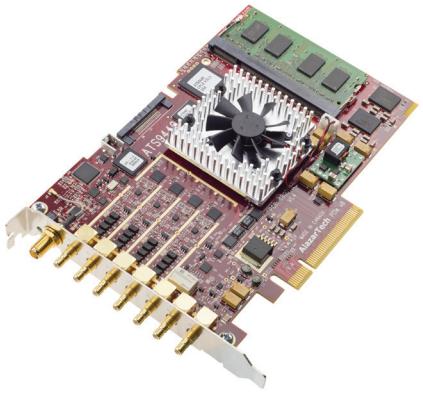
ATS9440
125 MS/s 4 channel PCIe Digitizer

- 1.6 GB/s PCI Express (8-lane) interface
- 4 channels sampled simultaneously
- 14-bit vertical resolution
- Up to 125 MS/s real-time sampling rate
- Up to 2 Gigasample dual-port memory
- Continuous streaming mode
- ±100 mV to ±4 V input range
- Asynchronous DMA device driver
- AlazarDSO® oscilloscope software
- Software Development Kit supports C/C++, C#, Python, MATLAB®, LabVIEW®
- Support for Windows® & Linux®



RoHS 3 COMPLIANT
2015/863/EU

CE

Product	Bus	Operating System	Channels	Max. Sample Rate	Bandwidth	Memory Per Channel	Resolution
ATS9440	PCIe x8	64-bit Windows & 64-bit Linux	4	125 MS/s	65 MHz Optional 120 MHz	Up to 2 Gig in single channel mode	14 bits

Overview

AlazarTech ATS®9440 is an 8-lane PCI Express (PCIe x8), quad-channel, high-speed, 14-bit, 125 MS/s waveform digitizer card capable of streaming acquired data to PC memory at rates up to 1.6 GB/s or storing it in its deep on-board dual-port acquisition memory buffer of up to 2 Gigasamples.

Each ATS9440 board has four Analog-to-Digital converter (ADC) chips that are clocked simultaneously using a low-jitter VCO to provide absolute synchronization.

SMB connectors are used to increase the I/O density on the back-panel of ATS9440.

Up to four ATS9440 boards can be configured as a Leader/Follower system to create a simultaneous sampling system of up to 16 input channels.

Users can capture data from one trigger or a burst of triggers. Users can also stream very large datasets continuously to PC memory or hard disk.

ATS9440 is supplied with AlazarDSO software that lets the user get started immediately without having to go through a software development process.

Users who need to integrate the ATS9440 in their own program can purchase a software development kit, ATS-SDK, for C/C++, C#, Python, MATLAB, and LabVIEW for both Windows and Linux operating systems.

All of this advanced functionality is packaged in a low-power, half-length PCI Express card.

Applications

Optical Coherence Tomography (OCT)

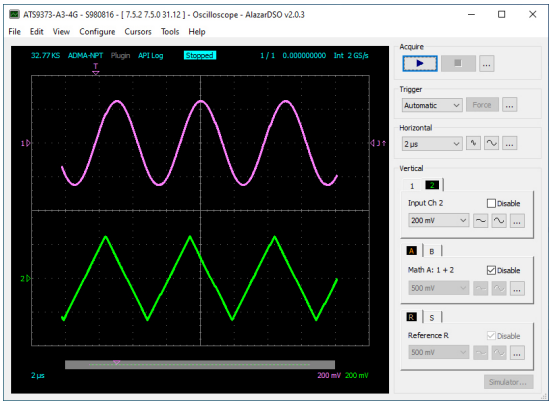
Ultrasonic & Eddy Current NDT/NDE

Terabyte Storage Oscilloscope

High-Resolution Oscilloscope

Spectroscopy

Multi-Channel Transient Recording



PCI Express Bus Interface

ATS9440 interfaces to the host computer using an 8-lane PCI Express bus. Each lane operates at 2.5 Gbps. PCIe bus specification v1.0a and v1.1 are supported. By definition, ATS9440 is also compatible with PCI Express Gen 2.

The physical and logical PCIe x8 interface is provided by an on-board FPGA, which also integrates acquisition control functions, memory management functions and acquisition datapath. This very high degree of integration maximizes product reliability.

Some PCIe slots use open-ended sockets to allow for longer cards. As such, ATS9440 requires at least one free 8-lane or 16-lane, or an open-ended slot on the motherboard.

Note: The number of lanes actually connected to a PCIe slot may be fewer than the number supported by the physical slot size. In other words, an 8-lane slot may not provide a x8 electrical connection. Users must ensure that the slot is electrically x8 to achieve maximum sustained transfer rates with ATS9440.

The AlazarTech® 1.6 GB/s benchmark was done on an ASUS® WS X299 SAGE motherboard.

Analog Input

An ATS9440 features four analog input channels with extensive functionality. Each channel has up to 65 MHz of full power analog input bandwidth. Note that the bandwidth can be increased to 120 MHz by purchasing the Wideband Input Upgrade.

With software-selectable attenuation, you can achieve an input voltage range of ±100 mV to ±4 V.

It must be noted that input impedance of all channels is fixed at 50 Ω.

Software-selectable AC or DC coupling further increases the signal measurement capability. Low-frequency cut-off for AC-coupled input is at approximately 100 kHz.

Acquisition System

ATS9440 PCI Express digitizers use state of the art 125 MSPS, 14-bit ADCs to digitize the input signals. The real-time sampling rate ranges from 125 MS/s down to 1 KS/s for internal clock and 1 MS/s for external clock.

The four channels are guaranteed to be simultaneous, as they use a common clock.

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

Infinite number of triggers can be captured by ATS9440, when it is operating using dual-port memory. In between the multiple triggers being captured, the acquisition system is re-armed by the hardware within 256 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, OCT and NMR spectroscopy.

On-Board Acquisition Memory

ATS9440 supports on-board memory buffers of 128 Megasamples, 1 Gigasamples and 2 Gigasamples. Note that one sample is stored as two bytes, so the 2 Gigasample model uses a 4 GB memory module.

Acquisition memory can either be divided equally between the four input channels or divided equally between any two of the four input channels or devoted entirely to one of the channels.

For example, ATS9440-128M provides 128 Megasamples of on-board memory when sampling in one-channel mode. In two-channel mode, it provides 64 Megasamples per channel of on-board memory. And in four-channel mode, it provides 32 Megasamples per channel of on-board memory.

When operated as dual-port memory, the on-board memory acts as a very deep FIFO between the Analog-to-Digital converters and PCI Express bus, allowing very fast sustained data transfers across the bus, even if the operating system or another motherboard resource temporarily interrupts DMA transfers.

