DATAQ Instruments Matlab Adaptor

Beta Version 0.3.0.0

Getting Started

1. Download the DATAQMatLabAdaptor.zip file located on the DATAQ Instruments website at: http://www.dataq.com/support/downloads/DATAQMatLabAdaptor.zip. The .zip file will contain the file: matlab.exe.

2. Extract and run matlab.exe. This will open the installation program and install the necessary components to run DATAQ Instruments' MatLab Adaptor.

   a. Select a Destination Directory. Remember the destination or write it down - you will need to know the destination to setup the daqdevs.txt file in Step 3.

   b. The Installation software will ask you if you would like to Backup any overwritten files. Choose Yes to backup the overwritten files, choose No to ignore.

   c. The Installation software ends.

3. Edit the **daqdevs.txt** file. See "Editing the daqdevs.txt file" on page 1 for more information. Correct Data for all installed hardware must be entered into this file.

4. Start (or Restart) MatLab to grab the settings from the daqdevs.txt file. MatLab's Data Acquisition Toolbox must be installed to run the DATAQ Instruments MatLab Adaptor. All "Analog In" functions of the Data Acquisition Toolbox are available in the adaptor. View the MatLab Help Files for information regarding the use of MatLab. View the "Sample Session" on page 9 or try the sample program downloaded in DATAQMatLabAdaptor.zip file for examples.

Editing the daqdevs.txt file

The **daqdevs.txt** file is located in the Destination Directory specified during installation (Step 2a above). Use Notepad or any other text editing software to access and change the file. All hardware you would like to use in the MatLab Adaptor must be installed as well as WinDaq Software in order to correctly identify each device in MatLab. The daqdevs.txt file contains three device descriptor lines per Hardware Device. The information in these lines cannot be determined until both the Hardware Device and WinDaq Acquisition software have been installed. Each device **must** have the correct Device Name, Driver Name, and Device ID to work correctly. See "Device Names, Driver Names, and Device IDs" on page 2 for correct entries.

Use the following format for each device's description (# is a comment line):

```
#Hardware Device #
Device Name
Driver Name
Device ID
```

For Example:

```
#Hardware Device 1
DI-194RS
DI102NT.DLL
COM2 194 4800
```

Follow these rules when entering device descriptor lines:

1. All three device descriptor lines must be kept together.
2. There can be no extra spacing at the end of a line.
3. Comments must take up an entire line and cannot be on any of the three device lines.
4. You may enter as many devices as you have installed on your PC.

Devices installed to your system at a later date may be added to the daqdevs.txt file. MatLab must be restarted each time the daqdevs.txt file is edited in order for the changes to take effect.

Device Names, Driver Names, and Device IDs

DI-194RS and DI-154RS

Device Name	Driver Name	Device ID
DI-194RS	DI1xxNT.dll	COMxx 194 4800
DI-154RS	DI1xxNT.dll	COMxx 154 4800

The **Device Name** must be entered exactly as shown in the above table.

In **Driver Name** xx = the COM port designation. See“Finding the COM port designation or LPT number of your Printer Port, Serial Port, or Virtual Serial Port Instrument” on page 8 to determine what COM port your device was installed to. Single Digit COM port designations require a “0” to be entered prior to the number (for a device installed to COM port 1 enter “01”).

Device ID consists of three parts: the COM port designation (COMxx), the hardware model number (194 or 154), and the Baud Rate (4800). The default Baud Rate for that instrument is shown. If the Baud Rate of the device has changed be sure to enter the current Baud Rate of the Device. See “Baud Rates” on page 7 for all the possible Baud Rates of your device.

Example: If you have installed a DI-194 to COM port 2 and never changed the Baud Rate you would enter the following 3 lines to the daqdevs.txt file:

```
DI-194RS
DI102NT.DLL
COM2 194 4800
```

DI-148 and DI-158 products

Device Name	Driver Name	Device ID
DI-148U	DI1xxNT.dll	COMxx 148 460800
DI-158U	DI1xxNT.dll	COMxx 158 460800
DI-158UP	DI1xxNT.dll	COMxx 158 460800

The **Device Name** must be entered exactly as shown in the above table.

In **Driver Name** xx = the COM port designation. These USB devices use a “Virtual COM Port” for communication. See“Finding the COM port designation or LPT number of your Printer Port, Serial Port, or Virtual Serial Port Instrument” on page 8 to determine what COM port your device was installed to. Single Digit COM port designations require a “0” to be entered prior to the number (for a device installed to COM port 1 enter “01”).

