Agilent Technologies

PCIe High-Speed Digitizer

2 Channels, 12-bit, up to 3.2 GS/s, DC up to 2 GHz
bandwidth, with on-board signal processing

U5303A

Startup Guide

Anticipate ___Accelerate ___Achieve

Agilent Technologies

Notices

Manual Part Number

U5303-90001

Edition

Wednesday, June 11, 2014

Sales and Technical Support

To contact Agilent for sales and technical support, refer to the "support" links on the following Agilent web resources:

- http://www.agilent.com/find/embedded

- www.agilent.com/find/assist (worldwide contact information for repair and service)

Information on preventing damage to your Agilent equipment can be found at www.agilent.com/find/tips.

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://regulations.corporate.agilent.com/DoC/search.htm.

Warranty

Technology Licenses

Restricted Rights Legend

Safety Notices

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.

Agilent 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.

Caution and Warning 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.

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 Agilent. 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 Agilent to maintain accuracy and functionality of the product). If you are unsure about the applicability of a replacement component, call an Agilent office for information.

Cleaning Precautions:

WARNING

To prevent electrical shock, disconnect the Agilent 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.
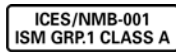
Front and Rear Panel Symbols:

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

N10149 The C-Tick mark is a registered trademark of the Australian Spectrum Management Agency.

ICES/NMB-001 ISM GRP.1 CLASS A — 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).

KCC-REM-ATi-BLMODSF01 — South Korean Class A EMC Declaration. this equipment is Class A suitable for professional use and is for use in electro-magnetic environments outside of the home.
A 급 기기 (업무용 방송통신기자재)
이 기기는 업무용 (A 급) 전자파적합기 기로서 판 매자 또는 사용자는 이 점을 주
의하시기 바라 며 , 가정외의 지역에서 사용하는 것을 목적으 로 합니다 .

This symbol indicates separate collection for electrical and electronic equipment, mandated under EU law as of August 13, 2005. All electric and electronic equipment are required to be separated from normal waste for disposal (Reference WEEE Directive, 2002/96/EC).

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 indicates the instrument is sensitive to electro-static 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.
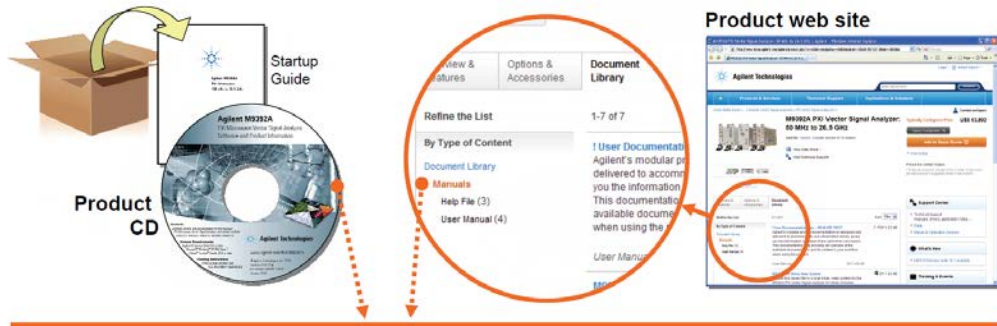
This symbol denotes a hot surface. The side cover of the module will be hot after use and should be allowed to cool for several minutes.

Table of Contents

Documentation Map

Agilent U5303A PCIe High-Speed Digitizer Introduction

The scope of this Startup Guide is to detail the processes of receiving and installing the Agilent U5303A 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 Agilent representative or contact us through our website at www.agilent.com/find/contactus
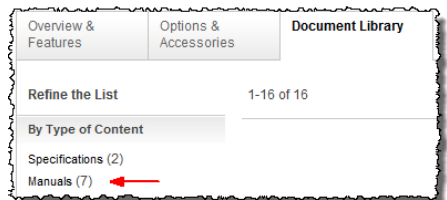
Related Documentation

This Startup Guide and the documentation listed below are contained on the CD supplied with your product and at www.agilent.com/find/U5303A. Select **Technical Support > Manuals**.