Maximum Sustained Transfer Rate

PCI Express support on different motherboards is not always the same, resulting in significantly different sustained data transfer rates. The reasons behind these differences are complex and varied and will not be discussed here.

ATS9440 users can quickly determine the maximum sustained transfer rate for their motherboard by inserting their card in a PCIe slot and running the bus benchmarking tool provided in AlazarDSO for Windows or AlazarFrontPanel for Linux.

ATS9440, which is equipped with dual-port on-board memory, will be able to achieve this maximum sustained transfer rate.

Recommended Motherboards or PCs

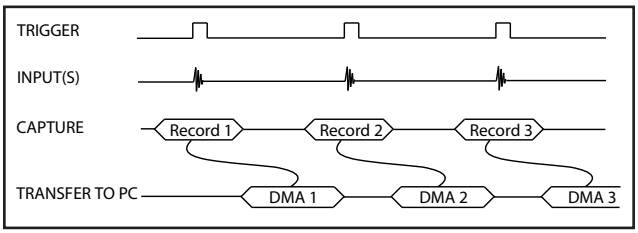
Many different types of motherboards and PCs have been benchmarked by AlazarTech. The ones that have produced the best throughput results (as high as 1.7 GB/s for PCIe Gen1) are listed here: www.alazartech.com/images-media/2246-AlazarTechRecommendedMotherboards.pdf.

It should be noted that some motherboards may behave unexpectedly. For example, one customer purchased

a P6T6 motherboard (instead of P6T7) and found that the throughput was limited to approximately 800 MB/s because P6T6 only supports 4-lane PCI Express connection, even though it uses the same x58 chipset.

Traditional AutoDMA

In order to acquire both pre-trigger and post-trigger data in a dual-ported memory environment, users can use Traditional AutoDMA.



Data is returned to the user in buffers, where each buffer can contain from 1 to 8191 records (triggers). This number is called RecordsPerBuffer.

Users can also specify that each record should come with its own header that contains a 40-bit trigger timestamp.

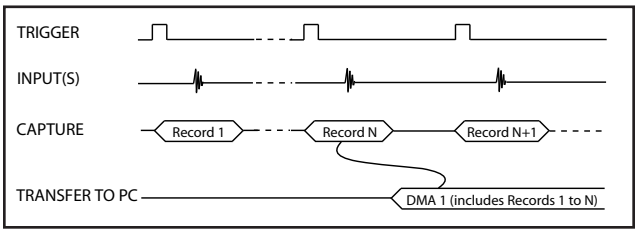
A BUFFER_OVERFLOW flag is asserted if more than 512 buffers have been acquired by the acquisition system, but not transferred to host PC memory by the AutoDMA engine.

In other words, a BUFFER_OVERFLOW can occur if more than 512 triggers occur in very rapid succession, even if all the on-board memory has not been used up.

No Pre-Trigger (NPT) AutoDMA

Many ultrasonic scanning and medical imaging applications do not need any pre-trigger data: only post-trigger data is sufficient.

NPT AutoDMA is designed specifically for these applications. By only storing post-trigger data, the memory bandwidth is optimized and the entire on-board memory acts like a very deep FIFO.



Note that a DMA is not started until RecordsPerBuffer number of records (triggers) have been acquired and written to the on-board memory.

NPT AutoDMA buffers do not include headers. However, users can specify that each record should come with its own footer that contains a 40-bit trigger timestamp. The footer is called NPT Footer.

More importantly, a BUFFER_OVERFLOW flag is asserted only if the entire on-board memory is used up. This provides a very substantial improvement over Traditional AutoDMA.

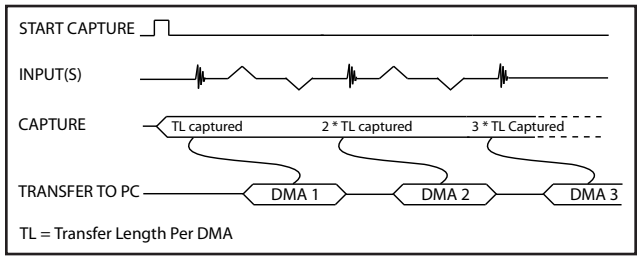
NPT AutoDMA can easily acquire data to PC host memory at the maximum sustained transfer rate of the motherboard without causing an overflow.

This is the recommended mode of operation for most ultrasonic scanning, OCT and medical imaging applications.

Continuous AutoDMA

Continuous AutoDMA is also known as data streaming mode.

In this mode, data starts streaming across the PCIe bus as soon as the ATS9440 is armed for acquisition. It is important to note that triggering is disabled in this mode.



Continuous AutoDMA buffers do not include headers, so it is not possible to get trigger time-stamps.

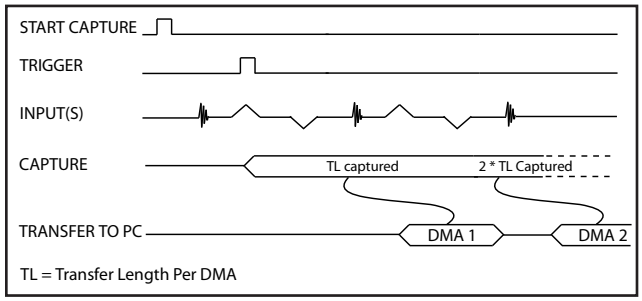
A BUFFER_OVERFLOW flag is asserted only if the entire on-board memory is used up.

The amount of data to be captured is controlled by counting the number of buffers acquired. Acquisition is stopped by an AbortCapture command.

Continuous AutoDMA can easily acquire data to PC host memory at the maximum sustained transfer rate of the motherboard without causing an overflow. This is the recommended mode for very long signal recording.

Triggered Streaming AutoDMA

Triggered Streaming AutoDMA is virtually the same as Continuous mode, except the data transfer across the bus is held off until a trigger event has been detected.



Triggered Streaming AutoDMA buffers do not include headers, so it is not possible to get trigger time-stamps.

A BUFFER_OVERFLOW flag is asserted only if the entire on-board memory is used up.

As in Continuous mode, the amount of data to be captured is controlled by counting the number of buffers acquired. Acquisition is stopped by an AbortCapture command.

Triggered Streaming AutoDMA can easily acquire data to PC host memory at the maximum sustained transfer rate of the motherboard without causing an overflow. This is the recommended mode for RF signal recording that has to be started at a specific time, e.g. based on a GPS pulse.

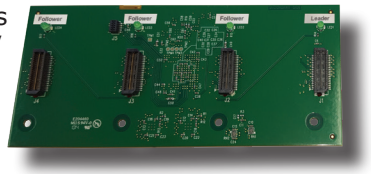
Leader/Follower Systems

Users can create a multi-board Leader/Follower system by synchronizing up to four ATS9440 boards using an appropriate SyncBoard-9440.

