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Startup
Guide

Keysight U1084A
PCIe High-Speed Digitizer

8-bit, up to 4 GS/s
and 1.5 GHz bandwidth



Notice: This document contains references to Agilent. Please note that Agilent's Test and Measurement business has become Keysight Technologies. For more information, go to www.keysight.com.

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Manual Part Number

U1084-90002

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Regulatory Compliance

This product has been designed and tested in accordance with accepted industry standards, and has been supplied in a safe condition. To review the Declaration of Conformity, go to http://www.keysight.com/go/conformity.

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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

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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.

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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).



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 방송통신기자재) 이 기기는 업무용 (A 급) 전자파적합기기로서 판 매자 또는 사용자는 이 점을 주 의하시기 바라 며 , 가정외의 지역에서 사용하는 것을 목적으 로 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.

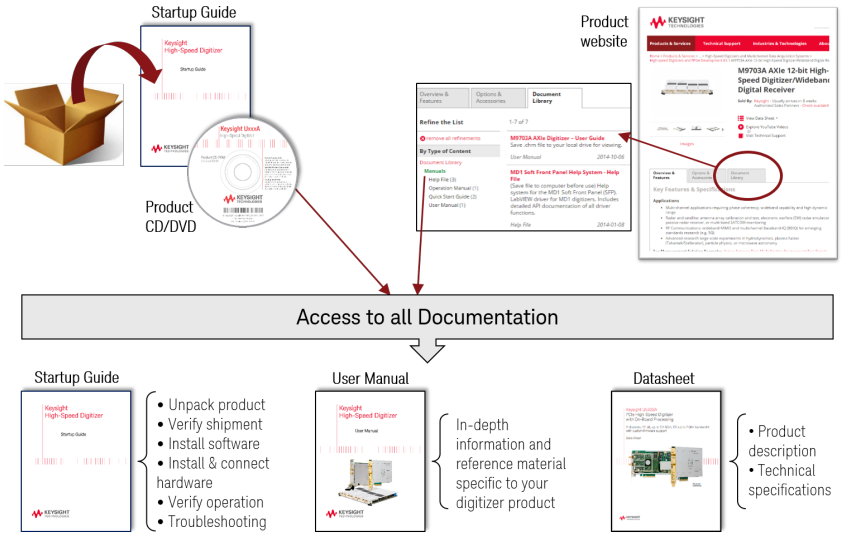
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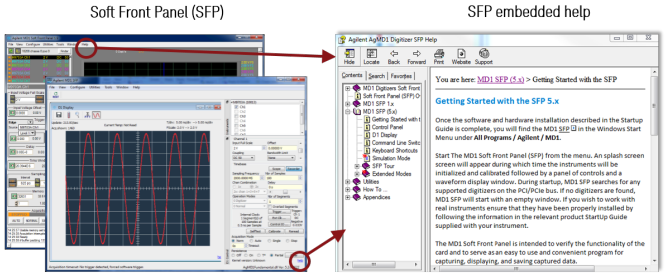
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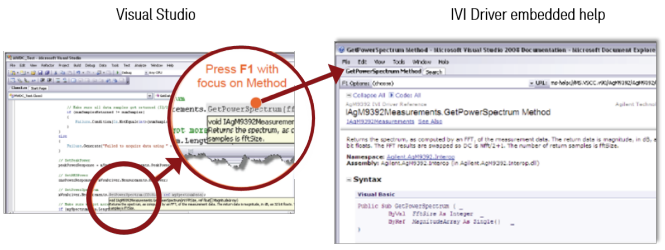
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Documentation Map

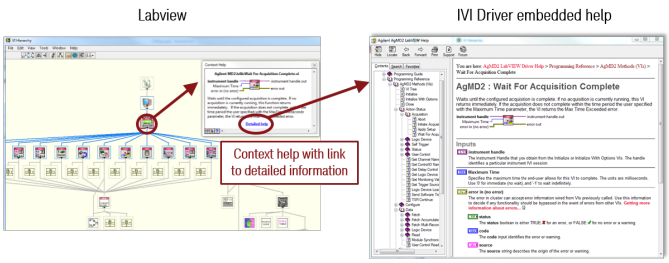




- Product Theory of operation
- Configuration
- Self test
- Field calibration
- Error report



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



- Labview driver programmer's reference

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U1084A PCIe High-Speed Digitizer Introduction

The scope of this Startup Guide is to detail the processes of receiving and installing the Keysight U1084A PCIe High-Speed Digitizer, installing the required software, and verifying basic module operation.

