Octopus multi-channel digitizer product introduction

The GaGe Octopus™ family of multi-channel digitizers features up to 8 channels in a single-slot PCI card with up to 125 MS/s sampling per channel, and up to 4 GB of on-board acquisition memory.

The Octopus family represents a new generation of GaGe digitizers and has the advanced features you would expect from a top performance signal capture card:

- 2, 4, or 8 simultaneous digitizing channels.
- Maximum sampling rates of 10, 25, 50, 65, 100, or 125 MS/s per channel.
- 128 MS to 2 GS on-board acquisition memory in a single full-length PCI slot.
- 12 or 14-bit vertical resolution
- Data transfer rates from CompuScope memory to PC memory as high as 200 MB/s through PCI Bus Mastering on a 66 MHz, 32 bit PCI bus.
- Better than 100 MHz input analog bandwidth specification.
- Ease of integration with External Clock In and Out, External Trigger In and Out.
- Ease of system development with Software Development Kits (SDKs) for C/C#, MATLAB, and LabVIEW. Operation under Visual Basic.NET and LabWindows/CVI is also possible from the C/C# Software Development Kit.
- Pre-Trigger Multiple Record functionality, which help optimize the use of the on-board memory by stacking data from successive acquisitions.
- Accuracy of ± 0.5% for precise absolute measurements of fine signal details.
- On-board self-calibration to guarantee consistent accuracy across input ranges and modes of operation. Self-calibration can be automatic or user-controlled to minimize down time and ensure availability of the card for measurement in test systems.
- Full-featured front-end, with software control over input ranges, coupling and impedances.
- Excellent frequency response and minimal phase distortion characteristics; designed for optimal cross-channel synchronization and smooth frequency response.
- Time-stamping acquired records using an on-board 44 bit counter that is clocked by a 66 MHz crystal oscillator. This is particularly useful in Multiple Record mode. Optionally, the time-stamp counter can use the sample clock as its source.
- On-board Phase Lock Loop (PLL) circuitry allows an external 10 MHz clock reference to synchronize the on-board internal sampling oscillator to provide the sampling clock signal.

Octopus family connectors and headers

CompuScope cards connect to the outside world through connectors, both analog (SMBs) and digital (PCI bus). This section describes these connectors for the Octopus card.

The connectors and headers on the 8-channel, 4-channel, and 2-channel Octopus digitizers are shown below:

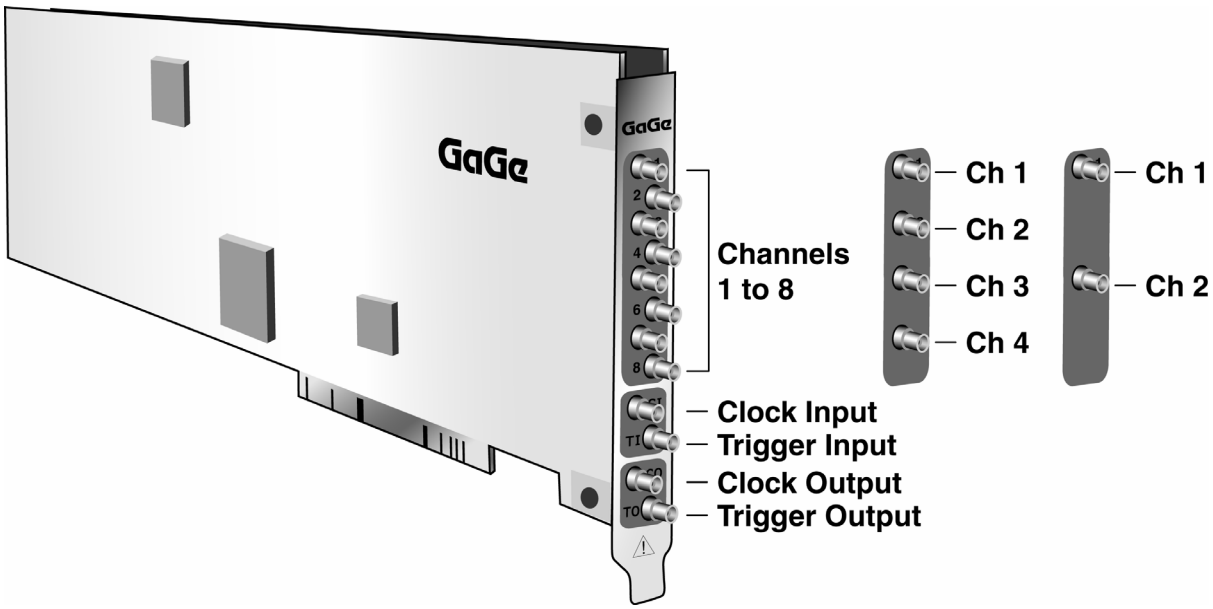

Figure 1: Connectors on the Octopus family

- **Channel 1 SMB** connector is the single-ended signal input for Channel 1.
- **Channel 2 SMB** connector is the single-ended signal input for Channel 2.
- **Channel 3 SMB** connector is the single-ended signal input for Channel 3.
- **Channel 4 SMB** connector is the single-ended signal input for Channel 4.
- **Channel 5 SMB** connector is the single-ended signal input for Channel 5.
- **Channel 6 SMB** connector is the single-ended signal input for Channel 6.
- **Channel 7 SMB** connector is the single-ended signal input for Channel 7.
- **Channel 8 SMB** connector is the single-ended signal input for Channel 8.
- **Clock Input SMB** connector is used to input a signal to be used as the sampling clock. This signal is referred to as the External Clock signal.
- **Trigger Input SMB** connector is used to input a signal that is used as an External Trigger. External Trigger is defined exactly as in an oscilloscope. This signal can be used to trigger the system but cannot be viewed or digitized.
- **Clock Output SMB** connector is used to supply the clock signal, either from the internal oscillator or from the External Clock Input, to another module of the test system or experimental setup. The characteristics of the Output are detailed in the Specifications section.
- **Trigger Output SMB** connector is used to supply a trigger signal generated by the card to another module of the test system or experimental setup.

Octopus family frequency response and bandwidth-limiting filter

A software-selectable low-pass Bessel filter with a 3 dB roll-off frequency of 20 MHz may be applied within the Octopus input signal conditioning circuitry. Application of this filter provides improved noise performance by removing high-frequency noise components from lower-frequency input signals.

A Bessel filter produces an extremely smooth response curve at all frequencies. Bessel filters are also ideal for their flat in-band group delay, flat pass-band response, and limited in-band distortion.

A graph indicating the input frequency response of the input channel with the filter applied is shown below.

Designed to satisfy a wide range of applications, it is critical that the Octopus family provides frequency measurements as precise and reliable as possible over the analog bandwidth of the card.

The Octopus family has a very flat frequency response, minimizing the attenuation or amplification of frequency components, so that the signals from each input channel are as identical as possible from the SMB connectors to the ADCs. The paths of clocking signals to the ADCs are also as similar to one another as possible.

The figure below illustrates the actual frequency response of the Octopus family using the following acquisition parameters. The sampling rate is 125 MS/s. The input range is ±500mV with DC input coupling and 50 Ω terminating input impedance. The signal attenuation is shown as a function of input signal frequency with and without the software-selectable 20 MHz low-pass Bessel filter applied.