SyncBoard-9440 is a mezzanine board that connects to the Leader/Follower connector along the top edge of the ATS9440 and sits parallel to the motherboard. For additional robustness, users can secure the SyncBoard-9440 to a bracket mounted on each of the ATS9440 boards.

SyncBoard-9440 is available is available in different widths: 2x, 4x, 2x-W, 3x-W or 4x-W.

SyncBoards with the -W suffix provide 2-slot spacing between ATS9440 cards to support some of the newer motherboards that space out the on-board x8 or x16 slots by two slots. The -W SyncBoards are also a better solution from thermal point of view, as there is better air flow with 2-slot spacing.



The 2x and 2x-W models allow a 2-board Leader/Follower system; the 3x-W model allows a 2 or 3-slot Leader/Follower system; and the 4x and 4x-W models allow 2, 3 or 4 board Leader/Follower systems.

The Leader board's clock and trigger signals are copied by the SyncBoard-9440 and supplied to all the Follower boards. This guarantees complete synchronization between the Leader board and all Follower boards.

It should be noted that SyncBoard-9440 does not use a PLL-based clock buffer, allowing the use of variable frequency clocks in Leader/Follower configuration.

A Leader/Follower system samples all inputs simultaneously and also triggers simultaneously on the same clock edge.

For optimal trigger accuracy, only the Leader board is allowed to trigger the acquisition system.

Multi-board Systems using ATS 4X1G

ATS9440: Sync 4X1G is a device that allows simultaneous sampling across multiple independent ATS9440 waveform digitizers. This is achieved by providing common clock and trigger signals to each digitizer.

Sync 4X1G supports Trigger Enable and Trigger Disable so that users can delay triggering until all digitizers are armed; this is a distinct advantage over passive signal splitters.

ATS Sync 4X1G comes with a software library that allows user software to control it.

Sync 4X1G interfaces to AlazarTech digitizer cards using a proprietary high-frequency cable. The provided cable terminates in a ganged micro-miniature RF connector, which is used to connect to the Sync 4X1G.

The other end of the cable terminates in male SMA and BNC connectors, which are used to connect to the digitizer External Clock and External Trigger respectively.

Sync 4X1G connects to the host computer using a provided USB cable. Please refer to the ATS Sync 4X1G datasheet for full specifications.

Asynchronous DMA Driver

The various AutoDMA schemes discussed above provide hardware support for optimal data transfer. However, a corresponding high-performance software mechanism is also required to make sure sustained data transfer can be achieved.

This proprietary software mechanism is called Async DMA (short for Asynchronous DMA).

A number of data buffers are posted by the application software. Once a data buffer is filled, i.e. a DMA has been completed, ATS9440 hardware generates an interrupt, causing an event message to be sent to the application so it can start consuming data. Once the data has been consumed, the application can post the data buffer back on the queue. This can go on indefinitely.

One of the great advantages of Async DMA is that almost 95% of CPU cycles are available for data processing, as all DMA arming is done on an event-driven basis.

To the best of our knowledge, no other supplier of waveform digitizers provides asynchronous software drivers. Their synchronous drivers force the CPU to manage data acquisition, thereby slowing down the overall data acquisition process.

Output Data Format

By default, ATS9440 data comes out as unsigned binary, where code 0 represents the negative full scale, code (2^n-1) represents the positive full scale with zero being 2^{n-1}.

It is possible to change the data format to signed binary using an API call. In signed binary format, zero is represented by code 0, positive full scale is represented by (2^{n-1}-1) and negative full scale is represented by (2^{n-1}).

Triggering

ATS9440 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.

While most oscilloscopes offer only one trigger engine, ATS9440 offers two trigger engines (called Engines J and K).

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.

External Trigger Input

The external trigger input on the ATS9440 is labeled EXT on the face plate.

By default, the input impedance of this input is 50 Ω and the full scale input range is ±3 Volts. The trigger signal is treated as an analog signal in this situation and a high-speed comparator receives the signal.

Starting with hardware version 1.2, it is also possible to trigger the ATS9440 using a 3.3 V TTL signal. Input impedance is approximately 6.73 kΩ in this mode.

Timebase

ATS9440 timebase can be controlled either by on-board low-jitter VCO or by optional External Clock.

On-board low-jitter VCO uses an on-board 10 MHz TCXO as a reference clock.

Optional External Clock

While the ATS9440 features low-jitter VCO and a 10 MHz TCXO as the source of the timebase system, there may be occasions when digitizing has to be synchronized to an external clock source.

ATS9440 External Clock option provides an SMA input for an external clock signal, which should be a high slew rate signal or LVTTL signal.

Input impedance for the External Clock input is fixed at 50 Ω. External clock input is always AC-coupled.

There are three types of External Clock supported by ATS9440. These are described below.

Fast External Clock

A new sample is taken by the on-board ADCs for each rising edge of this External Clock signal.

In order to satisfy the clocking requirements of the ADC chips being used, Fast External Clock frequency must always be higher than 1 MHz and lower than 125 MHz.

This is the ideal clocking scheme for OCT applications

Slow External Clock

This type of clock should be used when the clock frequency is either too slow or is a burst-type clock. Both these types of clock do not satisfy the minimum clock requirements listed above for Fast External Clock.

In this mode, the ATS9440 ADCs are run at a preset internal clock frequency. The user-supplied Slow External Clock signal is then monitored for low-to-high transitions. Each time there is such a transition, a new sample is stored into the on-board memory.

It should be noted that there can be a 0 to +8 ns sampling jitter when Slow External Clock is being used, as the internal ADC clock is not synchronized to the user-supplied clock.

10 MHz Reference Clock

It is possible to generate the sampling clock based on an external 10 MHz reference input. This is useful for RF systems that use a common 10 MHz reference clock.

ATS9440 uses an on-board low-jitter VCO to generate the 125 MHz or 100 MHz high-frequency clock used by the ADC. This sampling clock can then be decimated by any integer factor, e.g. 2, 3, 4 ...

Data Skipping

Data Skipping is defined as a sampling technique in which the user operates the ATS9440 at a fixed sampling frequency, but can selectively ignore some samples while storing the rest. The end result is non-uniform sampling, where the time between samples is not always the same.

This type of sampling can be very useful in some OCT applications.

AUX I/O Connectors

ATS9440 provides two AUX (Auxiliary) I/O SMB connectors that can be used to input or output various signals.

AUX 1 is a Trigger Output.

AUX 2 can be configured as either an Input or Output. It is configured as a Trigger Output by default.

