

ADQ14-FWDT Datasheet



Peer-to-peer streaming to AMD GPU



Peer-to-peer streaming to NVIDIA GPU

ADQ14-FWDT is a high-speed recording firmware and software package for the recognized ADQ14-series of high-speed, high resolution digitizers.

High duty cycle recording

Dead-time free triggering

PCIe Generation 3, 8 lanes

Peer-to-peer streaming to GPU

6 GBytes/s sustained data rate

6.8 GBytes/s peak data rate

Direct GMA for AMD GPU

GPUDirect RDMA for NVIDIA GPU

FWDT is available for these ADQ14 models in PCIe format:

ADQ14DC-2C	ADQ14AC-2C
ADQ14DC-4C	ADQ14AC-4C
ADQ14DC-1X	ADQ14AC-1X
ADQ14DC-2X	ADQ14AC-2X



ADQ14-FWDT Datasheet

Features

- 1 / 2 / 4 analog channels
- 2 / 1 GSPS per channel
- 14 bits vertical resolution
- Data rate adaptation trigger
- Data rate adaptation filter
- External trigger
- External sync
- PCI Express Generation 3 by 8 lanes
- 6 GBytes/s sustained data transfer rate
- 6.8 GBytes/s peak data transfer rate
- Peer-to-peer streaming support for GPU
- Direct GMA support for AMD GPU
- GPUDirect RDMA support for NVIDIA GPU

Applications

- RADAR
- LIDAR
- Wireless communication
- Scientific instruments
- Swept-Source OCT

Advantages

- PCIe form factor options for compact systems integration.
- Advanced analog front-end, trigger functions, and high sampling rate of ADQ14 for meeting systems requirements.
- Enables high speed real-time custom signal processing solutions for advanced systems. This optimizes cost of ownership.
- SP Devices' design services are available for fast integration to lower time-to-market.

Functional summary

ADQ14-FWDT consists of two parts; firmware upgrade of the PCI Express interface to Generation 3 by 8 lanes and software application support for setting up peer-to-peer streaming to GPU.

The Gen3x8 interface is general purpose and can be used for streaming data to host PC RAM or peer-to-peer streaming to a peripheral PCIe unit. Current implementation include software support for setting up peer-to-peer streaming to the GPUs in [Table 1](#).

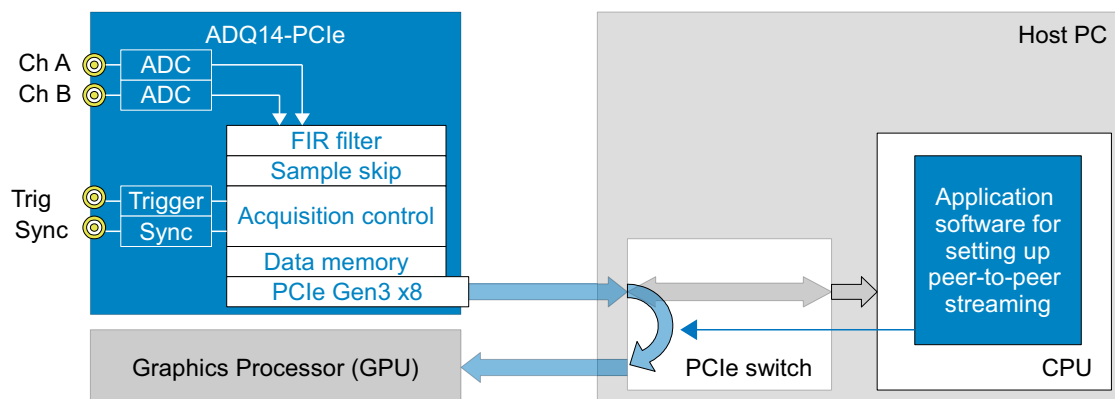
This firmware combines the power of the acquisition engine in the ADQ14-series of digitizers with the processing power of a GPU. This combination enables high-performance acquisition systems.

ADQ14-FWDT also contains support for data rate adaptation and acquisition control:

- FIR filter and sample skip for bandwidth control and dynamic range enhancement.
- Trigger and sync for acquisition timing control.
- Data memory for capture of long records.

