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Agilent E1438
VXI 100 MSa/s ADC
with filters and memory

User's Guide

Agilent Technologies

Agilent Technologies Part Number E1438-90010

Printed in U.S.A.
Print Date: December 2002, Fifth Edition

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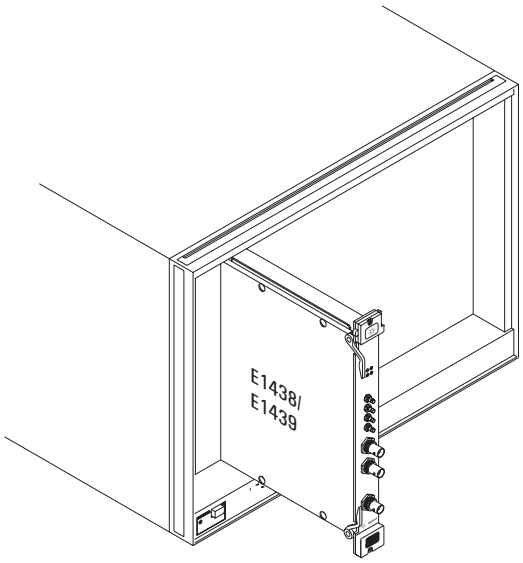
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The Agilent E1438 at a Glance

The Agilent E1438 100 MSa/s Digitizer with DSP and Memory provides high precision digitizing for time and frequency domain applications along with signal conditioning, filtering, and memory. The module plugs into a single C-size slot in a VXI mainframe.



Number of Channels	1
Type of Inputs	50 ohm
Input Bandwidth	150 MHz, 40 MHz alias protected
Sample Rate	100/102.4 Msample/second
Input Range	–21 to +30 dBm
Raw ADC resolution	12 bits
VXI Bus Support	VME (and Local Bus E1438D only)
VXI Device Type	Register based
I/O Data Port (E1438D only)	Fiber optic serial FPDP (front panel data port)
Size	C-sized, single slot

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What You Get With the Agilent E1438

The following items are included with your Agilent E1438:

Hardware

- Agilent E1438 ADC, C-size VXI module
- CD-ROM for Windows setup

Software

- CD-ROM for installation

  A Windows setup program that installs:

  - Firmware installation program
  - The Agilent E1438 VXI*plug&play* libraries and drivers
  - Soft Front Panel program for the Agilent E1438 with source files
  - Web-based help for the Agilent E1438
  - AGDSP function library and online help
  - Example programs and source files
  - Microsoft Visual C++ C-library and source files
  - Microsoft Visual Basic header files

Documentation

- Agilent E1438 Installation and Service Guide
- Online documentation available after software installation:
  - Agilent E1438 User's Guide in PDF format (this document)
  - Web-based help files providing operational information and programmer's reference
  - WinHelp files for the Agilent E1438 Soft Front Panel

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In This Book

This book documents the Agilent E1438 module. It provides:

- hardware installation information
- software installation information
- getting started information
- operational information
- programmer's reference
- replaceable parts

Other Documentation

Installation and Service information is provided as a printed document as well as in this PDF document.

After running the setup program the following documentation is available:

- Web-based help files are available from the Start menu.
- WinHelp for the Soft Front Panel is available from the application.

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1

Installing the Agilent E1438

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To inspect the Agilent E1438

The Agilent E1438 single channel VXI ADC Module was carefully inspected both mechanically and electrically before shipment. It should be free of marks or scratches and it should meet its published specifications upon receipt.

If the module was damaged in transit, do the following:

- Save all packing materials.
- File a claim with the carrier.
- Call your Agilent Technologies sales and service office.

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To install the Agilent E1438

Caution **To protect circuits from static discharge, observe anti-static techniques whenever handling the Agilent E1438 VXI ADC Module.**

1. Set up your VXI mainframe. See the installation guide for your mainframe.
2. Select a slot in the VXI mainframe for the E1438 module.
   The Agilent E1438D module's local bus receives ECL-level data from the module immediately to its left and outputs ECL-level data to the module immediately to its right. Every module using the local bus is keyed to prevent two modules from fitting next to each other unless they are compatible. If you will be using the local bus, select adjacent slots immediately to the left of the data-receiving module. If the VXI bus is used, maximum data rates will be reduced but the module can be placed in any available slot.
3. Using a small screwdriver or similar tool, set the logical address configuration switch on the E1438. (See the illustration on the next page.) Each module in the system must have a unique logical address. The factory default setting is 1100 0000 (192).

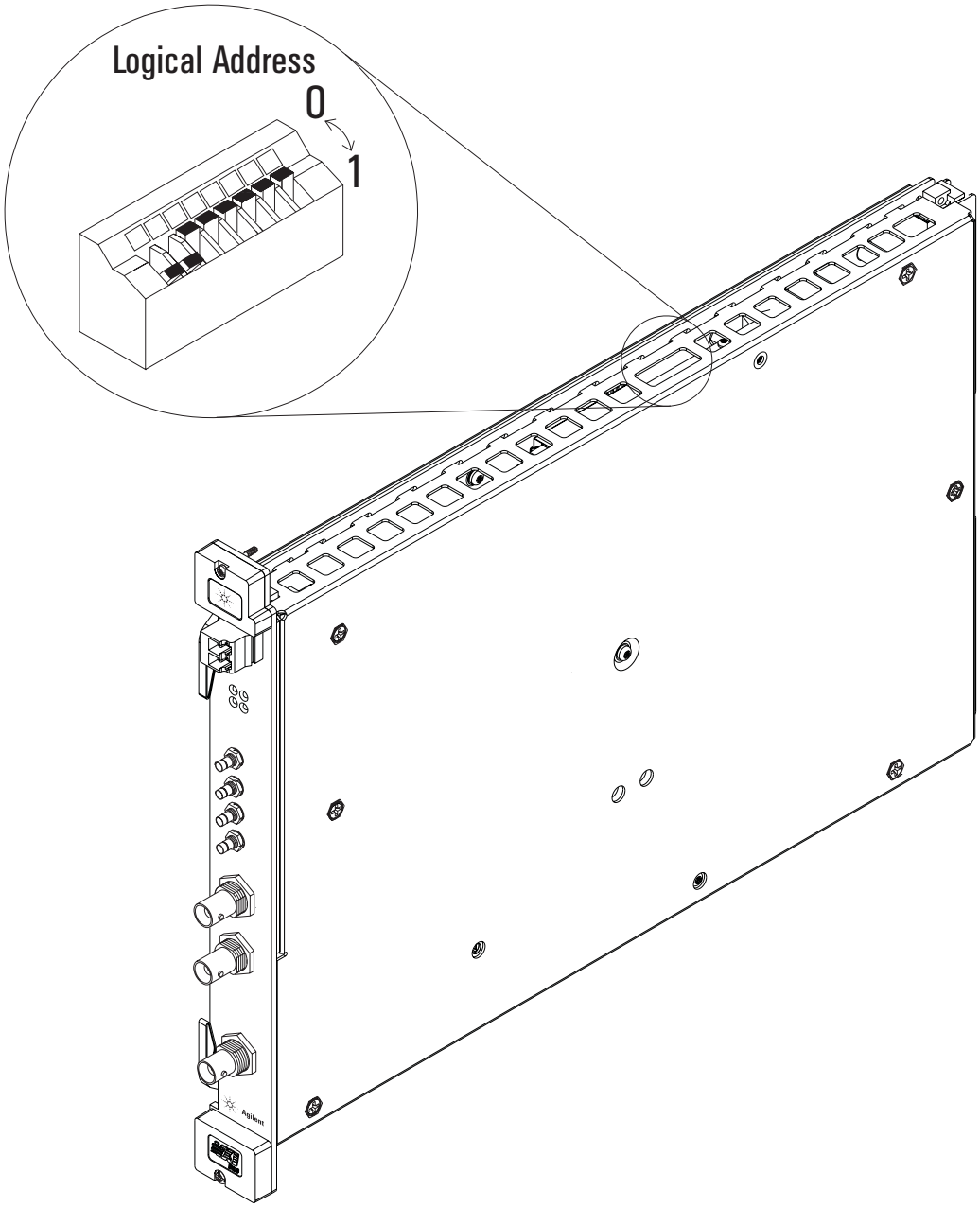
Note For optimal phase noise performance in multi-module systems it is recommended that the first channel be an Agilent E1438C or D[1]. The Agilent E1438C does not support local bus or fiber optic transfers.

Note Multi-module systems may include multiple Agilent E1438s or Agilent E1439s but not a mixture of the two types of modules.

[1]As opposed to the older A or B models.

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To install the Agilent E1438



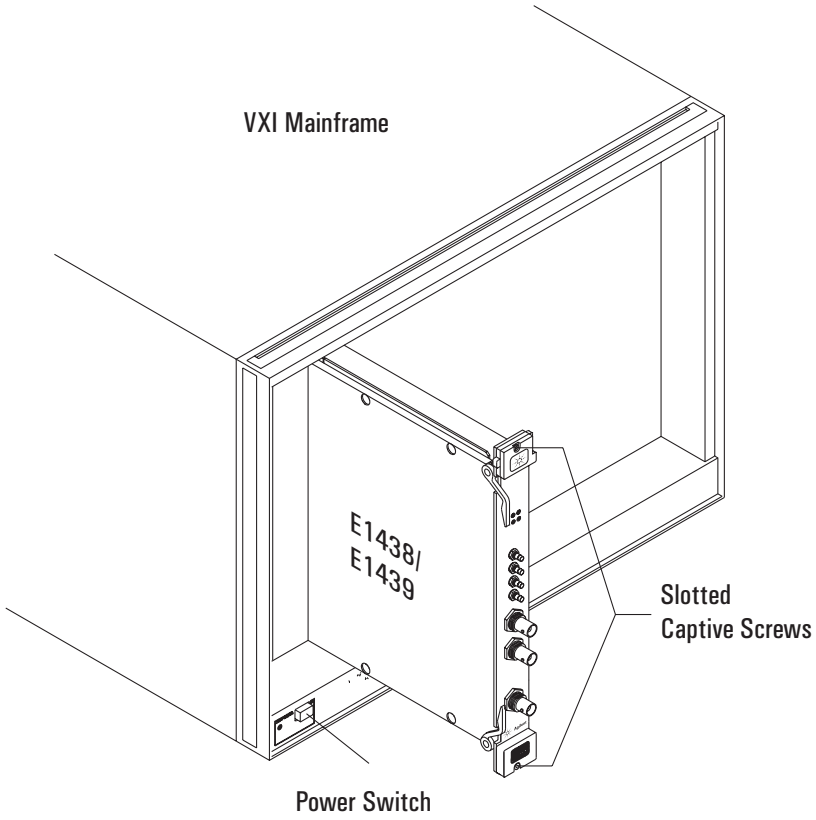
4. Set the mainframe's power switch to off (0).

Caution **Installing or removing the module with power on may damage components in the module.**

5. Place the module's card edges (top and bottom) into the module guides in the slot.
6. Slide the module into the mainframe until the module connects firmly with the backplane connectors. Make sure the module slides in straight and that the insertion/extraction levers are pressed parallel to the front panel.

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7. Attach the module's front panel to the mainframe chassis using the module's captive mounting screws.



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To clean fiber optic connectors

The Agilent E1438D has a fiber optic serial FPDP (front panel data port). Since the data transmits via light, the fiber optic connections must be clean. The following procedure describes how to clean fiber optic connectors.

Caution **Do not use any type of foam swab to clean optical fiber ends. Foam swabs can leave filmy deposits on fiber ends.**

1. **Apply pure isopropyl alcohol to a clean lint-free cotton swab or lens paper.**

   Cotton swabs can be used as long as no cotton fibers remain on the fiber end after cleaning.

2. **Clean the connector while avoiding the ends of the fiber.**
3. **Apply isopropyl alcohol to a new clean lint-free cotton swab or lens paper.**
4. **Clean the fiber end with the swab or lens paper.**

   Do not scrub during this initial cleaning because grit can be caught in the swab and become a gouging element.

5. **Immediately dry the fiber end with a clean, dry, lint-free cotton swab or lens paper.**
6. **Blow across the connector end face from a distance of 6 to 8 inches using filtered, dry, compressed air. Aim the compressed air at a shallow angle to the fiber end face.**

   Nitrogen gas or compressed dust remover can also be used.

Caution **Do not shake, tip, or invert compressed air canisters because this releases particles in the can into the air. Refer to instructions provided on the compressed air canister.**

7. **As soon as the connector is dry, connect or cover it for later use.**

Note To order multimode LC fiber optic cables, call Stratos Lightwave at (708) 867-9600 (http://www.stratoslightwave.com) or call Fiber Instrument at (800) 500-0347 (http://www.fisfiber.com).

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To store the module

Store the module in a clean, dry, and static free environment.

For other requirements, see storage and transport restriction in “Technical Specifications”.

To transport the module

- Package the module using the original factory packaging or packaging identical to the factory packaging.
- If returning the module to Agilent Technologies for service, attach a tag describing the following:
  - Type of service required
  - Return address
  - Model number
  - Full serial number

In any correspondence, refer to the module by model number and full serial number.

- Mark the container FRAGILE to ensure careful handling.
- If necessary to package the module in a container other than original packaging, observe the following (use of other packaging is not recommended):
  - Wrap the module in heavy paper or anti-static plastic.
  - Protect the front panel with cardboard.
  - Use a double-wall carton made of at least 200-pound test (32 ECT) material.
  - Cushion the module to prevent damage. For example, several layers of plastic bubble wrap is usually sufficient.

Caution

Do not use styrene pellets in any shape as packing material for the module. The pellets do not adequately cushion the module and do not prevent the module from shifting in the carton. In addition, the pellets create static electricity that can damage electronic components.

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To transport the module

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Getting Started with the Agilent E1438

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Getting Started and Introduction

This section helps you get your Agilent E1438 running and making simple measurements without programming. It shows you how to install the software libraries and how to run the Soft Front Panel program. It also introduces you to the example programs. The Host Interface Library is available as a Windows Library that communicates with the hardware using VISA (Virtual Instrument Software Architecture). VISA is the input-output standard upon which all the VXI*plug&play* software components are based..

This section assumes you have already installed the module in the VXI mainframe as shown in the previous chapter. It also assumes that you have installed a VXI interface according to the manufacturer's instructions.

Note Be sure to read the `readme` file for important up-to-date software installation information.

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System Requirements

System Requirements (Microsoft Windows)

- A Pentium-class personal computer:
- Microsoft Windows 2000, or NT.
- One of the following interfaces:
  - HP/Agilent FireWire –E8491B IEEE-1394 PC Link to VXI
  - National Instruments PCI MXI-2
  - Other VISA compliant VXI interface
- VISA (Virtual Instrument Software Architecture) library
- The computer must have a CD ROM drive for the installation media
- One of the following Web browsers:
  - Microsoft Internet Explorer 4.0 or greater
  - Netscape Navigator 4.08 or greater

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To install the Windows VXI*plug&play* drivers

This procedure assumes that you have already installed a VISA (Virtual Instrument Software Architecture) library.

Note

If you attempt to install the Windows VXIplug&play drivers without having installed a VISA library you will receive a fatal error.

1. Insert the CD labeled: “Agilent E1438 VXI 100 MSa/s ADC with filters and memory”
2. Run the program: *drive*:\windows\setup.exe
   Where *drive* represents the drive containing the setup CD.
3. The setup program asks you to confirm or change the directory path. The default directory path is recommended.
4. A dialog box asks if you want to install startup shortcuts
   This creates a program group called “AGE1438” within the *Vxipnp* directory that includes:
   - A shortcut to run the Agilent E1438 Soft Front Panel
   - A shortcut for the Agilent E1438 web-based online help file
   - A shortcut for the PDF version of the *Agilent E1438 User’s Guide*
   - A shortcut for the AGDSP web-based online help file
   - Several shortcuts for example programs
   - A shortcut for a readme file
5. A readme file may be displayed. If so, be sure to read it and follow the instructions.

Updating firmware

Future updates will be distributed on the Web. To check your current revision run the Info Utility or check Help/About in the Soft Front Panel program.

To check for new revisions access the Agilent Technologies Web page `http://www.agilent.com/` and search for "E1438".

Install the updated firmware using the firmware installation program—FirmwareInstall. This program’s default location is *drive*`:\vxipnp\`win[95|NT]`\age1438\firmware`. Start the program, then use the "Select File" button to locate the firmware image you want to install. Enter the VXI address of the instrument to be updated and click the "Update" button. The installation will take one or two minutes. This program requires VISA to be installed on the host computer.

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To use the Resource Manager

The Resource Manager is a program from your hardware interface manufacturer. It looks at the VXI mainframe to determine what modules are installed. You need to run it every time you power up. If you get the message: "VISUCCESS_DEVICE_NPRESENT" then run the Resource Manager.

Before running the Agilent E1438 software make sure that your hardware is configured correctly and that the Resource Manager runs successfully. Before using your measurement system, you must set up all of its devices, including setting their addresses and local bus locations. No two devices can have the same address. Usually addresses 0 and 1 are taken by the Resource Manager and are not available.

For more information about the Resource Manager, see the documentation with your hardware interface.

Note

Most Resource Managers will recognize the manufacturer and model number of the Agilent E1438 but if your interface requires that you enter this information manually, use the following:

```
Manufacturer number: 4095 (Hex FFF)

Model number: 622 (Hex 26E)
```

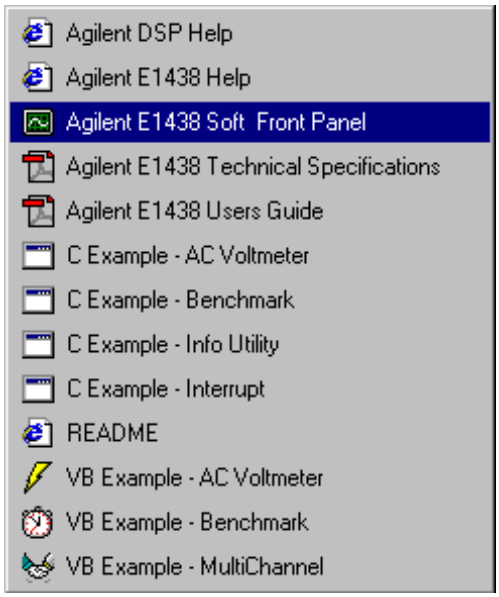

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To use the program group (Windows)

If you installed the program group using the default method during the installation procedure, you have a shortcut for a program group similar the one below. Access it through the Start button:
`Programs \ Vxipnp \ age1438`

This program group contains shortcuts that access the Soft Front Panel program, the User's Guide, online help, and example programs. The following pages provide an overview of these items.

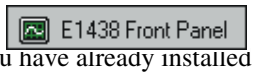
If you did not install the program group, executable files for each of the items represented by group shortcuts are available in the *drive*:\vxipnp directory and its subdirectories.



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To use the VXI*plug&play* Soft Front Panel (SFP)

In a Windows environment, the Soft Front Panel is the best place to start to explore the capabilities of the Agilent E1438. The Soft Front Panel is useful for checking your system to make sure that it is installed correctly and that all of its parts are working. You can also use it to make actual measurements, since it accesses most of the Agilent E1438's functionality.

Select the 

shortcut in your program group to start the program. This assumes you have already installed all required hardware and drivers (including VISA) and have run the configurator and Resource Manager required by your hardware interface.

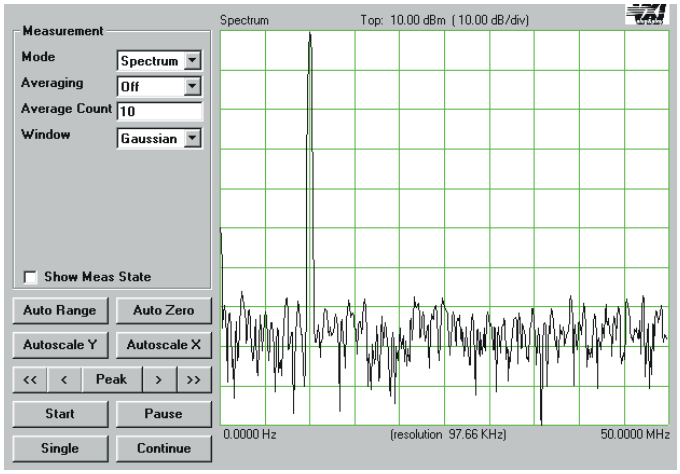
If prompted for the resource descriptor, use the default "VXI::192" unless the logical address of the Agilent E1438 has been changed from its default setting of 192. If it has been changed, type the appropriate logical address instead of 192, then press OK.

Note

You can also run the Agilent E1438 Front Panel in a simulation mode without an Agilent E1438 module, a hardware interface, or VISA libraries by typing "sim" in place of the resource descriptor.

The Agilent E1438 Front Panel Help, available from the Soft Front Panel Help menu, describes the capability of the Soft Front Panel and has links to functions that control and define many of the parameters.

The source files for this program are provided for you to use as sample code.



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To use the example programs

Several example programs are included that perform useful tasks and can serve as a basis for your own programs. When you installed your Agilent E1438 Windows libraries and drivers using the setup program or utility, you also installed executable and source code files for several useful example programs. The programs demonstrate programming the module with "C", Microsoft Visual Basic,

The executables for these examples require an Agilent E1438 and, for Windows, VXI*plug&play* support; in other words, they will not run in simulation mode like the Agilent E1438 Soft Front Panel program.

Shortcuts for the executables appear in the age1438 Windows program group if you added it during setup.

In Windows environments, executable files and source code for the Microsoft Visual Basic examples are installed in the *drive*:\vxipnp\win[95|NT]\age1438\vb directory. The "C" examples are in the ...\age1438\msc\examples directory.

The group of programs described here may be supplemented with additional programs later, which will be described in the online help or readme file.

ACVolts_32.exe

This is the simplest practical complete program using the Agilent E1438, and it functions like an AC voltmeter. It is written in Visual Basic.

acvolts.exe

This is a console version of acvolts_32.exe, written in Microsoft Visual C++.

Benchmark_32.exe

This performance benchmark program is really more of a utility than an example, although source code is provided. It allows users to measure data transfer rates and command processing times on their system without having to write new code. The utility is written in Visual Basic.

bench.exe

This is a console version of Benchmark_32.exe, written in Microsoft Visual C++.

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multchan_32.exe

This example shows how to synchronize two modules to achieve simultaneous sampling, filter decimation, and matched local oscillator phase. It is written in Visual Basic.

info.exe

This example shows how to retrieve option and revision information from an Agilent E1438, and it doubles as a handy utility. It is written as a console program in Microsoft Visual C++.

interrupt.exe

This example shows how to set up and trap a VXI interrupt to indicate an error condition in the Agilent E1438. It is written as a console program in Microsoft Visual C++.

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To use the example programs

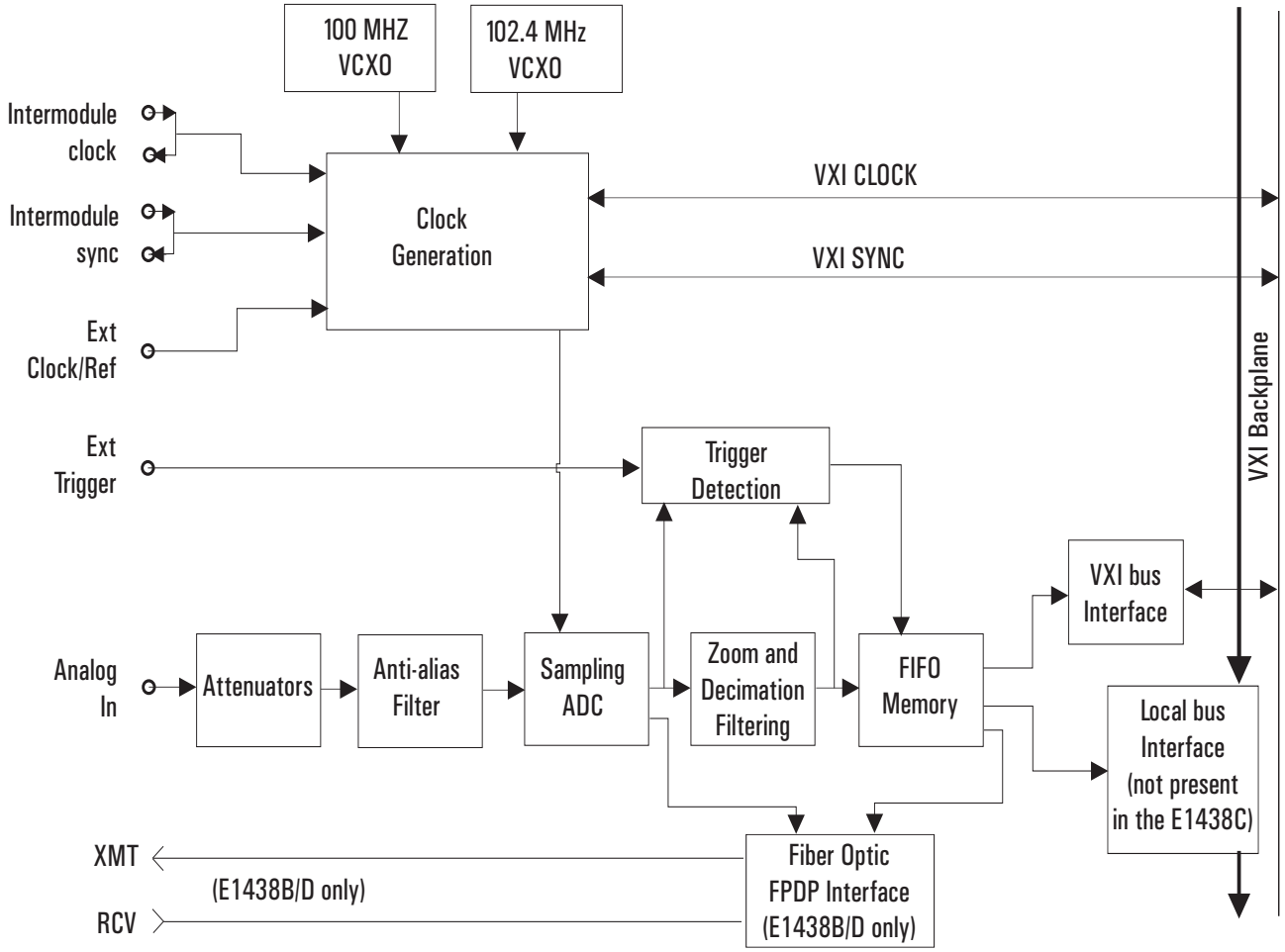
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Using the Agilent E1438

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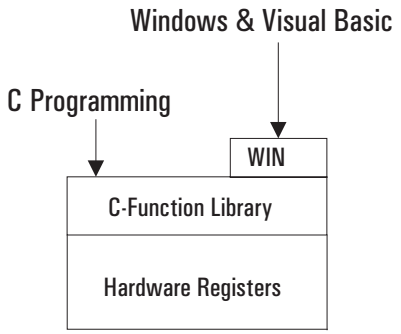
Agilent E1438 overview



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Programming the Agilent E1438

The Agilent E1438 is shipped with software and documentation to support a broad set of choices of controllers, I/O interfaces, programming languages, and operating systems. By virtue of its compliance to the VXI*plug&play* standard, the E1438 is most easily controlled in an environment conforming to one of the supported VXI*plug&play* frameworks. However, support is also supplied for other common hardware and software environments. The relationship among the various levels of programming is shown in the diagram below.



Windows framework

The primary development environment supported by the E1438 is the VXI*plug&play* WINNT framework specifications. It requires the following resources prior to the installation of the E1438:

- An embedded or a stand-alone Pentium-class PC
- Microsoft Windows 2000, or NT
- VISA interface library
- VISA compatible hardware interface
- Microsoft Visual C++ and/or Microsoft Visual Basic development system.

Additional details on the WIN framework can be found in the *VXIplug&play VPP-2 System Frameworks Specification, Revision 2.0*.

In addition to the C source code files, the E1438 includes compiled libraries, example programs, an interactive soft front panel program, online help files, and an installation program. The interactive soft front panel program allows the E1438 to be turned on, verified, and used for simple tasks without writing any user programs.

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C programming

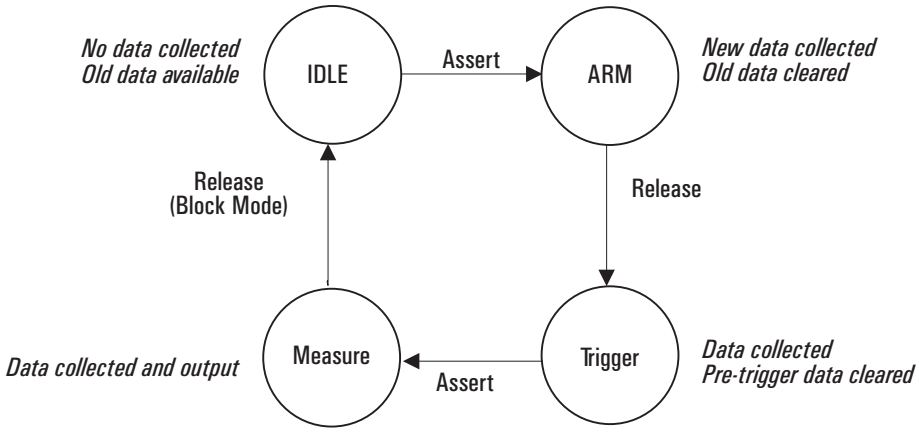
The E1438 is shipped with a source library of C-functions that can be called from user programs. This elevates the interface above the register level so the programmer does not have to be concerned with such things as register addresses and packing or splitting parameters into 16-bit register lengths. The library includes ANSI compliant source code files with all machine dependent code constrained to a single source file. By re-writing selected portions of the *machine.h* file, the programmer can create and compile an E1438 library that is compatible with virtually any development environment using the C language. The most common reason for re-writing *machine.h* is to accommodate I/O libraries other than VISA. In some cases, the library may need merely to be re-compiled to target a different processor type for the host computer.

Porting the E1438 library to a different computer environment is likely to be a fairly straight forward task. However, some of the higher level tools shipped with the E1438 may not be as easily ported. The interactive soft front panel and some example programs include human interfaces that depend on certain display and keyboard support which may be system dependent. Although source code is included for these applications, porting them to a different environment may present a greater problem than porting the library itself. The installation utilities are specifically targeted to operate on the supported development environments and may not be available in other environments.

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The measurement loop

The measurement loop progresses through four states. The transition from one state to the next is tied to the transition of the Sync signal. The effect of the Sync signal is summarized in the following diagram representing the four possible states of an Agilent E1438 module.



In the *Idle* state, the E1438 places no new data into the FIFO output buffer memory although previously measured data is retained in the buffer memory and is available for output via the VME (and also local bus, or fiber optic transmitter port on the E1438D). The module stays in the Idle state until the Sync line is asserted.

Upon entering the *Arm* state the E1438 clears old data. It remains in the Arm state until the Sync signal is released. If an E1438 is programmed with a pre-trigger delay, it collects enough data samples to satisfy this pre-trigger delay, and then releases the Sync line. If no pre-trigger delay has been programmed, the module releases the Sync line immediately. When all E1438s in a system have released the Sync line, the module moves to the Trigger state.

Upon entering the *Trigger* state, an E1438 that is programmed with a pre-trigger delay continues collecting data into the FIFO, discarding any data prior to the pre-trigger delay. An E1438 remains in the Trigger state until the Sync line is asserted. The Sync line may be asserted by a direct command or by any E1438 that encounters a trigger condition and is programmed to assert the Sync line. When the Sync signal is asserted, all modules synchronously move to the Measure state.

In the *Measure* state, the E1438 continues collecting data and sends the data saved in the FIFO memory to the selected I/O port, starting with the sample indicated by the trigger arrival, offset by the number of samples specified by the trigger delay. This data transfer continues until all data has been transferred or until the module meets the criteria for returning to the Idle state imposed by *block mode* or *continuous mode* operation constraints.

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Modules programmed for *block mode* operation assert the Sync line until a complete block of data, including any pre-programmed pre- or post-trigger delay, has been collected and is available to the I/O port. The module then releases the Sync line. The module returns to the Idle state when the block of data has been collected.

In *continuous mode,* a module releases sync immediately but moves to the Idle state only if explicitly programmed to do so or if the FIFO data buffer overflows because data cannot be read from the I/O port fast enough.

The measurement loop in multi-module systems

The following rules generally apply to transitions between states when multiple modules share a Sync signal:

- If any one module *asserts* the Sync line, a synchronous state transition occurs for all modules in a system.
- All modules in a system must have *released* the Sync line in order to bring about a synchronous transition to Trigger state.
- In block mode, each module releases the Sync line after its block of data has been collected. Immediately upon entering the Measure state in continuous mode, each module releases the Sync line. It continues to collect and output data until it is programatically signaled to stop or until the FIFO overflows. With the Sync line released it is then possible to change the center frequency for one or multiple modules without interrupting the measurement. See "Synchronizing changes in multi-module systems" on page 39.
- A module may be programmed explicitly to inhibit its transition to the Arm state despite Sync transitions.
- In addition to controlling the progression through the four module states, the Sync signal is used to synchronize the decimation counters and local oscillators of multiple E1438 modules.

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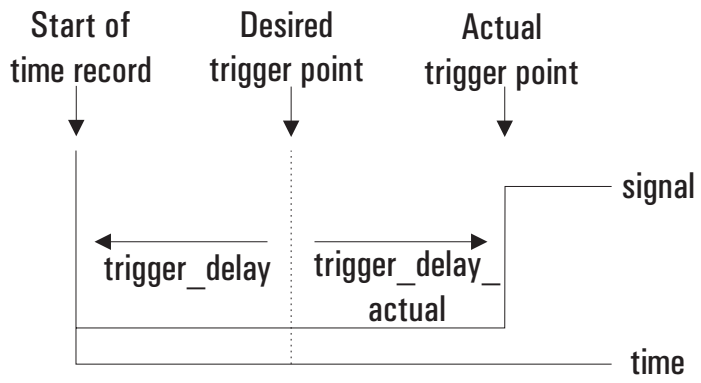
Delay and phase in triggered measurements

It is important to note that the trigger delay is specified in terms of output samples. When using the digital filters within the E1438 to reduce the sample rate, there are multiple ADC samples corresponding to each output sample. In order to determine the relationship between the first output sample of a block and the actual ADC sample where the trigger occurred, you must read the actual delay from the module using **age1438_trigger_delay_actual_get**.

This relationship varies from block to block and is a function of the particular value of counters within the digital filters at the time the trigger occurs. Thus the actual delay from the trigger event is the delay from **age1438_trigger_delay_get** multiplied by 2^{sigBw} (from **age1438_filter_bw_get** if filter decimation is used, or $2^{(sigBw-1)}$ if filter decimation is off). From this value, subtract the value returned by **age1438_trigger_delay_actual_get**. The result is in periods of the ADC sample clock. Special considerations apply in multi-module systems. See "Trigger and phase in multi-module systems" on page 40.

When doing a zoomed measurement, it may also be helpful to know the phase of the digital LO at the time the trigger occurred, since the LO is also running continuously and it has an arbitrary phase relationship with the trigger event. **age1438_trigger_phase_actual_get** returns the phase of the LO at the trigger point. The LO phase could be used in time domain averaging of blocks, or other operations involving zoomed blocks of data, so that the varying phase of the LO can be removed from the calculation.

The **trigger_delay** value is the time, measured in output samples, from the desired trigger point to the start of the time record. The **trigger_delay_actual** value is the time, measured in input samples, from the desired trigger point to the actual trigger point.



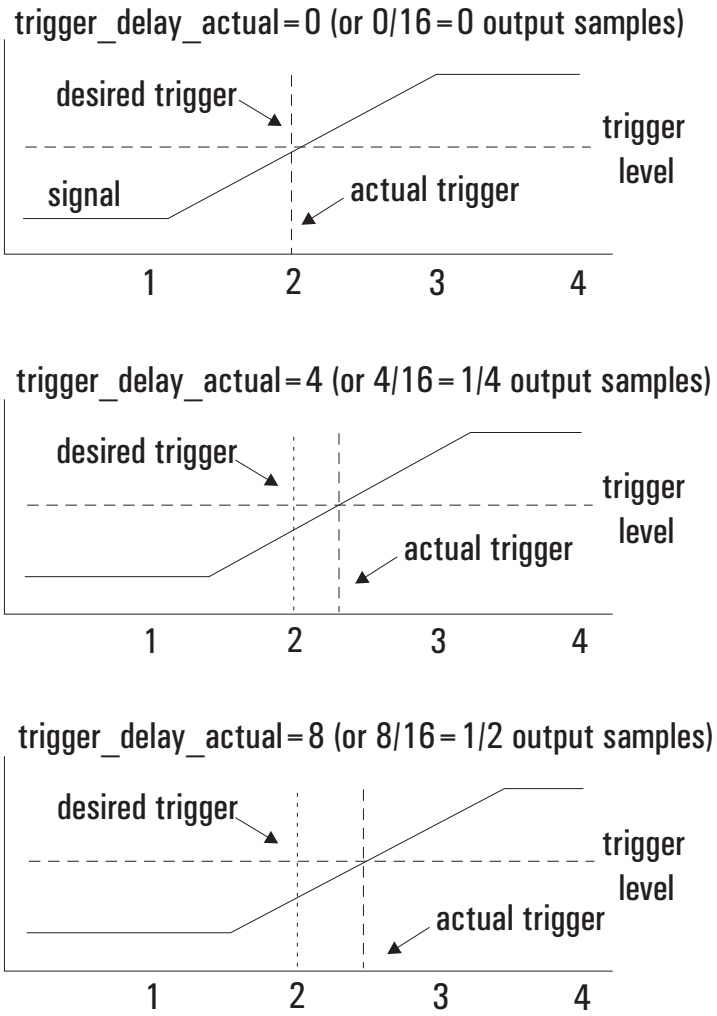
The following example illustrates how **trigger_delay** and **trigger_delay_actual** can be combined. In this example:

filter_bw=4 (2.4 MHz span)
filter_decimate = 1 (on)

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trigger_delay = -2 (a pre-trigger delay of 2)
Because the *filter_bw* is 4 with decimation on, there are 16 input samples for every output sample for a decimation rate of 2^4

.



The phase returned is the phase of the LO at the actual trigger point, not the desired trigger point. The following example illustrates how **age1438_phase_actual_get** might be used. In this example, the input signal is a sine wave at a frequency of 4 MHz. The module is set up as follows:

frequency_center = 4.5 MHz
filter_bw = 4 (2.4 MHz span)
filter_decimate = 1 (on)
trigger_type = 1 (ADC trigger)
trigger_delay = -32 (a pre-trigger delay of 32)
trigger_adclevel = 0
data_type = 1 (complex)

After the measurement is completed, call **age1438_delay_actual_get** and **age1438_phase_actual_get**. In this example, the values returned happened to be:

delay_actual = 16
phase_actual = 19697

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Due to the pretrigger delay of 32, the desired trigger point would have been at the 32nd sample of the time record. However, the **delay_actual** value of 16 indicates that the sample corresponding to the actual trigger is number $32+16/2^4$ or the 33rd sample. The measured phase of the 33rd (complex) sample, found via the atan2() function, is 159 degrees. The phase of the LO at this sample is 19697*360/65536=108 degrees. Adding these together to get the corrected phase of the input signal results in 267 degrees = -93 degrees, which is close to the expected phase of a sine wave triggered at its zero-crossing, which would be -90 degrees.

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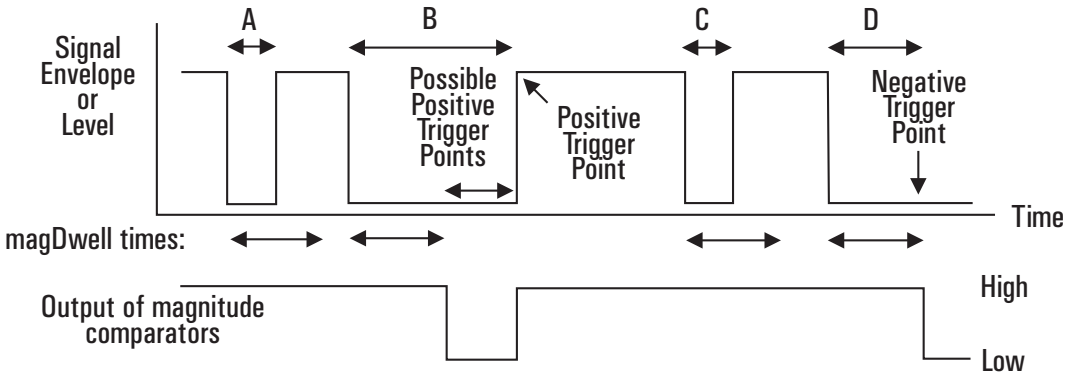
Magnitude trigger and magdwell time

The magnitude trigger operates on the magnitude of a (possibly filtered) signal. For a real signal, the magnitude is merely the absolute value of the signal. For a complex signal, the magnitude is the square root of the sum of the squares of the real and imaginary parts of the signal.

Because the magnitude trigger can operate on the filtered signal, the trigger can be more selective regarding what signals will cause a trigger than the ADC trigger. Only signals in the filter bandwidth around the center frequency will be considered when determining when a trigger occurs. Signals outside the filter's passband will be filtered out before the magnitude trigger circuit and will not cause any triggers to occur.

The magnitude trigger's behavior can be modified by the magDwell time. The magDwell time is the number of samples that a signal's magnitude must be low (i.e., below the magLevel threshold) before the magnitude trigger circuit will recognize the signal as being low. This can facilitate triggering off of a burst signal; for example, a tone burst or a TDMA burst. Due to the zero crossings within the tone burst, the ADC trigger can not reliably trigger on the leading edge of the burst. If you set the magDwell time longer than any potential drop outs within a burst and shorter than the gap between bursts, the magnitude trigger can easily catch the leading edge of a tone burst.

For a magnitude trigger with positive slope, the signal must be low for at least a magDwell number of samples. After that, the module will trigger the next time the signal goes above the magLevel threshold. For a negative slope, the module will trigger the first time that the signal is low for at least a magDwell number of samples after being high. Note that in this case, the trigger will occur a magDwell period of time after the end of the tone burst. You can use a negative trigger delay to compensate for this and to capture the end of the tone burst.



A. Time A is less than the magDwell time. The magnitude trigger does not recognize the signal as being low.

B. Time B is longer than the magDwell time. The magnitude trigger does recognize the signal as being low and a positive trigger may occur on the rising edge at the end of B.

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C. Time C is less than the magDwell time. The magnitude trigger does not recognize the signal as being low

D. Time D is longer than the magDwell time. The magnitude trigger does recognize the signal as being low and a negative trigger may occur at the end of D.

In the example shown, the signal is below the threshold at A and C, but in both of these cases, the signal is low for a time less than the magDwell time. Hence the magnitude trigger does not recognize the signal as low and these do not cause any triggers. About half way through B, the signal has remained low long enough so that the trigger recognizes the signal as low. After this, a positive trigger would occur on the next rising edge of the signal's magnitude. A negative trigger would occur at the end of D, a magDwell period of time after the falling edge.

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Frequency and filtering

The Agilent E1438's center frequency is normally set at zero (baseband measurement). However, you may set the center frequency to a non-zero value in order to examine a narrower span away from baseband (zoom measurement). The frequency band of interest, represented by digitized time data samples from the ADC, is mixed with the E1438 digital LO, a complex exponential, at the desired center frequency. As a result, the frequency band of interest in the input signal is shifted to a complex signal centered around dc. See "Synchronizing changes in multi-module systems" on page 39 for special considerations with respect to changing the center frequency in multi-module systems.

The default filter for E1438 measurements is an analog anti-alias filter. However, you may further isolate the frequency band of interest for more detailed analysis by using digital filtering. A decimating digital filter simultaneously decreases the bandwidth of the signal and decreases the sample rate. The built-in digital filters conform to the Nyquist sampling criterion, which guarantees that the output sample rate may be reduced by the same factor as the signal bandwidth reduction while still maintaining a complete representation of the underlying bandlimited signal.

