PCI Digitizers
BY ALAZARTECH

ATS460
125 MS/s 14-Bit PCI Digitizer

- 2 channels sampled at 14-bit resolution
- 125 MS/s simultaneous real-time sampling rate on each input
- ±20mV to ±20V input range
- Up to 128 Million samples of on-board acquisition memory per channel
- Optional Dual Port Memory
- API Panel software allows quick start-up without any development process
- Software Development Kit supports C/C++, VB and LabVIEW. Also Linux



Product	Bus	Operating System	Channels	Sampling Rate	Bandwidth	Memory Per Channel	Resolution
ATS460	PCI	Windows 2000/XP/ 98SE, Linux 2.6	2	125 MS/s to 10 KS/s	65 MHz	Up to 128 Msamples	14 bits

Overview

ATS460 is a state of the art, dual-channel, high resolution, 14 bit, 125 MS/s waveform digitizer card for PCI bus, capable of storing up to 128 Million samples per channel of acquired data in its on-board memory.

With optional Dual Port Memory, ATS460 allows users to build real-time data acquisition systems even under the Windows operating system, as users are allowed to read acquired data even while the next acquisition is in progress.

ATS460 PCI digitizers are an ideal solution for cost sensitive OEM applications that require a digitizer to be embedded into the customer's equipment.

For scientific customers who want to record multiple analog inputs simultaneously, ATS460 offers the best price-performance ratio for multi-channel data acquisition systems of up to 16 channels.

ATS460 is supplied with API Panel software that lets the user get started immediately without having to go through a software development process.

Users who need to integrate the ATS460 in their own program can purchase a Windows based software development kit, ATS-SDK for C/C++ and VB, or ATS-VI for LabVIEW for Windows or a Linux based ATS-Linux.

All of this advanced functionality is packaged in a low power, half-length PCI card available at a very aggressive price point.

Analog Input

An ATS460 features two analog input channels with extensive functionality. Each channel has 65 MHz of full power analog input bandwidth. With software selectable attenuation, you can achieve an input voltage range of ±20mV to ±20V. Attenuating probes (sold separately) can extend the voltage range even higher.

Software selectable AC or DC coupling further increases the signal measurement capability. Software selectable 50Ω input impedance makes it easy to interface to high speed RF signals.

For applications that require higher input bandwidth and the best signal integrity, an Amplifier Bypass Mode is available as a standard feature in V1.2 boards. This feature increases the input bandwith to 85 MHz, leaving the input range fixed at a nominal value of ±575 mV.

Acquisition System

ATS460 PCI digitizers use a pair of state of the art 125 MS/s, 14-bit ADCs to digitize the input signals. The real-time sampling rate ranges from 125 MS/s down to 10 KS/s. The two channels are guaranteed to be simultaneous, as they share the exact same clock.

An acquisition can consist of multiple records, with each record being captured as a result of one trigger event. A record may contain both pre-trigger and post-trigger data.

In between the multiple records being captured, the acquisition system is re-armed by the hardware within 64 sampling clock cycles.

This mode of capture, sometimes referred to as Multiple Record, is very useful for capturing data in applications with a very rapid or unpredictable trigger rate. Examples of such applications include medical imaging, ultrasonic testing, NMR spectroscopy and lightning test.

On-Board Acquisition Memory

The standard ATS460 PCI digitizer features a total of 32 MBytes of onboard memory, providing up to 8 Million points of acquisition memory for each channel.

Acquisition memory can optionally be upgraded to provide 128 Million samples per channel of signal storage.

Data is acquired into the onboard memory before being transferred to the host PC memory. This transfer is performed using Direct Memory Access (DMA), which uses scatter-gather bus mastering technology.

Optional Dual Port Memory

Optionally, ATS460 can be equipped with dual port acquisition memory. This means that data can be transferred to host PC memory even if an acquisition is in progress.

Other digitizers on the market do not provide dual-port memory, thus prolonging the re-arm time of the digitizer. This limits the maximum trigger repeat rate they can handle in applications involving fast triggers, such as medical imaging, ultrasonic testing, NMR spectroscopy and other pulse-echo testing methodologies.

ATS460, equipped with Dual Port Memory option, does not suffer from such drawbacks and provides the best solution for these applications.

For more details, contact the factory via e-mail at info@alazartech.com.

Software Selectable Bandwidth Limit

A majority of applications for PCI digitizers require oversampling of input signal, i.e. the frequency of the analog signal being digitized is a factor of 5 or 6 lower than the sample rate or even the Nyquist rate.

