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# M9703B AXIe High-Speed Digitizers

Eight CH, 12-bit, up to 3.2 GSa/s, DC up to 2 GHz bandwidth



# Notices

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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.

The following safety precautions should be observed before using this product and any associated instrumentation.

This product is intended for use by qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid

possible injury. Read and follow all installation, operation, and maintenance information carefully before using the product.

### **WARNING**

If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.

The types of product users are:

- Responsible body is the individual or group responsible for the use and maintenance of equipment, for ensuring that the equipment is operated within its specifications and operating limits, and for ensuring operators are adequately trained.
- Operators use the product for its intended function. They must be trained in electrical safety procedures and proper use of the instrument. They must be protected from electric shock and contact with hazardous live circuits.
- Maintenance personnel perform routine procedures on the product to keep it operating properly (for example, setting the line voltage or replacing consumable materials). Maintenance procedures are described in the user documentation. The procedures explicitly state if the operator may perform them. Otherwise, they should be performed only by service personnel.
- Service personnel are trained to work on live circuits, perform safe installations, and repair products. Only properly trained service personnel may perform installation and service procedures.

### **WARNING**

**Operator is responsible to maintain safe operating conditions. To ensure safe operating conditions, modules should not be operated beyond the full temperature range specified in the Environmental and physical specification. Exceeding safe operating conditions can result in shorter lifespans, improper module performance and user safety issues. When the modules are in use and operation within the specified full temperature range is not maintained, module surface temperatures may**

**exceed safe handling conditions which can cause discomfort or burns if touched. In the event of a module exceeding the full temperature range, always allow the module to cool before touching or removing modules from chassis.**

Keysight products are designed for use with electrical signals that are rated Measurement Category I and Measurement Category II, as described in the International Electrotechnical Commission (IEC) Standard IEC 60664. Most measurement, control, and data I/O signals are Measurement Category I and must not be directly connected to mains voltage or to voltage sources with high transient over-voltages. Measurement Category II connections require protection for high transient over-voltages often associated with local AC mains connections. Assume all measurement, control, and data I/O connections are for connection to Category I sources unless otherwise marked or described in the user documentation.

Exercise extreme caution when a shock hazard is present. Lethal voltage may be present on cable connector jacks or test fixtures. The American National Standards Institute (ANSI) states that a shock hazard exists when voltage levels greater than 30V RMS, 42.4V peak, or 60VDC are present. A good safety practice is to expect that hazardous voltage is present in any unknown circuit before measuring.

Operators of this product must be protected from electric shock at all times. The responsible body must ensure that operators are prevented access and/or insulated from every connection point. In some cases, connections must be exposed to potential human contact. Product operators in these circumstances must be trained to protect themselves from the risk of electric shock. If the circuit is capable of operating at or above 1000V, no conductive part of the circuit may be exposed.

Do not connect switching cards directly to unlimited power circuits. They are intended to be used with impedance-limited sources. NEVER connect

switching cards directly to AC mains. When connecting sources to switching cards, install protective devices to limit fault current and voltage to the card.

Before operating an instrument, ensure that the line cord is connected to a properly-grounded power receptacle. Inspect the connecting cables, test leads, and jumpers for possible wear, cracks, or breaks before each use.

When installing equipment where access to the main power cord is restricted, such as rack mounting, a separate main input power disconnect device must be provided in close proximity to the equipment and within easy reach of the operator.

For maximum safety, do not touch the product, test cables, or any other instruments while power is applied to the circuit under test. ALWAYS remove power from the entire test system and discharge any capacitors before: connecting or disconnecting cables or jumpers, installing or removing switching cards, or making internal changes, such as installing or removing jumpers.

Do not touch any object that could provide a current path to the common side of the circuit under test or power line (earth) ground. Always make measurements with dry hands while standing on a dry, insulated surface capable of withstanding the voltage being measured.

The instrument and accessories must be used in accordance with its specifications and operating instructions, or the safety of the equipment may be impaired.

Do not exceed the maximum signal levels of the instruments and accessories, as defined in the specifications and operating information, and as shown on the instrument or test fixture panels, or switching card.

When fuses are used in a product, replace with the same type and rating for continued protection against fire hazard.

Chassis connections must only be used as shield connections for measuring

circuits, NOT as safety earth ground connections.

If you are using a test fixture, keep the lid closed while power is applied to the device under test. Safe operation requires the use of a lid interlock.

Instrumentation and accessories shall not be connected to humans.

Before performing any maintenance, disconnect the line cord and all test cables.

To maintain protection from electric shock and fire, replacement components in mains circuits – including the power transformer, test leads, and input jacks – must be purchased from Keysight. Standard fuses with applicable national safety approvals may be used if the rating and type are the same. Other components that are not safety-related may be purchased from other suppliers as long as they are equivalent to the original component (note that selected parts should be purchased only through Keysight to maintain accuracy and functionality of the product). If you are unsure about the applicability of a replacement component, call an Keysight office for information.

**WARNING**

No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock do not remove covers. For continued protection against fire hazard, replace fuse with same type and rating.

PRODUCT MARKINGS:



The CE mark is a registered trademark of the European Community.



Australian Communication and Media Authority mark to indicate regulatory compliance as a registered supplier.



This symbol indicates product compliance with the Canadian

Interference-Causing Equipment Standard (ICES-001). It also identifies the product is an Industrial Scientific and Medical Group 1 Class A product (CISPR 11, Clause 4).



**MSIP-REM-Kst-  
BL15152**

South Korean Class A EMC Declaration. This equipment is Class A suitable for professional use and is for use in electromagnetic environments outside of the home. A 급 기기 (업무용 방송통신 기자재) 이 기기는 업무용 (A 급) 전자파적 합기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.



