

## eXpert Signal Averaging Firmware

Signal averaging is a powerful method of improving the fidelity of noisy repetitive signals. As shown in Figure 1 below, the process consists of making multiple acquisitions of a repetitive waveform and averaging all acquisitions together. Any random noise is subsequently averaged to near zero, while the amplitude of the underlying repetitive signal remains unchanged. Using signal averaging, small signals can be extracted from a background of high-amplitude noise, which may even be larger than the actual signal itself.

Utilizing the eXpert Signal Averaging Firmware on a GaGe CompuScope Digitizer allows users to detect a small repetitive signal in a noisy environment by conducting rapid signal averaging completely on the digitizer's onboard FPGA with absolutely no host system CPU loading.

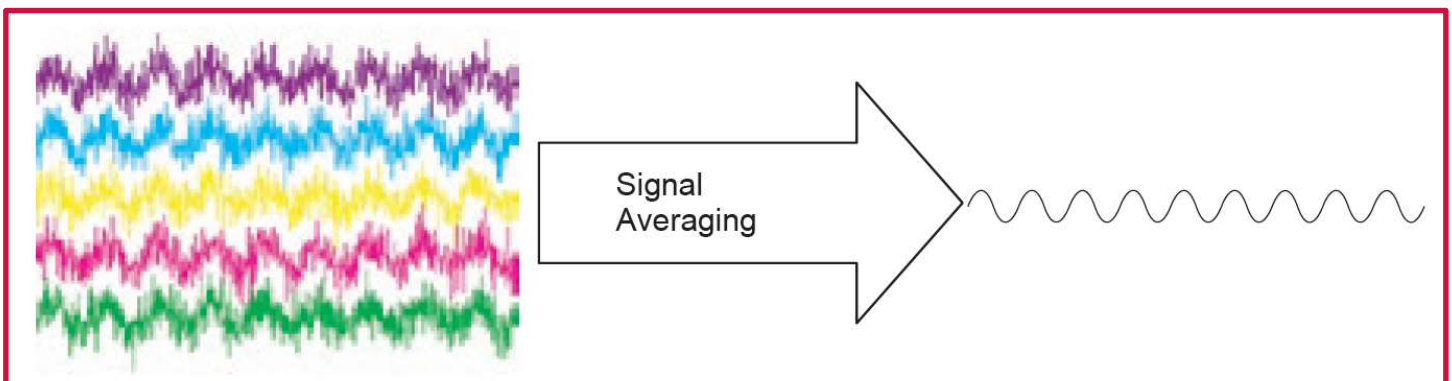
Waveforms may be signal averaged at a rate of greater than 100,000 waveforms per second with a maximum waveform length of 48,000 samples. Conducting signal averaging onboard the digitizer's FPGA also provides the benefit of reducing the amount of data to be transferred/off-loaded to the host PC system by a factor of more than 1,000 while at the same time allowing the host PC to handle other tasks in parallel.

Within the eXpert Signal Averaging Firmware, random noise on a signal is reduced by the square root of the number of averages. For example, 16 signal averages will reduce the noise on a signal by a factor of 4, while 100 signal averages will reduce the noise by factor of 10.

The maximum number of samples in a waveform that may be averaged is 48 kiloSamples divided by the number of active channels per CompuScope Digitizer card. For instance, for a CompuScope Digitizer card with 4 active channels, waveforms of up to 12 kiloSamples may be averaged using the eXpert firmware.

The maximum number of averages that may be performed in one averaging session is 1,024. Practically speaking, however, this is no real limitation since the data volume for transfer to the PC is reduced by a factor of more than 1,000 by the onboard signal averaging and thus the host CPU can then easily perform super-averaging of the averaged waveforms in order to extend the number of averages indefinitely.

The eXpert Signal Averaging Firmware is compatible with and requires one of the available GaGe Software SDKs for C/C#, MATLAB, or LabVIEW that provide a ready-made compiled sample program illustrating how to configure and use the signal averaging feature with documentation for its use in custom developed applications.



**Figure 1: Result of Signal Averaging Multiple Acquisitions to Remove Noise**

## ORDERING INFORMATION

eXpert Signal Averaging Firmware	Order Part Number
<p>eXpert Signal Averaging</p> <p><b>NOTE:</b> The eXpert Signal Averaging Firmware requires one of the available GaGe Software SDKs for C/C#, MATLAB, or LabVIEW and 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>• CS1250X</li><li>• EON</li><li>• EON Express</li><li>• Octave Express</li><li>• Octopus Express</li><li>• Oscar Express</li><li>• Razor 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>	250-181-001

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