DAQFlex

Software User's Guide

Document Revision 3
May 2011

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Table of Contents

About this User's Guide

What you will learn from this user's guide

This user's guide explains how to install, configure, and use the DAQFlex Framework communication protocol.

Conventions in this user's guide

For more information on …

Text presented in a box signifies additional information and helpful hints related to the subject matter you are reading.

Caution! Shaded caution statements present information to help you avoid injuring yourself and others, damaging your hardware, or losing your data.

bold text — **Bold** text is used for the names of objects on the screen, such as buttons, text boxes, and check boxes.

italic text — *Italic* text is used for the names of manuals and help topic titles, and to emphasize a word or phrase.

Where to find more information

Additional information about DAQFlex software is available on our website at www.mccdaq.com. You can also contact Measurement Computing Corporation by phone, fax, or email with specific questions.

- Phone: 508-946-5100 and follow the instructions for reaching Tech Support.
- Fax: 508-946-9500 to the attention of Tech Support
- Email: techsupport@mccdaq.com

Introducing DAQFlex Software

DAQFlex is a framework that combines a small footprint driver with a message-based command protocol. It is used to develop data acquisition applications that can be deployed across multiple operating systems and custom embedded systems. The DAQFlex protocol greatly simplifies driver and application development. All DAQ operations are programmed through a common command interface composed of a cross-platform *application programming interface* (API) and open-source driver.

The DAQFlex framework consists of a software API, DAQFlex device driver, and the DAQ device message engine. The message engine parses and converts the DAQFlex message-based command set into DAQ-specific commands that control the device and process data.

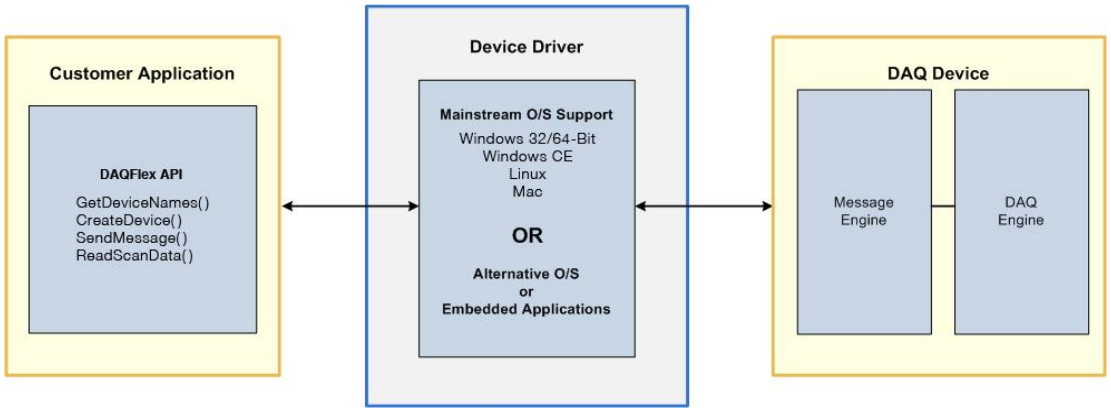


Figure 1. DAQFlex Framework

A DAQFlex program sends DAQFlex methods to the driver. The driver sends the encapsulated messages to the data acquisition device. The device interprets the message using the message engine, and sets its corresponding attributes using the DAQ engine. The data acquisition device then returns the requested data to the DAQFlex driver, which returns the data in an array (ScanData) to the program.

DAQFlex software includes the software API, device driver, FlexTest utility, and example programs.