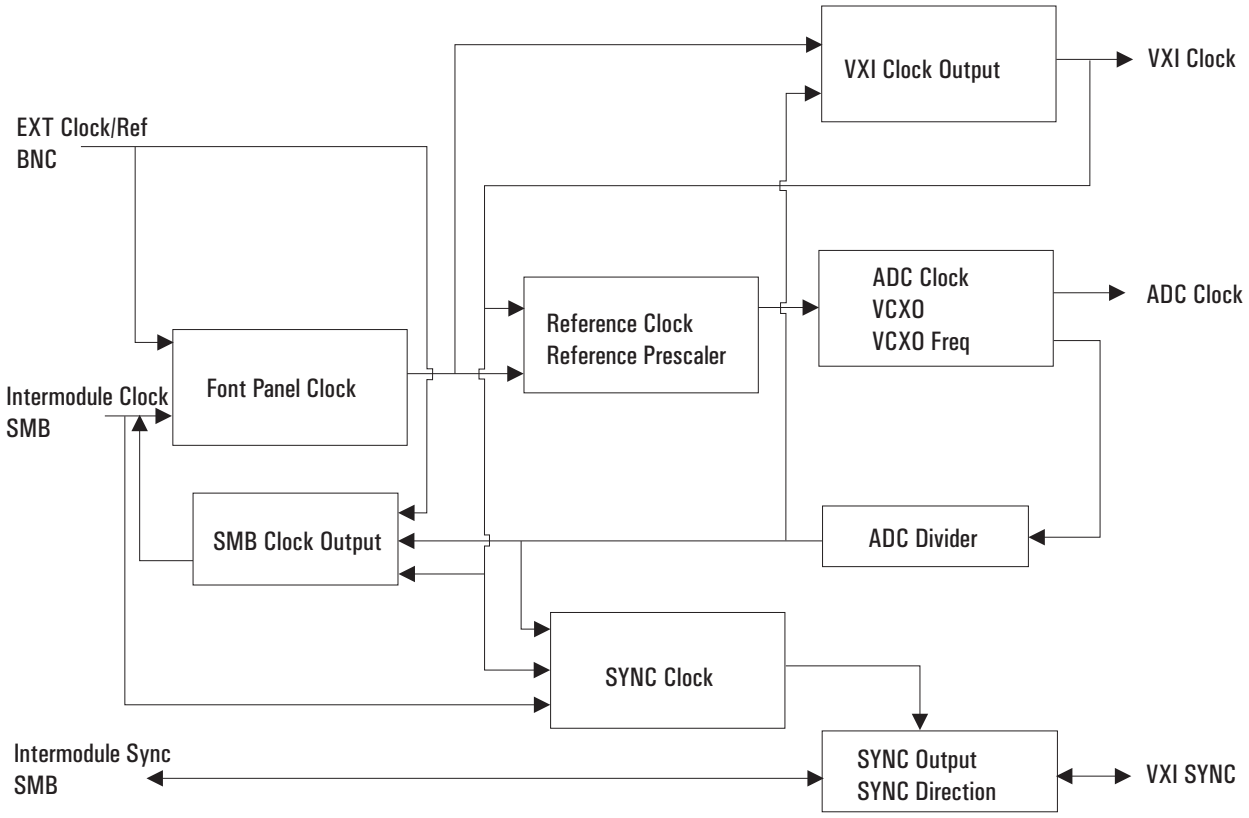
For each octave step in bandwidth reduction (except for the first octave), the E1438 digital filters automatically reduce the data rate by discarding alternate output samples. This process, called decimation, results in an output sample rate that is nominally four times the signal bandwidth whenever *sigBw*>0. This is still double the theoretical rate necessary to fully characterize the band limited signal. However, because the digital filters do not have a perfectly abrupt cutoff, the sample rate cannot be reduced to the theoretical limit without some aliasing of signals in the transition frequency band of the filters. In many applications, this limited aliasing potential is not important. For this reason you may optionally choose to apply a final factor-of-two decimation. See the Technical Specifications for detailed information on the digital filter shapes.

The decimation process used to reduce the output sample rate is driven from a "decimation counter" that keeps track of which samples to save and which ones to discard for each of the octave bandwidth reduction filter stages. In multi-module systems where synchronous sampling is required, the decimation counters in all the modules must be synchronous with each other. See "Synchronizing changes in multi-module systems" on page 39.

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Using clock and sync

The following diagram shows the flow of clock and sync signals:



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Managing multiple modules

Sharing Reference and Sync signals in multi-module systems

The Agilent E1438 supports synchronous operation among multiple E1438s by using a shared ADC clock and Sync signal to drive all the modules in a system. The shared Sync signal is used to synchronize critical operations including arming, triggering the beginning of data collection, setting a common phase of the local oscillators for zoom operation, and forcing concurrent output sample times when decimation is used. The Sync line transitions are constrained to not occur during the critical (setup and hold) regions of the external reference. The reference operates at 1/10 of the internal ADC clock, typically 10 or 10.24 MHz for a E1438 module. The reference can be either generated within the master module or an external reference can be fed into the master module through a front panel BNC.

Note For optimal phase noise performance in multi-module systems it is recommended that the first channel be an Agilent E1438C or D[1]. The Agilent E1438C does not support local bus or fiber optic transfers.

Note Multi-module systems may include multiple Agilent E1438s or Agilent E1439s but not a mixture of the two types of modules.

Clock distribution

When shared, the reference clock and sync lines are distributed among modules either on the VXI backplane using the ECL Trigger lines, or on the front panel using the SMB Clock/Ref extender connectors. When VXI backplane distribution is used with more than one VXI mainframe, the front panel Intermodule Clock and Sync connectors can be used to distribute clock and Sync lines from one mainframe to another.

Since the Sync transition timing relative to the reference input is critical, the module driving the Sync line should ideally be the same one identified as the master. However, when using backplane distribution, any E1438 in the same mainframe as the master can drive the Sync line.

When using the multi-sync mode of operation, the selection of front panel or backplane distribution of reference and Sync signals involves the following considerations:

- Backplane distribution requires the use of the ECL Trigger lines on the backplane, which are then unavailable to other modules.
- The overall time skew between the arrival of ADC clock edges is smaller when using backplane distribution, particularly if the master (or buffer) module is physically located in the center of the group of E1438 modules.
- Backplane distribution is more susceptible to pickup of jitter on the ADC clock from other digital activity on the VXI backplane. The extent of this pickup depends on the mainframe and on the other modules in the mainframe. One important step in reducing this pickup is to disable, whenever possible, the 10 MHz VXI clock generated by the slot-0 controller.

[1]As opposed to the older A or B models.

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- For backplane distribution make sure that all modules conform to VXI specification 1.4 or later with regard to their attachment to the ECL Trigger lines. See the Agilent E1438 Technical Specifications for the clock jitter (phase noise) specification degradation using backplane distribution.
- Front panel distribution requires the use of two short, equal length cables with SMB connectors between modules. In addition, unused SMB connectors on modules being used for front panel distribution must be terminated in 50 ohms.

The following diagrams show typical multi-module configurations and the clock setups that apply to each module:

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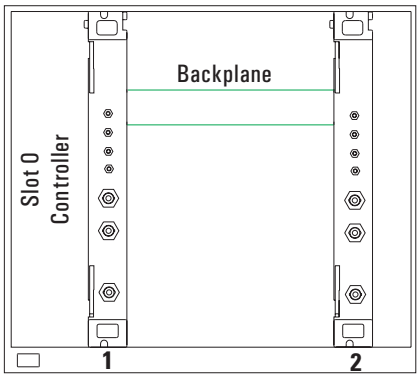
Managing multi-module systems

Note

The ⊗ symbol indicates a 50 ohm terminator, which is required on unused SMB connectors in systems using front panel distribution

Module #1 - "Rear master, internal reference" on page 82

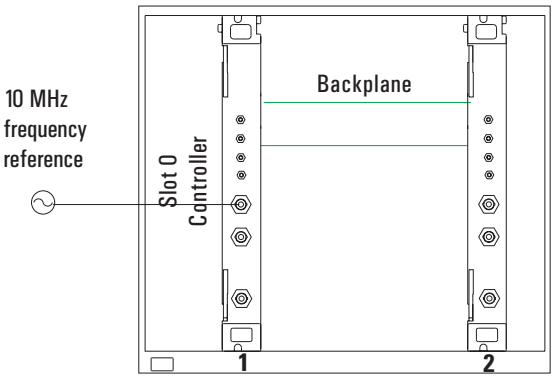
Module #2 - "Front slave, phase locked to master" on page 81



Internal clock and SYNC distribution using VXI backplane ECL trigger lines.

Module #1 - "Front master, phase locked to external reference" on page 81

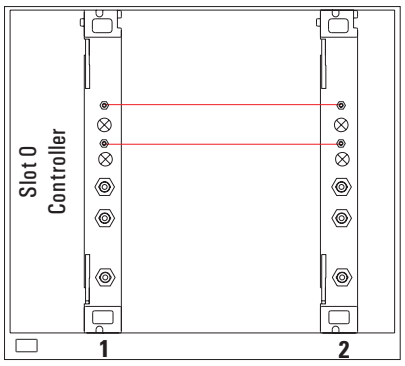
Module #2 - "Front slave, phase locked to master" on page 81



External reference and SYNC distribution using VXI backplane ECL trigger lines.

Module #1 - "Front master, internal reference" on page 80

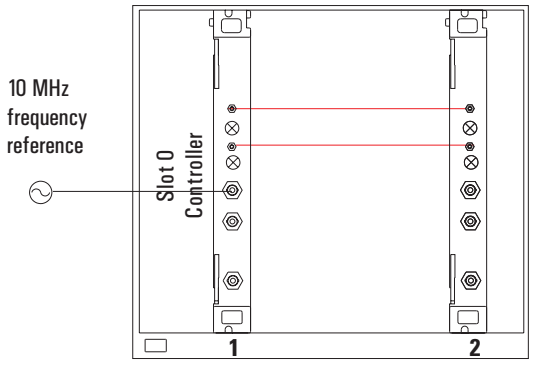
Module #2 - "Front slave, phase locked to master" on page 81



Internal clock and SYNC distribution using front panel SMB clock and SYNC extender connections.

Module #1 - "Front master, phase locked to external reference" on page 81

Module #2 - "Front slave, phase locked to master" on page 81



External reference and SYNC distribution using front panel SMB clock and SYNC extender connections.

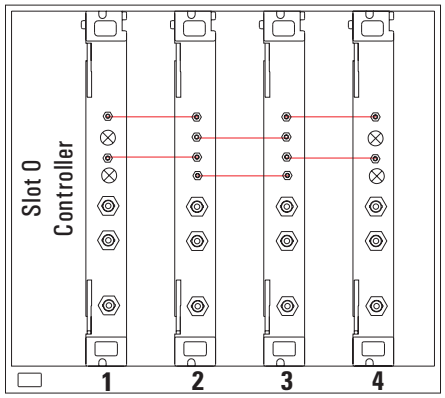
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Module #1 - "Front slave, phase locked to master" on page 81

Module #2 - "Front master, internal reference" on page 80

Module # 3 - "Front slave, phase locked to master" on page 81

Module #4 - "Front slave, phase locked to master" on page 81



Sharing clock and SYNC among several modules via front panel distribution.

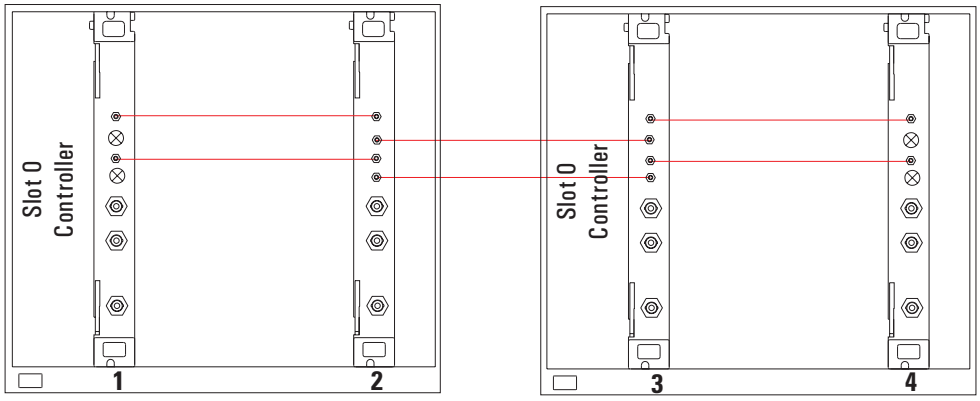
Managing multi-mainframe systems

Module #1 - "Front slave, phase locked to master" on page 81

Module #2 - "Front master, internal reference" on page 80

Module #3 - "Front slave, phase locked to master" on page 81

Module #4 - "Front slave, phase locked to master" on page 81



VXI Mainframe A VXI Mainframe B

Clock and SYNC distribution using front panel extender connections within and between mainframes.

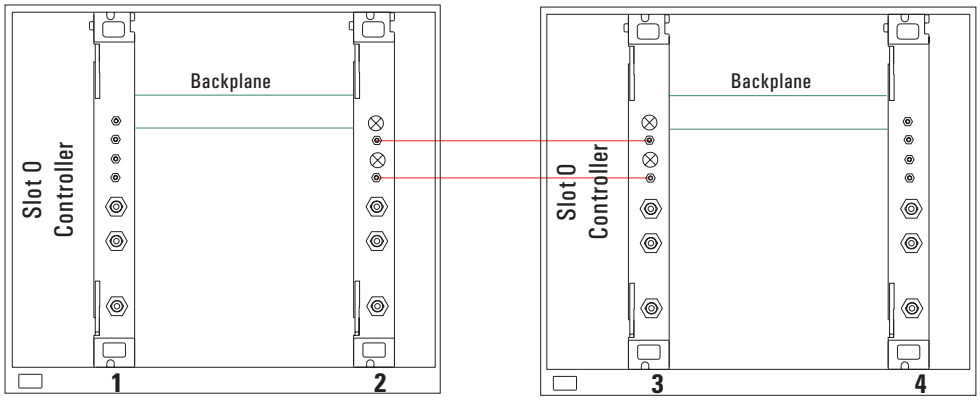
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Module #1 - "Front slave, phase locked to master" on page 81

Module #2 - "Send sync to slave" on page 84

Module # 3 - "Receive sync from master" on page 85

Module #4 - "Front slave, phase locked to master" on page 81



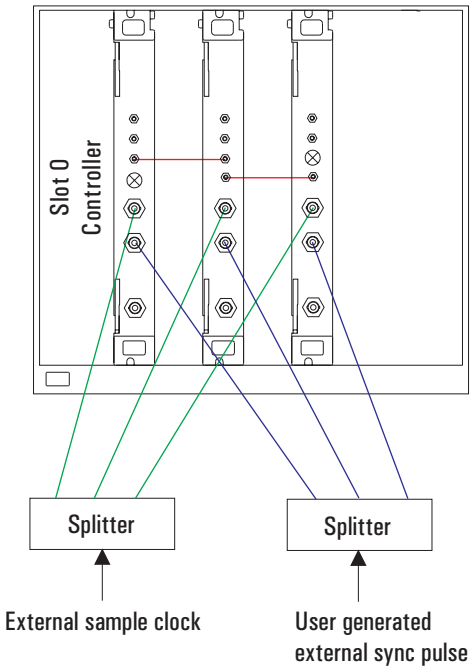
VXI Mainframe A VXI Mainframe B

Clock and SYNC distribution using front panel extender connections between mainframes and VXI backplane connections within mainframes.

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Using an external sample clock

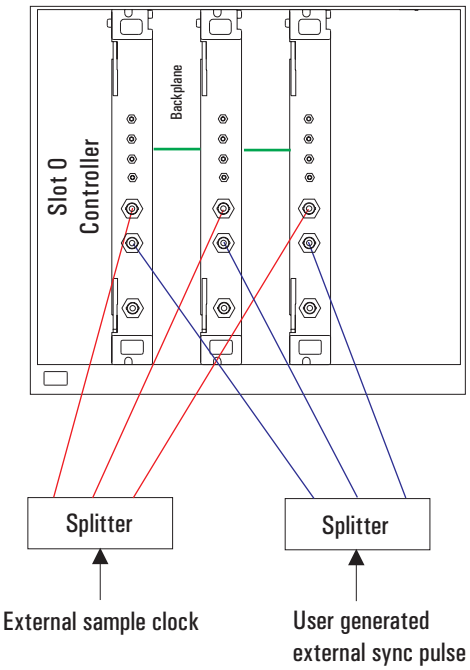
All modules "Front sync, external sample clock, wired-OR sync" on page 83



Sharing clock and SYNC among several modules using external sample. Front panel distribution.

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All modules "Rear sync, external sample clock, wired-OR sync" on page 84



Sharing clock and SYNC among several modules using external sample. Rear panel distribution.

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Synchronizing changes in multi-module systems

Multi-module systems require special treatment with respect to timing of frequency and filter changes. Center frequency changes may involve synchronizing the local oscillators of all modules in a system. Digital filter changes in multi-module systems require that the decimation counters be synchronized.

Calling the following functions voids synchronized multi-module setups:

age1438_clock_setup and related low-level clock setup functions
age1438_clock_recover
age1438_input_autozero
age1438_input_range_auto
age1438_self_test
age1438_state_recall

Special considerations apply to the measurement loop. See "The measurement loop in multi-module systems" on page 24.

Synchronous digital filter changes

In multi-module systems where synchronous sampling is required, the decimation counters in all the modules must be synchronous with each other. This condition can be forced by preparing each module in the system in advance. Any measurement in progress is terminated at this time and the module is placed in the Idle state. After each module is prepared, the next sync line transition causes the digital decimation counter to be reset and started at the same time. Once this is done, the decimation counters stay synchronized as long as the same ADC clock is used.

If you also intend to change the center frequency along with the digital filters, you should synchronize the digital filters first. Otherwise, the center frequency phase becomes unsynchronized when the digital filters are changed.

Synchronous center frequency changes

In multi-module systems you may prepare each module in advance of a frequency change, then perform the change synchronously by asserting the Sync line. This preserves the phase relationship of the local oscillators for all modules in the system. Certain special considerations apply to multi-module frequency changes:

- If all modules in a system are in the Idle state when the Sync line transition occurs, the LO frequency is updated and the next measurement is armed.
- If all modules are in the measurement state in continuous mode when the Sync line transition occurs, the LO frequency is synchronously updated, and the measurement continues.
- In continuous mode, care must be taken to assure that all modules are in the same state, either the Idle state or the Measure state, before the Sync line transition occurs, otherwise some modules re-arm while others continue the current measurement.
- In block mode, it is simplest to keep Forced Idle asserted during the Sync line transitions to keep all the modules in the Idle state.
- If you also intend to change the digital filters along with the center frequency, you should synchronize the digital filters first. Otherwise, the center frequency phase becomes non-synchronized when the digital filters are changed.

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Trigger and phase in multi-module systems

When you use triggering in multiple modules, you do not need to measure phase differences between two or more channels *if* the channels are set up *identically* in terms of digital filtering and LO frequency, *and* the digital filters and LOs are correctly synchronized. Since the filters and LOs are synced together, their actual trigger delays and LO phases are identical and will cancel out of relative phase measurements. Any remaining delay should be less than 10ns between two modules in the same mainframe.

Only the module that generates the trigger has knowledge of the delay between the trigger event and the start of data collection. Therefore, if you need the actual delay from the trigger, you should use the trigger delay correction from the module that generated the trigger. Likewise, you should obtain the LO phase at the time of the trigger from the module that generated the trigger. See “Delay and phase in triggered measurements” on page 25.

External sample synchronization in multi-module systems

There are two general instances where you might want to use an external sample clock in a system with multiple E1438s:

- You wish to have the ADC's sample at a rate other than the 100 and 102.4 MHz clocks supplied with the E1438.
- You wish more precise simultaneous sampling than can be provided by the normal scheme that uses the internal VCXOs within the modules locked together by a 10 MHz reference that is distributed from module to module. By exercising care in matching the skew of the sample clocks fed into each module, channel-to-channel group delays at low frequencies can be well below a nanosecond.

To use external sample clocks with multiple modules and still perform synced measurements, you need to use either the AGE1438_FRNT_SYNC_EXT_SAMP or AGE1438_REAR_SYNC_EXT_SAMP clock setups (see “age1438_clock_setup” on page 78). These setups use the signal that you feed into the Ext Clock/Ref BNC input of the E1438 as a sample clock for the ADC. A counter within the E1438 generates two lower frequency clocks, one for the DSP circuitry and one to clock the measurement SYNC signal between multiple modules. Since these clocks are generated independently within each module, the counters in each module must be synced together with a common externally generated signal in order to make properly synced and triggered measurements involving multiple channels. You feed this "external sample sync" signal into the External Trigger BNC and the module uses the signal to reset the counters to a known phase.

The external sample sync signal should be generated on the falling edge of the external sample clock, and fed into each module in the system by an identical length coax cable. Likewise, the sample clock should be fed into each Ext Clock/Ref BNC by an identical length coax cable from a common driver.

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Here is the sequence of operations:

1. **Put all modules into either the AGE1438_REAR_SYNC_EXT_SAMP mode or the AGE1438_FRNT_SYNC_EXT_SAMP mode with the age1438_clock_setup command.**
2. **Issue the age1438_ext_sample_sync (AGE1438_EXT_SAMPLE_SYNC_ENABLE) command to reset the counters within all the E1438s.**
3. **Generate the external sample sync pulse simultaneously into all modules. One way to do this is to use one of the VXI TTLTRG lines and reclock the signal with the falling edge of the sample clock. Note: If you are using an E1438A module with a serial number lower than US41140000, you will need some user supplied hardware to convert TTLTRG to ECL because older E1438As do not support TTL trigger.**
4. **Issue the age1438_clock_recover command to all modules since the DSP clock was interrupted between the age1438_ext_sample_sync command and the external sync signal on the Trigger input.**
5. **Sync the digital filters:**
   - Force all modules to idle (**age1438_meas_control**).
   - Send the **age1438_filter_sync** command to all modules.
   - Assert and release the sync line from the master module (**age1438_meas_control**).
   - Release all modules from idle (**age1438_meas_control**).
6. **Sync the digital local oscillators:**
   - Force all modules to idle (**age1438_meas_control**).
   - Set all module frequencies to zero (**age1438_frequency_center**).
   - Assert and release system Sync (**age1438_meas_control**).
   - Set the LO frequencies to the desired ones (**age1438_frequency_center**).
   - Toggle system Sync again to synchronously set the LO frequencies (**age1438_meas_control**).
   - Finally release all modules from idle (**age1438_meas_control**).
7. **Now you may take a measurement:**
   - Issue an **age1438_meas_start.**
   - Retrieve data from the modules when valid.

In the event that you do not supply a synchronizing signal in a reasonable length of time (or you change your mind about it), the DSP clock can be restored by issuing **age1438_ext_sample_sync** (AGE1438_EXT_SAMP_SYNC_CANCEL) followed by an **age1438_clock_recover**.

You should not need to perform the external sample sync operation again unless the external clocks are interrupted or the clock setup changed.

See also the diagrams earlier in this section that show the physical setup. All the functions mentioned above are described in "Functions listed alphabetically" in chapter 4.

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Transferring data

You can transfer data from the Agilent E1438C or D via the VMEbus. With the Agilent E1438D you can also transfer data via the Local Bus and via a fiber optic interface.

- The VMEbus is the universal data bus for VXI architecture. It provides flexibility and versatility in transferring data. Transfers over the VMEbus are 16 bits or 32 bits wide.
- The Local Bus on the Agilent E1438D supports faster transfer rates than the VMEbus. For example, if you are transferring data from the Agilent E1438D to the Agilent E9821, the Local Bus provides a direct pipeline to the Agilent E9821's DSPs.

  Using the Local Bus, you can transfer data in the background while processing data in a signal-processing module. All Local Bus data transfers originate in the Agilent E1438D and move towards a signal processing module to the right of the Agilent E1438D. If other modules generate data to the left of the input module, the Agilent E1438D passes the data to its right and inserts or appends its own data at the beginning or end of the frame.
- The fiber optic interface, available on the Agilent E1438D, provides data rates greater than 200 Mbytes/second. It can transmit filtered or unfiltered data, copy data from its receiver to its transmitter, or append data to copied data.

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Fiber Optic Interface

The E1438D provides a fiber optic interface that can transmit continuous full bandwidth data from the internal A/D converter. In addition, it can stream data from multiple synchronized modules operating at lower bandwidths onto a single fiber optic channel. An optical receiver can then simultaneously analyze data collected at different frequencies and bandwidths.

The E1438D fiber optic interface uses a serial data stream protocol providing high data throughput and low latency characteristics. This protocol is intended to be compatible with the Serial Front Panel Data Port Draft Standard (VITA 17.1, draft 0.5 dated February 26, 2001) currently under development by the VITA Standards Organization (http://www.vita.com). VITA 17.1 is not yet approved and manufacturers are not yet permitted to claim conformance to the draft standard. However, laboratory testing at Agilent Technologies has demonstrated interoperability of the E1438D with fiber optic products from other manufacturers that also intend to support the draft standard. These products include Systran Simplex Link Protocol products, such as the SL100 and SL240, and Mercury Computer products, such as the RINOJ-F RACEway I/O daughter card.

The following overview supplies the basic concepts required to use all the supported features. For details, see the descriptions of the API functions.

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Fiber Frames

Data is transmitted over the fiber interface in a series of fiber frames. Each fiber frame is composed of a series of 32-bit values, which encode to 40 bits. Each 32-bit value can either be data or an ordered set. Data and ordered sets are strung together to make the three types of fiber frames—Data Frame, BOF, and EOE. The Data Frame transmits 0 to 512 32-bit data words. The exact amount of data that is sent depends on the amount of data that is available when the fiber interface is ready to send the Data Frame. BOF (Beginning Of Frame) is a synchronizing event that can be sent just prior to the start of data transmission. EOE (End Of Epoch) is a synchronizing event that contains the last 4 data bytes in an epoch. An epoch is composed of one or more Data Frames followed by an EOE. The following shows the ordered sets and data that make up the three fiber frames:

Data Frame (Normal Data Fiber Frame)

IDLE[1]	SOF[2]	0 to 512 data words[3]	CRC[4]	FEOF[5]	SEOF[6]	GO/STOP[7]

BOF (Sync Without Data Fiber Frame)

IDLE[1]	SOF[2]	No data	CRC[4]	MEOF[8]	SEOF[6]	GO/STOP[7]

EOE (Sync with Data Fiber Frame)

SWDV[9]	SOF[2]	Last 4 data bytes in epoch[10]	CRC[4]	MEOF[8]	SEOF[6]	GO/STOP[7]

1. **Pad for Data Frame or BOF**
2. **Start Of Frame, framing event that embeds PIO1, PIO2, and DIR**
3. **32 bit or 4 Byte words, maximum 2048 Bytes**
4. **Cyclic Redundancy Check, optional**
5. **Frame End Of Frame, end of Data Frame**
6. **Status End Of Frame, embeds FIFO OV and NRDY**
7. **Flow controls**
8. **Mark End Of Frame, end of BOF and EOE**
9. **Sync With Data Valid, start of EOE**
10. **4 bytes, exactly**

Control Signals

PIO1, PIO2, DIR, and NRDY are FPDP (front panel data port) control signals. These signals can be defined by another product or you can define their meaning and application.

When an overflow condition in the transmit FIFO occurs, the E1438D asserts FIFO OV indicating a loss of data. This may occur in Append fiber mode if the available fiber bandwidth capability is exceeded.

If flow control is enabled, the E1438D responds to the STOP and GO signals. See "Generate" on page 48 for details.

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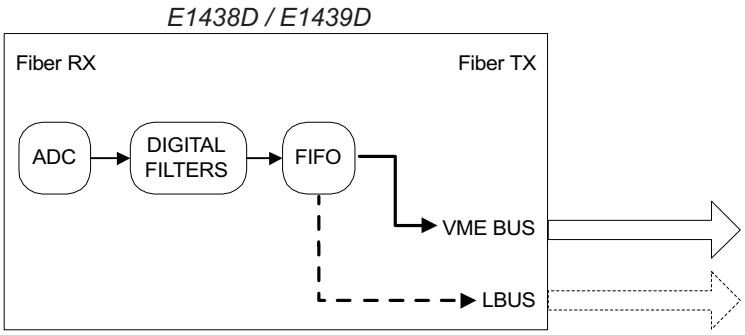
Fiber Modes

The E1438D's fiber interface can operate in five different modes:

- "Off" on page 45
- "Copy" on page 46
- "Raw" on page 47
- "Generate" on page 48
- "Append" on page 50

Off

The Off fiber mode disables the fiber transmitter but allows the fiber receiver to read control signals. Normal data collection and filtering continues, and the data port selection determines whether data is sent to the local bus (Agilent E1438D only) or read from the FIFO via the VME bus. See the following illustration.



Fiber Interface Setup

Fiber Mode	Off
Rate	setting ignored
BOF	setting ignored
CRC	setting ignored
Flow Control	setting ignored
Epoch Generate	setting ignored
Epoch Size	setting ignored

Note

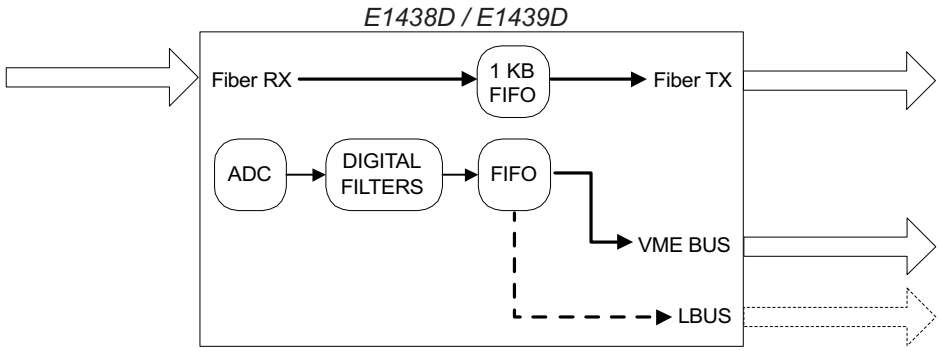
Setting the data port to Fiber while in the Off fiber mode causes the data FIFO to fill up with filtered ADC data, which then causes data collection to stop.

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Fiber Optic Interface

Copy

The Copy fiber mode copies optical data from its fiber receiver to its fiber transmitter without adding any data. Normal data collection and filtering continues, and the data port selection determines whether data is sent to the local bus (Agilent E1438D only) or read from the FIFO via the VME bus. Copy is the default fiber mode after power-on or reset. See the following illustration.



Fiber Interface Setup

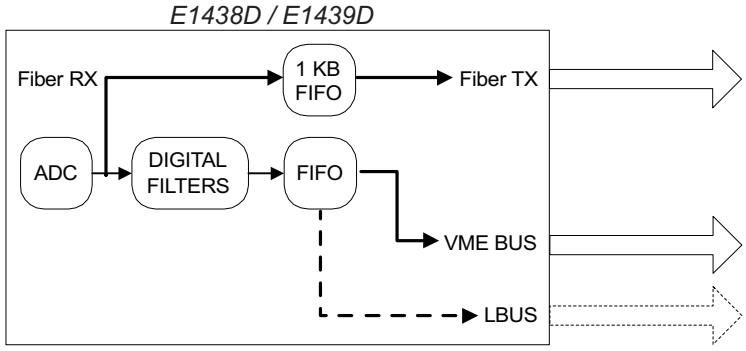
Fiber Mode	Copy
Rate	106 or 250 MBs
BOF	setting ignored
CRC	must match incoming signal
Flow Control	setting ignored
Epoch Generate	setting ignored
Epoch Size	setting ignored

Note Setting the data port to Fiber while in the Copy fiber mode results in an invalid instrument state.

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Raw

The Raw fiber mode transmits raw (i.e., unprocessed, full bandwidth) ADC data over the fiber interface. At the same time that the raw data is transmitted over the fiber interface, filtered ADC data can be sent over the local bus (Agilent E1438D only) or read from the FIFO via the VME bus. After selecting Raw, optical data transmission starts at the trigger event and is not affected by trigger delays or data delays. The raw data transmission continues even after the measurement is complete. Changing the fiber mode stops data transmission. See the following illustration.



Fiber Interface Setup

Fiber Mode	Raw
Rate	106[1] or 250 MBs
BOF	Optional
CRC	ON[2]
Flow Control	Optional
Epoch Generate	Optional
Epoch Size	Divisible by 4

1. **Only with external sample. Internal sample generates data too fast for this rate.**
2. **Some receivers may require CRC to be off for compatibility**

Note

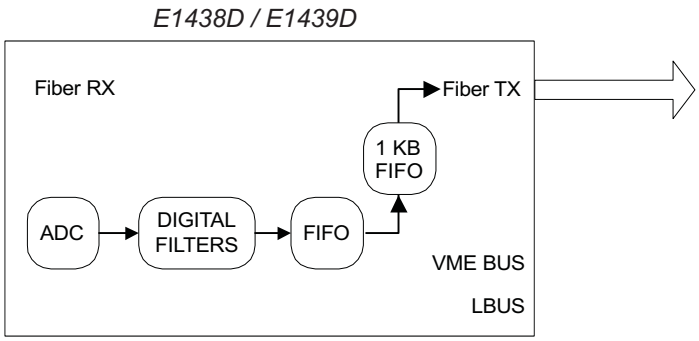
Setting the data port to Fiber while in the Raw fiber mode results in an invalid instrument state because raw and filtered data cannot both be sent over the fiber interface at the same time.

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Fiber Optic Interface

Generate

If flow control is off, Generate fiber mode transmits filtered ADC data over the fiber interface as soon as data is available. ADC data is not available via any other data port and received optical data is ignored. The following illustration shows an E1438D transmitting data when flow control is turned off.



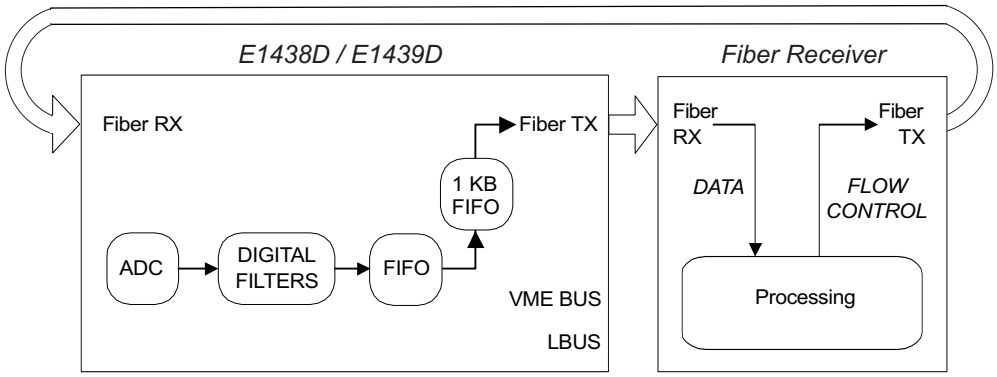
Fiber Interface Setup

Fiber Mode	Generate
Rate	106 or 250 MBs
BOF	Optional
CRC	ON[1]
Flow Control	OFF
Epoch Generate	Optional
Epoch Size	Divisible by 4

1. **Some receivers may require CRC to be off for compatibility**

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If flow control is on and the fiber receiver is capable of generating flow control signals, Generate fiber mode transmits filtered ADC data after the fiber receiver indicates that it is ready and a complete data block is ready to be transmitted. ADC data is not available via any other data port and received optical data, other than the flow control signals, is ignored. The following illustration shows an E1438D transmitting data to a fiber receiver when flow control is on.



Fiber Interface Setup

Mode	Generate
Rate	106 or 250 MBs
BOF	Optional
CRC	ON
Flow Control	No Copy
Epoch Generate	Optional
Epoch Size	Divisible by 4

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Append

The Append fiber mode copies optical data from its fiber receiver to its fiber transmitter and appends its own filtered ADC data. This mode is required in an optical fiber append chain. For the first module in an append chain, set the fiber mode to Generate, BOF to ON, and Epoch Generate to ON. The module generates data epochs in the standard fashion and a BOF is sent after each epoch. For all modules after the first, set fiber mode to Append, BOF to ON, and Epoch Generate to ON. Each module copies received data to its transmitter output until a BOF is received. The module then sends one epoch of filtered data from its ADC (if at least one block is available), followed by a BOF.

In block data mode, the data from a single trigger is transmitted. Subsequent triggers should not be generated faster than the data can be transmitted.

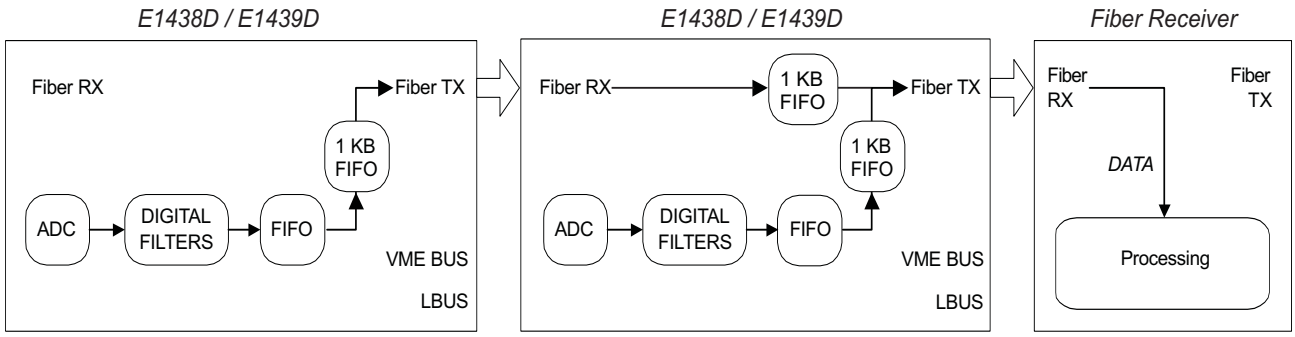
In continuous data mode, the generated data must not exceed the available fiber bandwidth, allowing the data to be merged without data loss from a FIFO overrun. Therefore, you must reduce the generated sample rate using either an external sample clock operating at a slower rate or data decimation. If you use an external sample clock operating at a slower rate, epoch size must be 1024 bytes (a larger epoch size causes a FIFO overrun resulting in a loss of data, and a smaller epoch size increases overhead reducing the available bandwidth). The available bandwidth is then about 101 MBytes/second or 238 MBytes/second. If you use data decimation, an epoch size of approximately 2048 bytes provides the maximum available bandwidth.

Note

Epoch size and block size must be equal (in bytes). Since block size is in samples, you can multiply block size by the number of bytes per sample to determine the equivalent epoch size. Conversely, you can divide the epoch size by the number of bytes per sample to determine the equivalent block size. Real 12-bit data contains 2 bytes per sample, complex 12-bit data and real 24-bit data contains 4 bytes per sample, and complex 24-bit data contains 8 bytes per sample.

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The following shows two E1438D modules in an append chain transmitting data to a fiber receiver when flow control is off.



Fiber Interface Setup

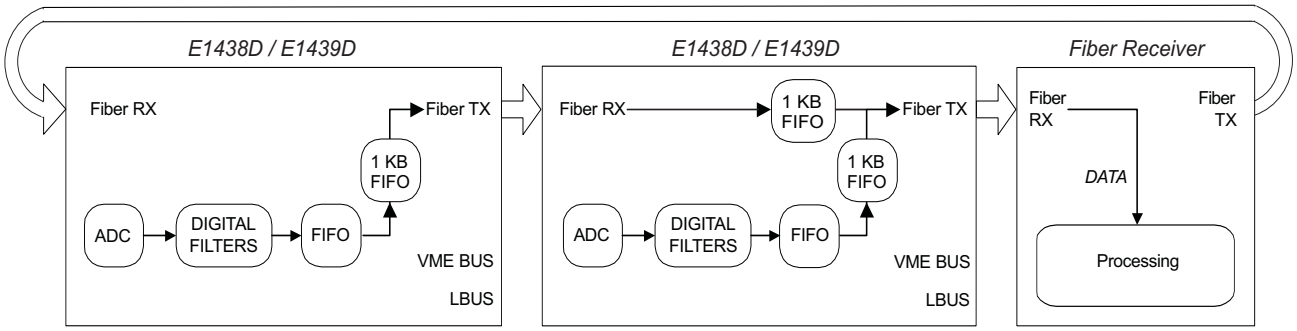
First E1438D in chain		**Next E1438D in chain**	
Mode	Generate	Mode	Append
Rate	106 or 250 MBs	Rate	same as module to left
BOF	ON	BOF	ON[1]
CRC	ON	CRC	ON
Flow Control	OFF	Flow Control	OFF
Epoch Generate	ON	Epoch Generate	ON
Epoch Size	Divisible by 4; must match blocksize	Epoch Size	Divisible by 4; must match blocksize

1. **The final module in an append chain may require BOF to be Off for compatibility with data receivers that cannot process BOFs.**

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Fiber Optic Interface

The following shows two E1438D modules in an append chain transmitting data to a fiber receiver when flow control is on.



Fiber Interface Setup

First E1438D in chain		Next E1438D in chain	
Mode	Generate	Mode	Append
Rate	106 or 250 MBs	Rate	same as module to left
BOF	ON	BOF	ON[1]
CRC	ON	CRC	ON
Flow Control	Copy	Flow Control	No Copy[2]
Epoch Generate	ON	Epoch Generate	ON
Epoch Size	Divisible by 4; must match blocksize	Epoch Size	Divisible by 4; must match blocksize

1. **The final module in an append chain may require BOF to be Off for compatibility with data receivers that cannot process BOFs.**
2. **Set intermediate modules to Copy and the last module to No Copy.**

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4

Agilent E1438 Programmer's Reference

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Introduction

The programmer's reference is presented as a set of VXI*plug&play* functions since this is the primary targeted environment. However, when you performed the setup for the Agilent E1438, drivers were installed to support various programming environments as described in "Programming the Agilent E1438" in chapter 3.

The function descriptions in the programmer's reference are valid for all environments. Be sure to follow the instructions in "Getting Started and Introduction" in chapter 2 to assure proper installation and to become familiar with the capabilities of your Agilent E1438 software in various programming environments. You should find the example programs particularly helpful for programming in various environments.

Many of the function descriptions in the programming reference include several related functions. You may use the primary function to set all related parameters or you may use the other functions within the group to set or query a single parameter.

Parameter variables are presented as alphanumeric values which are descriptive and easy to remember. However, for faster programming you may use the numeric equivalents for the parameter variables listed at the end of this section.

