CompuScope Cobra digitizer product introduction

The GaGe CompuScope Cobra™ family of 8-bit digitizers provides the most powerful combination of speed, memory, and bandwidth as well as a wide portfolio of advanced acquisition features such as up to 2 channels in a single-slot PCI card with up to 2GS/s sampling per channel, and up to 4 GS of on-board acquisition memory.

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

- 1 or 2 digitizing channels
- 1 or 2 GS/s maximum sampling rate per channel
- 256 MS to 4 GS on-board acquisition memory in a single full-length PCI slot
- 8-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
- Up to 1 GHz input analog bandwidth
- 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, LabWindows/CVI, and Delphi is also possible from the C/C# Software Development Kit
- Pre-Trigger Multiple Record functionality, which helps optimize the use of the on-board memory by stacking data from successive acquisitions
- Accuracy of ±1% for precise absolute measurements
- 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 filters.
- Excellent frequency response and minimal phase distortion characteristics; designed for optimal cross-channel synchronization and smooth frequency response that is constant within 1 dB up to a signal frequency of over 100 MHz.
- 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.

Cobra CompuScope digitizer connectors and headers

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

The connectors and headers on the 2-channel, and single-channel Cobra digitizers are shown below:

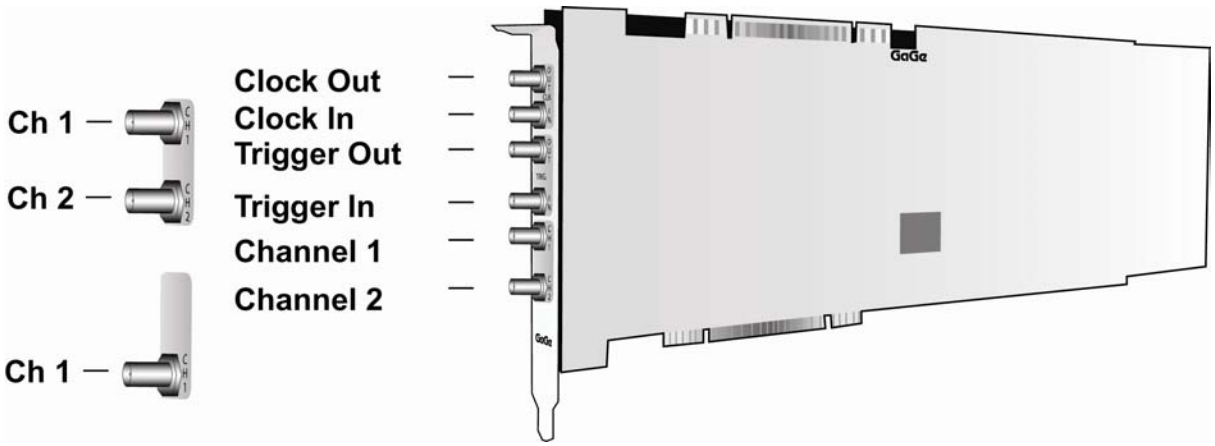


Figure 1: Connectors on the Cobra Digitizer

- **Channel 1 SMA** connector is the single-ended signal input for Channel 1.
- **Channel 2 SMA** connector is the single-ended signal input for Channel 2.
- **Clock In SMA** 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 In SMA** 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 Out SMA** 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 Out SMA** connector is used to supply a trigger signal generated by the card to another module of the test system or experimental setup.

Cobra CompuScope digitizer frequency response and bandwidth-limiting filter

A software-selectable low-pass Bessel filter with a 3 dB roll-off frequency of 200 MHz may be applied within the Cobra 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, Cobra digitzers provide frequency measurements as precise and reliable as possible over the analog bandwidth of the card.

The Cobra digitizers have 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 SMA 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 Cobra digitizers using the following acquisition parameters. The sampling rate is 1 GS/s. The input range is ±500mV with DC input coupling and 50 Ω terminating input impedance.

