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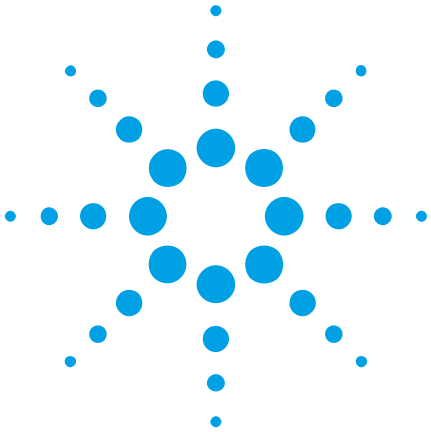
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User Manual

Agilent Acqiris

Averagers

Models covered:

AP235/AP240 with Avgr U1082A-AVG

AP100/AP200 U1081A

Agilent Technologies

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You can download the latest version of this manual from http://www.agilent.com/ by clicking on Manuals in the Technical Support section and then entering a model number. You can also visit our web site at http://www.agilent.com/find/acqiris. At Agilent we appreciate and encourage customer input. If you have a suggestion related to the content of this manual or the presentation of information, please contact your local Agilent Acqiris product line representative or the dedicated Agilent Acqiris Technical Support (ACQIRIS_SUPPORT@agilent.com).

Acqiris Product Line Information

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1. Out of the Box

1.1. Message to the User

Congratulations on having purchased an Agilent Technologies Acqiris data conversion product. Acqiris Digitizers/Averagers are high-speed data acquisition modules designed for capturing high frequency electronic signals. To get the most out of the products we recommend that you read this manual carefully. We trust the product you have purchased will meet with your expectations and provide you with a high quality solution to your data conversion applications.

1.2. Using this Manual

This guide assumes you are familiar with the operation of a personal computer (PC) running a Windows 2000/XP/Vista/7 (32/64) or other supported operating system. It also assumes you have a basic understanding of the principles of data acquisition using either a waveform digitizer or a digital oscilloscope.
The manual is divided into 4 separate sections. To understand the elements of operation for the module it is essential that you read them all.

Chapter 1	***OUT OF THE BOX,*** describes what to do when you first receive your new Acqiris product. Special attention should be paid to sections on safety, packaging and product handling. Before installing your product please ensure that your system configuration matches or exceeds the requirements specified.
Chapter 2	***INSTALLATION***, covers all elements of installation and performance verification. Before attempting to use your Acqiris product for actual measurements we strongly recommend that you read all sections of this chapter.
Chapter 3	***PRODUCT DESCRIPTION***, provides a full description of all the functional elements of the digitizer.
Chapter 4	***RUNNING THE ACQIRISLIVE APPLICATION***, describes the operation of AcqirisLive, an application that enables basic operation of Acqiris Digitizers and Averagers in a Windows 2000/XP/Vista/7 (32/64) environment. Note: **AcqirisMAQS** is an alternate software application offering many interesting possibilities for the control of acquisition systems in a single or multi-machine environment. Ask your sales representative or Agilent for more information.

For information necessary for writing your own software to control Acqiris products you should refer to the **Programmer's Guide** and the **Programmer's Reference Manual**.

1.3. Conventions Used in This Manual

The following conventions are used in this manual:

⚠	This icon to the left of text warns that an important point must be observed.
WARNING	Denotes a warning, which advises you of precautions to take to avoid being electrically shocked.
CAUTION	Denotes a caution, which advises you of precautions to take to avoid electrical, mechanical, or operational damages.
NOTE	Denotes a note, which alerts you to important information.
Italic	text denotes a warning, caution, or note.
Bold Italic	text is used to emphasize an important point in the text or a note
`mono`	text is used for sections of code, programming examples and operating system commands.
B,KB,MB,GB	is for Byte, KiloByte = 1024 bytes, MegaByte = 1024*1024 bytes, GigaByte = 1024*1024*1024 bytes

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1.4. Model Names

Agilent Technologies Inc. acquired Acqiris SA and its product lines in December 2006. Use the tables below to cross reference the legacy model name and new Agilent numbers

Agilent Model Number	Acqiris Model Name
U1081A-001	AP100
U1081A-003	AP200
U1082A-002-AVG	AP235
U1082A-001-AVG	AP240

1.5. Disclaimer and Safety

The AP Series PCI Averager cards have been designed to operate in a standard PCI slot found inside most personal computers. Power for the modules is provided by plugging them into a free slot (refer to the installation procedure).

⚠ ***CAUTION*:** ***Do not exceed the maximum input voltage rating! The maximum input voltage for 50 Ω input impedance is ±5 V.***

1.6. Warning Regarding Medical Use

The AP Series PCI Averager cards are not designed with components and testing intended to ensure a level of reliability suitable for use in treatment and diagnosis of humans. Applications of these cards involving medical or clinical treatment can create a potential for accidental injury caused by product failure, or by errors on the part of the user. These cards are ***not*** intended to be a substitute for any form of established process or equipment used to monitor or safeguard human health and safety in medical treatment.

⚠ ***WARNING*:** ***The modules discussed in this manual have not been designed for making direct measurements on the human body. Users who connect an Acqiris module to a human body do so at their own risk.***

1.7. Packaging and Handling

Your Averager is shipped with the following components:

- A compact disc in an Agilent Technologies paper CD envelope that includes
  - 10 product User Manuals in electronic form (8-bit Digitizers, 10-bit Digitizers, 12-bit Digitizers, Averagers, Analyzers, Signal Analyzers, Streamer Analyzers, Time-to-Digital Converters, 3-, 5-, and 8-slot CompactPCI Crates, and the 21-slot CompactPCI Crate),
  - 1 Programmer's Guide and 1 Programmer's Reference Manual,
  - device drivers with sample software for different operating systems, environments and languages,
  - the Analyzer Demo application, a demonstration program for the AC/SC Analyzer products,
  - the AcqirisLive application, a demonstration program for our digitizer and averager products,
  - the SSR Demo application, a demonstration program for the Acqiris AP235/AP240 Analyzers,
  - the APX01 Demo application, a demonstration program for the Acqiris AP101/AP201 Analyzers,
  - the TC Demo application, a demonstration program for the Acqiris TC840/TC842/TC890 Time-to-Digital Converters,
  - full installation procedures for use with Microsoft Windows, National Instruments LabVIEW RT, Wind River VxWorks, IVI-COM/C, and Linux software.
- A declaration of conformity
- Optional documentation such as a model-dependent document giving Specifications & Characteristics, a Calibration Certificate, or a Performance Verification

After carefully unpacking all items, inspect each to ensure there are no signs of visible damage. Also check that all the components received match those listed on the enclosed packing list. Agilent cannot accept responsibility for missing items unless we are notified promptly of any discrepancies. If any items are found to be missing or are

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received in a damaged condition please contact the Agilent service center or your local supplier immediately. Retain the box and packing materials for possible inspection and/or reshipment.

1.8. Warranty

All Agilent Acqiris Digitizer products are warranted to operate within specification, assuming normal use, for a period of at least one year from the date of shipment. Units sold before April 2008 had three year warranties, as do some more recent ones; in case of doubt examine your invoice. It is recommended that yearly factory calibration be made in order to verify product performance. All repairs, replacement and spare parts are warranted for a period of 3 months. Warranty extensions are available as an option.

Agilent endeavors to provide leading edge technology that includes the latest concepts in hardware and software design. As such software and firmware used with the products is under continual refinement and improvement. All software and instrument firmware is supplied "as is" with no warranty of any kind. Software and firmware is thoroughly tested and thought to be functional at the time of shipment. At Agilent's discretion software and firmware may be revised if a significant operational malfunction is detected.

In exercising this warranty, Agilent will repair or replace any product returned to the Agilent service center, within the warranty period. The warranty covers all defects that are a result of workmanship or materials. This excludes defects that are caused by accident, misuse, neglect, or abnormal operation.

The purchaser is responsible for returning the goods to the nearest Agilent service center. This includes transportation costs and insurance. Agilent will return all warranty repairs with transportation prepaid.

1.9. Warranty and Repair Return Procedure, Assistance and Support

Agilent acquired Acqiris SA and its product lines in December 2006. Please contact your nearest Agilent Service Center before returning any product for repair.

You can find information about technical and professional services, product support, and equipment repair and service on the Web, see http://www.agilent.com/find/service (or http://www.agilent.com/ and after selecting your country click on **Contact Us**). The service center will ask for your name, company, phone number and address, the model and serial numbers of the unit to be repaired, and a brief description of the problem.

Before issuing a Service Order the service center may ask you to communicate with us by phone or eMail so that we can learn as much as needed about the problems observed. If a unit returned under guarantee is found to be working normally and this procedure was not followed we reserve the right to charge you for the work done.

For your nearest customer support center please contact Acqiris Technical Support (ACQIRIS_SUPPORT@agilent.com) or come visit our web site at http://www.agilent.com/find/acqiris. Alternatively, contact Acqiris at 1-800 829-4444 in the USA, +41 22 884 32 90 in Europe or +61 3 9210 2890 in the Asia-Pacific region. The Agilent Support Centers can also help redirect you for any questions concerning the installation and operation of your equipment.

1.10. System Requirements

Acqiris products need the following minimum PC System Requirements in order to obtain reasonable performance from your digitizer.

Processor: 500 MHz Pentium (higher recommended). Some PowerPC systems running Wind River VxWorks are supported; please contact us for details.

Memory: 256 MB RAM. The previous number is a very rough estimate. Assuming that you are using AcqirisLive or an application of your own that operates on the acquired data it seems reasonable to ask for 10 times the total acquisition memory that you will be using at the same time in the application. Performance is likely to be degraded if less memory is available.

Display resolution: At least 1024 x 768 pixels and 256 colors for use of AcqirisLive or Demo applications.

Operating System: Microsoft Windows Vista, Vista 64-bit, 7, 7 64-bit, 2000/XP including 2003 Server, Wind River VxWorks 5.5.1 and 6.4, and Linux with kernels 2.4 and 2.6. Users with previous Windows OS versions (i.e. NT4) can download AcqirisSoftware 3.1 from the Agilent WEB site.

⚠ ***NOTE:*** *Windows 2000 will not be supported in future releases.*

⚠ ***NOTE:*** *Wind River VxWorks 5.5.1 will not be supported in future releases.*

Hard Drive Space: 300 MB for the Complete installation.

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CD Drive (or any method to copy the software installation files from CD to the hard drive such as LAN, floppy drive, etc.)

LabVIEW: Full driver implementations are available for National Instruments LabVIEW versions 8.5, 8.2.1, and 8.0. LabVIEW 7.1 is frozen at the level of Acqiris Software 3.2 with support for all instruments.

LabVIEW RT: National Instruments LabVIEW RT is supported for the same versions as shown above. The VISA driver must be version 3.0 or higher.

MATLAB: The MEX interface can be used with MathWorks MATLAB 7.3 or a newer version.

Visual BASIC: The interface files and examples are available for Microsoft Visual Basic .NET.

Tornado: The example files are useable with Wind River Tornado 2.2.1.

1.11. Transport & Shipping

⚠ ***CAUTION: Cards can be safely transported in their original shipping packages. The transport of AP cards mounted in a PC is a more delicate issue. Because of their mass the cards can vibrate loose unless they are properly secured and braced. However, properly mounted AP cards with XP102 fans can be sufficiently well held; the Adjustable retainer must be used so as to hold the card in place.***

To package the instrument for shipping:

Step	Notes
1. Place the instrument in its original packaging materials.	• If the original packaging materials are not available, use a professional packaging service. Contact your Agilent Service Center for more information.
2. Surround the instrument with at least 3 to 4 inches (8 to 10 cm) of its original packing material or bubble-pack to prevent the instrument from moving in its shipping container.	
3. After wrapping it with packing material, place the instrument in its original shipping container or a strong shipping container that is made of double-walled corrugated cardboard with 159 kg (350 lb) bursting strength.	• The shipping container must be large and strong enough to accommodate your instrument and allow at least 3 to 4 inches (8 to 10 cm) on all sides for packing material.
4. Seal the shipping container securely with strong nylon adhesive tape.	
5. Mark the shipping container “FRAGILE, HANDLE WITH CARE” to help ensure careful handling.	
6. Use the address obtained from your Agilent Technologies Service Center.	
7. Retain copies of all shipping papers.	

