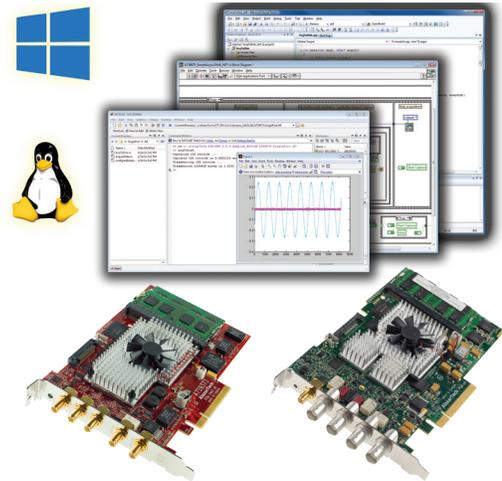# ATS-SDK
Software Development Kit

AlazarTech

- Software Development Kit for C/C++, C#, MATLAB®, LabVIEW® and Python

- Supports all AlazarTech® waveform digitizers

- Fully supports asynchronous DMA for highest data transfer rates

- Supports single-board and multi-board Systems

- Many example programs

- Thread-safe DMA routines

- Compatible with 32/64-bit Windows® and 64-bit Linux®

Product	Supported Operating Systems	Language Support	C Compiler Compatibility
ATS-SDK	32/64-bit Windows: Windows 10, Windows Server® 2019, Windows Server 2016 64-bit Linux: Ubuntu, Debian, and RHEL®	C/C++, C#, LabVIEW, MATLAB, Python	Windows: Microsoft Visual Studio® 2012 or later. Linux: GCC v.4.8.5 or later

Overview

AlazarTech ATS®-SDK is a Windows and Linux compatible software development kit created by AlazarTech to allow users to programmatically control and acquire data from its line of waveform digitizers.

With full support for C/C++ (Visual Studio, GCC or Clang) and C#, MATLAB, LabVIEW, and Python environments, ATS-SDK is the most powerful, efficient, and high-performance development kit.

For data streaming applications using AlazarTech's PCI Express waveform digitizers, ATS-SDK supports up to 6.8 GB/s sustained data throughput to computer memory or even disk, as long as the disk storage data rate is faster than acquisition throughput.

Since the device driver is able to lock down user buffers for DMA purposes, no memory copy commands are necessary in order for the user application to have access to acquired data. This allows customers to build real-time imaging and signal processing systems, even though Windows and Linux are non-real-time operating systems.

ATS-SDK supports single-card and multi-card Leader/Follower or Multiple-Independent systems.

ATS-SDK includes all necessary header files and function prototypes to allow the use of ATSApi DLL supplied by AlazarTech as part of the driver disk.

ATS-SDK manual, freely downloadable from AlazarTech website, provides complete details for all API functions.

When users purchase a license of ATS-SDK, they acquire a permanent license. AlazarTech's OEM-friendly licensing policy means that customers who embed the waveform digitizer in their own machine do not have to pay any royalties or other licensing fees for ATS-SDK. In other words, ATS-SDK is a one-time purchase.

Typical ATS-SDK Application

A typical ATS-SDK based user application that uses AutoDMA consists of the following minimum sections:

1) Setup waveform digitizer hardware parameters

   This includes input range, coupling and impedance, trigger parameters and on-FPGA FFT etc.

2) Setup DMA and create a queue of buffers

   Most imaging applications use No Pre Trigger (NPT) triggered acquisition, whereas most radio applications use continuous streaming

3) Start data capture

   User can initialize other system components before starting the capture

4) Wait for a buffer to be ready

5) Consume the buffer

   For highest performance, make sure data consumption is faster than the rate at which buffers are supplied by ATS-SDK.

6) Re-post consumed buffer to the buffer queue

   This allows an application to run infinitely, allowing 24/7 operation

7) Repeat steps 4, 5 and 6 until all result buffers have been consumed or the application has to be closed

Support for 32 & 64-bit Windows and 64-bit Linux Operating Systems

ATS-SDK provides support for 32-bit and 64-bit Windows, and 64-bit Linux operating systems.

Windows support 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 soft-

ware release. If there are issues related to Windows Server 2016 or 2019, tech support may not be as rapid as for other operating systems.

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.

ATS-SDK also supports Linux, as long as a device driver exists for a particular distribution. Starting from driver version 7.1.2, Dynamic Kernel Module Support (DKMS) drivers are available for the following Linux distributions: Ubuntu, Debian, and RHEL®. A complete list of available drivers can be found here: ftp://release@ftp.alazartech.com/Outgoing/Linux

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

Example Programs
A vast array of example programs are supplied with ATS-SDK.

