Keysight M8190A Arbitrary Waveform Generator

Getting Started Guide

KEYSIGHT TECHNOLOGIES

Notices

Manual Part Number

M8190-91020

Edition

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Keysight Technologies,

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For Assistance and Support

http://www.keysight.com/find/assist

Limitation of Warranty

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance. No other warranty is expressed or implied. Keysight Technologies specifically disclaims the implied warranties of Merchantability and Fitness for a Particular Purpose.

ESD sensitive device

All front-panel connectors of the M8190A are sensitive to Electrostatic discharge (ESD). We recommend to operate the instrument in an electrostatic safe environment.

There is a risk of instrument malfunction when touching a connector.

Please follow this instruction:

Before touching the front-panel connectors, discharge yourself by touching the properly grounded mainframe.

Warranty

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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 0 °C – 40 °C (32 °F – 105 °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.

Before Applying Power

Verify that all safety precautions are taken including those defined for the mainframe.

Line Power Requirements

The Keysight M8190A operates when installed in an 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.

Safety Symbols

Table 1 Safety Symbol

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.
	C-Tick Conformity Mark of the Australian ACA for EMC compliance.
	CE Marking to state compliance within the European Community: This product is in conformity with the relevant European Directives.
	General Recycling Mark

Table 2 Compliance and Environmental Information

Symbol	Description
	This product complies with the WEEE Directive (2002/96/EC) marketing 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 the WEEE Directive Annexure 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.

Contents

1 Introduction

Introduction

The Keysight M8190A is a 12 GSa/s Arbitrary Waveform Generator. It combines excellent signal fidelity with highest sampling rates. It offers up to 2 GSa waveform memory per channel and three different high bandwidth output paths to ideally address applications.

Features and Benefits

- Precision AWG with
  - 14-bit resolution up to 8 GSa/s with Option -14B
  - 12-bit resolution up to 12 GSa/s with Option -12G
  - 14-bit resolution up to 7.2 GSa/s with Option -DUC
- Spurious-free-dynamic range (SFDR) up to 80 dBc typical
- Harmonic distortion (HD) up to -72 dBc typical
- Standard arbitrary waveform memory size 128 MSa per channel with Option -14B and Option -12G, 64 MSa IQ sample pairs with Option -DUC
  - 2^{31} = ~2147 MSa arbitrary waveform memory per channel with Option -02G in 12 bit mode
  - ~1610 MSa arbitrary waveform memory per channel with Option -02G in 14 bit mode
  - ~805 MSa IQ sample pair arbitrary waveform memory per channel with Option -02G in DUC mode. I.e. with Option -02G and Option -DUC, the M8190A offers ~805 MSa I data and ~805 MSa Q data per channel.
- Analog bandwidth 3.5 GHz; (5 GHz with Option - AMP)
- Transition times 50 ps (20 % to 80 %) with Option - AMP
- Differential output
- Form-factor: 2-slot AXIe module
- Controlled via external PC or embedded AXIe system controller M9537A

Getting Started with M8190A

The M8190A is a modular instrument packaged in the AXIe form factor. AXIe is a new open standard for high-performance modular instrumentation. Three form factors are available: two-slot, five-slot and fourteen slot AXIe chassis. These include an embedded AXIe system module that does not occupy a module slot. In addition, an AXIe embedded controller forms an entire system that can control the M8190A AWG. This embedded controller consumes one module slot of the AXIe chassis. Besides using an embedded controller, the M8190A AWG can be controlled by an external desktop PC or an external laptop as well. For PCIe interface, a PCIe adapter card and PCIe cable are needed to connect to the AXIe chassis, and in case of USB 2.0, only a USB cable will be required.

There are two different ordering possibilities:

- AXIe chassis, PCIe or USB 2.0 cable, PC and M8190A AWG are ordered separately. The different components come in different packages and need to be installed. Please follow the instructions given in chapter 3 of M8190A User's Guide or the instructions given in the User's Guide of the AXIe chassis.
- M8190A bundle, there are two configurations available:
  - Option -BU1, contains a 5- slot AXIe chassis, embedded controller and the M8190A AWG. The M8190A firmware and SFP (soft front panel) is already installed and configured on the embedded controller.

    User set up:
    - Username: M8190a_admin
    - Password: admin!123

    Directory of the software:
    - Firmware:
      C:\Program Files (x86)\Keysight\M8190\bin
    - SoftFrontPanel:
      C:\Program Files (x86)\Keysight\M8190\SFP
  - Option -BU2, contains a 2- slot AXIe chassis and either a laptop cable with laptop adapter card or desktop cable with desktop adapter card. The AWG is already plugged in the 2- slot AXIe chassis. Cable and adapter card needs to be connected as described in chapter 2 of M8190A User's Guide or as described in the User's Guide of the AXIe chassis.

Related Documents

To access documentation related to the Keysight M8190A Arbitrary Waveform Generator, use one of the following methods:

- **CD** - Browse the product CD for M8190 documentation.
- **Start** > **All Programs** > **Keysight M8190** > **Keysight M8190 Documentation** - Provides links to all product documentation except for the IVI driver documentation.
- **Start** > **All Programs** > **Keysight Instrument Drivers** > A**gM8190 Arbitrary Waveform Generator** - Provides link to the product IVI driver help system.
- Go to the product web site (www.keysight.com/find/M8190A) and browse the manuals under **Document Library** tab.

Additional Documents

Additional documentation can be found at:

- http://www.keysight.com/find/M9502A for 2-slot chassis related documentation.
- http://www.keysight.com/find/M9505A for 5-slot chassis related documentation.
- http://www.keysight.com/find/M9514A for 14-slot chassis related documentation.
- http://www.keysight.com/find/M9048A for PCIe desktop adapter card related documentation.
- http://www.keysight.com/find/M9537A for embedded AXIe controller related documentation.
- http://www.keysight.com/find/M8190A for AXIe based AWG module related documentation.
- http://www.keysight.com/find/M8192A for AXIe based synchronization module related documentation.

2 M8190A Software Installation

This chapter explains the steps required to install M8190A software package.

2.1 Pre-Requisites

The following are the pre-requisites for installing Keysight M8190A software:

- The supported operating systems are:
  - Windows 10 (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 on the CD that is part of shipment content or at http://www.keysight.com/find/iosuite.