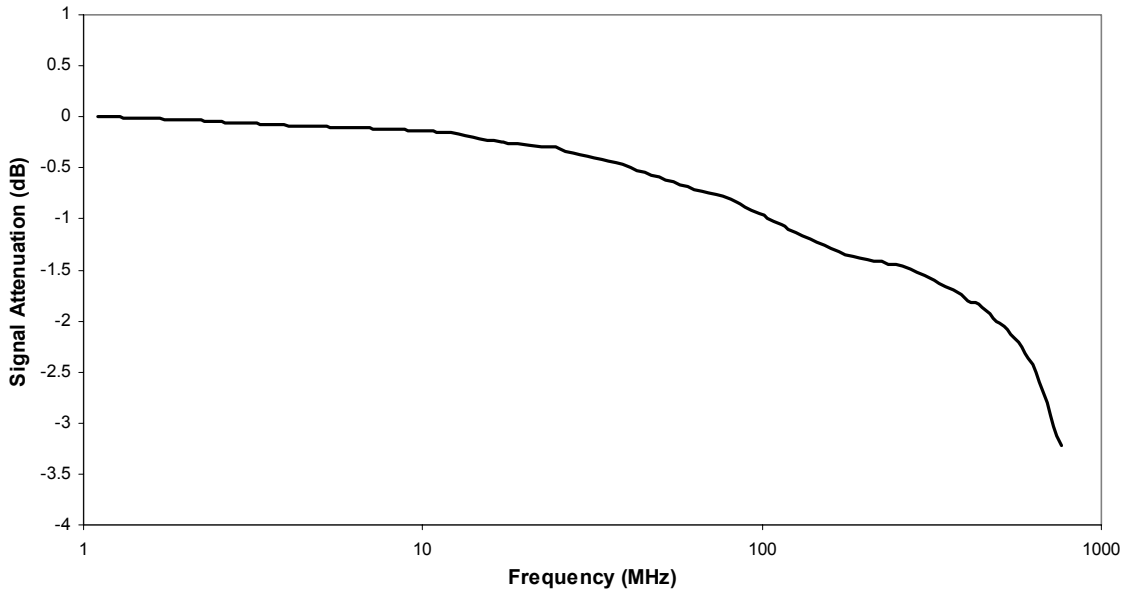


Figure 2: Illustration of the frequency response

Cobra CompuScope digitizer throughput & maximum PRF

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

Representative repetitive capture benchmarks in Single Record mode are shown below for the Cobra digitizer. 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 Cobra digitizer in single and dual channel acquisition modes as a function of capture depth. Results are shown for a 32-bit, 33 MHz PCI bus and for a 32-bit, 66 MHz PCI bus.