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Functions listed by class

Component	Capability	Subclass	Function Name
INITIALIZE & CLOSE			age1438_init (on page 132)
			age1438_close (on page 86)
MEASURE	READ	INITIATE	age1438_meas_control (on page 150)
			age1438_meas_init (on page 153)
			age1438_meas_start (on page 154)
			age1438_meas_status_get (on page 155)
			age1438_wait (on page 190)
MEASURE	READ	FETCH	age1438_read (on page 158)
			age1438_read64 (on page 158)
			age1438_read_raw (on page 161)
MEASURE	CONFIGURE		age1438_clock_fs (on page 76)
			age1438_clock_fs_get (on page 76)
			age1438_clock_recover (on page 77)
			age1438_clock_setup (on page 78)
			age1438_clock_setup_get (on page 78)
			age1438_combo_setup (on page 87)
			age1438_data_memsize_get (on page 88)
			age1438_data_scale_get (on page 89)
			age1438_data_setup (on page 90)
			age1438_ext_sample_sync (on page 104)
			age1438_ext_sample_sync_get (on page 104)
			age1438_filter_setup (on page 120)
			age1438_frequency_setup (on page 128)
			age1438_input_autozero (on page 134)
			age1438_input_range_auto (on page 137)
			age1438_input_setup (on page 141)
			age1438_input_range_convert (on page 138)6
			age1438_trigger_setup (on page 182)
MEASURE	CONFIGURE	LOW LEVEL	age1438_adc_clock (on page 72)
			age1438_adc_clock_get (on page 72)
			age1438_adc_divider (on page 73)
			age1438_adc_divider_get (on page 73)

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Component	Capability	Subclass	Function Name
			age1438_data_blocksize (on page 90)
			age1438_data_blocksize_get (on page 90)
			age1438_data_delay (on page 90)
			age1438_data_delay_get (on page 90)
			age1438_data_mode (on page 90)
			age1438_data_mode_get (on page 90)
			age1438_data_port (on page 90)
			age1438_data_port_get (on page 90)
			age1438_data_resolution (on page 90)
			age1438_data_resolution_get (on page 90)
			age1438_data_type (on page 90)
			age1438_data_type_get (on page 90)
			age1438_data_xfersize (on page 96)
			age1438_data_xfersize_get (on page 96)
			age1438_filter_bw (on page 120)
			age1438_filter_bw_get (on page 120)
			age1438_filter_decimate (on page 120)
			age1438_filter_decimate_get (on page 120)
			age1438_filter_sync (on page 123)
			age1438_frequency_center (on page 128)
			age1438_frequency_center_get (on page 128)
			age1438_frequency_center_raw (on page 125)
			age1438_frequency_center_raw_compute (on page 127)
			age1438_frequency_center_raw_get (on page 125)
			age1438_frequency_cmplxdc (on page 128)
			age1438_frequency_cmplxdc_get (on page 128)
			age1438_frequency_sync (on page 128)
			age1438_frequency_sync_get (on page 128)
			age1438_front_panel_clock_input (on page 131)
			age1438_front_panel_clock_input_get (on page 131)
			age1438_input_alias_filter (on page 141)
			age1438_input_alias_filter_get (on page 141)
			age1438_input_autozero (on page 134)
			age1438_input_coupling (on page 141)
			age1438_input_coupling_get (on page 141)
			age1438_input_offset (on page 135)
			age1438_input_offset_get (on page 135)
			age1438_input_offset_save (on page 136)
			age1438_input_range (on page 141)

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Component	Capability	Subclass	Function Name
			age1438_input_range_get (on page 141)
			age1438_input_signal (on page 141)
			age1438_input_signal_get (on page 141)
			age1438_reference_clock (on page 164)
			age1438_reference_clock_get (on page 164)
			age1438_reference_prescaler (on page 165)
			age1438_reference_prescaler_get (on page 165)
			age1438_smb_clock_output (on page 172)
			age1438_smb_clock_output_get (on page 172)
			age1438_sync_clock (on page 177)
			age1438_sync_clock_get (on page 177)
			age1438_sync_direction (on page 178)
			age1438_sync_direction_get (on page 178)
			age1438_sync_output (on page 179)
			age1438_sync_output_get (on page 179)
			age1438_trigger_adclevel (on page 182)
			age1438_trigger_adclevel_get (on page 182)
			age1438_trigger_delay (on page 182)
			age1438_trigger_delay_get (on page 182)
			age1438_trigger_delay_actual_get (on page 180)
			age1438_trigger_gen (on page 182)
			age1438_trigger_gen_get (on page 182)
			age1438_trigger_magdwell (on page 182)
			age1438_trigger_magdwell_get (on page 182)
			age1438_trigger_maglevel (on page 182)
			age1438_trigger_maglevel_get (on page 182)
			age1438_trigger_phase_actual_get (on page 181)
			age1438_trigger_slope (on page 182)
			age1438_trigger_slope_get (on page 182)
			age1438_trigger_type (on page 182)
			age1438_trigger_type_get (on page 182)
			age1438_vcxo (on page 186)
			age1438_vcxo_freq (on page 187)
			age1438_vcxo_freq_get (on page 187)
			age1438_vcxo_freq_preset (on page 188)
			age1438_vcxo_get (on page 186)
			age1438_vxi_clock_output (on page 189)
			age1438_vxi_clock_output_get (on page 189)
ROUTE	CONFIGURE		age1438_epoch_setup (on page 98)
			age1438_fiber_setup (on page 112)

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Component	Capability	Subclass	Function Name
			age1438_lbus_mode (on page 147)
			age1438_lbus_mode_get (on page 147)
			age1438_lbus_reset (on page 149)
			age1438_lbus_reset_get (on page 149)
ROUTE	CONFIGURE	LOW LEVEL	age1438_fiber_BOF (on page 112)
			age1438_fiber_BOF_get (on page 113)
			age1438_fiber_crc (on page 113)
			age1438_fiber_crc_get (on page 113)
			age1438_fiber_flow_control (on page 114)
			age1438_fiber_flow_control_get (on page 114)
			age1438_fiber_mode (on page 113)
			age1438_fiber_mode_get (on page 114)
			age1438_fiber_transfer_rate (on page 114)
			age1438_fiber_transfer_rate_get (on page 114)
			age1438_epoch_generate (on page 98)
			age1438_epoch_generate_get (on page 98)
			age1438_header (on page 99)
			age1438_epoch_header_get (on page 100)
			age1438_epoch_header_enable (on page 99)
			age1438_epoch_header_enable_get (on page 99)
			age1438_epoch_size (on page 98)
			age1438_epoch_size_get (on page 99)
ROUTE	CONTROL		age1438_fiber_clear (on page 106)
			age1438_fiber_error_clear (on page 107)
			age1438_fiber_LED_get (on page 110)
			age1438_fiber_rcv_signals_get (on page 111)
			age1438_fiber_signal_get (on page 115)
			age1438_fiber_verify (on page 116)
			age1438_fiber_xmt_BOF (on page 117)
			age1438_fiber_xmt_signals (on page 118)
			age1438_fiber_xmt_signals_get (on page 118)
UTILITY			age1438_attrib_get (on page 74)
			age1438_cal_get (on page 75)
			age1438_driver_debug_level (on page 97)
			age1438_driver_debug_level_get (on page 97)
			age1438_error_message (on page 102)
			age1438_error_query (on page 103)
			age1438_interrupt_mask_get (on page 145)
			age1438_interrupt_priority_get (on page 145)
			age1438_interrupt_restore (on page 144)

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Component	Capability	Subclass	Function Name
			age1438_interrupt_setup (on page 145)
			age1438_options_get (on page 156)
			age1438_product_id_get (on page 157)
			age1438_reset (on page 166)
			age1438_reset_hard (on page 167)
			age1438_revision_query (on page 168)
			age1438_self_test (on page 169)
			age1438_serial_number (on page 171)
			age1438_serial_number_get (on page 171)
			age1438_state_save (on page 174)
			age1438_state_recall (on page 173)
			age1438_status_get (on page 175)

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Functions listed by functional group

This section lists the programing functions in groups of related functions. A brief description of each group follows:

"Initializing and closing" on page 61: You must initialize the I/O driver and set up each module before using any other functions.

"Identification" on page 64: These functions identify the module, serial number and options.

"Analog setup" on page 61: These functions determine how the analog input section is configured.

"Data format" on page 61: An Agilent E1438 can collect either real or complex data in 12-bit or 24-bit format. It can collect data into various blocksizes or in a continuous mode. This data can be transferred either on the VXI backplane, the Local Bus or over the fiber interface.

"Digital processing" on page 62: The decimation filter provides bandpass filtering and decimation capabilities. You may also select limited frequency spans away from baseband.

"Measurement control" on page 64: These functions initiate or terminate the measurement loop.

"Timing" on page 64: The clock signals for the ADC sample clock can be set in a variety of ways. One Agilent E1438 can be enabled to drive the sample clock line on the VXI backplane or front panel to enable synchronization of multiple Agilent E1438 modules.

"Trigger" on page 65: These functions set all parameters associated with triggering the beginning of data collection.

"Synchronization (controlling multiple modules)" on page 66: These functions support synchronous operation among multiple Agilent E1438s by using shared ADC clock and Sync signals to drive all the modules in a system.

"Reading data" on page 65: The Agilent E1438 reads data from either the VME or the Local Bus data port. This data can optionally be scaled and converted to floating point.

"Interrupts" on page 64: The Agilent E1438 can be programmed to interrupt via the VXI backplane whenever certain status conditions are present.

"Debugging" on page 62: Allows you to identify program and hardware problems.

"Fiber Interface" on page 62: These functions are only available on E1438D.

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Initializing and closing

age1438_init (on page 132) –initializes the I/O driver for a module
age1438_close (on page 86) –closes the module's software connection

Analog setup

age1438_input_setup (on page 141) –sets all the analog input parameters
age1438_input_alias_filter (on page 141) –include/bypass the built-in analog anti-alias filter
age1438_input_alias_filter_get (on page 141) –gets the anti-alias filter state
age1438_input_autozero (on page 141) –nulls out the input dc offset in baseband mode
age1438_input_coupling (on page 141) –selects ac or dc input coupling
age1438_input_coupling_get (on page 141) –get the input coupling type
age1438_input_offset (on page 135) –sets the dc offset settings for the current range
age1438_input_offset_get (on page 135) –gets the dc offset settings
age1438_input_offset_save (on page 136) –saves the dc offset settings in NVRAM
age1438_input_range (on page 141) –sets the full scale input range
age1438_input_range_auto (on page 137) –performs auto-ranging
age1438_input_range_convert (on page 138) –converts input range to volts
age1438_input_range_get (on page 141) –gets the input range
age1438_input_signal (on page 141) –connect/disconnect the input signal to the input amplifier
age1438_input_signal_get (on page 141) –gets the input buffer amplifier state
age1438_state_save (on page 174) –saves the current module state
age1438_state_recall (on page 173) –recalls a previous module state

Data format

age1438_data_setup (on page 90) –sets all format and data output flow parameters
age1438_data_blocksize (on page 90) –determines the size of the output data block
age1438_data_blocksize_get (on page 90) –gets the output data block size
age1438_data_delay (on page 90) –determines FIFO delay in continuous mode
age1438_data_delay_get (on page 90) –gets FIFO delay
age1438_data_memsize_get (on page 88) –returns module's memory size
age1438_data_mode (on page 90) –selects block mode or continuous mode
age1438_data_mode_get (on page 90) –gets the data mode
age1438_data_port (on page 90) –selects VME bus, local bus or fiber interface for output transmission
age1438_data_port_get (on page 90) –gets the output port designation
age1438_data_resolution (on page 90) –selects 12 or 24 bits data resolution
age1438_data_resolution_get (on page 90) –gets the data resolution
age1438_data_scale_get (on page 89) –gets the data scale factor used to convert raw data to volts
age1438_data_type (on page 90) –selects real or complex output data
age1438_data_type_get (on page 90) –gets output data type
age1438_data_xfersize (on page 96) –allows a specified amount of data to be read before an entire block has been acquired.
age1438_data_xfersize_get (on page 96) –gets the data transfer size
age1438_lbus_mode (on page 147) –sets the transmission mode of the local bus
age1438_lbus_mode_get (on page 147) –gets the local bus transmission mode
age1438_lbus_reset (on page 149) –resets the local bus
age1438_lbus_reset_get (on page 149) –gets the local bus reset state

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Debugging

age1438_cal_get (on page 75) –gets last calibration date of specified board
age1438_clock_recover (on page 77) –allows recovery from an out-of-spec external sample clock
age1438_driver_debug_level (on page 97) –sets the debug level
age1438_driver_debug_level_get (on page 97) –gets the debug level
age1438_error_message (on page 102) –returns error information obtained from function calls
age1438_error_query (on page 103) –queries the module for the most recent error
age1438_status_get (on page 175) –retrieves the module's status register information
age1438_meas_status_get (on page 155) - retrieves the current measurement status register information
age1438_self_test (on page 169) –performs a self-test on the module and returns the result

Digital processing

age1438_combo_setup (on page 87) –a quick way to set blocksize, center frequency, and signal bandwidth with one function
age1438_filter_setup (on page 120) –sets the digital filter bandwidth and decimation filter parameters
age1438_filter_bw (on page 120) –selects a signal filter bandwidth
age1438_filter_bw_get (on page 120) –gets the signal filter bandwidth
age1438_filter_decimate (on page 120) –enables/disables an extra factor of 2 decimation
age1438_filter_decimate_get (on page 120) –gets current state of extra decimation
age1438_filter_sync (on page 123) –synchronizes the decimation filter counter
age1438_frequency_setup (on page 128) –sets all zoom center frequency parameters
age1438_frequency_center (on page 128) –sets the center frequency
age1438_frequency_center_get (on page 128) –gets the current center frequency
age1438_frequency_center_raw (on page 125) –quickly sets the center frequency
age1438_frequency_center_raw_compute (on page 127) –quickly calculates the values for **age1438_frequency_center_raw**
age1438_frequency_center_raw_get (on page 125) –gets the raw center frequency
age1438_frequency_cmplxdc (on page 128) –selects a complex baseband measurement
age1438_frequency_cmplxdc_get (on page 128) –gets the state of the baseband measurement mode
age1438_frequency_sync (on page 128) –prepares the module for a synchronous frequency change
age1438_frequency_sync_get (on page 128) –gets the state of the synchronous change mode

Fiber Interface

age1438_fiber_BOF (on page 112) –controls whether or not automatically generated BOF events are transmitted
age1438_fiber_BOF_get (on page 112) –returns the current value of *bofEnable*
age1438_fiber_clear (on page 106) –clears all data from the fiber interface FIFO buffers
age1438_fiber_crc (on page 112) sets up the fiber interface to transmit and receive cyclic redundancy checks.
age1438_fiber_crc_get (on page 112) –returns the current status of the cyclic redundancy check setting.
age1438_fiber_error_clear (on page 107)–clears fiber errors from the status register
age1438_fiber_error_get (on page 108) –returns the value of the fiber interface error reg-

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ister.

age1438_fiber_flow_control (on page 112) –configures fiber flow control, enabling or disabling transmitter flow control signals.

age1438_fiber_flow_control_get (on page 112) –returns the current status of the fiber flow control function.

age1438_fiber_LED_get (on page 110) –returns a data register indicating the state of the front panel XMT/RCV led's.

age1438_fiber_mode (on page 112) –selects the fiber interface mode.

age1438_fiber_mode_get (on page 112) –gets the current mode of the fiber interface.

age1438_fiber_rcv_signals_get (on page 111) –displays the current value of PIO1, PIO2, DIR and NRDY bits from the fiber receiver.

age1438_fiber_setup (on page 112) –sets the parameters associated with the fiber interface.

age1438_fiber_signal_get (on page 115) –returns a value indicating whether or not an optical signal is detected by the optical fiber interface receiver.

age1438_fiber_transfer_rate (on page 112) –selects the transfer rate for fiber optic data.

age1438_fiber_transfer_rate_get (on page 112) –gets the current selection of transfer rate for fiber optic data.

age1438_fiber_verify (on page 116) –proforms a verification of the fiber interface using either an internal of external signal path.

age1438_fiber_xmt_BOF (on page 117) –sends a BOF event used for synchronization with other fiber interfaces before data acquisition begins.

age1438_fiber_xmt_signals (on page 118) –sets the transmitted values of any PIO1, PIO2, DIR or, NRDY FPDP control signals on the fiber transmitter

age1438_fiber_xmt_signals_get (on page 118) –displays the current value of PIO1, PIO2, DIR and NRDY bits from the fiber transmitter.

age1438_epoch_generate (on page 98) –controls whether or not data epochs are generated.

age1438_epoch_generate_get (on page 98) –gets the current value of *epochGenerate*

age1438_epoch_header (on page 98) –sets the value of the first 32 bits of the epoch header. It can be used by the optical receiver to direct where to route and/or how to process associated epoch data.

age1438_epoch_header_get (on page 98) –returns the header value and the value of the increment count for the epoch header.

age1438_epoch_header_enable (on page 98) –controls whether or not epoch headers are generated

age1438_epoch_header_enable_get (on page 98) –returns the current value of header enable.

age1438_epoch_setup (on page 98) –sets the parameters relevant to the transmission of data epochs on the fiber interface.

age1438_epoch_size (on page 98) –sets the size of data epochs in bytes.

age1438_epoch_size_get (on page 98) –returns the current size of data epochs on the fiber interface

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Identification

age1438_product_id_get (on page 157) –returns the module's product identification string
age1438_options_get (on page 156) –returns the module's options
age1438_serial_number (on page 156) –sets the module's serial number for product repair purposes
age1438_serial_number_get (on page 156) –returns the module's serial number
age1438_revision_query (on page 168) –returns strings that identify the date of the module's firmware revision

Interrupts

age1438_attrib_get (on page 74) –gets low-level attributes of current I/O library session
age1438_interrupt_setup (on page 145) –sets all interrupt parameters
age1438_interrupt_mask_get (on page 145) –gets the interrupt event mask
age1438_interrupt_priority_get (on page 145) –gets the VME interrupt line
age1438_interrupt_restore (on page 144) –restores the interrupt masks to the most recent setting

Measurement control

age1438_meas_control (on page 150) –initiates and controls measurements in multi-module systems
age1438_meas_init (on page 153) –initiates a measurement without first checking for valid hardware setup
age1438_meas_start (on page 154) –checks for valid hardware setup and then initiates a measurement
age1438_reset (on page 166) –places the module in a known state
age1438_reset_hard (on page 167) –resets the module hardware

Timing

age1438_clock_setup (on page 78) –sets all timing parameters for commonly used measurement setups
age1438_clock_setup_get (on page 78) –gets the current clock setup
age1438_clock_fs (on page 76) –provides the frequency of an external sample clock
age1438_clock_fs_get (on page 76) –gets the current external sample clock frequency
age1438_adc_clock (on page 72) –specifies the ADC clock source
age1438_adc_clock_get (on page 72) –gets the ADC clock source
age1438_adc_divider (on page 73) –determines which divider is applied to the ADC clock source
age1438_adc_divider_get (on page 73)–gets the module's current clock divider state
age1438_ext_sample_sync (on page 104) –enables and disables external sample sync
age1438_ext_sample_sync_get (on page 104) –gets the state of external sample sync
age1438_front_panel_clock_input (on page 131) –specifies the source for the front panel clock
age1438_front_panel_clock_input_get (on page 131) –gets the front panel clock source
age1438_reference_clock (on page 164) –selects the source of the reference clock
age1438_reference_clock_get (on page 164) –gets the source of the reference clock
age1438_reference_prescaler (on page 165) –selects prescaling of the reference clock
age1438_reference_prescaler_get (on page 165) –gets prescaling of the reference clock
age1438_smb_clock_output (on page 172) –specifies which clock to output from the SMB

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clock connectors
age1438_smb_clock_output_get (on page 172) –gets which clock to output from the SMB clock connectors
age1438_sync_clock (on page 177) –selects the source of the sync signal
age1438_sync_clock_get (on page 177) –gets the source of the sync signal
age1438_sync_direction (on page 178) –selects front or rear panel availability of the sync signal
age1438_sync_direction_get (on page 178) –gets the state of front or rear panel clock availability
age1438_sync_output (on page 179) –selects the output for the sync signal
age1438_sync_output_get (on page 179) –gets the output for the sync signal
age1438_vcxo (on page 186) –selects whether the module should use an internal clock source
age1438_vcxo_get (on page 186) –gets whether the internal clock source is on or off
age1438_vcxo_freq (on page 187) –selects which internal clock the module uses
age1438_vcxo_freq_get (on page 187) –gets which internal clock the module uses
age1438_vcxo_freq_preset (on page 188) –selects which internal clock source should be used as a default
age1438_vxi_clock_output (on page 189) –selects which clock drives the VXI clock
age1438_vxi_clock_output_get (on page 189) –gets which clock drives the VXI clock

Trigger

age1438_trigger_setup (on page 182) –sets all parameters associated with triggering the beginning of data collection
age1438_trigger_adclevel (on page 182) –specifies the threshold for the ADC trigger
age1438_trigger_adclevel_get (on page 182) –gets the trigger threshold
age1438_trigger_delay (on page 182) –specifies a pre- or post-trigger delay time
age1438_trigger_delay_get (on page 182) –gets the trigger delay time
age1438_trigger_delay_actual_get (on page 180) –gets the actual delay time from the most recent trigger event
age1438_trigger_gen (on page 182) –determines whether a module can generate a trigger
age1438_trigger_gen_get (on page 182) –gets the trigger generation status
age1438_trigger_magdwell **(on page 182)** –specifies the dwell time (in samples) before a magnitude trigger.
age1438_trigger_magdwell_get **(on page 182)** –gets the magnitude trigger dwell time.
age1438_trigger_maglevel (on page 182) –specifies the threshold for a magnitude trigger
age1438_trigger_maglevel_get (on page 182) –gets magnitude trigger threshold
age1438_trigger_phase_actual_get (on page 181) –returns a representation of the phase value of the LO at the most recent trigger point
age1438_trigger_slope (on page 182) –selects a positive or negative trigger
age1438_trigger_slope_get (on page 182) –gets trigger slope
age1438_trigger_type (on page 182) –specifies the trigger type
age1438_trigger_type_get (on page 182) –gets trigger type

Reading data

age1438_data_scale_get (on page 89) –gets data scale factor
age1438_read (on page 158) –reads scaled 32-bit float data from FIFO
age1438_read64 (on page 158) –reads scaled 64-bit float data from FIFO, specifically for VEE applications
age1438_read_raw (on page 161) –reads raw data from FIFO

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Synchronization (controlling multiple modules)

age1438_clock_setup (on page 78) –supplies commonly used clock and sync configurations
See "Timing" on page 64 for low level clock and sync setup commands
age1438_clock_setup_get (on page 78) –gets the current clock and sync setup
age1438_clock_fs (on page 76) –provides a clock frequency for external sample clock configurations
age1438_clock_fs_get (on page 76) –gets the external clock frequency
age1438_filter_sync (on page 123) –synchronizes the decimation filter counter
age1438_frequency_sync and age1438_frequency_center (on page 128) –prepare the modules for frequency change
age1438_meas_control (on page 150) –synchronizes arming and triggering in multi-module systems
age1438_trigger_gen (on page 182) –determines whether a module can generate a trigger
age1438_trigger_gen_get (on page 182) –gets the trigger generation status
age1438_wait (on page 190) –facilitates the synchronization and control of multi-module systems

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Functions listed alphabetically

age1438_adc_clock (on page 72) –determines the ADC clock source
age1438_adc_clock_get (on page 72) –gets the ADC clock source
age1438_adc_divider (on page 73) –determines which divider is applied to the ADC clock source
age1438_adc_divider_get (on page 73)–gets the module's current clock divider state
age1438_attrib_get (on page 74) –gets low-level attributes of current I/O library session.
age1438_cal_get (on page 75) –gets last calibration date of specified board
age1438_clock_fs (on page 76) –provides the module with the frequency of an external sample clock
age1438_clock_fs_get (on page 76) –gets the current external sample clock frequency
age1438_clock_recover (on page 77) –allows recovery from an out-of-spec external sample clock
age1438_clock_setup (on page 78) –sets all timing parameters for commonly used measurement setups
age1438_clock_setup_get (on page 78) –gets the current clock setup
age1438_close (on page 86) –closes the module's software connection
age1438_combo_setup (on page 87) –a quick way to set blocksize, center frequency, and signal bandwidth with one function
age1438_data_blocksize (on page 90) –determines the size of the output data block
age1438_data_blocksize_get (on page 90) –gets the output data block size
age1438_data_delay (on page 90) –determines FIFO delay in continuous mode
age1438_data_delay_get (on page 90) –gets FIFO delay in continuous mode
age1438_data_memsize_get (on page 88) –returns module's memory size in megabytes
age1438_data_mode (on page 90) –selects block mode or continuous mode
age1438_data_mode_get (on page 90) –gets the data mode
age1438_data_port (on page 90) –selects VME bus, local bus or fiber interface for output port transmission
age1438_data_port_get (on page 90) –gets the output port designation
age1438_data_resolution (on page 90) –selects 12 or 24 bits data resolution
age1438_data_resolution_get (on page 90) –gets the data resolution
age1438_data_scale_get (on page 89) –gets data scale factor used to convert raw data to volts
age1438_data_setup (on page 90) –sets all format and data output flow parameters
age1438_data_type (on page 90) –selects real or complex output data
age1438_data_type_get (on page 90) –gets output data type
age1438_data_xfersize (on page 96) –allows a specified amount of data to be read before an entire block has been acquired
age1438_data_xfersize_get (on page 96) –gets the data transfer size
age1438_driver_debug_level (on page 97) –sets the debug level
age1438_driver_debug_level_get (on page 97) –gets the debug level
age1438_epoch_generate (on page 98) –controls whether or not data epochs are generated.
age1438_epoch_generate_get (on page 98) –gets the current value of *epochGenerate*

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age1438_epoch_header (on page 98) –sets the value of the first 32 bits of the epoch header. It can be used by the optical receiver to direct where to route and/or how to process associated epoch data.
age1438_epoch_header_get (on page 98) –returns the header value and the value of the increment count for the epoch header.
age1438_epoch_header_enable (on page 98) –controls whether or not epoch headers are generated
age1438_epoch_header_enable_get (on page 98) –returns the current value of header enable.
age1438_epoch_setup (on page 98) –sets the parameters relevant to the transmission of data epochs on the fiber interface.
age1438_epoch_size (on page 98) –sets the size of data epochs in bytes.
age1438_epoch_size_get (on page 98) –returns the current size of data epochs.
age1438_error_message (on page 102) –returns error information obtained from function calls.
age1438_error_query (on page 103) –queries the module for the most recent error.
age1438_ext_sample_sync (on page 104) –enables and disables sync to an external sample clock
age1438_ext_sample_sync_get (on page 104) –gets the state of external sample sync
age1438_fiber_BOF (on page 112) –controls whether or not automatically generated BOF events are transmitted
age1438_fiber_BOF_get (on page 112) –returns the current value of *bofEnable*
age1438_fiber_clear (on page 106) –clears all data from the fiber interface FIFO buffers
age1438_fiber_crc (on page 112) sets up the fiber interface to transmit and receive cyclic redundancy checks.
age1438_fiber_crc_get (on page 112) –returns the current status of the cyclic redundancy check setting.
age1438_fiber_error_clear (on page 107) –clears fiber errors from the status register
age1438_fiber_error_get (on page 108) –returns the value of the fiber interface error register.
age1438_fiber_flow_control (on page 112) –configures fiber flow control, enabling or disabling transmitter flow control signals.
age1438_fiber_LED_get (on page 110) –returns a data register indicating the state of the front panel XMT/RCV led's.
age1438_fiber_mode (on page 112) –selects the fiber interface mode.
age1438_fiber_mode_get (on page 112) –gets the current mode of the fiber interface.
age1438_fiber_rcv_signal_get (on page 111) –displays the current value of PIO1, PIO2, DIR and NRDY bits on the fiber receiver.
age1438_fiber_signal_get (on page 115) –returns a value indicating whether or not an optical signal is detected by the optical fiber interface receiver.
age1438_fiber_setup (on page 112) –sets the parameters associated with the fiber interface.
age1438_fiber_transfer_rate (on page 112) –selects the transfer rate for fiber optic data.
age1438_fiber_transfer_rate_get (on page 112) –gets the current selection of transfer rate for fiber optic data.
age1438_fiber_verify (on page 116) –preforms a verification of the fiber interface using either an internal of external signal path.
age1438_fiber_xmt_BOF (on page 117) –sends a BOF event used for synchronization with other fiber interfaces before data acquisition begins.
age1438_fiber_xmt_signals (on page 118) –sets the transmitted values of any PIO1, PIO2, DIR or, NRDY FPDP control signals on the fiber transmitter.
age1438_fiber_xmt_signals_get (on page 118) –displays the current value of PIO1,

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PIO2, DIR and NRDY bits on the fiber transmitter.

age1438_filter_bw (on page 120) –selects a signal filter bandwidth
age1438_filter_bw_get (on page 120) –gets the signal filter bandwidth
age1438_filter_decimate (on page 120) –enables/disables and extra factor of 2 decimation
age1438_filter_decimate_get (on page 120) –gets current state of extra decimation
age1438_filter_setup (on page 120) –sets the digital filter bandwidth and decimation filter parameters
age1438_filter_sync (on page 123) –synchronizes the decimation filter counter
age1438_frequency_center (on page 128) –sets the center frequency
age1438_frequency_center_get (on page 128) –gets the current center frequency
age1438_frequency_center_raw (on page 125) –quickly sets the center frequency
age1438_frequency_center_raw_compute (on page 127) –quickly calculates the values for **age1438_frequency_center_raw**
age1438_frequency_center_raw_get (on page 125) –gets the raw center frequency
age1438_frequency_cmplxdc (on page 128) –selects a complex baseband measurement
age1438_frequency_cmplxdc_get (on page 128) –gets the state of the baseband measurement mode
age1438_frequency_setup (on page 128) –sets all the zoom center frequency parameters
age1438_frequency_sync (on page 128) –prepares the module for a synchronous frequency change
age1438_frequency_sync_get (on page 128) –gets the state of the synchronous change mode
age1438_front_panel_clock_input (on page 131) –specifies the source of the front panel clock
age1438_front_panel_clock_input_get (on page 131) –gets the front panel clock source
age1438_init (on page 132) –initializes the I/O driver for a module
age1438_input_alias_filter (on page 141) –include/bypass the built-in analog anti-alias filter
age1438_input_alias_filter_get (on page 141) –gets the anti-alias filter state
age1438_input_autozero (on page 134) –nulls out the input dc offset in baseband mode
age1438_input_coupling (on page 141) –selects ac or dc input coupling
age1438_input_coupling_get (on page 141) –get the input coupling type
age1438_input_offset (on page 135) –sets the dc offset settings for the current range
age1438_input_offset_get (on page 135) –gets the dc offset settings
age1438_input_offset_save (on page 136) –saves the dc offset settings in NVRAM
age1438_input_range (on page 141) –sets the full scale range
age1438_input_range_auto (on page 137) –performs auto-ranging in baseband mode
age1438_input_range_convert (on page 138) –converts the input range to volts
age1438_input_range_get (on page 141) –gets the input range
age1438_input_setup (on page 141) –sets all the analog input parameters
age1438_input_signal (on page 141) –connect/disconnect the input signal to the input amplifiers
age1438_input_signal_get (on page 141) –gets the input buffer amplifier state
age1438_interrupt_mask_get (on page 145) –gets the interrupt event mask
age1438_interrupt_priority_get (on page 145) –gets the VME interrupt line
age1438_interrupt_restore (on page 144) –restores the interrupt masks to the most recent setting
age1438_interrupt_setup (on page 145) –sets both interrupt parameters
age1438_lbus_mode (on page 147) –sets the local bus transmission mode
age1438_lbus_mode_get (on page 147) –gets the local bus mode
age1438_lbus_reset (on page 149) –resets local bus

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age1438_lbus_reset_get (on page 149) –gets the local bus mode reset state
age1438_meas_control (on page 150) –initiates and controls measurements in multi-module systems
age1438_meas_init (on page 153) –initiates a measurement without first checking for valid hardware setup
age1438_meas_start (on page 154) –checks for valid hardware setup and then initiates a measurement
age1438_meas_status_get (on page 155) –returns the current measurement status.
age1438_options_get (on page 156) –returns the module's options
age1438_product_id_get (on page 157) –returns the module's product identification string
age1438_read (on page 158) –reads scaled 32-bit float data from FIFO
age1438_read_raw (on page 161) –reads raw data from FIFO
age1438_read64 (on page 158) –reads scaled 64-bit float data from FIFO, specifically for VEE applications
age1438_reference_clock (on page 164) –selects the source of the reference clock
age1438_reference_clock_get (on page 164) –gets the source of the reference clock
age1438_reference_prescaler (on page 165) –selects prescaling of the reference clock
age1438_reference_prescaler_get (on page 165) –gets prescaling of the reference clock
age1438_reset (on page 166) –places the module in a known state
age1438_reset_hard (on page 167) –resets the module hardware
age1438_revision_query (on page 168) –returns strings that identify the date of the firmware revision.
age1438_self_test (on page 169) –performs a self-test on the module and returns the result
age1438_serial_number (on page 156) –sets the module's serial number for product repair purposes
age1438_serial_number_get (on page 156) –returns the module's serial number
age1438_smb_clock_output (on page 172) –specifies which clock to output from the SMB clock connectors
age1438_smb_clock_output_get (on page 172) –gets which clock to output from the SMB clock connectors
age1438_state_save (on page 174) –saves the current module state
age1438_state_recall (on page 173) –recalls a saved module state
age1438_status_get (on page 175) –retrieves module's status register information
age1438_sync_clock (on page 177) –selects the source of the sync signal
age1438_sync_clock_get (on page 177) –gets the source of the sync signal
age1438_sync_direction (on page 178) –selects front or rear panel availability of the sync signal
age1438_sync_direction_get (on page 178) –gets the state of front or rear panel clock availability
age1438_sync_output (on page 179) –selects the output for the sync signal
age1438_sync_output_get (on page 179) –gets the output for the sync signal
age1438_trigger_adclevel (on page 182) –specifies the threshold for the ADC trigger
age1438_trigger_adclevel_get (on page 182) –gets the trigger threshold
age1438_trigger_delay (on page 182) –specifies a pre- or post-trigger delay time
age1438_trigger_delay_actual_get (on page 180) –gets the actual delay time from the most recent trigger event
age1438_trigger_delay_get (on page 182) –gets the trigger delay time
age1438_trigger_gen (on page 182) –determines whether a module can generate a trigger
age1438_trigger_gen_get (on page 182) –gets the trigger generation status
age1438_trigger_magdwell (on page 182) –specifies the dwell time (in samples) before a magnitude trigger

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age1438_trigger_magdwell_get (on page 182) –gets the magnitude trigger dwell time in samples
age1438_trigger_maglevel (on page 182) –specifies the threshold for a magnitude trigger
age1438_trigger_maglevel_get (on page 182) –gets magnitude trigger threshold
age1438_trigger_phase_actual_get (on page 181) –returns a representation of the phase value of the LO at the most recent trigger point
age1438_trigger_setup (on page 182) –sets all parameters associated with triggering the beginning of data collection
age1438_trigger_slope (on page 182) –selects a positive or negative trigger
age1438_trigger_slope_get (on page 182) –gets trigger slope
age1438_trigger_type (on page 182) –determines the trigger type
age1438_trigger_type_get (on page 182) –gets trigger type
age1438_vcxo (on page 186) –selects whether the module should use an internal clock source
age1438_vcxo_freq (on page 187) –selects which internal clock the module uses
age1438_vcxo_freq_get (on page 187) –gets which internal clock the module uses
age1438_vcxo_get (on page 186) –gets whether the internal clock source is on or off
age1438_vcxo_freq_preset (on page 188) –selects which internal clock source should be used as a default
age1438_vxi_clock_output (on page 189) –selects which clock drives the VXI clock
age1438_vxi_clock_output_get (on page 189) –gets which clock drives the VXI clock
age1438_wait (on page 190) –facilitates the synchronization and control of multi-module systems

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age1438_adc_clock

Specifies the ADC clock source. This description also includes the query function:

age1438_adc_clock_get

VXI*plug&play* Syntax

#include "age1438".h

ViStatus age1438_adc_clock(ViSession *id*, **ViInt16** *adcClock*);
ViStatus age1438_adc_clock_get(ViSession *id*, **ViPInt16** *adcClockPtr*);

Note

This command should be used only for specialized custom clock requirements. Most useful clock setups can be supplied by age1438_clock_setup.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

adcClock

AGE1438_VCXO_INTERNAL selects an internal oscillator within the module. **age1438_vcxo_freq** determines which oscillator is used. **age1438_vcxo** determines whether the internal oscillator is turned on. You must use all three of the functions to provide the desired internal clock source.

AGE1438_VCXO_EXT_REF takes an external reference signal on the front panel and uses a phase-locked loop to convert it to the ADC clock of the module. The ADC clock can be either 100 MHz or 102.4 MHz. The external reference used by the phase lock loop to synthesize the ADC clock can be either a 10 MHz or 10.24 MHz signal.

AGE1438_EXT_SAMPLE_CLOCK uses an external sample clock selected by **age1438_reference_clock**.

adcClockPtr points to the value of the current *adcClock*.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"Commands which halt active measurements" on page 198, "Default values" on page 201, "age1438_init" on page 132, "age1438_clock_setup" on page 78, "age1438_vcxo_freq" on page 187, "age1438_vcxo_freq_preset" on page 188, "age1438_vcxo" on page 186, "age1438_front_panel_clock_input" on page 131, "age1438_reference_clock" on page 164, "Using clock and sync" in chapter 3

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age1438_adc_divider

Determines which divider is applied to the ADC clock source. This description also includes the query function:

age1438_adc_divider_get

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_adc_divider(ViSession id, ViInt16 adcDivider);
ViStatus age1438_adc_divider_get(ViSession id, ViPInt16 adcDividerPtr);
```

Note

This command should be used only for specialized custom clock requirements. Most useful clock setups can be supplied by age1438_clock_setup.

Description

This function should generally be left in the default mode. The alternate mode applies to a different model of the module.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

adcDivider AGE1438_DIVIDE_BY_10 divides the ADC clock by 10.

AGE1438_DIVIDE_BY_38 divides the ADC clock by 38.

adcDividerPtr points to the current value of *adcDivider.*

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

Comments

The Agilent E1438 normally runs its sample clock at either 100 MHz or 102.4 MHz. The PLL divider divides the VCO by 10 to get either a 10 MHz or 10.24 MHz clock to compare to a 10 or 10.24 reference clock, which the user can supply through the front panel BNC. Alternatively the reference can come from a master module in the system via the back plane or front panel SMBs.

See Also

"Default values" on page 201, "age1438_init" on page 132, "age1438_clock_setup" on page 78, "Using clock and sync" in chapter 3

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age1438_attrib_get

Gets low-level attributes of current I/O library session.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_attrib_get(ViSession id, ViInt16 attribute, ViPint32 value);
```

Description

age1438_attrib_get is used primarily to manage the use of interrupts which requires making direct VISA function calls. Since interrupts are a shared resource across all modules using the VXI interface, it is not possible for the Agilent E1438 library, which governs single modules, to provide the functions to properly manage interrupts.

This function is used to access either the I/O library handle or the mapped I/O base address of the module. You should refer to the appropriate VISA documentation for descriptions of the I/O library functions.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

attribute designates the type of attribute to return.

AGE1438_IO_HANDLE accesses the I/O library handle.

AGE1438_IO_ADDRESS points to the mapped I/O base address of the module.

AGE1438_RM_HANDLE accesses the I/O library handle of the default resource manager.

AGE1438_DATA_REGISTER points to the mapped address of the Agilent E1438 data register. One or both of these parameters are used when calling I/O library functions directly.

value is the value of the requested attribute. For the VISA I/O library the value of the handle attribute corresponds to the vi parameter used by the majority of the I/O functions. The address attribute points to the base of the mapped I/O address space.

Example

See the interrupt.c example program.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

See Also

“age1438_init” on page 132, “age1438_interrupt_setup” on page 145

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age1438_cal_get

Gets last calibration date of specified board.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_cal_get(ViSession id, ViInt16 board, ViPInt32 datestampPtr);
```

Description

age1438_cal_get is used to read the date stamp of the last calibration.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

board AGE1438_01_BOARD returns calibration information for the 01 (digital/ADC) board.

AGE1438_02_BOARD returns calibration information for the 02 (input) board.

datestampPtr points to the return location for the timestamp of the most recent saved calibrations. Format is `YYYYMMDD` in base 10 notation.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"age1438_init" on page 132

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age1438_clock_fs

Provides the module with the frequency of an external sample clock. This description also includes the query:

age1438_clock_fs_get

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_clock_fs(ViSession id, ViReal64 fs);
ViStatus age1438_clock_fs_get(ViSession id, ViPReal64 fsPtr);
```

Description

This command is applicable only when an external sample clock is used. It is an order-dependent command and must be set after selecting the external sample clock.

When using an external sample clock or when a module is a non-master in a multi-module group, the frequency of the ADC clock is unknown by the module. It is the responsibility of the programmer to provide the correct frequency so that library functions dependent on *fs* operate properly. This value has no effect if the module is not set up to use the external sample clock.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

fs provides the module with the frequency of an external sample clock (from 10,000,000 to 103,000,000) connected to the Ext Clk TTL connector.

AGE1438_FS_MIN supplies the minimum external sample clock frequency.

AGE1438_FS_MAX supplies the maximum external sample clock frequency.

fsPtr points to the current value of the external sample clock frequency. If the Agilent E1438 is set to the internal ADC clock, this query returns the value of that clock frequency. If the Agilent E1438 is set to the external clock, this query returns the last value entered via the **age1438_clock_fs** function.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

See Also

“Default values” on page 201, “age1438_init” on page 132, “age1438_clock_setup” on page 78, “age1438_front_panel_clock_input” on page 131, “age1438_ext_sample_sync” on page 104, “Using clock and sync” in chapter 3

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age1438_clock_recover

Allows recovery from an out-of-spec external sample clock.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_clock_recover(ViSession id);
```

Description

This command is used to restore proper function if the module has received an out-of spec external sample clock. An out-of-spec situation could occur if the external sample clock is removed or changed during operation, or if it has glitches which don't meet specs. In this case the module would cease functioning and this command must be issued in order to resume proper operation after restoring a valid clock.

Parameters

id

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"Commands which halt active measurements" on page 198, "age1438_init" on page 132, "age1438_ext_sample_sync" on page 104, "age1438_clock_setup" on page 78

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age1438_clock_setup

Sets all timing parameters for commonly used measurement setups. This description also includes a query:

age1438_clock_setup_get

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_clock_setup(ViSession id, ViInt16 clockSetup);
ViStatus age1438_clock_setup_get(ViSession id, ViPInt16 clockSetupPtr);
```

Description

age1438_clock_setup is used to select the source and distribution of clocking and synchronization signals used by the Agilent E1438 module. The primary clock signal used by the module is the ADC clock, for which the rising edges indicate the time for each sample of the analog-to-digital converter.

This function changes the settings controlled by the following lower-level functions:

age1438_adc_clock
age1438_adc_divider
age1438_front_panel_clock_input
age1438_reference_clock
age1438_reference_prescaler
age1438_smb_clock_output
age1438_sync_clock
age1438_sync_direction
age1438_sync_output
age1438_vcxo

Note This function does not alter settings made with age1438_vcxo_freq, but it does control whether the selected VCXO is actually running.