⚠ ***CAUTION: Damage can result if the original packaging materials are not used. Packaging materials should be anti-static and cushion the instrument on all sides. NEVER USE STYRENE PELLETS IN ANY SHAPE AS PACKAGING MATERIALS. They do not adequately cushion the instrument or prevent it from moving in the shipping container. Styrene pellets can also cause equipment damage by generating static electricity or by lodging in fan motors.***

1.12. Maintenance

The cards do not require any maintenance. There are no user serviceable parts inside. A periodic factory calibration can be obtained on request.

1.13. Cleaning

Cleaning procedures consist only of exterior cleaning.

Clean the exterior surfaces of the module with a dry lint-free cloth or a soft-bristle brush. If any dirt remains, wipe with a cloth moistened in a mild soap solution. Remove any soap residue by wiping with a cloth moistened with clear water. Do not use abrasive compounds on any parts.

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1.14. Disposal and Recycling



Electronic equipment should be properly disposed of. Averagers and their accessories must not be thrown out as normal waste. Separate collection is appropriate and may be required by law.

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2. Installation

This chapter describes how to install the Acqiris hardware and software for Windows, National Instruments LabVIEW RT, Linux, or Wind River VxWorks.

⚠ ***NOTE:*** *For a first time installation we strongly recommend installing the software* ***before*** *inserting the hardware into the PC.*

2.1. U1091AK02 IC414 Installation

⚠ ***NOTE:*** *If you are going to install an IC414 interface for the first time and are running Windows 2000/XP you should follow the procedure below* ***before*** *installing the Acqiris hardware.*

2.1.1. IC414 Hardware installation hints

The PCI-8570/PXI-8570 User's Manual (Rev. 1.00) section 2.5 gives Hardware Installation instructions.

⚠ ***CAUTION***: ***Turn off the power of the PC; the PC may have to be unplugged to ensure that the PCI bus has no power available.*** Please ignore the PCI-8570 instruction to leave the power cord plugged in; Ground the chassis differently!

⚠ ***CAUTION:*** ***Touch the antistatic package to a grounded object before removing the card from the package. Electrostatic discharge can damage the card.***

The standard cable pair provided each have a red connector on one end and a black connector on the other. Therefore the correct connection can be made by plugging the Red connector into the L0Rx socket and the Black connector into the L0Tx socket on the PXI module and the other Red connector into the PCI module socket furthest from the PCI card internal base connector and the Black connector into the next socket.

If you intend to use 64-bit 66 MHz transfer to maximize data transfer speed you should cable a “bundled link” using two standard cable pairs and both the L0 and L1 pairs of connectors. You should also make sure that you configure the PXI-8570 M66EN Jumper correctly.

2.1.2. IC414 Windows software installation

Windows Vista/7 (32/64), XP64 and Linux users do not need to read any further since there is no special software installation.

Windows users should have the hardware installed as noted above. This software installation should be done before any Acqiris modules are placed in the CompactPCI crates. This may mean that you have to remove the module from the crate *as delivered*.

The crate should be turned on first followed by the PC. If the cabling and start-up sequence is done correctly there will be no LED illuminated on the PCI unit connected pair and the LED's of the PXI connected pair will be lit.

For **Windows XP** installation, Select the **Control Panel** under Settings in the **Start** menu. Then, if you are using the **Category View** select **Printers and Other Hardware.** After this, for both **Category** and **Classic** views, go to **System** and then display the **Hardware** tab to get access to the **Driver Signing** menu. Since neither the AdLink nor the Acqiris driver has been submitted for **Windows Logo testing** you must select either the **Ignore** or **Warn** action. The resulting menu looks as shown:



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The PCI-8570/PXI-8570 User's Manual (Rev. 1.00) section 2.4 contains the software installation instructions. These should be executed before allowing the hardware installation process to look for the driver. If you have an AdLink CD Version 2004A4 or later you can use it; if not you should download the latest driver from the WEB site (http://www.adlinktech.com/). You can then continue with the Hardware Installation. A reboot will then be necessary. At this point the Stargen Fabric PCI Adapter and the Stargen Aruba Fabric-to-PCI Bridge should appear correctly installed under System Devices in the Device Manager.



NOTE: If you have an AdLink CD Version 2005A3 or later you can find 8570install.exe in the folder X:\Driver Installation\PXI Platform\PXI Extension\PCI_PXI-8570\Wnt2kxp and the starfab1.inf file in the folder X:\Driver Installation\PXI Platform\PXI Extension\PCI_PXI-8570\Win98.

2.2. Installing the Software under Windows

2.2.1. Warnings

If Setup detects a previous installation of Acqiris software on your system, a warning screen will be displayed. It is recommended to exit Setup and uninstall older versions.

The installer from software releases prior to **Acqiris Software 2.0** installed the Digitizer Driver DLL files into the System directory. These will be removed by Setup. If you wish to keep the old installation on your system, you should exit Setup, and move all Acqiris driver files (acqiris*, acqrs* and acqir*) to some archive directory.

The DLL files will be installed into the bin subdirectory of the Acqiris software root, and the corresponding path will be added to the PATH environment variable.

2.2.2. Multiple Versions

With the software installation from **Acqiris Software 2.0** or above, it is possible to keep multiple versions on the same system, but you must specify a different root directory (i.e. Install Folder). If you keep the same directory, Setup will overwrite your previous installation.

To go back to a previous version, you must change the PATH environment variable and reinstall the Kernel driver.

1. Copy the SYS file from `<old_AcqirisSoftware_root>\bin\kernel` to the `Windows\System32\drivers` directory.
2. Change the AcqirisDxRoot, AcqirisDxDir and PATH environment variables to the old root.
3. Reboot the computer.

2.2.3. Installation

For a first time installation on your computer Agilent recommends that you install the software BEFORE installing the hardware on your system. When upgrading to a new version, you should leave your modules installed and powered during installation.



NOTE: **You will need administrator privileges to complete the software installation under Windows.**

Complete the following steps to install the software for Windows 2000/XP/Vista/7 (32/64).

Insert the *Acqiris Software CD* into the CD-ROM drive of your computer. If the Autorun program does not start automatically (Autoplay disabled), you can start it manually, or navigate to the *AcqirisSoftware\Windows* folder in order to display the files included.

Choose **Install AcqirisSoftware for Windows 2000/XP/2003 Server/Vista/7** (or run `Setup.exe` from the *AcqirisSoftware\Windows* folder). After several seconds for initialization the first of many screens will appear.

Please note the following points:

- It is good practice to remove any previously installed version of Acqiris software. If the program finds that there is still Acqiris software installed on your machine a warning panel will appear.
- When upgrading from an old version under Windows 2000, you must uninstall all Agilent Acqiris devices manually prior to running the installer.
- In the **Select Install Type** window selecting **Custom** installation will let you select individual packages for loading. The space indicated for LabVIEW, Firmware and UserManual packages is incorrect. The correct values are 7 MB, 40 MB, and 30 MB respectively. A full installation requires just under 300 MB of disk.

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- If MATLAB is installed on your machine, you will be asked to point the installer to the MATLAB root directory. You should do this if you want the installer to modify the standard startup.m file to add the paths for the MEX interface.
- In the **Installation Folder** window you will give the name of the root directory of the Acqiris software installation. If User Manuals (30 MB) and Firmware (40 MB) are loaded more space than indicated here will be required on the drive. For the case of a Tornado 2.2 installation the folder name should not contain any spaces.
- AcqirisLive needs the LabWindows/CVI 8.0 Run-Time Engine to run. If Setup has detected that a LabWindows/CVI Run-Time Engine is already installed on your system, it will ask you if you would like to install it locally for AcqirisLive anyway. If you are not sure about the version of the CVI Run-Time Engine on your system, it is recommended to install it locally.
- The **Installation Summary** window will be shown to allow you to check what you have asked for. At this point it is not too late to go back and make changes. The actual installation will only be started after clicking on "Install" in the next window.
- Please read the **IMPORTANT Information** window text. It could help you avoid serious problems.
- Registration of your installation will help Agilent provide you with better support. You will also be notified of updates and upgrades. All information submitted will be treated in accordance with Agilent's privacy policy. Setup will prepare a registration e-mail in your e-mail client application upon termination of the setup procedure. You can then decide whether or not you wish to send it. You may also add comments. Uncheck the box if you do not want to register your installation.
- After the software installation is complete you can either accept the suggestion to restart the computer or you should shutdown your computer and proceed with the hardware installation.

2.3. Installing the Software for Linux

Please refer to the README file on the Acqiris Software CD-ROM (AcqirisSoftware/linux folder) for detailed instructions to install the software for linux systems.

2.4. Installing the Hardware

1. Turn off the power of the PC and the crate in the case of a CompactPCI module.

⚠ ***CAUTION:*** ***For PCI modules the PC may have to be unplugged to ensure that the PCI bus has no power available. However, CompactPCI crates can be left plugged in since this ensures proper grounding.***

⚠ ***CAUTION:*** ***Touch the antistatic package to a grounded object before removing the card from the package. Electrostatic discharge can damage the card.***

2. Module in a PC: open the PC, identify a free PCI slot and carefully insert the DP Series card into it. Be sure to ground yourself by touching the grounded PC frame and avoid touching any components on the DP Series card. Make sure that the grounding of the card's mounting bracket to the back panel rail of the computer is done correctly. If present make sure that the fan's adjustable retainer is correctly positioned and tightened for mechanical support. Close the PC.

   Module in a CompactPCI crate: Follow the instructions of the crate manufacturer to insert the DC Series card into a free CompactPCI peripheral slot. Be sure to ground yourself by touching the grounded crate and avoid touching any components on the DC Series card. Be sure to tighten both front panel mounting screws to lock the module into place and insure proper grounding of the frame.

⚠ ***NOTE:*** *To ensure the best possible performance, users of Acqiris CC121 Crates with AS bus systems should respect the module placement rules to be found in the Agilent Acqiris 21-slot CompactPCI Crate User Manual.*

   PCI Bus extension module in a PC: Consult the manufacturer's documentation for any special instructions. Open the PC, identify a free PCI slot and carefully insert the card into it. Be sure to ground yourself by touching the grounded PC frame and avoid touching any components on the card. Make sure that the grounding of the card's mounting bracket to the back panel rail of the computer is done correctly. Close the PC. Connect the module to the CompactPCI crate controller.

3. Turn on the power of the crate(s), if present, and then the PC and start the operating system.

⚠ ***NOTE:*** *Acqiris digitizers are equipped with a LED. If this LED is not glowing orange or red when the power is applied there is a severe problem. Either the module is broken or the necessary voltages for its use are not available.*

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⚠ ***NOTE:*** *For proper system operation when using the IC200, IC414, or other PCI extension interface to connect a CC10X crate to a remote PC, the crate* ***must*** *be powered on before the PC in order for the PC BIOS to recognize the presence of the CompactPCI crate.*

4. If devices were installed using a previous version of Acqiris software the instruments in these logical positions may still appear as *Unknown Devices.* This can be changed to the new Acqiris type category with the Grey Diamond icon by **Uninstall**ing the device and then **Installing** again. Instructions on this procedure can be found in the **ReadMe.txt** file in the **manuals** folder of your Acqiris software installation.

2.5. After Restarting

2.5.1. Windows 2000

Under Windows 2000, you *must* login with administrator privileges after the first boot following the hardware installation; the Plug&Play system must have the appropriate privileges to be able to complete your hardware installation successfully. After a successful hardware installation, you will be able to use your Acqiris digitizer(s) with normal privileges.

At the first boot following the hardware installation, Windows will detect the new hardware and will install the devices automatically. The following image will appear.