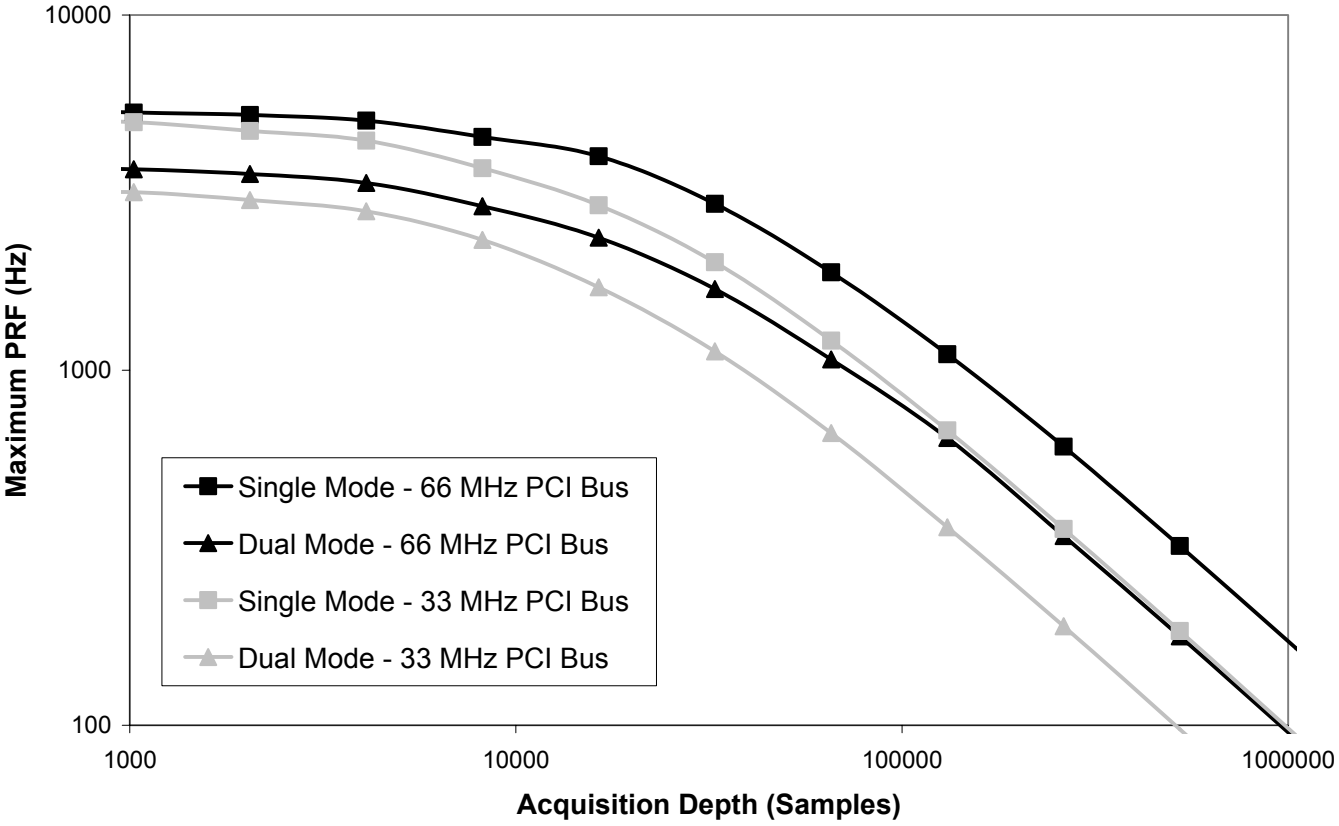
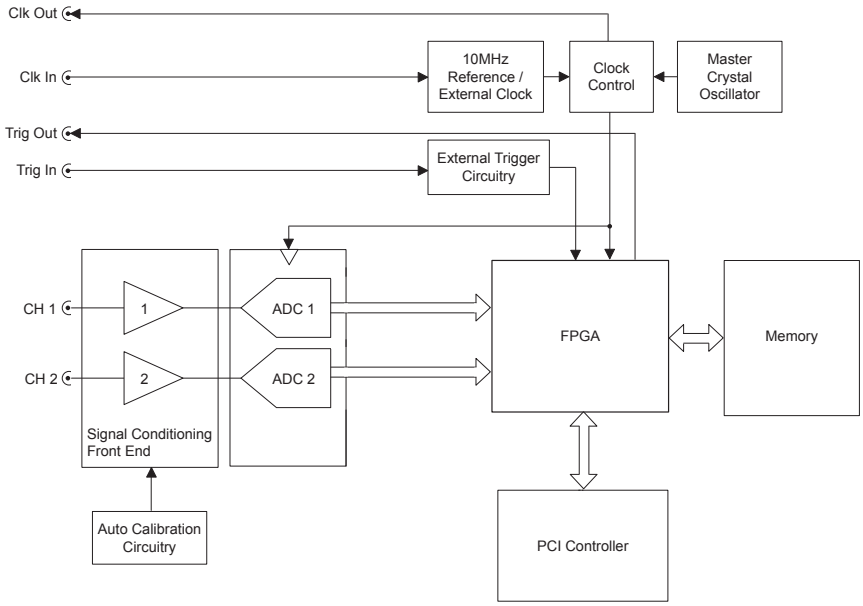


Figure 3: Maximum PRF vs. acquisition length

Cobra CompuScope Simplified Block Diagram



A/D SAMPLING

Resolution:	8 bits
Maximum Sampling Rate:	1 or 2 GS/s (model-dependent)
Sampling Rates:	2 GS/s, 1 GS/s, 500 MS/s, 250 MS/s, 125 MS/s, 100 MS/s, 50 MS/s, 25 MS/s, 10 MS/s, 5 MS/s, 2 MS/s, 1 MS/s, 500 kS/s, 200 kS/s, 100 kS/s, 50 kS/s, 20 kS/s, 10 kS/s, 5 kS/s, 2 kS/s