Note Setups using the external sample clock require that you use age1438_clock_fs to supply the clock frequency.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

clockSetup This parameter provides a quick way to set up most of the timing parameters for several standard clock configurations. The following setups are available:

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Simple clock setups for stand-alone modules

Internal reference

AGE1438_SIMPLE_INT_REF	
ADC_CLK	VCXO_INTERNAL
VCXO	VCXO_ON
ADC_DIVIDER	DIVIDE_BY_10
REFERENCE_PRESCALER	PRESCALE_BY_1
VXI_CLK_OUTPUT	CLOCK_OFF
REFERENCE_CLOCK	N/A
FRONT_PANEL_CLOCK	CLOCK_OFF
SMB_CLOCK_OUTPUT	CLOCK_OFF
SYNC_CLOCK	DIVIDED_ADC_CLOCK
SYNC_OUTPUT	SYNC_OUT_OFF
SYNC_DIRECTION	N/A

Phase locked to external reference

AGE1438_SIMPLE_EXT_REF	
ADC_CLK	VCXO_EXT_REF
VCXO	VCXO_ON
ADC_DIVIDER	DIVIDE_BY_10
REFERENCE_PRESCALER	PRESCALE_BY_1
VXI_CLK_OUTPUT	CLOCK_OFF
REFERENCE_CLOCK	FRONT_PANEL_CLOCK
FRONT_PANEL_CLOCK	BNC_CLOCK
SMB_CLOCK_OUTPUT	CLOCK_OFF
SYNC_CLOCK	DIVIDED_ADC_CLOCK
SYNC_OUTPUT	SYNC_OUT_OFF
SYNC_DIRECTION	N/A

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External sample clock

AGE1438_SIMPLE_EXT_SAMP

ADC_CLK	EXT_SAMPLE_CLOCK
VCXO	VCXO_OFF
ADC_DIVIDER	DIVIDE_BY_10
REFERENCE_PRESCALER	PRESCALE_BY_1
VXI_CLK_OUTPUT	CLOCK_OFF
REFERENCE_CLOCK	FRONT_PANEL_CLOCK
FRONT_PANEL_CLOCK	BNC_CLOCK
SMB_CLOCK_OUTPUT	CLOCK_OFF
SYNC_CLOCK	DIVIDED_ADC_CLOCK
SYNC_OUTPUT	SYNC_OUT_OFF
SYNC_DIRECTION	N/A

Front panel master-slave setups, one master per mainframe

Front master, internal reference

AGE1438_FRNT_MSTR_INT_REF

ADC_CLK	VCXO_INTERNAL
VCXO	VCXO_ON
ADC_DIVIDER	DIVIDE_BY_10
REFERENCE_PRESCALER	PRESCALE_BY_1
VXI_CLK_OUTPUT	CLOCK_OFF
REFERENCE_CLOCK	N/A
FRONT_PANEL_CLOCK	CLOCK_OFF
SMB_CLOCK_OUTPUT	DIVIDED_ADC_CLOCK
SYNC_CLOCK	DIVIDED_ADC_CLOCK
SYNC_OUTPUT	SYNC_OUT_SMB
SYNC_DIRECTION	FRNT_TO_REAR

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Front master, phase locked to external reference

AGE1438_FRNT_REAR_MSTR_EXT_REF

ADC_CLK	VCXO_EXT_REF
VCXO	VCXO_ON
ADC_DIVIDER	DIVIDE_BY_10
REFERENCE_PRESCALER	PRESCALE_BY_1
VXI_CLK_OUTPUT	CLOCK_OFF
REFERENCE_CLOCK	FRONT_PANEL_CLOCK
FRONT_PANEL_CLOCK	BNC_CLOCK
SMB_CLOCK_OUTPUT	DIVIDED_ADC_CLOCK
SYNC_CLOCK	DIVIDED_ADC_CLOCK
SYNC_OUTPUT	SYNC_OUT_SMB
SYNC_DIRECTION	FRNT_TO_REAR

Front slave, phase locked to master

AGE1438_FRNT_REAR_SLAV_EXT_REF

ADC_CLK	VCXO_EXT_REF
VCXO	VCXO_ON
ADC_DIVIDER	DIVIDE_BY_10
REFERENCE_PRESCALER	PRESCALE_BY_1
VXI_CLK_OUTPUT	CLOCK_OFF
REFERENCE_CLOCK	FRONT_PANEL_CLOCK
FRONT_PANEL_CLOCK	SMB_CLK
SMB_CLOCK_OUTPUT	CLOCK_OFF
SYNC_CLOCK	SMB_CLOCK
SYNC_OUTPUT	SYNC_OUT_SMB
SYNC_DIRECTION	FRNT_TO_REAR

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Rear panel master-slave setups, one master per mainframe

Rear master, internal reference

AGE1438_REAR_MSTR_INT_REF

ADC_CLK	VCXO_INTERNAL
VCXO	VCXO_ON
ADC_DIVIDER	DIVIDE_BY_10
REFERENCE_PRESCALER	PRESCALE_BY_1
VXI_CLK_OUTPUT	DIVIDED_ADC_CLOCK
REFERENCE_CLOCK	N/A
FRONT_PANEL_CLOCK	CLOCK_OFF
SMB_CLOCK_OUTPUT	CLOCK_OFF
SYNC_CLOCK	DIVIDED_ADC_CLOCK
SYNC_OUTPUT	SYNC_OUT_VXI
SYNC_DIRECTION	REAR_TO_FRNT

Rear master, phase locked to external reference

AGE1438_REAR_MSTR_EXT_REF

ADC_CLK	VCXO_EXT_REF
VCXO	VCXO_ON
ADC_DIVIDER	DIVIDE_BY_10
REFERENCE_PRESCALER	PRESCALE_BY_1
VXI_CLK_OUTPUT	DIVIDED_ADC_CLOCK
REFERENCE_CLOCK	FRONT_PANEL_CLOCK
FRONT_PANEL_CLOCK	BNC_CLOCK
SMB_CLOCK_OUTPUT	CLOCK_OFF
SYNC_CLOCK	DIVIDED_ADC_CLOCK
SYNC_OUTPUT	SYNC_OUT_VXI
SYNC_DIRECTION	REAR_TO_FRNT

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Rear slave, phase locked to master

AGE1438_REAR_SLAV_EXT_REF

ADC_CLK	VCXO_EXT_REF
VCXO	VCXO_ON
ADC_DIVIDER	DIVIDE_BY_10
REFERENCE_PRESCALER	PRESCALE_BY_1
VXI_CLK_OUTPUT	CLOCK_OFF
REFERENCE_CLOCK	VXI_CLOCK
FRONT_PANEL_CLOCK	CLOCK_OFF
SMB_CLOCK_OUTPUT	CLOCK_OFF
SYNC_CLOCK	VXI_CLOCK
SYNC_OUTPUT	SYNC_OUT_VXI
SYNC_DIRECTION	REAR_TO_FRNT

Multi-module external sample setups, set all modules the same

Front sync, external sample clock, wired-OR sync

AGE1438_FRNT_SYNC_EXT_SAMP

ADC_CLK	EXT_SAMPLE_CLOCK
VCXO	VCXO_OFF
ADC_DIVIDER	DIVIDE_BY_10
REFERENCE_PRESCALER	PRESCALE_BY_1
VXI_CLK_OUTPUT	CLOCK_OFF
REFERENCE_CLOCK	FRONT_PANEL_CLOCK
FRONT_PANEL_CLOCK	BNC_CLOCK
SMB_CLOCK_OUTPUT	CLOCK_OFF
SYNC_CLOCK	DIVIDED_ADC_CLOCK
SYNC_OUTPUT	SYNC_OUT_SMB
SYNC_DIRECTION	FRNT_TO_REAR

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Rear sync, external sample clock, wired-OR sync

AGE1438_REAR_SYNC_EXT_SAMP

ADC_CLK	EXT_SAMPLE_CLOCK
VCXO	VCXO_OFF
ADC_DIVIDER	DIVIDE_BY_10
REFERENCE_PRESCALER	PRESCALE_BY_1
VXI_CLK_OUTPUT	CLOCK_OFF
REFERENCE_CLOCK	FRONT_PANEL_CLOCK
FRONT_PANEL_CLOCK	BNC_CLOCK
SMB_CLOCK_OUTPUT	CLOCK_OFF
SYNC_CLOCK	DIVIDED_ADC_CLOCK
SYNC_OUTPUT	SYNC_OUT_VXI
SYNC_DIRECTION	REAR_TO_FRNT

Multiple mainframe setups

Send sync to slave

AGE1438_FRNT_MSTR_INT_REF

ADC_CLK	VCXO_INTERNAL
VCXO	VCXO_ON
ADC_DIVIDER	DIVIDE_BY_10
REFERENCE_PRESCALER	PRESCALE_BY_1
VXI_CLK_OUTPUT	DIVIDED_ADC_CLOCK
REFERENCE_CLOCK	N/A
FRONT_PANEL_CLOCK	CLOCK_OFF
SMB_CLOCK_OUTPUT	DIVIDED_ADC_CLOCK
SYNC_CLOCK	VXI_CLOCK
SYNC_OUTPUT	SYNC_OUT_BOTH
SYNC_DIRECTION	REAR_TO_FRONT

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Receive sync from master

AGE1438_FRNT_REAR_SLAV_EXT_REF	
ADC_CLK	VCXO_EXT_REF
VCXO	VCXO_ON
ADC_DIVIDER	DIVIDE_BY_10
REFERENCE_PRESCALER	PRESCALE_BY_1
VXI_CLK_OUTPUT	FRONT_PANEL_CLOCK
REFERENCE_CLOCK	FRONT_PANEL_CLOCK
FRONT_PANEL_CLOCK	SMB_CLOCK
SMB_CLOCK_OUTPUT	CLOCK_OFF
SYNC_CLOCK	SMB_CLOCK
SYNC_OUTPUT	SYNC_OUT_BOTH
SYNC_DIRECTION	FRONT_TO_REAR

clockSetupPtr points to the current value of *clockSetup*.

AGE1438_CUSTOM_CLOCK_SETUP is returned from **age1438_clock_setup_get** when low-level clock configuration functions are used to set up clocks to a non-standard configuration.

Example

The program multichan.exe example program provides an example of how to correctly set up a multi-module system with synchronous clocks.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

Effect on Active Measurement

age1438_clock_setup aborts any measurement in progress.

See Also

“Commands which halt active measurements” on page 198, “Default values” on page 201, “age1438_init” on page 132, “age1438_clock_fs” on page 76, “age1438_vcxo_freq” on page 187, “age1438_vcxo_freq_preset” on page 188, “age1438_clock_recover” on page 77, “age1438_ext_sample_sync” on page 104, “Using clock and sync” in chapter 3, “Managing multiple modules” in chapter 3

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age1438_close

Closes the module's software connection.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_close(ViSession id);
```

Description

age1438_close terminates the software connection to the module, deallocates system resources, and places the module in the Idle state. After this function has been executed the specified id identifier is no longer a valid parameter for function calls.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"age1438_init" on page 132

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age1438_combo_setup

Combines often used setup commands from various functions.

age1438_combo_setup sets signal bandwidth, blocksize and center frequency.

VXI*plug&play* Syntax

#include "age1438".h

ViStatus age1438_combo_setup(ViSession *id*, **ViInt16** *sigBw*, **ViInt32** *blocksize*, **ViInt32** *phase*, **ViInt32** *interpolate*);

Description

age1438_combo_setup provides a faster way to set up parameters from several functions which are often used together.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

blocksize See “age1438_data_setup” on page 90 for a description of the *blocksize* parameter.

interpolate See “age1438_frequency_center_raw” on page 125 for a description of the *interpolate* parameter.

phase See “age1438_frequency_center_raw” on page 125 for a description of the *phase* parameter.

sigBw See “age1438_filter_setup” on page 120 for a description of the *sigBw* parameter.

Comments

This command halts the current measurement which also releases the forced Idle state. If you use this command in multi-module systems to synchronously change the center frequency while the modules are forced to Idle, then you should subsquently call age1438_meas_control to re-assert the forced Idle condition.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

See Also

“Commands which halt active measurements” on page 198, “age1438_init” on page 132, “age1438_filter_setup” on page 120, “age1438_frequency_center_raw” on page 125, “age1438_data_setup” on page 90, “age1438_meas_control” on page 150

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age1438_data_memsize_get

Returns the module's memory size in megabytes.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_data_memsize_get(ViSession id, ViPInt16 memSizePtr);
```

Description

This command allows you to determine whether your module contains standard memory of 18 Mbytes or a larger memory option.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

memSizePtr points to the memory size in number of Megabytes.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

See Also

“age1438_init” on page 132, “age1438_data_setup” on page 90.

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age1438_data_scale_get

Gets the data scale factor.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_data_scale_get(ViSession id, ViPReal64 scalePtr);
```

Description

age1438_data_scale_get calculates the correct scale factor for raw data using the current data resolution and input range. The factor returned by this function is used to multiply raw data to get data in volts.

When the module is providing only the real part of complex data, the data is doubled to provide consistent spectrum measurements. This occurs with either shift decimation or when the real part of a zoomed signal with a non-zero center frequency is taken.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

scalePtr points to the calculated scale factor with which to scale raw data to volts.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

See Also

“age1438_init” on page 132, “age1438_data_setup” on page 90, “age1438_read_raw” on page 161, “age1438_input_range_auto” on page 137, “age1438_filter_setup” on page 120

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age1438_data_setup

Sets all format and data output flow parameters. This description also includes information on the following functions which set or query the format and flow parameters individually:

age1438_data_blocksize determines the size of the output data block.
age1438_data_blocksize_get gets the output data block size.
age1438_data_delay determines the FIFO delay in continuous mode.
age1438_data_delay_get gets the FIFO delay in continuous mode.
age1438_data_mode selects block mode or continuous mode.
age1438_data_mode_get gets the data mode.
age1438_data_port selects VME bus or local bus output port.
age1438_data_port_get gets the output port designation.
age1438_data_resolution selects 12 or 24 bits data resolution.
age1438_data_resolution_get gets the data resolution.
age1438_data_type selects real or complex output data.
age1438_data_type_get gets output data type.

VXI*plug&play* Syntax

```
#include "age1438".h

ViStatus age1438_data_setup(ViSession id, ViInt16 dataType, ViInt16 resolution, ViInt16
  mode, ViInt32 blocksize, ViInt32 dataDelay, reserved, ViInt16 port);
ViStatus age1438_data_blocksize(ViSession id, ViInt32 blocksize);
ViStatus age1438_data_blocksize_get(ViSession id, ViPint32 blocksizePtr);
ViStatus age1438_data_delay(ViSession id, ViInt32 dataDelay);
ViStatus age1438_data_delay_get(ViSession id, ViPInt32 dataDelayPtr);
ViStatus age1438_data_mode(ViSession id, ViInt16 mode);
ViStatus age1438_data_mode_get(ViSession id, ViPInt16 modePtr);
ViStatus age1438_data_port(ViSession id, ViInt16 port);
ViStatus age1438_data_port_get(ViSession id, ViPInt16 portPtr);
ViStatus age1438_data_resolution(ViSession id, ViInt16 resolution);
ViStatus age1438_data_resolution_get(ViSession id, ViPInt16 resolutionPtr);
ViStatus age1438_data_type(ViSession id, ViInt16 dataType);
ViStatus age1438_data_type_get(ViSession id, ViPInt16 dataTypePtr);
```

Description

Note

The functions, **age1438_data_delay, age1438_data_mode, age1438_data_resolution,** and **age1438_data_type** work the same for the fiber interface as they do for the other interfaces.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

blocksize determines the number of sample points in each output data block.

AGE1438_BLOCKSIZE_MIN selects the minimum blocksize.

AGE1438_BLOCKSIZE_MAX selects the maximum blocksize.

AGE1438_BLOCKSIZE_DEF sets the default blocksize.

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The range of available block sizes depends on the number of bytes required for each sample. The command accepts any number between 2 and memory size (in bytes) × 2/3. If the requested block size falls outside the range shown in the table the previous valid value is used and a status register flag (bit 6) is set indicating a setup error. The blocksize is updated after the setup is changed to be valid.

For real data *blocksize* is the number of real data values per data block. For complex data *blocksize* is the number of complex data pairs per data block.

The following table summarizes the available block sizes for each setting of the *dataType*, and *resolution* parameters.

data type	resolution	min. block size	max block size in Msamples (2 M*72 memory)[1]
real	12	6	12
real	24	3	6
complex	12	3	6
complex	24	2	3

1. **Parity memory is used in non-parity mode, so 2M×72 bit memory yields 18 Mbytes of FIFO storage.**

Note

Block size must be an even number. Considerably more samples may need to be taken in order to set the block available status bit.

blocksizePtr points to the current value of the *blocksize* parameter. The returned value is the closest valid value to the requested block size.

dataDelay is used to specify the minimum FIFO delay in number of samples. This parameter applies only in continuous mode.

AGE1438_DATA_DELAY_MAXsets the maximum allowable delay.

AGE1438_DATA_DELAY_MIN sets the minimum allowable delay.

dataDelayPtr points to the current value of the *delay* parameter.

dataType determines whether the Agilent E1438 collects and returns real or complex data.

Setting this parameter to AGE1438_REAL causes only the real part of the data to be returned for each sample

AGE1438_COMPLEX causes the real data followed by the imaginary data to be returned in each sample.

Normally, if the center frequency set with the **age1438_frequency_setup** function is zero, the type should be set to **AGE1438_REAL** since the imaginary component of each sample is zero anyway. When non-zero center frequencies are used the type should normally be set to **AGE1438_COMPLEX**, otherwise the imaginary component of the signal is lost.

when *dataType* is set to **AGE1438_REAL** and there is a non-zero center frequency the data scale value is doubled for consistent spectrum measurements

dataTypePtr points to the current value of the *dataType* parameter.

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mode selects whether the Agilent E1438's data collection operates in block mode or continuous mode.

AGE1438_BLOCK selects block transfer mode in which the measurement is halted after each block of data. To start collection of the next data block the module must be armed and triggered again. This mode is used whenever each block of data is to be associated with an individual trigger event.

AGE1438_CONTINUOUS means that a single arm and trigger event starts a measurement which runs continuously with no gaps between output data blocks. The measurement continues as long as the data is read out fast enough to prevent overflow in the output FIFO. The continuous mode is useful for continuous signal processing applications where data gaps are unacceptable.

modePtr points to the current value of the *mode* parameter.

port determines which output port is used to take data from the Agilent E1438 module.

Setting *port* to AGE1438_VME means the data is to be output using standard VME register reads. This is the instrument default.

Setting *port* to AGE1438_LBUS means the data is to be output as a byte-serial data stream via the VXI local bus (Agilent E1438D only) . When using the local bus port the module immediately to the right of the Agilent E1438 must be capable of receiving the local bus byte sequence.

Setting *port* to AGE1438_FIBER means the filtered ADC data is to be transmitted as a serial data stream over the fiber interface.

portPtr points to the current value of the *port* parameter.

resolution selects data resolution of either 12 or 24 bits by using resolution values of AGE1438_12BIT or AGE1438_24BIT respectively. Choosing 12-bit precision allows for more samples in the FIFO memory. Choosing 24 bits allows more dynamic range. Because of the broadband white noise present on the input of the analog-to-digital converter, it is normally sufficient to use 12 bit resolution whenever the **age1438_filter_setup** function specifies a signal bandwidth greater than 10 MHz. For narrower bandwidths much of the broadband white noise is filtered out, resulting in lower noise in the output data. To take advantage of this lower noise, you should use the 24-bit data resolution.

resolutionPtr points to the current value of the *resolution* parameter.

Comments

The following table summarizes the output word or byte sequence for each combination of *dataType*, *resolution*, and *port* parameters:

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data type	data resolution	port	transfer width	xfers[1]	sequence[2]
real	12 bit	VME	16 bit	1	R_0[11:0] | Z4 R_1[11:0] | Z4 ...
complex	12 bit	VME	16 bit	2	R_0[11:0] | Z4 Q_0[11:0] | Z4 R_1[11:0] | Z4 Q_1[11:0] | Z4 ...
real	24 bit	VME	16 bit	2	R_0[23:8] R_0[7:0] | Z8 R_1[23:8] R_1[7:0] | Z8 ...
complex	24 bit	VME	16 bit	4	R_0[23:8] R_0[7:0] | Z8 Q_0[23:8] Q_0[7:0] | Z8 R_1[23:8] R_1[7:0] | Z8 ...
real	12 bit	LBUS	8 bit	2	R_0[11:4] R_0[3:0] | Z4 R_1[11:4] R_1[3:0] | Z4 ...
complex	12 bit	LBUS	8 bit	4	R_0[11:4] R_0[3:0] | Z4 Q_0[11:4] Q_0[3:0] | Z4 R_1[11:4] R_1[3:0] | Z4 ...
real	24 bit	LBUS	8 bit	4	R_0[23:16] R_0[15:8] R_0[7:0] Z8 R_1[23:16] R_1[15:8] ...
complex	24 bit	LBUS	8 bit	8	R_0[23:16] R_0[15:8], R_0[7:0] Z8, Q_0[23:16] Q_0[15:8] Q_0[7:0] Z8 R_1[23:16] R_1[15:8] ...

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data type	data resolution	port	transfer width	xfers[1]	sequence[2]
real	12 bit	Fiber	32 bit	1/2	R_0[11:0] | Z4 | R_1[11:0] | Z4 R_2[11:0] | Z4 | R_3[11:0] | Z4,...
complex	12 bit	Fiber	32 bit	1	R_0[11:0] | Z4 | Q_0[11:0] | Z4 R_1[11:0] | Z4 | Q_1[11:0] | Z4 ...
real	24 bit	Fiber	32 bit	1	R_0[23:0] | Z8 R_1[23:0] | Z8 ...
complex	24 bit	Fiber	32 bit	2	R_0[23:0] | Z8 Q_0[23:0] | Z8 ... R_1[23:0] | Z8 ...

1. **That is, transfers required per measurement. A fraction indicates multiple samples per transfer.**
2. **Sequence Notation:**
   R = real number transfer; Q = imaginary number transfer; Z4 = 4 zero pad bits; Z8 = 8 zero pad bits (in the LSBs). Subscript denotes the sample number. Bracketed indices show which sample bits are contained in the transfer, MSB first. A vertical bar denotes bit-wise concatenation. Example: For a 12-bit sample sent to the LBUS, R0[11:4] indicates the 8 MSBs of the sample are transferred in the first byte. Then R0[3:0] | Z4 indicates the 4 LSBs of the sample are padded with 4 zero bits and transferred in the second byte.

The maximum rate at which data may be transferred to memory is determined by the ADC clock rate: MaxBytes/s = 1.5 × (ADC clock rate). Divide MaxBytes/s by 1.5 to get the 12-bit sample rate, and by 3 to get the 24-bit sample rate.

A limitation also applies to 32-bit, complex data transfers. Because this type of transfer cannot be made at the full sample rate, a level of decimation must be added in order to reduce the sample rate.

The following table summarizes the relationship between data parameter combinations, decimation, filter bandwidth, precision, and whether the combination permits block or continuous measurements:

Note Continuous mode is only limited by maximum transfer rate of the selected interface.

decimate	filterBW	sample rate (Msamples/s)	BW *fs*=100 MHz	12b real	24b real	12b complex	24b complex
n/a	0	100	40	b			
1	1	50	20	b,d		b	
0	2	50	10	b,d		b	
1	2	25	10	b,c,d	b,d	b,d	b
0	3	25	5	b,c,d	b,d	b,d	b
1	3	12.5	5	b,c,d	b,c,d	b,c,d	b,d

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decimate	filterBW	sample rate (Msamples/s)	BW *fs*=100 MHz	12b real	24b real	12b complex	24b complex
0	4	12.5	2.5	b,c,d	b,c,d	b,c,d	b,d
1	4	6.25	2.5	b,c,d	b,c,d	b,c,d	b,c,d
0	5	6.25	1.25	b,c,d	b,c,d	b,c,d	b,c,d

b = block mode, continuos mode to fiber at the fiber transfer rate of 250 Mbytes per second.
c = continuous mode to local bus
d = continuous mode to fiber at the fiber transfer rate of 106 Mbytes per second.

reserved is a short integer which is reserved for future use and should be set to 0.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"Commands which halt active measurements" on page 198, "Default values" on page 201, "age1438_init" on page 132, "age1438_frequency_setup" on page 128, "age1438_filter_setup" on page 120, "age1438_meas_control" on page 150, "age1438_clock_setup" on page 78

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age1438_data_xfersize

Allows data to be read before an entire block had been acquired.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_data_xfersize(ViSession id, ViInt32 xfersize);
ViStatus age1438_data_xfersize_get(ViSession id, ViPInt32 xfersizePtr);
```

Description

This command allows you to specify the allowable data transfer size in a situation where you want to read a large block of data in increments before an entire block has been acquired.

Note This function has no effect on the fiber output channel.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

xfersize specifies the data transfer size in samples.

AGE1438_XFERSIZE_MIN selects the minimum allowable transfer size.

AGE1438_XFERSIZE_MAX selects the maximum allowable transfer size. *xfersize* must be a sub-multiple of *blocksize* or an error is generated.

AGE1438_XFERSIZE_DEF sets the default transfer size.

Note *xfersize* is reset by any subsequent change in the *blocksize* parameter and therefore must be specified after *blocksize*. See “age1438_data_setup” on page 90.

xfersizePtr points to the data transfer size in number of bytes.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

See Also

“Commands which halt active measurements” on page 198, “age1438_init” on page 132, “age1438_data_setup” on page 90

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age1438_driver_debug_level

Sets and gets the debug level.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_driver_debug_level(ViSession id, ViInt16 debugLevel);
ViStatus age1438_driver_debug_level_get(ViSession id, ViPInt16 debugLevelPtr);
```

Description

This command allows you to set and get debug levels. Debug messages are sent to the application debugger using the Windows kernel function Output Debug String.

Note

This function only works under Windows.

This function only works with a debug build of the library.

Debug messages are received by the Microsoft Visual C++ debugger or can be received by the dbmon example program that comes with Microsoft Visual C++.

You can compile a DEBUG build by opening age1438_32.dsw, the Visual C++ project for the driver DLL, age1438_32.dll, and selecting the "age1438_32.dl-Win32 Debug" build configuration.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

debugLevel is the debug level.

debugLevelPtr points to the value of *debugLevel*.

Debug levels are defined as follows:

Debug Level	Description
AGE1438_DEBUG_LEVEL_0	Only output errors and algorithmic results
AGE1438_DEBUG_LEVEL_1	Add output of setup function calls
AGE1438_DEBUG_LEVEL_2	Add output of measurement function calls
AGE1438_DEBUG_LEVEL_3	Add output of status query function calls
AGE1438_DEBUG_LEVEL_4	Reserved
AGE1438_DEBUG_LEVEL_5	Add output of diagnostic function calls

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

See Also

“age1438_init” on page 132

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age1438_epoch_setup

Sets the parameters relevant to the transmission of data epochs over the fiber interface. This description also includes information on the following functions that set up or query the fiber epoch parameters individually:

age1438_epoch_generate controls whether data epochs are generated or not.
age1438_epoch_generate_get gets the epoch generation status.
age1438_epoch_header sets the value of the first 32 bits of the epoch header.
age1438_epoch_header_get returns the header value.
age1438_epoch_header_enable controls whether epoch headers are generated or not.
age1438_epoch_header_enable_get gets the header status.
age1438_epoch_size sets the size of the data epoch in bytes.
age1438_epoch_size_get gets the size of the data epoch

VXI*plug&play* Syntax

#include "age1438".h

ViStatus age1438_epoch_setup(Visession *id*, **ViInt16** *epochGenerate*, **ViInt32** *epochSize*, **ViInt16** *headerEnable*, **ViInt32** *initialValue*, **ViInt32** *incrementCount*);
ViStatus age1438_epoch_generate(Visession *id*, **ViInt16** *epochGenterate*);
ViStatus age1438_epoch_generate_get(Visession *id*, **ViPInt16** *epochGenteratePtr*);
ViStatus age1438_epoch_header(Visession *id*, **ViInt32** *headerValue*, **ViInt32** *incrementCount*);
ViStatus age1438_epoch_header_get(Visession *id*, **ViPInt32** *headerValuePtr*, **ViPInt32** *incrementCountPtr*);
ViStatus age1438_epoch_header_enable(Visession *id*, **ViInt16** *headerEnable*);
ViStatus age1438_epoch_header_enable_get(Visession *id*, **ViPInt16** *headerEnablePtr*);
ViStatus age1438_epoch_size(Visession *id*, **ViInt32** *epochSize*);
ViStatus age1438_epoch_size_get(Visession *id*, **ViPInt32** *epochSizePtr*);

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

epochGenerate controls whether or not data epochs are generated.

AGE1438_EPOCH_GEN_ON enables data epoch generation.

AGE1438_EPOCH_GEN_OFF disables sending end of epoch and epoch headers and disables generating data epochs.

When *epochGenerate* is off, EOE (End of Epoch) events and epoch headers are not sent however, data still is. Generally, *epochGenerate* should be on and should only be disabled for purposes of compatibility. This setting is ignored when the fiberMode is **AGE1438_FIBER_COPY**.

epochGeneratePtr points to the current value of *epochGenerate*

epochSize sets the size of data epochs in bytes.

AGE1438_EPOCH_SIZE_MIN selects the minimum data epoch size.

AGE1438_EPOCH_SIZE_DEF sets the data epoch size to the default.

AGE1438_EPOCH_SIZE_MAX selects the maximum data epoch size.

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The units of *epochSize* are always in bytes and this value must be divisible by 4, with a minimum value of 8 to a maximum value of 4,294,967,292 bytes.

Note For maximum compatibility with other fiber optic components, values divisible by 8 are recommended.

When the module is being used in a fiber append chain, *epochSize* must be set equal to *blocksize* (in bytes). Since the function **AGE1438_DATA_BLOCKSIZE** sets the blocksize in samples, the following table can be used to compute blocksize in bytes.

data type	resolution	bytes per sample
real	12	2
complex	12	4
real	24	4
complex	24	8

Note You may set *blocksize* and *epochSize* independently for the other *fiberMode* settings.

epochSizePtr points to the current value of *epochSize*

headerEnable controls whether or not epoch headers are generated.

AGE1438_HEADER_ON enables epoch header generation

AGE1438_HEADER_OFF disables epoch header is generation.

The default setting is off. Epoch headers are enabled only when epoch generation is enabled. Otherwise, epoch header settings are silently accepted. The epoch header setting must match the configuration of the optical receiver.

headerEnablePtr points to the current value of *headerEnable*

headerValue sets the value of the first 32 bits of the epoch header.

AGE1438_HEADER_VALUE_MIN selects the minimum value for the epoch header.

AGE1438_HEADER_VALUE_MAX selects the maximum value for the epoch header.

AGE1438_HEADER_INDEX_MASK is used for setting the value of the *headerIndex* field.

AGE1438_HEADER_INCR_MIN selects the minimum value for the *incrementCount*.

AGE1438_HEADER_INCR_MAX selects the maximum value for the *incrementCount.*

Epoch headers are 64 bits long. Of these, the last 32 bits are not used and set to zero. The first 32 bits are available and can be set by the user. The 10 least significant bits of the 32 non-zero bits contain a value that can be used by the optical receiver to direct where to route and/or how to process the associated epoch data. These 10 bits are called the *headerIndex* and can be set from a value of 0 to 1023. In addition the *headerIndex* can be sequentially incremented by 1 each time it is transmitted. The number of increments that are applied before returning to the original value is programmable by the user.

The *headerValue* sets the value of all 32 non-zero bits of epoch header, including the 10 least significant bits that comprise the *headerIndex* bit field. The default *headerValue* is 0 and the maximum value is (2^32 -1).

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headerValuePtr points to the current value of *initalValue*

incrementCount specifies the number of automatic increments to the *headerIndex* bit field. The default *incrementCount* is 0 and the maximum value is (2^10 -1).

Example

The following is a example of how the increment process works.

For *headerValue* = 0x12345678 and *incrementCount* = 0x2, the sequence of values for *headerValue* and *headerIndex* are:

Increment	headerValue	headerIndex
0	0x12345678	0x278
1	0x12345679	0x279
2	0x1234567A	0x27A
0	0x12345678	0x278
1	0x12345679	0x279
2	0x1234567A	0x27A

If an incremented header reaches a value where the *headerIndex* is 0x3FF, the next *headerIndex* will be 0x000, and no carry will be generated to the upper 22 bits of the header.

Note If the *incrementCount* is set to 0, incrementing the *headerIndex* field is disabled.

incrementCountPtr points to the current value of *incrementCount*

The following table is a summary of valid fiber, epoch setups. Please note that the designation of N/A means that this information is not applicable to this condition. In this case the setting is accepted but ignored. The designation of OK means the setting is accepted and implemented. The designation of NO means do not use this setting with this condition.

Option/fiberMode	Off	Copy[1]	Raw	Generate	Append
BOF_OFF[1]	N/A	N/A	OK	OK	OK
BOF_ON[2]	N/A	N/A	OK	OK[3]	OK[4]
CRC_OFF	N/A	OK[5]	OK	OK	OK[5]
CRC_ON[1]	N/A	OK[5]	OK	OK	OK[5]
FLOW_CONTROL_OFF[1]	N/A	N/A	OK	OK	OK
FLOW_CONTROL_COPY	N/A	N/A	OK	OK	OK
FLOW_CONTROL_NO_COPY	N/A	N/A	OK	OK	OK
EPOCH_GEN_OFF	N/A	N/A	OK	OK	NO
EPOCH_GEN_ON[1]	N/A	N/A	OK	OK[3]	OK[6]
HEADER_OFF[1]	N/A	N/A	OK	OK	OK
HEADER_ON[2]	N/A	N/A	OK	OK	OK

1. **Default instrument setting on power-up and reset.**
2. **Not applicable unless EPOCH _GEN_ON is enabled.**

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3. **This is required if this is the first module in an append chain.**
4. **This is required unless this is the last module in an append chain.**
5. **CRC_ON or CRC_OFF must correspond to the setting of the module supplying the data to the fiber interface.**
6. **This is required for all modules in an append chain.**

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"Default values" on page 201, "age1438_init" on page 132, "age1438_error_message" on page 102

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age1438_error_message

Returns error information obtained from function calls.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_error_message(ViSession id, ViStatus statusCode, ViChar
  errorMessage[]);
```

Description

age1438_error_message takes an error return value generated by a function and translates it to a readable string. This function includes host errors as well as firmware errors.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

errorMessage represents the error message string up to 256 characters long.

Note For this parameter you must allocate a character array of at least 256 characters AGE1438_STR_LEN_MIN, including the null byte, prior to calling this function in any programming language.

statusCode represents the instrument numeric error code.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an unknown error condition or other important status condition and may return VI_WARN_UNKNOWN_STATUS.

See Also

"age1438_init" on page 132, "age1438_error_query" on page 103, "Error messages" on page 199

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age1438_error_query

Queries the module for the first error in the queue.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_error_query(ViSession id, ViPint32 errorCode, ViChar errorMessage[]);
```

Description

age1438_error_query queries the module for the oldest error and returns the corresponding error message. This function does not report host errors that originate in the C library.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

errorCode points to the instrument numeric error code.

errorMessage points to the error message string up to 80 characters long. This message also indicates what function call generated the error.

Note For this parameter you must allocate a character array of at least 256 characters AGE1438_STR_LEN_MIN, including the null byte, prior to calling this function in any programming language.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

See Also

“age1438_init” on page 132, “age1438_error_message” on page 102

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age1438_ext_sample_sync

Enables synchronization of multiple modules. This description also includes the query:

age1438_ext_sample_sync_get

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_ext_sample_sync(ViSession id, ViInt16 syncEnable);
ViStatus age1438_ext_sample_sync_get(ViSession id, ViPInt16 syncEnablePtr);
```

Note This command should be used only for specialized custom clock requirements. Most useful clock setups can be supplied by age1438_clock_setup.

Description

This command is used to provide precision sampling in multi-module systems by synchronizing them to an external sample clock. The External Trigger BNC provides the input for a synchronizing signal. A splitter and identical cables provide external sample clock and user generated external sync pulse signals to each module.

Note This command requires specialized external hardware. “External sample synchronization in multi-module systems” in chapter 3.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

syncEnable AGE1438_EXT_SAMP_SYNC_ENABLE is used after calling **age1438_clock_setup** to select a multi-module external sample setup. A counter within the module is put into its reset state and the two clocks within the module that are derived from the sample clock stop operating; this includes the clock used by the DSP circuitry that runs at one-half the sample clock, and a clock running at one-tenth of the sample clock used for multi-module sync. As soon as a rising edge is applied to the External Trigger input of the Agilent E1438, the counter resumes counting from a known state and the two clocks mentioned above have a known phase. Since the clocks may be interrupted for some time, it is a good idea to call age1438_clock_recover after the counter has resumed counting.

AGE1438_EXT_SAMP_SYNC_CANCEL releases the module’s counter from its preset state and the clocks resume. It is still advisable to call age1438_clock_recover.

syncEnablePtr points to the value of *syncEnable*.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

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See Also

"Commands which halt active measurements" on page 198, "age1438_init" on page 132, "age1438_filter_sync" on page 123, "age1438_clock_setup" on page 78, "Managing multiple modules" in chapter 3, "Using clock and sync" in chapter 3, "External sample synchronization in multi-module systems" in chapter 3

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age1438_fiber_clear

This function clears all data from the fiber interface FIFO buffers.

VXI*plug&play* Syntax

#include "age1438".h

ViStatus age1438_fiber_clear(ViSession *id*);

Description

age1438_fiber_clear clears all data from the fiber interface FIFO buffers, and resets other internal transient states such as, "*reset to beginning of epoch*" and "*return to copy phase of append*".

Parameter

id is the VXI instrument session pointer returned by the **age1438_init** function.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"age1438_init" on page 132, "age1438_status_get" on page 175

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age1438_fiber_error_clear

This function clears the **AGE1438_STATUS_FIBER_ERROR** bit in the status register.

VXI*plug&play* Syntax

#include "age1438".h

ViStatus age1438_fiber_error_clear(ViSession *id***);**

Description

age1438_fiber_error_clear clears the **AGE1438_STATUS_FIBER_ERROR** bit in the status register. If the error is continuously present, the bit will not be cleared.

Parameter

id is the VXI instrument session pointer returned by the **age1438_init** function.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

See Also

“age1438_init” on page 132

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age1438_fiber_error_get

This function returns the value of the fiber interface error register when the **AGE1438_STATUS_FIBER_ERROR** bit is set.

VXI*plug&play* Syntax

#include "age1438".h

ViStatus age1438_fiber_error_get(ViSession *id,* **ViInt16** *fiberErrorPtr***);**

Description

age1438_fiber_error_get returns the fiber interface errors.

Parameter

id is the VXI instrument session pointer returned by the **age1438_init** function.

fiberErrorPtr points to the value of the fiber interface error. The bits are defined below:

Status Bit	Definition	Numeric Value	Description
9	FI_ERR_UNLOCKED	512	Indicates that the internal receive or transmit clock is not properly locked. This could be caused by a poor quality receive signal.
8	TX_ERR_OVERRUN	256	Indicates that data transmission is not sustainable because the raw data bandwidth has exceeded the available fiber capacity.
7	RX_ERR_FIFO_OVERFLOW	128	Indicates that data arriving on the fiber receive port has been lost.
6	RX_ERR_SYNC_LOST	64	Indicates that the receiver did not detect the synchronization signal.
5	RX_ERR_DISPARITY	32	Indicates an invalid stream of bits was detected in the received data.
4	RX_ERR_CODE_VIOLATION	16	Indicates an invalid stream of bits was detected in the received data.
3	RX_ERR_ALIGNMENT	8	Indicates an invalid stream of bits was detected in the received data.
2	RX_ERR_BEGIN_DISPARITY	4	Indicates an invalid stream of bits was detected in the received data.
1	RX_ERR_CRC	2	Indicates a cyclic redundancy check error has occurred on the receiver of the fiber interface.
0	RX_ERR_SIGNAL LOST	1	Indicates the signal is no longer being received on the fiber interface.

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Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"age1438_init" on page 132, "age1438_status_get" on page 175 "age1438_error_query" on page 103, "Error messages" on page 199

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age1438_fiber_LED_get

Returns a data register indicating the state of the front panel XMT/RCV LEDs.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_fiber_LED_get(ViSession id, ViPInt16 ledRegPtr);
```

Description

This function returns a register value that indicates the current state of the front panel XMT and RCV LEDs.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

ledRegPtr points to the current value of the LED register.

AGE1438_LED_RX_SIGNAL indicates an optical signal has been detected, the RCV LED is on or blinking.

AGE1438_LED_RX_DATA indicates data was received in approximately the last 500 ms, the RCV LED is blinking.

AGE1438_LED_TX_ENABLED indicates that the transmitter in enabled, the XMT LED is on or blinking.

AGE1438_LED_TX_DATA indicates local data was transmitted in approximately the last 500 ms, the XMT LED is blinking.

Note The AGE1438_STATUS_FIBER_ACTIVE bit is set when either of or both the XMT or RCV LEDs are blinking, indicating data is being received and/or being transmitted.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

See Also

“age1438_init” on page 132, “age1438_fiber_signal_get” on page 115, “age1438_status_get” on page 175

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age1438_fiber_rcv_signals_get

Returns the current value of the PIO1, PIO2, DIR, or NRDY bits present on the fiber receiver.

VXI*plug&play* Syntax

#include "age1438".h

ViStatus age1438_fiber_rcv_signals_get(ViSession *id,* **ViPInt16** *pio1*, **ViPInt16** *pio2,* **ViPInt16** *dir*, **ViPInt16** *nrdy*)**;**

Description

These are embedded Serial FPDP signals. The use of these bits is optional. Serial FPDP does not use these four signals directly, but simply transmits them from sender to receiver. This function displays the value of recovered PIO1, PIO2, DIR and NRDY bits on the fiber receiver.

Note This function will return AGE1438_FIBER_ERROR when a signal is present, but the fiber receiver is not synced to the signal. (e.g., when the wrong interface speed has been selected). The function will also return this error if it is selected and no signal is present.

Parameter

id is the VXI instrument session pointer returned by the **age1438_init** function.

pio1 Programmable I/O bit on the fiber receiver for user defined purposes.

pio2 Programmable I/O bit on the fiber receiver for user defined purposes.

Note The following are FPDP signals that are accommodated in the Serial FPDP protocol. For further information on these signals refer to ANSI/VITA 17-1998, Front Panel Data Port Specifications.

dir returns the *dir* FPDP control signal.

nrdy returns the *nrdy* FPDP control signal.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

AGE1438_FIBER_ERROR is returned if there is no optical energy detected on the RCV fiber port.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

See Also

“age1438_init” on page 132, “age1438_fiber_setup” on page 112, “age1438_fiber_xmt_signals” on page 118.

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age1438_fiber_setup

Sets the fiber interface parameters. This description also includes information on the following functions which set up or query the fiber parameters individually:

age1438_fiber_BOF controls whether or not automatically generated BOF events are transmitted.
age1438_fiber_BOF_get returns the current status of *bofEnable*.
age1438_fiber_crc sets up the fiber interface to transmit and receive cycle redundancy checking to the same value.
age1438_fiber_crc_get gets the current status of *crcEnable*.
age1438_fiber_flow_control enables or disables transmitter flow control signals.
age1438_fiber_flow_control_get returns the value of *flowControlMode.*
age1438_fiber_mode is used to select the fiber mode.
age1438_fiber_mode_get returns the current value of *fiberMode*.
age1438_fiber_transfer_rate selects the transfer rate for fiber optical data.
age1438_fiber_transfer_rate_get returns the current value of *transferRate*.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_fiber_setup(Visession id, ViInt16 mode, ViInt16 bofEnable, ViInt16
  flowControlEnable, ViInt16 crcEnable, ViInt16 transferRate);
ViStatus age1438_fiber_BOF(Visession id, ViInt16 bofEnable);
ViStatus age1438_fiber_BOF_get(Visession id, ViPInt16 bofEnablePtr);
ViStatus age1438_fiber_crc(Visession id, ViInt16 crcEnable);
ViStatus age1438_fiber_crc_get(Visession id, ViPInt16 crcEnablePtr);
ViStatus age1438_fiber_flow_control(Visession id, ViInt16 flowControlMode);
ViStatus age1438_fiber_flow_control_get(Visession id, ViInt16 flowControlModePtr);
ViStatus age1438_fiber_mode(Visession id, ViInt16 fiberMode);
ViStatus age1438_fiber_mode_get(Visession id, ViPInt16 fiberModePtr);
ViStatus age1438_fiber_transfer_rate(Visession id, ViInt16 transferRate);
ViStatus age1438_fiber_transfer_rate_get(Visession id, ViPInt16 transferRatePtr);
```

Parameter

id is the VXI instrument session pointer returned by the **age1438_init** function.

bofEnable configures the automatic generation of BOF events. Generally, this is only used by modules in an optical append chain.

