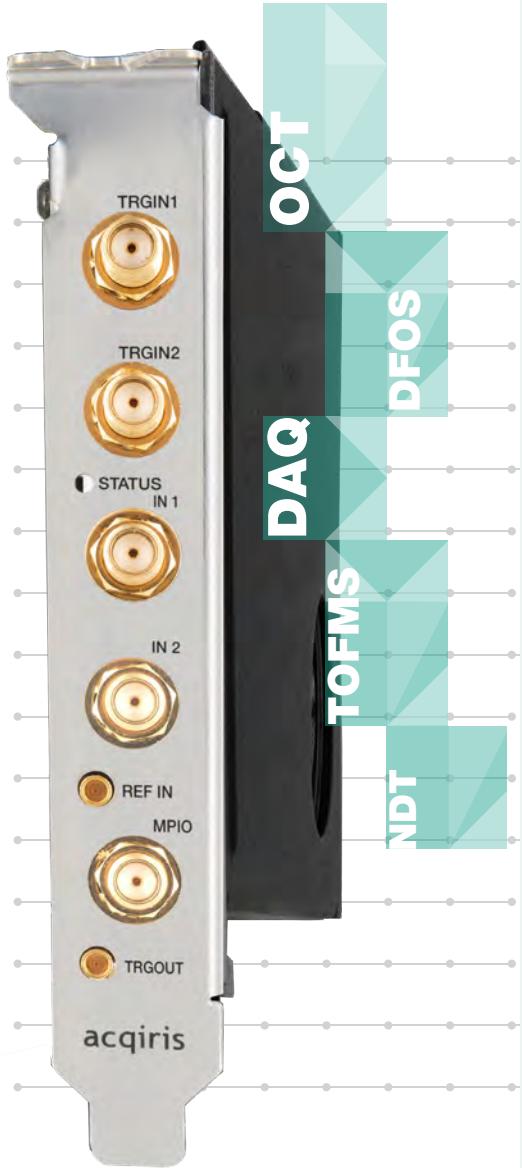




Acqiris SA6

12-bit Data Acquisition Card (DAQ),
with FPGA signal processing
2 channels, up to 1 GS/s

Preliminary datasheet



New super compact 12-bit PCIe DAQ

The SA6 Data Acquisition (DAQ) PCIe card, delivers an unmatched combination of performance, size, and value: accurately capturing waveforms at 1 GS/s simultaneously on 2 channels and enabling powerful real-time signal processing into a super compact footprint.

Combined with Acqiris AQOCT or AQDAQ Solution Package, this new platform achieves both high performance and a cost-effective technology fine-tuned for Swept-Source OCT, Distributed Fiber Optic Sensing, Ultrasound, Non-Destructive Testing, etc...

Optimized for OEMs, the SA6 new generation focuses on addressing typical medical and industrial application needs: its unique architecture enables flexible solutions, dedicated processing in its FPGA, and customization possibilities.

Essential features

- 12-bit resolution
- Compact size: Single half-length PCIe x8 slot with an integrated fan
- Sampling rates up to 1 GS/s on 2 channels simultaneously
- Bandwidth from DC up to 500 MHz (DC coupled)
- Streaming up to 7 GB/s and direct GPU transfer via RDMA
- Low consumption

Excellent signal fidelity

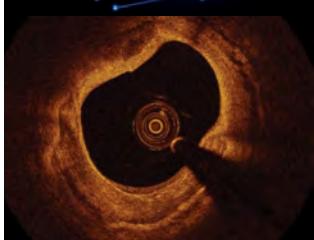
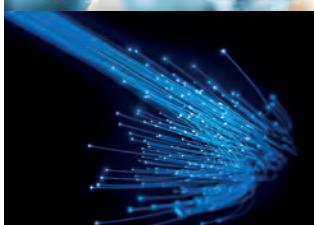
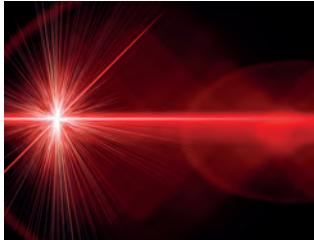
- Innovative low-noise front end achieving 9.3 ENOB
- Flexible full scale input range: 250 mV, 500 mV, 1 V, 2 V (selectable by software) maximizing effective resolution, particularly on low amplitude signals
- Fine channel delay alignment (ps resolution)
- Dual accurate trigger inputs

More than just a digitizer

- Real-time processing on board (SS-OCT signal processing, streaming...)
- General Purpose programmable I/O

Making the integration easy

Applications



With advanced real-time processing capabilities, the SA6 DAQ card is specially designed for OEM, industrial or research applications. As part of Acqiris's dedicated signal acquisition Solutions, the SA6 technology answers the typical needs for challenging measurements, imaging and processing systems, including:

- Medical or Industrial Imaging (e.g. Swept Source-OCT)
- Distributed Fiber Optic Sensing (DFOS)
- Mass Spectrometry - Time-of-Flight (MS-TOF)
- Ultrasound and Non-Destructive Testing
- Laser applications
- Physical experiments,...