- U5303A User Manual
- Help systems for the Agilent device drivers (IVI-C and IVI-COM, and LabVIEW G)
- Product specifications (Data Sheet)

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 U5303A 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.**

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
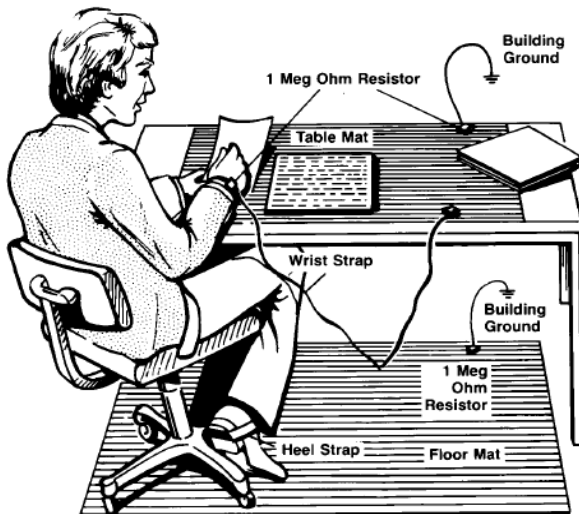
Electrostatic discharge (ESD) can damage or destroy electronic components. Use a static-safe work station to perform all work on electronic assemblies. The figure (left) shows a static-safe work station using two types of ESD protection: conductive table-mat and wrist-strap combination, and conductive 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 www.agilent.com/find/tips for information on preventing damage to your Agilent 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 Agilent to obtain a Return Material Authorization (RMA) and return address. For assistance finding Agilent contact information, go to www.agilent.com/find/assist (worldwide contact information for repair and service) or refer to the "Support" information on the product web page at www.agilent.com/find/U5303A

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, U5303A).

- 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 U5303A Shipment Contents

The following items are also included with your U5303A PCIe High-Speed Digitizer order:

Part Number	Quantity	Description
U5303A	1	PCIe High-Speed Digitizer.
8121-2530	1	Coaxial cable, MMCX to SMA, 1 m.
8121-2531	1	Auxiliary power cable, 4-Pin Male to Female 4-Conductor Floppy.
8121-2533	1	Auxiliary power cable, 15-Pin SATA Power Male to Power 4-Pin Floppy.
M9700-10001	1	Agilent MD2 High-Speed Digitizer Software & Product Information CD
E2094-60003	1	Agilent IO Libraries Suite CD.
U5303-90001	1	U5303A Startup Guide in hard copy.
5962-0476	1	Certificate of Calibration.
5959-4660	1	Recommended Due Date for Adjustment/Calibration.
9320-6741	1	ROHS (China addendum).

> **NOTE** All the files contained on the CDs are available for download at www.agilent.com/find/U5303A.

Step 3: Install the Software

System Requirements

Item	Windows 7® (32 or 64-bit), All versions.	Linux Kernel 2.6 or higher (32 or 64-bit), Debian 7.0, CentOS 6.
Operating system	**Windows 7®** (32 or 64-bit), All versions.	**Linux** Kernel 2.6 or higher (32 or 64-bit), Debian 7.0, CentOS 6.
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 Agilent IO Libraries Suite	100 MB
Video	Support for DirectX 9 graphics with 128 MB graphics memory recommended (Super VGA graphics is supported)	No graphics required (for headless system), or X Windows
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 7 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 or Dell T3610.

Install the Software

Agilent IO Libraries Suite (IOLS)

Agilent IO Libraries Suite (IOLS), which includes the Agilent Connection Expert. This software is included with your shipment (CD part number E2904-60003), and is also available at www.agilent.com/find/IOsuite. This software must be installed first.

1. From the Agilent IOLS CD (E2904-60003) browser launch the installer.

2. Follow the installer prompts to install the IO libraries.

> **NOTE** Version 16.3 update 2 (or higher) of the Agilent IO Libraries Suite is required.

> **NOTE** Version 17.0 (or higher) of the Agilent IO Libraries Suite requires MD2 version 1.3 (or higher).

Instrument software

Instrument software, which includes device drivers (IVI-C, IVI-COM) and documentation for your module. This software is included with your shipment (CD part number M9700-10001).

1. From the Agilent MD2 High-Speed Digitizer Software & Product Information CD launch the 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, please shut-down the PC.

Step 4: Install the Module

1. Ensure that the PC is switched off, and disconnect the power cord. Open the PC case.

   > **CAUTION** Follow ESD precautions when handling and installing the U5303A.