AGE1438_BOF_ON is used in an optical append chain. When used in this manner, all but the last module in the append chain should have BOF events enabled. The first module in the append chain should also have *fiberMode* set to AGE1438_FIBER_MODE_GENERATE. This will cause it to generate a BOF event after every EOE event, in other words, at the end of every data epoch it sends. All subsequent modules in an append chain should have *fiberMode* set to AGE1438_FIBER_MODE_APPEND. In this case, the module re-transmits received data epochs without modification. The reception of a BOF event alerts the module to the opportunity to insert a data epoch of its own, if available, between the reception of EOE and BOF events. AGE1438_BOF_ON is only available when *epochGenerate* is ON and *fiberMode* is either *generate* or *append,* otherwise this setting is silently accepted and ignored.

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AGE1438_BOF_OFF is the default setting. It blocks the transmission of all automatically generated BOF events. However, programmatically generated BOF events such as age1438_fiber_xmt_BOF,whichareusedinthesynchronizationoffiberinterfaces,arenotblocked.

bofEnablePtr points to the current value of *bofEnable*.

crcEnable determines whether or not cyclic redundancy checking (CRC) is performed on the fiber receiver and whether or not that information will be transmitted. Generally, cyclic redundancy checking should be enabled, but turning CRC off may solve compatibility problems with some fiber optic receivers.

AGE1438_CRC_ON enables CRC checking.

AGE1438_CRC_OFF disables CRC checking.

crcEnablePtr points to the current value of *crcEnable*.

fiberMode is used to turn the fiber interface off, configure it to copy data from the receiver to the transmitter port without adding data, configure the transmission of filtered ADC data, or configure appending ADC data to received data.

AGE1438_FIBER_MODE_RAW allows the transmission of unfiltered full bandwidth ADC data at the same time filtered ADC data is available to read on the VME bus or the local bus.

AGE1438_FIBER_MODE_OFF turns off both the fiber transmitter and receiver (although PIO1, PIO2, NRDY and DIR bits are still received). Normal data collection and digital processing continues.

Note If **age1438_data_port** is set to *fiber* while the fiber interface is turned off, the data FIFO will fill up with filtered ADC data and collection will stop. In this case, **age1438_meas_status_get** will return the error, AGE1438_NO_DATA_MEASUREMENT_PAUSED.

AGE1438_FIBER_MODE_COPY is the default *fiberMode* at power-on and reset. Data is copied from the fiber interface receiver to the fiber interface transmitter while the module is performing other measurements. For instance, filtered ADC data can be sent on the LBUS or read from the FIFO over the VME bus in accordance with the current setting of the **age1438_data_port** function, with this parameter set. However, selecting *fiber* as the data port while using this mode will result in setting the **AGE1438_STATUS_SETUP_ERROR** bit in the status register. This occurs because the fiber interface cannot perform both functions at the same time.

Note The E1438D fiber receiver's detect signal is used to activate the fiber transmitter. The E1438D fiber interface is not a data receiver. The function of the receive port is limited to copying data to the transmit port and to detecting FPDP control signals (e.g., PIO bits and flow control signals). Since signal detect works on light energy alone, there does not need to be valid data on the fiber receiver for there to be an output from the transmitter. If there is valid data present on the fiber receiver, it is copied to the fiber transmitter. This preserves data transparency but not necessarily protocol transparency. The outgoing protocol is always serial FPDP.

AGE1438_FIBER_MODE_RAW transmits unprocessed and unbuffered ADC data over the fiber interface. After selection, optical data transmission begins when the first measurement is triggered, and continues indefinitely after the measurement is complete. Transmission will continue until the fiber mode is changed to something other than AGE1438_FIBER_MODE_RAW or a fiber error occurs. While this raw data is being transmitted, filtered ADC data can still be sent over the local bus, or read from the FIFO via the VME bus. Attempting to set AGE1438_

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FIBER_MODE_RAW and the **age1438_data_port** to *fiber* will result in the AGE1438_STATUS_SETUP_ERROR bit being set. This is because the fiber interface cannot send both raw and filtered ADC data at the same time.

Note

Attempting to use the flow control while in AGE1438_FIBER_MODE_RAW fiber mode will likely result in a TX_ERR_OVERRUN error. The transmit FIFO size is only1 Kbyte

AGE1438_FIBER_MODE_GENERATE causes filtered ADC data to be transmitted over the fiber interface when one block is available in the FIFO. When flow control is enabled in this mode, an external optical receiver can send stop and go commands that cause the module to pause or resume data transmission. Received optical data other than data flow control signals are ignored.

AGE1438_FIBER_MODE_APPEND copies data from the fiber optic receiver to the fiber optic transmitter and appends its own filtered ADC data, when available.

fibermodePtr points to the current value of *fiberMode*.

flowControlMode configures fiber flow control. When flow control is on, an external optic receiver can pause or resume the fiber data transmission by sending a stop or go command. Received optical data other than flow control signals and PIO bits are ignored.

AGE1438_FLOW_CONTROL_NO_COPY responds to received flow control signals GO and STOP, and transmits GO.

AGE1438_FLOW_CONTROL_COPY responds to received flow control signals GO and STOP, and transmits the received flow control signal values.

AGE1438_FLOW_CONTROL_OFF disables fiber flow control.

flowControlModePtr points to the current value of *flowControlMode*.

transferRate sets both the transmitter and receiver raw data rates.

AGE1438_106MBS transfers data at the legacy data rate of 106 Mbytes per second. This is the default setting.

AGE1438_250MBS transfers data at 250 Mbytes per second. This is fast enough to support continuous transmission of data at the highest sample rates and bit depths.

transferRatePtr points to the current value of *transferRate*.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"Default values" on page 201, "age1438_init" on page 132, "age1438_error_message" on page 102

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age1438_fiber_signal_get

Returns a value indicating whether or not an optical signal is detected by the optical fiber interface receiver.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_fiber_signal_get(ViSession id, ViPInt16 fiberSignalPtr);
```

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

fiberSignalPtr returns a value indicating whether or not an optical signal has been detected by the fiber interface receiver.

AGE1438_NO_FIBER_SIGNAL indicates no optical signal has been detected by the fiber interface receiver.

AGE1438_FIBER_SIGNAL_PRESENT indicates an optical signal has been detected by the fiber interface receiver.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"age1438_init" on page 132, "age1438_fiber_LED_get" on page 110, "age1438_status_get" on page 175

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age1438_fiber_verify

This function verifies the operational condition of the fiber interface.

VXI*plug&play* Syntax

#include "age1438".h

ViStatus age1438_fiber_verify(ViSession *id*, **ViInt16** *verifyPath,* **ViInt16** *sec*);

Description

This function performs a verification of the fiber interface using either an internal or an external signal path. The internal signal path cannot test the actual RX/TX ports but does test the internal connections of the fiber interface to the rest of the module. The external signal path does test the RX/TX ports but requires connecting an optical short between the RX and TX fiber ports.

Note No fiber optic cables should be connected or disconnected during verification.

Parameter

id is the VXI instrument session pointer returned by the **age1438_init** function.

verifyPath indicates which path, internal or external, is being tested by **age1438_fiber_verify.**

AGE1438_FIBER_VERIFY_INTERNAL verifies the internal fiber interface connections to the rest of the module.

Note **age1438_self_test** performs five-second internal fiber verification.

AGE1438_FIBER_VERIFY_EXTERNAL verifies the operational condition of the RX and TX fiber ports by connecting an optical short between them.

sec sets the number of seconds the verification procedure will last based on this argument.

AGE1438_FIBER_VERIFY_MIN sets minimum fiber verification time in seconds.

AGE1438_FIBER_VERIFY_MAX sets maximum fiber verification time in seconds.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102

See Also

“age1438_init” on page 132, “age1438_self_test” on page 169

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age1438_fiber_xmt_BOF

This function sends a BOF event used for synchronization with other fiber interfaces before data acquisition begins.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_fiber_xmt_BOF(ViSession id);
```

Parameter

id is the VXI instrument session pointer returned by the **age1438_init** function.

Return Value **AGE1438_SUCCESS** indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"age1438_init" on page 132

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age1438_fiber_xmt_signals

Sets the transmitted values of PIO1, PIO2, DIR, and NRDY FPDP control signals on the fiber transmitter.

VXI*plug&play* Syntax

#include "age1438".h

ViStatus age1438_fiber_xmt_signals(ViSession *id,* **ViInt16** *pio1,* **ViInt16** *pio2,* **ViInt16** *dir*, **ViInt16** *nrdy*)**;**

Description

These are embedded Serial FPDP signals. The use of these bits is optional. Serial FPDP does not use these four signals directly, but simply transmits them from sender to receiver. These functions set the value of PIO1, PIO2, DIR and NRDY bits on the fiber transmitter. The default value of these signals is 0.

Parameter

id is the VXI instrument session pointer returned by the **age1438_init** function.

pio1 Programmable I/O bit on the fiber transmitter for user defined purposes.

pio2 Programmable I/O bit on the fiber transmitter for user defined purposes.

AGE1438_FIBER_SIG_ON FPDP control signals enabled.

AGE1438_FIBER_SIG_OFF FPDP control signals disabled. This is the default value for all signals.

Note The following are FPDP signals that are accommodated in the Serial FPDP protocol. For further information on these signals refer to ANSI/VITA 17-1998, Front Panel Data Port Specifications.

dir sets the *dir* FPDP control signal.

nrdy sets the *nrdy* FPDP control signal.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

See Also

“age1438_init” on page 132, “age1438_fiber_setup” on page 112, “age1438_fiber_rcv_signals_get” on page 111

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age1438_fiber_xmt_signals_get

Returns the current value of PIO1, PIO2, DIR, and NRDY bits present on the fiber transmitter.

VXI*plug&play* Syntax

#include "age1438".h

ViStatus age1438_fiber_xmt_signals_get(ViSession *id,* **ViPInt16** *pio1,* **ViPInt16** *pio2,* **ViPInt16** *dir*, **ViPInt16** *NRDY*);

Description

These are embedded Serial FPDP signals. The use of these bits is optional. Serial FPDP does not use these four signals directly, but simply transmits them from sender to receiver. These functions display the value of recovered PIO1, PIO2, DIR and NRDY bits on the fiber transmitter.

Parameter

id is the VXI instrument session pointer returned by the **age1438_init** function.

pio1 returns the current value of *pio1*.

pio2 returns the current value of *pio2*.

Note The following are FPDP signals that are accommodated in the Serial FPDP protocol. For further information on these signals refer to ANSI/VITA 17-1998, Front Panel Data Port Specifications.

dir returns the current value of *dir.*

nrdy returns the current value of *nrdy.*

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

See Also

“age1438_init” on page 132, “age1438_fiber_setup” on page 112, “age1438_fiber_rcv_signals_get” on page 111.

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age1438_filter_setup

Sets the digital filter bandwidth and decimation filter parameters. This description also includes information on the following functions which set or query the decimation filter parameters individually:

age1438_filter_decimate selects an extra factor of 2 decimation.
age1438_filter_decimate_get gets current state of extra decimation
age1438_filter_bw selects a signal filter bandwidth.
age1438_filter_bw_get gets the signal filter bandwidth

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_filter_setup(ViSession id, ViInt16 sigBw, ViInt16 decimate);
ViStatus age1438_filter_decimate(ViSession id, ViInt16 decimate);
ViStatus age1438_filter_decimate_get(ViSession id, ViPInt16 decimatePtr);
ViStatus age1438_filter_bw(ViSession id, ViInt16 sigBw);
ViStatus age1438_filter_bw_get(ViSession id, ViPInt16 sigBwPtr);
```

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

decimate selects the data output sample rate. When this parameter is set to AGE1438_DECIMATE_OFF the output sample rate is:

fs when *sigBw*=0, or

fs/2^(sigBw-1) when *sigBw*>0

When *decimate* is set to AGE1438_DECIMATE_ON the output sample rate is reduced by an additional factor of two by discarding alternate samples.

AGE1438_DECIMATE_SHIFT is like AGE1438_DECIMATE_ON but additional processing is performed that shifts the center frequency of zoomed data up by *fs*/4 and transforms the complex data stream into a real data stream without losing phase information. For consistent spectrum measurements the data scale value is doubled when using shift decimate.

decimatePtr points to the current value of the *decimate* parameter.

sigBw selects an alias protected signal filter bandwidth that is roughly ±*fs*/(2.56 × 2^(sigBw)) where *fs* is the ADC sample frequency. In zoom applications, where the center frequency is generally not zero, the zoom filter bandwidth is centered on the frequency programmed with the **age1438_frequency_setup** function. For baseband measurements the filter may equivalently be considered as a low pass filter of approximately bandwidth *fs*/(2.56 × 2^(sigBw)) since the negative frequencies are generally of no interest. The valid range of sigBw is 0 through 18. When sigBw = 0, no digital filtering is applied to the signal and the module relies on the analog anti-alias filter to limit the signal bandwidth to *fs*/2.56.

To more accurately calculate the bandwidth use the calculation ±*fs* × k/2^(sigBw) where:

k=.36 for .25 dB bandwidth
k=.44 for 3 dB bandwidth
k=.5 for 15 dB bandwidth

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k=.62 for 110 dB bandwidth

AGE1438_SIG_BW_MAX sets *sigBw* to the maximum value and the filter bandwidth to the minimum.

AGE1438_SIG_BW_MIN sets *sigBw* to the minimum value and filter bandwidth to the maximum.

sigBwPtr points to the current value of the *sigBw* parameter.

Caution

Selecting AGE1438_DECIMATE_ON when *sigBw*=0 results in aliasing (garbage data) due to upper limit of the sampling frequency and, therefore, causes the SETUP_ERROR bit to be set.

Selecting AGE1438_DECIMATE_SHIFT for non-zoomed data is not a useful configuration.

Comments

To ensure full alias-free operation the analog anti-alias filter (set by the **age1438_input_alias_filter** function) should be ON unless the application inherently bandlimits the input signal to less than *fs*/2. The analog anti-alias filter has a fixed bandwidth and thus is fully effective only when *fs* ≥ 100 MHz. If a slower external ADC clock is used, an additional analog filter of the appropriate bandwidth may be required for full alias protection.

The decimation process used to reduce the output sample rate is driven from a "decimation counter" which keeps track of which samples to save and which ones to discard for each of the octave bandwidth reduction filter stages. In multi-module systems where synchronous sampling is required, the decimation counters in all the modules must be synchronous with each other. This condition can be forced by using the **age1438_filter_sync** function.

The following table lists parameter combinations (see also "age1438_data_setup" on page 90) which result in invalid measurement conditions:

Invalid parameter combinations

resolution (bits)	dataType	decimate	sigBw
12 or 24	REAL or COMPLEX	OFF or SHIFT	1
12 or 24	REAL or COMPLEX	ON or SHIFT	0
12 or 24	COMPLEX	any	0
24	REAL or COMPLEX	OFF	2
24	REAL or COMPLEX	any	0 or 1
12 or 24	COMPLEX	SHIFT	any

All other combinations are valid.

Example

Here are some bandwidth and sample rate results using the "k" calculation for bandwidth:

fs = 100 MHz default internal ADC clock (all data in MHz)

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	Signal Bandwidth MHz		Sample Rate Msamples	
sigBw	**.25 dB**	**15 dB**	**Decimate OFF**	**Decimate ON**
1	±18	±25	N/A	50
2	±9	±12.5	50	25
3	±4.5	±6.25	25	12.5
4	±2.25	±3.125	12.5	6.5
> 4	Continue to decimate by factors of two			

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"Commands which halt active measurements" on page 198, "Default values" on page 201, "age1438_init" on page 132, "age1438_input_setup" on page 141, "age1438_clock_setup" on page 78, "age1438_frequency_setup" on page 128, "age1438_filter_sync" on page 123, "age1438_data_setup" on page 90, "Frequency and filtering" in chapter 3

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age1438_filter_sync

Synchronizes the decimation counter for multi-module systems.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_filter_sync(ViSession id);
```

Description

This function causes the digital decimation counter to be reset by the next Sync line rising transition. By calling **age1438_filter_sync** for every Agilent E1438 module using a shared ADC clock, and then calling **age1438_meas_control** to cause a sync transition, the decimation counters are prepared to start at the same time. Once this is done the decimation counters stay synchronized as long as the same ADC clock is used. You do not need to resynchronize the decimation counters when the digital filter bandwidths are changed.

Note

Resetting the decimation counter causes a transient in the digital filters. The transient takes about 30 decimated output sample periods to decay 100 dB. See the step response graphs in the Technical Specifications for more detail.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

Comment

The correct procedure for using this command is:

1. **Force all modules to idle using age1438_meas_control.**
2. **Call age1438_filter_sync for all modules.**
3. **Cause a sync transition with one module using age1438_meas_control without releasing force to idle.**
4. **Release force to idle on all modules.**

If you also want to synchronize frequency or phase see **age1438_frequency_setup**. This procedure also applies to those commands for multi-module systems.

Example

The multichan.exe example program provides an example of how to correctly set up a multi-module system with synchronous filters.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

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See Also

"age1438_init" on page 132, "age1438_filter_setup" on page 120, "age1438_frequency_setup" on page 128, "age1438_meas_control" on page 150, "Managing multiple modules" in chapter 3

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age1438_frequency_center_raw

Provides a fast way to set the center frequency

VXI*plug&play* Syntax

#include "age1438".h

ViStatus age1438_frequency_center_raw(ViSession *id*, **ViInt32** *phase*, **ViInt32** *interpolate*);
ViStatus age1438_frequency_center_raw_get(ViSession *id*, **ViPInt32** *phasePtr*, **ViPInt32** *interpolatePtr*);

Description

age1438_frequency_center_raw sets the center frequency without relying on the internal Agilent E1438 microprocessor to do floating point computations, since the internal microprocessor does not have a floating point co-processor. The parameters may be easily computed with age1438_frequency_center_raw_compute.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

phase specifies the phase part of the frequency.

interpolate specifies the interpolation part of the frequency.

phasePtr points to the current actual value of *phase*.

interpolatePtr points to the value of *interpolate*.

Comments

The following examples are provided in case you want to compute your own parameter values rather than use the recommended age1438_frequency_center_raw_compute function.

The following C code segment shows how to compute these parameters, where *freq* is `(center frequency/sample rate)`:

```
static void rawFreq(double freq, long *phase, long *interpolate)
{
    long ph, in;
    freq *= -1048576.0;
    ph = (long)fabs(freq);
    in = (long)(((fabs(freq)-(double)ph)*48828125)+0.5);
    if (freq < 0)
    {
        ph = -1 - ph;
        if (in !=0);
            in = 48828125 - in;
        else;
            ph = ph + 1;
    }
    *phase = ph;
```


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```
    *interpolate = in;
    return;
}
```

The equivalent Visual Basic example follows:

```
Private Sub rawFreq(dblFreq as Double)
    Dim dblFx As Double
    Dim lngIn As Long
    Dim lngPh As Long


    dblFx = -1048576# * dblFreq
    lngPh = Fix(Abs(dblFx))0
    lngIn = Fix(((Abs(dblFx) - CDbl(lngPh)) * 48828125#) + 0.5)
    If (dblFx < 0) Then
        lngPh = (-1) - lngPh
        If (lngIn) Then
            lngIn = 48828125 - lngIn
        Else
            lngPh = lngPh + 1
        End If
    End If
    Call age1438_frequency_center_raw(lngId, lngPh, lngIn)


End Sub
```

Example

An example of this in VB is included in the Front Panel code and can be activated by changing the following declaration in frmMain of E1438.vbp.

```
Const constFreqCentRaw = False    'When TRUE, set center frequency with
                                     'age1438_frequency_center_raw()instead of
                                     'age1438_frequency_center()
```

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"age1438_init" on page 132, "age1438_frequency_setup" on page 128, "age1438_frequency_center_raw_compute" on page 127

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age1438_frequency_center_raw_compute

Computes the raw center frequency parameters

VXI*plug&play* Syntax

#include "age1438".h

ViStatus age1438_frequency_center_raw_compute(ViSession *id*, **ViReal64** *center*, **ViPInt32** *phasePtr*, **ViPInt32** *interpolatePtr*);

Description

This function quickly computes the parameter values which you may use with age1438_frequency_center_raw**.** This function also allows you to compute many values in advance to facilitate quick frequency hopping.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

center provides the center frequency normalized to clock *fs*.

phasePtr points to the computed value of *phase*.

interpolatePtr points to the computed value of *interpolate*.

Example

Here is a Visual Basic snippet showing how to use this function:

```
Call age1438_frequency_center_raw_compute(lngId, dblCenterFreq, lngPh, lngIn)
Call age1438_frequency_center_raw(lngId, lngPh, lngIn)
```

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

See Also

“age1438_init” on page 132, “age1438_frequency_setup” on page 128, “age1438_frequency_center_raw” on page 125, “age1438_combo_setup” on page 87

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age1438_frequency_setup

Sets all the zoom center frequency parameters. This description also includes information on the following functions which set or query frequency parameters individually:

age1438_frequency_center sets the center frequency
age1438_frequency_center_get gets the current center frequency
age1438_frequency_cmplxdc selects a complex baseband measurement
age1438_frequency_cmplxdc_get gets the state of the baseband measurement mode
age1438_frequency_sync prepares the module for a synchronous frequency change
age1438_frequency_sync_get gets the state of the synchronous change mode

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_frequency_setup(ViSession id, ViInt16 cmplxDC, ViInt16 sync, ViReal64
  centerFreq);
ViStatus age1438_frequency_center(ViSession id, ViReal64 centerFreq);
ViStatus age1438_frequency_center_get(ViSession id, ViPReal64 centerFreqPtr);
ViStatus age1438_frequency_cmplxdc(ViSession id, ViInt16 cmplxDC);
ViStatus age1438_frequency_cmplxdc_get(ViSession id, ViPInt16 cmplxDCPtr);
ViStatus age1438_frequency_sync(ViSession id, ViInt16 sync);
ViStatus age1438_frequency_sync_get(ViSession id, ViPInt16 syncPtr);
```

Description

age1438_frequency_setup sets the center frequency of a zoomed measurement. The center of a frequency band of interest is converted to dc with this function. The frequency transition is phase continuous unless the center frequency is set to zero in which case the transition may be selected either to be phase continuous or phase reset. This function may also be used to synchronously change frequency in multiple-module systems.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

centerFreq supplies the center frequency normalized to the sample frequency. It is a number between –1.0 and +1.0, which is interpreted as a fraction of the sample frequency. *centerFreq* is the desired center frequency divided by the ADC sample frequency. For example, selecting 0.25 with a sample clock frequency of 100 MHz yields a center frequency of 25 MHz. The ADC sample frequency is returned by the **age1438_clock_fs_get** function. Negative frequencies select the negative image of the signal, which is spectrally inverted from the input signal.

AGE1438_CENT_FREQ_MIN selects the minimum allowable center frequency.

AGE1438_CENT_FREQ_MAX selects the maximum allowable center frequency.

AGE1438_CENT_FREQ_DEF sets the default center frequency.

centerFreqPtr points to the current actual value of the center frequency (as a fraction of the sample clock frequency).

cmplxDC selects either a phase continuous or phase reset transition when *freq*=0.

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AGE1438_CMPLXDC_OFF, combined with a frequency change to zero, causes phase to be reset to zero.

AGE1438_CMPLXDC_ON, combined with a frequency change to zero, does not reset the phase thereby generating a complex dc measurement at baseband. The state of this parameter does not affect any transition where *freq* is nonzero. Whether the real or complex data is saved and ultimately sent to the output port is determined by the **age1438_data_type** function

cmplxDCPtr points to the current actual value of *cmplxDC*.

sync when set to AGE1438_SYNC_OFF allows an immediate frequency change in single-module systems.

In multiple-module systems, setting this parameter to AGE1438_SYNC_ON prepares the modules for a frequency change, but does not actually bring about the change until the next ADC clock corresponding to the next assertion of the shared Sync signal. The Sync transition is generated by calling the **age1438_meas_control** function. Note that returning sync to OFF before the Sync signal transition has occurred forces an immediate asynchronous frequency change.

syncPtr points to the value of *sync*.

Comments

Although the *freq* parameter is a double precision floating point number, its effective resolution is 1/(2^19 × 5^11). This allows exact specification of any multiple of 1 mHz when *fs*=100 or 102.4 MHz. The actual frequency is set to the nearest available value. This value is returned by the **age1438_frequency_center_get** function. In multi-module systems this value represents the pending value rather than the current value when a frequency change is incomplete due to a pending Sync signal transition.

In multiple-module systems it is often desirable to force the frequency change to occur synchronously in order to preserve the phase relationship of the LOs. You may accomplish this by setting the sync parameter to ON for all the modules which are to be changed.

In configurations involving synchronous operation of multiple Agilent E1438 modules, the **age1438_frequency_setup** function provides a mechanism to force all LOs to the same phase. You can do this by first setting the frequency to zero and then synchronously changing the frequency to the desired value.

Example

The example program multichan.exe shows how to correctly perform synchronous frequency changes in a multi-module system.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

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See Also

"Default values" on page 201, "age1438_init" on page 132, "age1438_clock_setup" on page 78, "age1438_data_setup" on page 90, "age1438_clock_fs" on page 76, "age1438_meas_control" on page 150, "Frequency and filtering" in chapter 3, "Using clock and sync" in chapter 3, "Managing multiple modules" in chapter 3

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age1438_front_panel_clock_input

Specifies the source for the front panel clock. This description also includes the query function:

age1438_front_panel_clock_input_get

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_front_panel_clock_input(ViSession id, ViInt16 fpClock);
ViStatus age1438_front_panel_clock_input_get(ViSession id, ViPInt16 fpClockPtr);
```

Note

This command should be used only for specialized custom clock requirements. Most useful clock setups can be supplied by age1438_clock_setup.

Description

This function selects a front panel clock source that is used to drive the analog to digital converter (ADC) for single module operation or when a module is used as the master ADC clock source for a multi-module system.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

fpClock AGE1438_CLOCK_OFF specifies no front panel source.

AGE1438_SMB_CLOCK specifies clock input from the front panel Intermodule Clock/SMB connectors.

AGE1438_BNC_CLOCK specifies clock input from the front panel Ext Clock/Ref BNC connector.

fpClockPtr returns a pointer to the current value of *fpClock*.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

See Also

“Commands which halt active measurements” on page 198, “Default values” on page 201, “age1438_init” on page 132, “age1438_clock_setup” on page 78, “Using clock and sync” in chapter 3

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age1438_init

Initializes the I/O driver for a module.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_init(ViRsrc rsrcName, ViBoolean idQuery, ViBoolean resetInstr,
  ViPSession id);
```

Description

age1438_init must be the first routine called when you use the Agilent E1438 library. It establishes communication with the module and returns a module identification which is used with all subsequent functions involving this module. This function performs whatever initialization the I/O driver needs for the environment in which this library is running.

Parameters

id is a pointer to the VXI instrument Session identifier returned by this function for the module. This identifier is then used with all other functions which address this module. This value is not a VISA id and so cannot be used with VISA functions. Use age1438_attrib_get to get the VISA id.

idQuery set to AGE1438_MAG verifies the identity of the instrument by checking the manufacturer ID and model number in the module's VXI register set.

If set to AGE1438_OFF the function does not verify the module's identity. It is helpful to disable the id query if you want to use the driver with a similar module but do not need to modify the driver source code.

resetInstr places the module in the reset state when set to AGE1438_ON.

If set to AGE1438_OFF, the function disables the reset. Disabling the reset is useful for debugging in cases where resetting would take the instrument out of the state you want to test.

rsrcName specifies the interface and logical address. This descriptor varies depending on your I/O library.

An example of the descriptor form for the VISA I/O library is:

```
VXI[Board]::VXIlogical address [::INSTR]
```

Comments

If you receive a resource descriptor error, see your I/O library documentation to determine the correct descriptor form.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

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See Also

"Commands which halt active measurements" on page 198, "age1438_close" on page 86, "age1438_attrib_get" on page 74

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age1438_input_autozero

Nulls out the input dc offset voltage (applies to baseband input configuration only).

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_input_autozero(ViSession id);
```

Description

age1438_input_autozero updates a table of dc offset corrections to be used with each input setup condition. The applicable correction from this table is automatically added to the input offset parameter to achieve the correct dc offset value. Because of the length of time needed to execute this function, it is not automatically called when the module is reset. Thus, the user program is responsible for explicitly initiating the auto zero. This function should be called at least once after the temperature of the module has stabilized. The interval between calls after that depends on the importance of dc accuracy in the user application. It is not necessary to call the auto zero function for every change of input setup parameters since the correction table maintains values for all setup conditions.

Note

Calling **age1438_input_autozero** aborts any measurement already in progress and eliminates LO phase coherence and filter synchronization in a synchronous multi-module system. See the **age1438_filter_sync** and **age1438_frequency_sync** functions for details on how to re-establish LO phase coherence and filter synchronization.

Calling this function deletes any saved state and halts any measurement or fiber transfer.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

See Also

“Commands which halt active measurements” on page 198, “age1438_init” on page 132, “age1438_input_setup” on page 141, “age1438_input_offset_save” on page 136, “age1438_filter_sync” on page 123, “age1438_frequency_setup” on page 128

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age1438_input_offset

Sets the dc offset DAC setting for the current range. This description also includes the query:

age1438_input_offset_get

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_input_offset(ViSession id, ViInt16 coarseDac, ViInt16 fineDac);
ViStatus age1438_input_offset_get(ViSession id, ViPInt16 coarseDacPtr, ViPInt16
  fineDacPtr);
```

Description

These values are normally set by age1438_input_autozero so you generally would use this command only for special situations. The resultant values can be saved to non-volatile RAM with age1438_input_offset_save.

Each ac coupling range has a unique DAC setting. All dc coupling ranges use the same DAC setting as the highest range setting for ac coupling. The scaling between the coarse and fine DACs is approximately 100 to 1.

AGE1438_OFFS_DAC_MIN sets the minimum dc offset DAC setting.

AGE1438_OFFS_DAC_MAX sets the maximum dc offset DAC setting.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

coarseDac sets values of 0 to 255.

fineDac sets values of 0 to 255.

coarseDacPtr returns a pointer to the current value of *coarseDac*

fineDacPtr returns a pointer to the current value of *fineDac*

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

See Also

“Default values” on page 201, “age1438_init” on page 132, “age1438_input_autozero” on page 134, “age1438_input_offset_save” on page 136

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age1438_input_offset_save

Saves all DAC offset settings to non-volatile RAM.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_input_offset_save(ViSession id);
```

Description

Use this command if you want DAC offset settings to persist past power-down.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"age1438_init" on page 132, "age1438_input_setup" on page 141, "age1438_input_offset" on page 135

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age1438_input_range_auto

Performs auto-ranging.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_input_range_auto(ViSession id, ViReal64 sec);
```

Description

age1438_input_range_auto sets the range of a Agilent E1438 to the lowest value that does not cause an ADC overload to occur. The algorithm starts at the lowest range and moves up until there is no ADC overload.

Note Calling this function deletes any saved state and halts any measurement or fiber transfer.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

sec is the time in seconds to take data at each range to insure that an overload is detected. Setting this parameter to 0.0 results in the time being set automatically according to an algorithm that depends on block size and filter bandwidth.

AGE1438_RANGE_TIME_MIN selects the minimum autorange time.

AGE1438_RANGE_TIME_MAX selects the maximum autorange time.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"Commands which halt active measurements" on page 198, "age1438_init" on page 132, "age1438_input_setup" on page 141

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age1438_input_range_convert

Converts the input range to volts.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_input_range_convert(ViSession id, ViInt16 range, ViPReal64
  rangeVoltsPtr);
```

Description

age1438_input_range_convert converts the range of a Agilent E1438

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

range is the input range returned by **age1438_input_range_get**.

rangeVoltsPtr is the range in Volts.

Conversion values are as follows:

Variable	Range Index	Full Scale (dBm)	Full Scale Voltage (Vp)
AGE1438_RANGE_MAX	17		
AGE1438_RANGE_17	17	30	10.0
AGE1438_RANGE_16	16	27	7.08
AGE1438_RANGE_15	15	24	5.01
AGE1438_RANGE_14	14	21	3.55
AGE1438_RANGE_13	13	18	2.51
AGE1438_RANGE_12	12	15	1.78
AGE1438_RANGE_11	11	12	1.26
AGE1438_RANGE_10	10	9	.891
AGE1438_RANGE_9	9	6	.631
AGE1438_RANGE_8	8	3	.447
AGE1438_RANGE_7	7	0	.316
AGE1438_RANGE_6	6	-3	.224
INITIALIZE&CLOSE	5	-6	.158
AGE1438_RANGE_4	4	-9	.112
AGE1438_RANGE_3	3	-12	.0794
AGE1438_RANGE_2	2	-15	.0562
AGE1438_RANGE_1	1	-18	.0398
AGE1438_RANGE_0	0	-21	.0282
AGE1438_RANGE_MIN	0		

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Note These values are approximate. For more accuracy use age1438_data_scale_get.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

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See Also

"age1438_init" on page 132, "age1438_input_setup" on page 141, "age1438_data_scale_get" on page 89

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age1438_input_setup

Sets all the analog input parameters. This description also includes information on the following functions which set or query the input parameters individually:

age1438_input_alias_filter selects or bypasses the built-in analog anti-alias filter
age1438_input_alias_filter_get gets the anti-alias filter state
age1438_input_coupling selects ac or dc input coupling
age1438_input_coupling_get get the input coupling type
age1438_input_range sets the full scale range
age1438_input_range_get gets the input range
age1438_input_signal connect/disconnect the input signal to the input amplifier
age1438_input_signal_get gets the input buffer amplifier state

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_input_setup(ViSession id, ViInt16 reserved, ViInt16 range, ViInt16
  coupling, ViInt16 antiAlias, ViInt16 signal);
ViStatus age1438_input_alias_filter(ViSession id, ViInt16 antiAlias);
ViStatus age1438_input_alias_filter_get(ViSession id, ViPInt16 antiAliasPtr);
ViStatus age1438_input_coupling(ViSession id, ViInt16 coupling);
ViStatus age1438_input_coupling_get(ViSession id, ViPInt16 couplingPtr);
ViStatus age1438_input_range(ViSession id, ViInt16 range);
ViStatus age1438_input_range_get(ViSession id, ViPInt16 rangePtr);
ViStatus age1438_input_signal(ViSession id, ViInt16 signal);
ViStatus age1438_input_signal_get(ViSession id, ViPInt16 signalPtr);
```

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

antiAlias determines whether or not to use the built-in analog anti-alias filter. This filter only applies to baseband measurements.

AGE1438_ANTIALIAS_ON inserts a sharp-cutoff (9-pole) 40 MHz low-pass filter ahead of the analog-to-digital converter. You should leave the filter on at all times to insure band-limited, anti-aliased data.

AGE1438_ANTIALIAS_OFF replaces the low-pass filter with a soft-cutoff 3-pole low-pass filter.

antiAliasPtr points to the current value of the *antiAlias* parameter.

coupling specifies the ac or dc coupling mode of the input. This parameter applies to the baseband input configuration only.

AGE1438_DC connects the input directly to the 50 Ohm buffer amplifier.

AGE1438_ADC inserts a 0.2 µF capacitor between the input connector and the 50 Ohm buffer amplifier.

couplingPtr points to the current value of the *coupling* parameter for an Agilent E1438 or group of Agilent E1438s.

range is a range index number which is transformed to a full scale voltage value.

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AGE1438_RANGE_MAX sets the range to the maximum allowable.

AGE1438_RANGE_MIN sets the range to the minimum allowable.

Signal inputs with an absolute value larger than full scale generate an ADC overflow error.

Range values are as follows.

Variable	Range Index	Full Scale (dBm)	Full Scale Voltage (Vp)
AGE1438_RANGE_MAX	17		
AGE1438_RANGE_17	17	30	10.0
AGE1438_RANGE_16	16	27	7.08
AGE1438_RANGE_15	15	24	5.01
AGE1438_RANGE_14	14	21	3.55
AGE1438_RANGE_13	13	18	2.51
AGE1438_RANGE_12	12	15	1.78
AGE1438_RANGE_11	11	12	1.26
AGE1438_RANGE_10	10	9	.891
AGE1438_RANGE_9	9	6	.631
AGE1438_RANGE_8	8	3	.447
AGE1438_RANGE_7	7	0	.316
AGE1438_RANGE_6	6	–3	.224
AGE1438_RANGE_5	5	–6	.158
AGE1438_RANGE_4	4	–9	.112
AGE1438_RANGE_3	3	–12	.0794
AGE1438_RANGE_2	2	–15	.0562
AGE1438_RANGE_1	1	–18	.0398
AGE1438_RANGE_0	0	–21	.0282
AGE1438_RANGE_MIN	0		

Note These values are approximate. For more accuracy use age1438_data_scale_get.

rangePtr points to the current value of the *range* parameter.

signal determines whether or not the input signal is connected to the input amplifier.

AGE1438_SIGNAL_ON attaches the input signal to the 50 Ohm buffer amplifier.

AGE1438_SIGNAL_OFF redirects the input signal to a dummy 50 Ohm load, and feeds the buffer amplifier from an internally grounded 50 Ohm source resistance. The signal OFF setting is useful for making reference measurements without the signal applied. When using ac coupling the 0.2 µF capacitor remains between the input connector and its 50 Ohm termination.

signalPtr points to the current value of the *signal* parameter.

Comments

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To ensure full alias-free operation the analog anti-alias filter should be ON unless the application inherently bandlimits the input signal to less than *fs*/2. The analog anti-alias filter has a fixed bandwidth and thus is fully effective only when *fs* ≥ 100 MHz. If a slower external ADC clock is used, an additional analog filter of the appropriate bandwidth may be required for full alias protection.

When using the analog anti-alias filter, you may need to set the range parameter higher than the actual range of the input signal. The reason for this is that step changes of input voltage cause an overshoot and ringing response at the output of the anti-alias filter. The peak overshoot actually exceeds the input voltage step by about 20%. The range setting must accommodate this overshoot to avoid an ADC overflow.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"age1438_init" on page 132, "age1438_input_autozero" on page 134, "age1438_input_range_auto" on page 137, "age1438_input_range_convert" on page 138, "age1438_data_scale_get" on page 89

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age1438_interrupt_restore

Restores the interrupt masks to the setting last programmed with **age1438_interrupt_setup**.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_interrupt_restore(ViSession id);
```

Description

The interrupt masks set by the **age1438_interrupt_setup** function are cleared during the interrupt acknowledge cycle. This function restores the cleared interrupt masks.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"age1438_init" on page 132, "age1438_interrupt_setup" on page 145

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age1438_interrupt_setup

Sets both interrupt parameters. This description also includes information on the following functions which query the interrupt parameters individually:

age1438_interrupt_mask_get gets the interrupt event mask
age1438_interrupt_priority_get gets the VME interrupt line

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_interrupt_setup(ViSession id, ViInt16 intrNum, ViInt16 priority, ViInt16
  mask);
ViStatus age1438_interrupt_mask_get(ViSession id, ViInt16 intrNum, ViPInt16 maskPtr);
ViStatus age1438_interrupt_priority_get(ViSession id, ViInt16 intrNum, ViPInt16
  priorityPtr);
```

Description

An Agilent E1438 has two independent interrupt generators, each capable of interrupting on one of the seven VME interrupt lines when a status condition specified by a mask occurs.

age1438_interrupt_setup sets the interrupt mask, priority and which of the two interrupt generators on the Agilent E1438 is to be used. The remaining **age1438_interrupt_** functions query the mask and priority individually.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

intrNum is the number of the interrupt generator. The only values accepted are 0 and 1.

mask specifies the mask of events on which to interrupt. VXIbus specifications only allow the 8 most significant bits in the status register, bits 8 to 15, to be set as interrupts. Because of this, the desired mask value must be right shifted 8 positions. In the E1438, bits 14 and 15 of the status register cannot be used to generate interrupts, effectively leaving only 6 bits, 8 through 13, to generate interrupts.

priority specifies which of the seven VME interrupt lines to use. The only legal values are 0 through 7. Specifying 0 turns the interrupt off, while 7 is the highest priority.

maskPtr priorityPtr contain the current value of the interrupt *mask* and *priority* parameters.

Comments

Interrupt masks are cleared during the interrupt acknowledge cycle. Therefore, the command must be sent again or restored with "age1438_interrupt_restore" on page 144 in order to generate further interrupts.

Example

The program interrupt.exe described in the example programs provides an example of how to use interrupts correctly.

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Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"Default values" on page 201, "age1438_init" on page 132, "age1438_status_get" on page 175, "age1438_attrib_get" on page 74, "age1438_interrupt_restore" on page 144

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age1438_lbus_mode

Sets the local bus transmission mode (Agilent E1438D only) . This description also includes the query:

age1438_lbus_mode_get gets the current local bus mode.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_lbus_mode(ViSession id, ViInt16 lbusMode);
ViStatus age1438_lbus_mode_get(ViSession id, ViPInt16 lbusModePtr);
```

Description

age1438_lbus_mode sets the local bus to either generate, append, insert or pipeline data. The data port must be set to the local bus with the **age1438_data_port** function (See "age1438_data_setup" on page 90) before these modes take effect.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

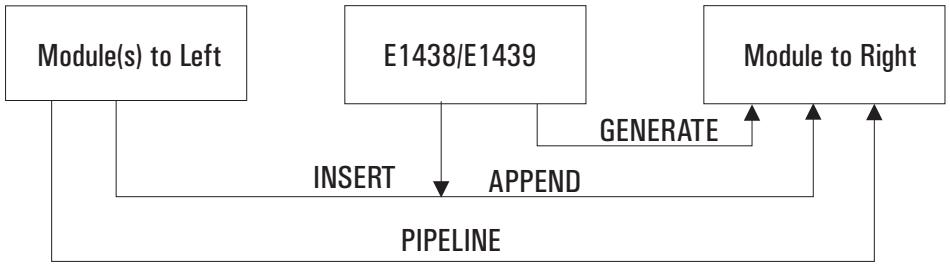
lbusMode selects the transmission mode of the local bus when it is enabled by the **age1438_data_port** function.

AGE1438_GENERATE forces the module at *id* to generate data only, not passing through data from other modules on the local bus.

AGE1438_APPEND causes the Agilent E1438 to pass data through from modules on its left and append its data to the end.

AGE1438_INSERT causes the Agilent E1438 to place its data on the local bus and then pass data through from modules on its left.

AGE1438_PIPELINE causes the Agilent E1438 to pipe data through from modules on its left without appending or inserting its own data. The state of this parameter is unaffected by switching back and forth between the local bus and the VME backplane with the **age1438_data_port** function.



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lbusModePtr points to the current value of the *lbusMode* parameter.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

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age1438_lbus_reset

Resets the local bus (Agilent E1438D only) . This description also includes the query:

age1438_lbus_reset_get gets the current local bus reset state

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_lbus_reset(ViSession id, ViInt16 lbusReset);
ViStatus age1438_lbus_reset_get(ViSession id, ViPInt16 lbusResetPtr);
```

Description

In order to avoid glitches in the local bus data, the local bus interface has strict requirements as to the order in which modules in a VXI mainframe have their local bus interface reset. Upon power-up or whenever any single module in the mainframe is put into a reset state, all modules should be placed into the reset state from left to right. Then all modules can be take out of reset from left to right.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

lbusReset puts the Agilent E1438's local bus into reset or takes it out of reset.

