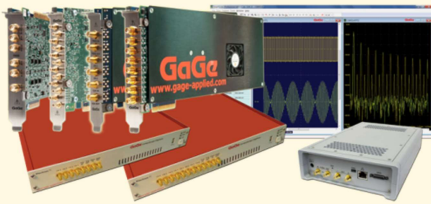


GaGe is a worldwide industry leader in high speed data acquisition solutions featuring a portfolio of the highest performance digitizers, PC oscilloscope software, powerful SDKs for custom application development, and turnkey integrated PC-based measurement systems.



## APPLICATIONS

Wideband Signal Analysis

RADAR Design and Test

Signals Intelligence (SIGINT)

Ultrasonic Non-Destructive Testing

LIDAR Systems

Communications

Optical Coherence Tomography

Spectroscopy

High-Performance Imaging

Time of Flight

Life Sciences

Particle Physics

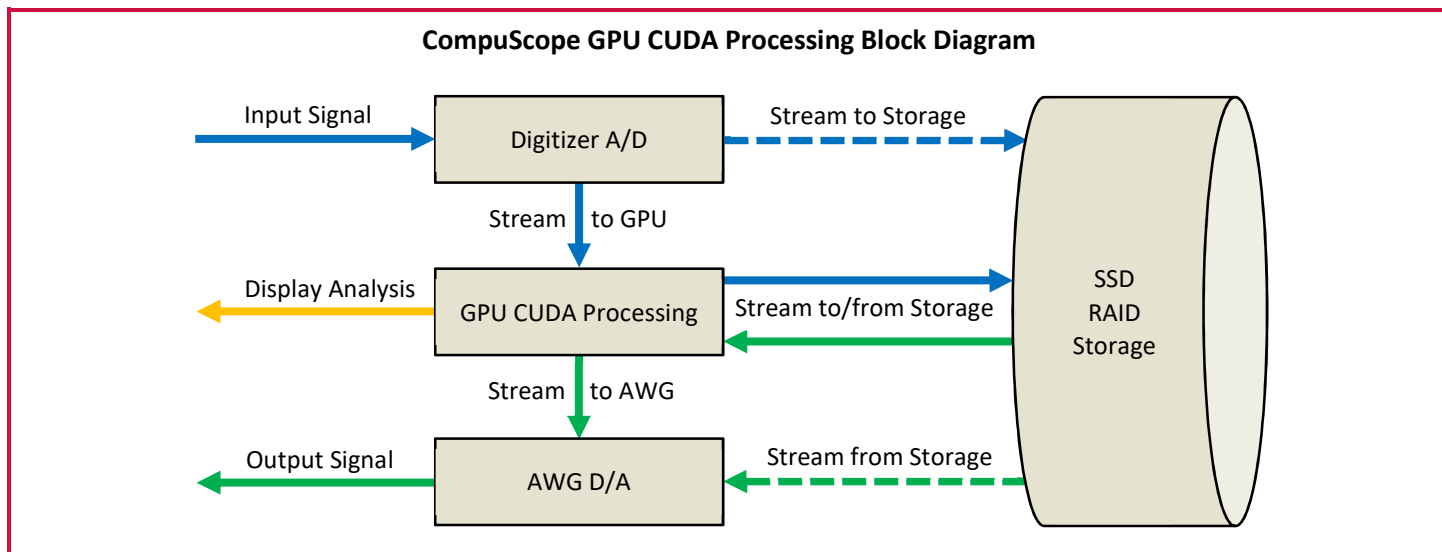
## CompuScope GPU CUDA Processing

### Real-Time High-Speed Digital Signal Processing



## FEATURES

- All CompuScope Express Digitizers with eXpert Streaming Supported
- Stream Acquired Signal Data to GPU for In-Line Processing in Real-Time
- Stream GPU Processed Data Results to Storage in Real-Time
- Up to 5 GB/s Data Stream Rates via PCIe Gen3 Interface
- Supports CUDA Compute Capability 3.0+ GPU Cards
- 10X ~ 100X Faster GPU Processing Calculation Times vs CPU Processing
- Easier & More Transportable C Language Based Programming for GPU
- Provided C SDK Sample Programs Illustrate:
  - Digitizer Streaming to GPU DSP Algorithms
  - Examples Programs such as FFT, Signal Averaging, and More
  - Easily Insert User Developed Custom Code for GPU Processing
  - Exploitation of GPU Vector Data Processing Capability
  - Usage of CUDA Library for Fastest Data Transfer Performance
  - Comparative Performance of GPU vs Host CPU Processing
  - GPU Streaming of Processed Data Results to Storage
- Available Sig-Station Systems for Maximum Performance
- Windows and Linux Operating Systems Supported



## Overview

Performing real-time digital signal processing (DSP) routines such as Fast Fourier Transform (FFT), Signal Averaging, Finite Impulse Response (FIR) Filtering, Digital Down Conversion (DDC) and more have traditionally required the use of dedicated DSP processors, Field Programmable Gate Arrays (FPGAs), or Application Specific Integrated Circuits (ASICs).