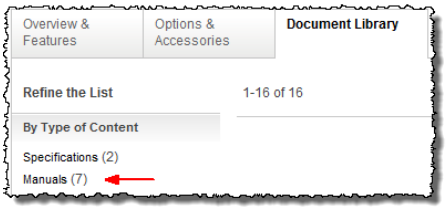
If you have any questions after reviewing this information, please contact your local Keysight representative or contact us through our website at www.keysight.com/find/contactus.

Related Documentation

This Startup Guide and the documentation listed below are contained on the CD supplied with your product. and at www.keysight.com/find/U1084A.

Select **Document Library> Manuals**

- U1084A User Manual
- Help system for the Soft Front Panel
- Help systems for the Keysight device drivers (IVI-C and IVI-COM, and LabVIEW G)



Or select **Document Library> Specifications**

- Product specifications for the Datasheet.

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Follow the Startup Sequence

This Start-Up 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 U1084A PCIe High-Speed Digitizer.

Step 1: Unpack and Inspect



Step 2: Verify Shipment



Step 3: Install Drivers and Software



Step 4: Install Modules



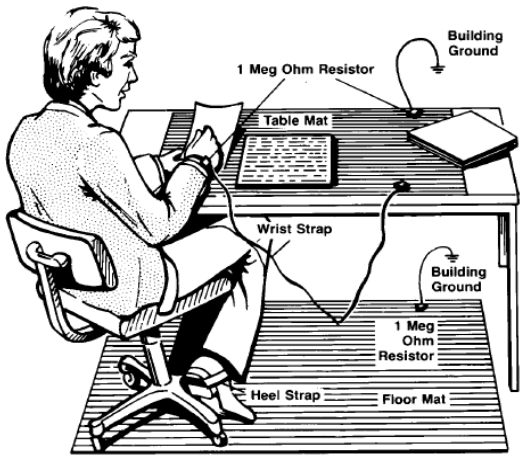
WARNING Closely follow the startup process flow in this document. Deviating from the sequence can cause unpredictable system behavior, damage your system, and may cause personal injury.

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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 MΩ 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.

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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 (worldwide contact information for repair and service) or refer to the "Support" information on the product web page at www.keysight.com/find/U1084A.
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, U1084A).
   - 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 U1084A Shipment Contents

The following items are also included with your U1084A PCIe High-Speed Digitizer order:

Part Number	Quantity	Description
U1084A	1	PCIe High-Speed Digitizer.
M9210-90007	1	Keysight MD1 High-Speed Digitizer Software and Product Information DVD
U1084-90002	1	Startup Guide in hard copy.

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Step 3: Install the Software

System Requirements

Item	Requirements	
Operating system	**Windows 7®** (32 or 64-bit), All versions.	**Linux** kernel 2.6 or higher (32 or 64-bit), Debian 6.0, CentOS 5
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	As per the minimum requirements of the chosen distribution.
Available disk space [1]	1.5 GB available hard disk space, includes: – 1 GB available for Microsoft .NET Framework 3.5 SP1 [2] – 100 MB for Keysight IO Libraries Suite	100 MB
Video	Support for DirectX 9 graphics with 128 MB graphics memory recommended (Super VGA graphics is supported)	Does not require graphics (headless system). X Windows with 1280x1024 recommended for SFP
Browser	Microsoft Internet Explorer 7.0 or higher	Distribution supplied browser.

[1] 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.

[2] .NET Framework Runtime Components are often installed by default with Windows Vista and later versions. Therefore, you may not need this amount of available disk space.

Hardware Requirements

A PC running one of the above operating systems.

Recommended models are: HP Z420, HP Z440, Dell T3610, or Dell T5810.

Install the Software

Instrument software

Instrument software contains device drivers (IVI-C, IVI-COM) and documentation for your module.