This product complies with the WEEE Directive marketing requirement. The affixed product label (above) 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 Annex 1, this product is classified as “Monitoring and Control instrumentation” product. Do not dispose in domestic household waste. To return unwanted products, contact your local Keysight office, or for more information see <http://about.keysight.com/en/companyinfo/environment/takeback.shtml>.



This symbol indicates the instrument is sensitive to electrostatic discharge (ESD). ESD can damage the highly sensitive components in your instrument. ESD damage is most likely to occur as the module is being installed or when cables are connected or disconnected. Protect the circuits from ESD damage by wearing a grounding strap that provides a high resistance path to ground. Alternatively, ground yourself to discharge any built-up static charge by touching the outer shell of any grounded instrument

chassis before touching the port connectors.



This symbol on an instrument means caution, risk of danger. You should refer to the operating instructions located in the user documentation in all cases where the symbol is marked on the instrument.



This symbol 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.



This symbol denotes a hot surface. The side cover of the module will be hot after use and should be allowed to cool for several minutes.

CLEANING PRECAUTIONS:

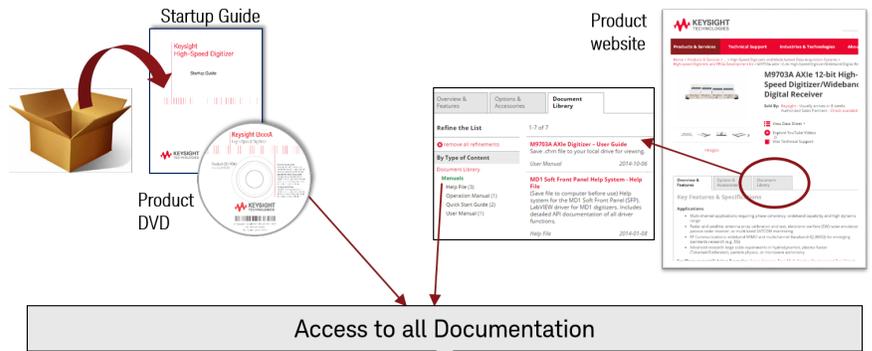
**WARNING**

To prevent electrical shock, disconnect the Keysight Technologies instrument from mains before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally. To clean the connectors, use alcohol in a well-ventilated area. Allow all residual alcohol moisture to evaporate, and the fumes to dissipate prior to energizing the instrument.

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# Documentation Map



**Startup Guide**

- Unpack product
- Verify shipment
- Install & connect hardware
- Verify operation
- Troubleshooting

**User Manual**

In-depth information and reference material specific to your digitizer product

**Datasheet**

- Product description
- Technical specifications

Soft Front Panel (SFP)

SFP embedded help

- Product Theory of operation
- Configuration
- Self test
- Self calibration
- Error report

Visual Studio

IVI Driver embedded help

- IVI-COM and IVI-C driver programmer's reference

LabVIEW

IVI Driver embedded help

- LabVIEW driver programmer's reference

# M9703B AXIe High-Speed Digitizers Introduction

The scope of this Startup Guide is to detail the processes of receiving and installing the Keysight M9703B AXIe High-Speed Digitizers, installing the required software, and verifying basic module operation.

If you have any questions after reviewing this information, please contact your local Keysight representative or contact us through our website at

[www.keysight.com/find/contactus](http://www.keysight.com/find/contactus).

## Related Documentation

If you have run the Keysight MD2 software installer on your PC, this Startup Guide and the related product documentation listed below have been installed to your hard drive.

Document	Description and location
Startup Guide	Includes procedures to help you to unpack, inspect, install (software and hardware), perform instrument connections, verify operation, and troubleshoot your product. <b>Start &gt; Keysight MD2 Digitizer &gt; M9703B Startup Guide</b>
User Manual	Provides in-depth information and reference material specific to your digitizer product. <b>Start &gt; Keysight MD2 Digitizer &gt; M9703B User Manual</b>
Data Sheet	In addition to a detailed product introduction, the data sheet supplies full product specifications. <b>Start &gt; Keysight MD2 Digitizer &gt; M9703B Data Sheet</b>
Soft Front Panel (help system)	Provides information on the use of the driver Soft Front Panel. <b>Start &gt; Keysight MD2 Digitizer &gt; MD2 SFP Help</b>
IVI Driver reference (help system)	Provides detailed documentation of the IVI-COM and IVI-C driver API functions, as well as information to help you get started with using the IVI drivers in your application development environment. <b>Start &gt; Keysight MD2 Digitizer &gt; AgMD2 IVI Driver Help</b>
LabVIEW Driver reference (help system)	Provides detailed documentation of the LabVIEW G driver API functions. <b>Start &gt; Keysight MD2 Digitizer &gt; LabVIEW Help</b>

## Follow the Startup Sequence

This StartUp Guide is intended to lead the user through the four steps of product installation as summarized in the diagram below. An optional fifth step shows how to perform an operational verification of the M9703B AXIe High-Speed Digitizers.

### Step 1: Unpack and Inspect



### Step 2: Verify Shipment



### Step 3: Install Drivers and Software



### Step 4: Install Modules



**WARNING**

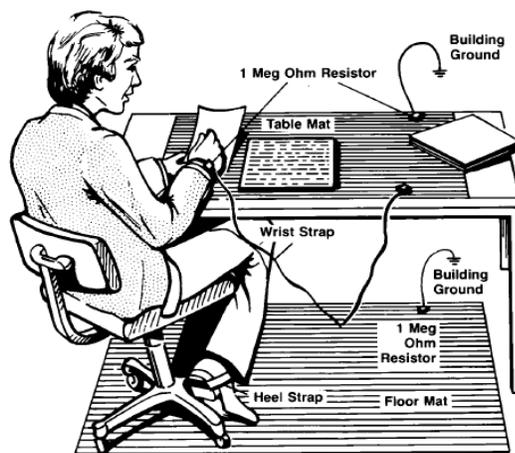
Closely follow the startup process flow in this document. Deviating from the sequence can cause unpredictable system behavior, damage your system, and may cause personal injury.

