ADQ8

Quick Start Guide for Linux
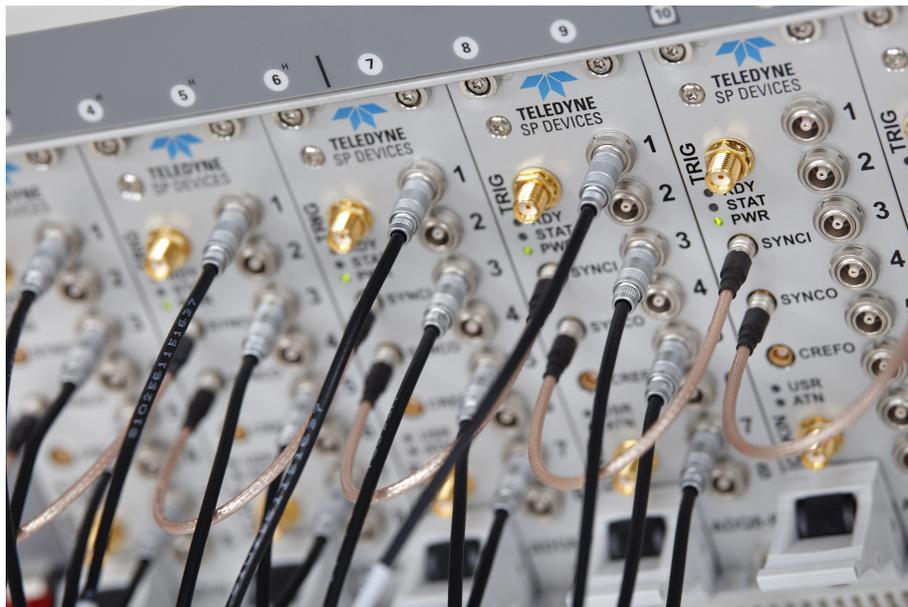
1   Introduction

Congratulations on having purchased a Teledyne SP Devices digitizer product. To get the most out of the digitizer we recommend that you read the documentation set carefully.

Disclaimers and Safety

Caution!   Ground the antistatic package before removing the device from the package. Electrostatic discharge may damage the card. Be sure to ground yourself by touching the grounded frame and avoid touching any components on the card.

Caution!   Before connecting any equipment to the digitizer, please check the absolute maximum ratings in the digitizer data sheet to assure that the connected equipment cannot damage the digitizer.

2   Installing the Software

To install the software development kit (SDK), enter the `packages/` directory and find the subdirectory corresponding to the Linux distribution and processor architecture of the host computer. Instructions for each distribution follows below[1].

> **❶ Important**
> Make sure the digitizer is connected to the host computer before you begin the installation process.

Ubuntu and Debian

Install the delivered SDK packages using `dpkg -i packagename`. Use the following order:

1. `spd-adq-pci-dkms` (needed for PCIe/PXIe/MTCA)

2. `libadq0`

3. `adqtools`

OpenSUSE and SUSE Linux Enterprise

Install the following packages using `zypper install packagename`:

- `make`

- `kernel-devel`

- `kernel-source`

- `gcc`

The version of `kernel-devel` and `kernel-source` must match your current kernel. Install the delivered SDK packages using `rpm -U packagename`. Use the following order:

1. `dkms` (needed for PCIe/PXIe/MTCA)

2. `spd-adq-pci-dkms` (needed for PCIe/PXIe/MTCA)

3. `libadq0`

4. `adqtools`

Fedora 19, 20 and 21

Install the following packages using `yum install packagename`:

- `dkms` (needed for PCIe/PXIe/MTCA)

Install the delivered SDK packages using `rpm -U packagename`. Use the following order:

1. `spd-adq-pci-dkms` (needed for PCIe/PXIe/MTCA)

2. `libadq0`

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[1]These instructions are also available in the README included in the SDK archive.

3. `adqtools`

Fedora 22 and higher

Install the following packages using `dnf install packagename`:

- `dkms` (needed for PCIe/PXIe/MTCA)

Install the delivered SDK packages using `dnf install packagename`. Use the following order:

1. `spd-adq-pci-dkms` (needed for PCIe/PXIe/MTCA)

2. `libadq0`

3. `adqtools`

CentOS / Red Hat Enterprise Linux / Scientific Linux

> **❶ Note**
>
> For RHEL6, use CentOS6 packages.

Install the following packages using `yum install packagename`:

- `make`

- `kernel-devel`

- `gcc`

The version of kernel-devel must match your current kernel. Install the SDK packages using `rpm -U packagename`. Use the following order:

1. `dkms` (needed for PCIe/PXIe/MTCA)

2. `spd-adq-pci-dkms` (needed for PCIe/PXIe/MTCA)

3. `libadq0`

4. `adqtools`

After installing all necessary packages, reboot the system so that `udev` reads the updated configuration and the driver loads. In earlier versions there was a package called `adqupdater` which is now replaced by the `adqtools` package.