Device ID consists of three parts: the COM port designation (COMxx), the hardware model number (148 or 158), and the Baud Rate (460800). The default Baud Rate for that instrument is shown. If the Baud Rate of the device has

changed be sure to enter the current Baud Rate of the Device. See “Baud Rates” on page 7 for all the possible Baud Rates of your device.

Example: If you have installed a DI-158UP and have determined that it has been designated to COM port 7 and never changed the Baud Rate you would enter the following 3 lines to the daqdevs.txt file:

```
DI-158UP
DI107NT.DLL
COM7 158 406800
```

DI-400 and DI-410

Device Name(s)	Operating System	Driver Name	Device ID
DI-400 or DI-410	Win95/98	DI2s32.dll	0
	WinNT/ME/200/XP	DI40nNT.dll	n

The **Device Name** must be entered exactly as shown in the above table.

In **Driver Name** and **Device ID** n = the WinRT virtual device number. The Driver Name can be found in the tpdataq.ini file located in the Windows folder of your hard drive. Use the Driver Name to determine the Device ID (“n” in Driver Name = Device ID).

Example: If you have installed a DI-400 and, after determining the Driver Name from tpdataq.ini is DI402NT.DLL, you would enter the following 3 lines to the daqdevs.txt file:

```
DI-400
DI402NT.DLL
2
```

DI-500/510/750/760 Series

Device Name(s)	Operating System	Driver Name	Device ID
DI-500-16-P DI-510-32-P DI-510-48-P DI-750-16-D DI-760-32-D DI-760-48-D	Win95/98	DI2s32.dll	0
	WinNT/ME/200/XP	DI50nNT.dll	n

The **Device Name** must be entered exactly as shown in the above table.

In **Driver Name** and **Device ID** n = the WinRT virtual device number. The Driver Name can be found in the tpdataq.ini file located in the Windows folder of your hard drive. Use the Driver Name to determine the Device ID (“n” in Driver Name = Device ID).

Example: If you have installed a DI-510-32-P on a Windows XP machine and, after determining the Driver Name from tpdataq.ini is DI501NT.DLL, you would enter the following 3 lines to the daqdevs.txt file:

```
DI-510-32-P
DI501NT.DLL
1
```

DI-710 Series

Device Name(s)	Driver Name	Device ID

DI-710-UH DI-710-UL DI-710-UHS DI-710-ULS	DI1xxNT.dll	COMxx 710 115200
DI-710-EH DI-710-EL DI-710-EHS DI-710-ELS	DI6nnNT.dll	IPaddress or IPaddress:Port

The **Device Name** must be entered exactly as shown in the above table.

USB Devices

In the **Driver Name** xx = the COM port designation. These USB devices use a "Virtual COM Port" for communication. See"Finding the COM port designation or LPT number of your Printer Port, Serial Port, or Virtual Serial Port Instrument" on page 8 to determine what COM port your device was installed to. Single Digit COM port designations require a "0" to be entered prior to the number (for a device installed to COM port 1 enter "01").

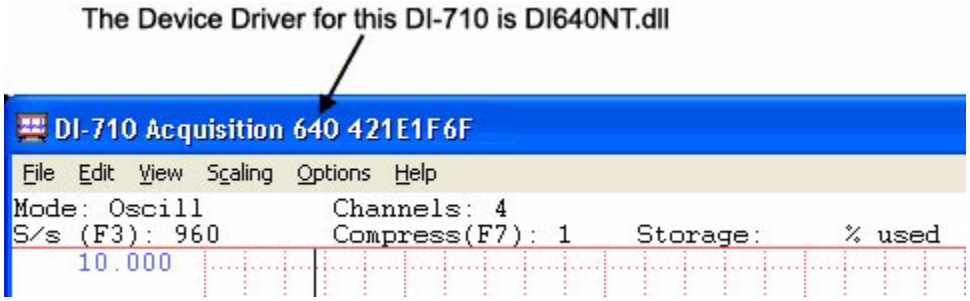
Device ID consists of three parts: the COM port designation (COMxx), the hardware model number (710), and the Baud Rate (115200). The default Baud Rate for that instrument is shown. If the Baud Rate of the device has changed be sure to enter the current Baud Rate of the Device. See "Baud Rates" on page 7 for all the possible Baud Rates of your device.

