Using MATLAB® with KEITHLEY KPCI Boards

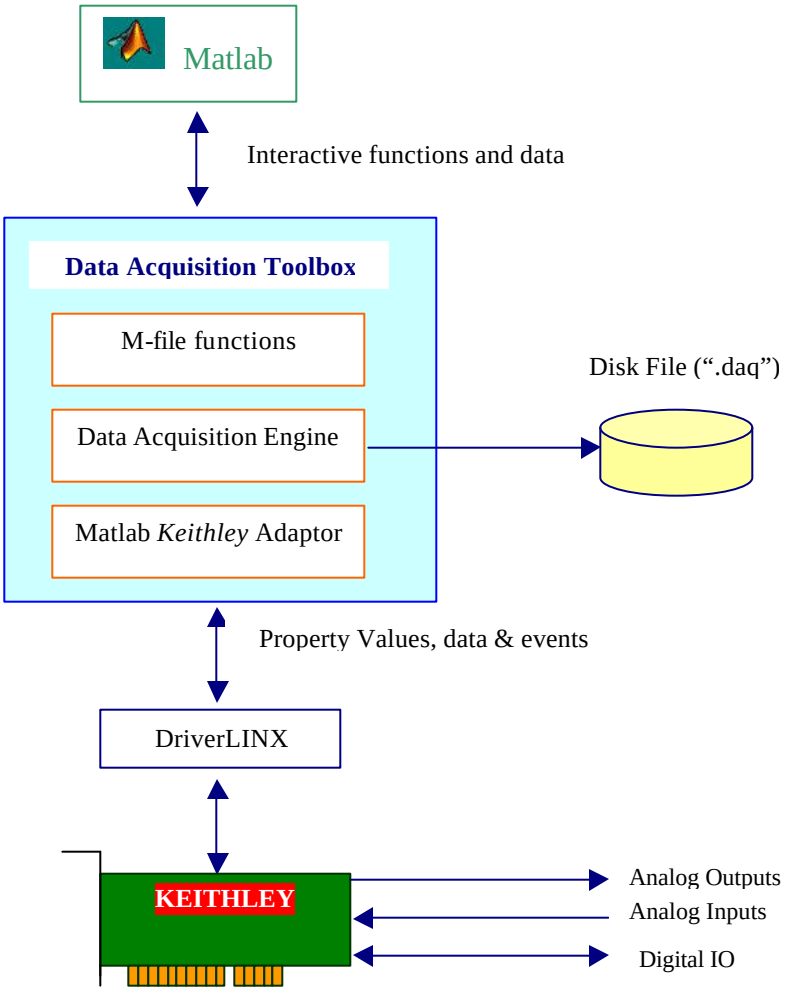
Background

MATLAB® is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment. At many universities, MATLAB is a widely accepted instructional tool for introductory and advanced courses in mathematics, engineering, and science.

MATLAB, toolboxes allow you to learn and apply specialized technology. Toolboxes are comprehensive collections of MATLAB functions (M-files) that extend the MATLAB environment to solve particular classes of problems.

The Data Acquisition Toolbox is a collection of M-file functions and MEX-files, the dynamic link libraries (DLLs) built on MATLAB® environment. The toolbox provides you with a framework for bringing live, measured data into MATLAB using PC-compatible, plug-in data acquisition hardware.

Data Acquisition Toolbox supports most Keithley data acquisition boards with 32-bit DriverLINX drivers. Please see the following page for a list of supported hardware. *Note: in some models, not all the hardware functionalities may be available in Matlab.*



Using Matlab with Data Acquisition Toolbox & Keithley boards.