AGE1438_LBUS_RESET_ON puts the Agilent E1438's local bus into reset while AGE1438_LBUS_RESET_OFF takes the Agilent E1438 out of reset.

lbusResetPtr points to the current value of the *lbusReset* parameter.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

See Also

“Default values” on page 201, “age1438_init” on page 132

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age1438_meas_control

Initiates and controls measurements in multi-module systems.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_meas_control(ViSession id, ViInt16 idle, ViInt16 sync);
```

Description

age1438_meas_control explicitly controls the measurement state.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

idle selects the condition of the Idle state.

AGE1438_ASSERT holds the module in the Idle state.

AGE1438_RELEASE reverses a previous **AGE1438_ASSERT** or ensures that no forced Idle is active.

sync selects the state of the sync signal.

age1438_meas_control also changes the state of the Sync signal, which is used to arm or trigger an Agilent E1438 module. In systems containing multiple Agilent E1438 modules the Sync signal is used to arm or trigger all modules simultaneously, and also to synchronize decimation counters and local oscillators among the Agilent E1438 modules.

AGE1438_ASSERT causes the module to assert the Sync signal.

AGE1438_RELEASE causes the module to release the Sync signal. When parameters of the **age1438_clock_setup** function which enable sync output are selected the module shares the sync signal with other Agilent E1438 modules. If any one of these modules asserts this shared Sync signal it then becomes asserted for all of them. All modules must release it before the shared Sync signal is released. Asserting then releasing the Sync line is used to start a measurement, load local oscillator values, or take a digital filter out of reset. These situations require a Sync line transition but do not require that the Sync line be held in a asserted state.

Note When the Sync line is asserted, it remains asserted for an adequate number of ADC clock cycles to ensure that the signal effect propagates to all the modules in the system. You can determine when the command is completed by looking as the Sync/Idle Complete bit in the Status Register.

Note Any command that halts the current measurement (See “Commands which halt active measurements” on page 198) also releases the forced Idle and Sync controls. If you want to hold a module in Idle after one of these commands you must call age1438_meas_control again after the command that halted the current measurement.

Comments

See “The measurement loop” in chapter 3 for details on how a measurement progresses through the four states.

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This function performs the following sequence:

1. **Waits for both the AGE1438_STATUS_HARDWARE_SET and AGE1438_STATUS_SYNC_COMPLETE bits to be set.**
2. **Returns AGE1438_STATUS_WAIT_TIMEOUT if more than three seconds elapses in step 1.**
3. **Returns AGE1438_SETUP_ERROR if AGE1438_STATUS_SETUP_ERROR was detected in step 1.**
4. **Writes data to the control register as prescribed by arguments to the function.**
5. **Clears the overload count maintained by the API.** **See "Comments on Overload" on page 159**
6. **Waits for AGE1438_STATUS_SYNC_COMPLETE.**
7. **Returns AGE1438_SYNC_NOT_COMPLETE if more than three seconds elapse in step 6, otherwise it returns AGE1438_SUCCESS.**

Special conditions prevail during the Measure state. If programmed for block mode operation in the Measure state, the module asserts the Sync signal (regardless of the **age1438_meas_control** *sync* parameter setting) until a complete block of data has been collected and is available to the I/O port. When the shared Sync signal is released, indicating that all block mode data collection is finished, all block mode modules move synchronously to the idle state. In continuous mode the module releases the Sync signal immediately after moving into the measure state. This allows the **age1438_meas_control** function to manipulate the Sync signal to cause synchronous changes to LO frequency while a continuous measurement is in progress. In continuous mode a module moves to the idle state only if explicitly programmed to do so or whenever the FIFO data buffer overflows.

In addition to controlling the progression through the four module states, the Sync signal is used to allow for synchronizing the decimation counters and local oscillators of multiple Agilent E1438 modules and synchronizing the *fs*/10 clock during external sampling. This is done by calling **age1438_filter_sync** and/or **age1438_frequency_sync** prior to asserting Sync with **age1438_meas_control**. This is normally done with the module in the Idle state; however, the center frequency can also be changed in the Measure state with **age1438_frequency_sync** if the modules are all programmed for continuous (non-block mode) data collection.

If all modules in a multi-module system are in the Idle state when the **age1438_meas_control** sync parameter is asserted, the LO frequency is updated and the next measurement is armed. If all modules are in the measurement state in continuous mode, the LO frequency is synchronously updated, and the measurement continues. In continuous mode you should ensure that all modules are in the same state, either the Idle state or the Measure state, before using **age1438_meas_control** to assert Sync. Otherwise some modules re-arm while others continue the current measurement. In block mode the sync assertion is ignored unless all modules are in the Idle state.

The **age1438_meas_control** function assures that a single module is in a valid state by checking that the *hardware complete* and *sync valid* bits in the status register are both true. In synchronous multi-module systems you should use the **age1438_wait** function for each module to assure a valid state in non-master modules within a synchronous group.

In the case of systems made up of multiple mainframes you must be aware that only modules in the mainframe containing the master module, as defined by **age1438_clock_setup**, may assert sync. Any sync asserted in other mainframes is ignored by modules in all mainframes. This is true only for rear panel sync. Front panel sync is not sensitive to master mainframe designation.

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Example

The program multichan.exe described in the example programs provides an example of how to correctly set up a multi-module measurement using **age1438_meas_control** to initiate state transitions.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"Commands which halt active measurements" on page 198, "Default values" on page 201, "age1438_init" on page 132, "age1438_status_get" on page 175, "age1438_data_setup" on page 90, "age1438_filter_sync" on page 123, "age1438_frequency_setup" on page 128, "age1438_clock_setup" on page 78, "age1438_wait" on page 190, "age1438_read" on page 158, "Managing multiple modules" in chapter 3, "The measurement loop" in chapter 3, "Using clock and sync" in chapter 3

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age1438_meas_init

Initiates a measurement without first checking for valid hardware setup.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_meas_init(ViSession id);
```

Description

age1438_meas_init provides an easy way to initiate a measurement in a single module.

Note

This command is slightly faster and slightly less robust than age1438_meas_start.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

Comments

See "The measurement loop" in chapter 3 for details on how a measurement progresses through the four states.

This function performs the following sequence:

1. **Clears the overload count maintained by the API.** **See "Comments on Overload" on page 159**
2. **Moves the module to the Idle state.**
3. **Generates a Sync transition which moves the module to the Arm state.**
4. **Always returns AGE1438_SUCCESS (no error conditions can be detected by this function).**

Return Value

This function always returns **AGE1438_SUCCESS** and does not return any error conditions.

See Also

"Commands which halt active measurements" on page 198, "age1438_init" on page 132, "age1438_meas_start" on page 154, "age1438_meas_control" on page 150, "age1438_status_get" on page 175, "age1438_read" on page 158

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age1438_meas_start

Checks for valid hardware setup and then initiates a measurement.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_meas_start(ViSession id);
```

Description

age1438_meas_start provides an easy way to initiate a measurement in a single module system. This command waits for a valid hardware setup, then, if the instrument is in a valid state, performs the equivalent of **age1438_meas_init**.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

Comments

See "The measurement loop" in chapter 3 for details on how a measurement progresses through the four states.

This function performs the following sequence:

1. **Waits for AGE1438_STATUS_HARDWARE_SET bit to be set.**
2. **Returns AGE1438_START_ERROR if more than three seconds elapses in step 1.**
3. **Returns AGE1438_SETUP_ERROR if AGE1438_STATUS_SETUP_ERROR was detected in step 1.**
4. **Performs age1438_meas_init and returns AGE1438_SUCCESS.**

Example

The program acvolts.exe described in the example programs provides an example of how to initiate a very simple measurement using **age1438_meas_start**.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"Commands which halt active measurements" on page 198, "age1438_meas_control" on page 150, "age1438_meas_init" on page 153, "age1438_status_get" on page 175, "age1438_read" on page 158, "The measurement loop" in chapter 3

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age1438_meas_status_get

Returns the current measurement status.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_meas_status_get(ViSession id, ViPInt16 readValid, ViPInt16 blockReady,
  ViPInt16 overload);
```

Description

This function is useful in determining the measurement status of a module when using the fiber interface. The advantage of using this function over **age1438_status_get**, is that this function decodes the measurement-related status register bits. This function returns the current measurement status, which is represented by one of the four following values that are encoded in the bottom two bits of the status register:

Status Bit	Definition	Values
0-1	AGE1438_STATUS_MEAS_ARM_WAIT	AGE1438_NO_DATA_WAITING_FOR_ARM
	AGE1438_STATUS_MEAS_IDLE	AGE1438_NO_DATA_MEASUREMENT_PAUSED
	AGE1438_STATUS_MEAS_IN_PROGRESS	AGE1438_NO_DATA_MEASUREMENT_IN_PROGRESS
	AGE1438_STATUS_MEAS_TRIG_WAIT	AGE1438_NO_DATA_WAITING_FOR_TRIGGER

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

readValid returns the state of the AGE1438_STATUS_READ_VALID status register bit.

blockReady returns the state of the AGE1438_STATUS_BLOCK_READY status register bit.

overload returns the state of the AGE1438_STATUS_OVERLOAD status register bit.

Return Value

The return value of this function is the current measurement status, as represented by one of four numeric values that are encoded in the bottom two bits of the status register shown in the table above.

See Also

"age1438_meas_control" on page 150, "age1438_meas_init" on page 153, "age1438_status_get" on page 175, "age1438_read" on page 158, "The measurement loop" in chapter 3

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age1438_options_get

Identifies module options.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_options_get(ViSession id, ViChar options[]);
```

Description

Returns a list of options separated by commas.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

options returns a string of up to 256 characters. For example "144" indicates option 144 (memory) is installed.

Note For this parameter you must allocate a character array of at least 256 characters AGE1438_STR_LEN_MIN, including the null byte, prior to calling this function in any programming language.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"age1438_init" on page 132

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age1438_product_id_get

Gets the module's product identification string.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_product_id_get(ViSession id, ViChar productId[]);
```

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

productId returns the module ID such as E1438C or E1438D.

Note For this parameter you must allocate a character array of at least 256 characters AGE1438_STR_LEN_MIN, including the null byte, prior to calling this function in any programming language.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"age1438_init" on page 132

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age1438_read

Reads scaled 32-bit floating-point data from the VME backplane register. This description also includes the following function:

age1438_read64 reads scaled 64-bit floating-point data, implemented specifically for VEE applications.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_read(ViSession id, ViReal32 data[], ViInt32 sampleCount, ViPInt16
  overloadPtr);
ViStatus age1438_read64(ViSession id, ViReal64 data[], ViInt32 sampleCount, ViPInt16
  overloadPtr);
```

Description

age1438_read returns a block of floating-point data from the Agilent E1438 that has been scaled to be in volts. The function waits for a block of data to be ready before attempting to read the block.

These functions can only read data from the VME backplane register. The data port of the Agilent E1438 must be set to AGE1438_VME by the **age1438_data_port** function for these functions to be effective.

Note

When using this function, INSTR_REAL32 should be defined when compiling C/C++ programs. To do this, in the Microsoft Visual Development environment, go to Project Settings, select the C/C++ tab, and add INSTR_REAL32 to the preprocessor definitions. In a makefile or on a command line, supply the option "/D INSTR_REAL32" to cl.exe. See the acvolts.exe example programs.

This function performs the following sequence:

1. **Checks for AGE1438_STATUS_READ_BLOCK and AGE1438_STATUS_ OVERLOAD.**
2. **If a block of data is NOT ready:**
   A. **The function immediately returns the current measurement state.**
3. **If a block of data IS ready:**
   A. **Data is read from the module.**
   B. **It is converted to a floating point number and scaled.**
   C. **The function returns any errors that were encountered when reading the data.**
   D. **The value of the overload argument is set to indicate whether any overloads have occurred since the last successful read.**

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Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

data is a pointer to the array into which the floating point data is to be placed. Be sure to allocate sufficient storage space at this location to hold the full data record as determined by the *sampleCount* parameter. Note that when the module is set to complex data type, the output data record contains 2 × *sampleCount* floating point values. For real data the record contains *sampleCount* floating point values.

sampleCount for **age1438_read** *sampleCount* is the number of real or complex data values to read. Real data is one 32-bit floating point value. Complex data is made up of two 32-bit floating point values comprising the real and imaginary values.

for **age1438_read64** *sampleCount* is the number of real or complex data values to read. Real data is one 64-bit floating point value. Complex data is made up of two 64-bit floating point values comprising the real and imaginary values.

This should never be set larger than the blocksize parameter set in the **age1438_data_blocksize** function. In continuous data collection mode, *sampleCount* should be set equal to blocksize to ensure that the entire data block is read out.

overloadPtr returns an overload indicator. The way to properly use the overload argument for the **age1438_read** or **age1438_read64** function is this:

1. Set up the hardware.
2. Call **age1438_meas_start**.
3. Call **age1438_read** or **age1438_read64**.

   If data is not available, the read function returns immediately with one of the following return values, and the overload indication is AGE1438_OFF:

   AGE1438_NO_DATA_MEASUREMENT_IN_PROGRESS
   AGE1438_NO_DATA_MEASUREMENT_PAUSED
   AGE1438_NO_DATA_WAITING_FOR_TRIGGER
   AGE1438_NO_DATA_WAITING_FOR_ARM

   When data is available, AGE1438_SUCCESS is returned and the overload value reflects whether an overload was encountered for the given data block.
4. In continuous mode, subsequent data blocks can be read by calling a **age1438_read** or **age1438_read64** function again (**age1438_meas_start** should not be called again).
5. When used in this way, an overload indication is given for each and every data block read in block mode. In continuous mode the overload indicator only means there was an overload sometime after calling **age1438_meas_start**.

Comments on Overload

Since reading the status register clears the overload bit, overloads are tracked at the API level.

In block mode, you receive the overload indication on a block-by block basis by calling **age1438_meas_start** and **age1438_read** in sequence.

In continuous mode, depending on the effective sample rate of the instrument and how often data is read, an overload indication returned by **age1438_read** may or may not correspond to the data returned. The overload indication only means that an overload has occurred since the most recent

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call to **age1438_meas_init**, **age1438_meas_init**, or **age1438_read**, whichever was issued last. You should be aware that it is likely that the reported overload occurred in data which has been acquired in the module, is waiting in the FIFO, but has not yet been read.

Return Value

AGE1438_SUCCESS
AGE1438_NO_DATA_MEASUREMENT_IN_PROGRESS
AGE1438_NO_DATA_MEASUREMENT_PAUSED
AGE1438_NO_DATA_WAITING_FOR_TRIGGER
AGE1438_NO_DATA_WAITING_FOR_ARM

See Also

"age1438_init" on page 132, "age1438_data_setup" on page 90, "age1438_meas_start" on page 154, "age1438_meas_init" on page 153, "age1438_meas_control" on page 150, "age1438_status_get" on page 175, "The measurement loop" in chapter 3

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age1438_read_raw

Reads raw, unscaled data from the VME backplane register.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_read_raw(ViSession id, ViInt16 data[], ViInt32 wordCount, ViPInt16
  overloadPtr);
```

Description

age1438_read_raw returns a block of raw, unscaled integer data from the FIFO.

This function can only read data from the VME backplane register. The data port of the Agilent E1438 must be set to AGE1438_VME by the **age1438_data_port** function for this function to be effective.

This function performs the following sequence:

1. **Checks for AGE1438_STATUS_READ_BLOCK and AGE1438_STATUS_ OVERLOAD.**
2. **If there is an overload then the overload count maintained by the API is incremented.**
3. **If a block of data is NOT ready:**
   A. **the function immediately returns the current measurement state and**
   B. **the value of the overload argument is set to AGE1438_OFF.**
4. **If a block of date IS ready:**
   A. **data is read from the module,**
   B. **the function returns any errors that were encountered when reading the data,**
   C. **the value of the overload argument is set to AGE1438_ON, and**
   D. **the overload count maintained by the API is set to zero.**

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

data is a pointer to the array into which the raw data record is to be placed. Be sure to allocate sufficient storage space to hold the full data record as determined by the *wordCount* parameter.

wordCount *wordCount* is the total number of data values to read into the data array from the Agilent E1438 output FIFO. The maximum *wordCount* depends on the blocksize, data type, and data resolution parameter settings.

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Data type	Resolution (bits)	Words per sample
REAL	12	2
REAL	24	4
COMPLEX	12	4
COMPLEX	24	8

In continuous data collection mode, *wordCount* should be set equal to the maximum possible *wordCount* to ensure that the entire data block is read out.

overloadPtr

returns an overload indicator. See "Comments on Overload" on page 159. The way to properly use the overload argument for the **age1438_read_raw** function is this:

1. Set up the hardware.
2. Call **age1438_meas_start**.
3. Call **age1438_read_raw**.

   If data is not available, the read function returns immediately with one of the following return values, and the overload indication is AGE1438_OFF:

   AGE1438_NO_DATA_MEASUREMENT_IN_PROGRESS
   AGE1438_NO_DATA_MEASUREMENT_PAUSED
   AGE1438_NO_DATA_WAITING_FOR_TRIGGER
   AGE1438_NO_DATA_WAITING_FOR_ARM

   When data is available, AGE1438_SUCCESS is returned and the overload value reflects whether an overload was encountered for the given data block.
4. In continuous mode, subsequent data blocks can be read by calling the **age1438_read_raw** function again (**age1438_meas_start** should not be called again).
5. When used in this way, an overload indication is given for each and every data block read in block mode. In continuous mode the overload indicator only means there was an overload sometime after calling **age1438_meas_start**.

Note

The primary purpose of the **age1438_read_raw** function is to provide the fastest possible way to read blocks of data from the module. Since this command does not perform data scaling after reading data it may save 10-20% of the overall **age1438_read** time, depending on the host computer in use. The resulting data ordering is dependent on the data type and resolution. The array may be cast as a long before reading the data to provide whole words.

Example

A declaration in the Front Panel example program can be changed to exercise age1438_read_raw() in frmMain of e1438.vbp:

```
Const constFreqCentRaw = False  'when TRUE, use age1438_read_raw()
                                'instead of age1438_read
```

Return Value

AGE1438_SUCCESS
AGE1438_NO_DATA_MEASUREMENT_IN_PROGRESS

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AGE1438_NO_DATA_MEASUREMENT_PAUSED
AGE1438_NO_DATA_WAITING_FOR_TRIGGER
AGE1438_NO_DATA_WAITING_FOR_ARM

See Also

"age1438_init" on page 132, "age1438_read" on page 158, "age1438_status_get" on page 175, "age1438_data_setup" on page 90, "The measurement loop" in chapter 3

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age1438_reference_clock

Selects the source of the reference clock. This description also includes the query function:

age1438_reference_clock_get

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_reference_clock(ViSession id, ViInt16 refClock);
ViStatus age1438_reference_clock_get(ViSession id, ViPInt16 refClockPtr);
```

Note

This command should be used only for specialized custom clock requirements. Most useful clock setups can be supplied by age1438_clock_setup.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

refClock AGE1438_FRONT_PANEL_CLOCK specifies the front panel clock be used as the reference clock. Use this in conjunction with age1438_front_panel_clock_input.

AGE1438_VXI_CLOCK specifies that the VXI (rear panel) clock be used as the reference clock. Use this in conjunction with age1438_vxi_clock_output.

refClockPtr Returns a pointer to the current value of *refClock*.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"Default values" on page 201, "age1438_init" on page 132, "age1438_clock_setup" on page 78, "age1438_front_panel_clock_input" on page 131, "age1438_vxi_clock_output" on page 189, "age1438_reference_prescaler" on page 165, "Using clock and sync" in chapter 3

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age1438_reference_prescaler

Selects prescaling of the reference clock. This description also includes the query function:

age1438_reference_prescaler_get

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_reference_prescaler(ViSession id, ViInt16 refPrescaler);
ViStatus age1438_reference_prescaler_get(ViSession id, ViPInt16 refPrescalerPtr);
```

Note

This command should be used only for specialized custom clock requirements. Most useful clock setups can be supplied by age1438_clock_setup.

Description

This function should generally be left in the default mode. The alternate mode applies to a different model of the module.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

refPrescaler AGE1438_PRESCALE_BY_1 divides the reference clock by one.

AGE1438_PRESCALE_BY_4 divides the reference clock by four.

refPrescalerPtr Returns a pointer to the current value of *refPrescalerPtr*.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"Default values" on page 201, "age1438_init" on page 132, "age1438_clock_setup" on page 78, "age1438_reference_clock" on page 164, "Using clock and sync" in chapter 3

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age1438_reset

Places the module in a known state.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_reset(ViSession id);
```

Description

age1438_reset returns the module's internal data structures to the power-up state but does not reset the hardware. This function can be called separately by this function, or may be selected in conjunction with the **age1438_init** function.

Note Calling this function halts any measurement or fiber transfer.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

Comments

The reset values are listed in "Default values" on page 201.

This command takes about 100 ms to complete.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"Commands which halt active measurements" on page 198, "age1438_init" on page 132, "age1438_reset_hard" on page 167

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age1438_reset_hard

Resets the module to the power-up state.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_reset_hard(ViSession id);
```

Description

age1438_reset_hard resets the module's firmware and hardware including the processor.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

Comments

The reset values are listed in "Default values" on page 201. In addition, the hardware registers, including the save register, are reset to the power-up state.

This command takes about 15 seconds to complete.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"Commands which halt active measurements" on page 198, "age1438_init" on page 132, "age1438_reset" on page 166

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age1438_revision_query

Returns strings that identify the date of the firmware revision.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_revision_query(ViSession id, ViChar driverRev[], ViChar instrRev[]);
```

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

driverRev returns the date and time of the module's driver revision in the form:

```
a.dd.dd OPERS Ddd Mmm Date hh:mm:ss YYYY where Ddd is the
abbreviated day of the week and Date is an integer from 1 to 31
```

instrRev returns the date, time, and board number of the module's firmware revision in the form:

```
mm-dd-yyyy hh:mm 01Bd: xxxx; 02Bd:xxxx where xxxx is a
manufacturer's date code used for service purposes.
```

Note For this parameter you must allocate a character array of at least 256 characters AGE1438_STR_LEN_MIN, including the null byte, prior to calling this function in any programming language.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"age1438_init" on page 132

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age1438_self_test

Performs a self-test and returns the result of that self test.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_self_test(ViSession id, ViPInt16 testResult, ViChar testMessage[]);
```

Description

The Agilent E1438 self test includes the following tests:

- Digital: verifies the integrity of paths from LO chip through the filters to the memory controller.
- Serial: verifies the integrity of serial setup path for each board.
- Memory: fills the entire DRAM then verifies that all the data is correct.
- Analog: verifies that auto zero adjust is working and that the input is triggering.
- Clock: verifies that the 100 MHz and 102.4 MHzoscillators are is working properly.
- Fiber: performs five-second internal fiber verification.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

testMessage points to the self test status message string up to 256 characters long.

Note For this parameter you must allocate a character array of at least 256 characters AGE1438_STR_LEN_MIN, including the null byte, prior to calling this function in any programming language.

testResult points to the instrument numeric error code.

Possible test result values are:

Error Message	Error Code (hex)	Self Test Status Message
AGE1438_ST_SUCCESS	0x000	self test successful
AGE1438_ST_HARDWARE_FAIL	0x001	hardware failure
AGE1438_ST_SERIAL1_FAIL	0x002	serial 1 test failed
AGE1438_ST_SERIAL2_FAIL	0x004	serial 2 test failed
AGE1438_ST_CLOCK1_FAIL	0X008	100 MHz clock test failed
AGE1438_ST_CLOCK2_FAIL	0x010	102.4 MHz clock test failed
AGE1438_ST_MEMORY_FAIL	0x020	memory test failed
AGE1438_ST_DIGITAL1_FAIL	0x040	real data path failed
AGE1438_ST_DIGITAL2_FAIL	0x080	complex data path failed

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Error Message	Error Code (hex)	Self Test Status Message
AGE1438_ST_ANALOG_FAIL	0x100	analog test failed
AGE1438_ST_FIBER_FAIL	0x200	fiber test failed
AGE1438_ST_EXECUTION_ERR	0x4000	self-test execution error

Note The required completion time for self-test is up to 25 seconds depending on the amount of memory in the module.

Note Calling this function halts any measurement or fiber transfer.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"Commands which halt active measurements" on page 198, "age1438_init" on page 132

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age1438_serial_number

Sets the serial number of the module. This description also includes the query function:

age1438_serial_number_get

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_serial_number(ViSession id, ViChar serialNum[]);
ViStatus age1438_serial_number_get(ViSession id, ViChar serialNum[]);
```

Caution **This command is to be used for repair purposes only.**

Description

This command is used to reassign a serial number after a module has been serviced.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

serialNum sends or gets a serial number of less than 16 characters

Note For this parameter you must allocate a character array of at least 256 characters AGE1438_STR_LEN_MIN, including the null byte, prior to calling this function in any programming language.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"age1438_init" on page 132

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age1438_smb_clock_output

Specifies which clock to output from the SMB clock connectors. This description also includes the query function:

age1438_smb_clock_output_get

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_smb_clock_output(ViSession id, ViInt16 smbClock);
ViStatus age1438_smb_clock_output_get(ViSession id, ViPInt16 smbclockPtr);
```

Note

This command should be used only for specialized custom clock requirements. Most useful clock setups can be supplied by age1438_clock_setup.

Description

This function selects the source of the output for the front panel SMB clock connectors.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

smbClock

AGE1438_BNC_CLOCK specifies that the BNC input be output from the SMB clock connectors.

AGE1438_CLOCK_OFF specifies no output from the SMB clock connectors.

AGE1438_DIVIDED_ADC_CLOCK specifies that the divided ADC clock be output from the SMB clock connectors.

AGE1438_VXI_CLOCK specifies that the VXI clock be output from the SMB clock connectors.

smbClockPtr Returns a pointer to the current value of *smbClock*.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"Default values" on page 201, "age1438_init" on page 132, "age1438_clock_setup" on page 78, "age1438_front_panel_clock_input" on page 131, "Using clock and sync" in chapter 3

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age1438_state_recall

Recalls a module's previous instrument state.

age1438_state_recall

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_state_recall(ViSession id);
```

Description

This function aborts any active measurement and recalls the instrument state previously saved by age1438_state_save. This function requires >100 ms to complete.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"Commands which halt active measurements" on page 198, "age1438_init" on page 132, "age1438_state_save" on page 174

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age1438_state_save

Saves the module's current instrument state.

age1438_state_save

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_state_save(ViSession id);
```

Description

This function may be used to save a state to which you want to return later. age1438_reset does not change a saved state. The state is not saved to non-volatile RAM.

Note

The saved state is lost by issuing the following commands: age1438_input_range_auto, age1438_input_autozero, age1438_self_test, and age1438_reset_hard.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"age1438_init" on page 132, "age1438_state_recall" on page 173

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age1438_status_get

Reads status register information for the module.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_status_get(ViSession id, ViPInt16 statusPtr);
```

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

statusPtr points to the status word. The bits are defined below:

Status Bit	Definition	Description
0-1	AGE1438_STATUS_MEAS_ARM_WAIT AGE1438_STATUS_MEAS_IDLE AGE1438_STATUS_MEAS_IN_PROGRESS AGE1438_STATUS_MEAS_TRIG_WAIT	These two bits indicate the current state of the measurement loop. See "The measurement loop" in chapter 3 and "age1438_meas_status_get" on page 155 for more information about these states
2	AGE1438_STATUS_PASSED	Passed: This bit is always set to 1
3	AGE1438_STATUS_READY	This bit is set when the module is ready after power-on. See the VXIbus Specifications for more information.
4	AGE1438_STATUS_FIBER_ACTIVE	This bit is set internally whenever any data has been written to the receive FIFO, or read from the transmit FIFO of the fiber interface within the past 500 milliseconds, approximately. The bit is cleared automatically when activity ceases on the fiber interface
5	AGE1438_STATUS_FIBER_ERROR	This bit is set internally whenever an error condition occurs on the fiber interface. Reading the status register does not clear this bit. To do this, the age1438_fiber_error_clear function must be used explicitly. The function age1438_fiber_error_get can be used to read the contents of the fiber error register. If the error is continuously present, the bit will not be cleared.
6	AGE1438_STATUS_SETUP_ERROR	Setup error: An invalid parameter value was requested. If an invalid block size was requested, the closest valid block size is used until a change to an interrelated parameter makes the requested block size valid. If a data resolution, data type, filter bandwidth, trigger delay, or filter decimation parameter was requested which would result in an inability to make a measurement, the previous valid parameter is used until a change to an interrelated parameter makes the requested parameter valid
7	AGE1438_STATUS_SYNC_COMPLETE	Sync/Idle Complete: This bit is set when the most recent user-initiated Sync or Idle change has propagated through to all modules in a system. The change is a result of asserting Sync or forcing Idle via the Control Register or issuing a meas_control command or function

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Status Bit	Definition	Description
8	AGE1438_STATUS_READ_VALID	This flag is set whenever there is at least one valid 16-bit data word available to be read via the VME data register. Not valid when using the local bus data port.
9	AGE1438_STATUS_BLOCK_READY	This bit is set in continuous mode whenever the size of the data in the FIFO is equal to or greater than the block size register. Check this bit before reading data to insure that a block of data may be transferred without fear of running out of data, thereby holding up the Local bus or VME bus. This bit is set in block mode whenever the module has successfully taken a block size number of samples since the most recent trigger and is cleared when the block is read out, when force to Idle is asserted, or when the module is armed for another measurement.
10	AGE1438_STATUS_ARMED	This bit is set whenever the module is in the Trigger state, or is in the Arm state and has satisfied its pre-trigger requirements. When this bit is set, the module releases the VXI Sync line. Once all modules release the Sync line, then all modules go to the Trigger state.
11	AGE1438_STATUS_FIFO_OVERFLOW	FIFO Overflow: This bit set when the FIFO buffer overflows in continuous mode
12	AGE1438_STATUS_OVERLOAD	This bit is set whenever the ADC converts a sample that exceeds the range of the ADC. The bit is cleared when the Status register is read.
13	AGE1438_STATUS_ERROR_QUEUE	This bit is set whenever there is an error in the error queue. It is cleared when the error queue is empty
14	AGE1438_STATUS_MODID	A (1) in this field indicates that the module is not selected via the P2 MODID line. A (0) indicates that the module is selected by a high state on the P2 MODID line
15	AGE1438_STATUS_HARDWARE_SET	This bit is set when all commands are complete and the hardware has been set

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

See Also

“age1438_init” on page 132

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age1438_sync_clock

Selects the source of the sync clock. This description also includes the query function:

age1438_sync_clock_get

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_sync_clock(ViSession id, ViInt16 syncClock);
ViStatus age1438_sync_clock_get(ViSession id, ViPInt16 syncClockPtr);
```

Note

This command should be used only for specialized custom clock requirements. Most useful clock setups can be supplied by age1438_clock_setup.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

syncClock

AGE1438_SMB_CLOCK specifies using the front panel clock on the SMB connectors as the sync clock.

AGE1438_VXI_CLOCK specifies using the VXI (rear panel) clock as the sync clock.

AGE1438_DIVIDED_ADC_CLOCK specifies using the divided ADC clock as the sync clock.

syncClockPtr Returns a pointer to the current value of *syncClock*.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

See Also

“Default values” on page 201, “age1438_init” on page 132, “age1438_clock_setup” on page 78, “age1438_sync_direction” on page 178, “age1438_sync_output” on page 179, “Using clock and sync” in chapter 3

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age1438_sync_direction

Selects front or rear panel availability of the sync signal. This description also includes the query function:

age1438_sync_direction_get

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_sync_direction(ViSession id, ViInt16 syncDirection);
ViStatus age1438_sync_direction_get(ViSession id, ViPInt16 syncDirectionPtr);
```

Note

This command should be used only for specialized custom clock requirements. Most useful clock setups can be supplied by age1438_clock_setup.

Description

This function determines whether the front or rear panel sync signal is available to the other panel.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

syncDirection AGE1438_SYNC_FRNT_TO_REAR specifies that front panel sync signal be available on the VXI backplane (rear panel).

AGE1438_SYNC_REAR_TO_FRNT specifies that the VXI backplane sync signal be available on the front panel SMB sync connectors.

syncDirectionPtr Returns a pointer to the current value of *syncDirection*.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"Default values" on page 201, "age1438_init" on page 132, "age1438_sync_output" on page 179, "age1438_sync_clock" on page 177, "Using clock and sync" in chapter 3

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age1438_sync_output

Selects the output for the sync signal. This description also includes the query function:

age1438_sync_output_get

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_sync_output(ViSession id, ViInt16 syncOutput);
ViStatus age1438_sync_output_get(ViSession id, ViPInt16 syncOutputPtr);
```

Note

This command should be used only for specialized custom clock requirements. Most useful clock setups can be supplied by age1438_clock_setup.

Description

This function selects which output the module should use for it's sync signal.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

syncOutput

AGE1438_SYNC_OUT_OFF specifies no sync signal output.

AGE1438_SYNC_OUT_BOTH specifies that the sync signal be output to both the front panel SMB sync connectors and the VXI backplane.

AGE1438_SYNC_OUT_SMB specifies that the sync signal be output to the front panel SMB sync connectors.

AGE1438_SYNC_OUT_VXI specifies that the sync signal be output to the VXI backplane.

syncOutputPtr Returns a pointer to the current value of *syncOutput*.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"Default values" on page 201, "age1438_init" on page 132, "age1438_clock_setup" on page 78, "age1438_sync_clock" on page 177, "age1438_sync_direction" on page 178, "Using clock and sync" in chapter 3

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age1438_trigger_delay_actual_get

Returns the actual trigger delay from the most recent trigger event.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_trigger_delay_actual_get(ViSession id, ViPInt32 actualDelayPtr);
```

Description

This delay value provides more accuracy than the trigger delay parameter alone since it includes a measurement of the fractional part of the output sample period between the previous output sample and the actual trigger event. The trigger delay accuracy improves the delay value to one ADC sample clock period rather than one output sample period. This can result in a substantial improvement in accuracy when narrow bandwidth decimation filtering is used.

age1438_trigger_delay_actual_get must be called for each new trigger event that requires precise delay measurement. The actual delay is still expressed in ADC sample periods.

In multiple module systems, the actual delay of the triggering module should be used to correct data from other modules in the system.

Note

Due to the way the data is packed within the module, it is possible to get values from this command that represent more than one output sample.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

actualDelayPtr points to the returned actual delay from the most recent trigger event representing the actual time from the desired trigger point to the actual trigger point.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"age1438_init" on page 132, "age1438_trigger_setup" on page 182, "age1438_trigger_phase_actual_get" on page 181, "Delay and phase in triggered measurements" in chapter 3, "Trigger and phase in multi-module systems" in chapter 3

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age1438_trigger_phase_actual_get

Returns a representation of the phase value of the LO at the most recent trigger point.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_trigger_phase_actual_get(ViSession id, ViPInt16 actualPhasePtr);
```

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

actualPhasePtr points to the returned value which is an integer from –32768 to 32767 and should be interpreted as follows:

```
AGE1438_TRIG_PHASE_0 represents 0 degrees (or 0)
AGE1438_TRIG_PHASE_90 represents 90 degrees (or 16384)
AGE1438_TRIG_PHASE_180 represents ±180 degrees (or -32768)
AGE1438_TRIG_PHASE_270 represents +270 (-90) degrees (or -16384)
```

In other words, each count represents 360/65536 degrees of phase.

To convert the returned phase value to degrees, multiply the returned value by 360/65536.

In multiple module systems, the actual phase of the triggering module should be used to correct data from other modules in the system.

The returned phase value represents the digital LO's phase at the time of the actual trigger. This time may vary from the time of the desired trigger by the value returned by age1438_trigger_delay_actual_get.

The LO phase could be used in time domain averaging of blocks, or other operations involving zoomed blocks of data, so that the varying phase of the LO can be removed from the calculation.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"age1438_init" on page 132, "age1438_trigger_setup" on page 182, "age1438_trigger_delay_actual_get" on page 180, "age1438_frequency_setup" on page 128, "Delay and phase in triggered measurements" in chapter 3, "Trigger and phase in multi-module systems" in chapter 3

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age1438_trigger_setup

Sets all triggering parameters. This description also includes information on the following functions which set or query the trigger parameters individually:

age1438_trigger_adclevel specifies the trigger threshold for an ADC trigger
age1438_trigger_adclevel_get gets the ADC trigger threshold
age1438_trigger_delay specifies a pre- or post-trigger delay time
age1438_trigger_delay_get gets the trigger delay time
age1438_trigger_gen determines whether a module can generate a trigger
age1438_trigger_gen_get gets the trigger generation status
age1438_trigger_magdwell specifies the wait (in samples) before transition causes trigger
age1438_trigger_magdwell_get gets the number of dwell samples
age1438_trigger_maglevel specifies the trigger threshold for a magnitude trigger
age1438_trigger_maglevel_get gets magnitude trigger threshold
age1438_trigger_slope selects a positive or negative trigger
age1438_trigger_slope_get gets trigger slope
age1438_trigger_type determines the trigger type
age1438_trigger_type_get gets trigger type

VXI*plug&play* Syntax

#include "age1438".h

ViStatus age1438_trigger_setup(ViSession *id*, **ViInt16** *trigType*, **ViInt32** *trigDelay*, **ViInt16** *adcLevel*, **ViInt16** *magLevel*, **ViInt16** *slope*, **ViInt16** *genTrig*, **ViInt32** *magDwell*);
ViStatus age1438_trigger_adclevel(ViSession *id*, **ViInt16** *adcLevel*);
ViStatus age1438_trigger_adclevel_get(ViSession *id*, **ViPInt16** *adcLevelPtr*);
ViStatus age1438_trigger_delay(ViSession *id*, **ViInt32** *trigDelay*);
ViStatus age1438_trigger_delay_get(ViSession *id*, **ViPint32** *trigDelayPtr*);
ViStatus age1438_trigger_gen(ViSession *id*, **ViInt16** *genTrig*);
ViStatus age1438_trigger_gen_get(ViSession *id*, **ViPInt16** *genTrigPtr*);
ViStatus age1438_trigger_magdwell(ViSession *id*, **ViInt32** *magDwell*);
ViStatus age1438_trigger_magdwell_get(ViSession *id*, **ViPInt32** *magDwellPtr*);
ViStatus age1438_trigger_maglevel(ViSession *id*, **ViInt16** *magLevel*);
ViStatus age1438_trigger_maglevel_get(ViSession *id*, **ViPInt16** *magLevelPtr*);
ViStatus age1438_trigger_slope(ViSession *id*, **ViInt16** *slope*);
ViStatus age1438_trigger_slope_get(ViSession *id*, **ViPInt16** *slopePtr*);
ViStatus age1438_trigger_type(ViSession *id*, **ViInt16** *trigType*);
ViStatus age1438_trigger_type_get(ViSession *id*, **ViPInt16** *trigTypePtr*);

Description

An Agilent E1438 can be triggered to collect data in a variety of ways. The trigger can be internally generated or can come from an external source. Multiple modules can be triggered synchronously. A variable pre- and post-trigger delay can be programmed for data collection. The slope and level of the trigger point on a signal can be selected. The source of the internal trigger can be either the output of the ADC or the magnitude of the complex output of the decimation filter.

age1438_trigger_setup is the function that sets all trigger parameters at once. An Agilent E1438 generates a trigger only when it is in the Trigger state and the Sync line on the VXI backplane is released. When a trigger is generated, the Agilent E1438 asserts the Sync line.

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Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

adcLevel is used to set the triggering signal threshold when using the ADC trigger source. This threshold is (full scale × adclevel/2048), where –2048 ≤adclevel ≤2047. There is hysteresis around the threshold in order to prevent multiple triggers from a single threshold crossing. Hysteresis is 20 ADC counts, or about 1% full scale.

Use AGE1438_ADC_LEVEL_MAX to set the maximum allowable level.

Use AGE1438_ADC_LEVEL_MIN to set the minimum allowable level.

Use AGE1438_ADC_LEVEL_DEF to set the default ADC trigger threshold.

An accurate value of full scale (in volts) can be found by:

```
full scale = (age1438_data_scale_get * 2^N)/k

where N = 15 if age1438_data_resolution == AGE1438_12_BIT
   N = 29 if age1438_data_resolution == AGE1438_24_BIT

and k = 2 if age1438_filter_decimate == AGE1438_DECIMATE_SHIFT
   k = 2 if age1438_data_type == AGE1438_REAL and age1438_frequency_center is non-zero
   k = 1 otherwise
```

adcLevelPtr points to the current value of the *adclevel* parameter.

trigDelay is the time delay, in units of output samples, between when a trigger is received and the first data point in the output data.

AGE1438_TRIG_DELAY_MIN selects the minimum allowable trigger delay.

AGE1438_TRIG_DELAY_MAX selects the maximum allowable trigger delay.

AGE1438_TRIG_DELAY_DEF sets the default trigger delay.

Negative values indicate a pre-trigger condition where samples prior to the trigger event are included in the output data. The amount of pre-trigger delay is limited to the number of samples which can be saved in the buffer memory. See the **age1438_data_setup** function description for the number of bytes used per sample. The delay limits depend on the data type as follows:

Trigger delay in output samples (DRAMsize in bytes)

	24 bit complex	24 bit real 12 bit complex	12 bit real
Post trigger	2^31–1	2^31–1	2^31–1
Pre-trigger	48–(DRAMsize/6)	48–(DRAMsize/3)	48–(DRAMsize/1.5)

If *trigDelay* is < (Pre-trigger) a bad parameter error is set.

trigDelayPtr points to the current value of the of *delay*.

genTrig determines whether a module may generate a trigger.

AGE1438_GENERATE_ON enables triggering.

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AGE1438_GENERATE_OFF disables triggering. This is useful in multi-module systems with the same trigger type where you want only certain module(s) to generate a trigger.

genTrigPtr points to the current value of the *genTrig* parameter.

magDwell represents the number of samples that the signal magnitude must dwell low before begin recognized as a low for the purpose of generating a magnitude trigger.

AGE1438_MAGDWELL_DEF

AGE1438_MAGDWELL_MAX

AGE1438_MAGDWELL_MIN

magDwellPtr points to the current value of the *magDwell* parameter

magLevel is used to set the triggering to detect when the envelope of a signal crosses the threshold while using the magnitude trigger type.

AGE1438_MAG_LEVEL_MAX sets the maximum allowable level and AGE1438_MAG_LEVEL_MIN sets the minimum allowable level.

AGE1438_MAG_LEVEL_FS sets the full scale magnitude trigger threshold.

AGE1438_MAG_LEVEL_DEF sets the default magnitude trigger threshold.

The threshold is set to (AGE1438_MAG_LEVEL_SCALE × *magLevel*) dB relative to full scale signal, where −337 ≤*magLevel* ≤40.

Comment

Magnitude triggering is performed on the log magnitude of the signal. Magnitude triggering occurs when the log magnitude of the signal crosses the specified magnitude trigger threshold. Because of these facts magnitude trigger operation will not always be intuitive, and there is a case that can be misinterpreted as improper operation:

Magnitude triggering may not occur when the magnitude trigger threshold level is set below the known maximum amplitude of the input signal. The problem in such a case is that the trigger threshold level is actually set too low, so that few, if any, signal samples fall below that level. A transition from below the magnitude trigger threshold to above may never be detected if a sample is not taken while the signal is below the trigger threshold. The solution is to INCREASE the magnitude trigger level to the level at which there are frequent filter samples occurring both above and below the magnitude trigger threshold

magLevelPtr points to the current value of the *magLevel* parameter.

slope selects the edge of the trigger source on which a trigger occurs for ADC and external triggers. AGE1438_POSITIVE sets triggering on the positive slope and AGE1438_NEGATIVE on the negative slope.

slopePtr points to the current value of the of the trigger *slope* parameter.

trigType determines the trigger source.

AGE1438_ADC generates a trigger based on the raw data samples from the ADC.

AGE1438_MAG generates a trigger based on the log magnitude of the signal after it has been filtered to a selectable bandwidth around the center frequency established by the **age1438_frequency_setup** function.

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AGE1438_EXTERNAL uses transitions on the signal applied to the BNC external trigger connector on the front panel.

AGE1438_EXTERNAL_ECL uses ECL level transitions on the signal applied to the BNC external trigger connector on the front panel.

Note AGE1438_EXTERNAL_ECL has the same constant value as the AGE1438_EXTERNAL constant in the E1438C. AGE1438_EXTERNAL is retained for backward compatibility.

AGE1438_EXTERNAL_TTL uses TTL level transitions on the signal applied to the BNC external trigger connector on the front panel.

