



# Acqiris SA3 family

12-bit Data Acquisition Card (DAQ),  
with FPGA signal processing  
1.5 GS/s to 6.25 GS/s  
from 1 to 3 channels

Preliminary datasheet



## New versatile 12-bit DAQ / digitizer family

The SA3 Data Acquisition (DAQ) family provides both high signal performances and a cost effective solution fine-tuned for various OEM's applications, such as Swept-Source OCT, TOF-MS, Lidar, Distributer Fiber Optic Sensing, Ultrasound, NDT, etc...

Performing fast signal acquisitions from 1.5 GS/s up to 6.25 GS/s, this new 12-bit digitizer platform offers efficient resolution, and a large bandwidth up to >2.5 GHz. It implements new Acqiris proprietary low noise front-end and the latest ADC technology. Thanks to its real-time advanced signal processing capability, the SA3 DAQ card enables a versatile, compact, low-power signal acquisition solution in a small footprint.

The SA3 new generation focuses on addressing OEM's and industrial application needs: its unique architecture enables flexible solutions, application dedicated processing in its FPGA, and customizations possibilities.

## Essential features

- 12-bit resolution
- Bandwidth from DC up to 2.4 GHz,
- Sampling rates options:
  - 1 channel up to 6.25 GS/s
  - 2 channels up to 3.125 GS/s simultaneously sampling
  - 2 channels up to 1.5625 GS/s simultaneously sampling
  - 3 channels : with 2-ch at 1.5 GS/s and 1-ch at 3.125 GS/s simultaneously sampling
- DC coupled
- Streaming capability up to 6 GB/s (PCIe Gen 3 interface)
- Single PCIe x8 slot
- Low acoustic noise with adaptative fan speed cooling

## Unique signal fidelity

- Low noise density and minimum signal distortion
- Flat frequency response
- High dynamic range

## More than just a digitizer

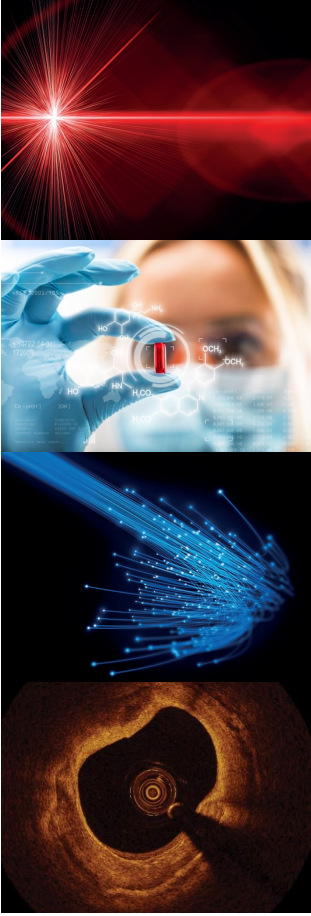
- Real-time processing on board (averaging, peak detection, SS-OCT signal processing, data reduction...)
- Programmable digital IOs\*
- Analog IOs\*
- Pulse generation capability\*, synchronized with trigger
- Open FPGA capability for custom real-time processing.

\* Depending on the version and applicative solution.

For more information contact us:  
[solutions@acqiris.com](mailto:solutions@acqiris.com)

# Making the integration easy

## Applications



With advanced real-time processing capabilities, the SA3 DAQ card is specially designed for OEM, industrial or research applications. As part of Acqiris's dedicated signal acquisition Solutions, the SA3 technology answers the typical needs for challenging measurements, imaging and processing systems, including:

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

The overall performance of Acqiris's new 12-bit SA3 platform enables deeper, faster and accurate measurement and analysis for final systems.

## Hardware platform

### Sampling rate versions

The SA3 12-bit PCIe DAQ is DC coupled and accurately captures waveforms from DC up to 2.5 GHz. The digitizer function comes with different hardware versions, as listed in the Table below.