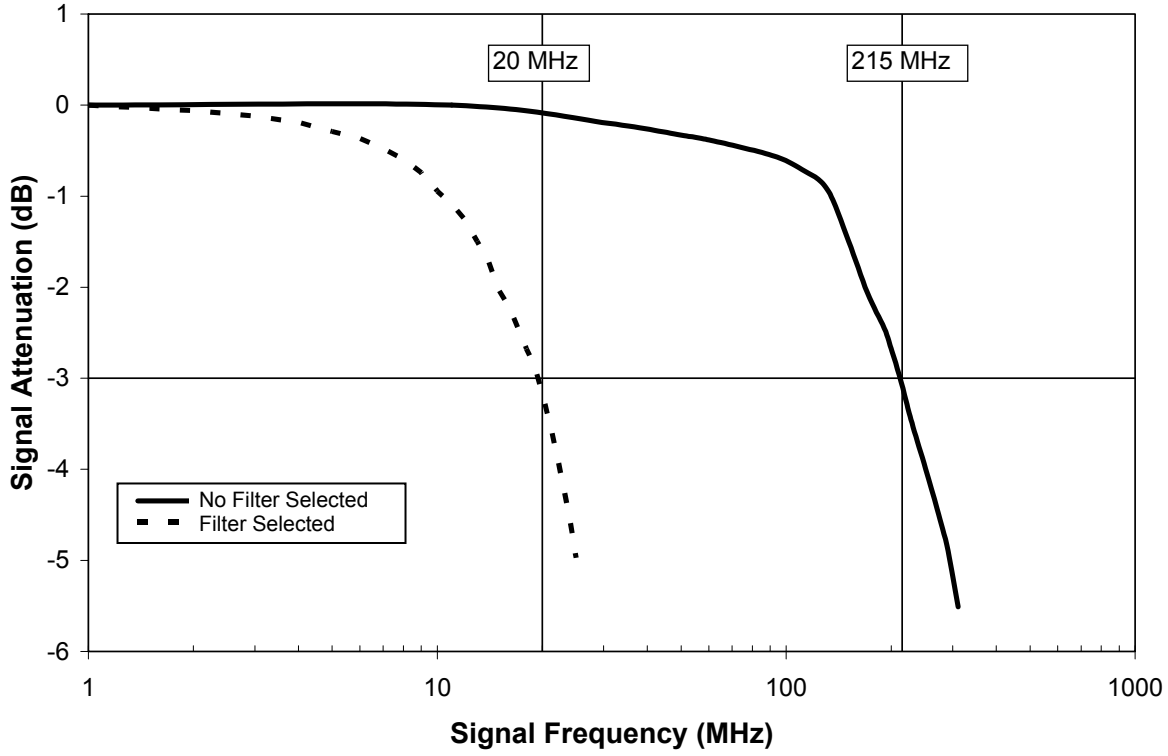

Figure 2: Illustration of the frequency response

Octopus multi-channel digitizer throughput & maximum PRF

A number of applications require the Octopus digitizer to acquire data based on a rapidly occurring trigger signal. These high Pulse Repeat Frequency (PRF) applications include radio, radar and ultrasound signal capture.

Representative repetitive capture benchmarks in Single Record mode are shown below for the Octopus family. In Single Record mode, the signal is captured into on-board CompuScope memory and the captured data are transferred through the PCI bus using PCI bus mastering to PC RAM.

Please note that much higher PRFs will be achieved using CompuScope Multiple Record mode.

Curves are shown for the Octopus digitizer in single, dual, quad and octal channel acquisition modes as a function of capture depth. Results are shown for a 32-bit, 33 MHz PCI bus. The PCI transfer rates were calculated from the linear portion of the curves at high depths.

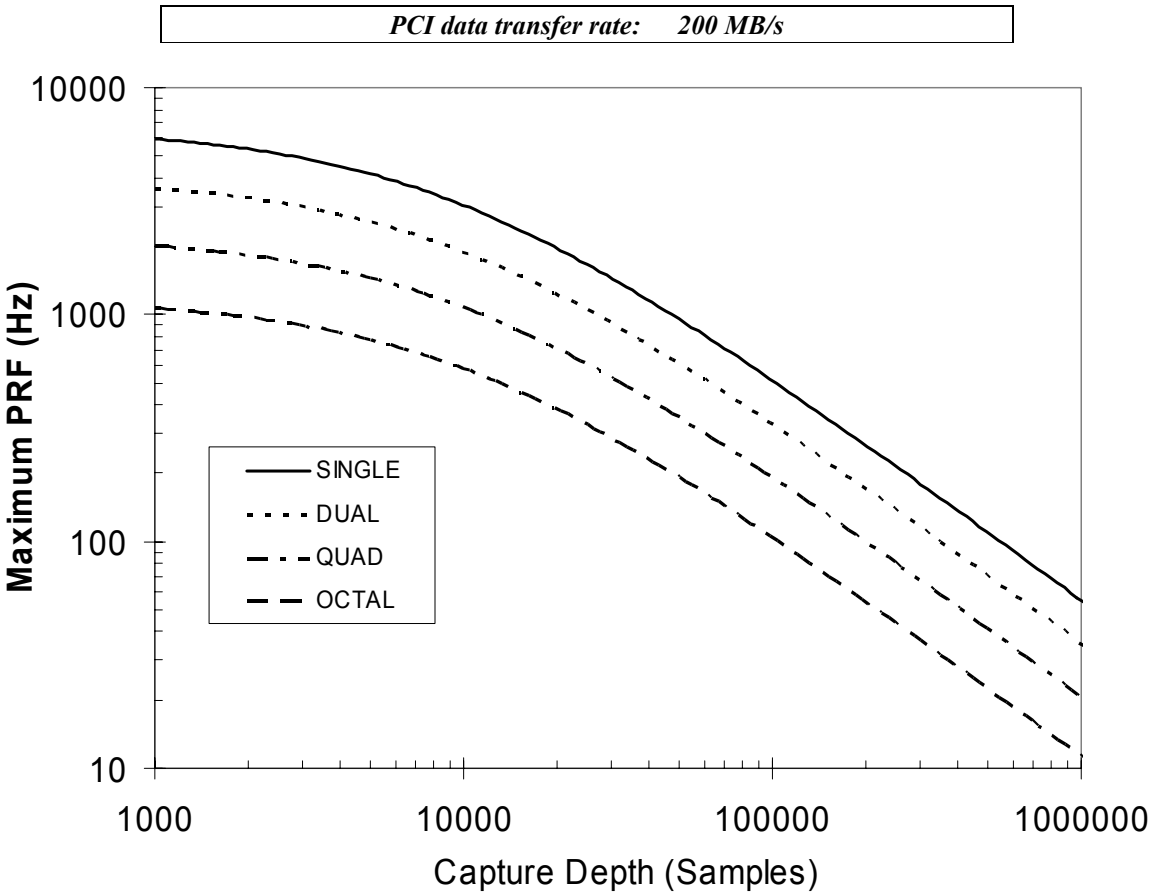

Figure 3: Maximum PRF vs. acquisition length