

# LEGION™ ADC HD

128-Channel, 80MSPS Analog-to-Digital Converter



## Applications

Photoacoustics (Optoacoustics)  
X-ray Induced Acoustics  
Thermoacoustics  
Acoustoelectrics  
3D Tomography  
Photoacoustic Microscopy (PAM)  
2D Imaging  
Multi-Sensor Monitoring  
Non-Destructive Testing  
Transducer Manufacturing  
Low Voltage Ultrasonics

The **LEGION™ ADC HD** unit offers fully parallel operation for simultaneous data acquisition from all channels without multiplexing in an ultra-compact external USB enclosure. Each unit supports up to 128 element detectors. Up to 16 ADC units can be operated in parallel to enable 2048 data acquisition channels. Incoming analog signals can be amplified on each channel by a fixed 40 dB using an optional integrated preamplifier. Sampling rate is fixed at 80 MSPS.

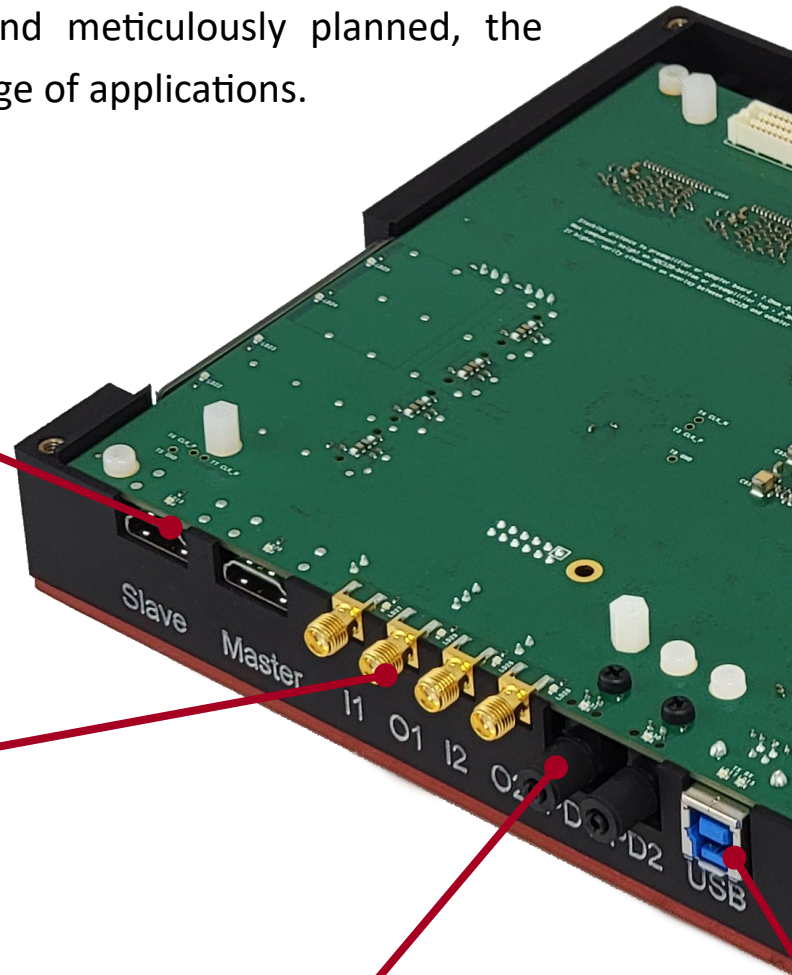
# FEATURES

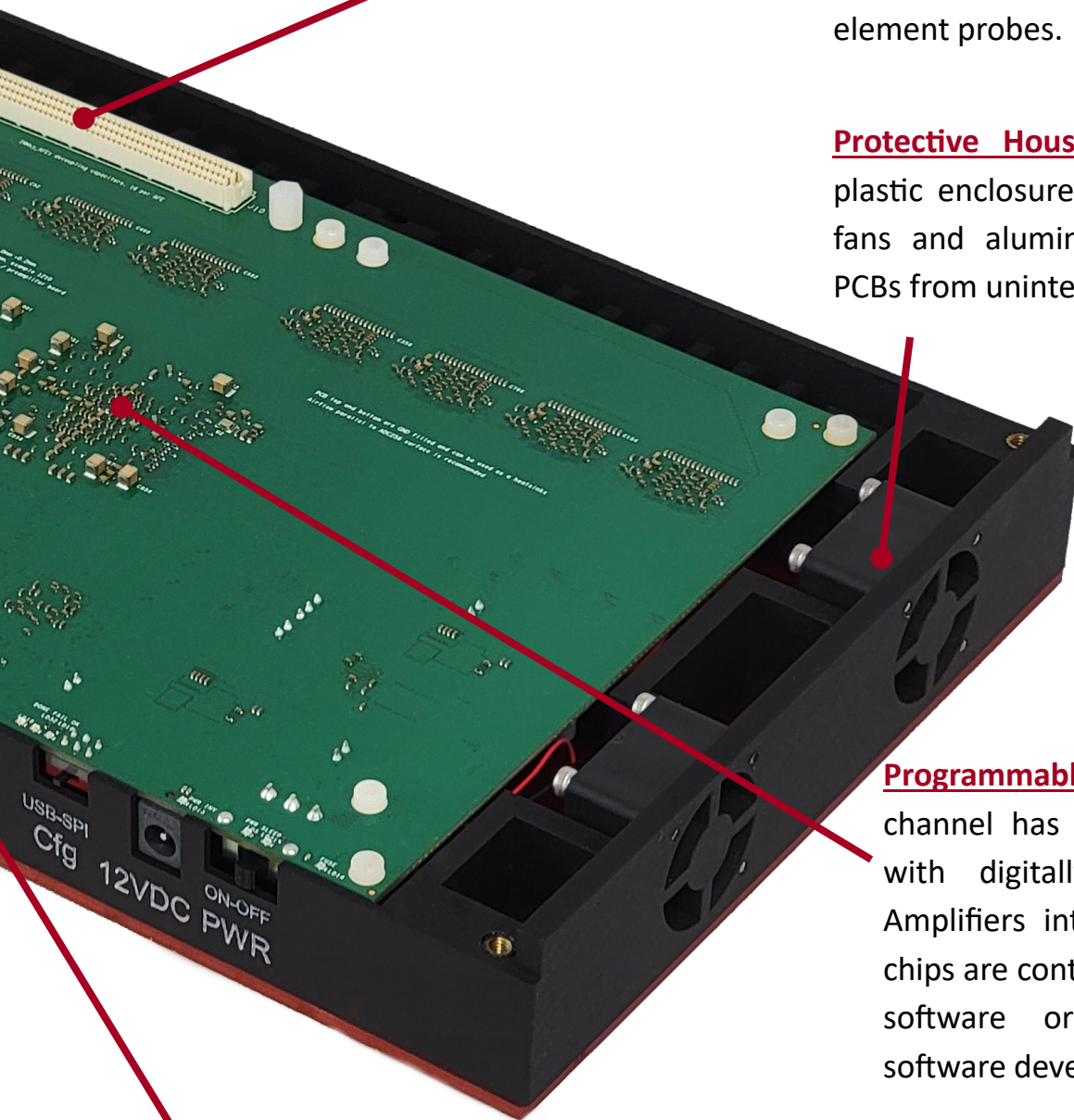
Each LEGION™ ADC HD undergoes a rigorous quality control process to ensure that all channels and features are operating at the highest level of performance. Thoroughly designed and meticulously planned, the LEGION™ ADC HD supports a wide range of applications.

**Parallel Channels** Connect up to 4 units in parallel and up to 16 units using our LEGION hub to acquire more data at fast data acquisition rates.

**Programmable Trigger Outputs** Generate trigger output at defined rate or repetition of external trigger input with programmed delay. Output trigger supplied through electrically isolated SMA connector can be used for triggering of external devices.