	SA310x	SA322x	SA331x
Number of channels	1-ch	2-ch	3-ch
Sampling rate	up to 6.25 GS/s	up to 6.25 GS/s on 1-ch or up to 3.125 GS/s on 2-ch	up to 1.5625 GS/s on ch1&2 and 3.125 GS/s on ch3 or up to 3.125 GS/s on 2-ch
Bandwidth	up to 2.4 GHz	2.4 GHz or 1.4 GHz*	2.4 GHz or 1.4 GHz*

Table 1. Key specifications of the SA3 hardware versions. (\*) Channel dependant bandwidth.

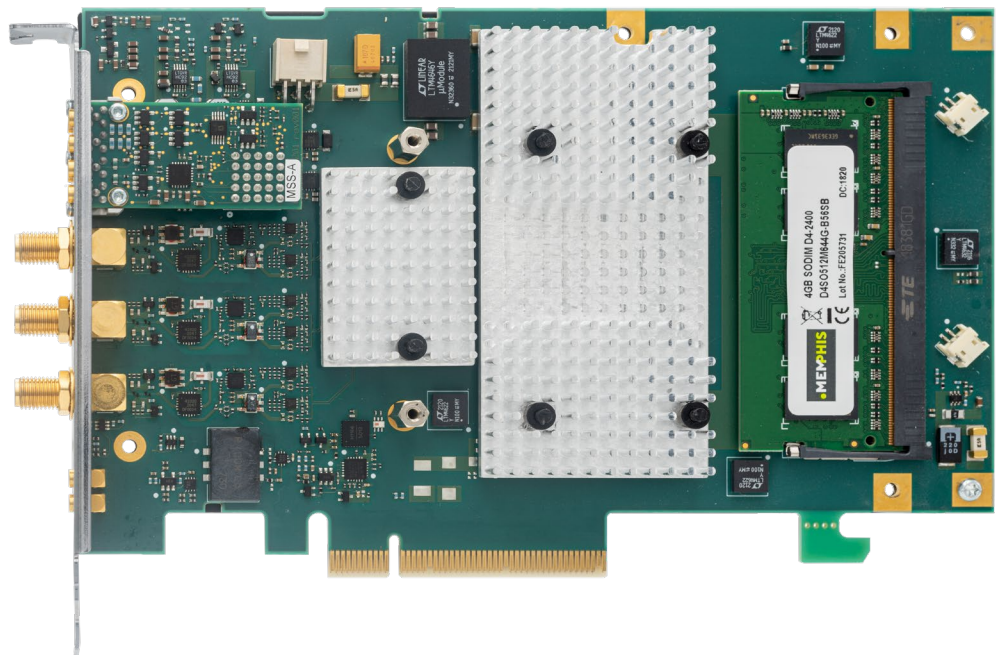


Figure 1. SA331 PCIe DAQ card - Open View.



# SA3 Acquisitions Solutions

## Unique technology

All the DAQ cards (a.k.a digitizers or ADC cards) from the SA3 family implement Acqiris proprietary ASICs enabling:

- Low noise and minimum signal distortion
- Accurate triggers and event time-stamps.

## On-board processing

The FPGA embedded in the SA3 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
  - Streaming records (CST)
- Reduced sampling rate (decimation)

In addition and depending on each application or customer requirements, the powerful Xilinx Kintex Ultrascale 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 SA3 DAQ cards are compatible with the different Acqiris Solution packages:

- AQTOF Solution is typically used by TOF-MS systems, spectrometry instruments and applications requiring real-time averaging or peak detection and analysis (peak-listing).
- AQOCT Solution is dedicated to SS-OCT, A-OCT, or polarization OCT for medical or industrial systems.
- AQDAQ Solution addresses standard digitizer application needs, including multi-triggers, streaming, .... 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](mailto:solutions@acqiris.com)

## Integration

In a host computer or externally, the SA3 data acquisition card occupies a single PCIe x8 slot including the rear fan for effective cooling.

Benefitting from the PCIe Gen 3 interface, the SA3 sustains data transfer to the host at up to 6 GB/s.