ATS460 features a software-controlled bandwidth limit switch, which reduces high frequency noise and improves signal to noise ratio. This switch is independently selectable for each input channel.

When selected, bandwidth limit switch can reduce the input bandwidth of a particular input to be approximately 20 MHz.

Natural Input Range

A waveform digitizer provides the best dynamic performance when it is operated within its Natural Input Range (NIR). The NIR of a digitizer is defined as the input range for which the input signal has the minimum amount of gain or attenuation.

Minimum gain ensures that there is a minimum amount of noise that is injected into the signal due to amplification. Minimum attenuation ensures that the ratio between the signal amplitude and the ground noise is the highest.

NIR for the ATS460 is the ±1 Volt input range.

Hi-Fi Input Range

Even in the Natural Input Range, the input stage of the ATS460 features a minimal amount of gain. ATS460 maintains a very good SNR, but the harmonic distortion is affected by the gain amplifier. Thus, gain accuracy is achieved at the expense of slightly increased harmonic distortion.

There are a number of applications in which this increased harmonic distortion is not acceptable. For these applications, ATS460 offer the Hi-Fi input range. In this input range, the gain amplifier is effectively bypassed to avoid harmonic distortion, resulting in extremely clean dynamic results.

When Hi-Fi range is selected, the input range is approximately ±1.3V.

Display of Very Large Data Sets

Capturing a very large amount of data is only part of the solution the ATS460 offers. ATS460 also provides very fast rendering of this data on the computer screen.

Most products on the market that provide large amount of storage memory use standard Windows display routines to plot data on the screen. This is extremely slow and can take many minutes to update the screen. Many software packages, such as LabVIEW, explicitly warn against using large data arrays.

ATS460 uses custom HyperDisP display management technology to render these very large datasets on the computer screen in a fraction of a second.

Zooming in and out of the signal is also supported by the custom HyperDisP display management technology.

Triggering

The ATS460 is equipped with sophisticated digital triggering options, such as programmable trigger thresholds and slope on any of the input channels or the External Trigger input.

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While most oscilloscopes offer only one trigger engine, ATS460 offers two trigger engines (called Engines X and Y). This allows the user to combine the two engines using a logical OR, AND or XOR operand.

The user can specify the number of records to capture in an acquisition, the length of each record and the amount of pre-trigger data.

A programmable trigger delay can also be set by the user. This is very useful for capturing the signal of interest in a pulse-echo application, such as ultrasound, radar, lidar etc.

Trigger Time Stamp

A 40-bit time stamp counter comes standard with the ATS460. This counter is initialized to a zero value when an acquisition session is started and increments once for every two samples captured, thus providing a 2-clock timing accuracy. The value of this counter is latched into on-board memory for each trigger, i.e. once per record, for up to 1000 records.

If the number of records exceeds 1000 when streaming, the earlier timestamp information will be overwritten by new readings.

This allows the user to find out the timing of each trigger in a multiple record acquisition relative to the start of the acquisition.

Multiple-Digitizer Synchronization

ATS460 features a Master/Slave connector that allows synchronization of multiple digitizers to allow truly synchronous sampling across as many as 16 channels.

A SyncBoard 460 (sold separately) is required to connect the Master/Slave connectors on multiple digitizers in the system together. Such a system is called a Master/Slave system.

SyncBoard 460 is a board-level product that features controlled impedance, equal length traces to deliver Positive Emitter Coupled Logic (PECL) level clock, trigger and initialization signals to each ATS460 in the system.

A Master/Slave system is guaranteed to sample simultaneously across all channels in that system. Triggering is also guaranteed to be simultaneous across all digitizers in the system.

ATS460 based master/slave systems provide the best price-performance for high channel count systems.

Optional External Clock

While the ATS460 features a low jitter, high reliability 125 MHz crystal oscillator as the source of the timebase system, there may be occasions when digitizing has to be synchronized to an external clock source.

ATS460 External Clock option provides an SMA input for an external clock signal, which can be a sine wave or LVTTL signal.

User can set the input impedance and coupling for the external clock input by setting the appropriate DIP switches located in the top-left corner of the ATS460 V1.2 printed circuit board.

In order to operate the ADC under optimal conditions, the user must set the appropriate frequency range for the external clock being supplied. The following ranges are supported:

Fast External Clock: 80 MHz < f_{EXT} < 125 MHz

Medium External Clock: 10 MHz < f_{EXT} < 80 MHz

Slow External Clock: f_{EXT} < 10 MHz

The active edge of the external clock is software selectable between the rising or falling edge.