**Optical and Electrical Trigger inputs** Sync external hardware (e.g. a laser) with data acquisition using electronic or optical IN ports.





**Input Connector** The unit comes with one SAMTEC SEAFP series port on a 128-channel bank. This port can be fitted with preamplifiers and medical grade connectors that support third-party 128-element probes.

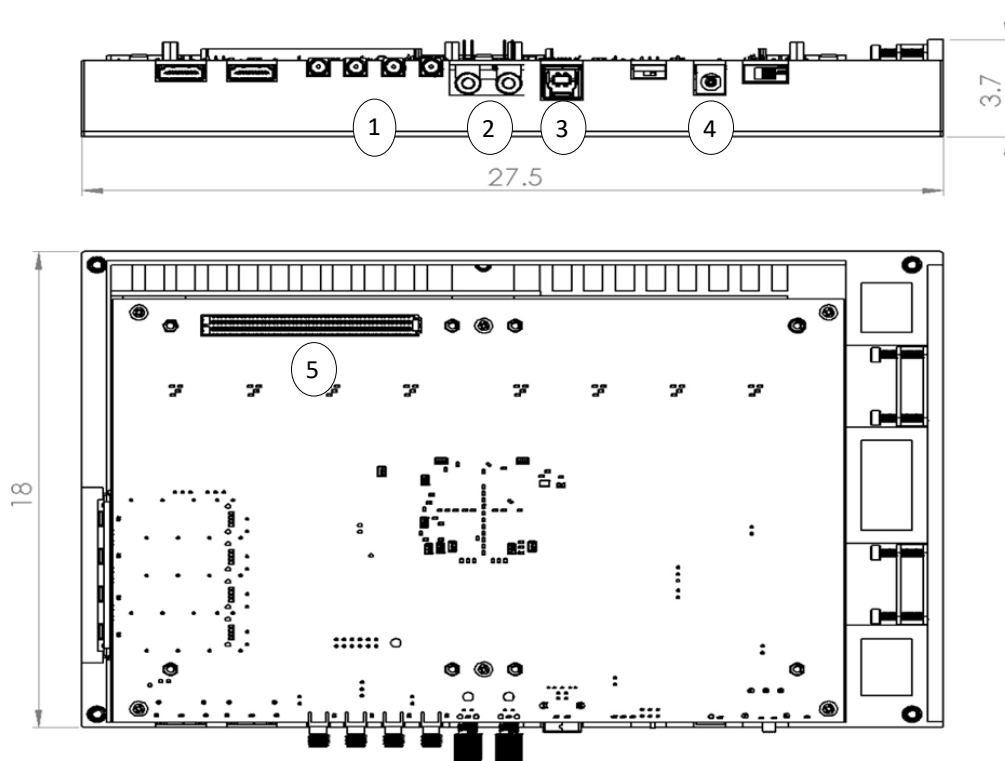
**Protective Housings** Durable and light plastic enclosures with integrated cooling fans and aluminum panels that protect PCBs from unintended exposure.

**Programmable Gain** Each analog channel has integrated amplifier with digitally controlled gain. Amplifiers integrated inside ADC chips are controlled using bundled software or a free-of-charge software development kit (SDK).

**Streaming ADCs** Analog-to-digital conversion is continuous with no buffering or multiplexing allowing faster data transmission and trigger rates. The practical data rate exceeds 90% of 400Mbps theoretical data bandwidth of USB 3.0.