The size of DSP processors, FPGAs, and ASICs are often resource limited and require significant development with specialized engineering skills in particular languages and platform tools that are often native and proprietary to the targeted device. These solutions are typically expensive in terms of the physical devices, required software development tools, lengthy development cycles and expertise resources.

With the evolution of increasing multi-core CPU resources, developers began to implement DSP routines utilizing the host CPU. The primary advantage of the host CPU platform is that it enables faster development utilizing more familiar programming environments such as C; as opposed to more complex VHDL based programming that is typically required for FPGAs. However a disadvantage is that the host CPU platform may still not be powerful enough to conduct complex processing routines, especially for real-time application requirements.

The use of a GPU provides the best of both capabilities, a fast familiar programming development environment such as C and more powerful computational capabilities than the host CPU platform to satisfy demanding real-time application requirements. GPUs incorporate many more cores with a high-speed memory bus that can be effectively utilized in parallel for efficient manipulation of large blocks of data.

The PCI Express (PCIe) interface bus is the key pathway for transferring data to and from the GPU at very high-speeds. Taking advantage of the GaGe eXpert PCIe Data Streaming firmware capability, GaGe CompuScope PCIe Digitizer models can simultaneously acquire and stream data to the GPU at sustained rates up to 5 GB/s via a PCIe Gen3 interface.

The Gage CompuScope C Software Development Kit (SDK) provides ready-made compiled sample programs illustrating how to configure and use the eXpert PCIe Data Streaming feature to stream acquired data to the GPU for processing AND how to effectively exploit the parallelized vector processing of the GPU to attain processing rates anywhere from 10X ~ 100X faster than the host CPU for display analysis.




This enables end users to quickly and easily begin working with GPU cards, focusing on the development of their custom in-line processing routines that is unique to their application. Projects can be developed rapidly and are more transportable working in a C programming environment with the GPU CUDA library.

The Gage CompuScope C SDK sample programs also illustrate streaming GPU processed data results continuously to high-speed storage for real-time data recordings of the processed output. Utilizing PCIe based storage systems allow for continuous signal capture and processing recording systems at high-speed sustained transfer rates at up to 5 GB/s within a Windows based environment.

GPU processed data can also be optionally streamed to PCIe Arbitrary Waveform Generators to effectively playback modified signals back out to the testing environment, suitable for applications such as Digital Radio Frequency Memory (DRFM).

## GPU CUDA Series

GaGe supports NVIDIA Tesla, Quadro, and GeForce series of GPU cards with a CUDA Compute Capability of 3.0+. The following table provides a general overview of certain capability ranges of each series for recent 6.0 to 7.5 CUDA rated models. We recommend checking NVIDIA for detailed specifications of specific NVIDIA models.

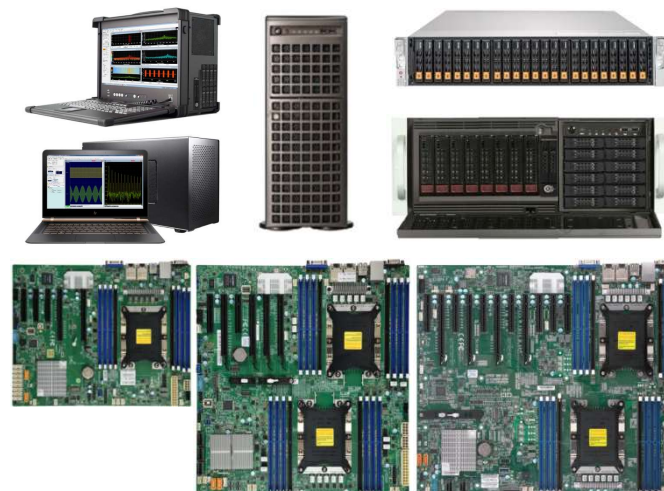
	Tesla Series	Quadro Series	GeForce Series
			