Example programs are classified according to programming languages supported: C/C++, MATLAB, C#, LabVIEW, and Python.

For any of the programming languages, each AlazarTech PCI Express Waveform Digitizer has its own set of sample programs.

This makes it very easy for programmers to use an appropriate example program as a starting point for their design without having to worry about specific board capabilities, as that has already been taken care of.

The list of sample programs provided is constantly evolving. As such, users should consult the latest Release Notes for ATS-SDK, which are available on AlazarTech's website.

Thread Safety
All API calls related to DMA have been verified to be thread safe in the sense that it is safe to post and consume buffers from different threads.

Board configuration functions that are usually called during the initial setup of the board are not guaranteed to be re-entrant or thread safe.

Note that multiple applications are not allowed to make calls to the same hardware device, as that can result in the hardware being put into an unstable or even unusable state.

For high-performance applications, the simplest (and most efficient) model is to dedicate one thread to handling the board(s) and use other threads or processes to consume the acquired data.

C/C++ Support
C/C++ Windows programmers can use Microsoft Visual Studio 2012 (v.11.0) and higher.

Note that if users want to use a project designed for Professional Edition under Express, they must download an appropriate SDK from Microsoft.

Linux programmers should use a GCC (version 4.8.5 or later) compiler for their distribution. Clang is also supported.

MATLAB Support
Users can programmatically control AlazarTech waveform digitizers from MATLAB using m-files. All API functions are available to MATLAB programmers using the *loadlibrary* function.

MATLAB support has been fully verified under Windows for versions R2016a through R2019b. Example programs should run properly under Linux as well, but this has not been tested by AlazarTech.

Note: the last 32-bit release of MATLAB was version R2015b; ATS-SDK, therefore, only supports 64-bit MATLAB

C# Support
C# programmers can access the ATS-SDK API via a very thin wrapper implemented as a separate library called AlazarApiNet. This wrapper defines all the functions and constants that are of interest of users of the ATS-SDK. There is a one-to-one mapping between API calls in the C/C++ DLL and on the C# side, which means that C# programmers can use the regular ATS-SDK guide as a reference.

C# example programs have been tested under MS Visual Studio 2012 up to 2019.

LabVIEW Support
Starting with ATS-SDK v7.0, AlazarTech has included support for LabVIEW in ATS-SDK. It is no longer necessary for customers to purchase a license of ATS-VI.

All development has been halted for ATS-VI, i.e. future AlazarTech digitizers will not have ATS-VI support.

AlazarTech no longer supports ATS-VI. As noted in previous versions of this document, support for existing ATS-VI releases ended as of January 1, 2018.

ATS-SDK includes LabVIEW VI's that act as wrappers around AlazarTech API functions. This method improves the efficiency of customer-written VIs and also provides superior documentation to LabVIEW users.

LabVIEW 2016 and higher have been tested with the example VIs. LabVIEW NXG is not supported.

Example Programs as Starting Point for Software Development
ATS-SDK is shipped with many example programs, which are meant to act as a starting point for customer's software development process. The code is written in a way that customers can easily include it in their own software with minimal effort.

The exact example program to use depends on the customer's application. The most common starting point for customers who want to capture data from a rapidly occurring trigger signal is the **NPT** example program (NPT stands for No Pre Trigger).

Example Program for Imaging Applications
Many users of AlazarTech waveform digitizers are involved in some kind of imaging, which requires acquisition of a two dimensional (2-D) image, also known as a *Frame*.

ATS-SDK includes example programs that shows how users can acquire 2-D images using a *Trigger Enable* signal (also called *Frame Trigger*) and an *External Trigger* (also called *Line Trigger*).

AlazarTech recommends the **NPT_Scan** example program as a good starting point for imaging applications.

Example Programs for Parallel Computing
ATS-SDK includes a C example program for Windows that show how users can use multi-core CPUs to do real time averaging of acquired data at rates up to 1.5 GB/s.

This example program is called **NPT_AverageMultithreaded**. Customers in Spectroscopy and Quantum Computing applications can use this innovative technique to replace hardware averaging digitizers from other suppliers at a fraction of their cost.

The same functionality is also available in a DLL called **ATS_Average**. AlazarTech has created example programs in LabVIEW and MATLAB that call this DLL to do real time averaging. Customers can download this DLL and example programs from the following link:

ftp://release@ftp.alazartech.com/Outgoing/Windows/ATS_Average

Example Programs for Gapless Data Streaming
ATS-SDK includes some example programs that show how users can acquire gapless data and stream it to user memory for real time signal processing or storage. This mode is also called Continuous Mode.