NOTE

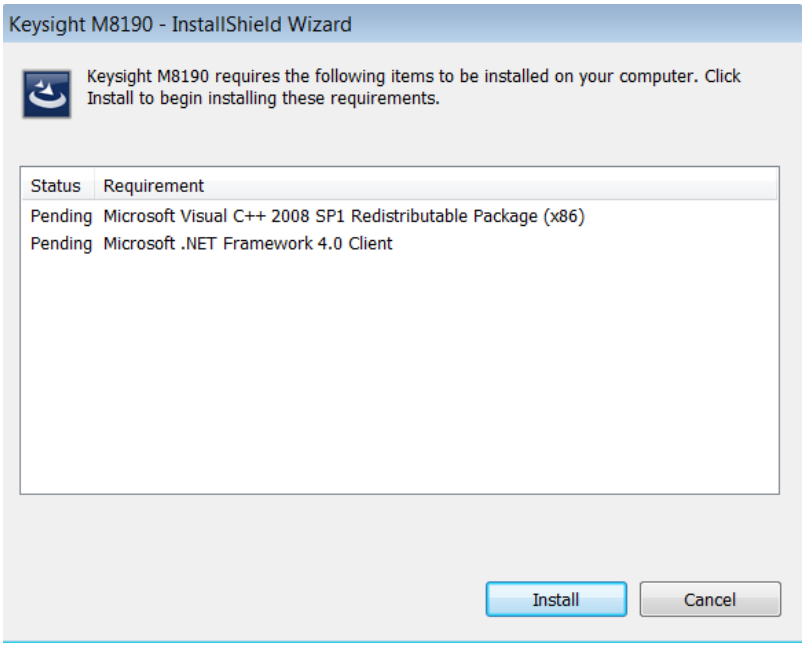
Even if a non-Keysight I/O library is already installed, it is still necessary to install the Keysight I/O library. The Keysight I/O library will install as "secondary" I/O library in this case. This use case is fully supported. There only needs to be some additional considerations when doing SCPI remote programming. For more information on SCPI remote programming, refer to M8190A User's Guide. A non-Keysight "primary" I/O library must support the HiSLIP protocol otherwise; the Soft Front Panel and the IVI drivers will not work.

2.2 Installation Process

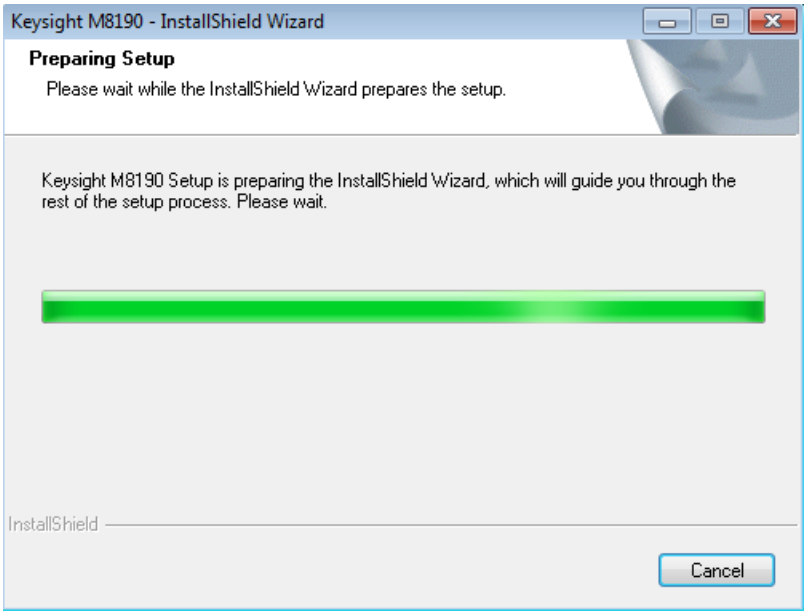
Follow the given steps to install **Keysight M8190A** software on your system.

1. Double-click the executable (M8190_Setup.exe). This executable file will be available either on CD or Web.
   See http://www.keysight.com/find/M8190A

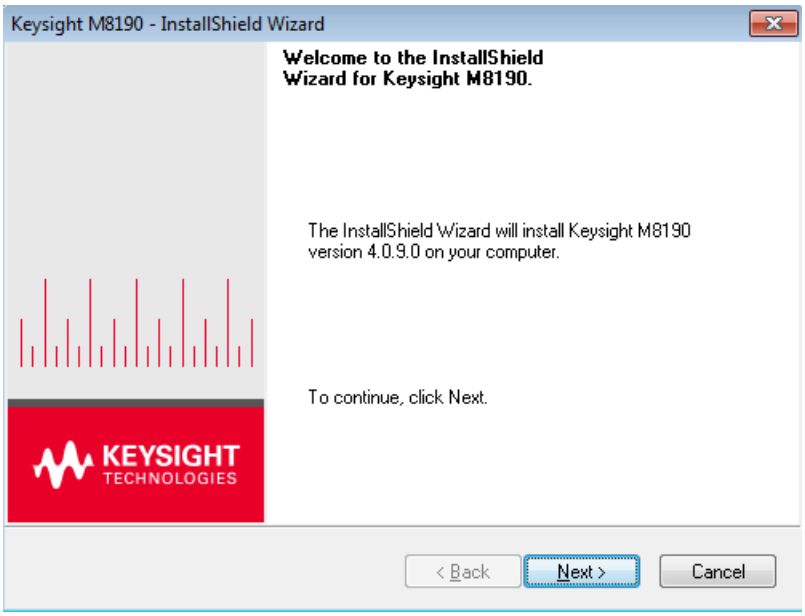
NOTE The installer will first check for some pre-requisites and install them, if necessary. It is possible that your PC requests a reboot during this step. Reboot your PC, if requested.



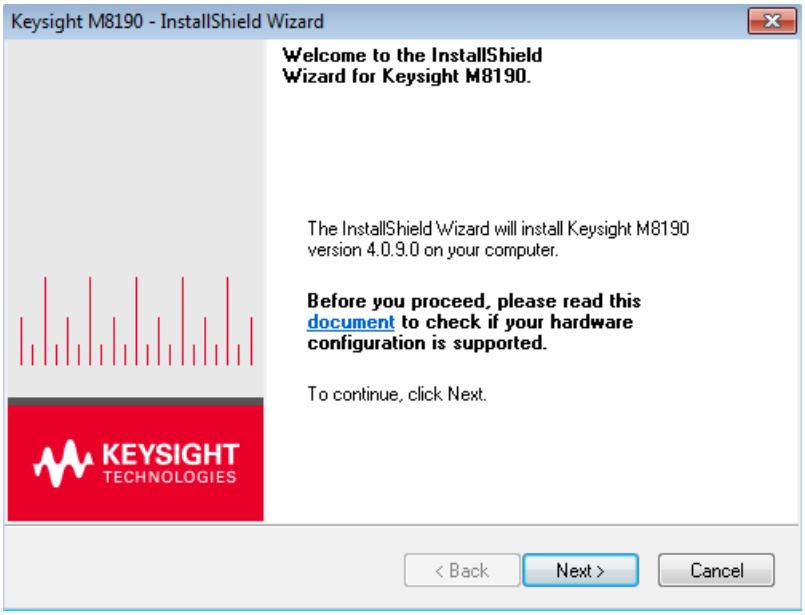
2. The Keysight **M8190A Setup** will prepare the **InstallShield Wizard** for the installation process. The following window will appear.