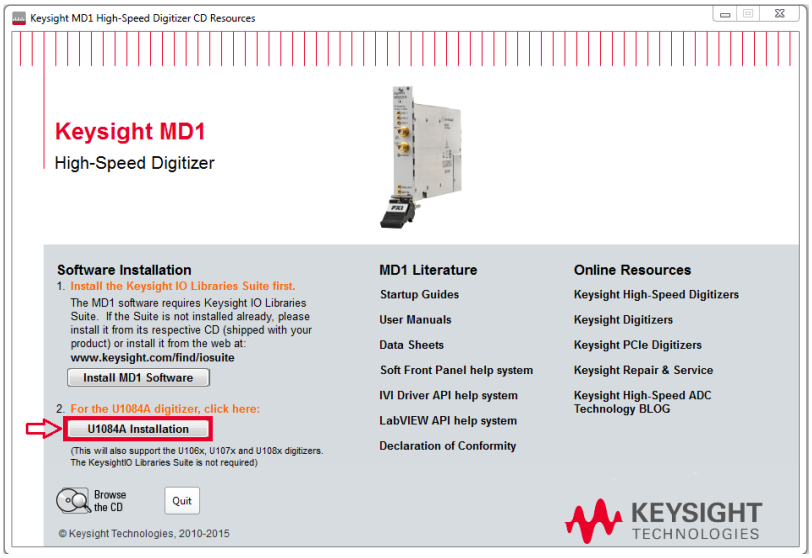
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This software is included with your shipment (Keysight MD1 High-Speed Digitizer Software and Product Information DVD, part number M9210-90007) or can be downloaded from the Keysight Technologies website: www.keysight.com/find/U1084, using the **Technical Support** tab, select **Drivers, Firmware & Software** then **Driver**.

Installation Procedure (Windows)

NOTE **Administrator privileges are required for the software installation.**

1. From the Keysight MD1 High-Speed Digitizer Software and Product Information DVD launch the installer.
2. The installation window will open.



3. Select the option **U1084A Installation**, which will install the software required for your digitizer (Keysight IO Libraries Suite is not required).
4. After installation is complete, please shut-down the PC.

The MD1 Software Package provides a specific fundamental driver (*AgMD1Fundamental.dll*), which will be installed in the **C:\Program Files\IVI Foundation\IVI\Bin** folder. In addition, it also provides the driver contained in the previous Acqiris Software Package (*AqDrv4.dll*), allowing backward compatibility with existing software applications.

The Soft Front Panel (SFP), device driver and MD1 LabVIEW driver will be installed in the **C:\Program Files (x86)\Agilent\MD1** folder.

The Acqiris LabVIEW driver, Acqiris MATLAB MEX interface, C++ examples and documentation will be installed in the **C:\Program Files (x86)\Agilent\MD1\U10xx_ Digitizers** folder.

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Installation Procedure (Linux)

The MD1 Software Package provides a specific fundamental driver (*libAgMD1Fundamental.so*) and a specific IVI-C driver (*libAgMD1.so*), which following the procedure detailed below, will be installed in the **/usr/lib/** folder.

The package also includes the driver which was contained in the previous Acqiris Software Package (*libAqDrv4.so*), allowing backward compatibility with existing software applications.

Please refer to the detailed installation instructions contained in the 'README' file, which is available from:

- The **/Linux** folder of the AgMD1 DVD (M9210-90007)
- The driver page of the Keysight Technologies website.
- Or the downloaded .tar.gz archive package.

Step 4: Install the Module

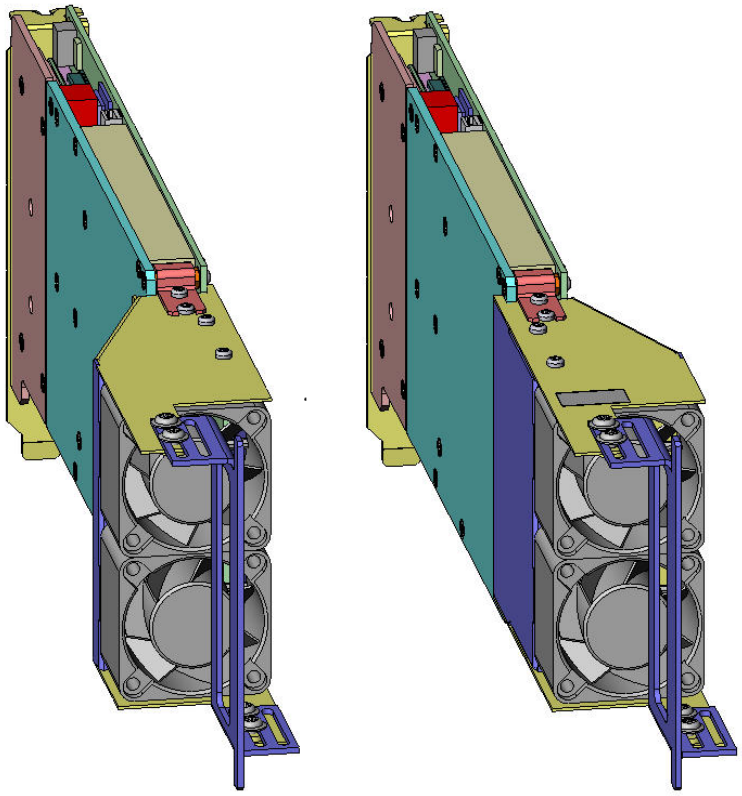
The U1084A features a x4 PCIe bus interface, and should be installed in either a 4x, a x8 or x16 slot.