# Software platform

## Easy software integration

The SA3 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 (ADE) such as VisualStudio (VB.NET, C#, C/C++), any ADE supporting C or .NET APIs, LabVIEW, MATLAB...

Additionally, our integration experts are use to provide guidelines and support you to help you through all the process of integration of the the SA3 card in your system.

## Interface compliance

Designed to benefit from very fast data interface, the product is compliant with PCI Express Gen3 x8 standard.

# SA331 - The 3-channel SA3 version

## Block diagram

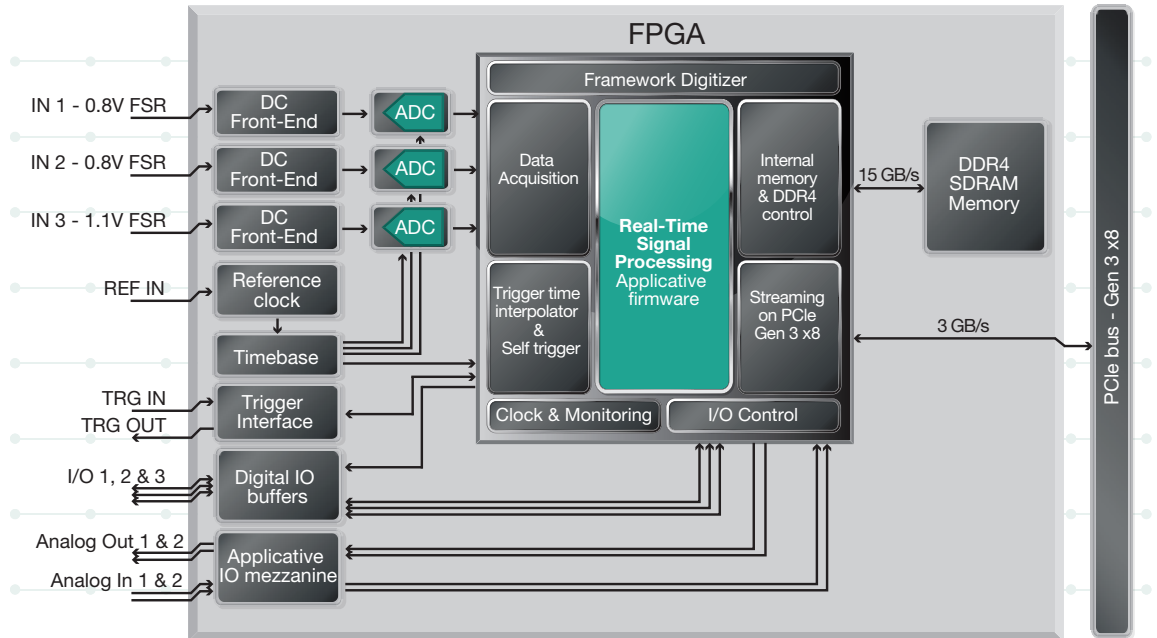


Figure 2. Top level block diagram of the SA331 PCIe DAQ card, with on-board real-time processing.



# SA331 - The 3-channel SA3 version

## Technical specifications and characteristics (Preliminary)

Analog input (IN - SMA connectors)		
Number of channel		3
Impedance <sup>1</sup>		50 $\Omega$ $\pm$ 2 % ( <i>typical</i> )
Coupling		DC
Full scale range (FSR)	IN1, IN2 IN3	800 mV 1.1V
Maximum input voltage	IN1, IN2 IN3	$\pm$ 1.5 V DC $\pm$ 1.5 V DC
Input voltage offset		$\pm$ 0.6 * FSR
Input frequency range (-3 dB bandwidth)	IN1, IN2 IN3	DC to 1.4 GHz ( <i>nominal</i> ) DC to 2.4 GHz ( <i>nominal</i> )
Effective numbers of bits (ENOB) <sup>2</sup>	@ 100 MHz @ 648 MHz	8.7 ( <i>nominal</i> ) 8.6 ( <i>nominal</i> )
Signal to noise distortion (SNR)	@ 100 MHz @ 648 MHz	54.3 dB ( <i>nominal</i> ) 53.3 dB ( <i>nominal</i> )
Spurious free dynamic range (SFDR)	@ 100 MHz @ 648 MHz	69 dBc ( <i>nominal</i> ) 61.4 dBc ( <i>nominal</i> )
Total harmonic distortion (THD)	@ 100 MHz @ 648 MHz	-67 dB ( <i>nominal</i> ) -64 dB ( <i>nominal</i> )