---

## Step 1: Unpack and Inspect the Module

**CAUTION** The module is shipped in materials which prevent damage from static. The module should only be removed from the packaging in an anti-static area ensuring that correct anti-static precautions are taken. Store all modules in anti-static envelopes when not in use.

### Electrostatic Discharge (ESD) Precautions



Electrostatic discharge (ESD) can damage or destroy electronic components. Use a static-safe work station to perform all work on electronic assemblies. The figure (left) shows a static-safe work station using two types of ESD protection: conductive table-mat and wrist-strap combination, and conductive floor-mat and heel-strap combination. Both types, when used together, provide a significant level of ESD protection. Of the two, only the table-mat and wrist-strap combination

provides adequate ESD protection when used alone. To ensure user safety, the static-safe accessories must provide at least 1 M $\Omega$  of isolation from ground.

**WARNING** DO NOT use these techniques for a static-safe work station when working on circuitry with a voltage potential greater than 500 volts.

### Inspect for Damage

After unpacking a module, inspect it for any shipping damage. Report any damage to the shipping agent immediately, as such damage is not covered by the warranty (see warranty information at beginning of this document).

**CAUTION** To avoid damage when handling a module, do not touch any exposed components or connector pins.

**NOTE** See <http://www.keysight.com/find/tips> for information on preventing damage to your Keysight equipment.

## Return a Module for Service

Should it become necessary to return a module for repair or service, follow the steps below:

1. Review the warranty information shipped with your product.
2. Contact Keysight to obtain a Return Material Authorization (RMA) and return address. For assistance finding Keysight contact information, go to [www.keysight.com/find/assist](http://www.keysight.com/find/assist) (worldwide contact information for repair and service).
3. Write the following information on a tag and attach it to the malfunctioning equipment:
  - Name and address of owner. A P.O. box is not acceptable as a return address.
  - Product model number (for example, M9703B).
  - Product serial number. The serial number label is located on the top cover of the module. The serial number can also be read from the Soft Front Panel interface, but only after the hardware is installed.
  - Description of failure or service required.
4. Pack the module in its original ESD bag and packing carton. If the original carton is not available, use bubble wrap or packing peanuts and place the instrument in a sealed container and mark the container “FRAGILE”.
5. On the shipping label, write ATTENTION REPAIR DEPARTMENT and the RMA number.

**NOTE**

If any correspondence is required, refer to the product by serial number and model number.

---

## Step 2: Verify M9703B Shipment Contents

The following items are also included with your M9703B AXIe High-Speed Digitizers order:

Part Number	Quantity	Description
M9703B	1	AXIe High-Speed Digitizers. (M9703B I/O is delivered with B01 application option).
M9700-10001	1	Keysight MD2 High-Speed Digitizer Software & Product Information DVD.
M9700-10005	1	Keysight High-Speed Digitizer Streaming Application Software DVD
M9703-90006	1	Startup Guide in hard copy.
5962-0476	1	Certificate of Calibration.
9320-6741	1	ROHS (China addendum).
U1092-80002	2	Cable, BNC (male) to MCX (male), 1 m.

**NOTE**

All the files contained on the DVDs are available for download at [www.keysight.com/find/M9703B](http://www.keysight.com/find/M9703B).

## Step 3: Install the Software

### System Requirements

Requirements	Windows	Linux
Operating system	Windows 10 <sup>®</sup> (32 or 64-bit), all versions <b>Note:</b> If using the Streaming Application Software DVD, Windows 10 <sup>®</sup> (64-bit) is required.	Linux Kernel 3.x, 4.x & 5.0 to 5.4
Processor speed	1 GHz 32-bit (x86), 1 GHz 64-bit (x64), no support for Itanium64	As per the minimum requirements of the chosen distribution
Available memory	1 GB minimum <sup>1</sup>	As per the minimum requirements of the chosen distribution
Available disk space	2.5 GB available hard disk space, includes <sup>2</sup> : 1.5 GB for Keysight IO Libraries Suite 1 GB for Keysight MD2 <b>Note:</b> 400 MB for Streaming Applications Software	100 MB
Display	Minimum of 1024 x 768, 96 or 120 DPI	No display required
Browser	Use a supported version of Microsoft Edge, Google Chrome, or Mozilla Firefox.	Distribution supplied browser

<sup>1</sup> On older PCs with minimum RAM, installation can take a long time when installing the IO Libraries Suite and the .NET Framework.

<sup>2</sup> Because of the installation procedure, less disk space may be required for operation than is required for installation. The amount of space listed above is required for installation. The .NET Framework Runtime Components are installed by default with most Windows installations, so you may not need this amount of available disk space.

## Hardware Requirements

Item	Requirements
Chassis	AXIe chassis (Keysight M9502A 2-slot, M9505A 5-slot, or M9506A 5-slot chassis recommended).
Host Controller:	Refer to the following online documents: <ul style="list-style-type: none"> <li>- Tested PC and PXI / AXIe Chassis Configurations: <a href="http://www.keysight.com/find/PXIAXIeTestedPC">http://www.keysight.com/find/PXIAXIeTestedPC</a></li> <li>- Diagnose and Resolve PXIe and AXIe Chassis Communication Problems: <a href="http://www.keysight.com/find/ResolvePXIAXIeComProblems">http://www.keysight.com/find/ResolvePXIAXIeComProblems</a></li> </ul>

## Install the Software - instructions for Windows

### CAUTION

Check if the Keysight MD2 software is installed already on your computer. If yes, first uninstall the Keysight MD2 software from the **Control Panel > Programs and Features** before installing the Keysight IO Libraries Suite (IOLS).