The overall performance of Acqiris's new 12-bit SA6 platform enables efficient, fast and accurate measurement and analysis for final systems.

Hardware platform

The SA6 12-bit PCIe DAQ is DC coupled and accurately captures waveforms from DC up to 500 MHz by sampling the signal at up to 1 GS/s, simultaneously on 2 channels.

Its half length PCIe form factor with integrated cooling and fans provides a very small footprint that fits tightly constrained medical or industrial instruments.

Featuring a PCIe interface Gen4 x4 or Gen3 x8, it allows data throughput up to 7GB/s.



Figure 1. Example of super compact integration of the SA621P in a mini-workstation



SA6 Acquisitions Solutions

Unique technology

The SA6 DAQ cards (a.k.a. digitizers or ADC cards) implement Acqiris proprietary front-end enabling:

- Low added noise and minimum signal distortion providing a large measurement dynamic range
- Flexible input signal full scale range (250 mV, 500 mV, 1V, 2V)

On-board processing

The FPGA embedded in the SA6 enables standard signal acquisition features:

- Digitizer calibration
- External or channel triggering
- Distortion reduction
- Data storage in the internal memory
- Data transferring to the host computer
- Multi-record mode allowing to capture successive triggered events
- Simultaneous acquisition and readout
 - Continuous Data Streaming (CST)
- Reduced sampling rate (decimation)

In addition and depending on each application or customer requirements, the FPGA can perform advanced real-time signal processing, allowing data reduction to be carried out on-board, minimizing transfer volumes and speeding-up analysis.

Solution packages

The SA6 DAQ cards are compatible with the different Acqiris Solution packages:

- AQOCT Solution is dedicated to SS-OCT, A-OCT for medical or industrial imaging.
- AQDAQ Solution addresses standard digitizer application needs, including multi-triggers, streaming, baseline stabilization. This Solution is typically used for DFOS, SAM, LiDAR, or other laser and high frequency applications...

For more information on a specific application or the possibility to develop custom solutions for OEMs, contact us at solutions@acqiris.com.

Integration

In a host computer or externally, the SA6 data acquisition card occupies a single PCIe x8 slot including the rear fan for effective cooling.

Benefiting from the PCIe Gen 3 interface, the SA6 sustains data transfer to the host at up to 7 GB/s.

Software platform

Easy software integration

The SA6 comes with a software development package depending on your application.

It includes drivers, API, code examples and documentation, to make easier the integration in your system.

Our software supports Windows or Linux, and works in the most popular development environments such as VisualStudio (C/C++, Python), any ADE supporting C, Python API or LabVIEW.

Additionally, our integration experts are used to provide guidelines and support you to help you through all the process of integration of the SA6 card in your system.

Interface compliance

Designed to benefit from very fast data interface, the product is compliant with PCI Express Gen3 x8 or Gen4 x4 standards.