2. The U5303A features a x8 PCIe bus interface, and should be installed in either a x8 or x16 slot.

3. When installing the U5303A ensure that it has optimum cooling, do not install it in a position where the integrated cooling fans may be obstructed.

4. The module requires an additional auxiliary power connection to the white connector at top edge of the module. If your PC has a free 'floppy drive power' connector, simply attach this.
   If your PC does not have a free connector of this type you may use one of the two supplied adapters.
   - If your PC has spare 4-pin Molex power connectors, use the supplied adapter 8121-2531.
   - If your PC only has the newer SATA power connectors, use the supplied adapter 8121-2533.
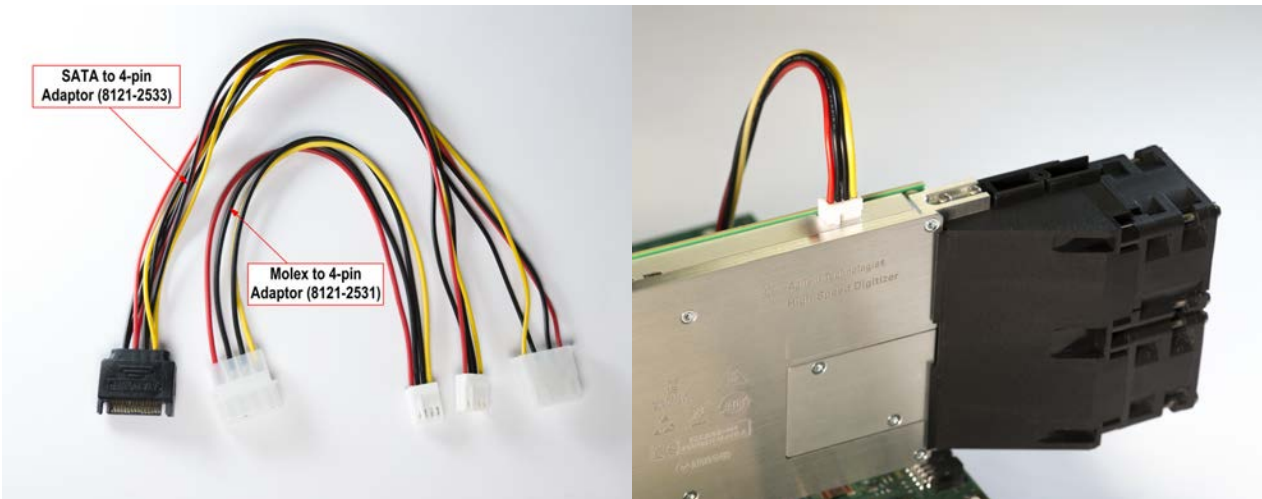
5. Replace any covers and switch-on the PC. Check the module front panel indicators - a few seconds after the boot process, both the '*Status*' and '*DPU*' LEDs should be green.

> **CAUTION** When disconnecting the auxiliary power cable, it is important to push it away from the PCB side of the U5303A in order to disengage the friction lock. Failure to do this could cause the module side of the connector to be withdrawn at the same time thus damaging it.
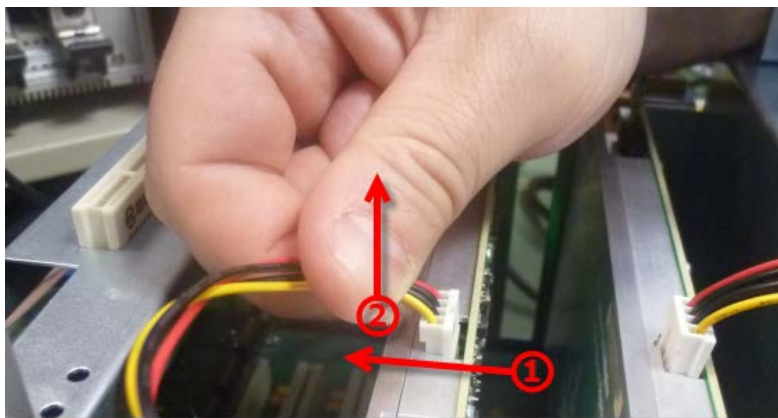
Note that the U5303A is optionally supplied with a card retainer (included if ordered as U5300A-001, or available separately by ordering U1092-CRM) which is able to pick up on slots at the end the full-length PCIe slot and provide additional support for the module. Use of this card retainer is highly recommended, in particular when the PC motherboard is oriented vertically. However if your PC hardware does not provide end slots, the card retainer may be removed from the module.