### Keysight IO Libraries Suite (IOLS)

The Keysight IO Libraries Suite (IOLS) contains the Keysight Connection Expert. This software is available at [www.keysight.com/find/IOsuite](http://www.keysight.com/find/IOsuite). This software must be installed first.

### NOTE

For Keysight IO Libraries Suite, the recommended version is indicated on MD2 Driver DVD or on [www.keysight.com/find/MD2](http://www.keysight.com/find/MD2). Follow instructions on the IO Libraries Suite Downloads page for installing the IO Libraries Suite.

### Instrument Software

The instrument software, which includes device drivers (IVI-C, IVI-COM) and documentation is delivered with your shipment (part number M9700-10001) or can be downloaded from [www.keysight.com/find/MD2](http://www.keysight.com/find/MD2).

### NOTE

**Version 1.12 or higher of the Keysight MD2 High-Speed Digitizer Software is required.**

1. From the Keysight MD2 High-Speed Digitizer Software & Product Information DVD, launch the installer; OR, if the software was downloaded from the web, run the downloaded installer.

2. Follow the installer prompts. Choose a "Complete" installation to install all software and documentation, or a "Custom" installation to select from a listing of components and other features.
3. After installation is complete, shut-down the PC.

## High-Speed Digitizers Streaming Application Software DVD for Windows

The Streaming Application Software DVD installs the software required for the options M9703B-CB1 and M9703B-CB2. This software is included with your shipment (DVD part number M9700-10005).

### NOTE

**Installation of the Streaming Application Software DVD is only required if option M9703B-CB1 or M9703B-CB2 is present in the Digitizer.**

1. Install Keysight MD2 High-Speed Digitizer Software.
2. From the Streaming Application Software DVD, launch the installer.
3. Follow the installer prompts and select the applications you want to install.

## Install the Software - instructions for Linux

### CAUTION

**Do not install Keysight IO Libraries Suite (IOLS) on the same Linux system as the MD2 Instrument Drivers. The MD2 drivers interact directly with the Digitizer hardware. MD2 on Linux is not compatible with IOLS on Linux.**

### Introduction

MD2 High-Speed Digitizer Instrument Drivers are available from Keysight for both Windows and Linux platforms. The Linux version can be installed on systems with kernel 3.x, 4.x & 5.0 to 5.4.

For kernels up to version 6.0, a patch is available. This is especially beneficial to customers using Ubuntu 20.04, who might otherwise have to downgrade to kernel version 5.4.

The name of the file that is downloaded from the Linux MD2 Driver webpage is ***LinuxMD2-2.5.1.tar.gz***. Extracting this file creates a directory called *LinuxMD2-2.5.1-0.72847M*. This directory includes a README file and seven subdirectories, namely:

*centos-7, centos-8, debian-10, debian-9, Docs, ubuntu-18.04, and ubuntu-20.04*

To install MD2, you must switch to the directory that is appropriate for your distribution. For example, if the distribution is *Ubuntu 18.04* (kernel version 5.4), switch to *ubuntu-18.04*.

Note that the exact commands vary from one distribution to another. As an example, for Centos distributions, \*.rpm packages are installed with the `rpm` command. For Debian distributions, \*.deb packages are installed with the `dpkg` command.

The instructions in the following section apply to Ubuntu 18.04. For other distributions, adapt accordingly, if necessary.

For more information, refer to the README file.

## Instructions for installing the MD2 Drivers on Linux

### NOTE

Before unpacking the Linux package, make sure dkms is installed. Example:

```
dkms status
```

If dkms is not already installed, install it. Example:

```
sudo apt-get install dkms
```

1. Download LinuxMD2-2.5.1.tar.gz from the [MD2 High-Speed Digitizer Instrument Drivers download page for Linux](#).

2. Extract the distributions.

```
tar -xvf LinuxMD2-2.5.1.tar.gz
```

3. Change to the directory that matches your Linux distribution.

4. Install all packages at once. For example:

```
sudo dpkg -i *.deb
```

### NOTE

It is not strictly necessary to install all packages. For basic operation of the modules, packages *agmodinst-dkms*, *ktvisa*, *md2-driver*, and *md2-firmware* must be installed. Refer to the README file for details.

## Instructions for installing the MD2 Driver Patch for Linux kernel 5.15 or 6.0

The instructions in the previous section guide you to install all packages, including *agmodinst*. However, for Linux kernel version 5.15 or 6.0, building the kernel driver fails if the previous steps are followed. Therefore, a patch must be installed.

1. Download the patch file.

It is an updated version of *agmodinst*, namely: `agmodinst-dkms_3.5.7_all.deb`.

2. Install the updated driver.

```
sudo dpkg -i agmodinst-dkms_3.5.7_all.deb
```

This replaces the previous version 3.5.5 and should build successfully.

## Create Symbolic Link

The following instructions ensure that the configuration file for the MD2 driver is found. This step is required for all Linux distributions.

```
sudo mkdir /etc/AgMD2
```

```
sudo ln -s /etc/AgMD2.ini /etc/AgMD2/AgMD2.ini
```

## Step 4: Install the Module

M9703B supported AXIe chassis configurations:

- In an M9502A 2-slot chassis, two M9703B modules could be used.
- In an M9505A 5-slot chassis, five M9703B modules could be used.
- In an M9506A 5-slot chassis, five M9703B modules could be used.
- In an M9514A 14-slot chassis, eight M9703B modules could be used.
- The empty slots must be closed using Y1221A AXIe Filler Module.