⚠ ***NOTE:*** *In some systems an application program (such as AcqirisLive) will not yet work correctly at this point. One additional boot cycle may be needed if this is the first time that a hardware board is being installed.*

2.5.2. Windows XP/Vista/7

Under these Windows versions, you *must* login with administrator privileges after the first boot following the hardware installation; the Plug&Play system must have the appropriate privileges to be able to complete your hardware installation successfully. After a successful hardware installation, you will be able to use your Acqiris digitizer(s) with normal privileges.

If you login with administrator privileges after the first boot following the hardware installation, Windows will detect the new hardware and start the “Found New Hardware Wizard” after a few seconds. There is no need to use Windows Update to search for the software. You can “Install the software automatically”.

⚠ ***NOTE:*** *In some systems an application program (such as AcqirisLive) will not yet work correctly at this point. One additional boot cycle may be needed if this is the first time that a hardware board is being installed.*

2.6. LabVIEW RT

During program development you can choose whether you use LabVIEW or LabVIEW RT compatible libraries by switching the version present in **National Instruments\LabVIEW m.n\instr.lib**. This swap can be facilitated by using the **Install VI library for LabVIEW or LabVIEW Real-Time** shortcut available in the Shortcut folder under **Start** → Programs.

There is only one Acqiris Driver. It supports all Acqiris Instruments. The instructions below concern LabVIEW RT as used in NI PXI processors.

The Aq_RT.inf and AqRT_4.ini files must be uploaded to the target. To do this,

- start the MAX application,
- right click on the target
- select file transfer
- select the Aq_RT.inf file on your host machine and upload ('To Remote') to the LabVIEW RT working directory (/NI-RT/system) on the target
- select the Aq_RT.ini file on your host machine and upload ('To Remote') to the LabVIEW RT working directory (/NI-RT/system) giving it the name AqDrv4.ini

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For Acqiris modules which need FPGA files you should,

- create the folder \firmware in the /NI-RT/system directory using the file transfer application
- select the FPGA files (from <AcqirisDxRoot>\Firmware) you want to copy to the target and upload them into the firmware directory

Restart the target after finishing the file transfers.

Restart the MAX Explorer and you should have Acqiris digitizers detected in your PXI system.

2.7. Installing the IVI-COM/C Driver

Please install Acqiris software for Windows first. Then the *Acqiris Software CD* Autorun program gives access to two installers:

- IVI Shared Components 1.4
- IVI-COM/C IviAqD1 driver

These must be installed in the order shown above. For more information you can then consult the Readme.txt file in the IVI\Drivers\IviAqD1 folder or the documentation through the program shortcut present under Ivi/IviAqD1.

2.8. Uninstalling devices under Windows

In the Device Manager, select the instrument to be uninstalled. Choose “Uninstall” from the “Action” menu. After all desired instruments have been uninstalled select “Scan for hardware changes” from the “Action” menu, or reboot the computer. Note that only those devices that are actually physically present are visible in the Device Manager.

2.9. Distribution for Windows 2000/XP/Vista/7 (32/64) and Linux

The manuals/ReadMe.txt file contains a list of files to be found after a complete installation of Acqiris software on Windows systems. Similarly the ReadMeLinux file gives the list of files corresponding to that installation.

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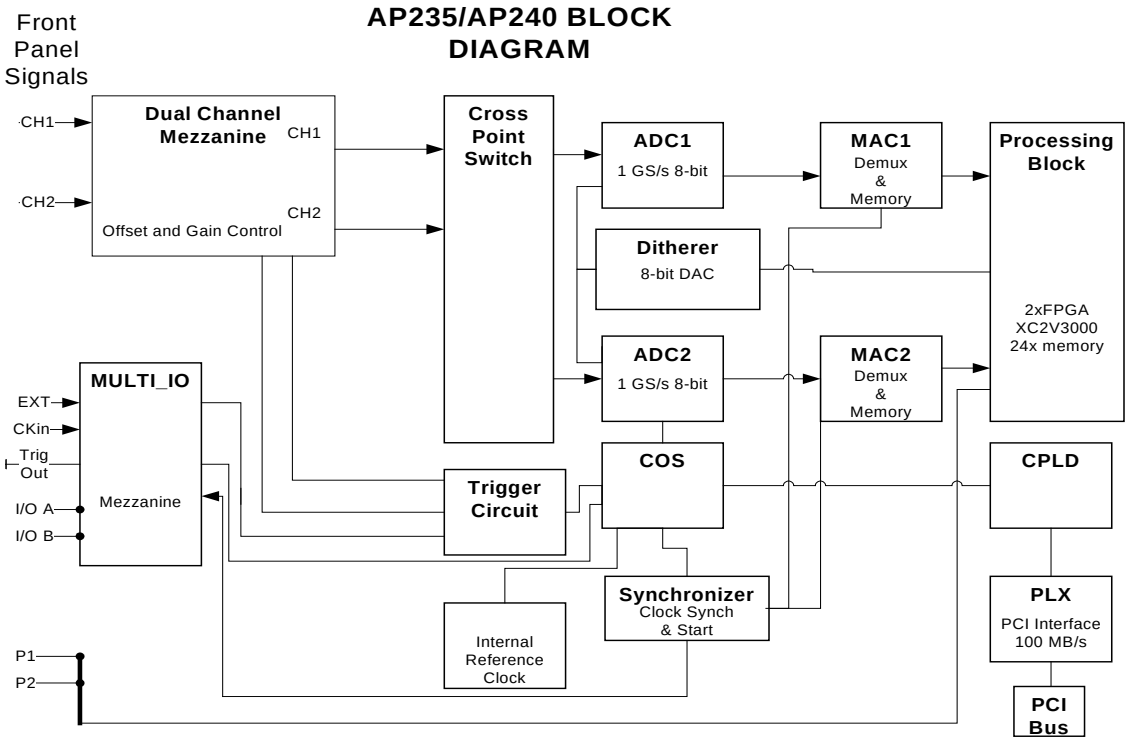
3. Product Description

3.1. Overview

Acqiris Averagers are designed to provide superior measurement precision and accuracy. Key acquisition specifications (such as DC accuracy, integral and differential non-linearity) have been optimized to deliver maximum measurement fidelity. Careful circuit layout, custom IC's and special packaging techniques have all been employed to reduce the overall random and correlated system noise. The use of custom IC's also dramatically reduces the total number of discrete components required. This has tremendous benefits on reliability and also allows the modules to use a minimal amount of power.

The AP series Averagers are PCI modules that plug directly into any vacant PCI slot in a PC. They are fully programmable over the PCI bus and can deliver 2 GS/s (AP240/AP200) and 1 GS/s (AP235/AP100) real time averaging performance. Signals on 2 channels with an Analog bandwidth limit at 1 GHz (AP240) or 0.5 GHz (AP235) can be analyzed simultaneously at sampling rates up to 1 GS/s and 0.5 GS/s, respectively. Alternatively, the AP100 and AP200 are single channel instruments with 0.5 GHz Analog bandwidth. Averaged Data can be transferred to a host processor over the PCI bus at speeds up to 100 Mbytes/s.

For complete technical specifications concerning your particular digitizer please refer to the product's Specifications & Characteristics. In addition, we maintain up-to-date versions of all product data sheets on our web site (http://www.agilent.com/find/acqiris). The data sheets are available in pdf format and are best viewed using Adobe Acrobat software. If you have trouble accessing our web site, or viewing the data sheets, please contact your nearest sales office.



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Key features

- **High Speed and Precision –** All averager models provide both an ultra-fast real-time summing capability and exceptionally high data transfer rates to the host processor.

  The two-channel AP240 delivers a real-time sampling rate of up to 1 GS/s with 1 GHz of analog bandwidth simultaneously on both channels, while the AP235 offers sampling to 0.5 GS/s and a bandwidth of 0.5 GHz. Alternatively they can be used as one channel instruments with double the sampling rate. The one-channel AP200 delivers a real-time sampling rate of up to 2 GS/s with 500 MHz of analog bandwidth, while the AP100 offers sampling to 1 GS/s.

  The high sampling rate is achieved in realtime for each trigger and does not require the use of interleaved sampling techniques. Compared to real-time sampling, interleaved techniques significantly slow down averaging speeds and reduce the total data throughput.

- **Signal conditioning –** The AP235/AP240 models include all the required input signal conditioning such as gain, from 50 mV to 5 V Full Scale, offset adjustment and 50 Ω DC coupling. The models AP100/AP200 Averager offer similar functionality with gains ranging from 50 mV to 500 mV Full Scale. The inputs are fully protected, and internal calibration is a built-in feature. A crystal controlled time base and advanced trigger circuits are used to allow fast and stable acquisitions.

- **Improved Timing –** In order to preserve the timing accuracy of successively summed acquisitions, the aveargers include two operating modes, with respect to the trigger. These are the **Non-Resync Mode** with jitter (clock positioning with respect to the trigger from acquisition to acquisition) of ± one-half clock cycle (minimum of 500 ps), and the **ReSync Mode** with jitter of ± 200 ps. The **ReSync Mode** also offers a trigger output with its edge synchronized to the sampling clock.

- **Better Accuracy -** Vertical resolution can also be improved with a special dithering circuit that can increases the dynamic range from 8 to 12 bits (when averaging more than 256 spectra). Dithering a signal involves the addition of a small, systematic, pseudo-random amount of DC offset to the acquired signal. The dithering range is user programmable within ± 15 ADC LSB's. Dithering improves measurement resolution and can dramatically reduce the errors associated with ADC effects such as differential non-linearity.

- **Fast Averaging -** The AP240 and AP235 systems have 2 MSamples of 24-bit accumulation memory/channel (optionally 8 MSamples/channel). The AP200 and AP100 systems have 2 MSamples of accumulation memory (optionally 8 MSamples). The accumulation memory receives the converted data from the digitizer, which in real-time manages the high-speed accumulation function. A high-speed on-board computing circuit performs the retrieve, add and store functions necessary to accumulate the signal in real time at the maximum sampling rate. At the highest sampling rate, summed events can be acquired with less than 3 µs dead time between them. For example, multiple acquisitions made at 2 GS/s sampling rate and containing 250 KSamples can be summed at sustained rates of up to 8000 shots per second. If 100 KSample records are used, the sustained summing rate can reach 20,000 shots per second. Once a sum is accumulated to the desired depth, a number of events selectable from one to 65,536, the signal is read out over the PCI bus and the division function necessary to obtain the average is performed inside the PC (if desired).

- **Add/Subtract Feature** – For the AP240 and AP235 systems the DPU Ctrl (I/O P1 and P2) allow hardware to choose, at the instant the trigger arrives, whether the data of the new trace will be added to or subtracted from the accumulated sum. This gives the user control over how background noise is taken into account in the accumulated sum.

- **Sequence Average Modes** – In time resolved applications, where multiple averaged waveforms must be acquired with very low dead time, the user can partition the averaging memory to store from 1 to 8191 separate accumulations of summed data. In standard segment accumulation mode the user selects the desired number of triggers per segment, N. The next segment will be started after the previous N triggers have been processed. For the AP240 and AP235 a round robin segment accumulation is also available. In this mode consecutive triggers can be accumulated into different segments. In particular, for stimulus-response experiments, one segment could be the averaged stimulus and another could be the averaged response. For the AP235 and AP240 in dual-channel mode, the length of each segment is adjustable from 16 samples up to the maximum 2 MS in steps of 16 points, while in the single-channel mode it is adjustable from 32 samples in steps of 32 samples. In the AP200, the length of each segment is adjustable from 32 samples up to the maximum 2 MS in steps of 32 samples, while in the AP100, it is adjustable from 16 samples to the maximum 2 MS in steps of 16 samples.

- **Numerous front panel control signals** – In order to ease the integration and synchronization of the Averager in a large variety of systems, a number of signals are made available on MMCX connectors on the instruments front panel. The following high-speed timing signals are available for all models: Inputs for Clock, Reference Clock, and Trigger Enable, Outputs for Trigger, Trigger Ready, Acquisition state, and Reference Clock. They also can accept a hardware input that controls the start of an average accumulation. Furthermore, the AP240 and AP235 have Add/Subtract control inputs as described above.

