase the hazard to your eyes.
- The laser module has built-in safety circuitry which will disable the optical output in the case of a fault condition.
- Refer servicing only to qualified and authorized personnel.

ESD Protection

CAUTION

All the connectors are very sensitive to electrostatic discharge (ESD). When you connect a device or cable that is not fully discharged to these connectors, you risk damage to the instrument and expensive instrument repairs.

CAUTION

Electrostatic discharge (ESD) can damage the circuits of the M829xA. Avoid applying static discharges to the front-panel connectors. Before connecting any coaxial cable to the connectors, momentarily short the center and outer conductors of the cable together. Avoid touching the front-panel connectors without first touching the frame of the instrument. Be sure the instrument and all connected devices (DUT, etc.) are properly earth-grounded (to a common ground) to prevent buildup of static charge and electrical over-stress.

Power and Ventilation Requirements

For power and ventilation requirements, refer to:

- http://www.keysight.com/find/M9514A for 14-slot chassis related documentation.
- http://www.keysight.com/find/M9505A for 5-slot chassis related documentation.
- http://www.keysight.com/find/M9502A for 2-slot chassis related documentation.

Thermal Protection

Overheating Detection

The instrument monitors its internal temperature. If the temperature exceeds approximately 80°C the power supply is switched off. The instrument will not turn on automatically if the temperature is decreasing again.

Fan Failure

If a fan is broken or prevented from operating by a blockage the temperature will increase. When the temperature exceeds approximately 80°C the overheating detection switches off the instrument for safety reasons. For reliability, it is recommended to send instruments with broken or defective fans immediately to Keysight Service for repair.

Battery

The M829xA does not have a battery.

Cleaning Recommendation

WARNING **To prevent electrical shock, disconnect the instrument from mains before cleaning. Use a dry cloth or one slightly dampened with water to clean external case parts. Do not attempt to clean internally.**

Keysight M8290A Optical Modulation Analyzer and High-Speed Digitizer Test Solution

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6 Specifications

KEYSIGHT TECHNOLOGIES

M8292A Modular Optical Modulation Analyzer Specifications

Table 4 M8292A Modular Optical Modulation Analyzer specifications

M8292A Modular optical modulation analyzer	Typical values
Maximum detectable symbol rate	74 Gbaud
Sample rate range	83 to 92 GSa/s
Maximum record length per channel	512 kSa[1]
ADC resolution	8 bit
Operating frequency range[4]	1 MHz to 40 GHz
Analog bandwidth, uncorrected	37 GHz (3 dB)
Optical wavelength operating range	1527.60 to 1570.01 nm (196.25 to 190.95 THz)
Average input power monitor accuracy	±0.4 dB
Optical phase angle of I-Q mixer after correction	90° ±0.5°
Relative skew after correction	< ±1 ps
Image suppression[5]	> 30 dB
Error vector magnitude noise floor	< 2.4% EVM rms at 2.5 GHz freq. offset[5] < 3.5% EVM rms at 10 GHz freq. offset[6]
Sensitivity[2]	–20 dBm –14 dBm (with Option 800)
Internal local oscillator (built-in)	
Wavelength settling time	< 30 s
Wavelength uncertainty	±4.5 pm (±560 MHz), guaranteed ±2.5 pm (±310 MHz), typical
Sidemode Suppression Ratio (SMSR)	≥50 dB
Relative Intensity Noise (RIN)[3]	–145 dB/Hz (10 MHz to 40 GHz)

External local oscillator input and output (Option 800)	
LO input wavelength range	1527.60 to 1570.01 nm
LO input power range	–3 dBm to +17 dBm
LO output power	> +9 dBm

1 *128 samples are unavailable, resulting in 511872 samples per channel effectively available.*

2 *Valid at EVM = 32.5% for 32 GBaud DP-QPSK corresponding to raw BER = 1E-3, boost mode off.*

3 *At maximum laser power.*

4 *Adjusted baseband frequency range available for signal analysis.*

5 *Valid at the following reference conditions*
- *Sampling rate 92 GSa/s*
- *Optical continuous wave signal at optical input port*
- *Signal power > 0 dBm*
- *Optical frequency is offset by 2.5 GHz from local oscillator frequency*
- *Vector analyzer I-Q spectrum span set to 12.5 GHz*
- *QPSK demodulation*
- *10 Gbaud symbol rate*
- *PolStokesAlign set to "Single Polarization"*
- *KFPhaseTrack with carrier phase variance set to 1E-4*
- *Result length set to 500 symbols*
- *Raised cosine filter selected as reference filter*
- *25° C ±5 K environmental temperature*