# SPECIFICATIONS

<b>128</b>	<i>channels<sup>1</sup></i>
<b>9 to 54 dB</b> (49 to 94 dB)	<i>programmable gain<sup>2</sup></i> (w/ optional preamplifiers)
<b>12.5 kHz to 30 MHz</b> (40 kHz to 30 MHz)	<i>analog bandwidth<sup>3</sup></i> (w/ optional preamplifiers)
<b>12-bit</b>	<i>resolution</i>
<b>0.3-80 MSPS</b>	<i>sampling rate</i>
<b>50 <math>\Omega</math></b> (2.2 M $\Omega$ )	<i>input impedance</i> (w/ optional preamplifiers)
<b>&gt; 200 Hz / fps</b>	<i>trigger / frame rate<sup>4</sup></i>
<b>8160</b>	<i>points / frame / channel<sup>5</sup></i>



Dimension are in cm. Weight 1-1.5 kg depending on configuration

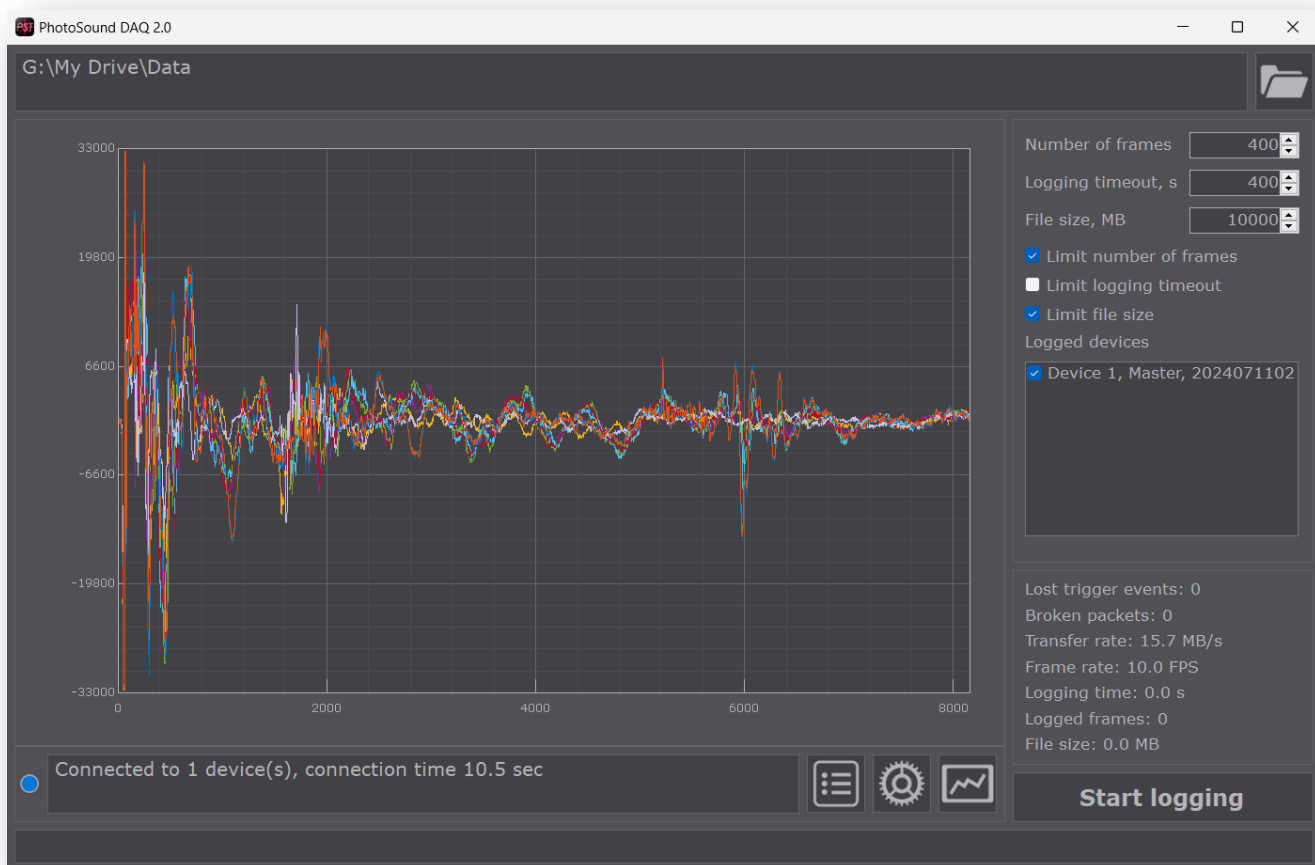
- |                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ol style="list-style-type: none"> <li>1. Two sets of programmable electrical trigger input and output (isolated SMA connectors)</li> <li>2. Two optical trigger inputs for connecting patch fibers allow precise triggering from external light sources</li> <li>3. USB 3.0 port for high data transmission</li> </ol> | <ol style="list-style-type: none"> <li>4. 12VDC 5A power connector (power supply included)</li> <li>5. Samtec SEAFP series input connector with support for up to analog 128-channels</li> </ol> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

