

Data Acquisition Toolbox 2.8

Acquire and send out data from plug-in data acquisition boards

The Data Acquisition Toolbox provides a complete set of tools for analog input, analog output, and digital I/O from a variety of PC-compatible data acquisition hardware. The toolbox lets you configure your external hardware devices, read data into MATLAB® for immediate analysis, and send out data.

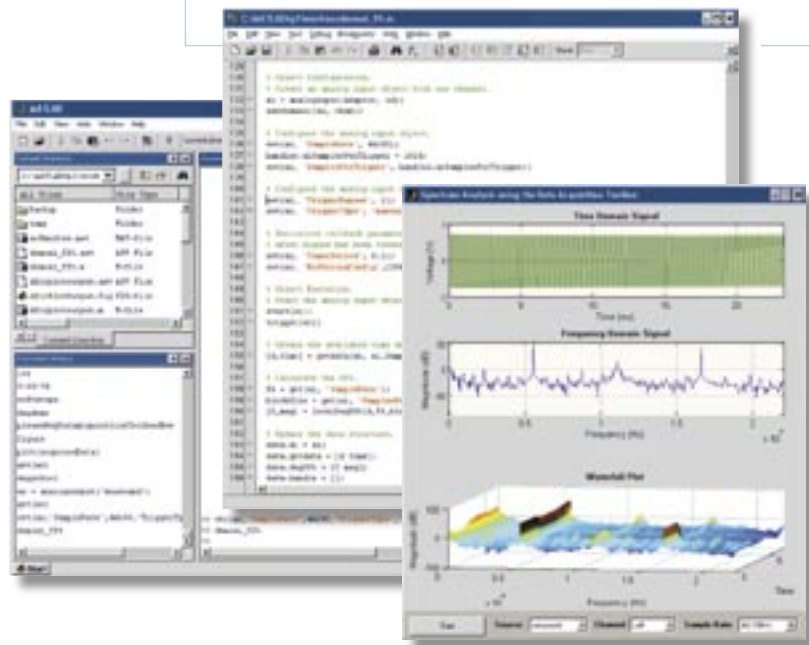
You can customize your acquisitions, access the built-in features of hardware devices, and incorporate the analysis and visualization features of MATLAB and related toolboxes into your design.

Together, MATLAB and the Data Acquisition Toolbox offer a single, integrated environment to support the entire data acquisition and analysis process. You can analyze or visualize your data, save it for post-processing, and make iterative updates to your test setup based on your analysis results.

Using the Data Acquisition Toolbox to acquire an input signal from a data acquisition board directly into MATLAB. The acquired data is displayed simultaneously as a time-domain signal, an instantaneous FFT, and a waterfall plot, making use of MATLAB signal processing and visualization capabilities.

KEY FEATURES

- Controls and communicates with a variety of industry-standard data acquisition devices
- Acquires live, measured data directly into MATLAB for immediate analysis
- Provides a single integrated environment for data acquisition, analysis, and visualization
- Performs “one shot” or continuous data acquisition
- Configures and accesses analog input, analog output, and digital I/O
- Streams data into a graphical display using the SoftScope software oscilloscope
- Directly interfaces to device-specific features, such as single-channel and multichannel acquisitions and single-point and buffered analog I/O
- Controls acquisitions with hardware and software triggers
- Provides a consistent software interface for easy substitution of hardware boards and vendors



INDEPENDENT ACQUISITION AND ANALYSIS

While the Data Acquisition Toolbox is collecting data, MATLAB can analyze and visualize data.



The Data Acquisition Toolbox supports three device objects: analog input, analog output, and digital I/O. The toolbox automatically performs A/D and D/A data conversions for receiving or sending data.

Supported Hardware Devices and Vendors

The Data Acquisition Toolbox supports PC-compatible data acquisition hardware from multiple vendors, including Advantech, Measurement Computing, and National Instruments, as well as Microsoft Windows compatible sound cards and the PC parallel port. The Data Acquisition Toolbox is also compatible with hardware from several data acquisition vendors via third-party adaptors.

For up-to-date information on supported third-party boards, visit www.mathworks.com/products/daq.