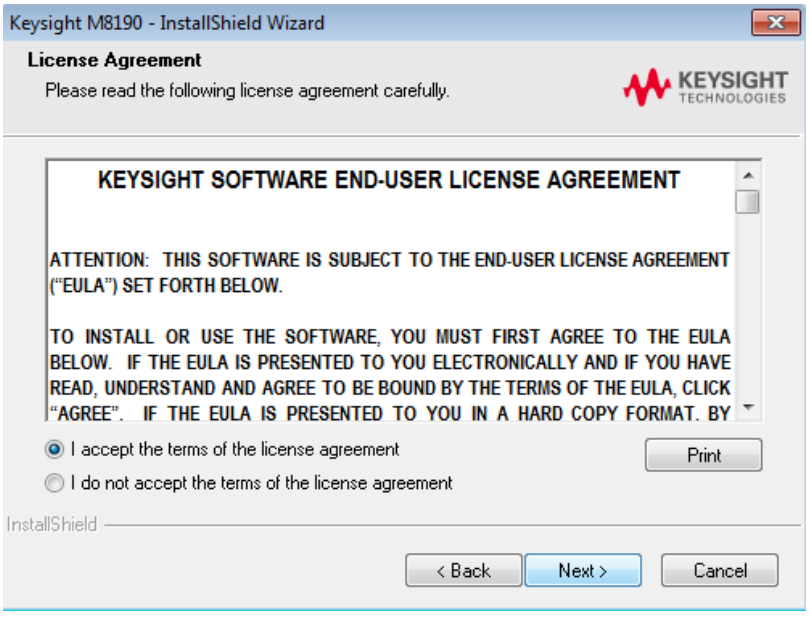
3. Follow the onscreen instructions to begin the installation process. Click **Next**.



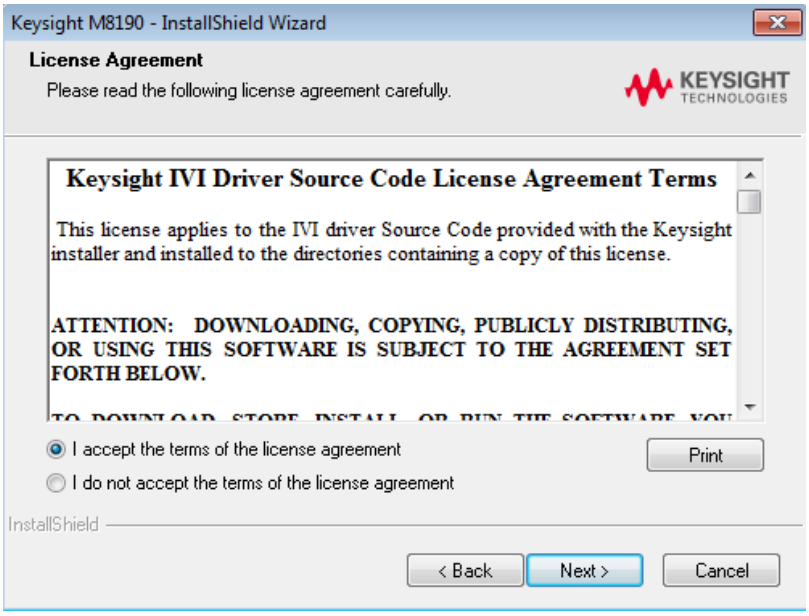
4. We recommend you to read the document to check if your hardware configuration is supported.
   Click Next to proceed to the license agreements.



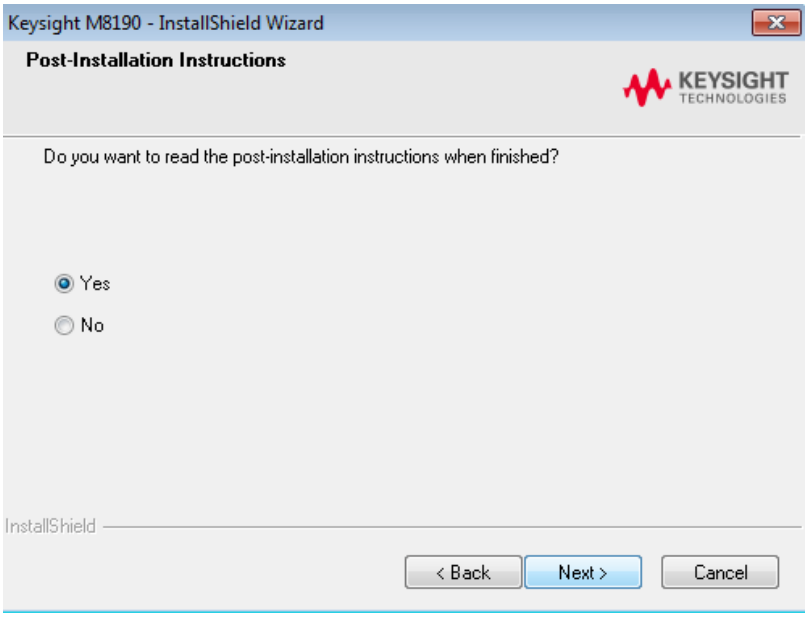
5. Accept the terms of Keysight software end-user license agreement.
   Click Next.



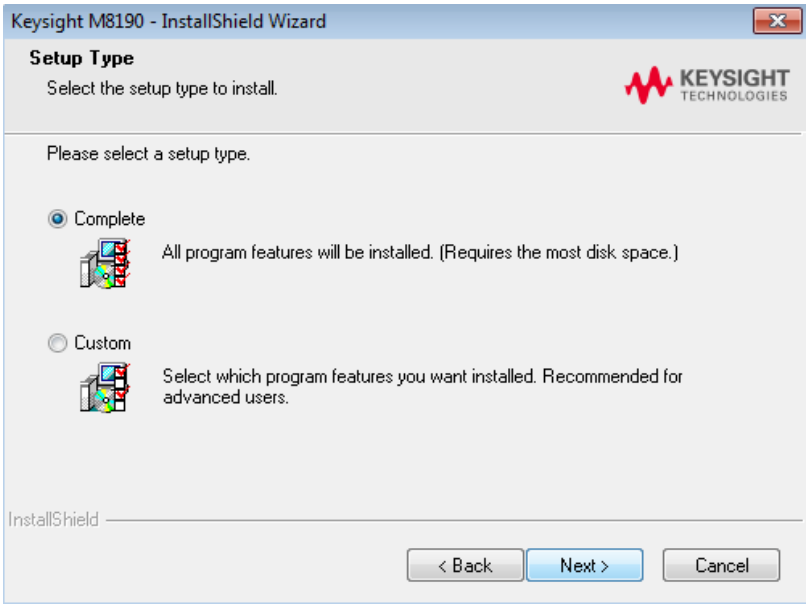
6. Accept the terms of Keysight IVI driver source code license agreement terms. Click **Next**.