It should be noted that if data consumption (storage or real time signal processing) is slower than the gapless data throughput, a buffer overflow error will be generated.

AlazarTech recommends example programs called **CS** as the starting point for such applications.

A slightly different mode of operation is called Triggered Streaming, where the digitizer board waits for a trigger event before starting a gapless data streaming. Customers should use example programs called **TR** for these applications.

Example Programs for Capturing into Very Large Buffer
Windows and Linux operating systems limit the amount of physical memory that can be locked down for DMA purposes. A further limit of 64 Megabytes is imposed by AlazarTech device driver for the maximum size of a DMA buffer.

Some customer applications require data to be captured into one very large (10s of Gigabytes) buffer.

AlazarTech has created an example program called **NPT_Segments** that shows how users can DMA gapless data into a very large buffer without violating any of the restrictions mentioned above. This code can be made available to customers on a case-by-case basis.

Example Programs for Using On-FPGA FFT
Some of the latest waveform digitizer boards from AlazarTech include on-FPGA FFT calculation capability. This feature can be very useful for customers involved in Optical Coherence Tomography (OCT).

ATS-SDK includes example programs on how to use this on-FPGA FFT circuit. Users should use the **NPT_on-FPGA_FFT** as the starting point.

Electronic Delivery
As of June 2020, AlazarTech software products are only available as a digital download. Customers who purchase ATS-SDK must provide a valid email address to receive their serial number, download link, and required password.

Software Licensing Policy
Users are allowed to freely distribute ATSApi dynamically linked library (DLL) and any compiled code generated using ATS-SDK, as long as there is an AlazarTech PCI Express waveform digitizer present in the same computer.

If an AlazarTech PCI Express waveform digitizer is not present in the computer, users must purchase a separate license for each computer on which ATS-SDK is installed.

In no case is the user allowed to distribute or share the source code of ATS-SDK with other users.

Extended Maintenance
ATS-SDK is a constantly evolving product, with new functionality being added on a regular basis.

The purchase of a license of ATS-SDK automatically allows customers to download updates from the AlazarTech website for a period of 12 months from the date of purchase.

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

The purchase must be made before expiration of the standard subscription (or before expiration of an extended subscription). Extended Maintenance can only be purchased while there is a valid subscription in place.

Get your subscription end date by registering your ATS-SDK at: www.alazartech.com/en/my-account/my-products/. You will need the SDK serial number, which can be found in the email you received with your download link and password. In the case of older purchases, the serial number can be found on the CD envelope.

How to Purchase ATS-SDK
ATS-SDK (order number ATS-SDK) is only available for purchase with an AlazarTech digitizer or with an ATS-GPU software library. ATS-SDK includes a software license and 1 year of software maintenance, which provides access to any new versions released during the maintenance period.

Customers who wish to purchase an ATS-SDK Software Development Kit without an AlazarTech digitizer or ATS-GPU software library must purchase order number ATS-SDK-WOD, which includes a software license, 1 year of software maintenance, and 5 hours of technical support.

Use with Out-of-Warranty Waveform Digitizers
In order to avoid possible disappointment in product functionality, customers purchasing ATS-SDK for use with an out-of-warranty waveform digitizer must first confirm that the digitizer is in working order by running a series of tests provided by AlazarTech: https://www.alazartech.com/en/support/faq/?faq=[1067].

AlazarTech reserves the right to refuse orders of ATS-SDK for use with an inadequately functioning digitizer.

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 Extended Warranty

section of each digitizer datasheet).

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.

ORDERING INFORMATION

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-SDK-1YR: 1 year extended maintenance for ATS-SDK	ATS-SDK-1YR
5 Hours of technical support	SUPPORT-HR5

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DATASHEET REVISION HISTORY

Changes from version 7.50 (Nov 2021) to version 7.60 — Section, Page

Added missing Linux distributions in *Supported Operating Systems*	Feature Table, pg. 1
Changed term for multi-board system to Leader/Follower	Overview, pg. 1
Updated Windows support information: added Windows 11	Support for 32 & 64-bit Windows, pg. 2 and 64-bit Linux Operating Systems
Updated section name and description to reflect the change in the way AlazarTech handles technical support.	Extended Maintenance, pg. 3
Added new section to explain the differences between ATS-SDK order numbers and the conditions under which they may be purchased.	How to Purchase ATS-SDK, pg. 3
Added new section to specify that customers who wish to use ATS-SDK with an out-of-warranty digitizer card are required to complete a series of tests to validate that the dgitizer is in working order prior to purchase.	Use with Out-of-Warranty, pg. 3 Waveform Digitizers
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. 3
Updated name for product *Software Development Kit* Now called: *ATS-SDK purchased with a digitizer board or ATS-GPU*	Ordering Information, pg. 4
Added products ATS-SDK-WOD and SUPPORT-HR5	Ordering Information, pg. 4