Digital conversion	
Resolution	12 bits
Acquisition memory	4 GB (2G samples) - <i>default configuration</i>
Sample clock source	Internal
Internal clock source	Internal, external reference
Real-time sampling rate	up to 1.5625 GS/s on 2 channel & 3.125 GS/s on the 3rd channel or up to 3.125 GS/s on 2 channels
Sampling clock jitter <sup>3</sup>	500 fs ( <i>nominal</i> )
Clock accuracy	$\pm$ 1.5 ppm ( <i>nominal</i> )
External reference clock (REF IN - MMCX-V connector)	
Impedance	50 $\Omega$ ( <i>nominal</i> )
Frequency range	10 MHz $\pm$ 1 kHz 100 MHz $\pm$ 1 kHz
Signal level	-3 dBm to +3 dBm ( <i>nominal</i> )
Coupling	AC
Acquisition modes	Single record, Multi-record, Streaming

Analog I/Os (AIO 1, 2, 3 and 4 - MMCX-V connectors)		
Analog Output	AIO 1, 2	Slow Analog Output, 300 $\Omega$ , DC Coupled, +/- 10V
Analog Input	AIO 3, 4	Slow Analog Input, High impedance, DC Coupled, +/- 10V

1. Input impedance is 150  $\Omega$  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.

# SA322 - The 2-channel SA3 version

## Block diagram

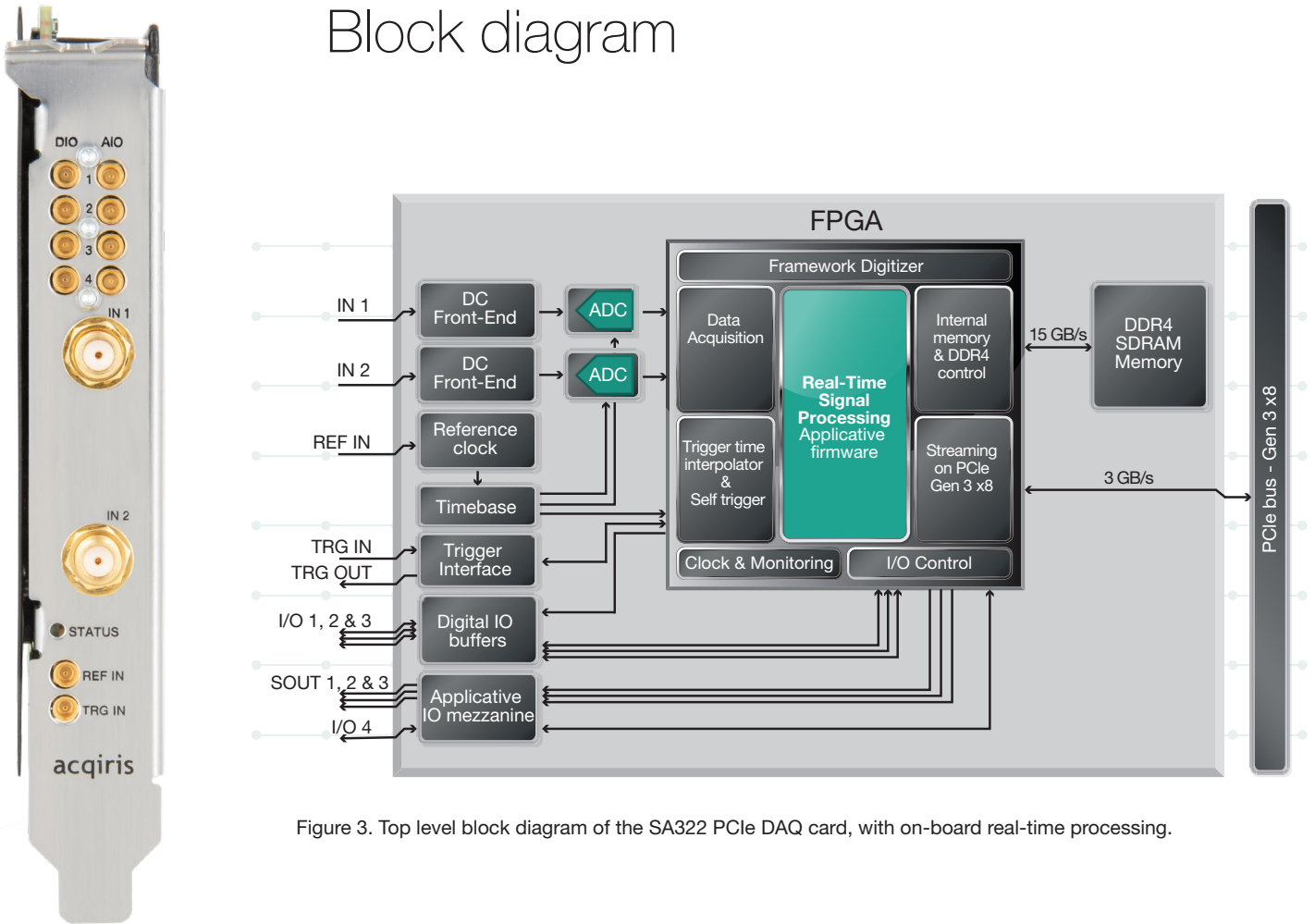


Figure 3. Top level block diagram of the SA322 PCIe DAQ card, with on-board real-time processing.

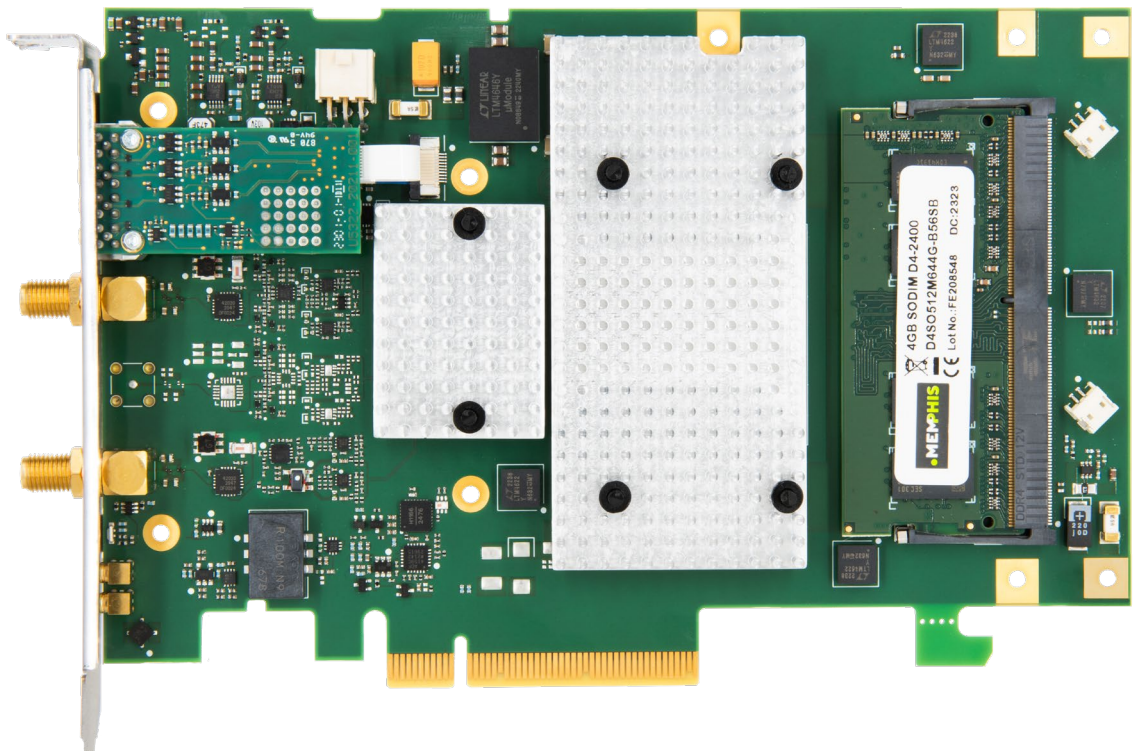


Figure 4. SA322 PCIe DAQ card - Open View.