When configured as a Trigger Output, AUX connector outputs a 5 Volt TTL signal synchronous to the ATS9440 Trigger signal, allowing users to synchronize their test systems to the ATS9440 Trigger.

When combined with the Trigger Delay feature of the ATS9440, this option is ideal for ultrasonic and other pulse-echo imaging applications.

AUX connector can also be used as a Trigger Enable Input and Programmable Clock Output.

Wideband Input Upgrade

A Wideband Input Upgrade (order number ATS9440-009) can be purchased. Bandwidth can be extended to 120 MHz with minimal effect on noise performance.

Calibration

Every ATS9440 digitizer is factory calibrated to NIST- or CNRC-traceable standards. To recalibrate an ATS9440, the digitizer must be shipped back to the factory.

Test Reports

AlazarTech thoroughly tests every digitizer that leaves the factory; each board must pass hundreds of tests before it is shipped to a customer.

In addition to an 8-hour burn-in, each digitizer undergoes a full Performance Verification Test (PVT) where functionality such as external trigger, internal & external clock are tested, and characteristics such as frequency response and bandwidth are measured to ensure that they are within specification.

Customers can obtain test reports for their AlazarTech digitizer (for a fee) by adding the following order number to their digitizer order: *TestReport*. When ordering test reports after the digitizer order, use: *TestReport-AO*.

On-Board Monitoring

Adding to the reliability offered by ATS9440 are the on-board diagnostic circuits that constantly monitor over 20 different voltages, currents and temperatures. LED alarms are activated if any of the values surpass the limits.

AlazarDSO Software

ATS9440 is supplied with the powerful AlazarDSO software that allows the user to setup the acquisition hardware and capture, display and archive the signals.

The Stream-To-Memory command in AlazarDSO allows users to stream a large dataset to motherboard memory.

AlazarDSO software also includes powerful tools for benchmarking the computer bus and disk drive.

Software Development Kits

AlazarTech provides easy-to-use software development kits for customers who want to integrate the ATS9440 into their own software.

A Windows-compatible software development kit, called ATS-SDK, includes headers, libraries and source code sample programs written in C/C++, C#, Python, MATLAB, and LabVIEW.

A Linux-compatible software development kit, called ATS-devel, includes headers, libraries and source code sample programs written in C++ and Python.

These programs can fully control the ATS9440 and acquire data in user buffers.

The purchase of an ATS-SDK license includes a subscription that allows users to download ATS-SDK updates from the AlazarTech website for period of 12 months from the date of purchase.

Customers who want to download new releases beyond this 12 month period should purchase extended maintenance (order number ATS-SDK-1YR).

ATS-GPU

ATS-GPU is a software library developed by AlazarTech to allow users to do real-time data transfer from ATS9440 to a GPU card at rates up to 1.6 GB/s.

Interfacing waveform digitizers to GPUs involves creating a software mechanism to move data from one to the other and back to user buffers. The standard techniques used most often can get the job done, but feature very low data throughput due to software overheads.

AlazarTech designed ATS-GPU to eliminate this software bottleneck so that data can be moved from AlazarTech digitizers to GPUs and from GPUs to user buffers at full PCIe bus speeds. Once the data is available in GPU memory, many types of digital signal processing (DSP) can be done on this data at near-hardware speeds.

ATS-GPU-BASE is supplied with an example user application in source code. The application includes GPU kernels that use ATS-GPU to receive data, do very simple signal processing (data inversion), and copy the processed (inverted) data back to a user buffer. All this is done at the highest possible data transfer rate.

Programmers can replace the data inversion code with application-specific signal processing kernels to develop custom applications.

Version 23.1.0 and higher of ATS-GPU-BASE includes a Boxcar Averaging example kernel that provides the ability to perform real-time boxcar averaging on signals acquired by AlazarTech waveform digitizers. It uses optimized GPU routines that allow raw data acquisition rates up to 6.9 GB/s. This signal processing module can lead to a major improvement of signal-to-noise ratio without using CPU resources and without doing FPGA programming.

ATS-GPU-OCT is the optional OCT Signal Processing library for ATS-GPU. It contains floating-point FFT routines that have also been optimized to provide the

maximum number of FFTs per second. Kernel code running on the GPU can do zero-padding, apply a windowing function, do a floating-point FFT, calculate the amplitude and convert the result to a log scale. It is also possible to output phase information.

FFTs can be done on triggered data or on continuous gapless stream of data. It is also possible to do spectral averaging. Our benchmarks showed that it was possible to do 240,000 FFTs per second when capturing data in quad-channel mode and using a NVIDIA® Quadro® P5000 GPU.

ATS-GPU-NUFFT is an extension of ATS-GPU-OCT that allows non-uniform FFTs to be performed on data acquired uniformly in time domain using a fixed sampling rate. For SS-OCTs where the wavelength does not vary linearly in time, a fixed sampling rate results in data that is non-uniformly distributed in frequency domain. ATS-GPU-NUFFT allows linearized FFTs to be performed on such data.

ATS-GPU supports 64-bit Windows and 64-bit Linux for CUDA®-based development.

Support for Windows

Windows support for ATS9440 includes Windows 11, Windows 10, Windows Server® 2019, and Windows Server 2016. As Windows Server 2019 and 2016 are seldom used by our customers, they are expected to work but are not regularly tested with each software release. If there are issues related to Windows Server 2016 or 2019, tech support may not be as rapid as for other operating systems.

Only 64-bit Windows operating systems are supported. The last 32-bit Windows driver is version 5.10.24, which supports Windows 7.

Microsoft mainstream support ended in 2018 for Windows 8.1 and Windows Server 2012 R2. As such, AlazarTech has ceased development on these operating systems. Current software and driver releases may work with these operating systems but they are not officially supported.

Due to lack of demand and due to the fact that Microsoft no longer supports these operating systems, AlazarTech no longer supports Windows 8, Windows 7, Windows XP, Windows Vista, Windows Server 2012, Windows Server 2008 R2, and Windows Server 2008.

Linux Support

AlazarTech offers Dynamic Kernel Module Support (DKMS) drivers for the following Linux distributions: Ubuntu, Debian, and RHEL®.

AlazarTech DKMS drivers may work for other Linux distributions but they have not been tested and technical support may be limited.

Users can download the DKMS driver and associated library for their specific distribution here: www.alazartech.com/en/linux-drivers/ats9440/16/

Only 64-bit Linux operating systems are supported.

A GUI application called AlazarFrontPanel that allows simple data acquisition and display is also provided.

ATS-SDK includes source code example programs for Linux, which demonstrate how to acquire data programmatically using a C compiler. Note that example programs are only provided for Python and C++.