---

**CAUTION** In any case, the remaining slots should be filled either with another instrument, or with an AXIe slot filler.

---

**CAUTION** The M9703B hardware does not support "hot-swap" operations. Before installing the module into the chassis, power-off the chassis to prevent damage to the module.

---

1. Make sure that the power cord is plugged-in to establish earth ground but the chassis power is Off (Standby).
2. Position the chassis so that there is ample space between the chassis fan intake and exhaust vents.
3. If you are using an embedded controller, this must normally be installed in slot 1 of the chassis. In this case, install the M9703B in slot 2 or higher.

**IMPORTANT** Keysight recommends that the latest, most up-to-date firmware always be used in the chassis and module. It is also recommended that the latest IO Libraries, chassis drivers, and MD2 drivers be installed in the host controller.

---

4. To insert the module into a chassis:
  - a. Align the module's board edges with the chassis guide rails and push it forward into the chassis. Note that it is the circuit board, not the metal cover plate, which must be inserted into the rails. The module should slide in easily, if it does not, withdraw it and re-check the alignment.
  - b. Locate the extraction handles at either end of the module. Extend the ends of both handles by pulling them inwards towards each other; the plastic ends will slide out by about 1 cm. Then put the handles into the extracted position by pivoting them outwards until they are perpendicular to the front panel as shown in the diagram below.



- c. Slide the module completely into the chassis. When the module's connectors contact the chassis backplane you will feel some resistance, and the extraction handles will begin to move inwards. Now, you may press the handles inwards and towards the front panel until the module is completely inserted.
- d. Slide the plastic ends of the extraction handles outwards and tighten the captive retaining screws at both ends of the module.



5. Install filler panels in any unused slots. Missing filler panels may disrupt necessary air circulation in the chassis.
6. If you are using a remote controller, with an interface such as the M9048B or M9049A, connect the cable from the chassis to the PC host, as per the instructions that came with the interface.
7. Power up the chassis. It is often necessary to wait until the chassis and its modules have completed their start-up sequence before proceeding to power-up the host controller.
8. Reboot or power-up the PC host. Check the module front panel indicators - after the boot process the **STATUS** LED should be green, and no other LEDs lit.

### Multi-module synchronization

The M9703B AXIe Digitizer includes the ability to maintain synchronization across multiple modules within the same AXIe chassis.

For details about multi-module location in the chassis and configuration prior to synchronization, refer to [M9703B User Manual](#) > **Multi-Module Synchronization** section.

Once the modules and chassis are configured, the multi-module acquisition can be performed. **MD2 Soft Front Panel** can be used to verify the configuration and synchronize the modules: See [MD2 SFP Help](#) > **Specific modes** > **Multi-module synchronization**.

## M9703B Front Panel Features



Front panel of M9703B (default).

## Front Panel Connectors

Connector	Type	Description
IN (1 - 8)	SMA female	The analog signal inputs, which are DC-coupled and 50 $\Omega$ terminated. The input full scale ranges are selectable, either 1 V or 2 V. Recommended maximum operating voltage is $\pm 3$ V (1V FSR) or $\pm 4.3$ V (2V FSR). Clamp at $\pm 3.6$ V (1V FSR) or $\pm 6.3$ V (2V FSR). Absolute maximum DC voltage rating $\pm 4.6$ V (1V FSR) or $\pm 5$ V (2V FSR). Frequency range is DC to 650 MHz (-F05) or DC to 2 GHz (-F10).
REF IN	MCX female	This external reference clock input is AC coupled and 50 $\Omega$ terminated. It can accept a 100 MHz signal up to 3 dBm (0.3 V rms / 50 $\Omega$ ). <i>Not available on M9703B I/O with application option B01<sup>1</sup>.</i>
CLK IN	SMA female	This external clock source is AC-coupled, with 50 $\Omega$ termination, and can accept signals up to +15 dBm (1.26 V rms / 50 $\Omega$ ). Frequency = 1.8 to 2 GHz with -SR1 option or 1.8 to 3.2 GHz with -SR2 option.
TRG 1, 2, 3	MCX female	These external trigger inputs are DC-coupled, 50 $\Omega$ terminated. The trigger level range is $\pm 5$ V.
TRG OUT	MCX female	Trigger Out signal.
DPU JTAG	USB Mini	JTAG FPGA debugging interface. Used in conjunction with the U5340A FDK.
CTR JTAG	USB Mini	Not currently supported.
I/O 1, 2	MCX female	User configurable Input / Output signal. 3.3 V CMOS and TTL compatible.

<sup>1</sup>User can connect the External Reference to the chassis and use AXIe reference.

**NOTE**

Digitizer can usually work with signals present at the external reference and clock inputs (REF IN and CLK IN). However, to ensure the best performance, or if the calibration is found to be unreliable, it is recommended to remove such signals when working with internal clock.

## Front Panel for M9703B I/O (with B01 application option)



Front panel of M9703B I/O (with B01 application option).

## Connectors specific to M9703B I/O (B01 application option)

Connector	Type	Description
JA, JB, JC, JD	USB Mini	JTAG FPGA debugging interface for I/O-EX mezzanine.
I/O-EX A, B, C, D	Omnetics Nano-D connector with 51 pins	Real time I/O interfaces with 48 I/Os on each of the four DPUs. User configurable input/output signals, 2.5 V CMOS compatible. Connector reference: (51) Socket female Bi-Lobe® Connector from Omnetics Connector ©.