Keithley Boards Supported by Data Acquisition Toolbox	
Bus	**Board**
ISA	DAS-800/801/802
	DDA-08/16
PCI	KPCI-1801HC/1802HC
	KPCI-3101/3102/3103/3104
	KPCI-3107/3108
	KPCI-3110
	KPCI-3116
	KPCI-3130/3132
	KPCI-3140 (digital IO sub system only)
	KPCI-3160
	KPCI-PIO24
	KPCI-PIO96
PCMCIA**	KPCMCIA-12AIAO-C**
	KPCMCIA-12AIAOH-C**
	KPCMCIA-12AI-C**
	KPCMCIA-12AIH-C**
	KPCMCIA-16AIAO-C**
	KPCMCIA-16AI-C**
	KPCMCIA-PIO24-C**
ISA	PDISO-8
	PIO-12
	PIO-24
	PIO-96J
	PIO-HV
	REL-16

Notes

- Despite 32-bit DriverLINX drivers, DAS-1700 & DAS-1800 series boards are currently not supported by Data Acquisition toolbox.
- ** If you are planning to use any of the PCMCIA models, please check with Keithley technical support first, (email: ustechsupport@keithley.com) for issues you may have with certain card & socket service drivers.
- DAS-1600/1400/1200/16 series boards are not supported by Data Acquisition toolbox because of 16-bit DriverLINX drivers.

Requirements

Keithley adaptor is the critical interface that enables the Data Acquisition Toolbox to communicate with DriverLINX device drivers for Keithley data acquisition boards. Please note that the Keithley adaptor is included in Data Acquisition Toolbox 2.2.

If you have an older version, you should upgrade to the current version (2.2).

Please see *www.mathworks.com* for more information on upgrading or downloading the adaptor <*http://www.mathworks.com/support/author/daq/keithley.shtml*>.

You also should have the latest version of DriverLINX drivers. *Please see http://www.keithley.com,* ***Download Center, Software Drivers*** for your board model.

Using the Data Acquisition Toolbox

You need to have DriverLINX properly loaded first in order to use the hardware. In order to check if the Keithley adaptor was installed, type "daqhwinfo keithley" at the Matlab command prompt. You should see:

```
ans =
          AdaptorDllName: [1x51 char]
       AdaptorDllVersion: '1.0'
             AdaptorName: 'keithley'
              BoardNames: {[1x17 char]}
       InstalledBoardIds: {'0'}
   ObjectConstructorName: {1x3 cell}
```

Example: Simple Analog Input

The service request set up in your M-file should look something like this:

```
1. Create the Device Object for DrvierLINX device
      ai = analoginput('keithley',0);

2. Select and Configure channels
      chan = addchannel(ai,0:2);       % ch 0,1,2
      set(chan,'InputRange',[-10 10])  % input range

3. Configure the property values
      set(ai,'SampleRate',40000)       % sample @40kHz
      set(ai,'SamplesPerTrigger',2000) % 2K Data points

4. Start the acquisition and get the data
      start(ai)

5. Get the data from the DAQ engine and plot
      data = getdata(ai);
      plot(data)

6. Clean up the memory
      delete(ai)
      clear ai
```

Performance

Currently Data Acquisition Toolbox only supports Analog Input, Analog Output and Digital IO subsystems. Counter Timer subsystem is not supported. The following table summarizes the current functionality and limitations.

	Analog Input	Analog Output	Digital IO	Counter Timer
Trigger				
Software	Yes	Yes	Yes	N/A
Digital Trigger	Yes	No	N/A	N/A
Analog Trigger	Yes	No	N/A	N/A
Trigger Type				
Pre-trigger	Yes	N/A	N/A	N/A
Post-trigger	Yes	N/A	N/A	N/A
About-Trigger	Yes	N/A	N/A	N/A
Pacing mode				
Paced	Yes	Yes	N/A	N/A
Burst	No	No	N/A	N/A
Clock Source				
Internal	Yes	Yes	N/A	N/A
external	No	No	N/A	N/A

Conclusion

By using the Data Acquisition Toolbox with Keithley adaptor, you can bring live data from Keithley data acquisition board into Matlab environment, where powerful tools such as data analysis, engineering graphics, modeling and simulation are at your disposal.

The only potential draw back is that not all the board's hardware functionalities may be available from Matlab. Please check Keithley web site for driver updates and availability of adaptors for other Keithley products.