Based on a minimum annual business commitment, the Linux driver source code license (order number ATS9440-LINUX) may be granted to qualified OEM customers for a fee. For release of driver source code, a Non-Disclosure Agreement must be executed between the customer's organization and AlazarTech.

All such source code disclosures are made on an as-is basis with limited support from the factory.

Accessories for Out-of-Warranty Products

Accessories, such as SyncBoards, purchased for use with in-warranty digitizer cards will be covered by a 1-year warranty.

Accessories purchased for use with out-of-warranty digitizers will not be warranted against defects in materials and workmanship. As AlazarTech cannot verify with certainty that the cause of any malfunction is not due to the non-warranted digitizer, accessories purchased for out-of-warranty digitizers will require a warranty waiver.

Upgrading Your Digitizer in The Field

It is always recommended to get upgrades installed at the factory with the initial digitizer purchase.

If the digitizer is still under warranty, it may be possible to add certain upgrades in the field, but there is a small chance that the upgrade will not work, in which case the digitizer would need to be returned to the factory to complete the upgrade.

If the digitizer is no longer under warranty, the upgrade must be done at the factory and there will be a minimum service charge in addition to the cost of the upgrade. This is so that AlazarTech can verify that the digitizer meets basic performance levels prior to any upgrade.

Technical Support

AlazarTech is known for its world-class technical support. Customers receive free technical support on hardware products that are under warranty.

AlazarTech digitizers come with a standard one (1) year parts and labor warranty. This warranty can be extended for a fee (more information can be found in the next section: *Extended Warranty*).

If your waveform digitizer is out of warranty, you will not be eligible for free technical support on AlazarTech hardware or software products and you will need to purchase technical support hours (order number SUPPORT-HR5) to obtain assistance.

In addition, any necessary repairs to your out-of-warranty hardware products will carry a minimum bench charge.

Extended Warranty

The purchase of an ATS9440 includes a standard one (1) year parts and labor warranty. AlazarTech hardware parts and labor warranty should be maintained to ensure uninterrupted access to technical support and warranty repair services.

Customers may extend their warranty by ordering the appropriate Extended Warranty:

ATS9440-061 for ATS9440-128M
ATS9440-062 for ATS9440-1G
ATS9440-063 for ATS9440-2G

This should be purchased before expiration of the standard warranty (or before expiration of an Extended Warranty).

If the warranty lapses, renewal at a later date will be subject to a reinstatement fee, to cover the administrative costs of warranty reinstatement, and a 6-month waiting period for repair claims. Furthermore, warranty must be extended at least 6 months past the current date.

Users can purchase up to 4 (four) additional years of warranty extensions for a maximum total of 5 years of warranty.

Get your warranty end date by registering your product at: www.alazartech.com/en/my-account/my-products/.

Export Control Classification

According to the Export Controls Division of Government of Canada, ATS9440 is currently not controlled for export from Canada. Its export control classification is N8, which is equivalent to ECCN EAR99. ATS9440 can be shipped freely outside of Canada, with the exception of countries listed on the *Area Control List* and *Sanctions List*. Furthermore, if the end-use of ATS9440, in part or in its entirety, is related to the development or deployment of weapons of mass destruction, AlazarTech is obliged to apply for an export permit.

RoHS Compliance

ATS9440 is fully RoHS compliant, as defined by Directive 2015/863/EU (RoHS 3) of the European Parliament and of the Council of 31 March 2015 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

All manufacturing is done using RoHS-compliant components and lead-free soldering.

REACH Compliance

AlazarTech verifies its supply chain against the latest REACH requirements. A compliance statement is usually available within 6 months of release of the European Chemicals Agency (ECHA) updated substance of very high concern (SVHC), Authorizations, and Restrictions lists.

EC Conformity

ATS9440 conforms to the following standards:

Electromagnetic Emissions:
CISPR 32:2015/AMD1:2019 /
EN 55032:2015/A11:2020 (Class A):
Multimedia Equipment (MME). Radio disturbance characteristics. Limits and method of measurement:
EN 61000-3-2:2014, EN 61000-3-3:2013.

Electromagnetic Immunity:
EN 55035:2017/A11:2020:
Multimedia Equipment (MME) Immunity characteristics — Limits and methods of measurement.

Safety:
IEC 62368-1:2014 / EN 62368-1:2014+A11:2017:
Audio/video, information and communication technology equipment - Part 1: Safety requirements.

ATS9440 also follows the provisions of the following directives: 2014/35/EU (Low Voltage Equipment); 2014/30/EU (Electromagnetic Compatibility).

FCC & ICES-003 Compliance

ATS9440 has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15, subpart B of the FCC Rules, and the Canadian Interference-Causing Equipment Standard ICES-003 issue 7 October 2020.

System Requirements

Personal computer with at least one free x8, or x16 or open-ended PCI Express slot (must be x8 slot to achieve full data throughput) and 16 GB RAM; if using AlazarDSO, 16 GB of free hard disk space is also required.

Power Requirements

+12 V	1.2 A, typical
+3.3 V	1.1 A, typical

Physical

Size	Single slot, half length PCIe card (4.377 inches x 6.5 inches excluding the connectors protruding from the front panel)
Weight	250 g

I/O Connectors

CH A, CH B, CH C, CH D TRIG IN, AUX 1, AUX 2	SMB female connectors
ECLK	SMA female connector

Environmental

Operating temperature	0 to 55 degrees Celsius, ambient
Storage temperature	-20 to 70 degrees Celsius
Relative humidity	5 to 95%, non-condensing

Acquisition System

Resolution	14 bits
Bandwidth (-3 dB)	
DC-coupled, 50 Ω	DC - 65 MHz for all input ranges
AC-coupled, 50 Ω	100 kHz - 65 MHz for all input ranges
Bandwidth with Wideband Upgrade	
DC-coupled, 50 Ω	DC - 120 MHz
AC-coupled, 50 Ω	100 kHz - 120 MHz
Number of channels	4, simultaneously sampled
Maximum Sample Rate	125 MS/s single shot
Minimum Sample Rate	
Internal clocking	10 KS/s single shot
Fast External Clock	1 MS/s single shot
Full Scale Input ranges 50 Ω input impedance:	±100 mV, ±200 mV, ±400 mV, ±1 V, ±2 V, and ±4 V, software-selectable
DC accuracy	±2% of full scale in all ranges
Input coupling	AC or DC, software-selectable
Input impedance	50 Ω ±5%
Absolute maximum input	±4 V (DC + peak AC for CH A, CH B, CH C, CH D and TRIG IN only without external attenuation)