ACQUISITION MEMORY

Available on-board memory:	256 MS, 512 MS, 1 GS, 2 GS, 4 GS

INPUT CHANNELS

Number of Inputs:	1 or 2 (model-dependent)
Connector:	SMA
Input Voltage Ranges:	±50 mV, ±100 mV, ±200 mV, ±500 mV, ±1 V, ±2 V, ±5 V
DC Accuracy:	±1 % (see Note 1)
Protection:	Diode-clamped
Absolute Maximum Input Voltage (see Note 2):	6 V RMS
Impedance:	50 Ω
Coupling:	AC or DC
ENOB (see Note 3):	7.4
SNR (see Note 3):	46 dB
THD (see Note 3):	-60 dB
SINAD (see Note 3):	46 dB
SFDR (see Note 3):	60 dB
DC Coupled Bandwidth:	DC to >500 MHz
AC Coupled Bandwidth:	20 kHz to >500 MHz
Flatness:	Within ±1 dB of ideal response to 100 MHz signal frequency

LOW-PASS FILTER

Type:	3-pole Bessel, 1 per channel
Cut-off Frequency:	200 MHz
Operation:	Individually software-selectable

DC OFFSET

A software-adjustable DC offset voltage may be independently applied to each input channel in order to optimize input range usage.

Span:	±100 % on all input ranges
Accuracy:	1 %

TRIGGERING

Source:	CH 1 or 2, EXT or manual
Trigger Level Accuracy:	Internal: ±1% of Full Scale External: ±2% of Full Scale
Slope:	Positive or Negative
Sensitivity:	5% of Full Scale Signal swing must be at least 5% of full scale in order to cause a trigger event. Smaller signals are rejected as noise.
Post-Trigger Data:	64 points minimum May be increased with 64 point resolution.
Trigger Engines:	2 per channel, 1 for External Trigger
Source Combination:	All trigger source combinations may be logically OR'ed together

TRIGGER IN (EXTERNAL TRIGGER)

Impedance:	2 kΩ or 50 Ω
Amplitude:	Absolute Maximum 6 V RMS
Voltage Range:	±1 V, ±5 V
Bandwidth:	>300 MHz
Coupling:	AC or DC
Connector:	SMA

TRIGGER OUT

Amplitude:	0 to 1.5 V into 50 Ω load
Impedance:	50 Ω compatible
Connector:	SMA

INTERNAL CLOCK

Accuracy:	±1 ppm (0 to 50°C ambient)

CLOCK IN (EXTERNAL CLOCK)

Maximum Frequency:	1 GHz
Minimum Frequency:	200 MHz
Absolute Maximum Input Voltage (see Note 1):	6 V RMS
Signal Level:	Minimum 200 mV RMS Maximum 500 mV RMS
Minimum Signal Slew Rate:	2 V/ns
Termination Impedance:	50 Ω
Duty Cycle:	50% ±5%
Connector:	SMA
Coupling:	AC

EXTERNAL REFERENCE

A 10 MHz External Reference signal may be used to synchronize Internal Sampling Clock

Signal Type:	Square Wave
Frequency:	10 MHz ±50 ppm
Signal Level:	Minimum 200 mV RMS Maximum 500 mV RMS
Impedance:	50 Ω
Connector:	SMA

CLOCK OUT

Maximum Frequency:	1 GHz
Minimum Frequency:	10 MHz
Signal Level:	±300 mV into 50 Ω Load
Connector:	SMA

Note: 10 MHz reference signal may be selected as output for synchronizing other instruments.

MULTIPLE RECORD

Pre-trigger Data:	Up to almost full on-board memory
Record Length:	64 points minimum. May be increased with 64 points resolution

TIMESTAMPING

Resolution:	One sampling interval
Counter turnover:	>24 hours continuous

CARD SIZE

Single-slot, full-length PCI

SYSTEM REQUIREMENTS

PCI-based computer, minimum Pentium II 500 MHz, with at least one free full-length PCI slot, 128 MB RAM, 1 GB hard drive.

POWER CONSUMPTION (IN WATTS, PER CARD)

DC Supply Voltage	Worst Case	Typical
+5 Volts	11 W	10 W
- 5 Volts	0 W	0 W
+3.3 Volts	23 W	22 W
+12 Volts	0.7 W	0.6 W
-12 Volts	0.7 W	0.6 W

Note: The 4 GS Cobra model consumes an extra 3 Watts of power from the +5 Volts supply, as compared with the 256 MS model. Intermediate memory models consume extra power proportionately.