# SA322 - The 2-channel SA3 version

## Technical specifications and characteristics (Preliminary)

Analog input (IN - SMA connectors)		
Number of channel		2
Impedance <sup>1</sup>		50 $\Omega$ $\pm$ 2 % (typical)
Coupling		DC
Full scale range (FSR)	IN1 IN2	400 mV 1.1V
Maximum input voltage		$\pm$ 1.5 V DC
Input voltage offset		$\pm$ 0.6 * FSR
Input frequency range (-3 dB bandwidth)	IN1 IN2	DC to 1.4 GHz (nominal) DC to 2.4 GHz (nominal)
Effective numbers of bits (ENOB) <sup>2</sup>	@ 100 MHz @ 648 MHz	8.7 (nominal) 8.6 (nominal)
Signal to noise distortion (SNR)	@ 100 MHz @ 648 MHz	54.3 dB (nominal) 53.3 dB (nominal)
Spurious free dynamic range (SFDR)	@ 100 MHz @ 648 MHz	69 dBc (nominal) 61.4 dBc (nominal)
Total harmonic distortion (THD)	@ 100 MHz @ 648 MHz	-67 dB (nominal) -64 dB (nominal)

Digital conversion	
Resolution	12 bits
Acquisition memory	4 GB (2G samples) - default configuration
Sample clock source	Internal
Internal clock source	Internal, external reference
Real-time sampling rate	up to 6.25 GS/s on 1 channel (interleaving) up to 3.125 GS/s on 2 channels
Sampling clock jitter <sup>3</sup>	500 fs (nominal)
Clock accuracy	$\pm$ 1.5 ppm (nominal)
External reference clock (REF IN - MMCX-V connector)	
Impedance	50 $\Omega$ (nominal)
Frequency range	10 MHz $\pm$ 1 kHz 100 MHz $\pm$ 1 kHz
Signal level	-3 dBm to +3 dBm (nominal)
Coupling	AC
Acquisition modes	Single record, Multi-record, Streaming

Synchronized Outputs (SOUT 1, 2 and 3 - MMCX-V connectors)	
Output coupling and voltage	DC coupling, TTL compatible, 2.2 V typ on 50 $\Omega$ load.