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- **High Data Throughput –**All of the Acqiris Averagers can easily be integrated into any standard computer with 1 free long PCI slot that provides the 3.3 V supply and adequate power as required by the cards. Averaged signals can be transferred, in DMA mode, directly to the processor over the PCI bus at rates of up to 100 Mbytes per second (4 ms for a 100 KS record, 10 ms for a 250 KS record, including DMA set up time overhead). In the case of the AP235 and AP240, if the full precision of the accumulated sum data is not desired, the 16-bit fast readout capability can further shorten the data transfer time.
- **Noise Suppressed Accumulation –** The Acqiris Averagers provide a noise suppression feature which makes if possible for the AP cards to enhance rarely occurring events, which, under most circumstances, disappear in signals with baseline noise. Only data points that exceed a user-defined threshold are added to the result. This considerably reduces the noise contribution and the signal-to-noise ratio is enhanced. Furthermore, the NSA mode implements a fixed baseline subtraction feature that is applied to the data values that are over the threshold. This can be used to greatly reduce the occurrence of data overflows. Therefore many more events can be accumulated before running the risk of data overflow.
- **TDC mode –** The Acqiris Averagers can also be used to accumulate a histogram of Time to Digitial Conversion (TDC) data. This mode exploits the threshold and baseline features defined in the NSA section above. The data of each segment is scanned to locate events above a user-defined threshold. Assuming that the event has at least the desired duration, a user-selectable value, the histogram will be incremented at the time of the middle of the event. The increment can be either a single count or the baseline corrected value at the middle of the event.

3.2. Channel Input

The principle characteristics of the input channels are given in the table below:

Model Agilent #	**Bandwidth into 50 Ω**	**Minimum Rise Time**	**BW Limiter selections**	**Maximum Full Scale**	**Maximum Offset**	**Other particularities**
AP240 U1082A-001	1 GHz	0.35 ns	20, 200, 700 MHz	5 V	5 V	2 channels
AP235 U1082A-002	0.5 GHz	0.7 ns	20, 200 MHz	5 V	5 V	2 channels
AP100/ AP200 U1081A-001 / U1081A-003	0.5 GHz for > 50 mV FS 200 MHz @ 50 mV FS	0.7 ns 1.8 ns	25 MHz	0.5 V	2 V	1 channel with 2 selectable inputs

3.2.1. Coupling & Impedance

Two 50 Ω signal input BNC connectors are provided. The AP240 and AP235 are two channel modules. In the case of the AP100 and AP200 these two connectors are multiplexed to the module's input. The active input may be selected by software to allow connection of one of the two possible signal sources. The 50 Ω coupling offers high quality termination with better than ± 1% precision. It is ideally suited for use with 50 Ω transmission lines.

All modules offer DC coupling. The AP240 and AP235 also provide AC coupling with a 32 Hz cutoff frequency.

3.2.2. Input Protection

The input amplifiers are fully protected against over-voltage signals. The device can tolerate an input current of up to 40A for 1 µs without damage to the front-end electronics. For extreme cases, such as detector sparking, an external coaxial spark gap and attenuator can be supplied on request (See ***APPENDIX A: U1092A-HVB XA100 BNC INPUT OVERVOLTAGE PROTECTION***).

3.2.3. Mezzanine Front-end

The front-end electronics are all mounted on a removable mezzanine card. In the event of accidental damage or as components fatigue over time (e.g. relays in high duty cycle automated testing applications), the mezzanine card allows for fast and efficient replacement.

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3.2.4. Bandwidth and Rise Time

The bandwidth specification indicates the frequency at which an input signal will be attenuated by 3 dB (approximately 30% loss of amplitude). The bandwidth also affects the minimum rise and fall times that can be passed through the front-end electronics. A pulse with a very sharp edge will be observed to have a minimum rise time (τ_{min}) determined by the front-end electronics. In general a pulse with a given 10-90% rise time ($\tau_{10\text{-}90real}$) will be observed with a slower value given by:

$$\tau_{10\text{-}90}^2 = \tau_{10\text{-}90real}^2 + \tau_{min}^2 \qquad \text{where} \quad \tau_{min}\,(\text{ns}) \approx 0.35\ (\text{GHz-ns}) / \text{BW}\ (\text{GHz})$$

If desired, hardware bandwidth limiters can be selected.

3.2.5. Input Voltage and Offset

The input channel provides a fully programmable amplifier with variable input voltage and offset. Full Scale (FS) input voltages are selectable from 50 mV to the maximum indicated in the table above in a 1, 2, 5 sequence. Care should be taken to select an input voltage range that will allow the signal to be recorded using as much dynamic range of the digitizer as possible. Signals going outside of the FS Range will be clipped and data values for the clipped portion of a signal should be regarded as erroneous. The Variable Offset is programmable in the range of ±2 V when using an FS Input Voltage setting of 500 mV or below, increasing to ± 5 V for FS settings above 500 mV.

3.2.6. Vertical Resolution

The AP Series Averagers use an ADC system with 8 bits of vertical resolution (256 levels). The dynamic range of the ADC covers the Full Scale (FS) of the Input Voltage setting. For example, if the Input Voltage is set to 500 mV then the ADC resolution is equivalent to 1.95 mV. To obtain the best dynamic range from the ADC care should be taken to ensure that the input signal varies over more than 50% of the Input Voltage Full Scale (FS) setting. The highest and lowest levels of the ADC correspond to underflow and overflow conditions. For the Averaging mode, any sums that contain such data are subject to unknown errors.

For the Averaging mode, vertical resolution increases as the number of acquisitions per average increases. It can be improved to up to 12 bits when averaging 256 or more traces.

3.2.7. DC Accuracy

The AP Series Averagers use low noise front-end electronics in order to ensure voltage measurement is made with accuracy and precision. DC voltage accuracy is better than ± 2% (± 1% typical) of the input voltage full-scale.

3.2.8. Linearity and Dithering

In the Digitizer mode the differential linearity is better than ±0.9 LSB for the AP240 and ±0.7 LSB for AP100/AP200. In the Averaging mode, an offset dither of up to ± 15 ADC codes can be added to the input signal. This dithering improves the Averager's differential and integral non-linearity and can reduce quantization non-linearity errors for low noise signals

The dithering range is selectable and has a resolution of $^1/_8$ of the ADC Least Significant Bit (LSB). The dithering is added as a controlled offset at the input of the ADC. The offset amount is different for each successive acquisition of a waveform. The offset sequence is

0, $-^1/_8$, $^1/_8$, $-^2/_8$, $^2/_8$, $-^3/_8$, $^3/_8$, . . . - (N-$^1/_8$), (N-$^1/_8$), -N, N, 0, $-^1/_8$, $^1/_8$ etc

N is programmable between 0 (no dithering) and 15. There are 16*N+1 states in the complete cycle.

Dithering over ± 15 ADC codes is expected to improve the Differential Non-Linearity (DNL) down to $^1/_{16}$ of one ADC code and the Integral Non-Linearity (INL) by a factor of two (~ ½ ADC code). However, underflow/overflow conditions must be avoided.

3.3. Trigger

3.3.1. Trigger Source

The trigger source can be a signal applied to either of the Input Channels (for internal triggering) or the External Trigger Input.

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The modules provide a front panel BNC External Trigger Input. The External Input provides a fully functional trigger circuit with selectable coupling, level and slope. The AP240 and AP235 have 50 Ω termination impedance with diode protection against overload. A ±5 V limit on trigger signals should be respected, although somewhat higher voltages for short time periods will not damage the unit.

The AP100 and AP200 have both 1 MΩ and 50 Ω termination impedance. Overload protection will automatically switch the coupling from 50 Ω to 1 MΩ if the signal is greater than ±5 V DC. If 50 Ω termination is selected a ±5 V limit on trigger signals should be respected, although somewhat higher voltages for short time periods will not damage the unit. For 1 MΩ input, signals up to ±100 V (DC + peak AC < 10 KHz) are allowed.

3.3.2. Trigger Coupling

Trigger coupling is used to select the coupling mode applied to the input of the trigger circuitry. The AC LF Reject mode couples signals capacitively and removes the input signal's DC component and frequencies below 50 Hz for the AP240 and AP235 models (and 50 KHz for the AP100 and AP200). DC mode allows all signal components to be passed through to the trigger circuit. The AP240 and AP235 models have an HF Reject mode that removes signal components above 50 KHz. They also implement an HF trigger that allows triggers to be reliably accepted at rates above ~ 1 GHz. In this mode, triggers occur on every fourth positive edge. In the HF mode negative slope and window triggers are not available.

3.3.3. Trigger Level

The trigger level specifies the voltage at which the selected trigger source will produce a valid trigger. The trigger level is defined as a set voltage. Using the internal trigger with DC coupling, the level (expressed in %) is set with respect to the midpoint voltage (V_m= – Offset voltage) of the digitizer's vertical scale. All trigger circuits have sensitivity levels that must be exceeded in order for reliable triggering to occur.

The AP240 and AP235 offer level control for all trigger coupling modes. Internal trigger level settings must be within V_m ± 0.5 FS, where FS is the channel Full Scale. In addition, they implement a Window trigger. Two trigger level thresholds are used to define the desired range. The trigger can then be chosen to occur either when the signal exits or enters the window range. This mode can be thought of as the appropriate OR of two edge triggers of opposite slope.

For the AP100 and AP200 the AC coupled mode is implemented with an auto-level trigger. Internal trigger level settings for DC coupling must be within V_m ± 0.6 FS, where FS is the channel Full Scale.

The AP240 and AP235 models allow the user to choose the external trigger Full Scale from the set of values 0.5, 1.0, 2.0 or 5.0 V. The external trigger level can then be set to values in the range ± 0.5 FS. The AP100 and AP200 models have an external trigger range of ± 3 V.

The AP series Averagers will trigger on signals with a peak-peak amplitude > 15% FS from DC to their bandwidth limit.

3.3.4. Trigger Slope

The trigger slope defines the direction of the signal that will be used to initiate the acquisition when it passes through the specified trigger level. Positive slope indicates that the signal is transitioning from a lower voltage to a higher voltage. Negative slope indicates the signal is transitioning from a higher voltage to a lower voltage.

3.3.5. External Trigger Output

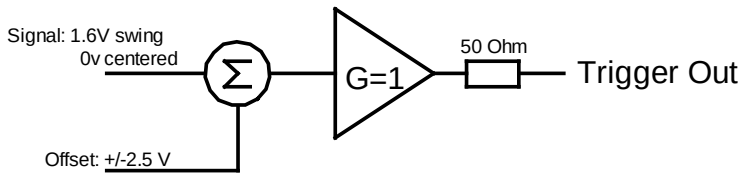
When the module is ready to be triggered and a valid trigger signal occurs, a trigger output is generated for external use. It is always available on the Front Panel Trigger Out MMCX connector.

⚠ ***NOTE:*** *The External Trigger Output functionality is implemented in the hardware. No Trigger Out signal occurs for software-generated triggers such as those of the AUTO mode of AcqirisLive or through the use of the function* ***AcqrsD1_forceTrigger****.*

Normally, the trigger output signal occurs when the module is ready to be triggered and a valid trigger signal occurs. As an aid in applications where a complete system has to be warmed-up before use, the averager can be put into a mode (**TrigAlways**) in which triggers received when the Averager is not in use are passed through and used to generate a trigger output. This mode is controlled using the function **AcqrsD1_configAvgConfig**.

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Trigger Output Block diagram:

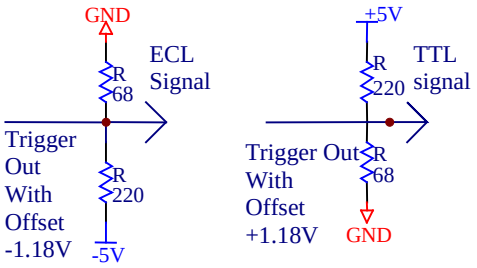


The output swing is 1.6 V (± 0.8 V) when unloaded and 0.8 V when terminated on 50 Ω. The rise and fall times are 2.5 ns typical. The offset can be adjusted, by software control in the range [–2.5 V, +2.5 V] unloaded, or [-1.25 V, +1.25 V] into 50 Ω. The maximum output current capability is ± 15 mA. As the output is retro-terminated, it is possible to drive a 50 Ω line unterminated (HiZ) without loss of performance.