## Front Panel LEDs

Indicator	Purpose	Color	State	Meaning
H/S	Hot Swap		Off	Normal operating mode
			Blue, blinking	Initializing
OOS	Out Of Service		Off	ATCA bus is ready
			Red	ATCA bus is not ready
LA, LB, LC, LD	DPU status		Off	DPU FPGA is not configured
			White	Idle
STATUS	Instrument status		White, blinking	Firmware initialization in progress
			Green, blinking	Software initialization in progress
			Orange, blinking	Warning (see note below)
			Red, blinking	Error (see note below)
			Green	OK

**NOTE**

If warning or error status is observed, try the following steps:

- Power-cycle the chassis (If using a PCIe expansion chassis, observe the power sequence requirements)
- If the error persists please contact Keysight technical support  
<http://www.keysight.com/find/contactus>.

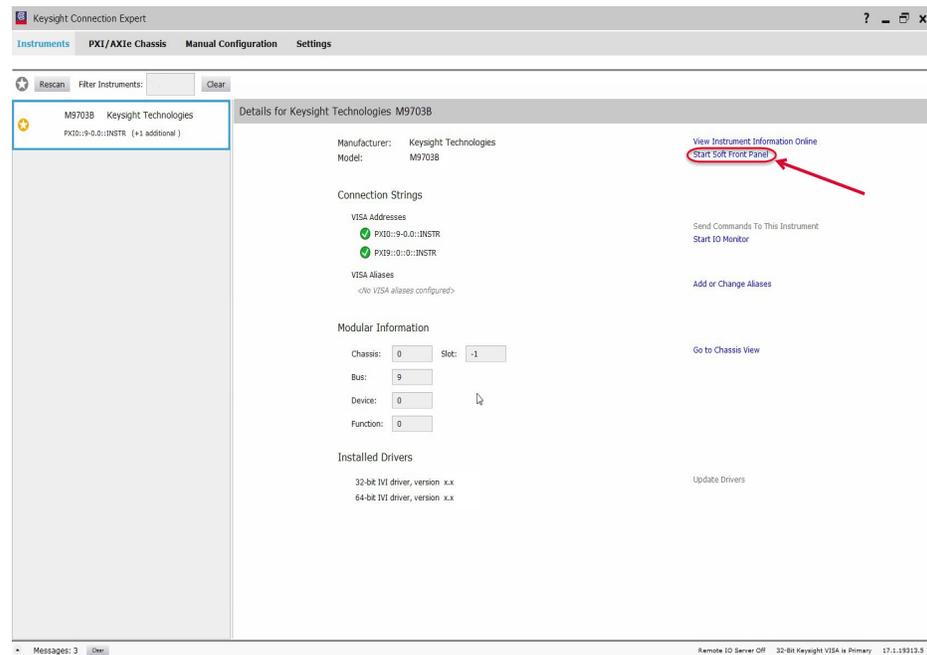
## Step 5: Verify Operation of the M9703B Module

### Keysight Connection Expert (Windows only)

The intention of this step is to verify correct operation of the newly installed module. Run **Keysight Connection Expert** by clicking the task bar icon , and select **Connection Expert**.

The list of installed modules is displayed. The instrument properties may be viewed by clicking on the desired instrument from the list on the left.

Review the configuration data and then click on **Start soft front panel** to launch the **MD2 Soft Front Panel**. This will provide control of the module for calibration, test and other operational verification procedures.



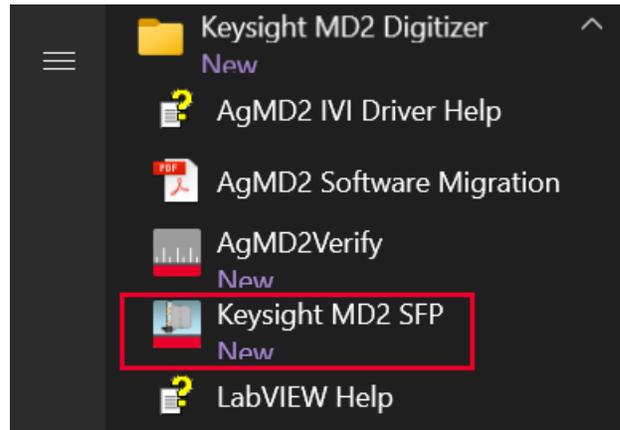
#### NOTE

If the module does not appear in the Keysight Connection Expert, first try the **Rescan** button. If that does not work, restart your PC or embedded controller and restart Keysight Connection Expert again.