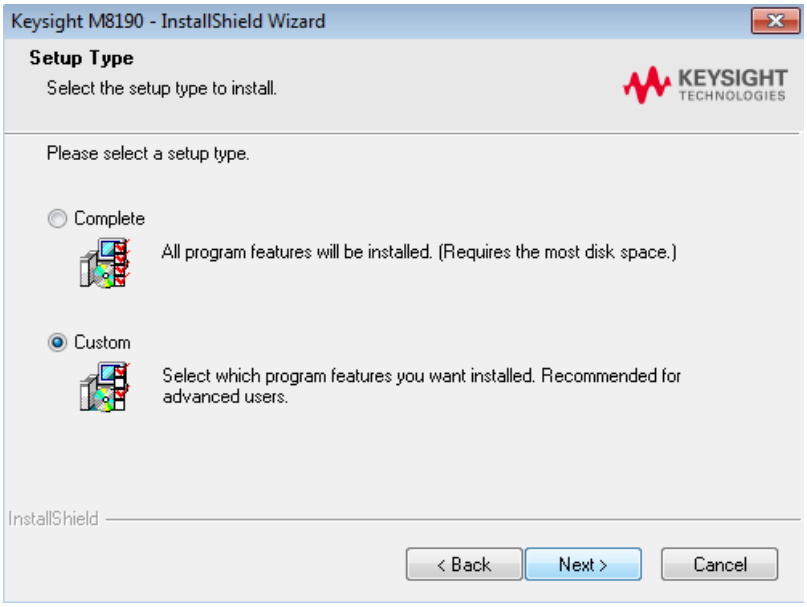
7. Select **Yes** if you want to read the post-installation instructions when finished. Click **Next** to select setup type.