The peer-to-peer streaming means that data is sent directly from the ADQ14 to the GPU via the PCIe switch. This means that the load on the CPU is minimized and leaves the CPU available for other tasks.

Sustained data rate is the effective data rate for real data when headers are excluded. This value is used for systems design.



Software support

ADQ14-FWDT is supported by the application programming interface, ADQAPI, supplied with the ADQ14 digitizer. This software development kit is an open programming interface for building high-performance applications based on the ADQ14 digitizer.

ADQ14-FWDT is also delivered with a number of software examples for fast integration including:

- How to set up the peer-to-peer streaming to the GPU.
- Example code for streaming to the GPU.
- Example code for streaming data to the host PC.

AMD GPU streaming support

ADQ14-FWDT supports peer-to-peer streaming to AMD GPUs in Windows and Linux. The models supported are AMD Radeon Pro Wx 5100, 7100, and 9100 with Direct GMA support. The software supports OpenCL™ programming language.

NVIDIA GPU streaming support

The ADQ14-FWDT supports peer-to-peer streaming to NVIDIA GPUs in Linux using GPU direct RDMA. The software comes with CUDA™ support for integration in the NVIDIA GPU.

Streaming to NVIDIA GPUs in Windows is done via the host CPU.

Application information

ADQ14-FWDT directly supports a number of applications for 3D imaging and the multi-channel capabilities enable support for a large variety of applications.

The two independent trigger inputs support pixel/line triggering as well as frame triggering (trig and sync). At each trigger, a record of consecutive samples is captured and sent to the GPU for immediate analysis. The frame sync primarily organizes the records but can also be used as a trigger gate to control which triggers to accept and which to discard. This reduces the amount of data to be transferred.

Application examples:

- In Swept-Source OCT the trigger and sync signals are used for A-scan and B-scan whereas the analog inputs of an ADQ14DC-2X-FWDT are used to capture the data and k-clock.
- Use the trigger as Time-of-Flight start and the sync to frame the acquisition in a mass spectrometry application. Use the analog input of an ADQ14DC-1X-FWDT to connect to the detectors.
- Let the trigger indicate the pulse start and sync indicate start of a sweep in a LIDAR applications. Select 1, 2 or 4 channels ADQ14DC-FWDT depending on the number of detectors in the system.

See application note 18-2069 for more details on applications.

Important notice

The data buffer on the ADQ14-FWDT is small. The transfer to a CPU RAM is thus sensitive to interruptions. Make sure that the PC can handle a reliable data transfer at the requested speed.

Technical data

Table 1: Supported GPU models.

GPU	OPERATING SYSTEM	DATA RATE PEER-TO-PEER ^{1 2} [GBYTES/S]
AMD Radeon Pro VX5100	Windows 10	6
	Linux ³	6
AMD Radeon Pro VX7100	Windows 10	6
	Linux ³	6
AMD Radeon Pro VX9100	Windows 10	6
	Linux ³	6
NVIDIA Quadro P4000	Windows 10	Via CPU
	Linux ³	6
NVIDIA Quadro P6000	Windows 10	Via CPU
	Linux ³	6
NVIDIA Tesla P40	Windows 10	Via CPU
	Linux ³	6
NVIDIA Tesla P100	Windows 10	Via CPU
	Linux ³	6

1. This is the sustained data rate supported by the ADQ14-FWDT. System performance depends on the performance of the other parts of the system. Note that not all motherboards support peer-to-peer streaming and not all motherboards support Generation 3 by 8 lanes PCIe.
2. Sustained data rate for records longer than 163 samples. Shorter records means that the data rate is reduced due to increased overhead.
3. Contact Teledyne SP Devices for supported versions of Linux.

Table 2: Data rate to CPU of host PC.

CPU	OPERATING SYSTEM	DATA RATE TO CPU ^{1 2} [GBYTES/S]
CPU of host PC	Windows 10	6
	Linux ³	6

1. This is the sustained data rate supported by the ADQ14-FWDT. System performance depends on the performance of the host PC.
2. Sustained data rate for records longer than 163 samples. Shorter records means that the data rate is reduced due to increased overhead.
3. Contact Teledyne SP Devices for supported versions of Linux.

