

Peak Detection is a widely used data analysis and reduction technique. GaGe's eXpert™ Peak Detection technology allows the detection of peaks within a set of digitized waveform data.

Digitized waveform data is analyzed within the CompuScope's on-board FPGA in order to provide only peak information to the user.

## APPLICATIONS

Radar Testing  
Lidar Testing  
Ultrasonic Testing  
Particle Counting  
Lightning testing  
Granular flow measurements

## eXpert™ Peak Detection Advanced On-board FPGA Technology

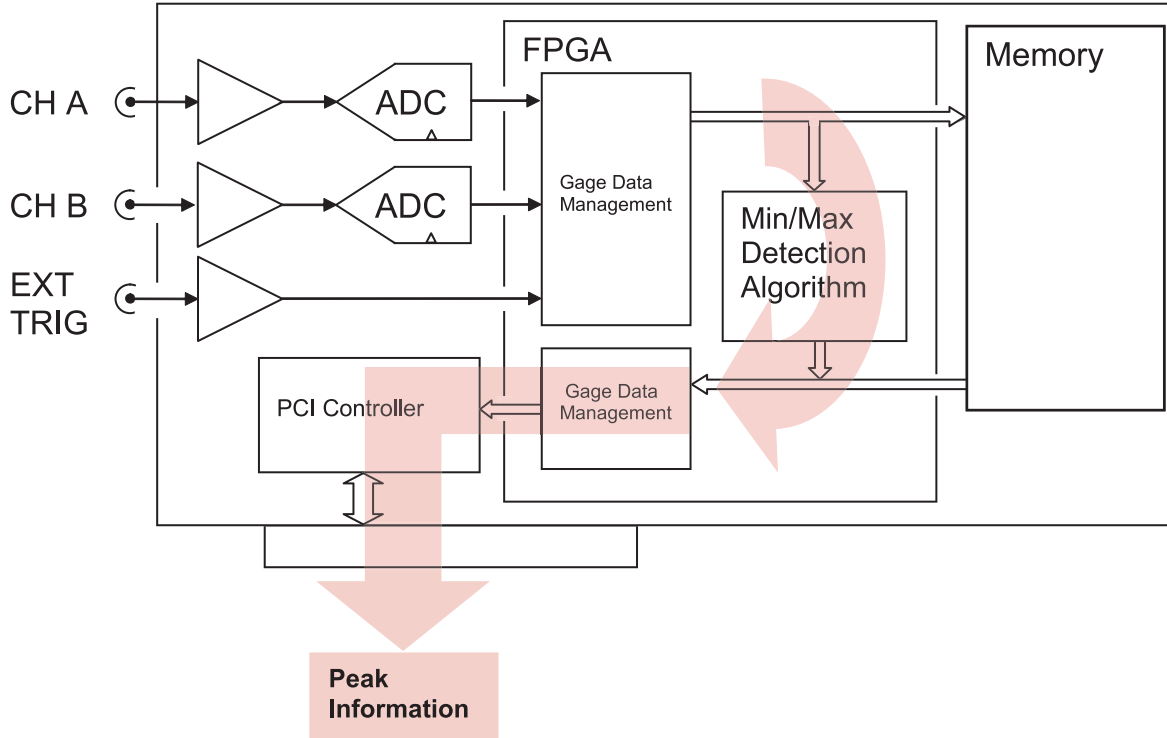


Traditionally, PC-based waveform digitizers provide raw data to user applications, which then analyze the data on the host PC using techniques such as peak detection. Often, waveform data throughput exceeds the capacity of the data bus or the speed of traditional peak detection analysis routines. For these requirements, GaGe now offers on-board eXpert Peak Detection Firmware for our new-generation high-performance digitizer cards.