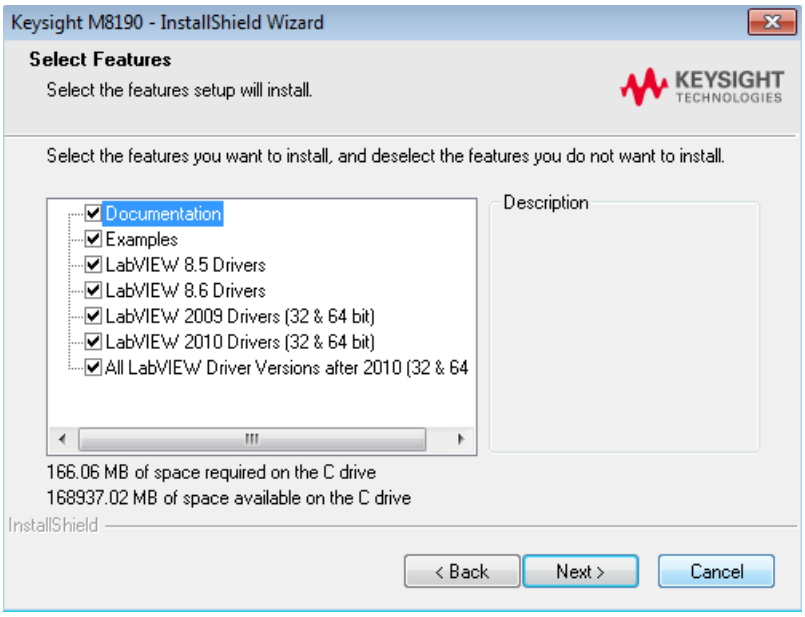


8. Select a setup type either **Complete** or **Custom**.
   Click **Next**.

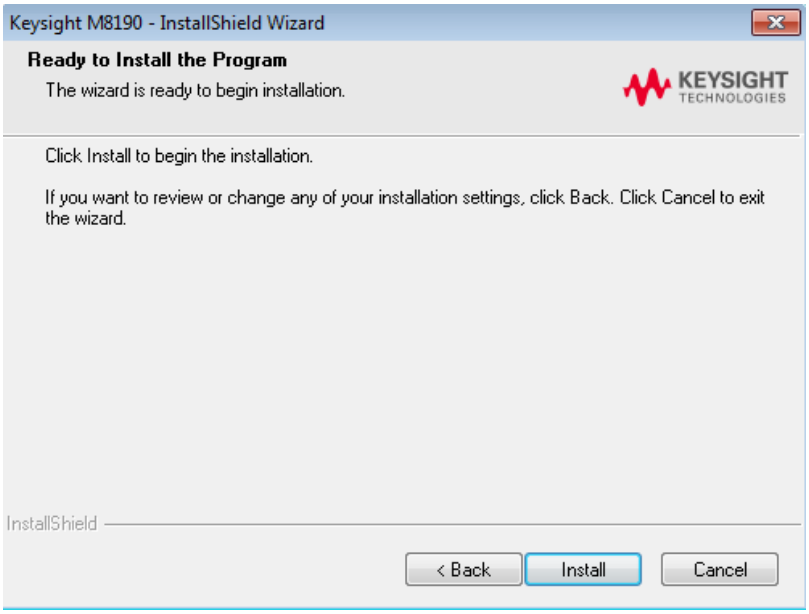


9. If you select **Custom** and click **Next**, you can specify which optional features will be installed:

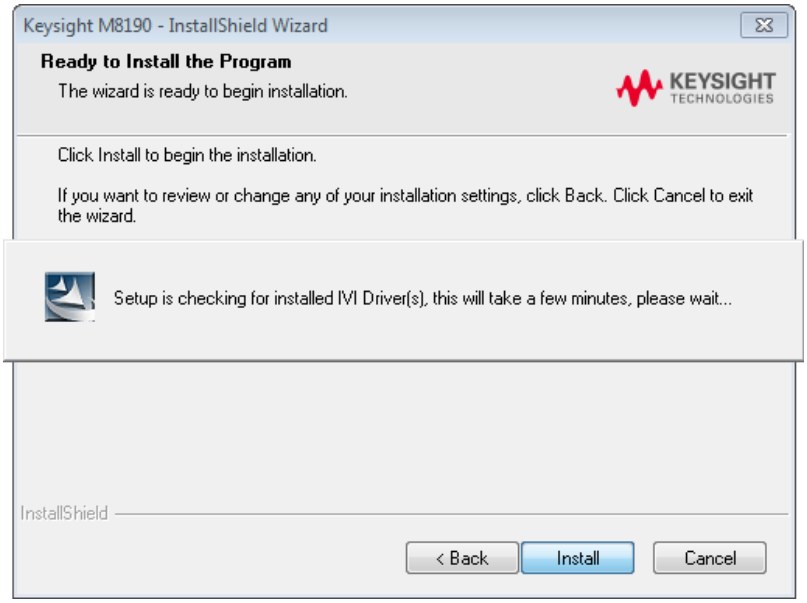


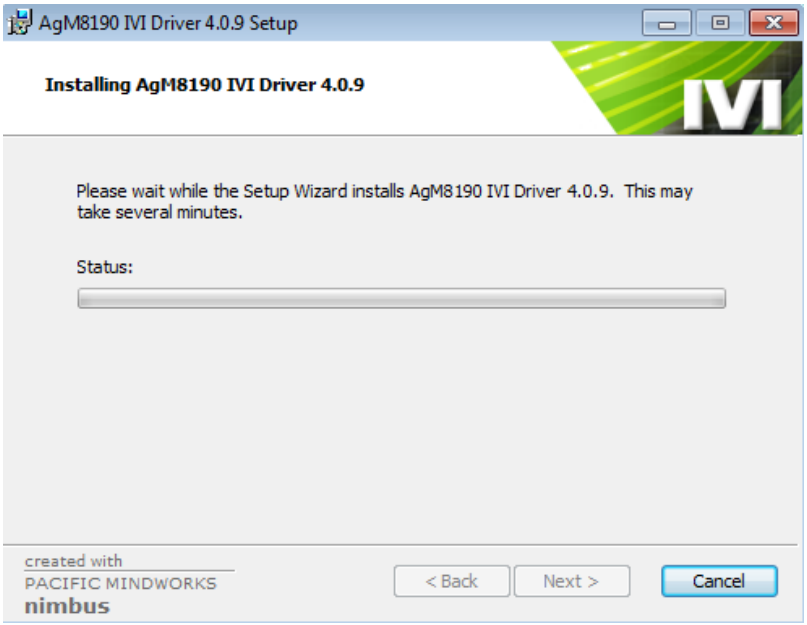


10. Click **Install** to begin installation.

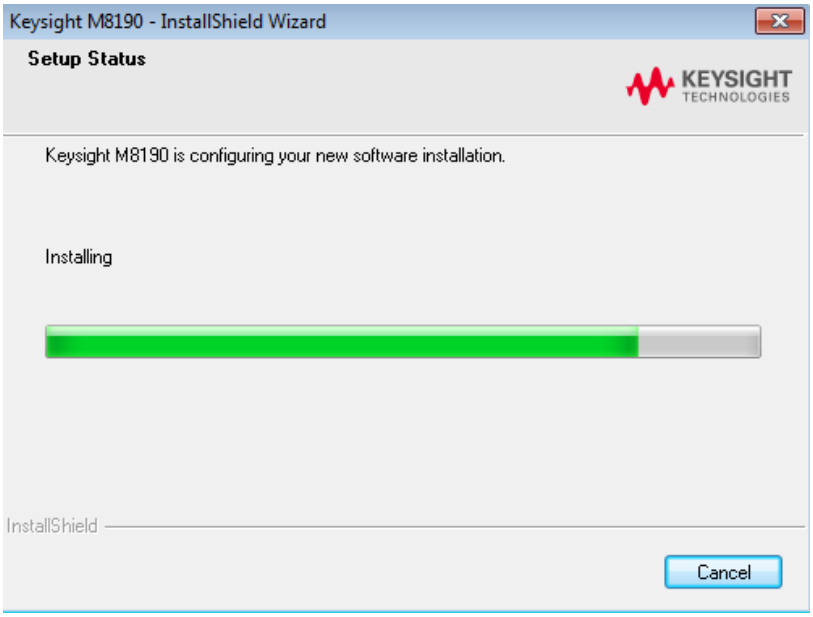


11. The **Setup Wizard** will now install AgM8190 IVI Drivers.



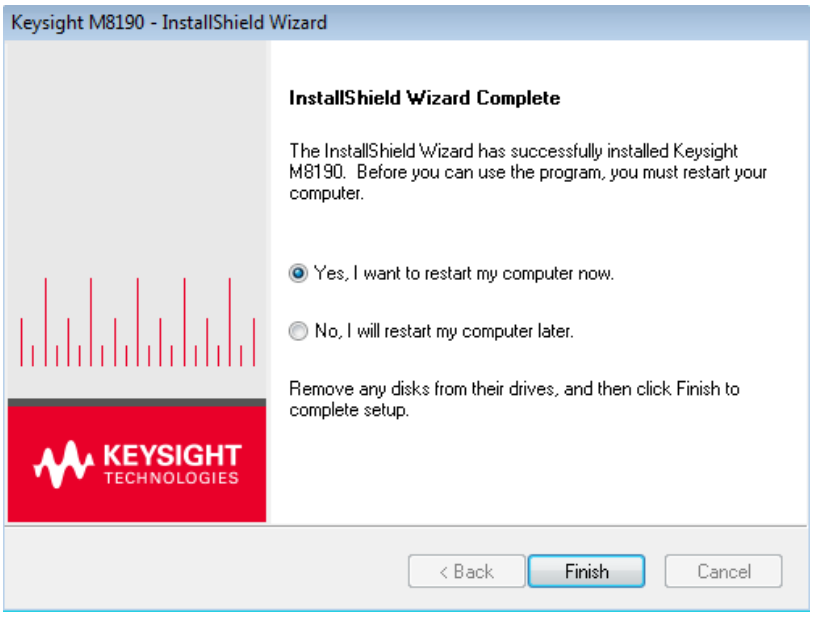


12. The Keysight M8190A will configure the new software installation.



13. The following screen will appear once the Keysight M8190A software is successfully installed on your system.

14. Click Finish to restart your system. Do not connect the AXIe chassis to your system using the PCIe or USB 2.0 cable during this reboot.



This completes the Keysight M8190A software installation.

2.3 Post Installation Steps

Follow the post installation steps as shown below:

NOTE If your instrument is already powered up and connected to your PC using the PCIe or USB 2.0 cable, just reboot your PC and start with step 5.

1. Shut down PC and instrument.
2. Connect the instrument to the PC using the PCIe or USB 2.0 cable. The USB 2.0 port is available for AXIe chassis with option U20 only.
3. Switch on the instrument. Wait until the 'Access' LED of the M8190A has switched from red to green.
4. Switch on the PC.
5. The PC should automatically recognize the instrument.
   Check this in the device manager; e.g. via Start > Control Panel > Device Manager, or right-click Computer > Manage > Device Manager:
   The instrument should be visible in the device tree as *Keysight – M8190*.

NOTE Your PC might request a reboot. Reboot your PC, if requested.

6. Check if the M8190 is also visible in the Keysight Connection Expert
   (e.g. via Start > Keysight IO Libraries Suite > Keysight Connection Expert).
   If something went wrong and the instrument is not shown in the PXI section, it may be necessary to reboot the PC once more.

2.4 Updating M8190A Software

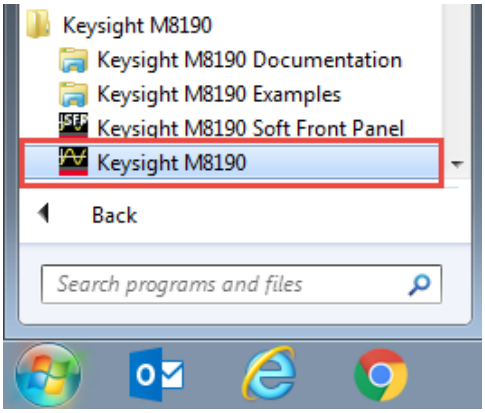
Updated versions of the M8190A software are available on the Keysight website. These software components are available as .EXE files. To download a software upgrade:

1. Go to http://www.keysight.com/find/M8190A.
2. Click the **Technical Support** tab.
3. Click **Drivers, Firmware & Software**.
4. Download the required software update from the list of available updates.
5. Install the software update. Refer to the steps described in the section Installation Process.