Acquisition Memory System

Memory Sizes Available	
Single Channel	128M, 512M or 1G samples per ch.
Dual Channel	64M, 256M or 512M samples per channel
Quad Channel	32M, 128M or 256M samples per channel
Record Length	Software-selectable with 32-point resolution. Record length must be a minimum of 256 points and maximum of the on-board memory size for single-port memory operation. There is no upper limit on the maximum record length in data streaming mode.
Number of Records	
Single-port memory	1 to 1000
Dual-port memory	Software-selectable from a minimum of 1 to a maximum of infinite number of records
Pre-trigger depth	From 0 to (Record Length –128) in NPT mode
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, 100 KS/s, 50 KS/s, 20 KS/s, 10 KS/s, 5 KS/s, 2 KS/s, 1 KS/s
Internal Clock accuracy	±2 ppm

Dynamic Parameters

Typical values measured on the 200 mV range of CH A of a randomly selected ATS9440. Input signal was provided by a Marconi 2018A signal generator, followed by a 9-pole, 10 MHz band-pass filter (TTE Q36T-10M-1M-50-720BMF). Input frequency was set at 9.9 MHz and output amplitude was 135 mV rms, which was approximately 95% of the full scale input. Input was averaged.

SNR	65.10 dB
SINAD	64.25 dB
THD	-64.80 dB
SFDR	-63.05 dB

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

Data Skipping Sampling Mode

Software-selectable	Yes
Maximum record length	Up to 32,768 points sampled by the fixed sampling clock

Optional ECLK (External Clock) Input

Input impedance	50 Ω
Input coupling	AC
Sampling Edge	Rising
Fast External Clock	
Signal Level	500 mV_{P-P} to 2 V_{P-P}
Maximum frequency	125 MHz
Minimum frequency	1 MHz
Slow External Clock	
Signal Level	3.3 V LVTTL
Maximum frequency	60 MHz
Minimum frequency	DC

Optional 10 MHz Reference PLL Input

Signal Level	500 mV_{P-P} to 2 V_{P-P} or 3.3 V LVTTL
Input impedance	50 Ω
Input Coupling	AC coupled
Input Frequency	10 MHz ± 0.1 MHz
Maximum frequency	10.1 MHz
Minimum frequency	9.9 MHz
Sampling Clock Freq.	125 MHz or 100 MHz

Triggering System

Mode	Edge triggering with hysteresis
Comparator Type	Digital comparators for internal (CH A, CH B, CH C, CH D) triggering and analog comparators for TRIG IN (External) triggering
Number of Trigger Engines	2
Trigger Engine Combination	Engine J, engine K, J OR K, software-selectable
Trigger Engine Source	CH A, CH B, CH C, CH D, TRIG IN, 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 µs resolution. Maximum settable value is 3,600 seconds. Can also be disabled to wait indefinitely for a trigger event

TRIG IN (External Trigger) Input

Input type	Analog or 3.3 V TTL†, software-selectable
Input coupling	DC only
Analog input impedance	50 Ω
Analog bandwidth (-3 dB)	DC - 65 MHz
Analog input range	±3 V
Analog DC accuracy	±10% of full scale input
Analog absolute max. input	±5 V (DC + peak AC without external attenuation)
TTL† input impedance	6.73 kΩ ±10%
TTL† min. pulse width	32 ADC sampling clocks
TTL† min. pulse amplitude	2 Volts
TTL† absolute max. input	-0.7 V to +5.5 V

TRIG OUT Output (AUX 1)

Connector Used	AUX I/O 1
Output Signal	5 Volt TTL
Synchronization	Synchronized to the ADC sampling clock.

Auxiliary I/O (AUX 2)

Signal direction	Input or Output, software-selectable. Trigger Output by default
Output types:	Trigger Output, Pacer (programmable clock) Output, Software-controlled Digital Output
Input types:	Trigger Enable Software readable Digital Input
Output	
Amplitude:	5 Volt TTL
Synchronization:	Synchronized to internal divide-by-16 clock
Input	
Amplitude:	3.3 Volt TTL
Input coupling:	DC

Materials Supplied

ATS9440 PCI Express Card

ATS9440 Software Installer (downloadable from product page)

Certification and Compliances

RoHS 3 (Directive 2015/863/EU) Compliance

REACH Compliance

CE Marking — EC Conformity

FCC Part 15 Class A / ICES-003 Class A Compliance

†*Triggering with TTL signal is available with hardware version 1.2 and higher.*

All specifications are subject to change without notice

ORDERING INFORMATION

ATS9440-128M	ATS9440-002
ATS9440-1G	ATS9440-003
ATS9440-2G	ATS9440-004
ATS9440: External Clock Upgrade	ATS9440-005
Test reports ordered with board	TestReport
Test reports ordered after board order	TestReport-AO
SyncBoard-9440 2x	ATS9440-007
SyncBoard-9440 4x	ATS9440-008
ATS9440: Wideband Input Upgrade	ATS9440-009
ATS9440-128M to 1G Upgrade	ATS9440-010
ATS9440-128M to 2G Upgrade	ATS9440-011
ATS9440-1G to 2G Upgrade	ATS9440-012
ATS9440: SyncBoard 2x-W	ATS9440-020
ATS9440: SyncBoard 3x-W	ATS9440-021
ATS9440: SyncBoard 4x-W	ATS9440-022
ATS9440-128M: One Year Extended Warranty	ATS9440-061
ATS9440-1G: One Year Extended Warranty	ATS9440-062
ATS9440-2G: One Year Extended Warranty	ATS9440-063
ATS9440: Sync 4X1G	ATS9440-025
ATS Sync xX1G: AC Wall Adapter	SYNC-X1G-PWR
ATS Sync 4X1G: GRF1-SMA/BNC cable	SYNC-4X1-CBL
SYNC-4X1G: One Year Extended Warranty	SYNC-4X1-061
ATS-SDK purchased with a digitizer board or ATS-GPU: License + 1 Year Subscription (Supports C/C++, Python, MATLAB, and LabVIEW)	ATS-SDK
ATS-SDK purchased separately: License + 1 Year Subscription + 5 hours of technical support (Supports C/C++, Python, MATLAB, and LabVIEW)	ATS-SDK-WOD
ATS-GPU-BASE: GPU Streaming Library License + 1 Year Subscription	ATSGPU-001
ATS-GPU-OCT: Signal Processing Library License + 1 Year Subscription (requires ATSGPU-001)	ATSGPU-101
ATS-GPU-NUFFT: ATS-GPU-OCT Extension for fixed-frequency sampled data License + 1 Year Subscription (requires ATSGPU-001 & ATSGPU-101)	ATSGPU-201
5 Hours of technical support	SUPPORT-HR5

Manufactured By:

Alazar Technologies, Inc.