It is also possible to reverse the orientation of the fan assembly in the case that two modules must be placed in adjacent slots, or other PC hardware obstructs the fitting. These three procedures are detailed below.

Fitting the module with the optional card retainer into your PC

1. Loosen (but do not remove) the screw (A) holding the rear card retainer, and slide it towards the fans.
2. Insert the module into the PCIe slot of the PC, ensuring that it is fully seated into the PCIe bus connector.
3. Fix the module to the PC either by fitting a screw, or by using a method integral to your PC model.
4. Fully extend the card retainer and ensure that it is inside the PC chassis support slot.
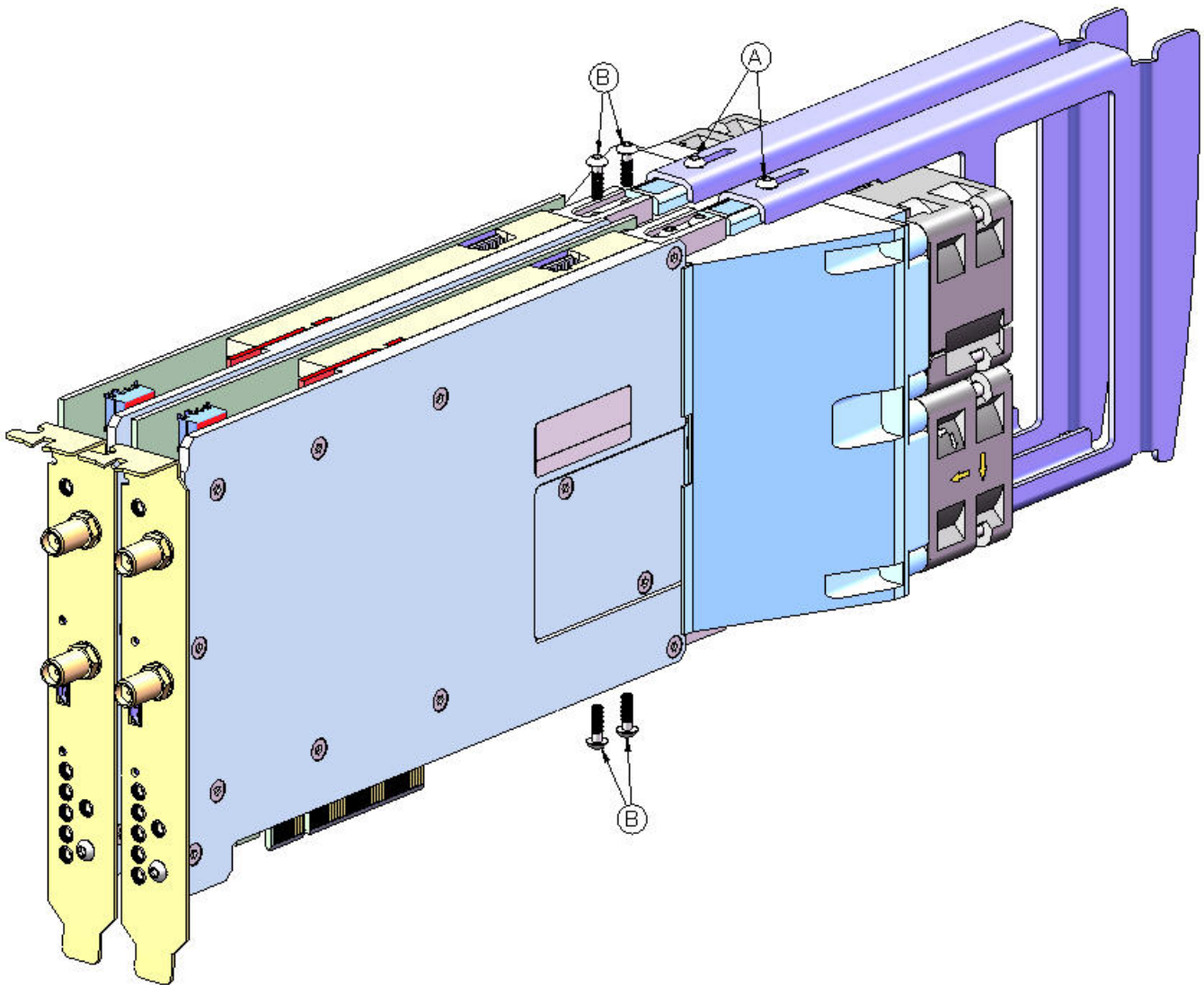5. Tighten the screw (A) (0.5 Nm torque).