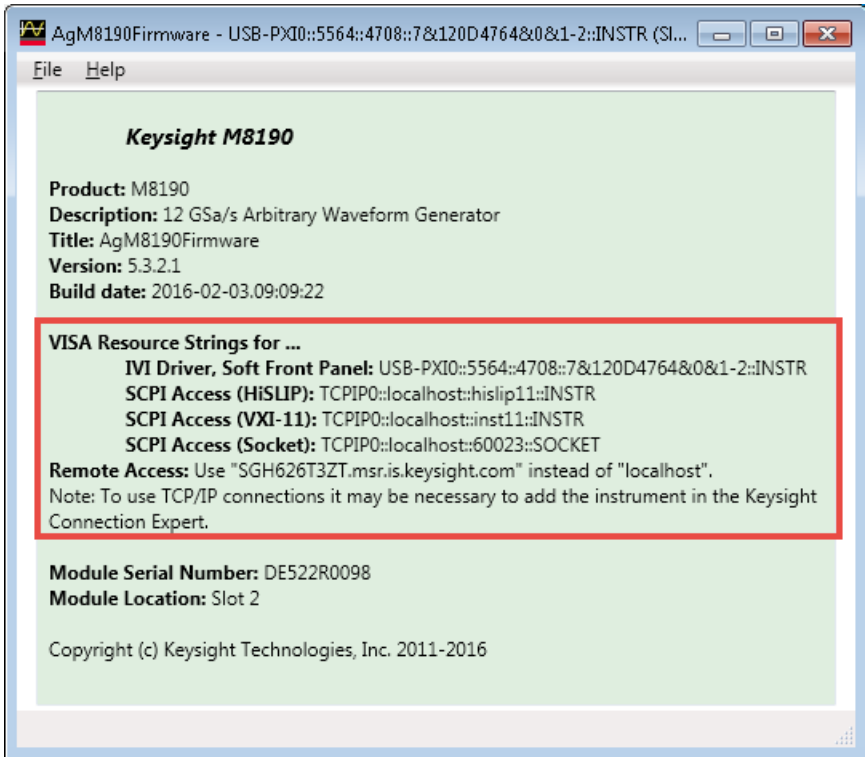
2.5 How to Use the Instrument

In order to use the instrument:

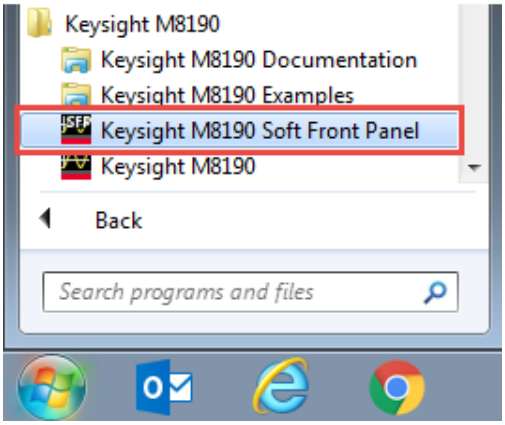
1. It must always be connected and switched on before you start the PC.
2. Start the firmware (**Start** > **All Programs** > **Keysight M8190** > **Keysight M8190**).



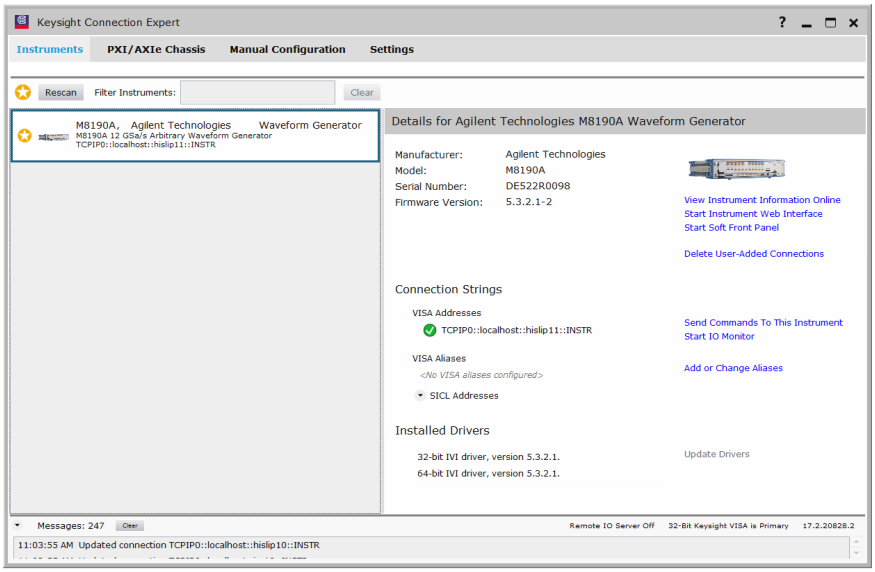
3. The user interface will display the VISA resource strings for different kinds of connection.



4. Using the appropriate VISA resource string you can:
   - Start the Soft Front Panel (**Start** > **All Programs** > **Keysight M8190** > **Keysight M8190 Soft Front Panel**).



– Control the instrument with your own application using the M8190 IVI Drivers or add it as a LAN instrument in the Keysight Connection Expert (TCPIP0::localhost::...) and control it using SCPI (with e.g. the VISA Assistant or your own application).



You must start the firmware in order to send SCPI commands to the instrument.

NOTE The M8190 IVI Drivers and the Soft Front Panel start the firmware automatically. In this case, the firmware is only visible as an icon in the task bar's notification area.

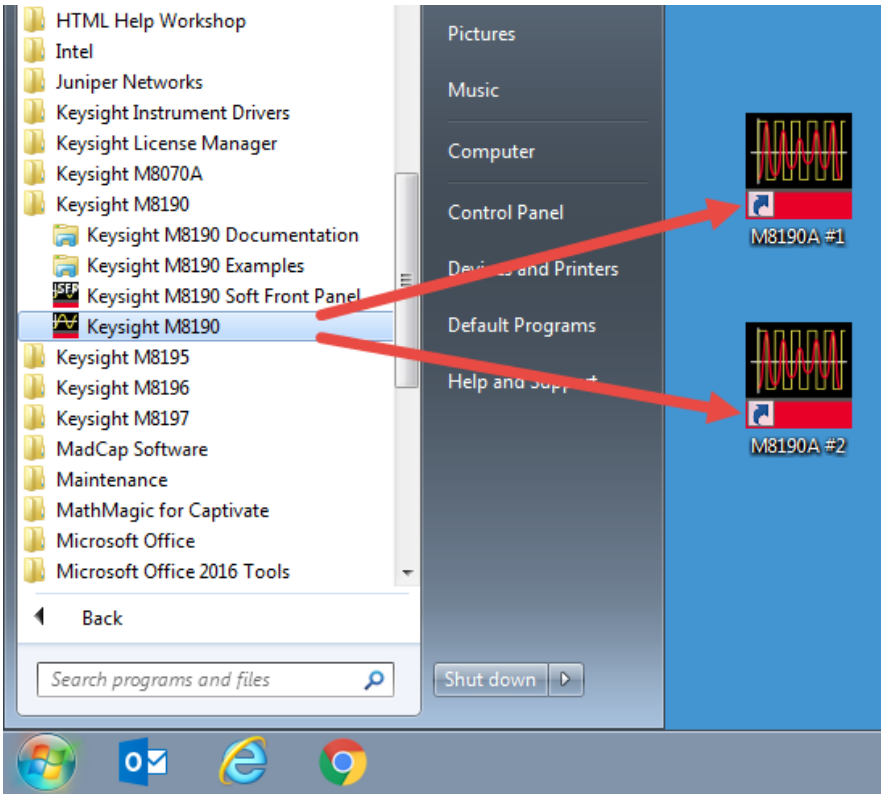
2.6 How to Access Two M8190A Modules in a Single Chassis

You can operate two M8190A modules in a single M9505A AXIe chassis. In this case, each module needs a separate instance of the M8190A firmware to control it. The two firmware instances can either run on the M9537A embedded controller inside the AXIe chassis or on a separate PC that is connected via PCIe or USB to the AXIe chassis.