Note AGE1438_EXTERNAL_TTL is supported on all E1438B, C and D modules, but it is not supported on early E1438A modules. A module with a serial number lower than US41140000 will result in the error AGE1438_TTL_TRIGGER_NOT_SUPPORTED.

AGE1438_USER disables the module from any event-driven trigger generation though it is still possible to force the module to trigger a measurement by pulling the Sync line once the module is in the trigger state. You may do this by calling the **age1438_meas_start** function, waiting for the module to reach the trigger state, then triggering the measurement by using **age1438_meas_control** to pull the Sync line.

AGE1438_IMMEDIATE triggers a measurement immediately upon entering the trigger state.

Note In multi-module systems all modules should be use the same trigger type in order to have the same actual delay.

trigTypePtr points to the current value of *trigType*.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

See Also

“Commands which halt active measurements” on page 198, “Default values” on page 201, “age1438_init” on page 132, “age1438_frequency_setup” on page 128, “age1438_data_setup” on page 90, “age1438_data_scale_get” on page 89, “age1438_filter_setup” on page 120, “age1438_meas_start” on page 154, “age1438_meas_control” on page 150, “age1438_trigger_phase_actual_get” on page 181, “age1438_trigger_delay_actual_get” on page 180, “The measurement loop” in chapter 3, “Managing multiple modules” in chapter 3, “Delay and phase in triggered measurements” in chapter 3, “Magnitude trigger and magdwell time” in chapter 3

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age1438_vcxo

Selects whether the internal clock source in the module is turned on or off. This description also includes the query function:

age1438_vcxo_get

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_vcxo(ViSession id, ViInt16 vcxoState);
ViStatus age1438_vcxo_get(ViSession id, ViPInt16 vcxoStatePtr);
```

Note

This command should be used only for specialized custom clock requirements. Most useful clock setups can be supplied by age1438_clock_setup.

Description

This function selects whether the internal clock source is turned on or off. If an internal source is used the age1438_vcxo_freq function selects which internal source to use.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

vcxoState AGE1438_VCXO_OFF specifies that both internal clock sources are turned off.

AGE1438_VCXO_ON that an internal source is turned on.

vcxoStatePtr Returns a pointer to the actual state of the VCXO.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"Commands which halt active measurements" on page 198, "Default values" on page 201, "age1438_init" on page 132, "age1438_clock_setup" on page 78, "age1438_vcxo_freq" on page 187, "Using clock and sync" in chapter 3

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age1438_vcxo_freq

Selects which internal clock source the module should use. This description also includes the query function:

age1438_vcxo_freq_get

VXI*plug&play* Syntax

#include "age1438".h

ViStatus age1438_vcxo_freq(ViSession *id*, **ViInt16** *vcxoFreq*);
ViStatus age1438_vcxo_freq_get(ViSession *id*, **ViInt16** *vcxoFreqPtr*);

Description

This function selects which internal clock source to use. The age1438_vcxo function determines whether the internal source is activated.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

vcxoFreq AGE1438_VCXO_100000KHZ selects the 100 MHz internal VCXO source.

AGE1438_VCXO_102400KHZ selects the 102.4 MHz internal VCXO source.

vcxoFreqPtr Returns a pointer to the current value of *vcxo_freq*.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to “age1438_error_message” on page 102.

See Also

“Commands which halt active measurements” on page 198, “Default values” on page 201, “age1438_init” on page 132, “age1438_clock_setup” on page 78, “age1438_vcxo_freq_preset” on page 188, “age1438_vcxo” on page 186

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age1438_vcxo_freq_preset

Selects which internal clock source should used as a default.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_vcxo_freq_preset(ViSession id, ViInt16 vcxoFreq);
```

Description

This function selects which internal clock frequency should be set in NVRAM for use upon power-up and reset.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

vcxoFreq AGE1438_VCXO_100000KHZ uses the 100 MHz internal source.

AGE1438_VCXO_102400KHZ uses the 102.4 MHz internal source.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"Default values" on page 201, "age1438_init" on page 132, "age1438_clock_setup" on page 78, "age1438_vcxo" on page 186, "age1438_vcxo_freq" on page 187

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age1438_vxi_clock_output

Selects which clock drives the VXI clock. This description also includes the query function:

age1438_vxi_clock_output_get

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_vxi_clock_output(ViSession id, ViInt16 vxiClock);
ViStatus age1438_vxi_clock_output_get(ViSession id, ViPInt16 vxiClockPtr);
```

Note

This command should be used only for specialized custom clock requirements. Most useful clock setups can be supplied by age1438_clock_setup.

Description

This function selects which clock the module should use to drive it's VXI clock.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

vxiClock

AGE1438_FRONT_PANEL_CLOCK specifies that the specified front panel clock drive the VXI clock.

AGE1438_CLOCK_OFF specifies not driving vxi clock on the backplane.

AGE1438_DIVIDED_ADC_CLOCK specifies using the divided ADC clock to drive the vxi clock.

vxiClockPtr Returns a pointer to the current value of *vxiClock*.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"Default values" on page 201, "age1438_init" on page 132, "age1438_clock_setup" on page 78, "age1438_front_panel_clock_input" on page 131, "Using clock and sync" in chapter 3

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age1438_wait

Facilitates the synchronization and control of multi-module systems.

VXI*plug&play* Syntax