PCI BUS INTERFACE

Bus Mastering:	Fully supported
Scatter-Gather:	Fully supported
Bus Width:	32 bits
Bus Speed:	66 MHz or 33 MHz
Bus Throughput:	200 MB/s to PC memory (PCI-X compatible at 66 MHz bus speed)
Compatibility:	PCI-compliant, v.2.2 Also operates in v.2.1 systems that supply 3.3 V to PCI slot

MULTI-CARD SYSTEMS

Operating Mode:	Master/Slave or Multiple Independent
Number of Cards:	
Master/Slave:	2 to 8 cards
Multiple/Independent:	Limited only by backplane

Note: In contrast to external multi-card synchronization methods, the Cobra CompuScope's internal rigid bridge-board Master/Slave architecture provides true simultaneous sampling, triggering and arming of all channels within a Master/Slave system.

Cobra CompuScopes automatically self-configure as Master, Slave or Independent cards depending upon detection of the Master/Slave bridge-board.

OPERATING SYSTEMS

Windows XP:	All Versions
Windows 2000:	SP1 or higher

APPLICATION SOFTWARE

GageScope: Windows-based software for programming-free operation

LITE Edition:	Included with purchase, provides basic functionality
Standard Edition:	Provides limited functionality of advanced analysis tools, except for Extended Math
Professional Edition:	Provides full functionality of all advanced analysis tools

SOFTWARE DEVELOPMENT KITS (SDK)

CompuScope SDK for C/C# for Windows*
CompuScope SDK for MATLAB for Windows
CompuScope SDK for LabVIEW for Windows

*C/C# SDK is compatible with LabWindows/CVI 7.0+ compiler.
Visual Basic.NET support available with purchase of C/C# SDK.

Contact your GaGe Sales Agent for information on Linux support.

WARRANTY

One year parts and labor

Certificate of NIST Traceable Calibration is included.

All specifications subject to change without notice.

Notes to specifications:

1) DC accuracy is ≠ 1% on all input ranges except ≠ 50 mV, where it is ≠ 2%.

2) On the ≠5 V Input Range, the maximum input is 8.5 V RMS Voltage

3) Measured at maximum sample rate using a 10 MHz sine wave with an amplitude of 95% of full scale. No on-board filtering is used.

1 GHz Cobra CompuScope Models

The signal conditioning front-end circuitry of the standard Cobra CompuScope models limits the 3 dB roll-off of their frequency response to slightly more than 500 MHz. On the 1 GHz Cobra CompuScope models, whose names include the post-fix "-1GHz", most signal conditioning front-end circuitry is bypassed so that the 3 dB roll-off frequency is greater than 1GHz. Input protection and AC/DC coupling selection are absent on the 1 GHz Cobra CompuScope models and there is a single input range of ±200 mV in both single and dual channel modes. All other standard Cobra CompuScope functionality is preserved.

ORDERING INFORMATION

Hardware & Upgrades

Cobra Model	Number of channels	Max. Single Channel Sampling Rate	Max. Dual Channel Sampling Rate	Part Number
CS22G8	2	2 GS/s	1 GS/s	COB-022-000
CS21G8	2	1 GS/s	500 MS/s	COB-021-000
CS11G8	1	1 GS/s	-	COB-011-000
CS22G8-1GHz	2	2 GS/s	1 GS/s	COB-022-001
CS21G8-1GHz	2	1 GS/s	500 MS/s	COB-021-001
CS11G8-1GHz	1	1 GS/s	-	COB-011-001

Memory Upgrade: 256 MS to 512 MS	MEM-181-001
Memory Upgrade: 256 MS to 1 GS	MEM-181-003
Memory Upgrade: 256 MS to 2 GS	MEM-181-005
Memory Upgrade: 256 MS to 4 GS	MEM-181-007
Master Multi-Card Upgrade	COB-181-002
Slave Multi-Card Upgrade	COB-181-003
Set 1 Cable SMA to BNC	ACC-001-031
Set 4 Cable SMA to BNC	ACC-001-033
eXpert Signal Averaging Firmware Option	250-181-001

GageScope® Software

GageScope: Lite Edition	Included
GageScope: Standard Edition (with Purchase of CompuScope Hardware)	300-100-351
GageScope: Professional Edition (with Purchase of CompuScope Hardware)	300-100-354

Software Development Kits (SDKs)

GaGe SDK Pack on CD	200-113-000
CompuScope SDK for C/C#	200-200-101
CompuScope SDK for MATLAB	200-200-102
CompuScope SDK for LabVIEW	200-200-103

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