Trigger Output

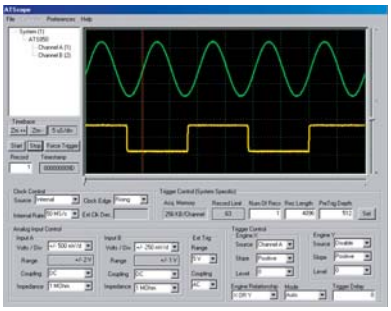
ATS460 can also be equipped with Trigger Output capability. This option uses the TRIG OUT BNC connector to output an LVTTL signal synchronous to the ATS460 Trigger signal, allowing users to synchronize their test systems to the ATS460 Trigger.

When combined with the Trigger Delay feature of the ATS460, this option is ideal for ultrasonic and other pulse-echo imaging applications.

Calibration

Every ATS460 digitizer is factory calibrated to NIST-traceable standards. To recalibrate an ATS460, the digitizer must either be shipped back to the factory or a qualified metrology lab.

Software



ATS460 is supplied with the API Panel software that allows the user to setup the acquisition hardware and capture, display and archive the signals.

A Windows compatible software development kit, ATS-SDK is also offered. It allows programs written in C/C++ and VisualBASIC to fully control the ATS460.

A set of high performance VIs for LabVIEW 6.1 and higher, called ATS-VI, can also be purchased.

A Linux based software development kit, ATS-Linux, is also available. Linux kernel versions up to v2.6 are supported.

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System Requirements

Pentium based computer with at least one free PCI slot, 512 MB RAM, 100 MB of free hard disk space, SVGA display adaptor and monitor with at least a 800 x 600 resolution. API Panel software requires Internet Explorer 5.0 or higher.

Power Requirements

+5V	2.2 A, typical for ATS460-8M 2.6 A, typical for ATS460-128M +5V voltage level must remain between the range of 4.75V to 5.20V at all times after power-on

Physical

Size	Single slot, half length PCI card (4.2 inches x 7.2 inches)
Weight	500 g

I/O Connectors

CH A, CH B, TRIG IN, TRIG OUT	BNC female connectors
ECLK	SMA female connector

Environmental

Operating temperature	0 to 55 ^{O} C
Storage temperature	-20 to 70 ^{O} C
Relative humidity	5 to 95%, non-condensing

Acquisition System

Resolution	14 bits Data is returned as MSB-justified 16 bit unsigned integers
Bandwidth (-3dB)	
DC-coupled, 1MΩ	DC - 65 MHz
DC-coupled, 50Ω	DC - 65 MHz
AC-coupled, 1MΩ	10 Hz - 65 MHz
AC-coupled, 50Ω	100KHz - 65 MHz
Bandwidth flatness:	± 1dB
Number of channels	2, simultaneously sampled
Maximum Sample Rate	125 MS/s single shot
Minimum Sample Rate	10 KS/s single shot for internal clocking
Full Scale Input ranges	
1 MΩ input impedance:	±20mV, ±40mV, ±50mV, ±80mV, ±100mV, ±200mV, ±400mV, ±500mV, ±800mV, ±1V, ±2V, ±4V, ±5V, ±8V, and ±10V, software selectable
50 Ω input impedance:	±20mV, ±40mV, ±50mV, ±80mV, ±100mV, ±200mV, ±400mV, ±500mV, ±800mV, ±1V, ±2V, and ±4V, software selectable
DC accuracy	±2% of full scale in all input ranges
Input coupling	AC or DC, software selectable
Input impedance	50Ω or 1MΩ ±1% in parallel with 30 pF ±10pF, software selectable
Input protection	
1MΩ	±28V (DC + peak AC for CH A, CH B and EXT only without external attenuation)
50Ω	±4V (DC + peak AC for CH A, CH B and EXT only without external attenuation)

Amplifier Bypass Mode

Standard Feature	On V1.2 and higher boards
DIP Switch selectable	Yes, indepdently for each channel on V1.2 and higher boards
Input Range	Approx. 525 mV rms (+7.5 dBm)
Input Coupling	DC, irrespective of the input coupling setting for the channel
Input Impedance	50 Ω, irrespective of the input impedance setting for the channel
Input bandwidth (-3dB)	85 MHz