Communicating with Unsupported Devices

The Data Acquisition Toolbox provides an adaptor kit that enables you to build custom interfaces to hardware not supported by the toolbox. For more information, refer to the Data Acquisition Toolbox documentation.

Working with the Data Acquisition Toolbox

You can execute Data Acquisition Toolbox functions from the command line or through MATLAB programs.

Based on MATLAB object technology, the toolbox provides functions for creating device objects that are directly associated with your hardware. These objects include base properties that apply to all supported hardware, such as sample rate, trigger settings, and channel properties. They also include device-specific properties that let you access the specific features and capabilities of your hardware.

Using Device Objects

Device objects provide a gateway to the hardware's functionality and enable you to control the behavior of your acquisition. For example, you can execute any supported analog input task via an analog input object created in MATLAB.

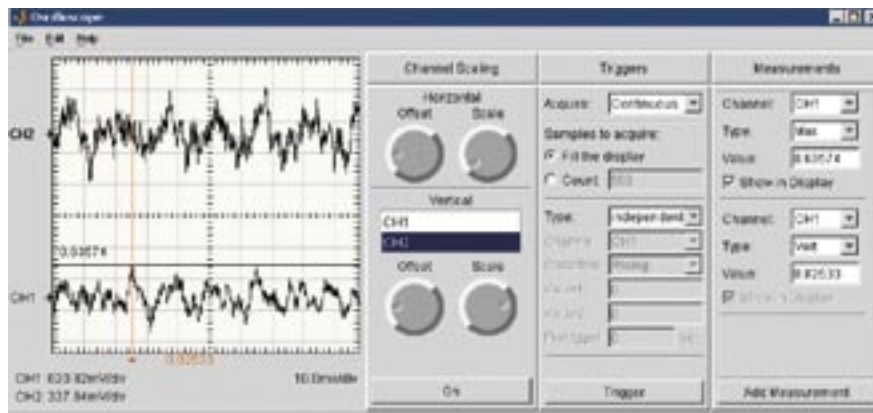
Analog Input

The analog input functions let you acquire signals from your hardware. You can create an analog input object, add channels to the object, acquire data to memory, read data into the workspace, and preview the most recently acquired data.

Analog Output

Analog output functions let you send signals out to your hardware. You can create an analog output object, add channels, queue data sets to be output, and generate analog signals.

Two channels of live audio data displayed and analyzed using the SoftScope software oscilloscope interface. SoftScope's measurement capabilities find the peak voltage of data streaming in through channel 1.



Digital I/O

Digital I/O functions enable you to generate or read digital signals using your hardware. You can create digital I/O objects, add lines, send data to the hardware, and read data into the workspace.

Channels and Lines

Data Acquisition Toolbox channels and lines are mapped to your hardware's channels and lines. The toolbox supports an unlimited number of channels/lines, enabling you to use as many as your hardware permits.

Controlling Your Acquisition

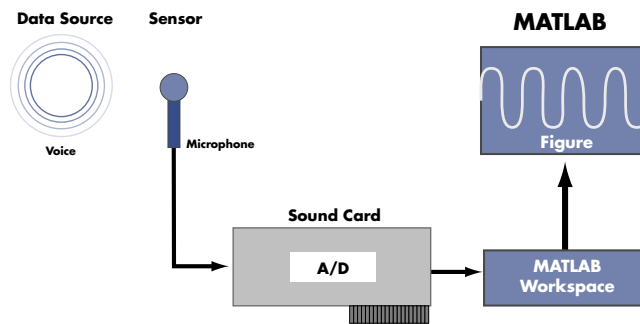
The Data Acquisition Toolbox supports a wide range of functions for controlling your acquisition. For example, you can set event information, evaluate the acquisition status, define triggers and callbacks, preview data while the device is running, and perform analysis on-the-fly. The toolbox also supports several hardware-specific properties that can be displayed and customized to your specifications.

Managing Data

Functions are provided for previewing and extracting your data for analysis. The toolbox streams data into MATLAB in double-precision floating-point format, enabling you to work with the data just as you would with any other matrix in MATLAB. You can also stream in data using a native hardware format.