For a TTL compatible signal, set the offset to 1.0 V and the swing at destination will be +0.2 to +1.8 V.

For an ECL compatible signal, terminated on 50 Ω to –1.2 V, set the offset to –1.2 V and the output will be in the range [–0.8 V, –1.6 V]).

Alternatively, to reduce the current drawn from the digitizer, the terminations here can be used:



3.3.6. Trigger Status

The front panel includes a tri-color LED indicator to show the status of the trigger. When the LED is green it indicates the trigger is armed and waiting for a valid trigger to occur. Red indicates that the trigger has occurred, the acquisition is complete and the data is waiting to be readout. The user can override the default functions and program the LED color in an application-specific manner.

3.4. Data Acquisition – Common

The AP series Averagers can be used either for averaging or for normal digitizer data acquisition. These two modes are quite different in their functioning. After describing some common characteristics they will be treated individually in the sections below. The digitizer mode is particularly useful when trying to configure an AP module for later use as an Averager.

3.4.1. Timing

A crystal controlled time base is used to generate the clock of the digitizer. Clock accuracy is better than ± 2 ppm, and individual sample points are recorded with better than ± 10 ps (< 2 ps rms) of sampling jitter.

3.4.2. Sampling Rate

The AP series Averagers include an analog-to-digital converter (ADC) that can sample waveforms in real time, at rates from 1 or 2 GS/s (0.5 ns per point) down to 100 S/s (10 ms per point). The sampling rate can be programmed and is selectable in a 1, 2, 2.5, 4, 5 sequence (i.e. 100 MS/s, 200 MS/s, 250 MS/s, 400 MS/s, 500 MS/s, 1GS/s, 2GS/s). The data of all of the active channels is acquired synchronously; all of the ADC's are acquiring data at the same time, to within a small fraction of the maximum sampling rate.

3.5. Data Acquisition - Digitizer Mode

3.5.1. Acquisition Memory and Time Base Range - Digitizer Mode

Data from the ADC is stored in on-board acquisition memory. The amount of memory in use for acquisition can be programmed and is selectable from 2 samples to 256KS, the full amount of acquisition memory available (with AP235/AP240 in single-channel mode). Note that the Averaging memory is much greater. The raw ADC data is treated as a value in the range [-128, +127], which corresponds to the voltage range [–FS/2 – Offset, +FS/2 – Offset].

For technical reasons, a certain memory "overhead" is required for each waveform, reducing the available memory by a small amount. In order to simplify programming, an interface function recommends the best sampling rate and

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the maximum possible number of data points, taking into account the available memory, the requested time window, the number of segments (in Sequence mode), as well as the required memory overhead.

The Time Base Range defines the time period over which data is being acquired. For example, the AP200 in the digitizer mode has an acquisition memory of just under 256 KS and maximum sampling rate of 2 GS/s. Thus, at the maximum sampling rate, the digitizer can record a signal over a time period of up to 130 µs (256 KS * 0.5 ns/point). The time base range can be adjusted by varying the amount of acquisition memory or the sampling rate of the digitizer.

3.5.2. Pre- and Post-Trigger Delay - Digitizer Mode

To increase trigger flexibility a pre- or post-trigger delay can be applied to the trigger position. However, pre-trigger is not available in the Averaging mode.

The amount of pre-trigger delay can be adjusted between 0 and 100% of the acquisition time window (i.e. sampling interval x number of samples), whereas the post-trigger delay can be adjusted between 0 and 200 million samples.

Pre- or post-trigger delays are just different aspects of the same trigger positioning parameter:

- The condition of 100% pre-trigger indicates that all data points are acquired prior to the trigger, i.e. the trigger point is at the **end** of the acquired waveform.
- The condition of 0% pre-trigger (which is identical to a post-trigger of 0) indicates that all data points are acquired immediately after the trigger, i.e. the trigger point is at the **beginning** of the acquired waveform.
- The condition of a non-zero post-trigger delay indicates that the data points are acquired after the trigger occurs, at a time that corresponds to the post-trigger delay, i.e. the trigger point is **before** the acquired waveform.

The digitizer hardware accepts pre- and post-trigger adjustments in increments of 16 samples. By definition post-trigger settings are a positive number and pre-trigger settings are a negative number.

Thus it is only natural that the software drivers provided treat pre- and post-trigger delays as a single parameter in seconds that can vary between *–nbrSamples * samplingInterval* (100% pre-trigger) and *+maxPostTrigSamples * samplingInterval* (max post-trigger). Since the Acqiris software drivers provide very accurate trigger position information upon waveform readout, the accepted resolution of the user-requested pre-/post-trigger delay is much better than 16 samples. For more details, refer to the **Programmer's Reference Manual.**

3.5.3. Single and Sequence Acquisitions - Digitizer Mode

Digitizers acquire waveforms in association with triggers. Each waveform is made of a series of measured voltage values (sample points) that are made by the ADC at a uniform clock rate. To maximize sampling rates and utilize memory as efficiently as possible, the digitizers include both Single and Sequential storage modes.

The Single Acquisition mode is the normal operation of most digitizer products. In this mode an acquisition consists of a waveform recorded with a single trigger. The user selects the sampling rate and acquisition memory size and sets the number of segments to 1 (default value).

The modules also include a built-in Trigger Time Interpolator (TTI) that measures the time from the trigger point to the first sample point. This information is essential for determining the precise relation between the trigger or other event of interest and the digitized samples of the signal. The TTI resolution is 80 ps.

The Sequence Acquisition mode allows the capture and storage of consecutive "single" waveforms. Sequence Acquisition mode is useful as it can optimize the digitizer's sampling rate and memory requirements for applications where only portions of the signal being analyzed are important. The mode is extremely useful in almost all impulse-response type applications (RADAR, SONAR, LIDAR, Time-of-Flight, Ultrasonics, Medical and Biomedical Research, etc.).

In Sequence Acquisition mode the acquisition memory is divided into a pre-selected number of segments. Waveforms are stored in successive memory segments as they arrive. Each waveform requires its own individual trigger. The memory can be divided into any number of segments between 2 and 200. In Sequence Acquisition mode the user needs to specify the sampling rate, the total acquisition memory and number of segments. Note that the Single Acquisition mode is just a special case of the Sequence Acquisition mode with the number of segments set to 1.

Sequence acquisition enables successive events, which can occur within a very short time, to be captured and stored without loss. A crucial feature of Sequence Acquisition mode is that it has a very fast trigger rearm time. A fast trigger rearm helps produce very low "dead time" (less than 800 ns for the highest available sampling rates) between the segments of a sequence acquisition. The "dead time" is the period after the end of an event when the card cannot digitize data for a new trigger event. To complement this mode of operation the digitizer can also measure and store the arrival time of each trigger using the information from the on board TTI (Trigger Time Interpolator). Readout of

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the individual trigger time stamps makes it possible to determine the time from one trigger to any other trigger in the sequential acquisition. The TTI resolution sets the resolution of the trigger time stamps.

3.6. Data Acquisition - Averaging Mode

Model - Mode	Channels	Maximum Sampling Rate	Maximum length for Average Default Memory	Maximum length for Average Optional Memory	Memory Minimum/ Increment	Start Delay Maximum
AP240 – Single-channel	1	2 GS/s	2M samples	8M samples	32	16M Samples
AP240 – Dual-channel	2	1 GS/s	2M	8M	16	16M
AP235 – Single-channel	1	1 GS/s	2M	8M	32	16M
AP235 – Dual-channel	2	0.5 GS/s	2M	8M	16	16M
AP200	1	2 GS/s	2M	8M	32	16M
AP100	1	1 GS/s	2M	8M	16	16M

3.6.1. Averaging Mode

In Averaging mode, newly acquired waveforms are summed in real-time with the corresponding samples of previous waveforms. The corresponding samples are those with identical delay calculated from the beginning (trigger time) of the acquisition. While the acquisition is running, the previous sum is read from the averaging memory, added to the incoming sample and written back to the averaging memory. A high-speed on-board computing circuit performs the retrieve, add and store functions necessary to average the signal in real time. Real time averaging is possible up to the maximum 2 GS/s sampling rate. In Averaging mode, the trigger starts the sampling clock, and only post-trigger data are acquired. The sums are stored in the 24-bit deep averaging memory, allowing the summation of up to 65,536 waveforms, without overflow. Each raw ADC datum is treated as a value in the range [0, 255], which corresponds to the voltage range [–FS/2 – Offset, +FS/2 – Offset].

3.6.2. Time Base Range

The Time Base Range defines the time period over which data is being acquired. For example, the AP240 in single-channel mode has an averaging acquisition memory of 2 MS and maximum sampling rate of 2 GS/s. Thus, at the maximum sampling rate, the digitizer can record a signal over a time period of up to 1.0 ms (2 MS * 0.5 ns/point). With the optional 8 MS averaging memory, this range can be extended to 4 ms. The time base range can be adjusted by varying the amount of acquisition memory or the sampling rate of the digitizer.

3.6.3. Averaging Memory

Data from the ADC is stored in the on-board averaging memory. The actual averaging memory size used for each acquisition can be programmed. The maximum values are given in the table above.

Segment time stamps and descriptors are also stored in the averaging memory.

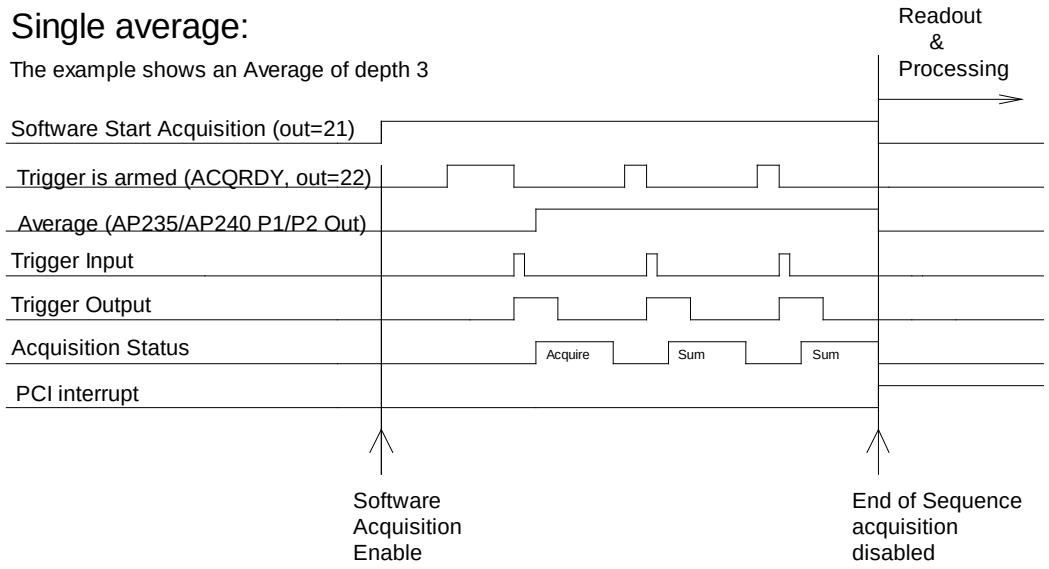
To ensure the use of maximum sampling rate and high timing resolution, we strongly recommend the use of long averaging memories whenever possible. For example, with the optional 8 MS memory, the model AP240 can record a signal over a 4 ms period at full sampling rate. The fast sampling rate ensures that all high frequency signal components, up to the full bandwidth of the Averager, are accurately recorded. If the averaging memory were reduced to just 20 KS then the sampling rate would need to be reduced to just 5 MS/s (20,000/4 ms) to record the same 4 ms period. All frequencies above 2.5 MHz would then be incorrectly digitized and important signal characteristics may be distorted or even completely missed.

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3.6.4. Single Average

When a single average is acquired, the series of events shown in the diagram below takes place:

- The trigger starts the acquisition (Clock pre-trigger is not possible in Average mode).
- After each waveform acquisition, the clock will stop and is restarted again only by the next trigger.
- When the whole average is complete, the module will stop acquiring.