6 *Valid at reference conditions as stated above, except for:*
- *Optical frequency is offset by 10 GHz from local oscillator frequency*
- *Vector analyzer I-Q spectrum span set to 50 GHz*
- *40 Gbaud symbol rate*

Table 5 M8292A Modular Optical Modulation Analyzer specifications (Continued)

Trigger input	Typical values
Input range	–4 V to +4 V
Threshold	–4 V to +4 V
Range	10 mV
Resolution	100 mV

Sensitivity	1 MHz to 40 GHz
Polarity	Selectable: positive, negative, either edge
Timing uncertainty	≤8 ns
Reference clock input	
Input frequency range	10 MHz to 17 GHz
Amplitude range	500 mV_{pp} to 2 V_{pp}
Impedance	50 Ohm (nominal)
Connector type	SMA (female)
Reference clock output	
Frequency with respect to sample rate	f_{Sa} / 512
Amplitude	0.9 V_{pp} (nominal)
Impedance	50 Ohm (nominal)
Connector	SMA (female)

Table 6 M8292A maximum ratings

Maximum ratings	
Maximum signal input power	+14.5 dBm
Signal input damage level	+15 dBm
External LO input power	
Maximum	+17 dBm
Damage level	+18 dBm
Reference clock input damage level	3 V_{pp}

M8296A Electrical High-Speed Digitizer Specifications

Table 7 M8296A Electrical High-Speed Digitizer Specifications

M8296A Electrical high-speed digitizer	Typical values
Maximum detectable symbol rate	74 GBaud
Sample rate range	83 to 92 GSa/s
Maximum record length per channel	512 kSa[1]
ADC resolution	8 bit
Operating frequency range[2]	50 kHz to 42 GHz
Analog bandwidth, uncorrected	37 GHz (3 dB), guaranteed[3]
Skew between different input channels	< ±250 ps
Skew between normal and complement	< ±1 ps
Input amplitude ranges	150 $mV_{pp,diff}$ 300 $mV_{pp,diff}$ 500 $mV_{pp,diff}$ 800 $mV_{pp,diff}$
Input impedance	50 Ohm (nominal)
Number of input channels	4
Trigger input	
Input range	–4 V to +4 V
Threshold	
Range	–4 V to +4 V
Resolution	10 mV
Sensitivity	100 mV
Polarity	Selectable: positive, negative, either edge
Timing uncertainty	≤ 8 ns

Reference clock input	
Input frequency range	10 MHz to 17 GHz
Amplitude range	500 mV_{pp} to 2 V_{pp}
Impedance	50 Ohm (nominal)
Connector type	SMA (female)
Reference clock output	
Frequency with respect to sample rate	f_{Sa} / 512
Amplitude	0.9 V_{pp} (nominal)
Impedance	50 Ohm (nominal)
Connector	SMA (female)

1 *128 samples are unavailable, resulting in 511872 samples per channel effectively available.*

2 *Adjusted baseband frequency range available for signal analysis.*

3 *Determined from a 9^{th} order polynomial fit to the measured amplitude response.*

Table 8 M8296A maximum ratings

Maximum ratings	
Damage level (single ended)	0.9 V_{pp} / 3 VDC
Damage level	3 V_{pp}

General Characteristics

Table 9 General characteristics

	M8292A Modular 92 GSa/s optical modulation analyzer	M8296A Modular 92 GSa/s 4-channel electrical high-speed digitizer
Dimensions (W x H x D)	322.25 mm x 60 mm x 281.5 mm	322.25 mm x 30 mm x 281.5 mm
Weight	3.6 kg	3.3 kg
Storage temperature range	–40° C to +70° C	
Operating temperature range	+5° C to +35° C	
Humidity	15% to 80% relative humidity, non-condensing	
Operating altitude	0 to 2000 m	
Power consumption	100 W at 92 GSa/s	
Safety designed to	IEC61010-1, UL61010, CSA22.2 61010.1 tested	
EMC tested to	IEC61326-1	
Form factor	2-slot AXIe	1-slot AXIe
Warm-up time	30 minutes	
Recommended re-calibration interval	2 years	

Declaration of Conformity

Click the following link to view or download the latest version of DoC:
http://www.keysight.com/go/conformity

Edition 1.0, November 2017

www.keysight.com

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