To fit the module to the PC / chassis please use the following procedure:

1. Ensure that the PC is switched off, and disconnect the power cord. Open the PC case.
2. Follow ESD precautions when handling and installing the U1084A.
3. When installing the U1084A ensure that it has optimum cooling, do not install it in a position where the integrated cooling fans may be obstructed.
4. Loosen (but do not remove) the 4 screws holding the rear support bracket (shown in violet in the diagram), and slide it towards the fans.
5. Insert the module into the PCIe slot of the PC or chassis, ensuring that it is fully seated into the PCIe bus connector.
6. Fit a screw to the top front panel and tighten it.
7. Fully extend the rear support bracket and ensure that it is inside the PCIe back plane rail.
8. Tighten the 4 screws. (0.5 Nm torque)
9. Replace any covers and switch-on the PC. Check the module front panel indicators - a few seconds after the boot process, both the '*Status*' and '*DPU*' LEDs should be green.

WARNING **Both the front panel screw and the rear support bracket must be used to correctly support the unit. Failure to do this could result in damage to the unit.**

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Reversing the orientation of the fan assembly

The U1084A Digitizers are supplied with a fan unit. This fan unit is required for operation, and should not be removed.

The cooling fan assembly of the U1084A takes up 2 PC slots at the rear. It has been designed to be mounted in either a left or right orientation to allow adaptation to different PC or chassis hardware, or also to allow two U1084A modules to be positioned side-by-side.

To change the orientation please use the following procedure:

1. Remove the 2 screws (top & bottom) nearest to the front of the fan unit, and remove the 2 retaining clips (shown pale red in the diagram).
2. Slide the fan unit approximately 15mm to the rear unit it clears the circuit board, and rotate it by 180°.
3. Slide the fan unit back towards the module until it is fully seated into the locating slots.
4. Replace the 2 retaining clips, and refit and tighten the 2 screws (0.5 Nm torque).

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U1084A Front Panel Features



Front Panel Connectors

Connector	Type	Description
TR IN	MCX female	External trigger input. Trigger level range: ± 5 V. CouplingDC, AC or HF reject. Impedance: 50 Ω and 1 MΩ.
CLK IN	MCX female	The external clock signal input is DC-coupled and 50 Ω terminated. Can accept signals Frequency: 1 GHz or 2 GHz.
INPUT 1, 2	BNC female	The analog signal input is AC or DC-coupled and 50 Ω terminated. Maximum input voltage is ±5 V DC. The input full scale ranges are selectable from 50 mV to 5V. Bandwidth depends on the option: -001: DC to 1.5 GHz (1.8 GHz typ.) -002: DC to 1.5 GHz (1.8 GHz typ.) -003: DC to 500 MHz (typ.)
TR OUT	MCX female	A trigger signal output, DC-coupled. Amplitude: ±0.8 V. Output impedance: 50 Ω.
I/O A, B, C	MCX female	User configurable multi-purpose input/output signals. 3.3 V CMOS and TTL compatible.

STATUS LED

LED State	Description
	Power is not present or the module has a fault.
	Indicates that the trigger is armed and waiting for a valid trigger to occur.
	Indicates that a trigger has occurred, and the acquisition is complete.

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Step 5: Using the Applications

The following section provides information on using the installed Utilities, Demonstration applications and Drivers, both for Windows and Linux environments.