SA621 DAQ card or module Block diagram

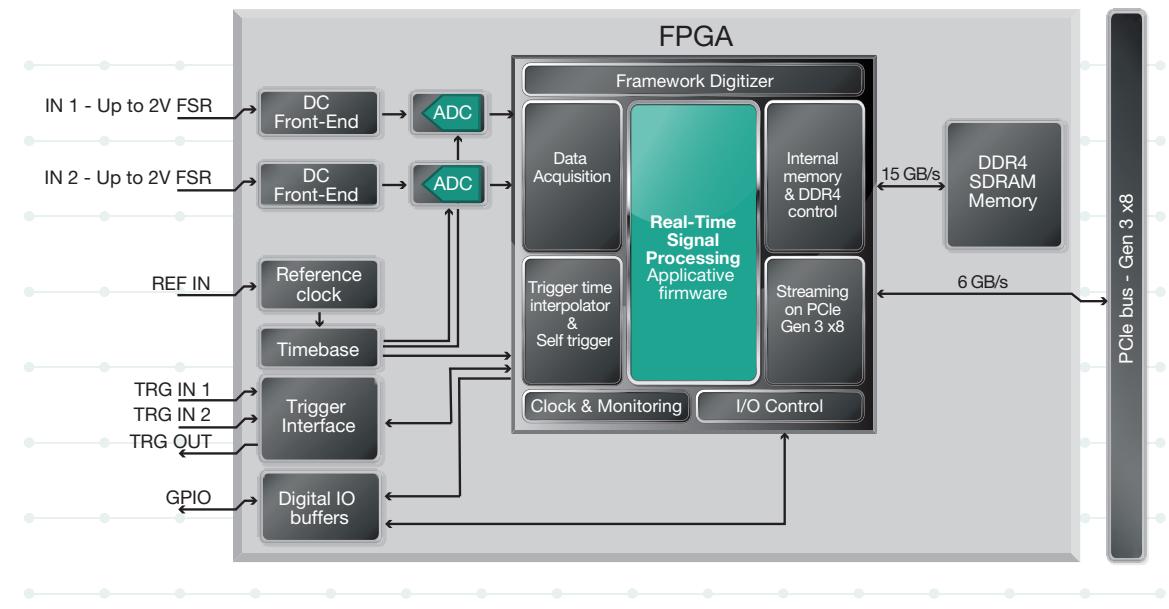


Figure 2. Top level block diagram of the SA621 PCIe DAQ card, with on-board real-time processing.

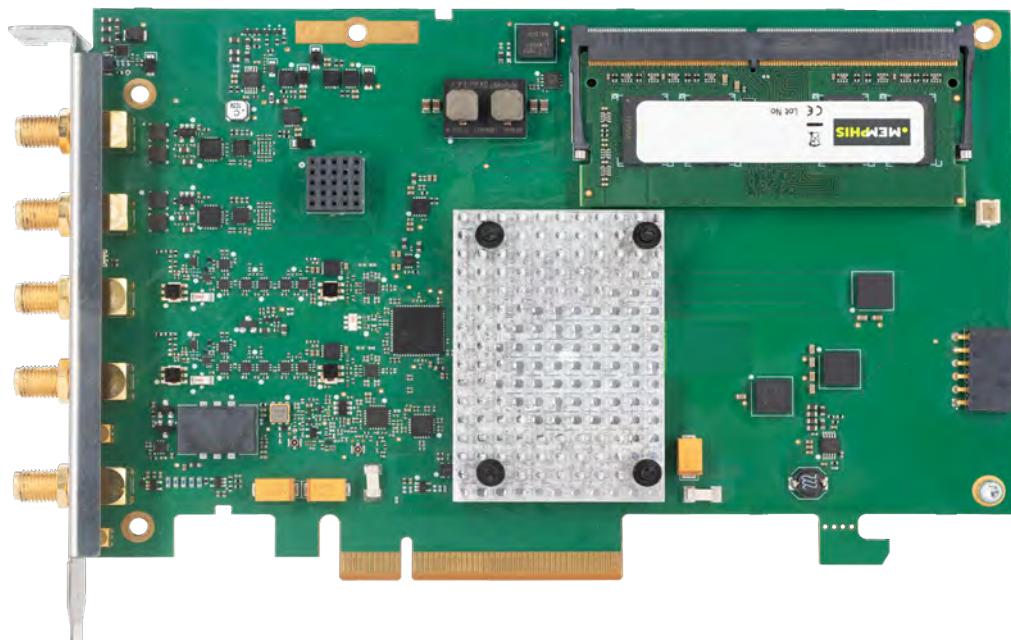


Figure 3. SA621 PCIe DAQ card - Open View.



SA621 DAQ card or module

Technical specifications and characteristics (Preliminary)

Analog input (IN1, IN2 - SMA connectors)

Number of channels	2	
Impedance ¹	$50 \Omega \pm 2\%$ (<i>typical</i>)	
Coupling	DC	
Full scale range (FSR)	IN1, IN2	250mV, 500mV, 1V, 2V (selectable by software)
Maximum input voltage	IN1, IN2	$\pm (\text{FSR} + 0.3\text{V})$ DC
Input voltage offset		$\pm 0.6 * \text{FSR}$
Input frequency range (-3 dB bandwidth)	IN1, IN2	DC to 500 MHz (<i>nominal</i>)
Effective number of bits (ENOB) ²	@ 100 MHz	9.3 (<i>nominal</i>)
Signal-to-noise ratio (SNR)	@ 100 MHz	59.2 dB (<i>nominal</i>)
Spurious-free dynamic range (SFDR)	@ 100 MHz	73.4 dBc (<i>nominal</i>)