- (1) Single unit supports 128 channels. Multiple units support up to 2048-channel configurations.
- (2) Depends on mode selection. Measured using signal generator and oscilloscope with 50  $\Omega$  input.
- (3) @ -6 dB. Depends on probe, mode and parameter selection (low pass programmable filters available).
- (4) with 8160 points per channel. Rates up to 400 Hz supported when using 128-channels only. Depends on PC specifications.

Minimum PC Requirements: 6th generation Genuine Intel® quad-core processor, 8 GB DDR RAM. USB3 port on Intel® host controller, 500 GB PCIe 3.0 x4 SSD w/ heatsink, Microsoft Windows 10 64-bit Home. Recommended PC Requirements: Current generation 6+ core processor, 16+ GB DDR RAM, USB3 port, 1 TB PCIe 3.0 x4 SSD w/ heatsink (e.g. Samsung 970 Pro), Microsoft Windows 10 64-bit Pro

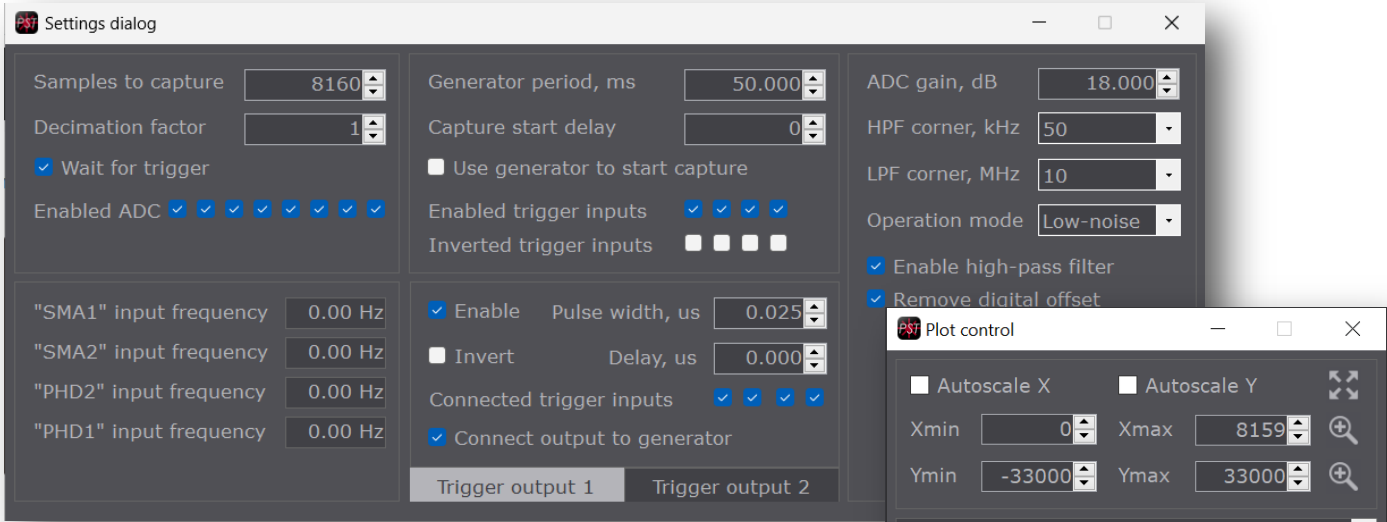
# SOFTWARE

The LEGION™ ADC HD standalone software package included with every unit is based on the C++ computing environment and provides complete control over all unit functions. A free-of-charge backend SDK written in C# .NET is compatible with many frontend languages such as LabView, MATLAB®, etc.