## FEATURES

- Captured data is stored directly to on-board Field Programmable Gate Array (FPGA) to provide peak information to the user
- Data volume is greatly decreased so that PCI traffic is correspondingly reduced
- Peak information consists of the maximum and minimum values within a waveform and their positions
- Compact Channel Peak Information Set occupies a data volume of less than 80 Bytes per CompuScope card
- Highly efficient PCI transfer of Peak Information Sets that are accumulated in a circular buffer within the FPGA that is periodically polled and flushed by the controlling software
- Re-arm time within 1~2 microseconds after waveform acquisition (or less for larger acquisitions)
- Compatible with CompuScope C/C# Software Development Kit (SDK)

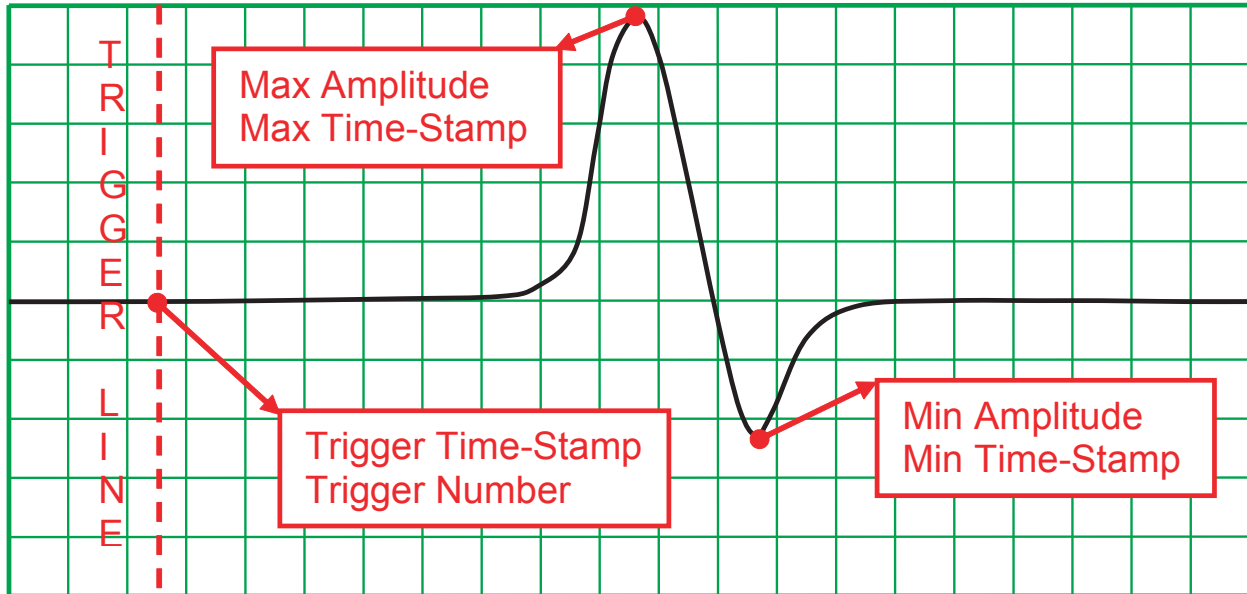
## Peak Detection Simplified Block Diagram



The Peak Information Set contains the minimum and maximum peak values within a waveform data set. These peak values are the absolute peak positions of the waveform when the peak occurs and the on-board time-stamping counter indicates the time of the occurrence. The list of parameters that comprise the Peak Information Set is shown in the table below:

PEAK INFORMATION SET					
(TOTAL SIZE = 8 BYTES + 16 BYTES + 24 BYTES × NUMBER OF CHANNELS)					
NAME	DESCRIPTION	TYPE	SIZE	GROUP NAME	GROUP SIZE
Structure Size	The size of the base structure for compatibility purposes	uInt32	4 Bytes	Header	8 Bytes
Number of channels	The number of channel information sets	uInt32	4 Bytes		
Trigger Number	The trigger count, which may be used to account for missed triggers, if any	uInt32	4 Bytes	Trigger information set	16 Bytes
Reserved		uInt32	4 Bytes		
Trigger Time-Stamp	The Time-Stamp counter output that marks the occurrence time of the trigger event.	int64	8 Bytes		
Max Amplitude	The maximum value that occurs within the waveform data set	int16	2 Bytes	Channel information set	24 Bytes
Min Amplitude	The minimum value that occurs within the waveform data set	int16	2 Bytes		
Reserved		uInt32	4 Bytes		
Max Time-Stamp	The Time-Stamp counter output that marks the occurrence time of the maximum	int64	8 Bytes		
Min Time-Stamp	The TimeStamp counter output that marks the occurrence time of the minimum	int64	8 Bytes		

The peak information parameters are also illustrated in the diagram below for clarity.