```
#include "age1438".h
ViStatus age1438_wait(ViSession id);
```

Description

This function assures that all slave modules are completely set up before issuing measurement control commands to the master module. Prior to calling **age1438_meas_control** for the master module in multi-module systems, you should call **age1438_wait** for each other module within the related synchronous group to which you have previously sent commands.

This function polls the status register of the indicated module until the **AGE1438_STATUS_HARDWARE_SET** and **AGE1438_STATUS_SYNC_COMPLETE** bits are both true, or until approximately three seconds have elapsed. The function returns **AGE1438_SUCCESS** immediately after the status bits are set, or, if the time-out limit is reached, **AGE1438_STATUS_WAIT_TIMEOUT** is returned.

Parameters

id is the VXI instrument session pointer returned by the **age1438_init** function.

Return Value

AGE1438_SUCCESS indicates that a function was successful.

Values other than **AGE1438_SUCCESS** indicate an error condition or other important status condition. To determine the error message, pass the return value to "age1438_error_message" on page 102.

See Also

"age1438_init" on page 132, "age1438_meas_start" on page 154, "age1438_meas_control" on page 150

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Equivalent numeric values for variables

Variable Name	Numeric Value
AGE1438_01_BOARD	0
AGE1438_02_BOARD	1
AGE1438_12BIT	1
AGE1438_24BIT	0
AGE1438_106MBS	0
AGE1438_250MBS	1
AGE1438_AC	1
AGE1438_ADC	1
AGE1438_ADC_LEVEL_DEF	0
AGE1438_ADC_LEVEL_MAX	2047
AGE1438_ADC_LEVEL_MIN	-2048
AGE1438_ANTIALIAS_OFF	0
AGE1438_ANTIALIAS_ON	1
AGE1438_APPEND	2
AGE1438_ASSERT	1
AGE1438_BLOCK	0
AGE1438_BLOCKSIZE_DEF	1024
AGE1438_BLOCKSIZE_MAX	805306320
AGE1438_BLOCKSIZE_MIN	2
AGE1438_BOF_OFF	0
AGE1438_BOF_ON	1
AGE1438_BNC_CLOCK	1
AGE1438_CENT_FREQ_DEF	0.0
AGE1438_CENT_FREQ_MAX	+.5
AGE1438_CENT_FREQ_MIN	-.5
AGE1438_CLOCK_OFF	0
AGE1438_CMPLXDC_OFF	0
AGE1438_CMPLXDC_ON	1
AGE1438_COMPLEX	1
AGE1438_CRC_OFF	0
AGE1438_CRC_ON	1
AGE1438_CONTINUOUS	1

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Equivalent numeric values for variables

Variable Name	Numeric Value
AGE1438_CUSTOM_CLOCK_SETUP	-1
AGE1438_DATA_DELAY_MAX	805306320
AGE1438_DATA_DELAY_MIN	0
AGE1438_DATA_REGISTER	3
AGE1438_DC	0
AGE1438_DEBUG_LEVEL_0	0
AGE1438_DEBUG_LEVEL_1	1
AGE1438_DEBUG_LEVEL_2	2
AGE1438_DEBUG_LEVEL_3	3
AGE1438_DEBUG_LEVEL_4	4
AGE1438_DEBUG_LEVEL_5	5
AGE1438_DECIMATE_OFF	0
AGE1438_DECIMATE_ON	1
AGE1438_DECIMATE_SHIFT	2
AGE1438_DIVIDE_BY_10	0
AGE1438_DIVIDE_BY_38	1
AGE1438_DIVIDED_ADC_CLOCK	2
AGE1438_EPOCH_GEN_OFF	0
AGE1438_EPOCH_GEN_ON	1
AGE1438_EPOCH_SIZE_MIN	8
AGE1438_EPOCH_SIZE_DEF	1024
AGE1438_EPOCH_SIZE_MAX	4294967292
AGE1438_EXTERNAL	2
AGE1438_ERR_BASE	0X80000000 + 0X3FFC0800
AGE1438_EXTERNAL_ECL	2
AGE1438_EXTERNAL_TTL	5
AGE1438_EXT_SAMPLE_CLOCK	2
AGE1438_EXT_SAMP_SYNC_ENABLE	1
AGE1438_EXT_SAMP_SYNC_CANCEL	0
AGE1438_FI_ERR_UNLOCKED	512
AGE1438_FIBER	2
AGE1438_FIBER_MODE_APPEND	4
AGE1438_FIBER_MODE_COPY	1
AGE1438_FIBER_MODE_GENERATE	3
AGE1438_FIBER_MODE_OFF	0
AGE1438_FIBER_MODE_RAW	2
AGE1438_FIBER_SIG_OFF	0
AGE1438_FIBER_SIG_ON	1
AGE1438_FIBER_SIGNAL_PRESENT	1

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Variable Name	Numeric Value
AGE1438_FIBER_VERIFY_INTERNAL	0
AGE1438_FIBER_VERIFY_EXTERNAL	1
AGE1438_FIBER_VERIFY_MIN	1
AGE1438_FIBER_VERIFY_MAX	1073
AGE1438_FLOW_CONTROL_OFF	0
AGE1438_FLOW_CONTROL_NO_COPY	1
AGE1438_FLOW_CONTROL_COPY	2
AGE1438_FRNT_MSTR_EXT_REF	8
AGE1438_FRNT_MSTR_INT_REF	7
AGE1438_FRNT_REAR_MSTR_EXT_REF	10
AGE1438_FRNT_REAR_MSTR_INT_REF	27
AGE1438_FRNT_REAR_SLAV_EXT_REF	28
AGE1438_FRNT_SLAV_EXT_REF	9
AGE1438_FRNT_SYNC_EXT_SAMP	21
AGE1438_FRONT_PANEL_CLOCK	3
AGE1438_FS_MAX	103e6
AGE1438_FS_MIN	10e6
AGE1438_GENERATE	1
AGE1438_GENERATE_OFF	0
AGE1438_GENERATE_ON	1
AGE1438_HEADER_INCR_MIN	0
AGE1438_HEADER_INCR_MAX	1023
AGE1438_HEADER_INDEX_MASK	0x3FF
AGE1438_HEADER_OFF	0
AGE1438_HEADER_ON	1
AGE1438_HEADER_VALUE_MIN	0
AGE1438_HEADER_VALUE_MAX	4294967295
AGE1438_IMMEDIATE	4
AGE1438_INSERT	3
AGE1438_IO_ADDRESS	1
AGE1438_IO_HANDLE	0
AGE1438_LBUS	1
AGE1438_LBUS_RESET_OFF	0
AGE1438_LBUS_RESET_ON	1
AGE1438_LED_RX_SIGNAL	1
AGE1438_LED_RX_DATA	2
AGE1438_LED_TX_ENABLED	4
AGE1438_LED_TX_DATA	8
AGE1438_MAG	3
AGE1438_MAGDWELL_DEF	1

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Equivalent numeric values for variables

Variable Name	Numeric Value
AGE1438_MAGDWELL_MAX	16777215
AGE1438_MAGDWELL_MIN	0
AGE1438_MAG_LEVEL_DEF	-128
AGE1438_MAG_LEVEL_FS	0
AGE1438_MAG_LEVEL_MAX	40
AGE1438_MAG_LEVEL_MIN	-337
AGE1438_MAG_LEVEL_SCALE	0.37628749457997662
AGE1438_NEGATIVE	1
AGE1438_NO_FIBER_SIGNAL	0
AGE1438_OFF	0
AGE1438_OFFS_DAC_MAX	255
AGE1438_OFFS_DAC_MIN	0
AGE1438_ON	1
AGE1438_PIO_OFF	0
AGE1438_PIO_ON	1
AGE1438_PIPELINE	0
AGE1438_POSITIVE	0
AGE1438_PRESCALE_BY_1	0
AGE1438_PRESCALE_BY_4	1
AGE1438_RANGE_0	0
AGE1438_RANGE_1	1
AGE1438_RANGE_2	2
AGE1438_RANGE_3	3
AGE1438_RANGE_4	4
AGE1438_RANGE_5	5
AGE1438_RANGE_6	6
AGE1438_RANGE_7	7
AGE1438_RANGE_8	8
AGE1438_RANGE_9	9
AGE1438_RANGE_10	10
AGE1438_RANGE_11	11
AGE1438_RANGE_12	12
AGE1438_RANGE_13	13
AGE1438_RANGE_14	14
AGE1438_RANGE_15	15
AGE1438_RANGE_16	16
AGE1438_RANGE_17	17
AGE1438_RANGE_MAX	17
AGE1438_RANGE_MIN	0
AGE1438_RANGE_TIME_MAX	20

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Variable Name	Numeric Value
AGE1438_RANGE_TIME_MIN	0
AGE1438_RATE_106MBS	0
AGE1438_RATE_250MBS	1
AGE1438_REAL	0
AGE1438_REAR_MSTR_EXT_REF	15
AGE1438_REAR_MSTR_INT_REF	14
AGE1438_REAR_SLAV_EXT_REF	16
AGE1438_REAR_SYNC_EXT_SAMP	22
AGE1438_RELEASE	0
AGE1438_RM_HANDLE	2
AGE1438_RX_ERR_	
AGE1438_RX_ERR_ALIGNMENT	8
AGE1438_RX_ERR_BEGIN_DISPARITY	4
AGE1438_RX_ERR_CODE_VIOLATION	16
AGE1438_RX_ERR_CRC	2
AGE1438_RX_ERR_DISPARITY	32
AGE1438_RX_ERR_FIFO_OVERFLOW	128
AGE1438_RX_ERR_SIGNAL_LOST	1
AGE1438_RX_ERR_SYNC_LOST	64
AGE1438_RX_ERR_UNLOCKED	512
AGE1438_SIG_BW_MAX	18
AGE1438_SIG_BW_MIN	0
AGE1438_SIGNAL_OFF	0
AGE1438_SIGNAL_ON	1
AGE1438_SIMPLE_EXT_REF	1
AGE1438_SIMPLE_EXT_SAMP	2
AGE1438_SIMPLE_INT_REF	0
AGE1438_SMB_CLOCK	4
AGE1438_ST_ANALOG_FAIL	0X100
AGE1438_ST_CLOCK1_FAIL	0X008
AGE1438_ST_CLOCK2_FAIL	0X010
AGE1438_ST_DIGITAL1_FAIL	0X040
AGE1438_ST_DIGITAL2_FAIL	0X080
AGE1438_ST_EXECUTION_ERR	0X4000
AGE1438_ST_FIBER_FAIL	0X200
AGE1438_ST_HARDWARE_FAIL	0X001
AGE1438_ST_MEMORY_FAIL	0X020
AGE1438_ST_SERIAL1_FAIL	0X002
AGE1438_ST_SERIAL2_FAIL	0X004
AGE1438_ST_SUCCESS	0X000

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Equivalent numeric values for variables

Variable Name	Numeric Value
AGE1438_STATUS_ARMED	0x400
AGE1438_STATUS_BLOCK_READY	0x200
AGE1438_STATUS_ERROR_QUEUE	0x2000
AGE1438_STATUS_FIBER_ACTIVE	0x10
AGE1438_STATUS_FIBER_ERROR	0x20
AGE1438_STATUS_FIFO_OVERFLOW	0x800
AGE1438_STATUS_HARDWARE_SET	0x8000
AGE1438_STATUS_MEAS_ARM_WAIT	0x1
AGE1438_STATUS_MEAS_IDLE	0x0
AGE1438_STATUS_MEAS_IN_PROGRESS	0x2
AGE1438_STATUS_MEAS_TRIG_WAIT	0x3
AGE1438_STATUS_MODID	0X4000
AGE1438_STATUS_OVERLOAD	0x1000
AGE1438_STATUS_PASSED	0x4
AGE1438_STATUS_READ_VALID	0x100
AGE1438_STATUS_READY	0x8
AGE1438_STATUS_SETUP_ERROR	0x40
AGE1438_STATUS_SYNC_COMPLETE	0x80
AGE1438_STR_LEN_MIN	256
AGE1438_SYNC_FRNT_TO_REAR	0
AGE1438_SUCCESS	0
AGE1438_SYNC_OFF	0
AGE1438_SYNC_ON	1
AGE1438_SYNC_OUT_BOTH	3
AGE1438_SYNC_OUT_OFF	0
AGE1438_SYNC_OUT_SMB	2
AGE1438_SYNC_OUT_VXI	1
AGE1438_SYNC_REAR_TO_FRNT	1
AGE1438_TRIG_DELAY_DEF	0
AGE1438_TRIG_DELAY_MAX	2147286000
AGE1438_TRIG_DELAY_MIN	-805108700
AGE1438_TRIG_PHASE_0	0
AGE1438_TRIG_PHASE_90	16384
AGE1438_TRIG_PHASE_180	-32768
AGE1438_TRIG_PHASE_270	-16384
AGE1438_TX_ERR_OVERRUN	256
AGE1438_USER	0
AGE1438_VCXO_100000KHZ	0
AGE1438_VCXO_102400KHZ	1
AGE1438_VCXO_EXT_REF	1

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Variable Name	Numeric Value
AGE1438_VCXO_INTERNAL	0
AGE1438_VCXO_OFF	0
AGE1438_VCXO_ON	1
AGE1438_VME	0
AGE1438_VXI_CLOCK	5
AGE1438_XFERSIZE_DEF	1024
AGE1438_XFERSIZE_MAX	805306320
AGE1438_XFERSIZE_MIN	2

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Commands which halt active measurements

age1438_adc_clock
age1438_clock_recover
age1438_clock_setup
age1438_combo_setup
age1438_data_blocksize
age1438_data_delay
age1438_data_resolution
age1438_data_type
age1438_data_xfersize
age1438_ext_sample_sync
age1438_fiber_verify
age1438_filter_bw
age1438_filter_decimate
age1438_filter_setup
age1438_front_panel_clock_input
age1438_init
age1438_input_autozero
age1438_input_range_auto
age1438_meas_control
age1438_meas_init
age1438_meas_start
age1438_reset
age1438_reset_hard
age1438_self_test
age1438_state_recall
age1438_trigger_delay
age1438_trigger_setup
age1438_vcxo
age1438_vcxo_freq

Commands which void synchronized multi-module setups:

age1438_clock_setup and low-level clock setup functions
age1438_clock_recover
age1438_input_autozero
age1438_input_range_auto
age1438_self_test
age1438_state_recall

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Error messages

Warnings and errors are based on the value VI_ERROR

Error Number	Parameter	Description
0x0000	AGE1438_SUCCESS	No error, command succeeded
0x80000000+0x3FFC0800	AGE1438_ERR_BASE	Base number for error values
AGE1438_ERR_BASE + 0x0001	AGE1438_BAD_COMMAND	Invalid command code
AGE1438_ERR_BASE + 0x0002	AGE1438_INVALID_HW_CONFIG	The hardware configuration is not supported
AGE1438_ERR_BASE + 0x0003	AGE1438_PARM_ERROR	Invalid command parameter
AGE1438_ERR_BASE + 0x0004	AGE1438_NV_SAVE_ERROR	Error while saving to non-volatile memory
AGE1438_ERR_BASE + 0x0005	AGE1438_DOWNLOAD_ERROR	Error while downloading new firmware
AGE1438_ERR_BASE + 0x0006	AGE1438_SERIAL_TIMEOUT	Serial bus time-out; hardware error
AGE1438_ERR_BASE + 0x0007	AGE1438_BYTE_SWAP_ERROR	Incorrect byte-order setting
AGE1438_ERR_BASE + 0x0008	AGE1438_START_ERROR	Start error
AGE1438_ERR_BASE + 0x0009	AGE1438_HARDWARE_FAILURE	Hardware failure
AGE1438_ERR_BASE + 0x000a	AGE1438_WATCHDOG_RESET_ERROR	Watchdog timer caused a hard reset, possibly due to a hardware problem
AGE1438_ERR_BASE + 0x0011	AGE1438_NO_DATA_MEASUREMENT_IN_PROGRESS	No data available, a measurement is in progress.
AGE1438_ERR_BASE + 0x00102	AGE1438_NO_DATA_MEASUREMENT_PAUSED	No data available, the measurement is paused
AGE1438_ERR_BASE + 0x0013	AGE1438_NO_DATA_WAITING_FOR_TRIGGER	No data available, trigger has not occurred
AGE1438_ERR_BASE + 0x0014	AGE1438_NO_DATA_WAITING_ FOR_ARM	No data available, acquiring pre-trigger data
AGE1438_ERR_BASE + 0x0016	AGE1438_NO_E1438_FOUND	No AGE1438 found at specified logical address
AGE1438_ERR_BASE + 0x0017	AGE1438_PROC_READY_TIMEOUT	Time-out is waiting for AGE1438 command processor
AGE1438_ERR_BASE + 0x0018	AGE1438_MEMORY_ALLOCATION_ERROR	Memory allocation error

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Error Number	Parameter	Description
AGE1438_ERR_BASE + 0x001b	AGE1438_INTERFACE_HARDWARE_INCOMPATIBILE	Interface hardware incompatible with instrument drivers
AGE1438_ERR_BASE + 0x001d	AGE1438_NULL_ID	ID parameter is zero, function aborted
AGE1438_ERR_BASE + 0x0001e	AGE1438_STATUS_WAIT_TIMEOUT	Time-out waiting for desired status
AGE1438_ERR_BASE + 0x00067	AGE1438_AUTOZERO_ERROR	Autozero error
AGE1438_ERR_BASE + 0x00068	AGE1438_AUTOZERO_CONVERGENCE_ERROR	Possible hardware problem
AGE1438_ERR_BASE + 0x00069	AGE1438_AUTOZERO_SIGN_ERROR	Possible hardware problem
AGE1438_ERR_BASE + 0x006c	AGE1438_AUTORANGE_ERROR	Autorange error
AGE1438_ERR_BASE + 0x0080	AGE1438_SETUP_ERROR	Hardware setup error
AGE1438_ERR_BASE + 0x0081	AGE1438_SYNC_NOT_COMPLETE	Command or Idle assertion did not complete
AGE1438_ERR_BASE + 0x000b	AGE1438_FIBER_ERROR	Fiber interface error
AGE1438_ERR_BASE + 0x0015	AGE1438_FIBER_HARDWARE_REQUIRED	Fiber hardware required error
AGE1438_ERR_BASE + 0x0019	AGE1438_TTL_TRIGGER_NOT_SUPPORTED	Hardware does not support TTL trigger

Errors required for SICL/SPIL when using HP E1485

Error Number	Parameter	Description
AGE1438_ERR_BASE + 0x0082	AGE1438_UNKNOWN_STATUS	Unknown error
AGE1438_ERR_BASE + 0x0083	AGE1438_SHARED_MEMORY_MAP_ERROR	Conflict in memory mapping
AGE1438_ERR_BASE + 0x0084	AGE1438_SPIL_ERROR	Unexpected SPIL error
AGE1438_ERR_BASE + 0x0085	AGE1438_SICL_ERROR	SICL specific error

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Default values

Function	Parameter	Default Value
"age1438_adc_clock" on page 72	adcClock	AGE1438_VCXO_INTERNAL
"age1438_adc_divider" on page 73	adcDivider	AGE1438_DIVIDE_BY_10
"age1438_clock_setup" on page 78	clockSetup	AGE1438_SIMPLE_INT_REF
"age1438_data_setup" on page 90	blocksize	AGE1438_BLOCKSIZE_DEF
	dataDelay	AGE1438_DATA_DELAY_MIN
	dataType	AGE1438_REAL
	mode	AGE1438_BLOCK
	port	AGE1438_VME
	resolution	AGE1438_12BIT
"age1438_data_xfersize" on page 96	xfersize	AGE1438_XFERSIZE_DEF
"age1438_epoch_setup" on page 98	epochGenerate	AGE1438_EPOCH_GEN_ON
	epochSize	AGE1438_EPOCH_SIZE_DEF
	headerEnable	AGE1438_HEADER_OFF
	incrementCount	AGE1438_HEADER_INCR_MIN
	headerValue	AGE1438_HEADER_VALUE_MIN
"age1438_ext_sample_sync" on page 104	syncEnable	AGE1438_EXT_SAMP_SYNC_CANCEL
"age1438_fiber_setup" on page 112	bofEnable	AGE1438_BOF_OFF
	crcEnable	AGE1438_CRC_ON
	fiberMode	AGE1438_FIBER_MODE_COPY
	flowControlEnable	AGE1438_FLOW_CONTROL_OFF
	transferRate	AGE1438_106MBS
"age1438_fiber_xmt_signals" on page 118	pio1	AGE1438_FIBER_SIG_OFF
	pio2	AGE1438_FIBER_SIG_OFF
	dir	AGE1438_FIBER_SIG_OFF
	nrdy	AGE1438_FIBER_SIG_OFF
"age1438_filter_setup" on page 120	decimate	AGE1438_DECIMATE_OFF
	sigBw	AGE1438_SIG_BW_MIN
"age1438_frequency_setup" on page 128	cmplxDC	AGE1438_CMPLXDC_OFF
	centerFreq	AGE1438_CENT_FREQ_DEF
	sync	AGE1438_SYNC_OFF
"age1438_front_panel_clock_input" on page 131	fpClock	AGE1438_CLOCK_OFF
"age1438_input_setup" on page 141	antialias	AGE1438_ANTIALIAS_ON

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Default values

Function	Parameter	Default Value
	coupling	AGE1438_DC
	range	AGE1438_RANGE_MAX
	signal	AGE1438_SIGNAL_ON
"age1438_interrupt_setup" on page 145	mask	0
	priority	0
"age1438_lbus_mode" on page 147	lbusMode	AGE1438_PIPELINE
"age1438_lbus_reset" on page 149	lbusReset	AGE1438_LBUS_RESET_ON
"age1438_meas_control" on page 150	idle	AGE1438_RELEASE
	sync	AGE1438_RELEASE
"age1438_reference_clock" on page 164	refClock	AGE1438_VXI_CLOCK
"age1438_reference_prescaler" on page 165	refPrescaler	AGE1438_PRESCALE_BY_1
"age1438_smb_clock_output" on page 172	smbClock	AGE1438_CLOCK_OFF
"age1438_sync_clock" on page 177	syncClock	AGE1438_DIVIDED_ADC_CLOCK
"age1438_sync_direction" on page 178	syncDirection	AGE1438_SYNC_FRNT_TO_REAR
"age1438_sync_output" on page 179	syncOutput	AGE1438_SYNC_OUT_OFF
"age1438_trigger_setup" on page 182	adcLevel	AGE1438_ADC_LEVEL_DEF
	genTrig	AGE1438_GENERATE_ON
	magDwell	AGE1438_MAGDWELL_DEF
	magLevel	AGE1438_MAG_LEVEL_DEF
	slope	AGE1438_POSITIVE
	trigDelay	AGE1438_TRIG_DELAY_DEF
	trigType	AGE1438_IMMEDIATE
"age1438_vcxo" on page 186	vcxoState	AGE1438_VCXO_ON
"age1438_vcxo_freq" on page 187	vcxoFreq	AGE1438_VCXO_100000KHZ
"age1438_vcxo_freq_preset" on page 188	vcxoFreq	AGE1438_VCXO_102400KHZ
"age1438_vxi_clock_output" on page 189	vxiClock	AGE1438_CLOCK_OFF

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VXI*plug&play* Syntax Quick Reference

ViStatus age1438_adc_clock(**ViSession** *id*, **ViInt16** *adcClock*)
ViStatus age1438_adc_clock_get(**ViSession** *id*, **ViPInt16** *adcClockPtr*)
ViStatus age1438_adc_divider(**ViSession** *id*, **ViInt16** *adcDivider*)
ViStatus age1438_adc_divider_get(**ViSession** *id*, **ViPInt16** *adcDividerPtr*)
ViStatus age1438_attrib_get(**ViSession** *id*, **ViInt16** *attribute*, **ViPint32** *value*)
ViStatus age1438_cal_get(**ViSession** *id*, **ViInt16** *board,* **ViPInt32** *datestampPtr*)
ViStatus age1438_clock_fs(**ViSession** *id*, **ViReal64** *fs*)
ViStatus age1438_clock_fs_get(**ViSession** *id*, **ViPReal64** *fsPtr*)
ViStatus age1438_clock_recover(**ViSession** *id*)
ViStatus age1438_clock_setup(**ViSession** *id*, **ViInt16** *clockSetup*)
ViStatus age1438_clock_setup_get(**ViSession** *id*, **ViPInt16** *clockSetupPtr*)
ViStatus age1438_close(**ViSession** *id*)
ViStatus age1438_combo_setup(**ViSession** *id*, **ViInt16** *sigBw*, **ViInt32** *blocksize*, **ViInt32** *phase*, **ViInt32** *interpolate*)
ViStatus age1438_data_memsize_get(**ViSession** *id*, **ViPInt16** *memSizePtr*)
ViStatus age1438_data_scale_get(**ViSession** *id*, **ViPReal64** *scalePtr*)
ViStatus age1438_data_setup(**ViSession** *id*, **ViInt16** *dataType*, **ViInt16** *resolution*, **ViInt16** *mode*, **ViInt32** *blocksize*, **ViInt32** *dataDelay*, *reserved*, **ViInt16** *port*)
ViStatus age1438_data_blocksize(**ViSession** *id*, **ViInt32** *blocksize*)
ViStatus age1438_data_blocksize_get(**ViSession** *id*, **ViPint32** *blocksizePtr*)
ViStatus age1438_data_delay(**ViSession** *id*, **ViInt32** *dataDelay*)
ViStatus age1438_data_delay_get(**ViSession** *id*, **ViPInt32** *dataDelayPtr*)
ViStatus age1438_data_mode(**ViSession** *id*, **ViInt16** *mode*)
ViStatus age1438_data_mode_get(**ViSession** *id*, **ViPInt16** *modePtr*)
ViStatus age1438_data_port(**ViSession** *id*, **ViInt16** *port*)
ViStatus age1438_data_port_get(**ViSession** *id*, **ViPInt16** *portPtr*)
ViStatus age1438_data_resolution(**ViSession** *id*, **ViInt16** *resolution*)
ViStatus age1438_data_resolution_get(**ViSession** *id*, **ViPInt16** *resolutionPtr*)
ViStatus age1438_data_type(**ViSession** *id*, **ViInt16** *dataType*)
ViStatus age1438_data_type_get(**ViSession** *id*, **ViPInt16** *dataTypePtr*)
ViStatus age1438_data_xfersize(**ViSession** *id*, **ViInt32** *xfersize*)
ViStatus age1438_data_xfersize_get(**ViSession** *id*, **ViPInt32** *xfersizePtr*)
ViStatus age1438_driver_debug_level(**ViSession** *id*, **ViInt16** *debugLevel*)
ViStatus age1438_driver_debug_level_get(**ViSession** *id*, **ViPInt16** *debugLevelPtr*)
ViStatus age1438_epoch_setup(Visession *id***, ViInt16** *epochGenerate***, ViInt32** *epochSize***, ViInt16** *headerEnable***, ViInt32** *initialValue***, ViInt32** *incrementCount*)
ViStatus age1438_epoch_generate(Visession *id***, ViInt16** *epochGenterate*)
ViStatus age1438_epoch_generate_get(Visession *id***, ViPInt16** *epochGenteratePtr*)
ViStatus age1438_epoch_header(Visession *id***, ViInt32** *headerValue***, ViInt32** *incrementCount*)
ViStatus age1438_epoch_header_get(Visession *id***, ViPInt32** *headerValuePtr***, ViPInt32** *incrementCountPtr*)
ViStatus age1438_epoch_header_enable(Visession *id***, ViInt16** *headerEnable*)

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ViStatus age1438_epoch_header_enable_get(Visession *id***, ViPInt16** *headerEnablePtr*)
ViStatus age1438_epoch_size(Visession *id***, ViInt32** *epochSize*)
ViStatus age1438_epoch_size_get(Visession *id***, ViPInt32** *epochSizePtr*);
ViStatus age1438_error_message(ViSession *id*, **ViStatus** *statusCode*, **ViChar** *errorMessage[]*)
ViStatus age1438_error_query(ViSession *id*, **ViPint32** *errorCode*, **ViChar** *errorMessage[]*)
ViStatus age1438_ext_sample_sync(ViSession *id***, ViInt16** *syncEnable*)
ViStatus age1438_ext_sample_sync_get(ViSession *id***, ViPInt16** *syncEnablePtr*)
ViStatus age1438_fiber_clear(ViSession *id*)
ViStatus age1438_fiber_error_clear(ViSession *id*)
ViStatus age1438_fiber_error_get(ViSession *id,* **ViInt16** *fiberErrorPtr*)
ViStatus age1438_fiber_LED_get(ViSession *id*, **ViPInt16** *ledRegPtr*)
ViStatus age1438_fiber_rcv_signals_get(ViSession *id,* **ViPInt16** *pio1*, **ViPInt16** *pio2,* **ViPInt16** *dir*, **ViPInt16** *nrdy*);
ViStatus age1438_fiber_setup(Visession *id***, ViInt16** *mode***, ViInt16** *bofEnable***, ViInt16** *flowControlEnable***, ViInt16** *crcEnable***, ViInt16** *transferRate***)**
ViStatus age1438_fiber_BOF(Visession *id***, ViInt16** *bofEnable***)**
ViStatus age1438_fiber_BOF_get(Visession *id***, ViPInt16** *bofEnablePtr***)**
ViStatus age1438_fiber_crc(Visession *id***, ViInt16** *crcEnable***)**
ViStatus age1438_fiber_crc_get(Visession *id***, ViPInt16** *crcEnablePtr***)**
ViStatus age1438_fiber_flow_control(Visession *id***, ViInt16** *flowControlMode***)**
ViStatus age1438_fiber_flow_control(Visession *id***, ViInt16** *flowControlModePtr***)**
ViStatus age1438_fiber_mode(Visession *id***, ViInt16** *fiberMode***)**
ViStatus age1438_fiber_mode_get(Visession *id***, ViPInt16** *fiberModePtr***)**
ViStatus age1438_fiber_signal_get(ViSession *id*, **ViPInt16** *fiberSignalPtr*)
ViStatus age1438_fiber_transfer_rate(Visession *id***, ViInt16** *transferRate***)**
ViStatus age1438_fiber_transfer_rate_get(Visession *id***, ViPInt16** *transferRatePtr***)**
ViStatus age1438_fiber_verify(ViSession *id*, **ViInt16** *verifyPath,* **ViInt16** *sec*)
ViStatus age1438_fiber_xmt_BOF(ViSession *id*)
ViStatus age1438_fiber_xmt_signals(ViSession *id,* **ViInt16** *pio1,* **ViInt16** *pio2,* **ViInt16** *dir*, **ViInt16** *nrdy*)
ViStatus age1438_fiber_xmt_signals_get(ViSession *id,* **ViInt16** *pio1,* **ViInt16** *pio2,* **ViInt16** *dir*, **ViInt16** *nrdy*)
ViStatus age1438_filter_setup(ViSession *id*, **ViInt16** *sigBw*, **ViInt16** *decimate*)
ViStatus age1438_filter_decimate(ViSession *id*, **ViInt16** *decimate*)
ViStatus age1438_filter_decimate_get(ViSession *id*, **ViPInt16** *decimatePtr*)
ViStatus age1438_filter_bw(ViSession *id*, **ViInt16** *sigBw*)
ViStatus age1438_filter_bw_get(ViSession *id*, **ViPInt16** *sigBwPtr*)
ViStatus age1438_filter_sync(ViSession *id*)
ViStatus age1438_frequency_center_raw(ViSession *id*, **ViInt32** *phase*, ViInt32 *interpolate*)
ViStatus age1438_frequency_center_raw_get(ViSession *id*, **ViPInt32** *phasePtr*, ViPInt32 *interpolatePtr*)
ViStatus age1438_frequency_center_raw_compute(ViSession *id*, **ViReal64** *center*, **ViPInt32** *phasePtr*, **ViPInt32** *interpolatePtr*)
ViStatus age1438_frequency_setup(ViSession *id*, **ViInt16** *cmplxDC*, **ViInt16** *sync*, **ViReal64** *centerFreq*)
ViStatus age1438_frequency_center(ViSession *id*, **ViReal64** *centerFreq*)
ViStatus age1438_frequency_center_get(ViSession *id*, **ViPReal64** *centerFreqPtr*)
ViStatus age1438_frequency_cmplxdc(ViSession *id*, **ViInt16** *cmplxDC*)
ViStatus age1438_frequency_cmplxdc_get(ViSession *id*, **ViPInt16** *cmplxDCPtr*)
ViStatus age1438_frequency_sync(ViSession *id*, **ViInt16** *sync*)
ViStatus age1438_frequency_sync_get(ViSession *id*, **ViPInt16** *syncPtr*)

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ViStatus age1438_front_panel_clock_input(**ViSession** *id*, **ViInt16** *fpClock*)
ViStatus age1438_front_panel_clock_input_get(**ViSession** *id*, **ViPInt16** *fpClockPtr*)
ViStatus age1438_init(**ViRsrc** *rsrcName*, **ViBoolean** *idQuery*, **ViBoolean** *resetInstr*, **ViPSession** *id*)
ViStatus age1438_input_autozero(**ViSession** *id*)
ViStatus age1438_input_offset(**ViSession** *id*, **ViInt16** *coarseDac*, **ViInt16** *fineDac*)
ViStatus age1438_input_offset_get(**ViSession** *id*, **ViPInt16** *coarseDacPtr*, **ViPInt16** *fineDacPtr*)
ViStatus age1438_input_offset_save(**ViSession** *id*)
ViStatus age1438_input_range_auto(**ViSession** *id*, **ViReal64** *sec*)
ViStatus age1438_input_range_convert(**ViSession** *id*, **ViInt16** *range*, **ViPReal64** *rangeVoltsPtr*)
ViStatus age1438_input_setup(**ViSession** *id*, **ViInt16** *reserved*, **ViInt16** *range*, **ViInt16** *coupling*, **ViInt16** *antiAlias*, **ViInt16** *signal*)
ViStatus age1438_input_alias_filter(**ViSession** *id*, **ViInt16** *antiAlias*)
ViStatus age1438_input_alias_filter_get(**ViSession** *id*, **ViPInt16** *antiAliasPtr*)
ViStatus age1438_input_coupling(**ViSession** *id*, **ViInt16** *coupling*)
ViStatus age1438_input_coupling_get(**ViSession** *id*, **ViPInt16** *couplingPtr*)
ViStatus age1438_input_range(**ViSession** *id*, **ViInt16** range)
ViStatus age1438_input_range_get(**ViSession** *id*, **ViPInt16** *rangePtr*)
ViStatus age1438_input_signal(**ViSession** *id*, **ViInt16** *signal*)
ViStatus age1438_input_signal_get(**ViSession** *id*, **ViPInt16** *signalPtr*)
ViStatus age1438_interrupt_restore(**ViSession** *id*)
ViStatus age1438_interrupt_setup(**ViSession** *id*, **ViInt16** *intrNum*, **ViInt16** *priority*, **ViInt16** *mask*)
ViStatus age1438_interrupt_mask_get(**ViSession** *id*, **ViInt16** *intrNum*, **ViPInt16** *maskPtr*)
ViStatus age1438_interrupt_priority_get(**ViSession** *id*, **ViInt16** *intrNum*, **ViPInt16** *priorityPtr*)
ViStatus age1438_lbus_mode(**ViSession** *id*, **ViInt16** *lbusMode*)
ViStatus age1438_lbus_mode_get(**ViSession** *id*, **ViPInt16** *lbusModePtr*)
ViStatus age1438_lbus_reset(**ViSession** *id*, **ViInt16** *lbusReset*)
ViStatus age1438_lbus_reset_get(**ViSession** *id*, **ViPInt16** *lbusResetPtr*)
ViStatus age1438_meas_control(**ViSession** *id*, **ViInt16** *idle*, **ViInt16** *sync*)
ViStatus age1438_meas_init(**ViSession** *id*)
ViStatus age1438_meas_start(**ViSession** *id*)
ViStatus age1438_meas_status_get(**ViSession** *id,* **ViPInt16** *readValid***, ViPInt16** *blockReady,* **ViPInt16** *overload***)**
ViStatus age1438_options_get(**ViSession** *id*, **ViChar** *options[]*)
ViStatus age1438_product_id_get(**ViSession** *id*, **ViChar** *productId[]*)
ViStatus age1438_read(**ViSession** *id*, **ViReal32** *data[]*, **ViInt32** *sampleCount*, **ViPInt16** *overloadPtr*)
ViStatus age1438_read64(**ViSession** *id*, **ViReal64** *data[]*, **ViInt32** *sampleCount*, **ViPInt16** *overloadPtr*)
ViStatus age1438_read_raw(**ViSession** *id*, **ViInt16** *data[]*, **ViInt32** *wordCount*, **ViPInt16** *overloadPtr*)
ViStatus age1438_reference_clock(**ViSession** *id*, **ViInt16** *refClock*)
ViStatus age1438_reference_clock_get(**ViSession** *id*, **ViPInt16** *refClockPtr*)
ViStatus age1438_reference_prescaler(**ViSession** *id*, **ViInt16** *refPrescaler*)
ViStatus age1438_reference_prescaler_get(**ViSession** *id*, **ViPInt16** *refPrescalerPtr*)
ViStatus age1438_reset(**ViSession** *id*)
ViStatus age1438_reset_hard(**ViSession** *id*)
ViStatus age1438_revision_query(**ViSession** *id*, **ViChar** *driverRev[]*, **ViChar** *instrRev[]*)

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ViStatus age1438_self_test(**ViSession** *id*, **ViPInt16** *testResult*, **ViChar** *testMessage[]*)
ViStatus age1438_serial_number(**ViSession** *id*, **ViChar** *serialNum[]*)
ViStatus age1438_serial_number_get(**ViSession** *id*, **ViChar** *serialNum[]*)
ViStatus age1438_smb_clock_output(**ViSession** *id*, **ViInt16** *smbClock*)
ViStatus age1438_smb_clock_output_get(**ViSession** *id*, **ViPInt16** *smbclockPtr*)
ViStatus age1438_state_recall(**ViSession** *id*)
ViStatus age1438_state_save(**ViSession** *id*)
ViStatus age1438_status_get(**ViSession** *id*, **ViPInt16** *statusPtr*)
ViStatus age1438_sync_clock(**ViSession** *id*, **ViInt16** *syncClock*)
ViStatus age1438_sync_clock_get(**ViSession** *id*, **ViPInt16** *syncClockPtr*)
ViStatus age1438_sync_direction(**ViSession** *id*, **ViInt16** *syncDirection*)
ViStatus age1438_sync_direction_get(**ViSession** *id*, **ViPInt16** *syncDirectionPtr*)
ViStatus age1438_sync_output(**ViSession** *id*, **ViInt16** *syncOutput*)
ViStatus age1438_sync_output_get(**ViSession** *id*, **ViPInt16** *syncOutputPtr*)
ViStatus age1438_trigger_delay_actual_get(**ViSession** *id*, **ViPInt32** *actualDelayPtr*)
ViStatus age1438_trigger_phase_actual_get(**ViSession** *id*, **ViPInt16** *actualPhasePtr*)
ViStatus age1438_trigger_setup(**ViSession** *id*, **ViInt16** *trigType*, **ViInt32** *trigDelay*, **ViInt16** *adcLevel*, **ViInt16** *magLevel*, **ViInt16** *slope*, **ViInt16** *generate*, **ViInt32** *magDwell*)
ViStatus age1438_trigger_adclevel(**ViSession** *id*, **ViInt16** *adcLevel*)
ViStatus age1438_trigger_adclevel_get(**ViSession** *id*, **ViPInt16** *adcLevelPtr*)
ViStatus age1438_trigger_delay(**ViSession** *id*, **ViInt32** *trigDelay*)
ViStatus age1438_trigger_delay_get(**ViSession** *id*, **ViPint32** *trigDelayPtr*)
ViStatus age1438_trigger_gen(**ViSession** *id*, **ViInt16** *genTrig*)
ViStatus age1438_trigger_gen_get(**ViSession** *id*, **ViPInt16** *genTrigPtr*)
ViStatus age1438_trigger_magdwell(**ViSession** *id*, **ViInt32** *magDwell*)
ViStatus age1438_trigger_magdwell_get(**ViSession** *id*, **ViPInt32** *magDwellPtr*)
ViStatus age1438_trigger_maglevel(**ViSession** *id*, **ViInt16** *magLevel*)
ViStatus age1438_trigger_maglevel_get(**ViSession** *id*, **ViPInt16** *magLevelPtr*)
ViStatus age1438_trigger_slope(**ViSession** *id*, **ViInt16** *slope*)
ViStatus age1438_trigger_slope_get(**ViSession** *id*, **ViPInt16** *slopePtr*)
ViStatus age1438_trigger_type(**ViSession** *id*, **ViInt16** *trigType*)
ViStatus age1438_trigger_type_get(**ViSession** *id*, **ViPInt16** *trigTypePtr*)
ViStatus age1438_vcxo(**ViSession** *id*, **ViInt16** *vcxoState*)
ViStatus age1438_vcxo_get(**ViSession** *id*, **ViPInt16** *vcxoStatePtr*)
ViStatus age1438_vcxo_freq(**ViSession** *id*, **ViInt16** *vcxoFreq*)
ViStatus age1438_vcxo_freq_get(**ViSession** *id*, **ViInt16** *vcxoFreqPtr*)
ViStatus age1438_vcxo_freq_preset(**ViSession** *id*, **ViInt16** *vcxoFreq*)
ViStatus age1438_vxi_clock_output(**ViSession** *id*, **ViInt16** *vxiClock*)
ViStatus age1438_vxi_clock_output_get(**ViSession** *id*, **ViPInt16** *vxiClockPtr*)
ViStatus age1438_wait(**ViSession** *id*)

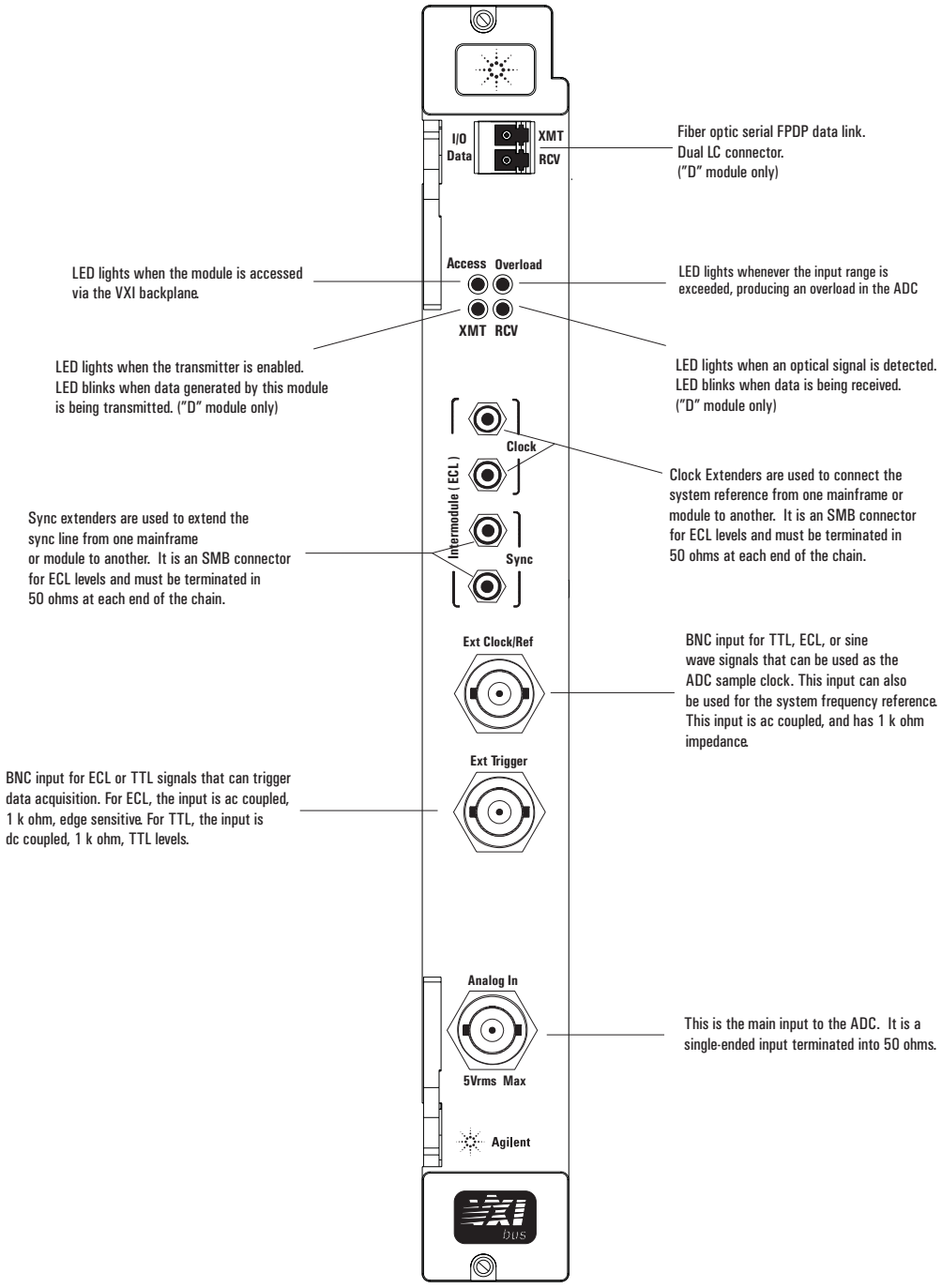
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Module Description

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Front Panel Description



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VXI backplane connections

Power Supplies and Ground

The E1438 conforms to the VME and VXI specifications for pin assignment. The current drawn from each supply is listed in the Technical Specifications.

Data Transfer Bus

The E1438 conforms to the VME and VXI specifications for pin assignment and protocol. Only A16/D16/D32 data transfers are supported, thus the upper addresses are ignored.

DTB Arbitration Bus

The E1438 is not capable of requesting bus control, thus it does not use the Arbitration bus. To conform to the VME and VXI specifications, it passes the bus lines through.

Priority Interrupt Bus

The E1438 generates interrupts by applying a programmable mask to its status bits. The priority of the interrupt is determined by the interrupt priority setting in the control register.

Utility Bus

The VME specification provides a set of lines collectively called the utility bus. Of these lines, the E1438 only uses the SYSRESET* line.

Pulling the SYSRESET* line low (a hardware reset) has the same effect as setting the reset bit in the Control Register (a software reset), with two exceptions. The exceptions are:

- The Control Register is also reset.
- All logic arrays are reloaded.

Reloading the logic arrays enables the hardware reset to recover from power dropouts, which may invalidate the logic setup.

Local Bus

The VXI specification includes a 12-wire local bus between adjacent module slots. Using the local bus, Agilent Technologies has defined a standard byte-wide ECL protocol that transfers data from left to right at up to 100 Mbyte/second. The E1438D can be programmed to output its data using this high speed port instead of the VME data output register. The Data Port Control register determines which output port is used.

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Trigger Lines

The VXI specification provides 8 TTL and 2 ECL trigger lines that can be used for module-specific signaling. When programmed in a multi-input configuration, the E1438 uses the ECL trigger lines, designating ECLTRG0 as the SYNC line and ECLTRG1 as the 10 MHz Reference Clock (CLOCK). These lines can be extended to other mainframes using the SMB connectors on the front panel. The SMB connectors can also be used for intermodule synchronization within a mainframe, leaving the ECL trigger lines free for other purposes.

The CLOCK line is the master reference clock for a synchronous system of multiple E1438 modules. Only one E1438 module in each mainframe is allowed to drive this line.

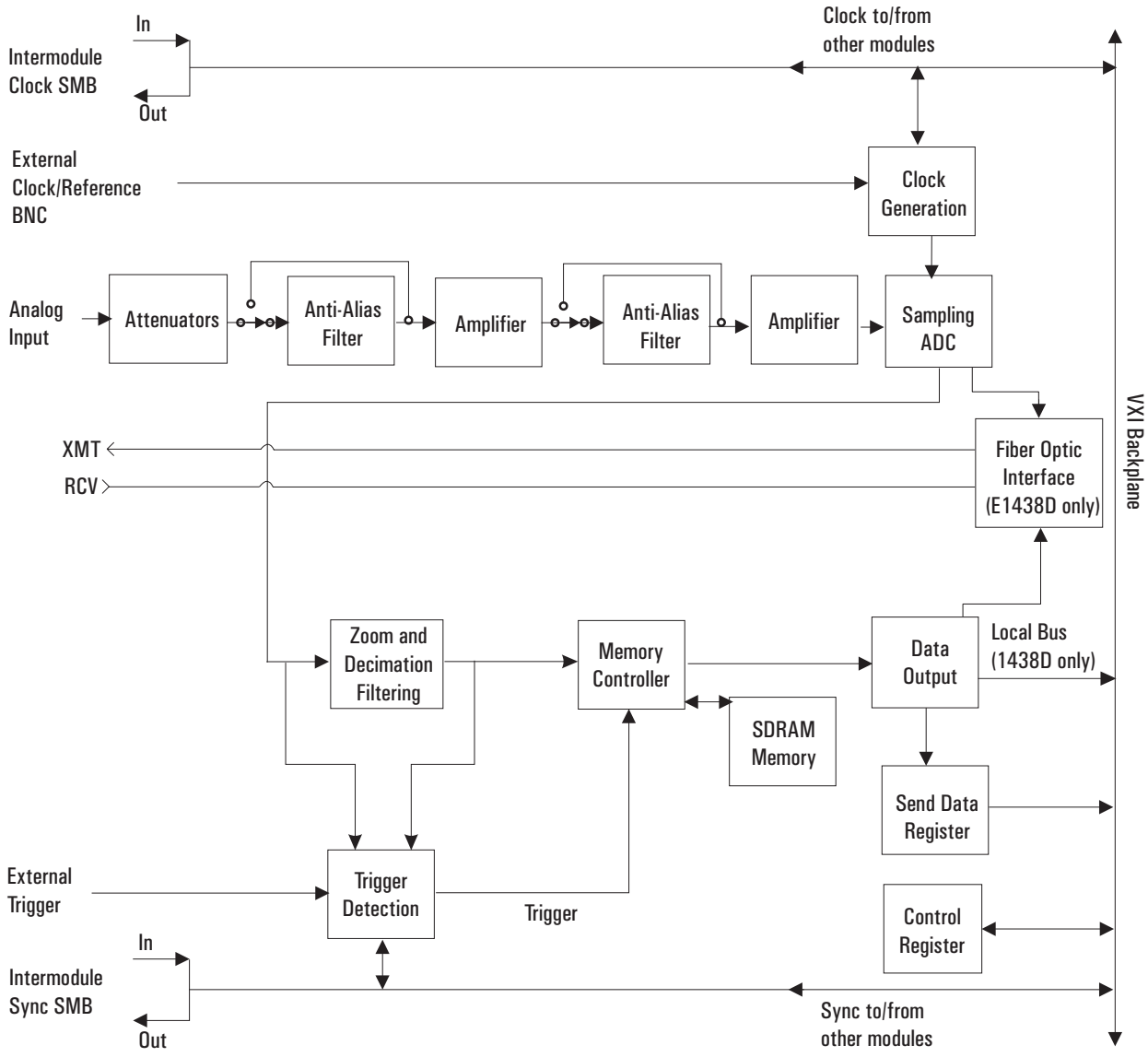
The SYNC line is used to send timing signals among E1438 modules in a multi-input system. Any module that drives this line must do so synchronously with CLOCK so that transitions on SYNC do not occur near the rising edge of CLOCK. This ensures that all modules with a synchronous state machine clocked on CLOCK interprets SYNC in a consistent manner for each cycle of the state machine. SYNC is used for synchronizing, arming, and triggering signals between E1438 modules. The interpretation of the SYNC line is dependent on the states of the module described in “The measurement loop” on page 23. The E1438 module is also capable of controlling the SYNC line synchronously via the control register.

For more information on multi-module operation see “Managing multiple modules” on page 32.

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Block diagram and description

More detailed descriptions of selected elements in the diagram below appear further on in this section.



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Input

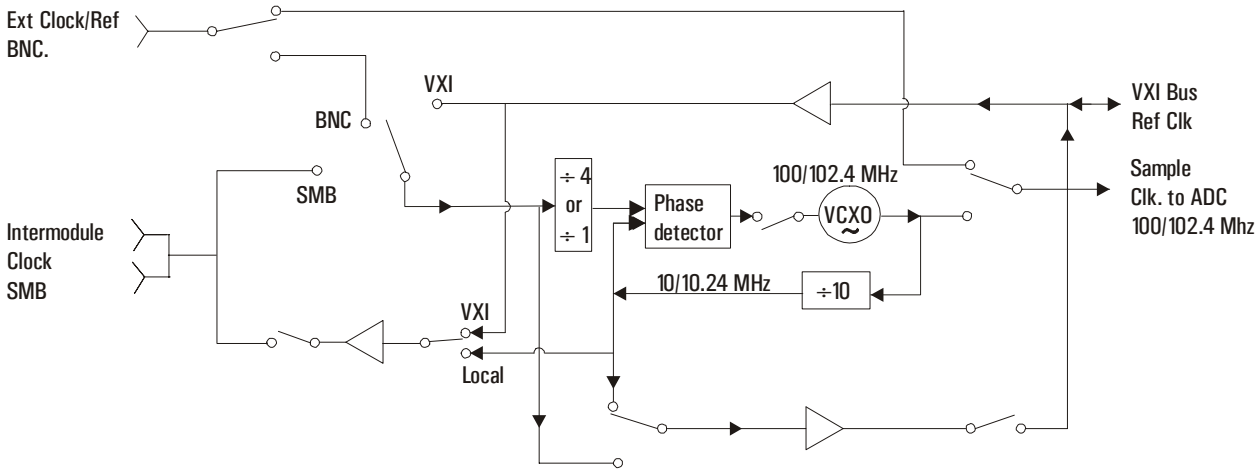
The input is terminated by the input amplifier that follows the first half of the anti-alias filter. The bandwidth of the input is 40 MHz. The attenuation of the input is programmable.

Under program control, the input signal can be ac coupled. This allows the system to measure low level ac signals in the presence of a large dc offset.

Clock Generation

The usual source for a clock signal is the 100 MHz or the 102.4 MHz crystal oscillator inside the E1438. However, the E1438 can also accept an external clock signal through a front-panel BNC "Ext Clock/Ref". This signal can be TTL, ECL, or sine wave.

In a system using more than one E1438, the ADCs can be synchronized by programming them to use a common SYNC line on the backplane as a reference. One of the modules can be the clock master that drives this line. This master clock can be extended to other mainframes by connecting an "Intermodule Clock" SMB connector to an "Intermodule Clock" SMB connector on an E1438 in the second mainframe.



Anti-alias Filter

Since the normal ADC sample rate is 100 MHz, a complete representation of the input signal can be achieved only for bandwidths up to 50 MHz. Frequency components above 50 MHz can cause ambiguous results (aliasing).

The anti-alias filter attenuates these high frequency components to reduce aliasing. The anti-alias filter in the E1438 is flat to 40 MHz and rejects signals above 60 MHz by at least 90 dB. Thus the 0-40 MHz frequency range of the sampled signal is -90 dB alias free. The filter's transition band from 40 MHz to 60 MHz affects flatness and allow some aliasing in the sampled signal frequency range of 40 MHz to 50 MHz.

In cases where alias filtering is not necessary, the E1438 can be programmed to bypass the anti-alias filter. To avoid incorrect results, the alias filter bypass mode should be used with caution; it is not recommended for normal operation.

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Sampling ADC

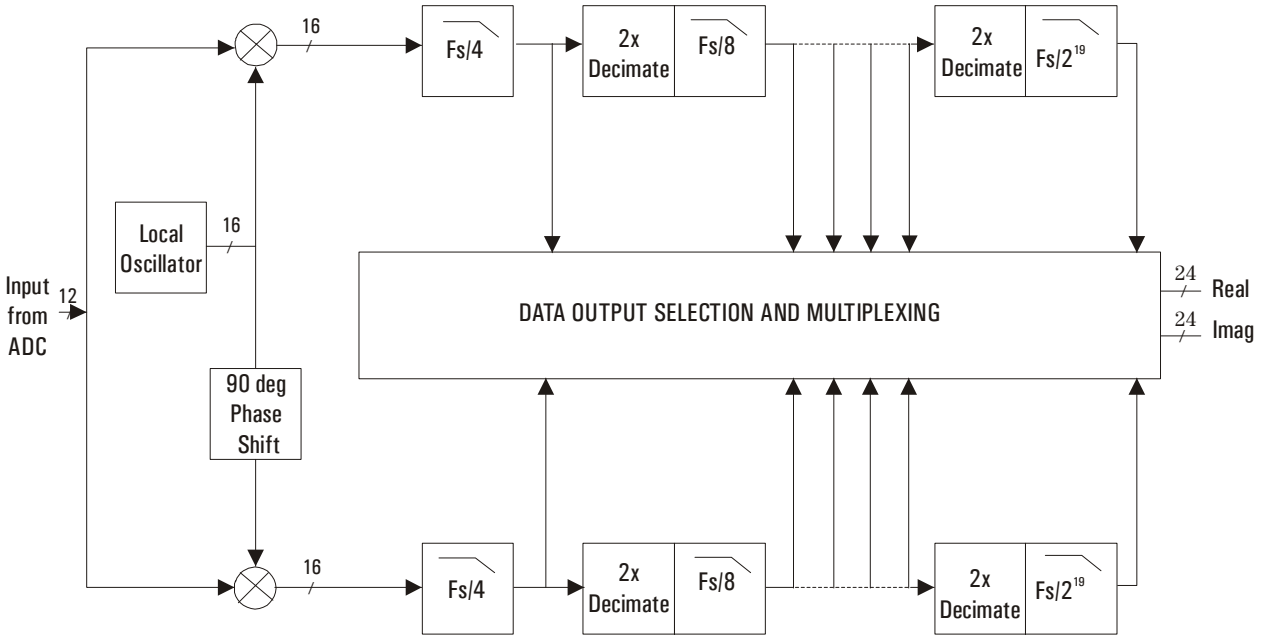
The heart of the E1438 is a precision analog-to-digital converter (ADC). The ADC generates 12 bit outputs at a sample rate up to 102.4 MHz. This raw unfiltered data can be output via the E1438D's fiber optic interface.

Zoom and Decimation Filtering

This section uses digital circuitry to allow programmable changes in the center frequency and signal bandwidth of the E1438 (zoom). This is done at high speed for real-time operation.

Bandwidth is controlled by a chain of digital low-pass filters (see the diagram below). Each of the filters reduces the bandwidth by a factor of two (decimation). With the ADC sample rate (*fs*) set to the standard internal 100.0 MHz rate, the bandwidth choices are 40 MHz, 20 MHz, 10 MHz,…76 Hz around the programmed local-oscillator (LO) frequency.

Real and imaginary components of the signal are each computed to 24-bit precision, so the complex output of the decimation filtering block contains 48 bits. Whether or not all of these bits are stored in memory is programmable.



Memory Controller and SDRAM Memory

The E1438 can be programmed to save the real component of the signal or to save the complete complex signal. The data precision can be set to 12 bits or 24 bits. Thus, each sample occupies from 1.5 to 6 bytes of memory in the SDRAM. The memory controller block packs the selected data into 72-bit words, which are stored in the SDRAM memory. Since the standard SDRAM depth is 2M × 72 bits, it is possible to hold up to 12-Msamples in memory at one time.

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The memory may be configured either in block mode or in continuous mode. In block mode, data collection initiated by a trigger proceeds until a specified block length is captured. The measurement is then paused so that the data can be read out. This mode is useful in capturing single transient events or whenever the output data rate is too high to be read and processed in real time.

In continuous mode, data collection is initiated by a trigger and continues as long as the SDRAM memory does not overflow. Data may be read out of the memory while the measurement is in progress. If the reading of data is sufficiently fast, the SDRAM memory never overflows and the measurement continues indefinitely. If the SDRAM memory should ever overflow then the measurement stops and waits for data to be read out, the measurement to be re-armed, and a new trigger to be initiated. This mode of operation is useful for real-time applications that employ a high speed signal processor to continuously read and operate on each sample of data. Data can be read from the SDRAM memory in bursts to accommodate pauses for such things as disk access times or block mode computations.

The effective trigger time may be offset from the actual trigger event by programming a trigger timing offset. See the Technical Specifications for the limits of the pre-trigger and post-trigger offset.

Data Output

You can transfer data from the E1438C or E1438D via the VMEbus. With the E1438D, you can also transmit data via a fiber optic interface and the Local Bus.

To use the VXI backplane, the E1438 can be programmed so that the output of the memory controller is sent to the Send Data register. The 12- or 24-bit sample data is zero-padded out to 16 or 32 bits. The register can then be read by any controller compatible with the VME standard. Maximum data flow is about 2 MB/s.

The local bus allows data transfers over a high speed 8-bit ECL bus to an adjacent module (to the right) in the VXI mainframe. Multiple adjacent E1438D modules can send data to one signal processor module. The signal processor must be one that supports the Agilent Technologies ECL local bus protocol, such as the Agilent E9821. In addition to higher speed (up to 66 MB/s), the local bus has the advantage that data can be output at the same time that control signals are being sent over the VXI backplane.

The E1438D's fiber optic interface provides data rates greater than 200 MB/s. It is implemented as a serial FPDP (front panel data port). The serial FPDP is a high-speed low-latency serial communication link.

In all three of the data output modes, the samples must be read out sequentially, offset by the trigger delay.

Fiber Optic Interface

The E1438D's fiber optic interface can transmit filtered or unfiltered data, copy data from its receiver to its transmitter, or append data to copied data. The interface's receiver port is not a data receiver—it merely copies data to its transmitter port and detects FPDP control signals (e.g., PIO bits and flow control signals).

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Trigger Detection

The trigger event used to start a measurement can be generated in five different ways:

- Software
- External
- ADC threshold
- Log-magnitude
- Immediate

External and ADC threshold triggering modes support slope selection. In ADC or log-magnitude mode, the trigger threshold has hysteresis (20 ADC sample counts for the ADC trigger, and 1.5 dB for the magnitude trigger) to prevent noise-generated triggers of the wrong slope. Log magnitude triggering is based on the magnitude of the complex signal after zooming and filtering and only supports positive slope trigger detection.

The external trigger mode is selectable between ECL and TTL. The trigger signal must be connected to the Ext Trigger BNC connector on the front panel. In ECL trigger mode, this input is ac coupled with an impedance of 1 k ohm so any signal with a sharp rising or falling transition greater than 100 mV (i.e., TTL or ECL) can be used as an external trigger source. Minimum pulse width is 300 ns. Since the ECL trigger input is an ac-coupled comparator with hysteresis, its initial state is unknown. Before using it, a trigger pulse should be applied to the Ext Trigger connector to initialize it to a known state. In TTL trigger mode, the external trigger input is dc coupled with an impedance of 1 k ohm and uses normal TTL level thresholds (0.8 V and 2.0 V).

Note

External TTL trigger is not supported on E1438A modules with serial numbers lower than US41140000.

Any E1438 module can trigger other E1438 modules using a shared sync line on the VXI backplane. This Sync line can be extended to other mainframes by connecting a "Sync" SMB connector in one mainframe to a "Sync" SMB connector on an E1438 in the second mainframe. All modules in a synchronous system are triggered on the same ADC sample.

The E1438 hardware samples the trigger source once every sample clock, so the trigger condition must be present for at least one sample clock in order to be recognized.

Control Registers

The E1438 module is controlled by firmware using registers mapped into the 16-bit VXI address space.

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Replacing Assemblies

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Replaceable parts

The Agilent E1438 must be returned to Agilent Technologies for service or calibration. Exchange modules are shipped with no memory so you must move the memory from the original module to the replacement module. This section shows you how to add or replace memory modules.

For information on upgrading your module or replacing parts, contact your local Agilent Technologies sales and service office. See the Technical Specifications or the Agilent Technologies web site (http://www.agilent.com) for a list of office locations and addresses.

Ordering Information

To order parts in the U.S., call Agilent Technologies Parts Direct Ordering at (877) 447-PART or go to https://www.parts.agilent.com/. Outside the U.S., please contact your local Agilent Technologies parts center.

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Code Numbers

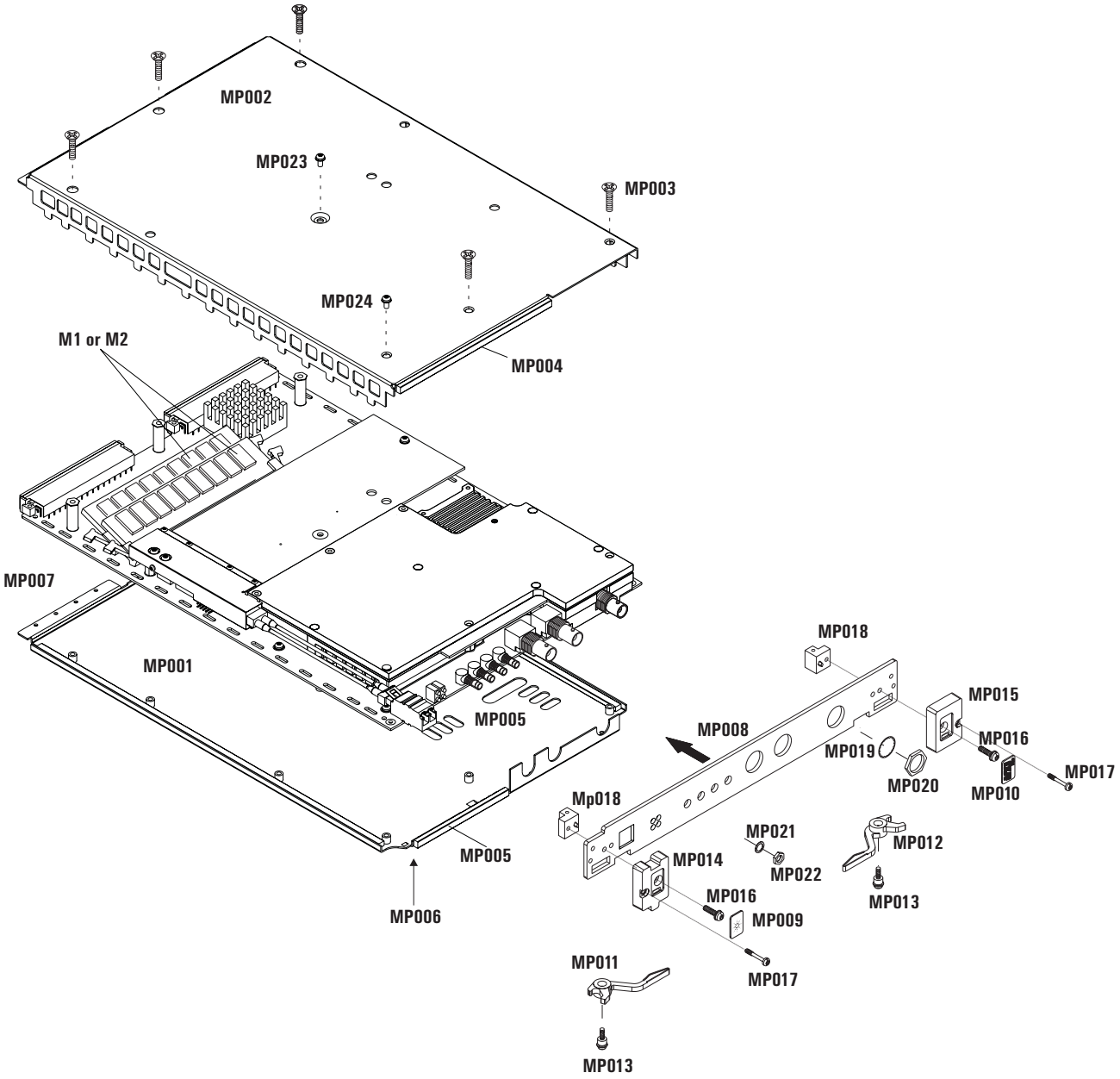
The following table provides the name and location for the manufacturers' code numbers (Mfr. Code) listed in the replaceable parts table.

Mfr. No.	Mfr. Name	Location
28480	Agilent Technologies, Inc.	Palo Alto, CA U.S.A.
03647	Instrument Specialties Co. Inc.	Delaware Water Gap, PA U.S.A.
04637	Phelps Dodge Corp.	New York, NY U.S.A.
16044	Kingston Technology Corp.	Fountain Valley, CA U.S.A
07606	ITW Inc. / Medalist	Glenview, IL U.S.A.
04605	Fischer Special Mfg. Co	Cincinnati, OH U.S.A.
05610	Textron, Inc.	Providence, RI U.S.A.
06363	Oudensha America Inc.	Elk Grove Village, IL U.S.A.

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Assemblies

Caution **The module is static sensitive. Use the appropriate precautions when removing, handling, and installing to avoid damage.**

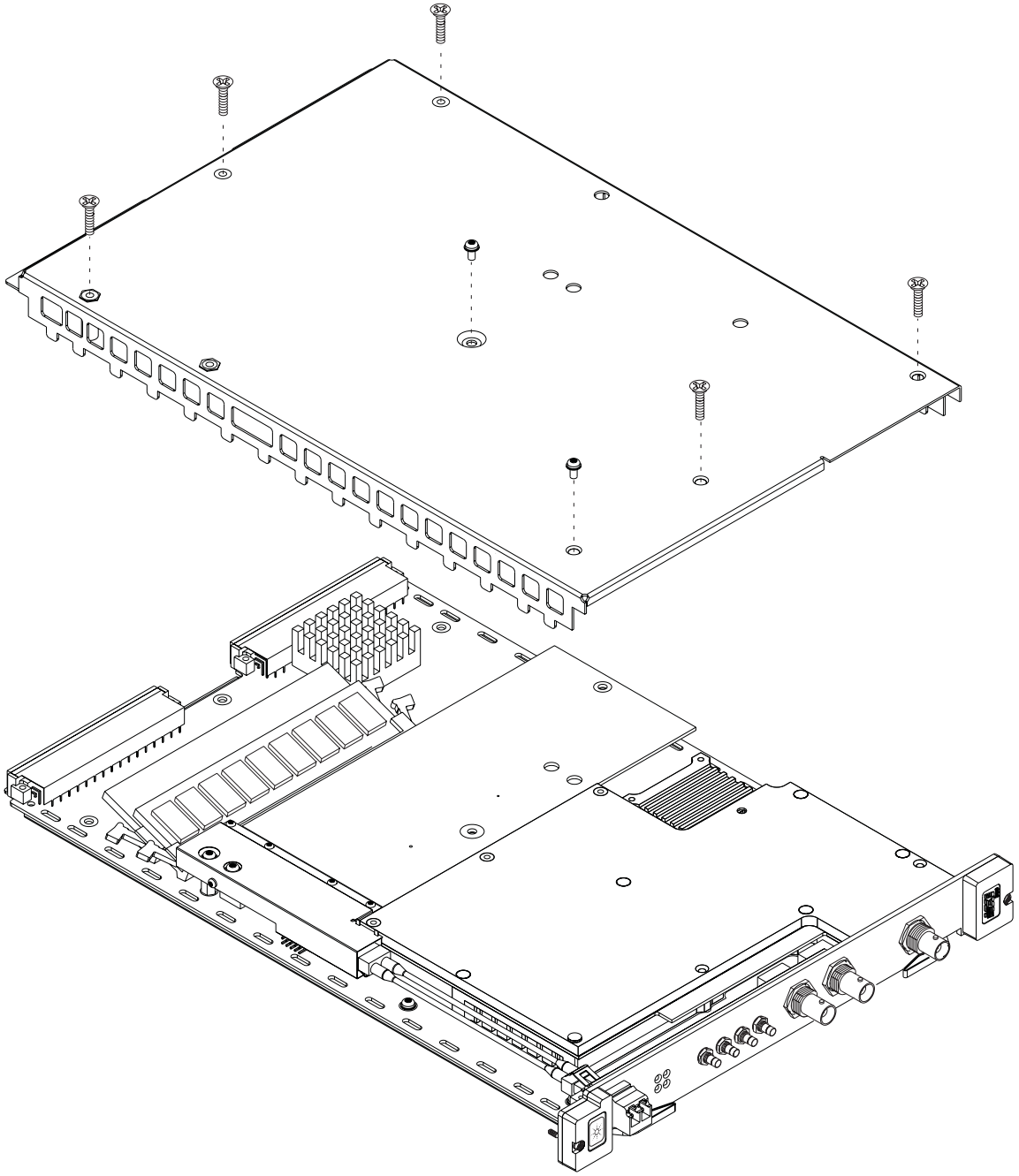


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Ref Des	Agilent Part Number	Qty	Description	MfrCode	Part Number
	E1438-69201	1	E1438A EXCHANGE MODULE	28480	E1438-69201
	E1438-69211	1	E1438B EXCHANGE MODULE	28480	E1438-69211
	E1438-69202	1	E1438C EXCHANGE MODULE	28480	E1438-69202
	E1438-69212	1	E1438D EXCHANGE MODULE	28480	E1438-69212
M1	1818-7889	1	SYNC DIMM 16MB 2X72 66MHZ - 16 M mem	16044	KTM66X72/16
M2	1818-7901	2	SYNC-DIMM 16MX72 PC100 168-DIMM - 128 M mem	16044	KGM100X72C3/128
M2	1818-8606	2	SYNC-DIMM 16MX72 PC100 168-DIMM - 512 M mem	16044	KVR100X72C3/512
MP001	E1438-00203	1	SHTF-BOTTOM COVER	28480	E1438-00203
MP002	E1438-00242	1	SHTF-TOP COVER	28480	E1438-00242
MP003	0515-1135	5	SCREW-MACH M3 x 0.5 25MM-LG	05610	0515-1135
MP004	E1438-40601	1	GSKT-RFI-FRT PNL	28480	E1438-40601
MP005	E1485-40601	2	GSKT-RFI-BTTM CVR	28480	E1485-40601
MP006	8160-0686	2	RFI STRIP-FINGERS	03647	00786-185
MP007	8160-0634	0.4	RFI STRIP-FINGERS	03647	0097-0611
MP008	E1438-00234	1	FRONT PANEL 'E1438A'	28480	E1438-00234
MP008	E1438-00244	1	FRONT PANEL 'E1438B'	28480	E1438-00244
MP008	E1438-00235	1	FRONT PANEL 'E1438C'	28480	E1438-00235
MP008	E1438-00245	1	FRONT PANEL 'E1438D'	28480	E1438-00245
MP009	7121-7893	1	PLT-NAME 'SPARK'	06363	7121-7893
MP010	7121-7965	1	PLT-NAME VXI 'PLUG&PLAY'	06363	7121-7965
MP011	E1400-45101	1	MOLD-TOP	28480	E140045101
MP012	E1400-45102	1	MOLD-BOTTOM	28480	E140045102
MP013	E1400-00610	2	SCR-ASM SHLDR	28480	E1400-00610
MP014	E1400-45011	1	MOLD TOP-'SPARK'	28480	E1400-45011
MP015	E1400-45008	1	MOLD BTTM-'VXI'	28480	E1400-45008
MP016	0515-0664	2	SCREW MACHINE ASSEMBLY M3 X 0.5 12MM-LG	07606	0515-0064
MP017	0515-2733	2	SCREW SPCL M2.5 X 0.45 17MM-LG PAN-HD	07606	0515-2733
MP018	E1400-40104	2	CAST	28480	E1400-40104
MP019	2190-0068	3	WASHER-LK INTL T 1/2 IN .505-IN-ID	07606	1924-02NP
MP020	2950-0154	3	NUT-HEX-DBL-CHAM 1/2-28-THD .078-IN-THK	04605	2950-0154
MP021	2190-0124	4	WASHER-LK INTL T NO. 10 .195-IN-ID	04637	500222
MP022	2950-0078	4	NUT-HEX-DBL-CHAN 10-32-THD .067-IN-THK	04637	500220
MP023	0515-0430	1	SCREW-MACHINE M3 X 0.5 6MM-LG	05610	0515-0430
MP024	0515-1103	1	SCREW-MACHINE M3 X 0.5 10MM-LG	05610	0515-1103

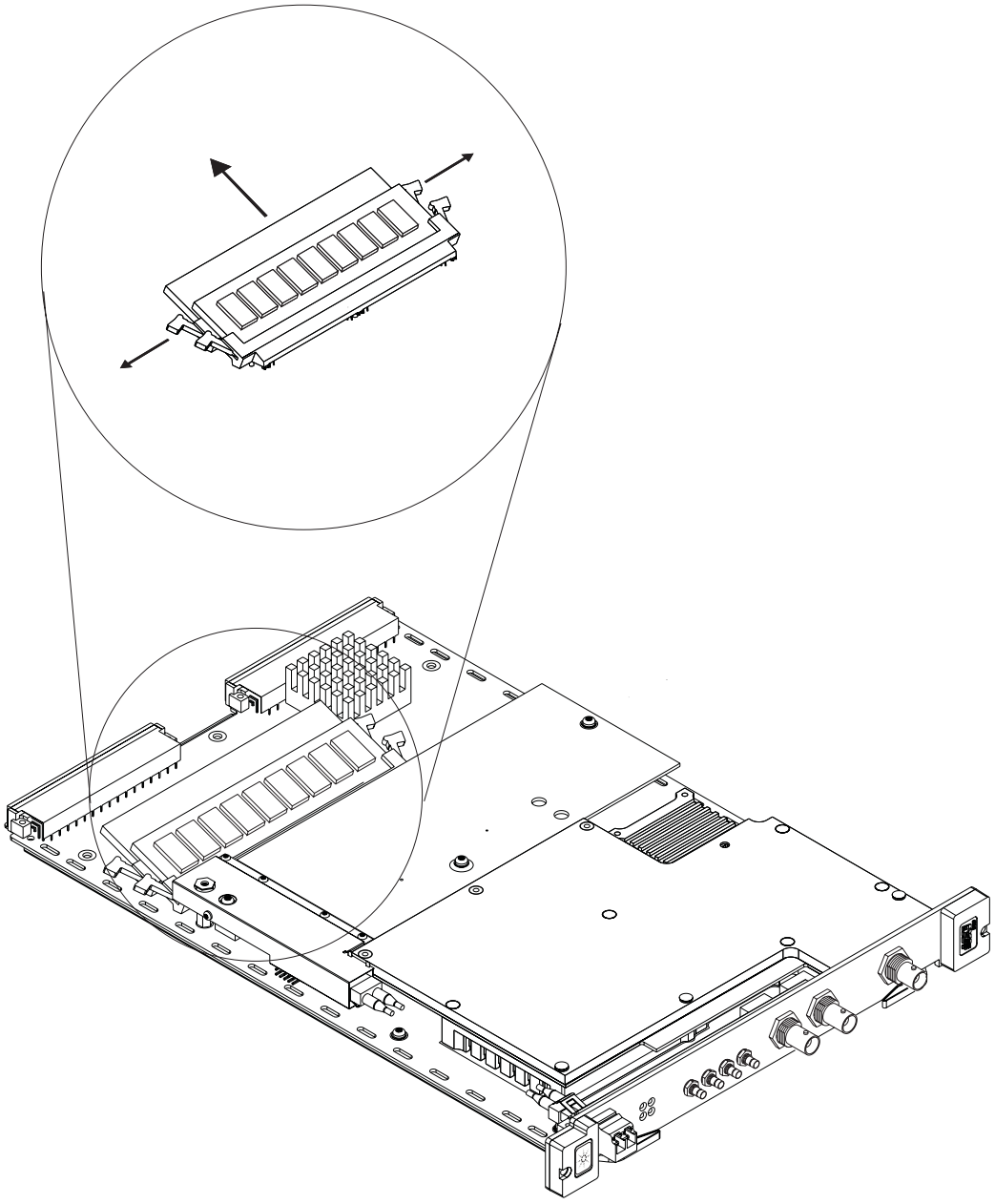
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To remove the top cover



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To remove the M1, M2 assemblies



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Glossary

anti-alias filter	**An analog low pass filter inserted the signal path to eliminate undesirable frequency components which appear under the alias of another (baseband) frequency. For more information, see *Spectrum and Network Measurements* available through your Agilent Technologies Sales Office.**
baseband	**A band in the frequency spectrum that begins at zero. In contrast a zoomed band is centered on a specific center frequency.**
block mode	**A mode in which the Agilent E1438 stops taking data as soon as a block of data has been collected.**
block size	**The number of sample points in a block of data. For complex data, block size is the number of complex data pairs per data block.**
BOF	**A fiber frame that acts as a synchronizing event.**
continuous mode	**A mode in which the Agilent E1438 collects data continuously. It does not stop taking data unless the FIFO overflows.**
data frames	**A fiber frame that contains 0 to 512 32-bit data words.**
decimation filter	**A digital filter that simultaneously decreases the bandwidth of the signal and decreases the sample rate. The digital filter provides alias protection and increases frequency resolution. For more information, see Spectrum and Network Measurements available through your Agilent Technologies Sales Office.**
EOE	**A fiber frame that contains the last 4 data bytes in an epoch.**
epoch	**One or more data frame followed by an EOE.**
fiber frame	**A series of 32-bit values that can either be data or an ordered set.**
FIFO	**A First In, First Out buffer and controller used to transmit data.**
FPDP	**Front panel data port.**
LO	**Local oscillator**
VCXO	**Voltage controlled crystal oscillator**
zoom	**Selects a frequency span around a specified center frequency. This is also known as band selectable operation.**

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If you are contacting Agilent Technologies about a problem with your Agilent E1438 module, please provide the following information:

Model number:

Software version:

Serial number:

Options:

Date the problem was first encountered:

Circumstances in which the problem was encountered:

Can you reproduce the problem?

What effect does this problem have on you?

United States	1 800 452 4844
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About this edition

December 2002: This edition documents the transition from the Agilent E1438A to the Agilent E1438C and from the Agilent E1438B to the Agilent E1438D. The A and B models will become obsolete. The Agilent E1438C has no local bus capability.

April 2001: This edition documents the new fiber optic interface on the Agilent E1438B. In addition, this edition documents the new external TTL trigger on all Agilent E1438B modules and on Agilent E1438A modules with a serial number greater than US41140000.

May 2000: This edition documents a new software upgrade utility, FirmwareInstall, and a new function, age1438_frequency_center_raw_compute. In addition, the descriptions changed for the following functions:

- age1438_clock_setup
- age1438_trigger_setup
- age1438_combo_setup

November 1999: In this edition, all references to the product changed to support rebranding the product from Hewlett-Packard to Agilent Technologies.

September 1999: First Edition

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