- Platform Support and Hardware Requirements
- Installing the DAQFlex Software Library
- Using DAQFlex Software
- DAQFlex Software Reference
- DAQFlex Message Reference
- FlexTest Utility
- C# and VB .NET Example programs
- DAQFlex Hardware Reference

Platform support

You can run the DAQFlex communication protocol on a computer running one of the following operating systems and software:

- Microsoft Windows 7/Vista/XP (32-bit or 64-bit)
  - Windows 7
  - Windows Vista
  - Windows XP (SP2 or later)
  - Microsoft .NET® Framework 2.0 or later

- Microsoft Windows CE

  Development requirements:
  - Microsoft Windows XP (SP2)/Vista operating system
  - Microsoft Visual Studio 2008 or later
  - Microsoft .NET Compact Framework 3.5
  - Microsoft ActiveSync

  Deployment requirements:
  - Windows CE 5.0
  - X86 or ARM CPU
  - Microsoft .NET Compact Framework 3.5
  - DaqFlex.dll
  - Mcusb.dll
  - Mcwinceusb.dll
- Macintosh (32-bit or 64-bit)
  - MAC OS X
  - Leopard 10.5 or later
  - Mono Framework 2.0 or later
  - libusb user-mode driver version 1.0.0.0
- Linux (32-bit or 64-bit)
  - Linux (2.4 kernel or later)
  - Mono Framework 2.0 or later
  - libusb user-mode driver version 1.0.0.0

Hardware requirements

- Intel Pentium 4, 1 GHz or higher
- Minimum of 512 MG of RAM (1 GB or higher recommended)
- Video card with 128 MB memory
- Video display with 800 x 600 resolution or greater, and 256 colors or greater
- Microsoft-compatible mouse

Installing the DAQFlex software library

DAQFlex software operates with standard drivers for Windows, Mac, and Linux. Follow the procedure below specific to your operating system to install the DAQFlex software.

Windows 7, Windows Vista, and Windows XP

1. Go to the DAQFlex download page at www.mccdaq.com/DAQFlexDL and select the **Windows 32/64-bit** option.
2. Run the Windows **DAQFlex.exe** installer file.
3. Follow the installer instructions.

Connect your DAQFlex device after installing the software. You can run the **FlexTest.exe** test application from the **Start** menu, or build and run the C# or VB .NET example programs included in the installation using ExampleBuilder or Visual Studio (version 2005 or later).

Refer to the *C# and VB Example Programs* chapter on page 94 for instructions on running the DAQFlex example programs, and to the *Hardware Reference* chapter on page 96 for the API components and messages supported by DAQFlex supported hardware.

Windows CE

1. Go to the DAQFlex download page at www.mccdaq.com/DAQFlexDL and select the **Windows CE** option.
2. Run the **DAQFlex for Windows CE.msi** installer file.
3. Follow the installer instructions.
4. After the DAQFlex software is installed, copy the Windows CE device drivers (`mccusb.dll` and `mccwinceusb.dll`) from the `DAQFlex for Windows CE\Drivers\ directory` (\X86 or \XScale folder) to the device's Windows directory.

Connect your DAQFlex device after installing the software. You can run the **FlexTest.exe** test application from the **Start** menu, or build and run the C# or VB .NET example programs included in the installation using Visual Studio (version 2008 or later).

Refer to the *C# and VB Example Programs* chapter on page 94 for instructions on running the DAQFlex example programs, and to the *Hardware Reference* chapter on page 96 for the API components and messages supported by DAQFlex supported hardware.

Mac OS X

1. Go to the DAQFlex download page at www.mccdaq.com/DAQFlexDL and select the **Mac OS** option.
2. Run the DAQFlex installer package (**DAQFlex.pkg**).
3. Follow the installer instructions.

Connect your DAQFlex device after installing the software. You can run the FlexTest application located in the `/Applications/Measurement Computing/DAQFlex` folder. Additionally, you can build and run the example programs included in the installation using ExampleBuilder.

Refer to the C# and VB Example Programs chapter on page 94 for instructions on running the DAQFlex example programs, and to the *Hardware Reference* chapter on page 96 for the API components and messages supported by DAQFlex supported hardware.