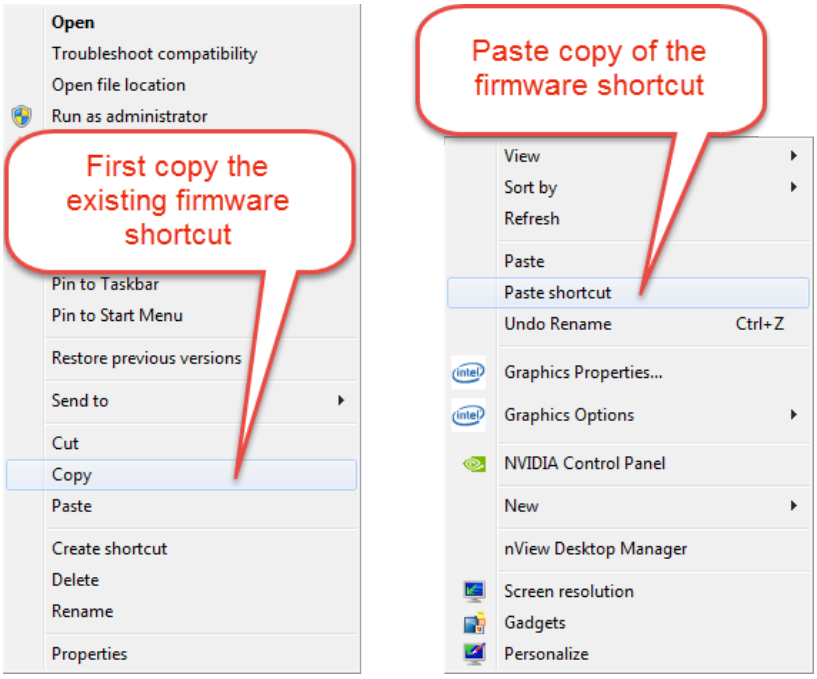
If you have more than one module in the same chassis, you must specify the firmware which module it should control. Also, since both instances of the firmware are running on the same PC, you also must instruct the firmware, which TCP/IP port it should use for remote commands.

Following are the recommend steps to do that:

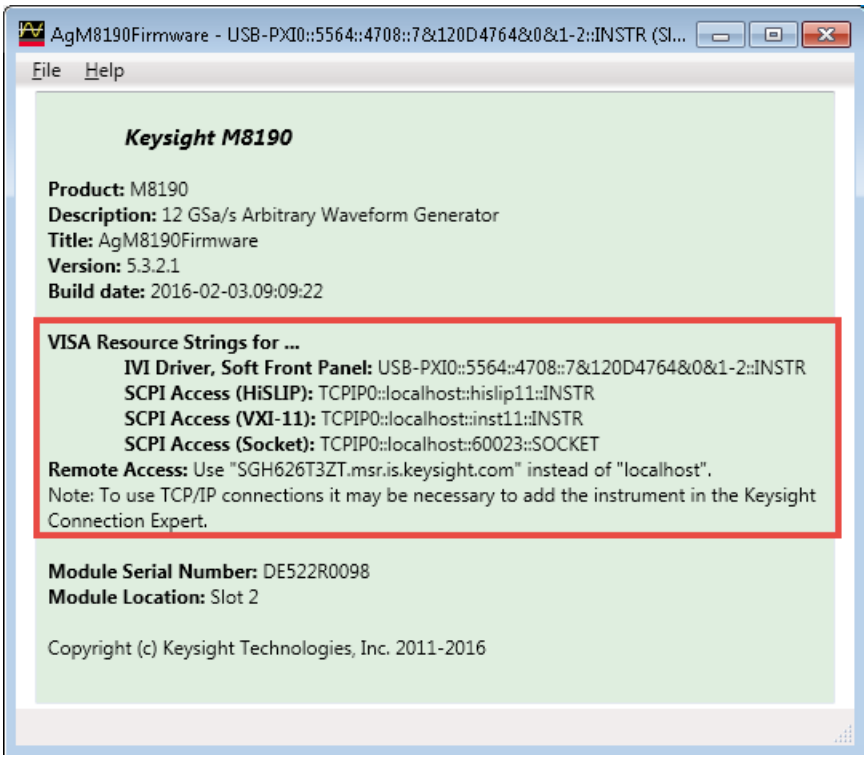
Step 1 - Create a shortcut of the M8190A firmware on your desktop and rename it to “M8190A #1”. Then create another shortcut of the firmware and rename “M8190A #2”.



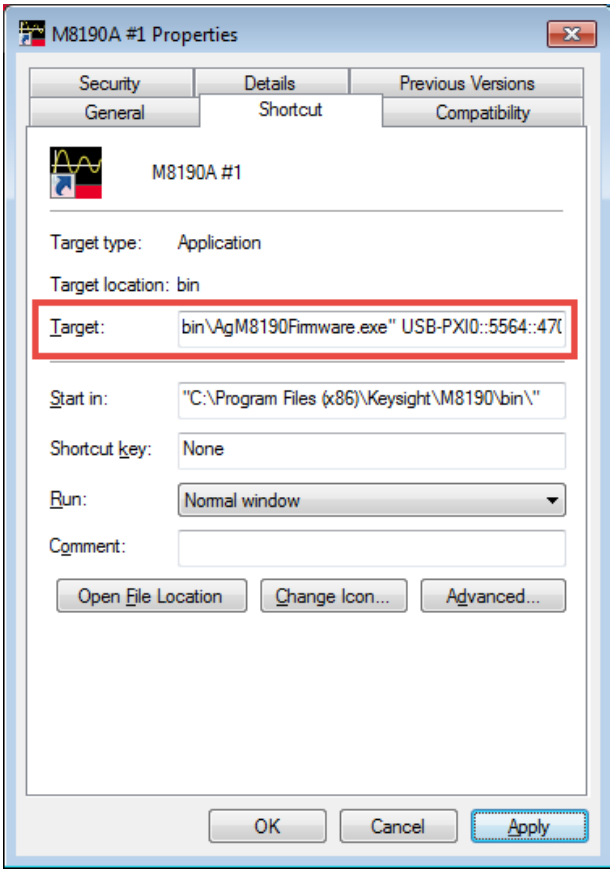
You can also copy an existing firmware shortcut present on the desktop and then paste it (Paste shortcut) two times:



Step 2 - Now, open the M8190A firmware and identify the VISA Resource Strings for the two M8190A modules.



