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 (maximum sampling rate on 16-bit Octopus digitizer is 25 MS/s).
- 128 MS to 2 GS on-board acquisition memory in a single full-length PCI slot.
- 12, 14, or 16-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.
- Greater than 100 MHz input analog bandwidth specification (greater than 20 MHz for 16-bit Octopus digitizers)
- Ease of integration with External Clock In (available on 12 and 14-bit Octopus digitizers) and Clock 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.
- Software selectable low-pass filter available for each channel on 12 and 14-bit Octopus digitizers.
- Excellent frequency response and minimal phase distortion characteristics; designed for optimal cross-channel synchronization and smooth frequency response that is within ±0.5 dB of ideal response up to 90 MHz (up to 7 MHz for 16-bit Octopus digitizers).
- 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:

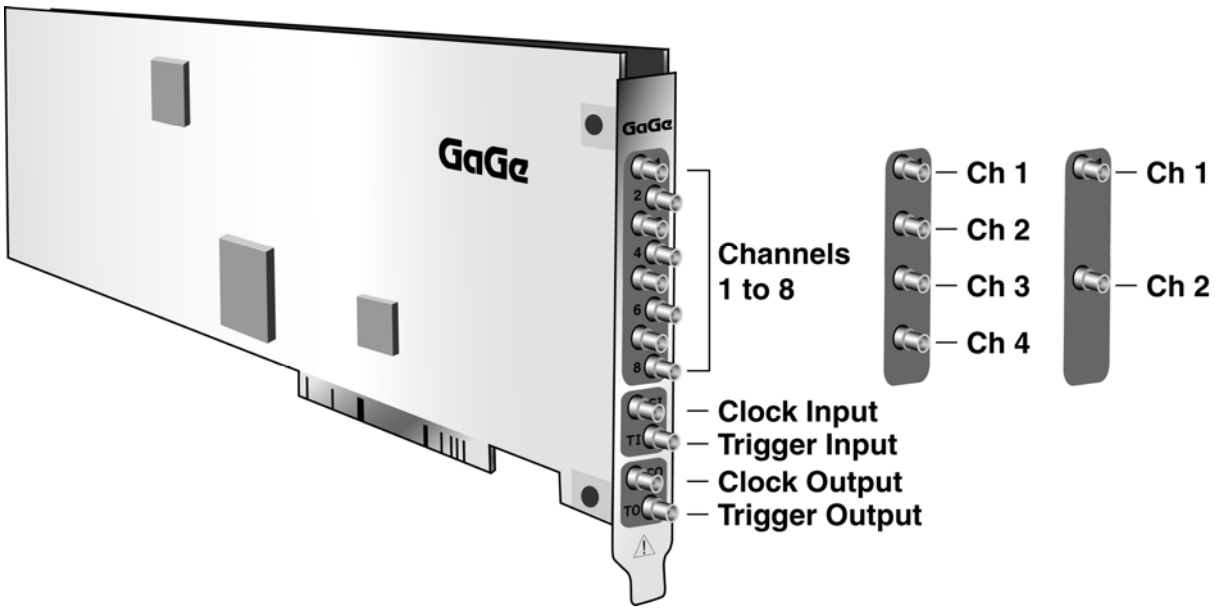

Figure 1: Connectors on the Octopus family

- **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 the input for an External Clocking signal that is used as the ADC sampling clock. (available on 12 or 14-bit Octopus digitizers). The clock input SMB may also used to input a 10 MHz Reference Signal (supported on all Octopus models).
- **Trigger Input SMB** connector is used to input an External Trigger signal. External Triggering is defined exactly as for an oscilloscope. This signal can be used to trigger the system but cannot be viewed or digitized.
- **Clock Output SMB** connector supplies the ADC clocking signal, whether it comes from the internal oscillator or from the External Clock Input, to another module of the test system or experimental setup. The clock output SMB connector may also be configured to output the Octopus' on-board high accuracy 10 MHz Reference Signal. The characteristics of the Output are detailed in the Specifications section.
- **Trigger Output SMB** connector supplies 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

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 figure below illustrates as a solid line the actual frequency response of the 12 and 14-bit Octopus family using the following acquisition parameters: 125 MS/s sampling rate, ±2V input range, 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.

For optimal flexibility each channel on the 12 and 14-bit Octopus digitizers is equipped with a software selectable low-pass Bessel filter with a 3 dB roll-off frequency of 20 MHz. 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. Application of this filter provides improved noise performance by removing high-frequency noise components from lower-frequency input signals.

In addition, the figure below illustrates as a dashed line the input frequency response of the 12 and 14-bit Octopus digitizers with the Bessel filter applied. The same dashed line also represents the frequency response of the 16-bit Octopus digitizers.