Example: If you have installed a DI-710-UH that has been designated to COM Port 4 and have never changed the Baud Rate you would enter the following 3 lines to the daqdevs.txt file:

```
DI-710-UH
DI104NT.DLL
COM04 710 115200
```

Ethernet Devices

In **Driver Name** nn = the order in which the Ethernet device was installed (in comparison with other DI-710 instruments). This number will be in the range of 40 to 69 and can be determined by running the device in WinDaq Acquisition. The title bar in WinDaq Acquisition software will contain (from left to right): the Model Number of the device; the word "Acquisition"; the 3 digit Driver Name number; and the Serial Number of the Device.



The **Device ID** is the IP address of the instrument. If you are accessing the device over the internet you will also need to enter the Port number designation.

Example: If you have installed a DI-710-EHS to your local network and have determined the Device Driver number is 640 (by opening WinDaq Acquisition software) and the IP address is 192.168.1.2 you would enter the following 3 lines to the daqdevs.txt file:

```
DI-710-EHS
DI640NT.DLL
192.168.1.2
```

DI-715B Series

Device Name(s)	Driver Name	Device ID
DI-715B-U DI-715B-US	DI1xxNT.dll	COMxx 715 115200
DI-715B-E DI-715B-ES	DI6nnNT.dll	IPaddress or IPaddress:Port

The **Device Name** must be entered exactly as shown in the above table.

USB Devices

In the **Driver Name** xx = the COM port designation. These USB devices use a "Virtual COM Port" for communication. See"Finding the COM port designation or LPT number of your Printer Port, Serial Port, or Virtual Serial Port Instrument" on page 8 to determine what COM port your device was installed to. Single Digit COM port designations require a "0" to be entered prior to the number (for a device installed to COM port 1 enter "01").

Device ID consists of three parts: the COM port designation (COMxx), the hardware model number (715), and the Baud Rate (115200). The default Baud Rate for that instrument is shown. If the Baud Rate of the device has changed be sure to enter the current Baud Rate of the Device. See "Baud Rates" on page 7 for all the possible Baud Rates of your device.

Example: If you have installed a DI-715B-U that has been designated to COM Port 11 and have never changed the Baud Rate you would enter the following 3 lines to the daqdevs.txt file:

```
DI-715B-U
DI111NT.DLL
COM11 715 115200
```

Ethernet Devices

In **Driver Name** nn = the order in which the Ethernet device was installed (in comparison with other DI-715B instruments). This number will be in the range of 70 to 99 and can be determined by running the device in WinDaq Acquisition. The title bar in WinDaq Acquisition software will contain (from left to right): the Model Number of the device; the word "Acquisition"; the 3 digit Driver Name number; and the Serial Number of the Device (see DI-710 Ethernet Devices on page 4 above).

The **Device ID** is the IP address of the instrument. If you are accessing the device over the internet you will also need to enter the Port number designation.

Example: If you have installed a DI-715B-E to your local network and have determined the Device Driver number is 670 (by opening WinDaq Acquisition software) and the IP address is 192.168.1.5 you would enter the following 3 lines to the daqdevs.txt file:

```
DI-715B-E
DI670NT.DLL
192.168.1.5
```

DI-718B Series

Device Name(s)	Driver Name	Device ID
DI-718B-U DI-718B-US	DI1xxNT.dll	COMxx 718 115200

DI-718B-E DI-718B-ES	DI6nnNT.dll	IPaddress or IPaddress:Port

The **Device Name** must be entered exactly as shown in the above table.

USB Devices

In the **Driver Name** xx = the COM port designation. These USB devices use a "Virtual COM Port" for communication. See"Finding the COM port designation or LPT number of your Printer Port, Serial Port, or Virtual Serial Port Instrument" on page 8 to determine what COM port your device was installed to. Single Digit COM port designations require a "0" to be entered prior to the number (for a device installed to COM port 1 enter "01").

Device ID consists of three parts: the COM port designation (COMxx), the hardware model number (718), and the Baud Rate (115200). The default Baud Rate for that instrument is shown. If the Baud Rate of the device has changed be sure to enter the current Baud Rate of the Device. See "Baud Rates" on page 7 for all the possible Baud Rates of your device.