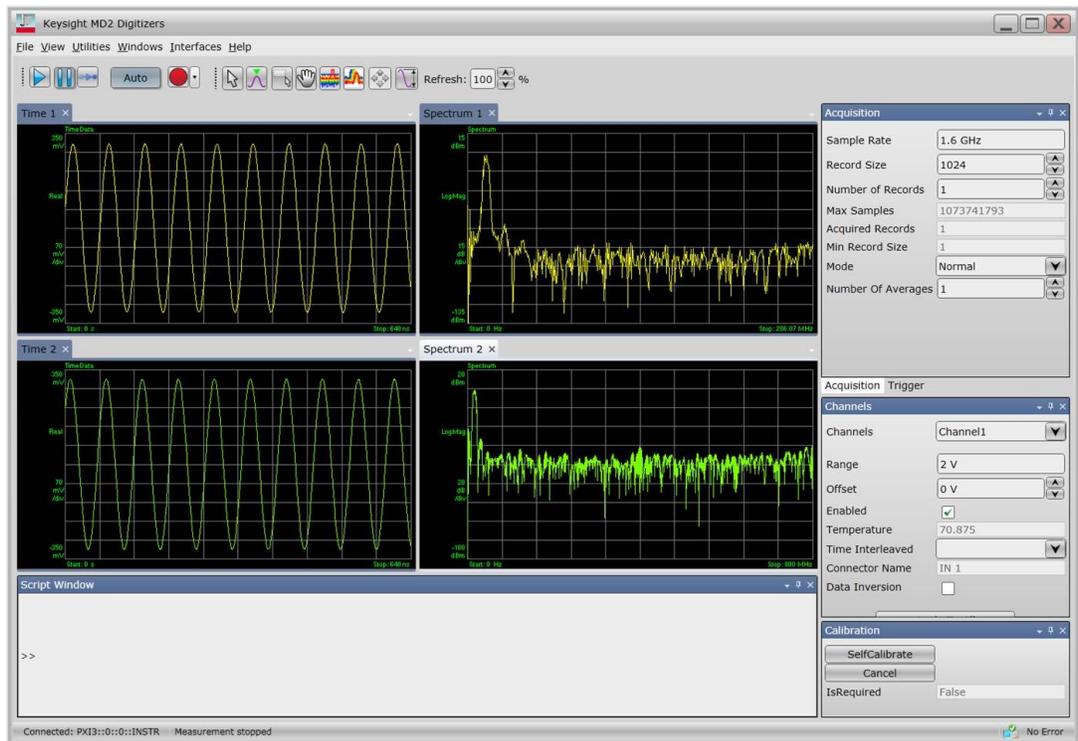
## Driver Graphical Interface: MD2 Soft Front Panel (Windows only)

The **Keysight MD2 SFP** (Soft Front Panel) is a graphical interface for High-Speed Digitizer Instrument Drivers that enables the control of any supported digitizers.

The MD2 SFP can be launched from **Keysight Connection Expert**, either directly or from the **Windows Start Menu > Keysight MD2 Digitizer > Keysight MD2 SFP**.



The **Connection window** opens with the selection of the digitizer to monitor. After selecting your digitizer, click **Connect**. For details, please refer to **MD2 SFP Help**.



Example of display after running a high-speed digitizer acquisition with the MD2 SFP (Acquisition parameters depends on your digitizer).

## Perform a Verification of the M9703B (optional)

### Requirements for Verification

The correct operation of the M9703B may be verified by the use of a simple application which carries out several performance checks on a signal acquired from an external Function Generator.

### Required Hardware

An external signal source is required. Almost any sine wave or function generator capable of generating a signal with an amplitude of 300 mV rms into 50  $\Omega$  at a frequency of 1 MHz may be used.

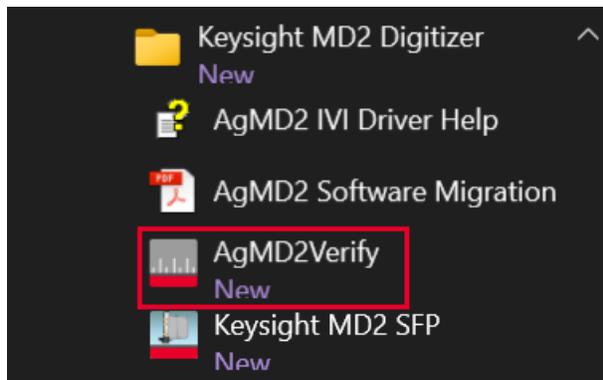
Hardware	Description
RF Analog Signal Generator	e.g. Keysight N5181B
1x BNC - SMA cable	50 $\Omega$ Coaxial BNC(m) to SMA(m) cable (100 cm)
1x Keysight 1250-1476 Adaptor	Type N(m) to BNC(f) adaptor

### Operational Verification Procedure

**CAUTION** Do not exceed the maximum voltage level at the INPUT connector ( $\pm 3.6$  V DC)

1. Configure the RF Generator to produce a Sine signal with a Frequency of 1.0 MHz, an Amplitude of 300 mV rms (+2.55 dBm).
2. Connect the Signal Generator output to the IN 1 connector, and enable the output.
3. Perform one of the following steps, depending on whether you are a Windows or Linux user:
  - In Windows, launch the *AgMD2Verify* utility from **Windows Start Menu > Keysight MD2 Digitizer > AgMD2Verify**.

## Step 5: Verify Operation of the M9703B Module



A command shell window will open. Select the instrument PXI address. Then, **Press any key** to start the test.

- In Linux, the *AgMD2Verify* utility is installed by the *md2-verify* pack under `/usr/bin/AgMD2Verify`. After installation, you can launch *AgMD2Verify* or *AgMD2Verify <PXI\_address>*, specifying the PXI address in case of multiple instruments.  
For example: `--$ AgMD2Verify <PXI51::0::0::INSTR>`.

The screen capture below shows the result of a successful verification:

A screenshot of the AgMD2Verify application window. The window title is 'AgMD2Verify'. The main content is a terminal window showing the following text:

```
AgMD2Verify
=====
Driver identifier: AgMD2
Driver revision: 1.8.X.X
Driver vendor: Keysight Technologies
Driver description: IUI Driver for AgMD2 family of digitizers [Compiled for 64-bit.]

0) Verify resource PXI16::0::INSTR
1) Verify resource PXI3::0::INSTR
Selection? (or [ENTER] to exit) 0
Please connect a sinusoidal signal of 1.0 MHz and 300 mU rms (2.55 dBm) to channel 1 input.
Press any key to continue...
Checking instrument PXI16::0::INSTR
-----
Instrument model: M9703B
Instrument options: LW2,F06,FDK,INT,M40,SR2
Manufacturer: Keysight Technologies
Firmware revision: CTRL FPGA 3.1.0.54355, <
A 3.3.23.54342M, <2>DPU FPGA 3.3.23.54342M, <
D 23/9, <1>FE CPLD 23/9, <2>FE CPLD 23/10, <
Serial number: SN 131291
Simulate: False

Reference signal:
Waveform: Sinusoidal
Frequency: 1.0 MHz
Amplitude: 300 mU rms (2.55 dBm)

Acquisition parameters:
Record size: 16000
Sample rate: 1.60E+009

Channel parameters:
Channel: Channel1
Range: 1.00 U
Offset: 0.00 U
Coupling: AgMD2VerticalCouplingDC

Trigger parameters:
Level: 0.00 U
Slope: AgMD2TriggerSlopePositive
Delay: -5.25 us
ActiveSource: Internal

Acquiring data: --> OK
Signal amplitude: 438.90 mU
Reference: 424.26 mU
Error: 3.45 % --> OK
Signal RMS: 312.01 mU
Reference: 300.00 mU
Error: 4.00 % --> OK
Signal frequency: 1.000 MHz
Reference: 1.000 MHz
Error: 0.01 % --> OK
```