Running the MD1 SFP Application

MD1 SFP is an application which is intended to verify the functionality of the module and to serve as an easy to use and convenient program for capturing, displaying, and archiving captured data.

This program uses the AgMD1 and other associated drivers to control any supported digitizers. It is installed at the same time as those drivers.

Windows

There are currently two versions of the SFP application available under Windows. The SFP 1.x version is gradually being phased out by the introduction of the MD1 SFP (5.x). However at this point in time the SFP 5 application does not fully support all products, modes of operation or features that are supported by the SFP 1.x, and so the user must decide which SFP to use depending on their application.

MD1 SFP (5.x)

The Soft Front Panel SFP 5 can be launched from *Start > All Programs > Agilent > MD1 > MD1 SFP or MD1 SFP_64*

MD1 SFP 1.x

This application which was previously known as 'AcqirisLive' has one feature which the MD1SFP (5.x) does not; that it supports the acquisition from multiple modules simultaneously. Users who require this feature or prefer this application, may continue to utilize this version.

To run the application: *Start > All Programs > Agilent > MD1 > MD1 SFP 1.x*

Linux

To run the MD1 SFP 5 for Linux, enter the following command: `AgMD1SFP5`

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NOTE If you receive an error regarding a missing dependency in *libQtXxx.so.4:*
AgMD1SFP5 requires the Qt4 GUI library version 4.5 or higher, to be present on your system. If it is not, please install it using the appropriate package manger for your distribution (apt-get, yum or YaST).

For more information the SFP_Help / User Guide may be accessed from the `Docs/` folder.

Running C/C++, LabVIEW or MATLAB Applications under Windows

Several example programs may be found in the folder:
C:\Program Files (x86)\Agilent\MD1\U10xx_Digitizers\C++\Windows\VS2008

Existing C/C++ software applications

If you have previously written applications with the Acqiris software, it will be necessary to make some changes to your project to use the new AgMD1Fundamental driver as follows:

1. In the project properties, set the include directory to:
   `C:\Program Files (x86)\Agilent\MD1\U10xx_Digitizers\include`
   (default installation).
2. In the project properties, link to the new library:
   `AgMD1Fundamental.lib` (in place of AqDrv4.lib)
   or,
   `AgMD1Fundamental_64.lib` (in place of AqDrv4_64.lib)
   These libraries are located in:
   C:\Program Files (x86)\Agilent\MD1\U10xx_Digitizers\lib
3. In your code, include the header file:
   `AgMD1Fundamental.h` (in place of AcqirisImport.h and AcqirisD1Import.h)

You may now compile and run your existing code with the new AgMD1Fundamental driver.

New C/C++ software applications

Simply refer to the information in the Programmers Guide and Programmers Reference documents, and also in the example programs:

- Programmers Reference Manual, U1092-90002
- Programmers Guide, U1092-90003

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These manuals will be installed to your computer with the driver package, and may be found from the Windows Start Menu: *Start* > *All Programs* >*Agilent* > *MD1* > *Documentation*

LabVIEW applications

Use the Acqiris LabVIEW driver (uses AqDrv4.dll) which is provided in the folder:
C:\Program Files (x86)\Agilent\MD1\U10xx_Digitizers\LabVIEW

MATLAB applications

Use the MATLAB MEX interface which is provided in the folder:
C:\Program Files (x86)\Agilent\MD1\U10xx_Digitizers\MATLAB

Running C/C++ Applications under Linux

Several example programs may be found in the .tar.gz package file, under the folder:
/MD1_Software_Linux_X.xx.xx.tar/LinuxMD1-X.xx.xx/U10xx/Examples/

New C/C++ software applications

Please refer to the programming information contained in the README file, section 6.2.
An example program and makefile is located in: `/usr/share/doc/md1/examples`

Existing C/C++ software applications

If you have previously written applications with the Acqiris software, it will be necessary to make some changes to your project to use the new *AgMD1Fundamental* driver as follows:

1. In the Makefile, link to the new library:
   `-lAgMD1Fundamental` (in place of -lAqDrv4)
2. In your code, include the header file:
   `AgMD1Fundamental.h` (in place of AcqirisImport.h and AcqirisD1Import.h)

You may now compile and run your existing code with the new *AgMD1Fundamental* driver.

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