Example: If you have installed a DI-718B-US that has been designated to COM Port 3 and have never changed the Baud Rate you would enter the following 3 lines to the daqdevs.txt file:

```
DI-718B-US
DI103NT.DLL
COM03 718 115200
```

Ethernet Devices

In **Driver Name** nn = the order in which the Ethernet device was installed (in comparison with other DI-718B instruments). This number will be in the range of 0 to 39 and can be determined by running the device in WinDaq Acquisition. The title bar in WinDaq Acquisition software will contain (from left to right): the Model Number of the device; the word "Acquisition"; the 3 digit Driver Name number; and the Serial Number of the Device (see DI-710 Ethernet Devices on page 4 above).

The **Device ID** is the IP address of the instrument. If you are accessing the device over the internet you will also need to enter the Port number designation.

Example: If you have installed a DI-718B-E to your local network and have determined the Device Driver number is 600 (by opening WinDaq Acquisition software) and the IP address is 192.168.1.1 you would enter the following 3 lines to the daqdevs.txt file:

```
DI-718B-E
DI600NT.DLL
192.168.1.1
```

DI-720/730/740 Series

Device Name(s)	Operating System	Driver Name	Device ID
DI-720-P DI-730-P DI-740-P	Win95/98	DI2s32.dll	0
	WinNT/ME/2000/XP	DI50nNT.dll	n
DI-720-USB DI-730-USB DI-740-USB	Win95/NT	N/A	N/A
	Win98/ME/200/XP	DI72nNT.dll	n
DI-720-EN DI-730-EN DI-740-EN	All	DI80xNT.dll	IPaddress

The **Device Name** must be entered exactly as shown in the above table.

Printer Port Devices

In **Driver Name** n = LPT port number the instrument was installed on. If you don't know which Printer Port your device has been installed to see "Finding the COM port designation or LPT number of your Printer Port, Serial Port, or Virtual Serial Port Instrument" on page 8.

Example: If you have installed a DI-720-P to LPT 1 in Windows XP you would enter the following 3 lines to the daqdevs.txt file:

```
DI-720-P
DI501NT.DLL
1
```

USB Devices

In **Driver Name** and **Device ID** n = the USB ID of the device. If you don't know the USB ID of your device look in the tpdataq.ini file (located in the Windows folder on your hard drive) for the Driver Name. The USB ID is designated when installing multiple devices and increases by one starting with 0 (i.e., if you only installed one DI-720/730/740 USB device your USB ID will be 0).

Example: If you have installed one DI-720-USB you would enter the following 3 lines to the daqdevs.txt file:

```
DI-720-USB
DI720NT.DLL
0
```

Ethernet Devices

In **Driver Name** n = the order of WinDaq/IP installation. Look in the tpdataq.ini file (located in the Windows folder on your hard drive) for the correct Driver Name.

Example: If you have installed DI-720-EN at IP address 192.168.1.1 and, after determining the Driver Name from tpdataq.ini is DI800NT.DLL, you would enter the following 3 lines to the daqdevs.txt file:

```
DI-720-EN
DI800NT.DLL
192.168.1.1
```

Baud Rates

This Table lists all the possible Baud Rates for each Serial Port (or Virtual Serial Port) instrument where Device ID requires a Baud Rate.

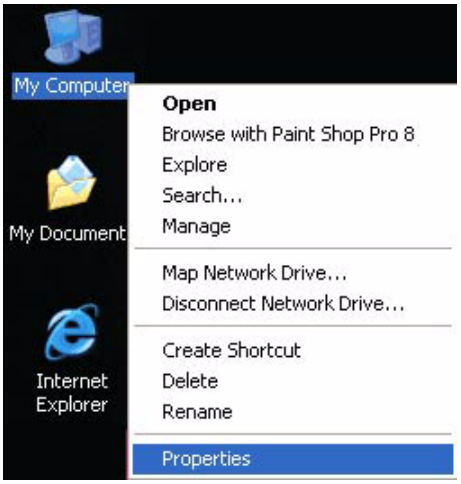
Instruments	Possible Baud Rates
DI-154RS, DI-194RS	2400, 4800, 9600
DI-148U, DI-158U, DI-158UP	4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600
DI-710 USB Devices, DI-715B USB Devices, DI-718B USB Devices	4800, 9600, 19200, 38400, 57600, 115200

Finding the COM port designation or LPT number of your Printer Port, Serial Port, or Virtual Serial Port Instrument

You must know the COM Port (serial devices or virtual serial devices) or LPT number (printer port devices) your device has been installed to in order to use your device in MatLab.