1. Input impedance is 150  $\Omega$  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.

# SA310 - The 1-channel SA3 version

## Block diagram

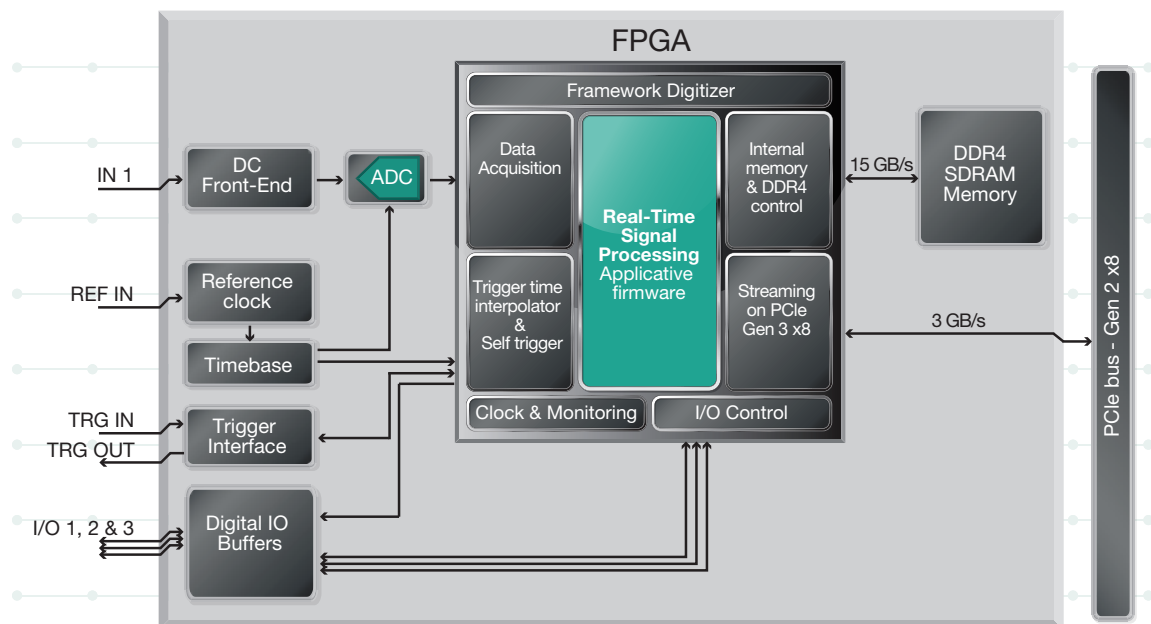


Figure 5. Top level block diagram of the SA310 PCIe ADC card, with on-board real-time processing.





# SA310 - The 1-channel SA3 version

## Technical specifications and characteristics (Preliminary)

### Analog input (IN - SMA connectors)

Number of channel	1	
Impedance <sup>1</sup>	50 Ω ± 2 % (typical)	
Coupling	DC	
Full scale range (FSR)	1.1 V	
Maximum input voltage	± 1.5 V DC	
Input voltage offset	± 0.6 * FSR	
Input frequency range (-3 dB bandwidth)	DC up to 2.4 GHz	
Effective numbers of bits (ENOB) <sup>2</sup>	@ 100 MHz	8.7 (nominal)
	@ 648 MHz	8.6 (nominal)
Signal to noise distortion (SNR)	@ 100 MHz	54.3 dB (nominal)
	@ 648 MHz	53.3 dB (nominal)
Spurious free dynamic range (SFDR)	@ 100 MHz	69 dBc (nominal)
	@ 648 MHz	61.4 dBc (nominal)
Total harmonic distortion (THD)	@ 100 MHz	-67 dB (nominal)
	@ 648 MHz	-64 dB (nominal)

### Digital conversion

Resolution	12 bits	
Acquisition memory	4 GB (2G samples) - <i>default configuration</i>	
Sample clock source	Internal	
Internal clock source	Internal, external reference	
Real-time sampling rate	up to 6.25 GS/s on 1 channel	
Sampling clock jitter <sup>3</sup>	500 fs (nominal)	
Clock accuracy	± 1.5 ppm (nominal)	
External reference clock (REF IN - MMCX-V connector)		
Impedance	50 Ω (nominal)	
Frequency range	10 MHz ± 1 kHz 100 MHz ± 1 kHz	
Signal level	-3 dBm to +3 dBm (nominal)	
Coupling	AC	
Acquisition modes	Single record, Multi-record, Streaming	

### Calibration

The SA310P is factory calibrated and delivered with a certificate of calibration.

### Definitions for specifications

**Specifications** describe the warranted performance of calibrated cards that have been stored for a minimum of 2 hours within the operating temperature range of 0 to 50 °C, unless otherwise stated, and after a 45-minute warm-up period. Data represented in this document are specifications unless otherwise noted.

**Characteristics** describe product performance that is useful in the application of the product, but that is not covered by the product warranty. Characteristics are often referred to as Typical or Nominal values.

- Typical describes usual performance, which 80 % of cards will meet when operated over a 20 to 30 °C temperature range. Typical performance is not warranted.
- Nominal describes representative performance that is useful in the application of the product when operated over a 20 to 30 °C temperature range. Nominal performance is not warranted.