Linux

1. Using your Software/Package manager, verify that the **Mono framework** (version 2.4 or later) and the **libusb** user-mode driver are installed on your Linux system.
   If these versions aren't listed, information on installing, updating, or adding software repositories to your Software/Package manager can be found at the following links. Click here to go to the Mono web site. Click here to go to the libusb web site.
2. As a root user, create a symbolic link to the `libusb-1.0` shared object file. For example:
   - `ln -s /usr/lib/libusb-1.0.so.0/usr/lib/libusb-1.0.so`

   The actual file location may vary.
3. Extract the files from the **DAQFlex-2.0.tar.gz** archive file on the DAQFlex software CD using an archive manager.
4. In a terminal window, set the current directory to `DAQFlex/Source/DAQFlexAPI`.
5. As a root user, run the following commands:
   - `make`
   - `make install`
6. Restart the system.

Connect your DAQFlex device after installing the software. You can run the FlexTest application by running the command `$ flextest` from a terminal window. Additionally, you can build and run the C# example programs included in the installation using MonoDevelop or the Mono command line interpreter.

Refer to the *C# and VB Example Programs* chapter on page 94 for instructions on running the DAQFlex example programs, and to the *Hardware Reference* chapter on page 96 for the API components and messages supported by DAQFlex supported hardware.

Using DAQFlex Software

The following procedure describes how to program a DAQFlex-supported device with DAQFlex software.

1. Add a reference to the DAQFlex assembly to your project.
   - In Visual Studio and MonoDevelop, this assembly is listed under the .NET tab of the Add Reference dialog as **DAQFlex API**.
     If your project is a C# project, add the following statement to your source file:
   - `using MeasurementComputing.DAQFlex;`
2. Get a list of device names using the static method **GetDeviceNames()**:

C#

```
string[] deviceNames;

deviceNames = DaqDeviceManager.GetDeviceNames(DeviceNameFormat.NameAndSerno);
```

VB

```
Dim deviceNames As String()

deviceNames = DaqDeviceManager.GetDeviceNames(DeviceNameFormat.NameAndSerno)
```

GetDeviceNames gets the names of DAQFlex devices detected by the DAQFlex API. **DeviceNameFormat** is an enumeration that specifies the format of the returned values. This enumeration defines four different formats:

Member Name	Description
NameOnly	The returned values contain only the device name.
NameAndSerno	The return values contain the device name with the device serial number formatted as "DeviceName::SerialNumber".
NameAndID	The return values contains the device name with the device's user-defined ID formatted as "DeviceName::DeviceID".
NameSernoAndID	The return values contains the device name, the device serial number and the device's user-defined ID formatted as "DeviceName::SerialNumber::DeviceID".

Note: Each DAQFlex API method will throw an exception if an error occurs, and should be enclosed within a **Try/Catch** block.

3. Get a device object using the static method **CreateDevice()**:

C#

```
int deviceNumber = 0;

DaqDevice device;

string deviceName = deviceNames[deviceNumber];

device = DaqDeviceManager.CreateDevice(deviceName);
```

VB

```
Dim deviceNumber As Integer

Dim device As DaqDevice

Dim deviceName As String

deviceNumber = 0

deviceName = deviceNames(deviceNumber)

device = DaqDeviceManager.CreateDevice(deviceName)
```

4. Once you have a DaqDevice object, use the **SendMessage()** method to program your DAQFlex-supported device.

C#

```
DaqResponse response;
response = device.SendMessage("AI{0}:RANGE=BIP10V"); // set the input range for channel 0
response = device.SendMessage("?AI{0}:VALUE"); // read a single value from channel 0
```

VB

```
Dim response As DaqResponse
response = device.SendMessage("AI{0}:RANGE=BIP10V") ' set the input range for channel 0
response = device.SendMessage("?AI{0}:VALUE") ' read a single value from channel 0
```

- The DaqResponse object contains a method for getting the response as a string and a method for getting the response as a numeric.

To get the response as a string, use the **ToString()** method:

C#

```
string value = response.ToString();
```

VB

```
Dim value As String

value = response.ToString()
```

To get the response as a numeric, use the **ToValue()** method:

C#

```
double value = response.ToValue();
```

VB

```
Dim value As Double
value = response.ToValue()
```

If the response does not contain a numeric value, ToValue() returns Double.NaN.