**The standalone software PhotoSoundDAQ.exe** offers an easy-to-use interface that can control the LEGION™ ADC HD and provides functions for data visualization and data capture. To start collecting data, simply set the data logging folder, check the acquisition limits and “Start logging”.

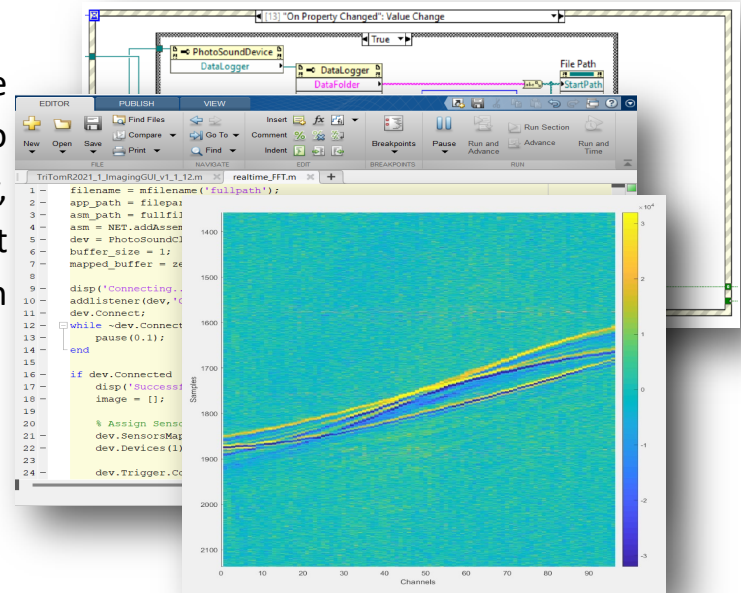
If capture parameters need adjustment, quick-access icons can be used to open windows for data capture settings and plot controls.



**The Settings dialog** provides controls for data acquisition, onboard gain and filter settings, as well as configuration options for trigger inputs and outputs. Samples can be captured from all 128-channels or individually selected groups with 16-channels each.

**The Plot control window** displays the list of channels to show/hide on the main window data plot. The scale of the plot can be adjusted with quick selection tools or by manually entering the targeted range. A sensors map can be assigned to view signals from specific probe elements to match the variety of ways in which third-party probes are connected.

**The Software Development Kit (SDK)** can be used to bring device controls and data into common data processing tools such as LabView, MATLAB®, and others. This includes most programming languages that can interface with C# & .NET frameworks.



# VERSATILE

## Legion ADC HD - Max Data Transfer With Various Decimation Factors

Effective Sampling rate (MS/s)	Decimation Factor*	# Samples per frame	Frame Acquisition Time (μs)	Max Trigger Rate (Hz)	Transfer Speed** (MB/s)
80.000	1	8160	102.0	247	386.4
80.000	1	4032	50.4	499	386.4
80.000	1	2016	25.2	997	386
80.000	1	960	12.0	2,092	385.9
80.000	1	480	6.0	4,167	384.5
80.000	1	192	2.4	10,309	381.4
80.000	1	96	1.2	20,408	378.8
40.000	2	8160	204.0	241	376.9
40.000	2	4032	100.8	487	376.8
40.000	2	2016	50.4	973	376.7
40.000	2	960	24.0	2,041	376.4
20.000	4	8160	408.0	229	359.3
20.000	4	4032	201.6	464	359.3
20.000	4	2016	100.8	928	359.2
20.000	4	960	48.0	1,946	358.8
10.000	8	8160	816.0	210	328.5
10.000	8	4032	403.2	424	328.5
10.000	8	2016	201.6	848	328.4
10.000	8	960	96.0	1,779	328.2
5.000	16	8160	1632.0	179	280.5
5.000	16	4032	806.4	362	280.5
5.000	16	2016	403.2	725	280.2
5.000	16	960	192.0	1,520	280.2
4.000	20	8160	2040.0	167	261.4
4.000	20	4032	1008.0	338	261.4
4.000	20	2016	504.0	675	261.4
4.000	20	960	240.0	1,416	261.3
3.330	24	8160	2448.0	156	244.8
3.330	24	4032	1209.6	316	244.8
3.330	24	2016	604.8	632	244.8
3.330	24	960	288.0	1,326	244.6
2.500	32	8160	3264.0	139	217.1
2.500	32	4032	1612.8	280	217.1
2.500	32	2016	806.4	561	217.1
2.500	32	960	384.0	1,176	217
1.250	64	8160	6528.0	95	149.5
1.250	64	4032	3225.6	193	149.5
1.250	64	2016	1612.8	386	149.5
1.250	64	960	768.0	811	149.4
0.625	128	8160	13056.0	59	92.1

