eXpert PCIe Data Streaming Firmware

All Gage PCI Express (PCIe) CompuScope Digitizers are capable of streaming acquired waveform data through the PCIe bus directly to the host PC RAM by utilizing the eXpert PCIe Data Streaming Firmware.

By contrast, in standard Memory Mode operations the waveform data is first acquired to the digitizer card's onboard memory, acquisition is stopped, and then the data residing in onboard memory can be transferred to the host PC system.

eXpert PCIe Data Streaming Mode operations provide two distinct advantages over standard Memory Mode. First, Streaming Mode may overcome the acquisition time limit imposed by the size volume of the dedicated onboard digitizer memory. Second, in Streaming Mode the user does not need to await completion of waveform acquisition before accessing the resulting waveform data, which is necessary in Memory Mode.

Thus Streaming Mode allows for the capability to simultaneously acquire and stream data to targeted host CPUs or GPUs for further signal processing analysis and/or to high-speed storage systems for signal recording operations.

When Streaming Mode is enabled, the digitizer's dual-port architecture of its onboard memory is utilized by acquiring data to onboard memory as well as transferring the data from onboard memory to PC RAM simultaneously via its PCIe interface at high-speed rates by interleaving write and read data packets.

GaGe streaming software allows data streaming in either of two distinct modes: Continuous Mode or Segmented Mode. In Continuous Mode, signal digitization is initiated by a single trigger and then proceeds continuously – for several seconds, minutes, or hours – with no breaks until the acquisition is terminated. For example, a user might stream data in Continuous Mode for 10 minutes at a rate of 1 GigaSamples/second, which will create a total of 600 GigaSamples of data.

Alternately, in Segmented Mode, multiple triggers are detected during streaming acquisition. Each trigger creates a pre-set amount of pre- and post-trigger data that form one segment or waveform. Dead-time between successive waveforms may be as short as 2 microseconds. For example, a user might choose to stream waveforms consisting of 1,000 pre-trigger samples and 3,000 post-trigger samples at 1 GS/s with a trigger rate of 100 kHz for 10 minutes. This would create a total data volume of 100 kHz × 4,000 Samples × 600 seconds = 240 GigaSamples.

In all Streaming Mode operations, all of the digitizer's onboard memory is configured to work as a large FIFO buffer to provide ample data buffering between the digitizer and the host PC. The waveform data is transferred efficiently through the digitizer PCIe interface to the host PC system RAM using DMA transfer mechanisms with circular buffers.

It is the combined use of the digitizer Streaming Mode, with onboard memory operating as a FIFO buffer, and efficient high-speed DMA transfers to multiple circular system RAM buffers that make it possible to achieve high performance real-time sustained data streaming operations within a non-real-time operating system such as Windows.

The digitizer card will only DMA transfer data to the system if the PCIe interface tells it that it can receive data, so data overflow will NOT occur at the PCIe interface. If the host PCIe interface can't receive data at a particular time, due to another host OS system activity, new acquisition data is accumulated in the onboard memory of the digitizer card that is operating as a FIFO buffer. The FIFO buffer dynamically grows and shrinks as needed, to accommodate the host system OS response to data transfer requests. GaGe digitizers are supplied with memory capacities of 2-4 GS, (optionally larger). These large onboard memories are essential for achieving sustained real-time streaming using a non-real-time host OS.

In the event that the onboard digitizer memory completely fills up, an acquisition FIFO overflow occurs that is caught and flagged as an error. This type of FIFO overflow error condition is usually a result of the underlying host system and/or receiving target's performance capabilities not being adequate enough to support the application's high-speed sustained data rates. Users must take care in calculating their application's data streaming rate requirements and ensuring that the host system and receiving target are fully capable of supporting the desired streaming rate.

The eXpert PCIe Data Streaming Firmware requires the GaGe C/C# SDK that provides ready-made compiled sample programs illustrating how to configure and use the PCIe Data Streaming feature with documentation for its use in custom developed applications.

The GaGe C/C# SDK includes three separate sample programs that illustrate streaming usage:

Sample Program	Description
GageStream2Analysis_Simple	A simple single-threaded streaming acquisition from a single CompuScope Digitizer. This is the best starting point for a single CompuScope Digitizer streaming application. Analysis is performed on raw waveform data.
GageStream2Analysis	A multi-threaded streaming acquisition from a single CompuScope Digitizer or Master/Slave CompuScope Digitizer System. This is the best starting point for a multi-CompuScope Digitizer streaming application. Analysis is performed on time-stamp data.
GageStream2Disk	A multi-threaded streaming acquisition and recording to targeted storage from a single CompuScope Digitizer or Master/Slave CompuScope Digitizer System. Streams raw waveform data to drive storage. Used to verify integrity of streamed data.

Sig-Station System Options

Optional Sig-Stations are available for providing complete turn-key systems designed specifically for integrating GaGe advanced instruments and maximizing their operational performance.

Sig-Stations come with all GaGe cards, features, and software fully tested and installed so that the user can be up and running with their system solution right out of the box; thus saving time and minimizing risks of self-integrated systems. Custom system configurations can be defined to meet specific customer application requirements.

These systems incorporate the latest in PC-based technology and utilize workstation class motherboards with multiple dedicated bandwidth PCIe slots, high multi-core count Xeon CPUs, and large system memory capacity. Integrated high-speed data storage systems for real-time signal recording applications requiring a guaranteed continuous sustained data streaming rate with no missing data can be included.

Contact us for a system tailored for your application.

ORDERING INFORMATION

eXpert PCIe Data Streaming Firmware	Order Part Number
eXpert PCIe Data Streaming **NOTE:** The eXpert PCIe Data Streaming Firmware requires the GaGe C/C# SDK and is compatible for use with the following GaGe Digitizer Model Series sold separately: • Cobra Express • CobraMax Express • EON Express • Octave Express • Octopus Express • Oscar Express • Razor Express • RazorMax Express Please refer to the separate GaGe product datasheets for these digitizer models for their full specification details and ordering information.	STR-181-000

Data Sheet Revision 0 – 07/17/2017
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