3.6.5. Sequence Average Mode

For time resolved applications where multiple averaged waveforms must be acquired with minimal dead time between them, the Sequence Average mode is available. This mode partitions the averaging memory into a pre-selected number of segments. Each memory segment is then used to store accumulations of summed data. The number of segments can be chosen from 1 to 8191. The length of each segment is adjustable from the Memory minimum value in the table above, in steps of that value, up to the maximum consistent with the memory size and the number of segments. The dead time after the acquisition of a trigger is 3 µs.

As with a Single Average, Sequence Average sums are stored in the 24-bit deep averaging memory; this allows the summation of up to 65,536 8-bit waveforms. Post acquisition processing of sequence mode acquisitions in the host computer can further enhance the sums. E.g. in order to obtain 32-bit sums, up to 256 sequence-averaged waveforms may be added together. The maximum number of acquisitions for an average can thus be increased to over 16 million waveforms.

It should be noted that the normal Sequence Average mode is not at all like the Sequence Acquisition Mode of digitizers as described earlier. The data associated with successive triggers is summed in a segment until the desired depth, N_{succ}, is attained. The next trigger initiates the sum of the following segment.

The AP240 and AP235 Averagers also implement a round-robin Sequence Average mode. In this case, successive triggers go into the same segment until the desired count, N_{succ} is reached. The next trigger goes into the next segment and the entire loop over segments is repeated until each segment has been worked on N_{robin} times. This implementation will allow >65536 triggers to be accumulated into a 24-bit word. Therefore, there is a possibility for the accumulated sum to wrap around 0; For the particular case, Segments = 2, N_{succ} =1 and N_{robin} = N the acquisition will contain the accumulated data for the N odd triggers in segment 1 and for the N even triggers in segment 2.

To complement the Sequence Average mode, the digitizer can also measure and store the times when the first trigger of each segment occurred. Either the Internal 10 MHz reference clock or the PCI 33 MHz clock can be used to generate this timestamp. Readout of the time stamps allows the determination of the time from the beginning of one

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Average to that of any other Average in the sequential acquisition. Timing measurements between trigger events is possible with a resolution of 100 ns or 30 ns depending on which clock is in use.

The averager can also store the state of 4 bits at the time of the first trigger of each segment of each acquisition. These bits, which will be called hardware markers, are those of logic signals at the P1, P2, MMCX I/O A, and MMCX I/O B inputs. See section 3.8 **Front Panel Inputs and Controls**.

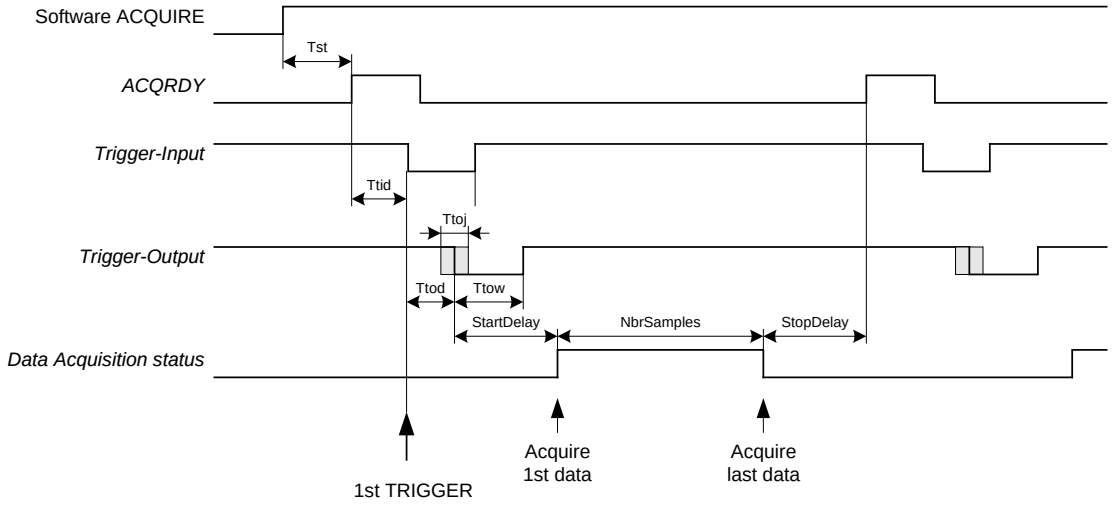
In the Sequence Average mode, the module needs as many triggers as defined by the sequence setting, (N_{succ} * N_{robin}) * number of segments.

3.6.6. Trigger Overview

Before the Averager starts acquiring signals it must be armed and in a ready state. Arming the module is done by software (ACQUIRE command). The Averager will then wait for a trigger to start an acquisition (see the timing diagram below).

When the Signal Averager is armed (via the **AcqrsD1_acquire** command) and ready to acquire data, it generates, after a time ***Tst*** (which may vary between 50 µs and 10 ms, depending on the processor and the operating system used) a Ready signal (ACQRDY). This signal is available on the front panel I/O MMCX connector. The Ready signal is normally used to activate an external event, such as firing a laser.

This external event in turn can produce a signal that can be used to generate the trigger for the Signal Averager. The trigger-input pulse can have a delay ***Ttid*** that can vary from zero to as long as required. The Ready signal (ACQRDY) is reset with the arrival of the trigger pulse. When the acquisition is running, or when the module has not



been enabled to start the acquisition, ACQRDY is set low.

When the trigger is received, the Averager generates a trigger output which is then used internally to start the acquisition after a predetermined delay shown as ***StartDelay*** in the diagram above. The trigger output is provided for applications where an external signal source must be synchronized with the internal sampling clock. The Averager trigger output edge is synchronized to the sample clock to within < 100 ps. The trigger output accurately preserves the sample timing with respect to the event of interest from shot-to-shot. Ideally, the trigger output is used to synchronously activate an event serving as the zero-time reference for the time-dependent phenomena that are measured in each accumulated waveform. As an example, the trigger output could activate the application of an electric or magnetic field to a sample under test. This method ensures that the application of the field is identically synchronized to the sample clock for each shot contained within the average. It also means that each sample in the accumulated sum is identically positioned shot-to-shot with respect to a fixed zero-time reference, provided that the time between the trigger output and the event waveform is kept constant.

The trigger output has, with respect to the trigger input, a delay of around ***Ttod*** ± ***Ttoj/2***, where ***Ttod*** is about 10 ns and ***Ttoj*** is either 400 ps or 1 clock pulse, depending on the mode of operation as explained in the next section. The digitizing clock is started at a precise, user configurable time after the trigger output pulse. This is shown as ***StartDelay*** in the diagram above. ***StartDelay*** is adjustable from its minimum as given in the table below, in steps of the time of the memory increment value, up to the maximum value given in the table.

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StartDelay /Sampling Rate	AP240 Single-channel	AP235 Single-channel	AP240 Dual-channel	AP235 Dual-channel	AP200	AP100
2GS/s	18.8 ns	NA	NA	NA	18.8 ns	NA
1	22.6	22.6	18.8 ns	NA	22.6	18.8 ns
0.5	38.2	38.2	22.6	22.6	38.2	22.6
0.4			25.8	25.8		25.8
Zero points						
	10	10	5	5	10	5

These results apply to current versions of the FPGA firmware. It should also be noted that when the user configurable **StartDelay** is 0, the first few data points (as shown in the table above) of 32-bit summed waveform data are automatically set to 0 (bottom of the range) and should be ignored.

The Averager can be used to limit the system's overall event rate. A rate adjustment delay ***StopDelay*** can be programmed in steps from zero to the model maximum with the same range and resolution as ***StartDelay***. For maximum acquisition rates ***StopDelay*** should be set to zero.

3.6.7. Random and Synchronized Triggers

The Averagers have two trigger synchronization modes, **Non-Resync** or **Resync**. Normally the user's trigger input is not synchronized with respect to the internal sampling clock.

In **Non-Resync** mode**,** the internal trigger signal, which generates the trigger output and starts the digitizing clock after ***StartDelay***, is not resynchronized with respect to the internal sampling clock. The trigger output is synchronized with respect to the sampling clock to better than ± 100 ps. The jitter, i.e. the variation of the position of the clock with respect to the input trigger time, as a function of sampling rate is shown in the table below. In order to preserve the timing accuracy of successively summed acquisitions, the Averagers also offer a **Resync** mode**,** where the jitter is limited to ± 200 ps (at the highest sampling rate).

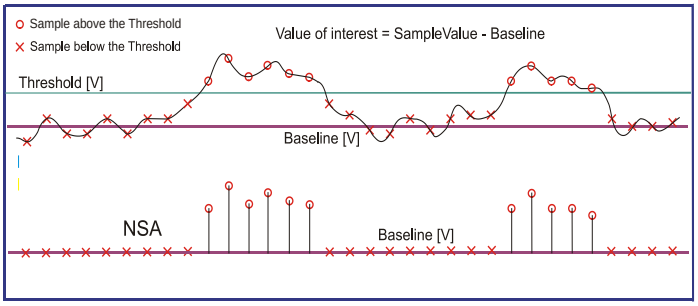
The **Resync** mode is the preferred method for applications where the acquisition jitter (and the trigger out jitter) must be minimized to avoid loss of effective system bandwidth typically associated with the higher jitter found when using the **Non-Resync** mode**.**

Sampling Clock Synchronization with respect to Trigger Input				
Sample Rate	**Resynchronized Mode**		**Non-Resynchronized Mode**	
	AP200 or AP240/AP235 Single-channel	**AP100 or AP240/AP235 Dual-channel**	**AP200 or AP240/AP235 Single-channel**	**AP100 or AP240/AP235 Dual-channel**
2 GS/s	± 200 ps	--	± 500 ps	--
1 GS/s	± 325 ps	± 200 ps	± 1 ns	± 500 ps
500 MS/s	± 325 ps	± 325 ps	± 1 ns	± 1 ns
400 MS/s	± 400 ps	± 400 ps	± 1.25 ns	± 1.25 ns
≤250 MS/s	± 400 ps	± 400 ps	± 1.25 ns	± 1.25 ns

3.6.8. Noise Suppressed Accumulation

In some applications, such as time of flight mass spectroscopy, the signal is a rare event sitting on top of a noisy baseline. The averaging process will reduce the random noise. However, to enhance the Averager's ability to detect such signals in the presence of synchronous noise, the Averagers allow the user to set a threshold that has to be exceeded for each data value to be entered into the sum. The threshold should be set above the level of the noise (synchronous and asynchronous). Furthermore, as an aid to the user or in order to avoid overflow in the summed data, a fixed number, the NoiseBase, can be subtracted from each data value before the summation is done. Both of these values are specified as absolute voltages, V_{thresh} and V_{base} , which are converted into their ADC code equivalent values, *base* and *threshold*. This is shown in the following picture:

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Thus, for each trigger and in each time bin, *i*, if the data value exceeds the threshold then the threshold minus the base value will be added to the sum, s_i:

$$s_i = \sum_{data>threshold} (data_i - base)$$

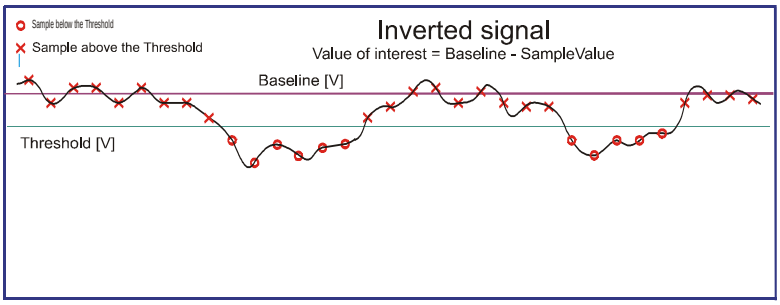
and $< V_i >= 1/N * \sum_{V_i > V_{thresh}} (V_i - V_{base})$ where N is the total number of acquisitions

and where $base = (V_{base} - V_{lower\ edge\ of\ range})/FS*256$ and

$threshold = (V_{thresh} - V_{lower\ edge\ of\ range})/FS*256$

Note that V_{base} can be below $V_{lower\ edge\ of\ range}$ if so desired.