Step 3 - Now change the properties of the two newly created shortcuts. You need to add new parameters to the target string. Copy the Visa Resource String for first firmware and add it to the target field and press "OK".



Step 4 – Similarly, copy the Visa Resource String for second firmware and add it to the target field and press "OK".

Once you have created the shortcuts, start the firmware instances by double-clicking on these shortcuts.

2.7 Basic Problems

Query The M8190A firmware does not come up.

Solution You should power cycle the chassis and reboot the host system.
The following is the power-up sequence:

1. Power up the chassis first. Use the ON/STANDBY button on the front panel of the chassis.
2. Wait until the chassis ESM Status LED becomes steady green.
3. Wait another 60 seconds for the chassis to finish booting up.
4. Power up the remote host.

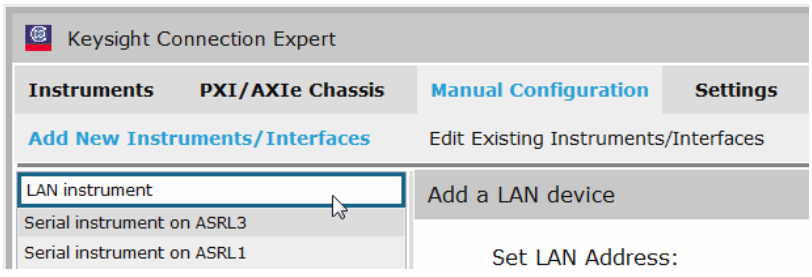
NOTE **If you are using the AXIe Embedded Controller Module as the host computer, then you need not perform the host PC power up steps because the Embedded Controller startup is managed internally and the controller automatically starts after the chassis power is stable.**

Query The instrument is not listed in Keysight Connection Expert's Instruments View.

Solution

1. See if the instrument is listed in Keysight Connection Expert's Instruments View. Many LAN instruments are auto-discovered and you do not need to add them. When the system starts for the first time you will see the PXI instrument entry in the Keysight Connection Expert's Instruments View:

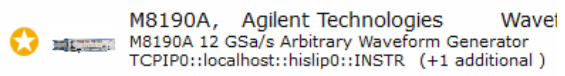
2. If the instrument is not listed, click the **Rescan** button in the Instruments View and wait for the "Rescan complete" message to appear in the message area at the bottom of the window. This may cause the instrument to be added to the list.
3. If the instrument is still not listed, follow the instructions below to add the instrument manually.



   a. Select **Manual Configuration**.
   b. Select **Add New Instruments/Interfaces**.

c. When the system is first configured and started, the TCP/IP LAN connection will not be available. You should manually add the LAN instrument manually. To do so, select **LAN Instrument** from the list of devices that can be added, at the left of the screen. While doing so, make sure that the firmware is running in the background.

d. Fill in the instrument's properties. The IP address of the instrument will be the IP address of the PC running the firmware or localhost.



e. Test the connection.

f. Click **Accept**.

For more details, refer to online help of Keysight Connection Expert.

Query The M8190A firmware comes up, but the M8190A SFP (Soft Front Panel) does not comes up.

Solution Ensure that same version of both M8190A Firmware and M8190A IVI drivers must be properly installed.

Query The M8190A firmware display an error message asking for a log file.

Solution The stated folder might be a hidden one. When entering the path manually in the File Explorer (...\AppData\...) it should show up.

Query M8190A firmware upgrade is not successful.

Solution If your firmware upgrade is not successful, follow the given steps:

1. Manually uninstall the old versions of the M8190A Firmware and the M8190A IVI driver.
2. Now, start the fresh installation of the new M8190A firmware version.

Query The AXIe chassis or a module does not power up.

Solution If the chassis or a module does not appear to power up, check the following:

- The circuit breakers at the rear of the chassis are set to the right, which is the ON position.
- The AC power cords are connected to a working power source.
- The electrical circuits are not overloaded. Check the combined power requirements of all equipment on the same circuit.
- There are no empty slots in the chassis. Leaving slots empty can overheat the inserted modules, causing them to shut down.

Query Contacting Keysight for sales, service and support.

Solution To contact Keysight for sales, service and support, go to; www.keysight.com/find/contactus.

3 AXIe Chassis

Introduction

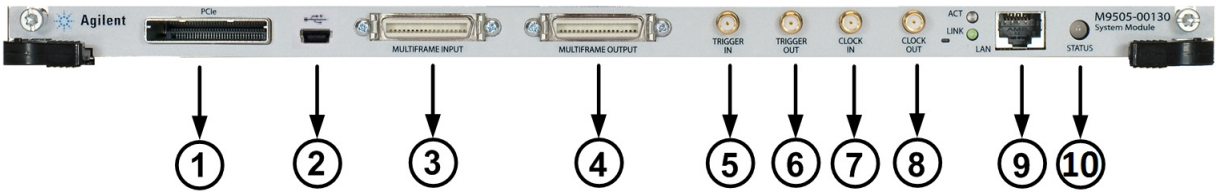
This chapter describes the usage of the AXIe chassis in combination with the M8190A.

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

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

3.1 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 available for AXIe chassis with option U20 only.
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 M8190A. The M8190A has its own Trigger In. The Trigger Out of the AXIe ESM cannot be controlled by the M8190A.
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 M8190A.
10	Status Light	Indicates the chassis status.

4 M8190A Maintenance

Introduction

This chapter explains how to install and maintain the M8190A. It covers the following topics:

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

4.1 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 M8190A. 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.

4.2 Power and Ventilation Requirements

For power and ventilation requirements, refer to:

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

4.3 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.

4.4 Battery

The M8190A does not have a battery.

4.5 Operating Environment

Storage Temperature	–40 °C to +70 °C
Operating Temperature	0 °C to 40 °C
Humidity	95%R.H. (at 40 °C)
Altitude	Up to 2000 m
Installation	Category II
Pollution	Degree 2

WARNING

The instrument is not designed for outdoor use. Do not expose the instrument to rain or other excessive moisture. Protect the instrument from humidity and temperature changes, which could cause condensation within the instrument.
Do not operate the instrument in the presence of flammable gases, fumes or powders. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

4.6 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.

5 Characteristics

5.1 Performance Specification

The performance specification can be found in the Data Sheet of the M8190A at:
http://www.keysight.com/find/M8190A

5.2 General

Power consumption	210 W (nom), 12 GSa/s operation
Operating temperature	0 °C to 40 °C
Storage temperature	-40 °C to 70 °C
Operating humidity	5 % to 80 % relative humidity, non-condensing
Operating altitude	up to 2000 m
Safety designed to	IEC 61010-1, UL 61010-1, CAN/CSA-C22.2 No. 61010-1
EMC tested to	IEC61326-1
Warm-up time	30 min
Calibration interval	1 year recommended
Warranty	1 year standard

Cooling Requirements

When operating the M8190A choose a location that provides at least 80 mm of clearance at rear, and at least 30 mm of clearance at each side for the AXIe chassis.

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www.keysight.com