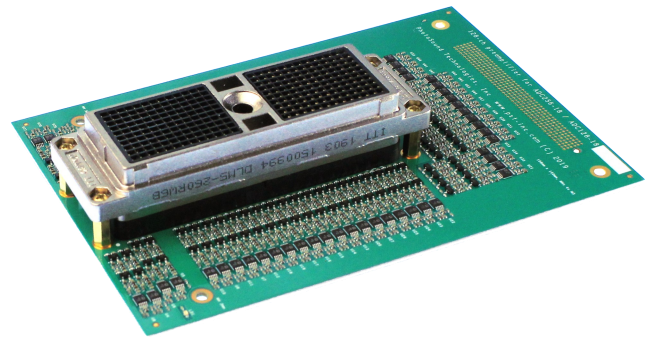
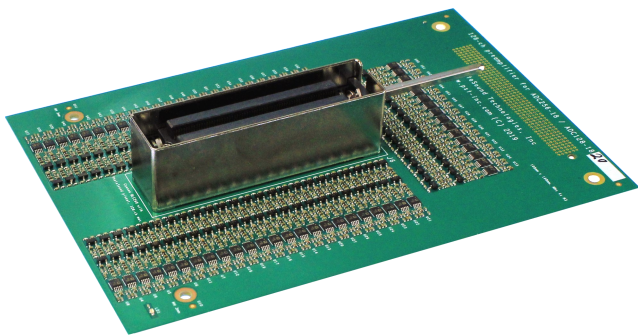
\*Decimation Factor down samples the fixed 80 MSPS rate of the ADC board by the factor specified. This does not physically change the sampling rate of the ADC boards but instead drops the sampling events in the memory buffer needed to reach the specified down sampled sampling rate. The dropped events are equally temporally spaced.

\*\*Test performed using AMD-based PC running Windows 10 Pro. Actual results may vary depending on system and operating conditions.



# OPTIONAL PREAMPS

Optional 128 Channel preamplification boards add an additional 40 dB of fixed gain and change the input from low ( $50 \Omega$ ) to high ( $2.2 \text{ M}\Omega$ ) impedance. Preamplifiers on each channel measure only  $2 \times 25\text{mm}$ , resulting in an overall compact design. The entire assembly (ADC+AMP) is integrated into a single, protective housing.



## Medical Grade Cannon QLC260

Compact, 260-pin connector for newer probes and ring-arrays. Each channel is connected to a signal and ground pin to minimize crosstalk. Cannon QLC260 connectors have superior shielding which reduces noise. Recommended for high element count ring arrays.

## Medical Grade Cannon DLM260

Popular 260-pin connector used in many third-party ADCs and ultrasound products. Typical configuration consists of connecting one board to half the number of channels for 128-element probes.