Figure 1 -   Diagram showing fan/support assembly fixings (U5303A shown as example)

Removing the card retainer

1. Remove the screw (A) in the figure.
2. Withdraw the card retainer.

Installing the card retainer (if not previously fitted)

1. Slide the card retainer onto the fan module and fit screw (A) to the top of the retainer.

Reversing the orientation of the fan assembly

1. Remove the 4 screws (B) nearest to the front of the fan unit.
2. Slide the fan unit approximately 15 mm to the rear until it clears the circuit board, disconnect the power cables, and rotate the fan unit by 180°.
3. Reconnect the power cables.
4. Slide the fan unit back towards the module until it is fully seated into the locating slots.
5. Refit the 4 screws, push the fan unit upwards away from the circuit board and tighten the four screws (0.5 Nm torque).

U5303A Front Panel Features

Front Panel Connectors

Connector	Type	Description
TRG IN	MMCX	External trigger input, 50 Ω DC terminated, ±5 V range.
IN 1, 2	SMA	The analog signal inputs, which are DC-coupled and 50 Ω terminated. The input full scale ranges are selectable:

Range	Maximum Input
1 V	3 Vrms, ±3.6 Vpk
2 V	4.3 Vrms, ± 6.3 Vpk

Connector	Type	Description
JTAG	Micro USB	Provides connection to the DPU for use with the U5340A FPGA Development Kit.
TRG OUT	MMCX	Trigger Out signal. User selectable from several functions.
I/O 1, 2, 3	MMCX	User configurable Input / Output signal. 3.3 V CMOS and TTL compatible.
CLK IN	MMCX	External clock input. AC coupled and 50 Ω terminated, signal level: +5 to +15 dBm. Please refer to datasheet for details.
REF IN	MMCX	External reference clock input, AC coupled and 50 Ω terminated. It can accept a 100 MHz signal from -3 to +3 dBm.

Front Panel LEDs

Indicator	Purpose	Color	State	Meaning
DPU	DPU status	⚪	Off	DPU is not configured
		🟢	Green, blinking	Module initialization in progress
		🟢	Green	Module OK (firmware not yet loaded)
		⚪	White	DPU firmware loaded (ready)
STATUS	Module status	⚪	White, blinking	Firmware initialization in progress
		🟢	Green, blinking	Module initialization in progress
		🟡	Yellow, blinking	Warning
		🔴	Red, blinking	Error
		🟢	Green	OK (ready)

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

- Power-cycle the chassis (If using a PCIe interface to external PC, observe the power sequence requirements)
- If the error persists please contact Agilent technical support

Step 5: Verify Operation of the U5303A Module

The intention of this step is to verify correct operation of the newly installed module. Run Agilent Connection Expert by right-clicking the task bar icon [IO], and select **Agilent Connection Expert**.

It will display the modules that are installed. Review the configuration data and then launch the SFP. This will provide control of the module for self test and other operational verification procedures.

Agilent U5303A Instrument Properties
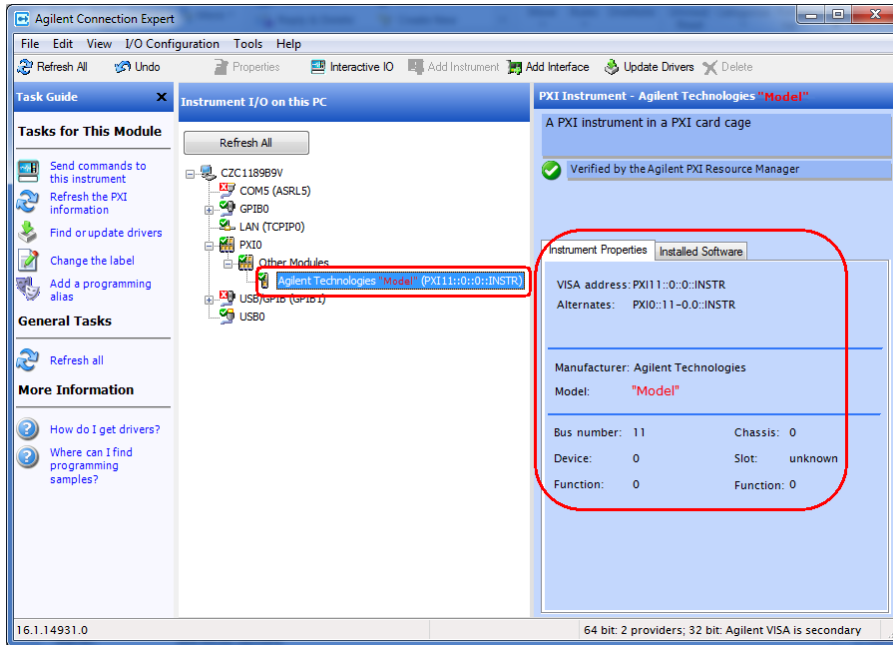
The instrument properties may be viewed by clicking on the desired instrument and then on the **Instrument Properties** tab in the right pane.