When you no longer need the DaqDevice object, you can release it by calling the **ReleaseDevice()** method:

C#

```
DaqDeviceManager.ReleaseDevice(device);
```

VB

```
DaqDeviceManager.ReleaseDevice(device)
```

Reading and writing software-paced I/O

The following examples demonstrate how to perform asynchronous single-point I/O using DAQFlex software:

- Reading an analog input channel
- Writing to an analog output channel
- Reading a digital port
- Writing to a digital bit
- Reading a digital bit
- Writing to a digital port
- Reading a counter input channel

Reading an analog input channel

C#

```
// Read the value of analog input channel 0
String[] Devices;
DaqDevice MyDevice;
DaqResponse Response;

try
{
   // Get a list of message-based DAQ devices
   Devices = DaqDeviceManager.GetDeviceNames(DeviceNameFormat.NameAndSerno);

   // Get a DaqDevice object for device 0
   MyDevice = DaqDeviceManager.CreateDevice(Devices[0]);

   // Send device messages using the DaqDevice object
   MyDevice.SendMessage("AI{0}:RANGE=BIP10V");
   MyDevice.SendMessage("AI:CAL=ENABLE");
   MyDevice.SendMessage("AI:SCALE=ENABLE");

   // Read and display the daq response
   Response = MyDevice.SendMessage("?AI{0}:VALUE");
   label1.Text = Response.ToString();
}
catch (Exception ex)
{
   // handle error
   label1.Text = ex.Message;
}
```

VB

```
' Read the value of analog input channel 0
Dim Devices As String ()
Dim MyDevice As DaqDevice
Dim Response As DaqResponse

Try
   ' Get a list of message-based DAQ devices
   Devices = DaqDeviceManager.GetDeviceNames(DeviceNameFormat.NameAndSerno)

   ' Get a DaqDevice object for device 0
   MyDevice = DaqDeviceManager.CreateDevice(Devices(0))

   ' Send device messages using the DaqDevice object
   MyDevice.SendMessage("AI{0}:RANGE=BIP10V")
   MyDevice.SendMessage("AI:CAL=ENABLE")
   MyDevice.SendMessage("AI:SCALE=ENABLE")

   ' Read and display the daq response
   Response = MyDevice.SendMessage("?AI{0}:VALUE")
   Label1.Text = Response.ToString()
   Catch Ex As Exception
        ' handle error
        Label1.Text = Ex.Message()
   End Try
```

Writing to an analog output channel

C#

```
// Write a value to analog output channel 0
String[] Devices;
DaqDevice MyDevice;

try
{
   // Get a list of message-based DAQ devices
   Devices = DaqDeviceManager.GetDeviceNames(DeviceNameFormat.NameAndSerno);

   // Get a DaqDevice object for device 0
   MyDevice = DaqDeviceManager.CreateDevice(Devices[0]);

   // Send device messages
   MyDevice.SendMessage("AO{0}:RANGE=BIP10V");
   MyDevice.SendMessage("AO:CAL=ENABLE");
   MyDevice.SendMessage("AO:SCALE=ENABLE");
   MyDevice.SendMessage("AO{0}:VALUE=2.53");
}
catch (Exception ex)
{
   // handle error
   label1.Text = ex.Message;
}
```

VB

```
' Write a value to analog output channel 0
Dim Devices As String()
Dim MyDevice As DaqDevice

Try
   ' Get a list of message-based DAQ devices
   Devices = DaqDeviceManager.GetDeviceNames(DeviceNameFormat.NameAndSerno)

   ' Get a DaqDevice object for device 0
   MyDevice = DaqDeviceManager.CreateDevice(Devices(0))

   ' Send device messages
   MyDevice.SendMessage("AO{0}:RANGE=BIP10V")
   MyDevice.SendMessage("AO:CAL=ENABLE")
   MyDevice.SendMessage("AO:SCALE=ENABLE")
   MyDevice.SendMessage("AO{0}:VALUE=2.53")
Catch Ex As Exception
   ' handle error
   Label1.Text = Ex.Message
End Try
```