6600 TRANS-CANADA HIGHWAY, SUITE 310
POINTE-CLAIRE, QC, CANADA H9R 4S2

TOLL FREE: 1-877-7-ALAZAR OR 1-877-725-2927
TEL: (514) 426-4899 FAX: (514) 426-2723

E-MAIL: sales@alazartech.com

DATASHEET REVISION HISTORY

Changes from version 1.4M (Feb 2024) to version 1.4N	Section, Page
Modified PCIe specification slot requirements to include open-ended slots	PCI Express Bus Interface, pg. 2
Added section	Test Reports, pg. 6
Updated system requirements	System Requirements, pg. 9
Replaced install disk on USB flash drive with downloadable content	Materials Supplied, pg. 10
Added test report order numbers	Ordering Information, pg. 11

Changes from version 1.4L (Dec 2023) to version 1.4M	Section, Page
Added section on ATS9440: Sync 4X1G	Multi-board Systems using ATS 4X1G, pg. 3
Modified warranty reinstatement fee information	Extended Warranty, pg. 7
Specified that Operating temperature is ambient	Environmental, pg. 9
Added Sync 4X1G, its accessories and extended warranty: ATS9440-025, SYNC-X1G-PWR, SYNC-4X1-CBL, SYNC-4X1-061	Ordering Information, pg. 11

Changes from version 1.4K (Nov 2022) to version 1.4L	Section, Page
Corrected unsigned binary positive full scale to 2^{n}-1 (was incorrectly stated as 2^{n-1}-1), corrected signed binary positive full scale to 2^{n-1}-1 (was incorrectly stated as 2^{n-2}-1) and negative full scale 2^{n-1} (was incorrectly stated as 2^{n-2}).	Output Data Format, pg. 4
Added paragraph on Boxcar Averaging for *ATS-GPU-BASE*	ATS-GPU, pg. 6
Modified to include new warranty reinstatement policy	Extended Warranty, pg. 7
Added section for REACH Compliance	REACH Compliance, pg. 8
Absolute maximum input: Corrected label for External Trigger from EXT to TRIG IN	Acquisition System, pg. 9
Trigger Engine Source: Corrected label for External Trigger from EXT to TRIG IN	Triggering System, pg. 10
Added REACH Compliance to list of Certification and Compliances	Certification and Compliances, pg. 10

Changes from version 1.4J (July 2022) to version 1.4K	Section, Page
Removed 32-bit Windows	Feature Table, pg. 1
Added new section to specify default output data format is unsigned binary and that it can be changed to signed binary via an API call.	Output Data Format, pg. 4
Removed section; this feature has been deprecated	Dummy Clock Switchover, pg. 5
Separate description for Linux SDK to detail supported programming languages	Software Development Kits, pg. 6
Noted that only 64-bit Windows is supported and that the last driver version that supports 32-bit Windows is 5.10.24.	Support for Windows, pg. 6
Updated download link for the Linux driver and associated library, and added note: ATS-SDK example programs are only provided for Python and C++	Linux Support, pg. 7
Added new section to detail AlazarTech's accessory policy	Accessories for Out-of-Warranty Products, pg. 7
Added new section to detail AlazarTech's upgrade policy	Upgrading Your Digitizer in The Field, pg. 7
Removed section; this feature has been deprecated	Dummy Clock Switchover, pg. 10

Changes from version 1.4I (Nov 2021) to version 1.4J	Section, Page
Changes to maintenance subscription inclusions: removed technical support	Software Development Kits, pg. 6
Added Windows 11	Support for Windows, pg. 6
Added new section to specify how AlazarTech handles technical support: Customers receive free technical support on hardware products that are under warranty. Out-of-warranty support requires the purchase of support hours.	Technical Support, pg. 7
Updated specification name from *Input protection* to *Absolute maximum input* Actual value did not change.	Acquisition System, pg. 8
Updated specification names (actual values did not change): *Analog input protection* to *Analog absolute max. input* *TTL input protection* to *TTL absolute max. input*.	TRIG IN (External Trigger) Input, pg. 9
Updated name for product *Software Development Kit* Now called: *ATS-SDK purchased with a digitizer board or ATS-GPU*	Ordering Information, pg. 10
Added products ATS-SDK-WOD and SUPPORT-HR5	Ordering Information, pg. 10

DATASHEET REVISION HISTORY

Changes from version 1.4H (Oct 2021) to version 1.4I	Section, Page
Changed term for multi-board system to *Leader/Follower*	Leader/Follower Systems, pg. 4
Specified number of extended warranties that users may purchase	Extended Warranty, pg. 7

Changes from version 1.4G (July 2021) to version 1.4H	Section, Page
Updated support status for Windows 8.x and Windows Server versions 2012 R2, 2016, 2019	Support for Windows, pg. 6
Updated Linux Support: only 64-bit Linux operating systems are supported	Linux Support, pg. 7

Changes from version 1.4F (Jan 2020) to version 1.4G	Section, Page
Changed terminology from *Information Technology Equipment (ITE)* to *Multimedia Equipment (MME)*	EC Conformity, pg. 7
Removed *5 V-compliant* from 3.3 V TTL input	External Trigger Input, pg. 4
Updated section *ATS-GPU* and added paragraph on ATS-GPU-NUFFT	ATS-GPU, pg. 6
Updated Linux Support (RHEL) and added new DKMS drivers	Linux Support, pg. 6
Updated product registration URL	Extended Warranty, pg. 7
Updated standards and directives	EC Conformity, pg. 7
Updated year of FCC and ICES-003 standards	FCC & ICES-003 Compliance, pg. 7
Corrected TRIG IN Input type: removed (5 V compliant)	TRIG IN (External Trigger) Input, pg. 9
Added Auxiliary I/O input coupling (DC)	Auxiliary I/O (AUX I/O), pg. 9
Updated software descriptions and added order number for ATS-GPU-NUFFT	Ordering Information, pg. 10