Table 3: ADQ14-FWDT parameters

		-1X	-2C -2X	-4C
Record size	[kSamples/channel]	128	64	32
Sample skip		2 4 8 9 10 ... 65536	2 4 5 6 7 ... 65536	2 4 8 9 10 ... 65536
Filter length		32	32	32
Sustained data rate to host PC	[GBytes/s]	6	6	6
Peak data rate from ADQ14-FWDT	[GBytes/s]	6.8	6.8	6.8

Ordering information

Order firmware option -FWDT together with the ADQ14 digitizer.

It is also possible to order -FWDT separately for loading into an ADQ14 digitizer. Indicate the model of ADQ14 to get the correct version of -FWDT.

Important Information

Teledyne Signal Processing Devices Sweden AB (Teledyne SP Devices) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to Teledyne SP Devices' general terms and conditions supplied at the time of order acknowledgment.

Teledyne SP Devices warrants that each product will be free of defects in materials and workmanship, and conform to specifications set forth in published data sheets, for a period of one (1) year. The warranty commences on the date the product is shipped by Teledyne SP Devices. Teledyne SP Devices' sole liability and responsibility under this warranty is to repair or replace any product which is returned to it by Buyer and which Teledyne SP Devices determines does not conform to the warranty. Product returned to Teledyne SP Devices for warranty service will be shipped to Teledyne SP Devices at Buyer's expense and will be returned to Buyer at Teledyne SP Devices' expense. Teledyne SP Devices will have no obligation under this warranty for any products which (i) has been improperly installed; (ii) has been used other than as recommended in Teledyne SP Devices' installation or operation instructions or specifications; or (iii) has been repaired, altered or modified by entities other than Teledyne SP Devices. The warranty of replacement products shall terminate with the warranty of the product. Buyer shall not return any products for any reason without the prior written authorization of Teledyne SP Devices.

In no event shall Teledyne SP Devices be liable for any damages arising out of or related to this document or the information contained in it.

TELEDYNE SP DEVICES' EXPRESS WARRANTY TO BUYER CONSTITUTES TELEDYNE SP DEVICES' SOLE LIABILITY AND THE BUYER'S SOLE REMEDY WITH RESPECT TO THE PRODUCTS AND IS IN LIEU OF ALL OTHER WARRANTIES, LIABILITIES AND REMEDIES. EXCEPT AS THUS PROVIDED, TELEDYNE SP DEVICES DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT.

TELEDYNE SP DEVICES DOES NOT INDEMNIFY, NOR HOLD THE BUYER HARMLESS, AGAINST ANY LIABILITIES, LOSSES, DAMAGES AND EXPENSES (INCLUDING ATTORNEY'S FEES) RELATING TO ANY CLAIMS WHATSOEVER. IN NO EVENT SHALL TELEDYNE SP DEVICES BE LIABLE FOR SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING LOST PROFIT, LOST DATA AND THE LIKE, DUE TO ANY CAUSE WHATSOEVER. NO SUIT OR ACTION SHALL BE BROUGHT AGAINST TELEDYNE SP DEVICES MORE THAN ONE YEAR AFTER THE RELATED CAUSE OF ACTION HAS ACCRUED. IN NO EVENT SHALL THE ACCRUED TOTAL LIABILITY OF TELEDYNE SP DEVICES FROM ANY LAWSUIT, CLAIM, WARRANTY OR INDEMNITY EXCEED THE AGGREGATE SUM PAID TO SP BY BUYER UNDER THE ORDER THAT GIVES RISE TO SUCH LAWSUIT, CLAIM, WARRANTY OR INDEMNITY.

Worldwide Sales and Technical Support

www.spdevices.com

Teledyne SP Devices Corporate Headquarters

Teknikringen 6
SE-583 30 Linköping
Sweden

Phone: +46 (0)13 465 0600

Fax: +46 (0)13 991 3044

Email: info@spdevices.com

Copyright © 2018 Teledyne Signal Processing Devices Sweden AB. All rights reserved, including those to reproduce this publication or parts thereof in any form without permission in writing from Teledyne SP Devices.