A distinctive parameter in the Peak Information Set is the Trigger Number parameter. It is possible that, while the peak detection algorithm is processing a waveform caused by a given trigger, another trigger event occurs. This trigger event and its associated peak information will thus be missed by the CompuScope hardware. In this event, however, the Trigger Number value will be incremented by the missed trigger. Consequently, the user will find that the Trigger number between consecutive Peak Information Sets increased by 2 instead of by 1 and so will know that a trigger was missed and can correctly account for it.

## PEAK DETECTION EXAMPLE

Consider a two board CS14200 system sampling simultaneously on four channels at 200 MS/s. Assume further that peaks of interest occur somewhere within 50 microseconds after an external trigger and that these triggers occur every 100 microseconds. The raw data volume per trigger is:

$$(2 \text{ Bytes per 14-bit Sample}) \times (4 \text{ channels}) \times (50 \text{ microsecond}) \times (200 \text{ MS/s}) = 80 \text{ kBytes}$$

At the maximum sustainable PCI transfer rate of 200 Megabytes/second, transfer of these raw data would take,  $80 \text{ kB} / (200 \text{ MB/s}) = 400 \text{ microseconds}$ , which far exceeds the available 100 microseconds in between triggers. Without eXpert Peak Detection, four out of five triggers would be missed.

The eXpert Peak Detection firmware is capable of reducing the 80 kB raw data set by a factor of over 600 to a mere 120 Byte Peak Information Set. By dramatically reducing data volume, the eXpert on-board Peak Detection is easily able to detect and deliver peak data within the allowed 100 microsecond time period.



## ORDERING INFORMATION

eXpert Peak Detection Firmware is available at time of purchase with any of GaGe's new-generation high-performance digitizers such as the CS14200, CS12400, or CS14105. Alternatively, the option may be ordered as a field upgrade. The option is available for all CompuScope hardware configurations and functionality. Special bundle pricing is available on the purchase of any three eXpert firmware options.

Specifically, eXpert Peak detection analysis may operate using all CompuScope signal conditioning setting, trigger conditions and may be implemented in any Master/Slave multi-card CompuScope system. Normal operation of the CompuScope hardware is retained since the standard CompuScope FPGA image is loaded by all non-eXpert software.

The eXpert Peak Detection firmware may be used on a maximum of 2 channels per CompuScope card. For instance, a 4- or 8-channel Octopus CompuScope card may use eXpert Peak Detection on only 2 channels. However, all 8 channels on a 4-card CompuScope 14200 Master/Slave multi-card system may use eXpert Peak Detection.

Because of the advanced software functionality and performance required in order to exploit the Peak Detection image, its usage is not supported under LabVIEW and MATLAB. An advanced SDK sample program that operates Peak Detection Firmware is included with the CompuScope C/C# SDK. The C peak detection sample program launches a repetitive peak detection session and then continuously polls the firmware and flushes available Peak Information Sets. These sets are then stored in a simple ASCII file.

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

### **Toll-Free (US 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's products visit:

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

## ORDERING INFORMATION

Note: the eXpert Peak Detection Firmware Option is only available on the following products: CS12400, CS14200, CS14105, and the Octopus™ family of CompuScope digitizers (CS82XX & CS83XX).

eXpert Peak Detection Firmware Option 250-181-003  
eXpert Firmware Option bundle 888-100-026  
(Signal Averaging, FIR Filtering and Peak Detection)

Updated July 24, 2006

Copyright © 2006 Gage Applied Technologies. All rights reserved.