Changes from version 1.4E (May 2019) to version 1.4F	Section, Page
Changed *Sampling Rate* column to *Max. Sample Rate*	Feature Table, pg. 1
Added AlazarFrontPanel (for Linux) as benchmarking tool	Maximum Sustained Transfer Rate, pg. 2
Replaced signal sine wave requirement with high slew rate for external clock signal	Optional External Clock, pg. 5
Removed qualified metrology lab as option for recalibrating ATS9440	Calibration, pg. 5
Specified Windows 7 version support, re-ordered list of operating systems, and added end-of-support notice for Windows 7 and Windows Server 2008 R2	Support for Windows, pg. 6
Specified Linux distributions: CentOS, Debian, and Ubuntu	Linux Support, pg. 6
Clarified specifications by separating Fast and Slow External Clock Changed fast ext. clock signal from "400 mV_{P-P} to 2 V_{P-P}" to "500 mV_{P-P} to 2 V_{P-P}" Removed sine wave requirement Removed maximum and minimum amplitude, spec included in signal level	Optional ECLK (External Clock) Input, pg. 8
Changed signal level from "±100 mV to ±500 mV Sine wave or 3.3 V LVTTL" to "500 mV_{P-P} to 2 V_{P-P} or 3.3 V LVTTL"	Optional 10 MHz Reference PLL Input, pg. 9
Corrected Output types (removed Busy Output and added Pacer Output)	Auxiliary I/O (AUX 2), pg. 9

Changes from version 1.4D (Jan 2019) to version 1.4E	Section, Page
Updated ATS-GPU benchmarks (FFTs per second, number of channels, and GPU)	ATS-GPU, pg. 6
Removed *ATS-GMA* section as this product is being discontinued	ATS-GMA, pg. 6
Added section *Extended Warranty*	Extended Warranty, pg. 7
Updated Trademark information	pg. 7
Specified that listed Pre-trigger depth applies to NPT mode	Acquisition Memory System, pg. 8
Removed ATS-GMA order numbers (ATSGMA-001, ATSGMA-101)	Ordering Information, pg. 10

Changes from version 1.4C (Sept 2018) to version 1.4D	Section, Page
Updated *Sanctions List* URL	Export Control Classification, pg. 7
Updated Trademark information	pg. 7

Changes from version 1.4B (Jan 2018) to version 1.4C	Section, Page
Updated RoHS Compliance to RoHS 3	Global change
Clarified Operating System Support	Feature Table, pg. 1
Correction of trigger engines: changed to J and K (instead of X and Y)	Triggering, pg. 4

DATASHEET REVISION HISTORY

Changes from version 1.4B (Jan 2018) to version 1.4C (continued)	Section, Page
Specified that External Trigger Input 3.3 V TTL input is 5 V-compliant	External Trigger Input, pg. 4
Added AUX connector configurations for AUX 1 and AUX 2	AUX Connectors, pg. 5
Added information on ATS-SDK license	Software Development Kits, pg. 6
Specified 64-bit version for Windows and Linux support	ATS-GPU, pg. 6
Added *ATS-GMA* section	ATS-GMA, pg. 6
Added list of supported Microsoft Windows versions	Support for Windows, pg. 6
Added Trademark information	pg. 7
Added missing AUX IO	I/O Connectors, pg. 8
Corrected Minimum Sample Rates and removed Bandwidth Flatness	Acquisition System, pg. 8
Added *Acquisition Memory System* section	Acquisition Memory System, pg. 8
Added Maximum Amplitude: 2 V_{P-P}	Optional ECLK (External Clock) Input, pg. 8
Added "PLL" to section name for clarity, corrected Input Frequency tolerance, and added Max. and Min. Frequencies	Optional 10 MHz Reference PLL Input, pg. 9
Corrected Trigger Engine Combination	Triggering System, pg. 9
Clarified specs by providing separate specifications for Analog and TTL input, Added TTL min. pulse width, TTL min. pulse amplitude, and TTL input protection	TRIG IN (External Trigger) Input, pg. 9
Edited *TRIG OUT Output* section title to include *(AUX 1)*	TRIG OUT Output (AUX 1), pg. 9
Added *Auxiliary I/O (AUX 2)* section	Auxiliary I/O (AUX 2), pg. 9
Added subscription length for ATS-SDK, ATSGPU-001, ATSGPU-101 Added products ATSGMA-001, ATSGMA-101	Ordering Information, pg. 10

Changes from version 1.4A (Oct 2017) to version 1.4B	Section, Page
Updated ATS9440 image	(Introduction), pg. 1
Added note about NPT Footers	No Pre-Trigger (NPT) AutoDMA, pg. 3
Added CNRC as calibration standard	Calibration, pg. 6
Added -BASE and -OCT to ATS-GPU description for clarity	ATS-GPU, pg. 6
Corrected size of card	Physical, pg. 8
Updated email address	Manufactured By, pg. 9

Changes from version 1.4 (Sept 2017) to version 1.4A	Section, Page
Added bandwidth for optional Wideband Upgrade	Feature Table, pg. 1
Added Wideband Input section	Wideband Input Upgrade, pg. 6
Added Bandwidth with Wideband Upgrade	Acquisition System, pg. 8
Updated description for product ATSGPU-001 & ATSGPU-101	Ordering Information System, pg. 9

Changes from version 1.2 (Nov 2013) to version 1.4	Section, Page
Added Python to list of SDK supported languages, and Support for Windows & Linux	Features, pg. 1
Added Python & LabVIEW to list of supported languages for ATS-SDK, removed ATS-VI	Overview, pg. 1
Specified that input impedance of all channels is fixed at 50 Ω	Analog Input, pg. 2
Added 2-slot-spacing SyncBoards (-W models)	Master/Slave Systems, pg. 4
Updated TTL External Trigger Input Impedance to 6.73 kΩ	External Trigger Input, pg. 5
Modified AlazarDSO description	AlazarDSO Software, pg. 6
Updated ATS-SDK description: added Python, removed ATS-VI	Software Development Kits, pg. 6
Added section on ATS-GPU	ATS-GPU, pg. 6
Replaced section *ATS-Linux* with *Linux Support*; now includes download link & updated description	Linux Support, pg. 6
Added Export Control Classification information	Export Control Classification, pg. 6
Added section on RoHS compliance	RoHS Compliance, pg. 6
Added section on EC Conformity	EC Conformity, pg. 7
Added section on FCC & ICES-003 Compliance	FCC & ICES-003 Compliance, pg. 7

DATASHEET REVISION HISTORY

Changes from version 1.2 (Nov 2013) to version 1.4 (continued)	Section, Page
Updated External Trigger Input Impedance for TTL input to 6.73 kΩ ±10%	TRIG IN (External Trigger) Input, pg. 9
Updated list of Certification and Compliances	Certification and Compliances, pg. 9
Replaced product ATS9440-SDK with ATS-SDK	Ordering Information, pg. 9
Removed products ATS9440-VI (ATS-SDK now supports LabVIEW), ATS9440-LIN	Ordering Information, pg. 9
Added products ATS9440-020, ATS9440-021, ATS9440-022, ATS9440-061, ATS9440-062, ATS9440-063, ATSGPU-001, ATSGPU-101	Ordering Information, pg. 9