Changes from version 7.40 (June 2020) to version 7.50 — Section, Page

Updated GCC version to 4.8.5	Global change
Updated Windows support information: add Windows Server 2016 & 2019, End support for: Windows 8, 7, XP, Vista, and Windows Server 2012, 2008 Updated Linux support information: add RHEL, remove CentOS	Support for 32 & 64-bit Windows, pg. 2 and 64-bit Linux Operating Systems

Changes from version 7.30 (Jan 2019) to version 7.40 — Section, Page

Updated Linux support information to include new DKMS drivers (driver v.7.1.2+)	Support for 32 & 64-bit Windows, pg. 2 and 64-bit Linux Operating Systems
Added note: ATS-SDK only supports 64-bit MATLAB: MATLAB R2015b was the last 32-bit release and ATS-SDK supports MATLAB versions R2016a through R2019b	MATLAB Support, pg. 2
Added section Electronic Delivery	Electronic Delivery, pg. 3
Updated location of serial number	Extended Support and Maintenance, pg. 3

Changes from version 7.23a (May 2019) to version 7.30 — Section, Page

Added Microsoft Visual Studio trademark information	Global change
Updated list of Supported Operating Systems and C Compiler Compatibility	Feature Table, pg. 1
Updated list of Windows Supported Operating Systems Added end-of-support notice for Windows 7 and Windows Server 2008 R2 Specified Linux distributions: CentOS, Debian, Ubuntu	Support for 32 & 64-bit Windows, pg. 1 and Linux Operating Systems
Updated Microsoft Visual Studio version to 2012 (v.11.0) and higher Updated GCC version to version 4.4.7 or later	C/C++ Support, pg. 2
Updated verified MATLAB versions to R2016a through R2019b	MATLAB Support, pg. 2
Updated tested versions: Visual Studio 2012 to 2019	C# Support, pg. 2
Updated tested versions: LabVIEW version to 2016 and higher Noted that LabVIEW NXG is not supported	LabVIEW Support, pg. 2

Changes from version 7.23 (Jan 2019) to version 7.23a — Section, Page

Added note about *Extended Support and Maintenance* purchasing conditions, and how to obtain your subscription end date	Extended Support and Maintenance, pg. 3

Changes from version 7.15B (Feb 2018) to version 7.23 — Section, Page

Added Trademark information	Global change
Updated latest supported MATLAB version to R2017b	MATLAB Support, pg. 2
Updated supported LabVIEW version and removed support for LabVIEW 7.0	LabVIEW Support, pg. 2

DATASHEET REVISION HISTORY

Changes from version 7.15A (Jan 2018) to version 7.15B   Section, Page

Specified 64-bit for Linux   Feature List, pg. 1

Specified 64-bit for Linux in Supported Operating Systems   Feature Table, pg. 1

Updated section name and specified 64-bit support for Linux Operating Systems   Support for 32 & 64-bit Windows, pg. 1
and 64-bit Linux Operating Systems

Changes from version 7.15 (Nov 2017) to version 7.15A   Section, Page

Removed Windows XP and Vista from list of Supported Operating Systems   Feature Table, pg. 1

Specified version R2 for Windows Server 2008 on list of Supported Operating Systems   Feature Table, pg. 1

Removed Windows XP and Vista from list of Supported Operating Systems   Support for 32 & 64-bit Windows, pg. 1
and Linux Operating Systems

Specified version R2 for Windows Server 2008 on list of Supported Operating Systems   Support for 32 & 64-bit Windows, pg. 1
and Linux Operating Systems

Added paragraph with list of Operating Systems no longer supported by AlazarTech   Support for 32 & 64-bit Windows, pg. 2
and Linux Operating Systems

Updated support status of ATS-VI, which was supported until the end of 2017   LabVIEW Support, pg. 2

Updated email address   Manufactured By, pg. 3

Changes from version 7.1 (Oct 2015) to version 7.15   Section, Page

Replaced section *Annual Subscription* with *Extended Support and Maintenance*   Extended Support and Maintenance, pg. 3

Replaced ATSSDK-ANN with ATS-SDK-1YR   Ordering Information System, pg. 3