1. Access the **Device Manager** utility in Windows.

2. Right-click on the **My Computer** icon.



3. Click on **Properties**.

4. Depending on which operating system you have:

   a. Win98/ME - Click on the **Device Manager** Tab

   b. Win2000/XP - Click on the **Hardware** Tab, then click on the **Device Manager** Option.

5. Find **Ports (COM & LPT)** and expand the list by clicking on the **+** box directly to the left. This shows all COM and LPT ports currently assigned on your computer. Find your DATAQ device(s) in the list. The COM port number or LPT number will be in parentheses immediately after the model name. For example **DATAQ DI158-UP (COM3)** means your DI-158-UP instrument is intalled to COM port 3.

Common Errors

Error	Probable Cause	Resolution
	The Device Name has been entered incorrectly into daqdevs.txt.	Check the tables above for the correct Device Name and enter it exactly as shown.

`>> start(ai)`
`??? Dataq Error Code: 5 - Information Error`
 	
`>> start(ai)`
`??? Dataq Error Code: 5 - Information Error`
 	
`>> start(ai)`
	DI-148 and DI-158 products have an intermittent error when attempting to start if not using a suggested Baud Rate (see “DI-148 and DI-158 products” on page 2 for the suggested Baud Rate).	Edit the daqdevs.txt file (see “Editing the daqdevs.txt file” on page 1) with a suggested Baud Rate (see “DI-148 and DI-158 products” on page 2) and re-issue the start command.

`>> start(ai)` `??? Dataq Error Code: 1 - Driver Error`	Most likely means that the COM port is not set up correctly in the daqdevs.txt file.	Check what COM port your device is connected to in the Hardware Manager and enter it correctly in the daqdevs.txt file.

