FWDSU Datasheet

The firmware option FWDSU allow the ADQ digitizer to operate together with ADQDSU in a high-speed recording system. The firmware FWDSU allow peer-to-peer data streaming to the ADQDSU. Unnecessary load of the PC is thus avoided. FWDSU enables

- **Support for un-limited storage size**

- **Seamless recording**

- **Peer-to-peer streaming**

1 FWDSU INTRODUCTION

1.1 Features

- Peer-to-peer streaming to SSD storage device
- 6.8 GByte/s write speed
- Seamless handover for continuous recording to SSD array

1.2 Applications

- Data Recording
- RF systems
- LIDAR
- Scientific instruments

1.3 Advantages

- Enables a high-speed recording system with peer-to-peer data streaming
- Minimize the load on the CPU and RAM of the host PC
- Proven combination of digitizer and storage for fast and trouble-free integration

2   OPERATION

2.1   System design streaming data to disk

High-performance data acquisition systems produce big amount of data at high speed. The FWDSU enables peer-to-peer streaming to SSD storage, a concept of storing large amount of data without loading the PC. The peer-to-peer streaming allows the data from the ADQ series digitizer to be passed directly to an SSD storage without passing the RAM of the PC. How this works in practice differs between systems:

FWDSU is available for PXIe systems. In a PXIe system, peer-to-peer means that the data from the ADQ digitizer is transferred to the SSD storage via the PCIe switch in the backplane of the chassis. The selected model of PXIe chassis must support this set-up.

FWDSU is available for PCIe format in standard PC. There are several possible implementations of the PCIe bus system. Most common is that the peer-to-peer data stream goes directly from the digitizer to the SSD storage via the root complex of the CPU chip set. The performance is then influenced by this chip set. In some motherboards, there is a switch on the PCIe bus. The data then passes the switch instead of the root complex. Pay attention to the routing possibilities when selecting motherboard.

FWDSU allow parallel write to multiple SSDs for increased write speed. FWDSU also allow seamless handover to enable continuous the recording. There is no limit on the amount of data that can be managed in the system[1]. The requirement is that all ADQDSU shall be within the same PCIe tree as the ADQ digitizer.

2.2   Data acquisition using FWDSU

FWDSU contain the data acquisition features of the standard firmware FWDAQ. For more information, see manual of ADQ7 and datasheet of ADQ7.

2.3   Data format

The FWDSU is designed for storing data at maximum throughput. Data is thus written sequentially to the SSD. There is no file system on the SSD. The data contains header information for interpreting the content of the SSD.

Reading the data is done via supplied read-out software. It is recommended to off-load the data from the SSD as soon as possible and organize it in a file system for archiving.

---

[1] This is only limited by the available SSDs.

2.4   Software library

The data streaming is controlled by the software library ADNVDS, which is included with the delivery of FWDSU. ADNVDS contains functions for controlling the disks, streaming data and read out and interpret the stored data.

3 TECHNICAL DATA

Technical parameters are valid for data transfer to SSD. For data acquisition parameters, see ADQ7 datasheet.

Table 1 Data interface

Parameter	Unit	Value
Supported versions of data transfer standard PCIe		Gen1 Gen2 Gen3
Supported number of PCIe lanes		1 4 8
Data rate[2] in PXIe / PCIe with backplane switch	GBPS	6.8
Data rate in PCIe through AMD root complex	GBPS	6.8
Data rate in PCIe through Intel root complex[3]	GBPS	3.3
Maximum recording time[4]		Unlimited
Simultaneous accessible SSDs[5]		8
Data format on SSD[6]		Custom

Table 2 Software support

Parameter	Value
Operating system	Windows 10 Linux
Example code for writing to disk	C
API	C / C++
Streaming library	ADNVDS
Data read-out	ADNVDS

---

[2] This is the supported data rate of the FWDSU. Other system parameters may limit the speed.

[3] The combination of the DMA in the FPGA and the parameter set in the root complex limits the speed. The transfer rate is only verified up to 10th generation of Intel's root complex.

[4] The recording time is limited by the size of the available storage.

[5] The parallel write increases the recording speed. When the SSDs are full, seamless handover to a new set of SSDs is supported.

[6] See user guide for ADQDSU

4   COMPATIBLE DIGITIZER MODELS

The FWDSU is compatible with the following models

- ADQ7DC-PCIe 2 and 1 channels mode
- ADQ7DC-PXIe 2 and 1 channels mode

Note that the ADQ7 digitizers can stream data to an SSD via host PC memory using any firmware. FWDSU is only required for enabling peer-to-peer streaming.

5   COMPATIBLE DISK MODELS

The FWDSU is compatible with many PCIe NVME SSD devices. Different SSD give different system performance[7].

The following models have been tested in PXIe

- ADQDSU-8T-PXIe
- ADQDSU-32T-PXIe

The following unit has been tested in PCIe

- SSD models using NVMe protocol. List of tested units
  - Samsung 970 Pro
  - Samsung 980 Pro
  - Sabrent Rocket 4TB

---

[7] When selecting SSD, pay attention to the sustained write speed. The write speed may drop after a certain amount of data.

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 three (3) years. 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 8D
SE-583 30 Linköping
Sweden

Phone: +46 (0)13 465 0600

Fax: +46 (0)13 991 3044

Email: info@spdevices.com