Logging Data

Functions are available for logging data to disk, memory, or both while the analog input object is running. You can log data, events, and errors. In addition, functions are provided for extracting data from toolbox-generated log files.



Setup for a data acquisition and analysis session. The Data Acquisition Toolbox enables MATLAB to interface with the data acquisition boards, such as sound cards.

Using SoftScope

SoftScope is a graphical user interface for selecting and configuring data acquisition sources and then acquiring, viewing, and analyzing data using a familiar, oscilloscope-like interface. SoftScope lets you quickly verify hardware operation and perform live data analysis using a library of built-in measurement functions. You can extend SoftScope with your own analysis functions and export data from SoftScope to the MATLAB workspace.

Incorporating Events and Callbacks

Most data acquisition tasks are initiated by events. An event occurs at a specific time after a condition is met. Event types supported by the Data Acquisition Toolbox include:

- Start and stop
- Number of samples acquired
- Errors
- Triggers
- Number of samples output

Events may result in one or more callbacks. All the preceding event types execute an M-file function that you specify.

Handling Errors

The Data Acquisition Toolbox provides a consistent set of error and warning messages. If a hardware error message is not handled by the toolbox, an “external error” is reported with the vendor-specific hardware error message.

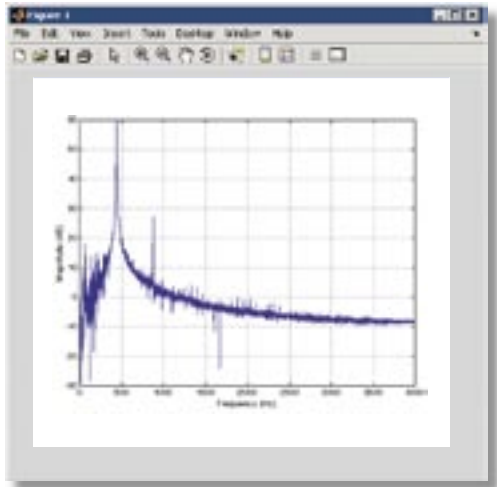
Converting Engineering Units

The Data Acquisition Toolbox automatically converts acquired data into values that represent specific engineering units (for example, volts or Newtons). The toolbox directly supports linear scaling and offsets. In addition, you can use MATLAB to apply nonlinear calibration curves. You can set engineering unit conversions for each data channel.

Evaluating Your Acquisition

You can evaluate the status of your acquisition and the available data acquisition resources, including installed hardware, hardware drivers, and adaptors, by displaying:

- Device object and channel status
- Hardware information
- Data acquisition engine information



```

% Create an analog input object to communicate with the
% data acquisition device.
ai = analoginput('winsound');
addchannel(ai, 1);

% Configure the object to acquire 2 seconds of data at 8000 Hz.
Fs = 8000;
duration = 2;
set(ai, 'SampleRate', Fs);
set(ai, 'SamplesPerTrigger', duration*Fs);

% Start the acquisition and retrieve the data.
start(ai);
data = getdata(ai);

% Determine the frequency components of the data.
xfft = abs(fft(data));
mag = 20*log10(xfft);
mag = mag(1:end/2);
plot(mag);

% Clean-up
delete(ai);
clear ai;

```

A script illustrating the four steps of a typical MATLAB data acquisition session: creation, configuration, acquisition, and clean-up. A few lines of code let you acquire 2 seconds of data from a data acquisition board, calculate the frequency components of the data, and plot the results in MATLAB.

Required Products

MATLAB

Related Products

Signal Processing Toolbox. Perform signal processing, analysis, and algorithm development.

Curve Fitting Toolbox. Perform model fitting and analysis

Instrument Control Toolbox. Control and communicate with test and measurement instruments

Image Acquisition Toolbox. Acquire images and video from industry-standard hardware

MATLAB Report Generator. Automatically generate documentation for MATLAB applications and data

MATLAB Compiler. Convert MATLAB applications into stand-alone applications and software components

Platform and System Requirements

For platform and system requirements, visit www.mathworks.com/products/daq

For demos, application examples, tutorials, user stories, and pricing:

- Visit www.mathworks.com

- Contact The MathWorks directly

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