# of GPU Cores:	2,560 – 5,120	256 – 5,120	768 – 5,120
# of Tensor Cores:	320 – 640	288 – 576	240 – 544
GPU Clock Rates:	0.585 – 1.59 GHz	1.05 – 1.815 GHz	1.2 – 1.785 GHz
Floating Point 64-bit (FP64) Double-Precision:	0.2 – 7 TFLOPS	0.02 – 7.4 TFLOPS	0.07 – 7.4 TFLOPS
Floating Point 32-bit (FP32) Single-Precision:	5.5 – 14 TFLOPS	0.6 – 16.3 TFLOPS	2.3 – 16.3 TFLOPS
Floating Point 16-bit (FP16) Half-Precision:	0.1 – 28 TFLOPS	0.01 – 32.6 TFLOPS	0.07 – 7.45 TFLOPS
Memory Bandwidth:	192 – 900 GB/s	32 – 870 GB/s	84 – 672 GB/s

GPUs are particularly efficient in performing floating point calculations by conducting highly parallel computations across multiple cores simultaneously.

Applications requiring higher accuracy mathematical calculations can utilize double-precision 64-bit floating point for data values twice in size than single-precision 32-bit floating point. Lower half-precision 16-bit floating point can be utilized for applications that require even less accuracy such as neural network training or inference. More recently, Tensor cores have been introduced into GPUs for accelerating large matrix based operations utilized in deep learning or artificial intelligence (AI) operations.

CUDA is NVIDIA's parallel computing platform and programming model that allows for the GPU to be utilized for general purpose computing using familiar software development environments such as C or C++. The CUDA Toolkit software is provided directly by NVIDIA at no charge with detailed documentation and various coding samples to help with application development.

## Sig-Station System Options



Optional Sig-Stations are available for providing complete turn-key systems for GPU capability working with GaGe high-speed instruments. Sig-Stations are high-performance PC workstations that are designed specifically for integrating advanced instruments and maximizing their operational performance.

For real-time operations, it is critical that the underlying host platforms are fully capable of sustaining high-speed PCIe data streaming rates to and from the GPU. Traditional lower cost desktop based platforms often restrict performance capabilities by placing multiple PCIe slots behind shared PCIe switches. Sig-Station systems utilize dedicated bandwidth PCIe slot architecture for maximum sustained PCIe streaming rates for multiple cards simultaneously.

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 to configure a system tailored for your application.



## ORDERING INFORMATION

CompuScope GPU CUDA Processing	Order Part Number
<p>The CompuScope GPU CUDA Processing package includes the following bundled items:</p> <ol style="list-style-type: none"><li>1.) eXpert PCIe Data Streaming Firmware (STR-181-000)</li><li>2.) CompuScope C/C# Software Development Kit (200-200-101)</li></ol> <p>NOTE: GPU card is not included.</p> <p>The eXpert PCIe Data Streaming Firmware is compatible for use with the following GaGe Digitizer Model Series sold separately:</p> <ul style="list-style-type: none"><li>• Cobra Express</li><li>• CobraMax Express</li><li>• EON Express</li><li>• Octave Express</li><li>• Octopus Express</li><li>• Oscar Express</li><li>• Razor Express</li><li>• RazorPlus Express</li><li>• RazorMax Express</li></ul> <p>Please refer to the separate GaGe product datasheets for these digitizer models for their full specification details and ordering information.</p> <p>The CompuScope C/C# SDK provides ready-made compiled sample programs illustrating:</p> <ul style="list-style-type: none"><li>• Use of eXpert PCIe Data Streaming feature to stream acquired data to a GPU for processing.</li><li>• How to effectively exploit the parallelized vector processing of the GPU for signal processing routines with various examples.</li><li>• Optionally stream GPU processed data results continuously to high-speed storage for real-time data recordings of the processed output.</li></ul> <p>To maximize performance, customers should take care to select suitable host systems with dedicated bandwidth PCIe slots with sufficient power and cooling. High-performance GPU cards typically require dual slot space with additional power and good cooling air flow.</p> <p>Optional Sig-Stations are available for providing complete turn-key systems for GPU capability working with GaGe high-speed instruments. Contact us to configure a system tailored for your application.</p>	BDL-GPU-000

900 N. State St.  
Lockport, IL 60441-2200

### Toll-Free (USA and Canada):

Phone: 1-800-567-4243  
Fax: 1-800-780-8411

### Direct:

Phone: 1-514-633-7447  
Fax: 1-514-633-0770

### Email:

[prodinfo@gage-applied.com](mailto:prodinfo@gage-applied.com)

To find your local sales representative or distributor or to learn more about GaGe products visit:

[www.gage-applied.com](http://www.gage-applied.com)

### WARRANTY

Standard two years parts and labor.

Unless otherwise specified, all dynamic performance specs have been qualified on engineering boards. All specifications are subject to change without notice.

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