Similarly, if the signal of interest is negative going and the data of interest lie below a threshold, data inversion can be enabled and the application of the same recipe gives the same result for the following input:



$$s_i = \sum_{data<255-threshold} (255 - data_i - base)$$

and $< V_i >= 1/N * \sum_{V_i < V_{thresh}} (V_{base} - V_i)$

where $base = (V_{upper\ edge\ of\ range} - V_{base})/FS*256$ and

$threshold = (V_{upper\ edge\ of\ range} - V_{thresh})/FS*256$

Note that V_{base} can be above $V_{upper\ edge\ of\ range}$ if so desired.

The result of this is that the summed or averaged data always shows positive peaks. In order to ensure that the threshold can be applied and that the values contributing to the sum are always positive and because the base value is stored as a signed 8-bit number it is required that:

For positive going signals (data above a threshold)

$0 < threshold < 255$ or, equivalently, $-FS/2 - Offset < V_{thresh} < +FS/2 - Offset$

$threshold \geq base$ or, equivalently, $V_{thresh} \geq V_{base}$ and

$-128 \leq base \leq 127$ or, equivalently, $-FS - Offset < V_{base} < -Offset$

For negative going signals (data below a threshold)

$0 < threshold < 255$ or, equivalently, $-FS/2 - Offset < V_{thresh} < +FS/2 - Offset$

$threshold \geq base$ or, equivalently, $V_{thresh} \leq V_{base}$ and

$-128 \leq base \leq 127$ or, equivalently, $-Offset < V_{base} < +FS - Offset$

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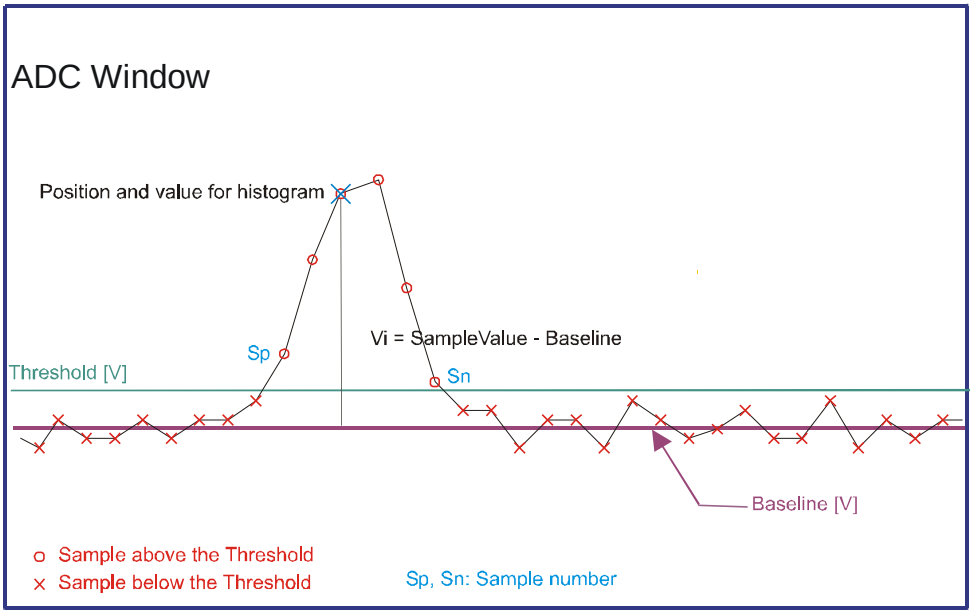
The average value is obtained by dividing the sum by the total number of triggers which is often much greater than the number of triggers that actually contributed to the sum. The interpretation of the absolute voltage value is not obvious.

3.6.9. TDC Histogram mode

This mode implements the accumulation of a histogram of peak position values based on the NSA analysis introduced above. Defining a peak as a number of consecutive data values above the threshold, a peak will be accepted if its width (the number of values) is greater than the user-defined minimum in the range [0,3]. The peak's time t_i is defined as that of the datum in the middle or just to the left of the middle of the peak. The peak's value is chosen to be either 1 or the value V_i. The peak will be rejected if its width is greater than 16 values.

The TDC histogram will have the same length as that of the associated waveform with segments. The accumulated value for a single bin is stored in a 24-bit sum. The acquisition will run for the number of triggers defined by the number of segments, the round-robin count, and the number of waveforms to be entered into a segment accumulation before incrementing the segment. Each waveform can contain an arbitrary number of peaks satisfying the definition above.

The process of accumulating a TDC histogram is very similar to the process of accumulating the sum used in



averaging. The difference is that instead of adding the current waveform to the sum we convert that waveform into one in which only the acceptable peaks have a single non-zero point and we sum that derived waveform into the accumulated sum.

3.6.10. Real-time Add/Subtract control

Some applications may have the possibility to have triggers with and without the usual background. The background can include both contributions from the Acqiris module as well as those from the experimental apparatus. If the user provides a digital signal to indicate whether the data associated to the current trigger should be added to or subtracted from the accumulated sum it becomes possible to cancel the Background contributions to the sum. We know of two such examples;

1. Some of the triggers provide an analog input V_1 = + Signal + Background while the other triggers provide V_2 = – Signal + Background. In this case if we provide equal numbers of triggers of the two types then

   $<V> = 1/n * (\Sigma V_1 – \Sigma V_2) = \text{Signal}$

2. Some of the triggers provide an analog input V_1 = + Signal + Background while the other triggers provide V_2 = + Background. In this case if we provide equal numbers of triggers of the two types then

   $<V> = 1/n * (\Sigma V_1 – \Sigma V_2) = \text{Signal}/2$

Note that the technique poses no requirements on the relative magnitudes of the Signal and the Background. To successfully exploit the method the vertical range of the channel has to be chosen so as to avoid both underflow and overflow for both V_1 and V_2. However, the final result is independent of the offset of the channel. When reading back the data the driver will not take the offset into account in the usual way. If the user reads back 32-bit sums their values can be negative. Real-time Add/Subtract should not be combined with NSA or TDC modes.

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3.6.11. Pre Acquisition Triggers

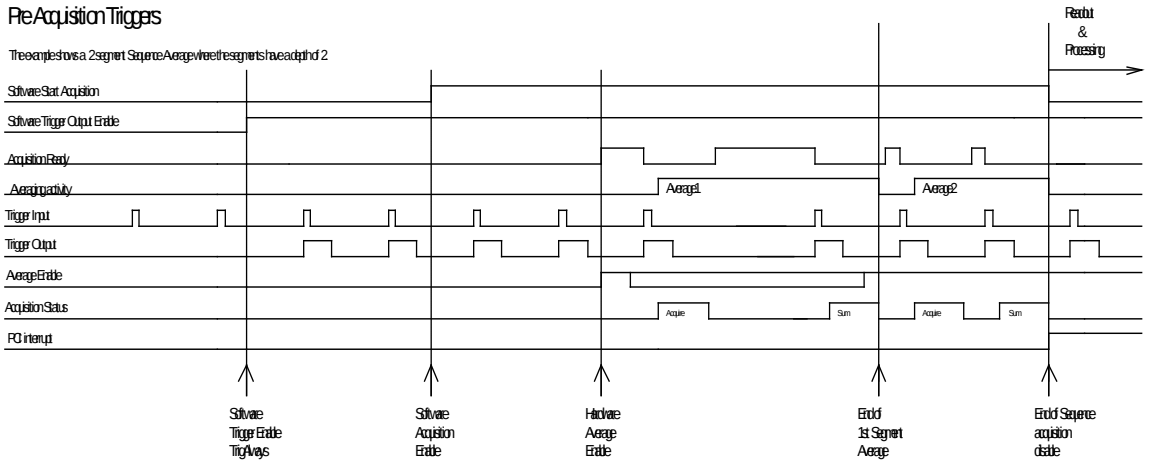
For applications where thermal effects must be taken into account, the Averager module has the capability of generating trigger output pulses that can be used to activate the system even when the associated event will not be acquired. The trigger output pulses can be used to stabilize systems prior to starting the acquisition. A call to **AcqrsD1_configAvgConfig** using the parameter string **"TrigAlways"** will cause these pulses to be generated. In this case the Control I/O Trigger armed signal is also active and the trigger rate should not exceed that which can normally be taken under the chosen acquisition conditions.

The Acquisition Ready signal can be observed on either of the I/O A or B MMCX connectors when appropriately configured. The Average Enable signal can be sent in to the module using the I/O A or B connector for the AP100/AP200 or the P1/P2 control for the AP235/AP240. The Average Enable can be configured to act as either a low-high transition event enabling the start of the averaging process (Start Veto Enable) or as a level which must be high to allow an individual trigger to be accepted (Average Trigger Enable).

3.7. External Clock and Reference

For applications where the user wants to replace the internal clock of the digitizer, and drive the ADC with an external source, an External Clock or Reference signal input is available. The Clock or Reference signals can be entered into the digitizer via the MMCX CK connector on the front panel.

When using an External Clock, the user must ensure that the input signal has a frequency between 20 MHz and 2000 MHz for the AP235/AP240 models (or between 10 MHz and 500 MHz for the AP100/AP200 models) and a minimum amplitude of at least 1 V peak-to-peak (2 V for the AP100/AP200 models). The External Clock allows the digitizer to make a voltage measurement when the clock signal passes through a predefined threshold.



Normally the external clock sampling rate is the same as the external clock frequency; however for the AP240/AP235 single-channel mode the sampling rate is ½ of the clock frequency. The threshold range is variable and user selectable between ± 2 V. The signals should not exceed ±5 V amplitude.

For applications that require greater timing precision and stability than is obtainable from the internal clock, a 10 MHz Reference signal can be used. The amplitude and threshold conditions, for an External Reference, are the same as for the External Clock. If phase synchronization between several digitizers is required, the reference signal should be applied to all of them. The allowed frequency range is [9.0 MHz, 10.2 MHz].

When using an External Clock, the **Resync** trigger mode is not functional.

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3.8. Front Panel Inputs and Controls

Name		Function		Connector
		AP100/AP200	AP240/AP235	
INPUT A	Channel 1	Signal input A	Channel 1 input	BNC 1
INPUT B	Channel 2	Signal input B	Channel 2 input	BNC 2
TRIGGER IN		Trigger input		BNC 3
		User configurable (see below).		MMCX I/O A
TRIGOUT		Signal occurs after an accepted TRIGGER. It is synchronous to the acquisition Clock and can be used to trigger events synchronously to the acquisition clock.		MMCX TR
		User configurable		MMCX I/O B
CLKEXT		50 Ω External clock / External reference Input		MMCX CK
		NA	User configurable (see below)	P1
		NA	User configurable (see below)	P2

The I/O A, I/O B, P1 and P2 signals are 3.3 V compatible CMOS. This means that, on input, low is < 0.7 V and high must be in the range [1.7 V, 5.0 V]. An unconnected signal will be high. This definition ensures TTL compatibility. On output, the low level will be in the range [0 V, 0.7 V] and the high level in the range [1.7 V, 3.3 V] for HiZ. The high level output will typically give 0.8 V into 50 Ω. The I/O A or B connectors can be used for the following output signals: *10 MHz reference clock, Acquisition skipping to next segment, Acquisition is active, Trigger is armed*. They can also be used for *Enable trigger input* or *Averager Start Veto* for the AP100/AP200. The AP240/AP235 P1 and P2 connectors can be used for *Enable trigger input, Averager Start Veto*, or *Real-time Add/Subtract Control* inputs and the *Average* output.

To ensure proper operation of the segment recording of hardware markers, the logical state of P1, P2, MMCX I/O A, and MMCX I/O B inputs, the input must be stable for a time interval starting 10 ns before the trigger and continuing until 20 ns after it. This implies that the HF Reject trigger coupling should not be used. If the individual inputs are not in the disable state the corresponding bits will be useless.