Reading a digital bit

C#

```
// Read the value of digital port 0, bit 0
String[] Devices;
DaqDevice MyDevice;
DaqResponse Response;

try
{
   // Get a list of message-based DAQ devices
   Devices = DaqDeviceManager.GetDeviceNames(DeviceNameFormat.NameAndSerno);

   // Get a DaqDevice object for device 0
   MyDevice = DaqDeviceManager.CreateDevice(Devices[0]);

   // Read and display the daq response
   MyDevice.SendMessage("DIO{0/0}:DIR=IN");
   Response = MyDevice.SendMessage("?DIO{0/0}:VALUE");
   label1.Text = Response.ToString();
}
catch (Exception ex)
{
   // handle error
   label1.Text = ex.Message;
}
```

VB

```
' Read the value of digital port 0, bit 0
Dim MyDevice As DaqDevice
Dim Response As DaqResponse
Dim Devices As String ()

Try
   ' Get a list of message-based DAQ devices
   Devices = DaqDeviceManager.GetDeviceNames(DeviceNameFormat.NameAndSerno)

   ' Get a DaqDevice object for device 0
   MyDevice = DaqDeviceManager.CreateDevice(Devices(0))

   ' Read and display the daq response
   MyDevice.SendMessage("DIO{0/0}:DIR=IN")
   Response = MyDevice.SendMessage("?DIO{0/0}:VALUE")
   Label1.Text = Response.ToString()
Catch Ex As Exception
   ' handle error
   Label1.Text = Ex.Message
End Try
```

Writing to a digital bit

C#

```
// Write a value to digital port 0, bit 0
String[] Devices;
DaqDevice MyDevice;
DaqResponse Response;

try
{
   // Get a list of message-based DAQ devices
   Devices = DaqDeviceManager.GetDeviceNames(DeviceNameFormat.NameAndSerno);

   // Get a DaqDevice object for device 0
   MyDevice = DaqDeviceManager.CreateDevice(Devices[0]);

   // Send device messages
   MyDevice.SendMessage("DIO{0/0}:DIR=
   MyDevice.SendMessage("DIO{0/0}:VALUE=
   label1.Text = response.ToString();
}
catch (Exception ex)
}
   // handle error
   label1.Text = ex.Message;
}
```

VB

```
' Write a value to digital port 0, bit 0
Dim MyDevice As DaqDevice
Dim Response As DaqResponse
Dim Devices As String ()

Try
   ' Get a list of message-based DAQ devices
   Devices = DaqDeviceManager.GetDeviceNames(DeviceNameFormat.NameAndSerno)

   ' Get a DaqDevice object for device 0
   MyDevice = DaqDeviceManager.CreateDevice(Devices(0))

   ' Send device messages
   MyDevice.SendMessage("DIO{0/0}:DIR=
   Response = MyDevice.SendMessage("DIO{0/0}:VALUE=
   Label1.Text = Response.ToString
Catch Ex As Exception
   ' handle error
   Label1.Text = Ex.Message
End Try
```

Reading a digital port

C#

```
// Read the value of digital port 0
String[] Devices;
DaqDevice MyDevice;
DaqResponse Response;

try
{
   // Get a list of message-based DAQ devices
   Devices = DaqDeviceManager.GetDeviceNames(DeviceNameFormat.NameAndSerno);

   // Get a DaqDevice object for device 0
   MyDevice = DaqDeviceManager.CreateDevice(Devices[0]);

   // Send device messages
   MyDevice.SendMessage("DIO{0}:DIR=IN");

   // Read and display the daq response
   Response = MyDevice.SendMessage("?DIO{0}:VALUE");
   Label1.Text = Response.ToString();
}
catch (Exception ex)
{
   // handle error
   label1.Text = ex.Message;
}
```