Digital conversion

Resolution	12 bits
Acquisition memory	4 GB (4G samples)
Sample clock source	Internal
Internal clock source	Internal, external reference
Real-time sampling rate	500 MS/s to 1 GS/s on 2 channels
Sampling clock jitter ³	50 fs (<i>typical</i>)
Clock accuracy	$\pm 1.5 \text{ ppm}$ (<i>nominal</i>)
External reference clock (REF IN - MMCX connector)	
Impedance	50Ω (<i>nominal</i>)
Frequency range	10 MHz ± 1 kHz 100 MHz ± 1 kHz
Signal level	-3 dBm to +3 dBm (<i>nominal</i>)
Coupling	AC
Acquisition modes	Single record, Multi-record, Streaming

1. Input impedance is 150Ω during the self-calibration process

2. Measured for a -1 dBFS input signal

3. Jitter figure based on phase noise integration from 100 Hz to 100 MHz in internal reference.

SA621 DAQ card or module

Other technical specifications and characteristics (Preliminary)

Trigger

The trigger source:

- User defined signal level on the input channels (IN1, IN2)
- External signal applied on TRG IN1, TRG IN2
- Software trigger

A pre- or post-trigger delay can also be applied to the trigger position at picoseconds resolution to increase triggering flexibility. The very fast trigger rearm time of the SA6 is a crucial feature to achieve low dead time.

Trigger	
Trigger mode	Positive or negative edge
Trigger source	External, Channel, Software
Channel trigger frequency range	DC to 1 GHz (<i>nominal</i>)
Channel trigger accuracy	1 sample at the channel sampling rate
Rearm time (dead time)	< 50 ns (<i>nominal</i>)
External trigger (TRG IN1, TRG IN2 - SMA connectors)	
Coupling	DC
Impedance	50 Ω ± 5%.
Level range	± 5 V
Minimum amplitude	0.3 V pk-pk
Trigger time precision	25 ps RMS
Trigger out (TRG OUT - MMCX connector)	1 (programmable), TTL compatible, 2.2 V typ on 50 Ω load

Trigger Time Interpolator

When using an external trigger, the digitizer accurately measures and stores the time of each trigger. This information is essential to determine the precise relation between the trigger and the signal digitized samples. The trigger time interpolator (TTI) is a high-precision integrated time-to-digital converter that guarantees trigger time-stamp measurement accuracy.

Programmable I/O (GPIO - SMA connector)	
Functions	General Purpose 5V-tolerant programmable I/O (Application dependent)
Input/Output signal	DC coupling, 50 Ω source, TTL

System requirements ¹		
Topic	Windows	Linux
Operating systems	Windows 11 and 10 (32-bit and 64-bit), all versions	Linux Kernel 4 or higher (32 or 64-bit), Debian, Ubuntu, Rocky ² , ...
Processor speed	1 GHz 32-bit (x86), 1 GHz 64-bit (x64), no support for Itanium 64	As per the minimum requirements of the chosen distribution
Available memory	1 GB minimum	As per the minimum requirements of the chosen distribution
Available disk space	1.5 GB available hard disk space	100 MB
Temperature range	Check upon environment requirement. It might not allow to go as high as the DAQ card allows.	

1. Contact support@acqiris.com for a list of recommended host computers.
2. Contact us for more details on supported distributions



Environmental and physical

Usage	Indoor use recommended (outdoor is possible provided the ADC card is within an environment that guarantees indoor conditions)	
Pollution degree	2	
Temperature range	Operating ^{1, 2}	0 to +45 °C (sea-level to 10,000 feet)
		0 to +40 °C (10,000 to 15,000 feet)
Non-operating		-40 to +70 °C
Altitude	Up to 15,000 feet (4 572 meters)	
Relative humidity range	Operating ³	10 % to 90 % RH, non-condensing
	Non-operating ³	5 % to 95 % RH, non-condensing

Quality

Samples of this product have been type tested and verified to be robust against the environmental stresses of Storage, Transportation and End-use; those stresses include but are not limited to temperature, humidity, shock, vibration, altitude and power line conditions.

Mechanical characteristics

Form factor	PCIe x8 half length	
Size	With fan integrated ⁵	18.7 W x 126.3 H x 169.5 D mm
Weight	< 351 g (< 0.77 lbs)	

Power consumption⁴

+ 3.3 V/ + 12 V	Power on PCIe edge connector 20 W (nominal)
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1. Host computer internal ambient temperature at intake of the digitizer's fan.
2. Tested in accordance with IEC 60068-2-1 and IEC 60068-2-2.
3. Tested in accordance with IEC 60068-2-30 and IEC 60068-2-78.
4. Power measured in digitizer mode.



Configuration and Ordering information

Ordering information

Model	Description
SA621P	PCIe 12-bit DAQ card with FPGA signal processing includes: <ul style="list-style-type: none">– Fan assembled on module– 5-year standard warranty



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