3.9. Internal Calibration

The software drivers supplied include calibration functions for the timing, gain and offset settings, which can be executed upon user request. The digitizers are never calibrated in an “automatic” way, i.e. as a side effect of another operation. This ensures programmers have full control of all calibrations performed through software in order to maintain proper event synchronization within automated test applications.

The model AP series Averagers include a high precision voltage source and a 16-bit DAC, used to determine the input voltage and offset calibration.

For accurate time and voltage measurements it is recommended to perform a calibration once the module has attained a stable operating temperature (usually reached with a few minutes after power on). Further calibration should not be necessary unless temperature variations occur. Calibration can usually be performed with signals present at the channel, external, and clock inputs. However, if the calibration is found to be unreliable, as shown by a calibration failure status, it may be necessary to remove such signals.

3.10. Factory Calibration

Whilst the Internal Calibration function will provide a good degree of confidence that your instrument is operating within its specifications on a day-to-day basis, Agilent recommends that each instrument undergoes a Factory Calibration at least annually to ensure that it remains within the specified performances.

Factory Calibration is the process of measuring the actual performance of an instrument-under-test using lab instruments that in turn have significantly better performance than the instrument-under-test. Lab instrument performance must be traceable to the International System (SI) Units via a national metrology institute (NIST, NPL, NRC, PTB, CENAM, INMETRO, BIPM, etc.)

The measured performance is then compared to published data sheet specifications. Agilent Technologies tests the performance corresponding to all data sheet specifications, for all installed options, every time. If we observe your instrument to be out-of-specification, we always adjust it and re-test before we return it to you.

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For more information, or to return your instrument to Agilent for calibration please see www.agilent.com/find/calibration

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3.11. Electrical, Environmental and Physical Specifications

3.11.1. Electrical

	Power Consumption (W)	CURRENT REQUIREMENTS (A)			
Model	**Maximum / Typical**	**+12 V**	**+5 V**	**+3.3 V**	**−12 V**
AP240	60 / 46	1.1	2.7	8.3	0.04
AP235	60 / 46	1.1	2.7	8.3	0.04
AP100	36.7	0.7	1.9	4.5	0.05
AP200	56.6	0.9	3.0	7.6	0.05

The Maximum Power Consumption has been increased by 10% over the value calculated with the currents shown to take into account higher allowed values for the PCI voltages.

Except for the high total power consumption all modules conform to Revision 2.2 of the PCI Local Bus Specification. They use the PCI Bus at 33 MHz. All of these modules are capable of DMA transfers at rates ~100 MB/s.

3.11.2. Environmental and Physical

The modules have a Declaration of Conformity according to ISO/IEC Guide 22 and EN45014 and **CE** Marks of Compliance.

Operating Temperature

0° to 40°C

The above values are for the ambient temperature of the room (or equivalent) where the PC is located. The temperature as measured on the board may well be significantly higher. On-board temperatures above 60°C should be avoided

Relative Humidity

5 to 95% (non-condensing)

Dimensions

All AP modules conform to the PCI standard and require a long card slot. When used with the XP102 Fan the overall length can be adjusted from ~325 mm up to the long card slot maximum of 342.3 mm.

EMC Immunity & Emissions

Complies with European EMC Directive 2004/108/EC
• IEC/EN 61326-2-1
• CISPR Pub 11 Group 1, class A
• AS/NZS CISPR 11
• ICES/NMB-001

This ISM device complies with Canadian ICES-001.
Cet appareil ISM est conforme à la norme NMB-001 du Canada.

Required Airflow

XP102 Fan unit required. AP Averagers are delivered with this Fan unit.

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4. Soft Front Panel (SFP) Applications

The Agilent SFP Applications (previously called AcqirisLive) are intended to verify the functionality of the card 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.

4.1. SFP Versions

There are currently two versions of the SFP application.

The SFP 1.x version is gradually being phased out by the introduction of the SFP version 5. 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.

4.1.1. SFP 5.x

This newer version of the SFP application supports all products which are covered by the MD1 driver. New features, and replication of features which currently exist in the older SFP 1.x will be introduced progressively into the 5.x version.

This version supports:

- All Agilent U10xx (8, 10 & 12-bit Digitizers).
- All Agilent Mxxxx series Digitizers. (Except M9202A in DDC mode)
- DGS, DCT, SAR/SSR, Peak TDC modes of operation.

4.1.2. SFP 1.x

This application which was previously known as 'AcqirisLive' contains some features which have not yet been implemented in the SFP 5 application. Users who prefer this application or wish to use one of the features below may continue to do so.

This version is required currently if you wish to use any of the following instruments, or features:

- Using M9202A in DDC mode.
- U1082A, AP100 or AP200 Averagers.
- U1084A in Averager mode.
- Using multiple modules at the same time.

4.2. SFP Documentation

Information on the operation of both of the above SFP versions may be found in the 'AgMD1 Digitizers – User Guide & Soft Front Panel Help'. This is an HTML Help system (.chm) which may be found on the CD supllied with your product, or from the windows 'Start Menu' after you have installed your product software. Look under – ***Start > All Programs > Agilent > MD1 > 'MD1 Help'***

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5. Appendix A: U1092A-HVB XA100 BNC Input Overvoltage Protection

Specifications and User Instructions

The XA100 Acqiris option contain two elements :
- 3dB BNC Attenuator
- 90V BNC Spark Gap

The XA100 overvoltage protection kit allows the digitizers with 50 Ohm only input (without high impedance input) to withstand a high voltage surge of up to 5 kV.

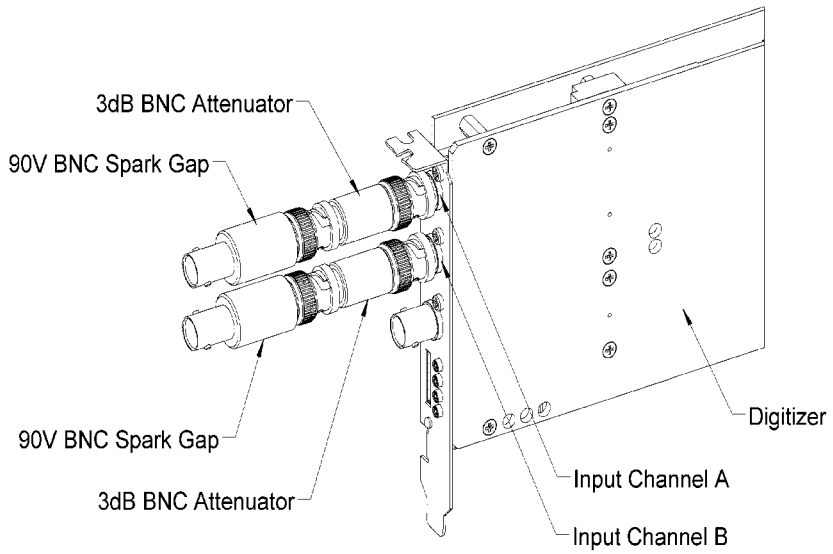
XA100 SPECIFICATIONS :

- Frequency range : DC to 1GHz
- Input impedance : 50 Ohm
- Attenuation : 3 dB
- VSWR, DC to 1GHz : < 1.25
- Impulse discharge current (8/20 us pulse) : 10 kA
- Weight : 60 g
- Length : 85 mm

ATTENTION :

- BOTH the 90V spark gap and the 3dB attenuator MUST be used in order to absorb very high current.

- In order to limit the input current, the attenuator MUST be inserted between the spark gap and the input of the module, as shown in the figure below.



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6. Appendix B: U1091AX02 XP102 Fan Unit for the AP Family of Modules

Specification and Assembly Instructions

SPECIFICATIONS :

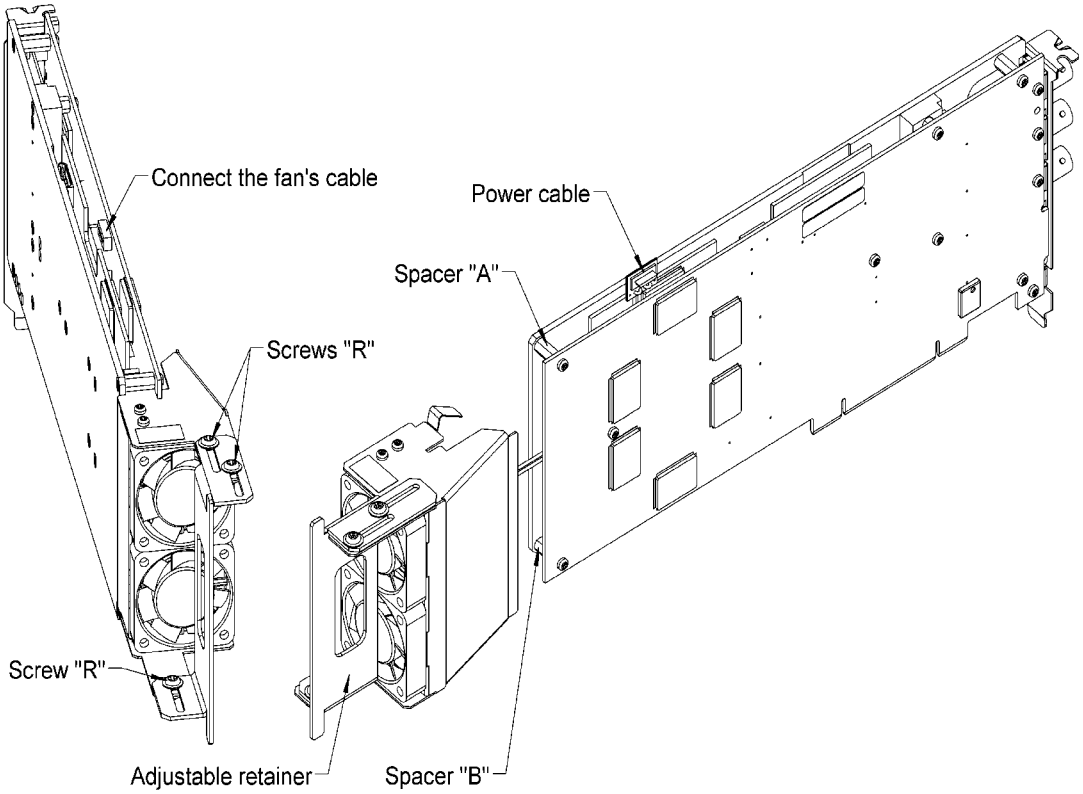
Airflow : 16 m3/h, typical speed 6500 rpm, maximal noise 30 dB(A).
Nominal Voltage : 5 VDC.
Power input : 2.1 W.
With electronic protection against reverse polarity, impedance-protected against blocking and overloading.
Operating temperature : 0 °C to 70 °C.
Life expectancy (at 25 °C) : 50000 hours.
Safety approvals : CE, VDE, UL, and CSA.
Materials : Box of stainless steel, aluminium and fan of fiberglass reinforced plastic, PBT housing, PA impeller.

HOW TO INSTALL/REMOVE THE FAN ON A DIGITIZER :

1. Remove the digitizer from the PC, prior to installing or removing the fan unit.
2. Twist the fan's cable a few times in order for the 2 wires to stay together.
3. Introduce the cable between the spacers "A" and "B" at the back of the digitizer.
4. Push the fan unit into the back of the digitizer so that the two springs lock into place.
5. Insure that the two springs are safely attached behind the two spacers and that the fan's box is in contact with the digitizer cover.
6. Connect the fan's cable as shown in the figure below. The position of the power connector can vary between different digitizer models.
7. To remove the fan unit, first unplug its power cable and then press on both fan springs and pull it away from the digitizer.

HOW TO INSTALL/REMOVE THE DIGITIZER IN A PCI SLOT OF A PC :

1. Install the fan on the digitizer as described above.
2. Release the three screws "R" from the adjustable retainer and move the retainer against the fans.
3. Introduce the digitizer into the PCI slot and tighten the front panel screw.
4. Push the retainer into the PCI slot guide and tighten the three screws "R". The digitizer is now installed.
5. To remove the digitizer it is necessary to first release the three screws "R" and pull back the adjustable retainer.



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