1. Input impedance is 150 Ω 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.

# SA310, SA322 and SA331

## Other technical specifications and characteristics (Preliminary)

### Trigger

The trigger source:

- User defined signal level on the input channel (IN 1)
- External signal applied on TRG IN
- 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 SA3 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 2.5 GHz ( <i>nominal</i> )
Channel trigger accuracy	1 sample at the channel sampling rate
Rearm time (deadtime)	< 50 ns ( <i>nominal</i> )
External trigger (TRG IN - MMCX-V connector)	
Coupling	DC
Impedance	50 Ω +/- 5%
Level range	± 5 V
Minimum amplitude	0.3 V pk-pk
Trigger time precision	25 ps RMS
Frequency range	DC to 2 GHz
Trigger out (DIO1 - MMCX-V 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/Os (DIO 2, 3 and 4 - MMCX-V connectors)	
Functions	Application dependant
Input/Output signal	DC coupling, 50 Ω source, TTL

System requirements <sup>1</sup>		
Topic	Windows	Linux
Operating systems	Windows 10 (32-bit and 64-bit), All versions	Linux Kernel 4 or higher (32 or 64-bit), Debian, Ubuntu, CentOS
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, includes 1 GB for Microsoft .NET Framework	100 MB
Display	Minimum of 1024 x 768, 96 or 120 DPI	No display required
Temperature range	Check upon environment requirement. It might not allow to go as high as ADC card allows.	

1. Contact [support@acqiris.com](mailto:support@acqiris.com) for a list of recommended host computers.



Environmental and physical		
Usage		Indoor use recommended (outdoor is possible provided the ADC card is within an environment that guarantee indoor conditions)
Pollution degree		2
Temperature range	Operating <sup>1,2</sup>	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 <sup>3</sup>	10 % to 90 % RH, non-condensing
	Non-operating <sup>3</sup>	5 % to 95 % RH, non-condensing
Electro-magnetic compliance		Complies with European EMC Directive 2014/30/EU EN 61326-1:2013 (industrial) EN 55011:2016 Group 1, Class A And with international standards: IEC 61326-1:2012 CISPR 11:2015 / AMD1:2016 USA: CFR 47 Part 15, Subpart B, Class A Canada: ICES-003, Class A
Safety		The product was tested and found to be in conformity with: IEC 61010-1:2010 EN 61010-1:2010 / AMD1:2019 And National differences: - USA: UL 61010-1 (3rd Ed.); Am. 1 - Canada: CAN/CSA-C22.2 No 61010-1 Complies with European Low Voltage Directive (LVD) 2014/35/EU
Environmental		Directive 2015/863/EU (RoHS 3) EN 50581 :2012
Acoustic		Acoustic noise emission LpA < 50 or 60 ? dB ( <i>nominal</i> ) Operator position, Normal operation mode

Power consumption <sup>4</sup>		
+ 3.3 V / + 12 V		Power on PCIe edge connector < 35W ( <i>nominal</i> )

Mechanical characteristics		
Form factor		PCIe x8 standard
Size	With rear fan <sup>5</sup>	21.5 W x 245.1 H x 126.3 D mm <sup>6</sup>
Weight		< 430 gr ( < 0.95 lbs)

## 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.



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.
5. 60 m³/h airflow is required. The unit must be operated with the included fan.
6. Optional card retainer can be ordered to stabilize the PCIe card in the host computer.



# Configuration and Ordering information

## Ordering information

Model	Description
SA3xxP	PCIe 12-bit DAQ card with FPGA signal processing includes: <ul style="list-style-type: none"><li>- Fan assembled on module</li><li>- 5-year standard warranty</li></ul>
Configurable options	
Sampling rate, memory and firmware version depending on the selected solution	
Card retainer (recommended if the card is assembled horizontally or in harsh environment)	



## Accessories

Model	Description
SA300P-100	MMCXV male to SMA female cable, 10cm

## Contacts

### Information or Inquiries

[Solutions@acqiris.com](mailto:Solutions@acqiris.com)

### Support

[support@acqiris.com](mailto:support@acqiris.com)

### Headquarters

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