Red boxes highlight specific parts of the output: 'Depends on MD2 version.' next to the driver revision, 'This information depends on the digitizer model and ordered options.' next to the instrument options, and two boxes at the bottom: 'The verification tests depends on the digitizer model.' and 'Check that all the test results are OK.'

**NOTE**

AgMD2Verify checks the version of the Control FPGA firmware. If the version is not up-to-date, the tool will automatically propose to update the firmware using the "Firmware Update Utility". Once the Control FPGA firmware has been updated successfully, please power off your computer and restart it again for the update to take effect. You may then proceed with the AgMD2Verify utility as described in this section.

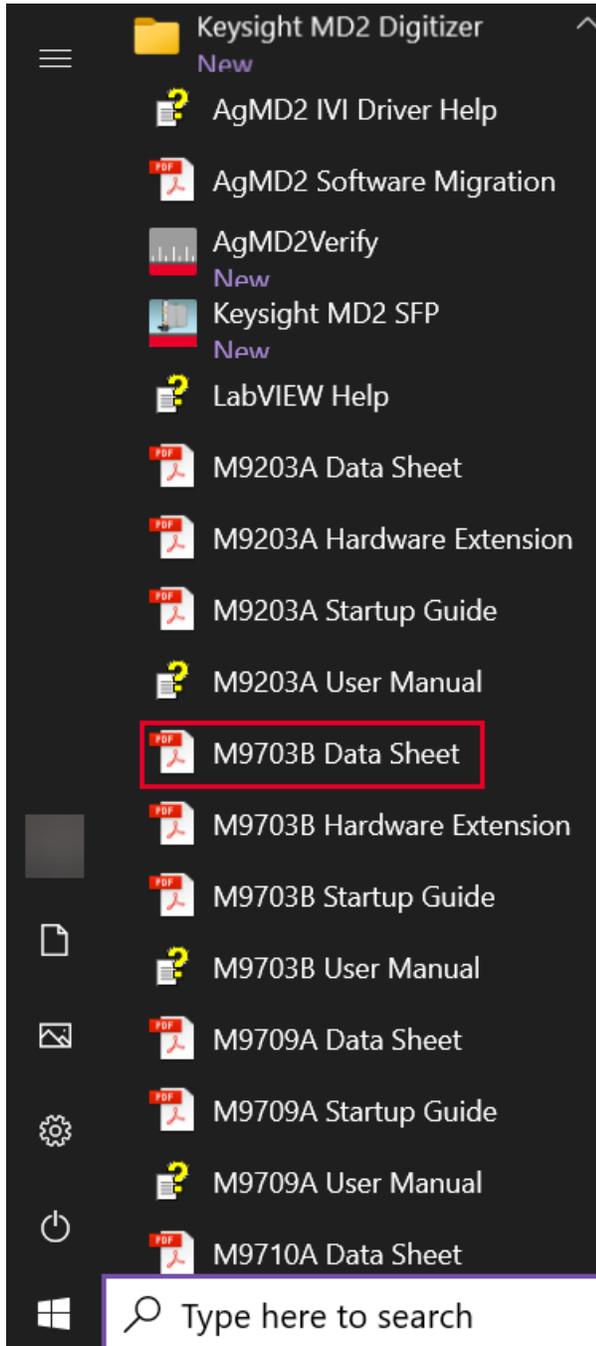
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If a problem is found

1. Verify that you have made all configuration settings as shown above.
2. Verify that the RF generator is ON and producing the desired signals at the end of the cable. This can be done with an oscilloscope.
3. Verify that the problem is reproducible.
4. Contact Keysight technical support for assistance. Contact details may be found at: [www.keysight.com/find/contactus](http://www.keysight.com/find/contactus).

## Keeping Documentation up-to-date (Windows only)

M9703B datasheet and manuals are included in the MD2 software download. The documentation can be opened from the Windows Start menu.



The same documentation is also available from the Keysight website. Occasionally, it is necessary to make changes to the datasheet or manuals. The changes appear immediately in the documentation posted on the website. If you find that the

documents that you open from the Start menu are not in agreement with those on the Keysight website, you can follow these steps to bring them into alignment.

1. Open folder “C:\Program Files\Keysight\MD2\Help” and identify the file that must be replaced.
  - File names are self-explanatory: <Model>\_DataSheet.pdf, or <Model>\_StartupGuide.pdf.
2. Click the hyperlink that opens the required file at [www.keysight.com](http://www.keysight.com), and save it using the appropriate file name (or save as the default name, and rename it later).
3. Ensure the file in question at “..\MD2\Help” is not currently in use, and move the downloaded file to this location.
4. When prompted that “the destination folder already has a file named <file name>”, choose to “replace the file in the destination”.

This information is subject to change  
without notice.

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