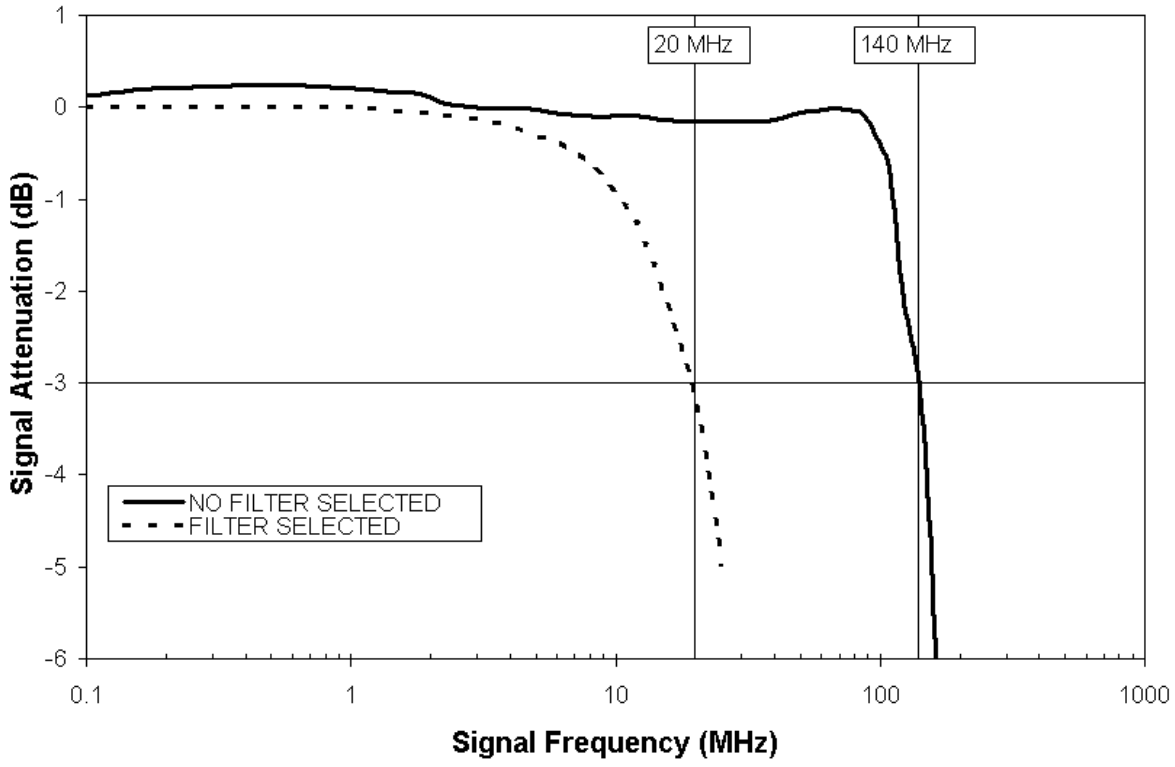

Figure 2: Illustration of the frequency response

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, 66 MHz PCI bus (PCI-X). The Octopus PCI transfer rate, calculated from the linear portion of the curves at high depths, is shown below.

PCI data transfer rate: 200 MB/s

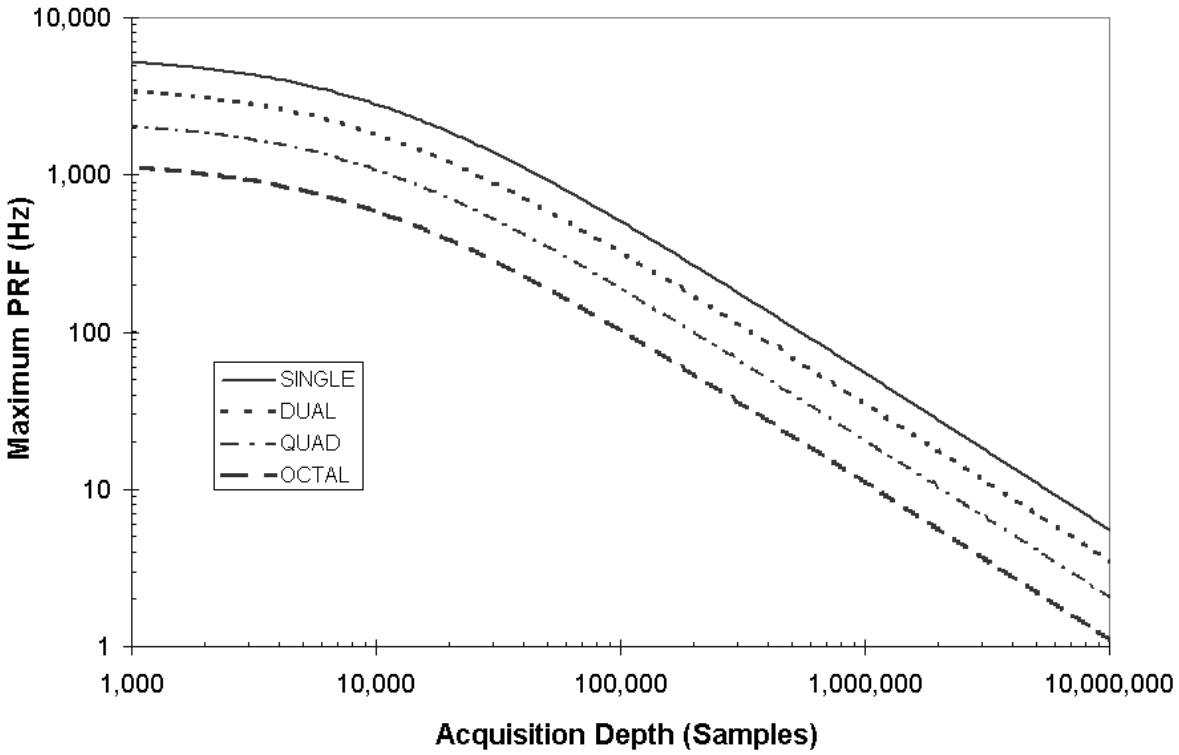

Figure 3: Maximum PRF vs. acquisition length