Device Access Rights

ADQ devices show up prefixed with `/dev/adq_pcie_` and `/dev/adq_usb_`. The default `udev` setting is to add read/write access to the user group `adq`. The `libadq0` package will create a user group called `adq` if that group does not already exist in the system. To grant a user access to the device, add the user to the `adq` group using with

```
$ usermod -a -G adq <username>
```

The user will have to logout and login again for the changes to take effect.

Compatibility

The PCIe kernel module supports kernel versions from 2.6.32 and forward, however kernel version 3.8.0 or newer is recommended. The PCIe kernel module is not signed and thus will not load if your kernel uses *secure boot*. If secure boot is enabled, it will need to be disabled before the kernel module can be loaded. Refer to your distribution documentation on how to do this.

ADQAPI

The ADQAPI is the application programming interface (API) used by the host computer to communicate with the digitizer. The API functions are detailed in the ADQAPI reference guide [1] and general usage is documented in the ADQAPI user guide [2]. There are two different interfaces available: a C interface and a C++ interface. Most programming languages, e.g. Python, have a foreign function interface granting the ability to call functions from C dynamic link libraries directly, making this the more general interface of the two.

Digitizer Studio

Digitizer Studio is an easy-to-use stand-alone program which allows for configuration and operation of ADQ digitizers from Teledyne SP Devices. The application is able to collect and plot data, and to calculate key performance metrics such as SNR and SFDR. Collected data can be stored on disk for later use, e.g. to compare measurements. The application exists for diagnostic purposes and to simplify the process of getting started with the digitizer. Digitizer Studio is also a stand-alone measurement instrument application.

Please note that to reach the full potential of the digitizer in a real-time application, the SDK is recommended since only a subset of the digitizer's full functionality is controllable from Digitizer Studio. Refer to the datasheet of Digitizer Studio [3] for supported hardware, firmware and operating systems. For more information, see the Digitizer Studio user guide [4].

> **❶ Note**
>
> Firmware options FWATD and FWPD have separate GUIs.

3 Connecting the Digitizer to the Host Computer

After the SDK has been installed, it is time to connect your digitizer to the host computer. The connection procedure depends on the form-factor.

PXIe

> For PXIe units you need a host computer with a free PXIe or cPCIe slot. With the host computer powered off, plug in the digitizer. Power on the host computer.

MTCA

> For a MTCA unit you need a host computer with an available MTCA slot. With the host computer powered off, plug in the digitizer. Power on the host computer.

PXIe Front Panel

RDY	Not used
STA/STAT	Blinking red light in combination with PWR LED off indicates that the device has overheated and partially powered down to prevent damage.
PWR	Solid green light indicates power and status OK.
USR/USER	Solid blue light when the digitizer is acquired by an application using the ADQAPI.
ATN	PXIe attention LED

MTCA Front Panel

> **Note**
>
> The LEDs are labeled according to the AMC.0 standard.

> **Important**
>
> Hot Swap is only supported on Linux.

LED 1	Provides feedback on *failures* and *out of service* status. Solid red light if an error is detected.
LED 2	Provides *in service* status. Solid green light while the digitizer is operational.
BLUE LED	Provides feedback on the Hot Swap state of the digitizer.
	Solid—safe to disconnect the digitizer.
	Blinking—wait before disconnecting the digitizer.
	Off—the digitizer is operational and *unsafe* for extraction. Pull hot swap pin gently to activate indicator.

4   Using the Digitizer

To introduce you to the interface for our digitizers: the ADQAPI, there are source code examples provided in the `examples/` directory in the SDK archive. We recommended you to browse through the contents of this directory to get an overview of the available example code.

> **ⓘ Note**
>
> Please note that there are different source code examples for different products and firmwares.

You can launch Digitizer Studio (described on p. 4)

- either from a terminal, as:

```
$ digitizerstudio
```

- or if your distribution features an application menu, from the corresponding menu entry.

It is also helpful to familiarize yourself with the documentation for your specific product. Which documents to read depend on which firmware your digitizer is running. Refer to p. 9 for an overview of the available resources. Additional documentation is available on our web site[2].

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[2]https://www.spdevices.com/documentation

Common resources

Resource	Description
MAN 17-2000	The ADQ8-8C product manual
MAN 19-2302	The ADQ8-4X product manual
UG 18-2059	Describes how to manage firmware files.
UG 08-0214	The ADQAPI user guide
RG 14-1351	The ADQAPI reference guide, documents the functions in the ADQAPI.

Firmware-specific resources

Resource	FWDAQ
User guides	
Source code examples in C	`ADQAPI_example` `standard_example`
GUIs	Digitizer Studio (UG 20-2382)
Application notes	

References

[1] Teledyne Signal Processing Devices Sweden AB, *14-1351 ADQAPI Reference Guide*. Technical Manual.

[2] Teledyne Signal Processing Devices Sweden AB, *08-0214 ADQAPI User Guide*. Technical Manual.

[3] Teledyne Signal Processing Devices Sweden AB, *20-2381 Digitizer Studio Datasheet*. Technical Specification.

[4] Teledyne Signal Processing Devices Sweden AB, *20-2382 Digitizer Studio User Guide*. Technical Manual.

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