Example of ADC unit with  
2x Cannon QLC260 AMPs



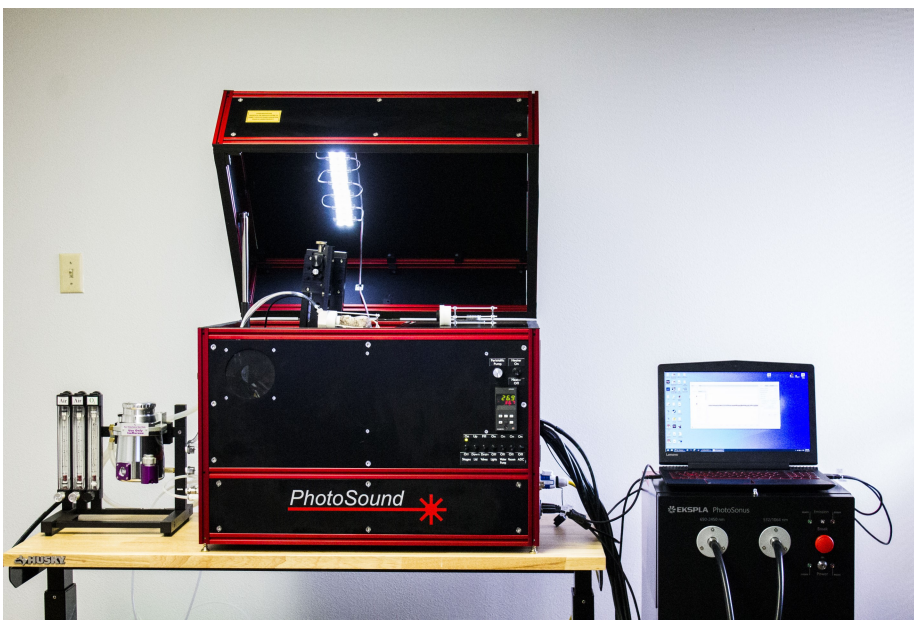
Example of ADC unit with  
1x Cannon DLM260 AMP

# DESIGN. BUILD.

The LEGION™ ADC HD is the perfect data acquisition solution for the most challenging application and system integration requirements. PhotoSound engineers excel in designing advanced technology with high channel counts, low signal acquisition in high noise environments, photonic light source synchronization and RF shielded components.

## High Channel Count Platforms

Connect up to 16 LEGION™ ADC units in parallel with 512- and 1024- transducer ring arrays and up to 200 Hz high repetition rate, high power tunable laser systems. Push the limits of imaging and data acquisition technology!



Custom Real-time PhotoAcoustic Tomography Platform designed by PhotoSound®

# ACQUIRE.

## Multi-Modal 3D Tomography

Reinvent optical imaging through multi-modal platforms that combine high resolution photoacoustic technology, powered by the LEGION™ ADC, with conventional fluorescence and bioluminescence tomography.



PhotoSound® TRITOM™, discover the power of light and sound



PhotoSound® MoleculUS™, ultrasonic imaging with molecular analysis

## UltraSound PhotoAcoustic (USPA) Imaging

Combine the photoacoustic optimized LEGION™ ADC (preamps, laser triggering, receive only, etc.) with transmit/receive ultrasound optimized electronics. Co-register familiar ultrasound features with molecular analysis data provided by high resolution photoacoustic imaging.

# About PhotoSound®

PhotoSound Technologies, Inc. was founded in September 2015 in Houston, Texas USA to develop and manufacture new imaging products and technologies. Deriving it's name from Alexander Graham Bell's discovery of the production of sound by light, PhotoSound excels in research, development and manufacturing of specialized equipment for biomedical applications based on photoacoustics.

The company developed and patented the first commercially available imaging instrument based on Photoacoustic Fluorescent Tomography (PAFT) and manufactures unique data acquisition systems with up to 256 channels on a single board with the ability to run up to 16 boards in parallel with a synchronization hub.

Engineers and application scientists at PhotoSound possess some of the best expertise in the market with skills in tunable laser development, transducer implementation and complex ADC/AMP board designs. All employees at PhotoSound are committed to provide every customer with the highest quality products and services with short delivery times and competitive pricing.

Version LEGIONHD.001.2024 © 2024

All specifications are subject to change without notice.

The LEGION™ ADC HD ECCN classification is EAR99.

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