NOTE If the module does not appear in the Agilent Connection Expert, first try the 'Refresh All' button. If that does not work, restart your PC or embedded controller and start Agilent Connection Expert again.

Agilent U5303A Installed Software
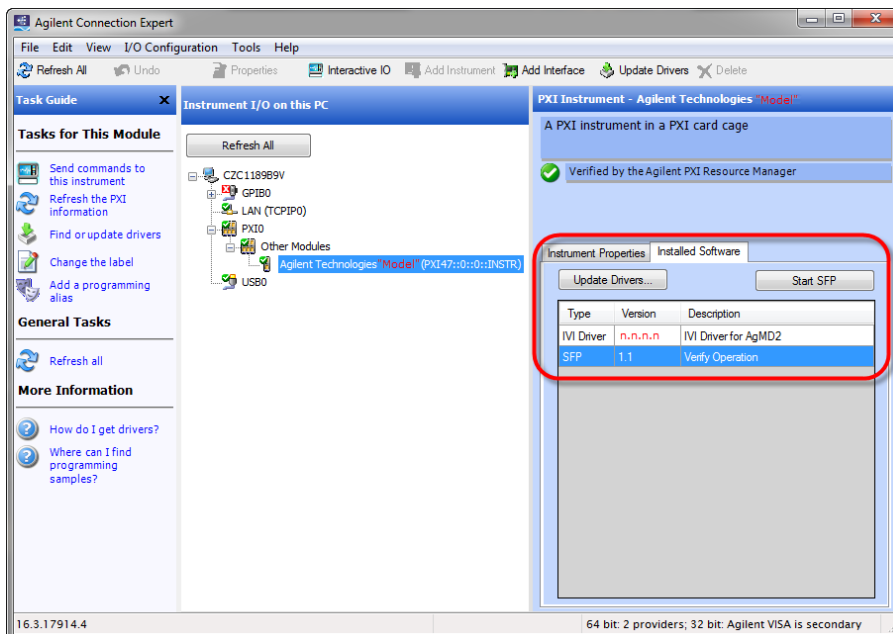
A verification utility may be launched by selecting the **Installed Software** tab, selecting the 'SFP - Verify Operation' item and then clicking on **Start SFP**.

Perform a Verification of the U5303A (optional)

Requirements for Verification

The correct operation of the U5303A 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 Ω at a frequency of 1 MHz may be used.

Hardware	Description
Analog Signal Generator	e.g. Agilent N5181A, E4428C, ..
SMA cable	50 Ω Coaxial cable with SMA(m)

Operational Verification Procedure

CAUTION   Do not exceed the maximum voltage level at the INPUT connector.

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 turn on the output.
3. Launch the *Verify* utility from Agilent Connection Expert as explained in Step 5 of this Startup Guide. A command shell window will open.
4. **Press any key** to start the test. The screen capture below shows the result of a successful verification:


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 Agilent technical support for assistance. Contact details may be found at: www.agilent.com/find/contactus

The Modular Tangram

The four-sided geometric symbol that appears in Agilent modular product literature is called a tangram. The goal of this seven-piece puzzle is to create shapes—from simple to complex. As with a tangram, the possibilities may seem infinite as you begin to create a new test system. With a set of clearly defined elements—hardware, software—Agilent can help you create the system you need, from simple to complex.
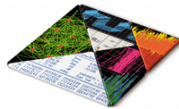
Challenge the Boundaries of Test

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