On-Board Acquisition Memory System

Onboard acq memory	32 MB for ATS460-8M 512 MB for ATS460-128M
Acquisition Memory/ch	Up to 8 Million samples per channel for ATS460-8M Up to 128 Million samples per channel for ATS460-128M
Record Length	Software selectable with 16 point resolution. Record length must be a minimum of 128 points. Maximum record length is limited by the acquisition memory per channel.
Number of Records	Software selectable from a minimum of 1 to a maximum of 1,000 or (Acquisition Memory Per Channel / (Record Length+16)), whichever is lower
Pre-trigger depth	0 to (Record Length-64), software selectable with 16 point resolution
Post-trigger depth	Record Length - Pre-trigger depth

Timebase System

Timebase options	Internal Clock or External Clock (Optional)
Internal Sample Rates	125 MS/s, 100 MS/s, 50 MS/s, 20 MS/s, 10 MS/s, 5 MS/s, 2 MS/s, 1 MS/s, 500 KS/s, 200 KS/s, 100KS/s, 50 KS/s, 20KS/s, 10KS/s
Internal Clock accuracy	±25 ppm

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Dynamic Parameters

Typical values measured using a randomly selected ATS460 with Amplifier Bypass Mode. Input was provided by a HP8656A signal generator, followed by a 9-pole, 1 MHz band-pass filter (TTE Q36T-1M-100K-50-720B). Input frequency was set at 1 MHz and output amplitude was 500 mV rms, which is approximately 95% of the 525 mVrms full scale input in Amplifier Bypass Mode.

SNR	70.8 dB
SINAD	67.99 dB
THD	-71.13 dB
SFDR	-71.56 dB

Note that these dynamic parameters may vary from one unit to another, with input frequency and with the full scale input range selected.

Optional ECLK (External Clock) Input

Signal Level	±500mV Sine wave or 3.3V LVTTL
Input impedance	50Ω or 1KΩ, selectable
Maximum frequency	125 MHz for Fast External Clock 80 MHz for Med. External Clock 10 MHz for Slow External Clock
Minimum frequency	80 MHz for Fast External Clock 10 MHz for Med. External Clock DC for Slow External Clock
Decimation factor	Software selectable from 1 to 100,000
Sampling Edge	Rising or Falling, software selectable

Triggering System

Mode	Edge triggering with hysteresis
Comparator Type:	Digital comparators for internal (CH A, CHB) triggering and analog comparators for TRIG IN (External) triggering
Number of Trigger Engines	2
Trigger Engine Combination	OR, AND, XOR, selectable
Trigger Engine Source	CH A, CH B, EXT, Software or None, independently software selectable for each of the two Trigger Engines
Hysteresis	±5% of full scale input, typical
Trigger sensitivity	±10% of full scale input range. This implies that the trigger system may not trigger reliably if the input has an amplitude less than ±10% of full scale input range selected
Trigger level accuracy	±5%, typical, of full scale input range of the selected trigger source
Bandwidth	65 MHz
Trigger Delay	Software selectable from 0 to 9,999,999 sampling clock cycles
Trigger Timeout	Software selectable with a 10 us resolution. Maximum settable value is 3,600 seconds. Can also be disabled to wait indefinitely for a trigger event

ORDERING INFORMATION

ATS460-8M	ATS460-001
ATS460-128M	ATS460-010
ATS460: Dual Port Memory Upgrade	ATS460-002
ATS460: 8 Meg to 128 Meg Upgrade	ATS460-011
ATS460: Amplifier Bypass Upgrade	ATS460-003
ATS460: External Clock Upgrade	ATS460-004
ATS460: Trigger Output Upgrade	ATS460-005
SyncBoard 460 2X	ATS460-006
SyncBoard 460 4X	ATS460-007
SyncBoard 460 8X	ATS460-008
C/C++, VB SDK for ATS460	ATS460-SDK
LabVIEW VI for ATS460	ATS460-VI
Linux Driver for ATS460	ATS460-Linux

TRIG IN (External Trigger) Input

Input impedance	1 MΩ in parallel with 30pF ±10pF
Bandwidth (-3dB)	
DC-coupled	DC - 25 MHz
AC-coupled	10 Hz - 25 MHz
Input range	±5V or ±1V, software selectable
DC accuracy	±10% of full scale input
Input protection	±28V (DC + peak AC without external attenuation)
Coupling	AC or DC, software selectable

Optional TRIG OUT Output

Output Signal	5 Volt TTL
Synchronization	Synchronized to rising edge of sampling clock

Materials Supplied

- ATS460 PCI Card
- ATS460 Hardware Manual
- ATS460 Install Disk

Certification and Compliances

CE Mark Compliance

All specifications are subject to change without notice

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