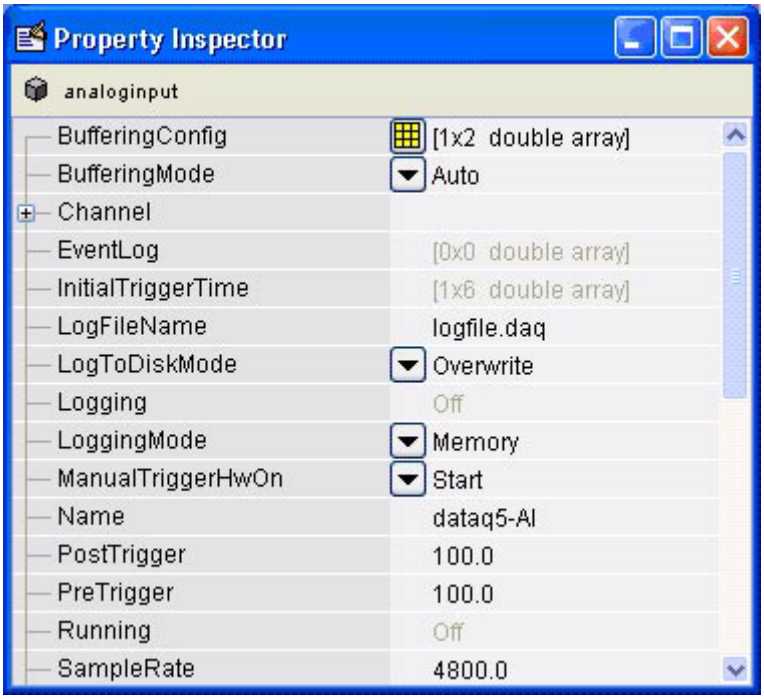
Sample Session

The following is a sample Matlab Session using the DATAQ Adaptor. Comments appear in Green. To learn more about the MatLab Data Acquisition Toolbox commands, consult the MatLab Help documentation.

```
% Use daqhwinfo to display data acquisition hardware information. The following
line returns general information about the Data Acquisition Toolbox.
>> d=daqhwinfo

d =

          ToolboxName: 'Data Acquisition Toolbox'
       ToolboxVersion: '2.7 (R14SP3)'
        MATLABVersion: '7.1 (R14SP3)'
    InstalledAdaptors: {3x1 cell}

% Get a list of the Installed Adaptors. If the dataq.dll has been properly
registered it will show up as dataq in the adaptor list.
>> d.InstalledAdaptors

ans =
```

```
    'dataq'
    'parallel'
    'winsound'

% Set d equal to hardware information about the dataq adaptor.
>> d=daqhwinfo('dataq')

d =

           AdaptorDllName: 'C:\0.2.7.0\dataq.dll'
        AdaptorDllVersion: '0.2.9.3'
              AdaptorName: 'dataq'
               BoardNames: {'DI-158-UP'  'DI-158-U'  'DI-710-EHS'}
        InstalledBoardIds: {'0'  '1'  '2'}
    ObjectConstructorName: {3x3 cell}

% Create the analog input object ai for dataqsdk adaptor. For this example
session, the hardware ID = 0 for the DI-158-UP, 1 for the DI-158-U, 2 for the
DI-710-EHS. Hardware ID's are listed in the adaptor properties above -
BoardNames: {'DI-158-UP'  'DI-158-U'  'DI-710-EHS(42277E12)'},
InstalledBoardIds: {'0'  '1'  '2'}.
% The next line selects the DI-710-ELS device for analog input.
>> ai=analoginput('dataq',2)

Display Summary of Analog Input (AI) Object Using 'DI-710-EHS'.

  Acquisition Parameters:  1000 samples per second on each channel.
                           1000 samples per trigger on each channel.
                           1 sec. of data to be logged upon START.
                           Log data to 'Memory' on trigger.

      Trigger Parameters:  1 'Immediate' trigger(s) on START.

           Engine status:  Waiting for START.
                           0 samples acquired since starting.
                           0 samples available for GETDATA.

AI object contains no channels.

% Add a range of channels 1, 2, 3, 4 (0=1, 1=2, etc.)
>> addchannel(ai,0:3)


 Index:  ChannelName:  HwChannel: InputRange: SensorRange: UnitsRange: Units:

   1   'Phys. Chan. 1'     0       [-10 10]    [-10 10]    [-10 10]   'Volts'

   2   'Phys. Chan. 2'     1       [-10 10]    [-10 10]    [-10 10]   'Volts'

   3   'Phys. Chan. 3'     2       [-10 10]    [-10 10]    [-10 10]   'Volts'

   4   'Phys. Chan. 4'     3       [-10 10]    [-10 10]    [-10 10]   'Volts'

% Set the SampleRate.
>> set(ai,'SampleRate',240)

% Set the SamplesPerTrigger to Infinity, this will allow for continuous scanning
until the stop(ai) command is issued.
>> set(ai,'SamplesPerTrigger',Inf)

% Use the inspect command to change the analog input properties in the Property
Inspector
```

```
>> inspect(ai)
```




```
% Look at the analog input object properties again to review your settings.
>> ai

Display Summary of Analog Input (AI) Object Using 'DI-710-EHS'.

  Acquisition Parameters:  240 samples per second on each channel.
                           Continuous sampling on each channel.
                           Inf sec. of data to be logged upon START.
                           Log data to 'Memory' on trigger.

      Trigger Parameters:  1 'Immediate' trigger(s) on START.

           Engine status:  Waiting for START.
                           0 samples acquired since starting.
                           0 samples available for GETDATA.

AI object contains channel(s):

 Index:  ChannelName:  HwChannel: InputRange: SensorRange: UnitsRange: Units:

   1   'Phys. Chan. 1'     0       [-10 10]    [-10 10]    [-10 10]   'Volts'

   2   'Phys. Chan. 2'     1       [-10 10]    [-10 10]    [-10 10]   'Volts'

   3   'Phys. Chan. 3'     2       [-10 10]    [-10 10]    [-10 10]   'Volts'

   4   'Phys. Chan. 4'     3       [-10 10]    [-10 10]    [-10 10]   'Volts'

% Start acquiring data
>> start(ai)

% Put acquired data into m-by-n matrix, where m rows = samples, and n columns =
number of channels. The next statement gets 100 samples of data returned in the
native data format of the device.
>> d=getdata(ai,100,'native')
```

```
% NOTE: Currently you must use the 'native' data format for getdata.
% Convert the native data to Volts with the formula below.
% First you must convert the native data to a double:
>> d2 = double(d)
% Then convert to volts by multiplying the native data (in double format) by the
% full scale range (this example uses a +/- 10 volts full scale device), then
% divide by 32767
>> volts = (d2*10)/32767

% Plot the data and label the figure axes.
>> plot(volts)
>> xlabel('Samples')
>> ylabel('Signal (Volts)')

% Stop acquiring data.
>> stop(ai)

% Delete the analog input object.
>> delete(ai)

% Remove the object from the MATLAB workspace.
>> clear ai
```