VB

```
' Read the value of digital port 0
Dim MyDevice As DaqDevice
Dim Response As DaqResponse
Dim Devices As String ()

Try
   ' Get a list of message-based DAQ devices
   Devices = DaqDeviceManager.GetDeviceNames(DeviceNameFormat.NameAndSerno)

   ' Get a DaqDevice object for device 0
   MyDevice = DaqDeviceManager.CreateDevice(Devices(0))

   ' Send device messages
   MyDevice.SendMessage("DIO{0}:DIR=IN")

   ' Read and display the daq response
   Response = MyDevice.SendMessage("?DIO{0}:VALUE")
   Label1.Text = Response.ToString()
Catch Ex As Exception
   ' handle error
   Label1.Text = Ex.Message
End Try
```

Writing to a digital port

C#

```
// Write a value to digital port 0
String[] Devices;
DaqDevice MyDevice;
DaqResponse Response;

try
{
   // Get a list of message-based DAQ devices
   Devices = DaqDeviceManager.GetDeviceNames(DeviceNameFormat.NameAndSerno);

   // Get a DaqDevice object for device 0
   MyDevice = DaqDeviceManager.CreateDevice(Devices[0]);

   // Send device messages
   MyDevice.SendMessage("DIO{0}:DIR=OUT");
   MyDevice.SendMessage("DIO{0}:VALUE=128");
   label1.Text = response.ToString();
}
catch (Exception ex)
}
   // handle error
   label1.Text = ex.Message;
}
```

VB

```
' Write a value to digital port 0
Dim MyDevice As DaqDevice
Dim Response As DaqResponse
Dim Devices As String ()

Try
   ' Get a list of message-based DAQ devices
   Devices = DaqDeviceManager.GetDeviceNames(DeviceNameFormat.NameAndSerno)

   ' Get a DaqDevice object for device 0
   MyDevice = DaqDeviceManager.CreateDevice(Devices(0))

   ' Send device messages
   MyDevice.SendMessage("DIO{0}:DIR=OUT")
   Response = MyDevice.SendMessage("DIO{0}:VALUE=128")
   Label1.Text = Response.ToString
Catch Ex As Exception
   ' handle error
   Label1.Text = Ex.Message
End Try
```

Reading a counter input channel

C#

```
// Read counter channel 0
String[] Devices;
DaqDevice MyDevice;
DaqResponse Response;

try
{
   // Get a list of message-based DAQ devices
   Devices = DaqDeviceManager.GetDeviceNames(DeviceNameFormat.NameAndSerno);

   // Get a DaqDevice object for device 0
   MyDevice = DaqDeviceManager.CreateDevice(Devices(0));

   // Start the counter
   MyDevice.SendMessage("CTR{0}:VALUE=0");
   MyDevice.SendMessage("CTR{0}:START");

   // Read and display the daq response
   for(int i = 1;i<=10;i++)
   {
       System.Threading.Thread.Sleep(750);
       Response = MyDevice.SendMessage("?CTR{0}:VALUE");
       label1.Text = Response.ToString();
       Application.DoEvents();
   }

   // Stop the counter
   MyDevice.SendMessage("CTR{0}:STOP");
}
catch (Exception ex)
{
   // handle error
   label1.Text = ex.Message;
}
```

VB

```
' Read counter channel 0
Dim MyDevice As DaqDevice
Dim Response As DaqResponse
Dim Devices As String ()

Try
   ' Get a list of message-based DAQ devices
   Devices = DaqDeviceManager.GetDeviceNames(DeviceNameFormat.NameAndSerno)

   ' Get a DaqDevice object for device 0
   MyDevice = DaqDeviceManager.CreateDevice(Devices(0))

   Dim I As Integer

   ' Start the counter
   MyDevice.SendMessage("CTR{0}:VALUE=0")
   MyDevice.SendMessage("CTR{0}:START")

   ' Read and display the daq response
   For I = 1 To 10
       System.Threading.Thread.Sleep(750)
       Response = MyDevice.SendMessage("?CTR{0}:VALUE")
       Label1.Text = Response.ToString()
       Application.DoEvents()
   Next
```

```
    ' Stop the counter
    MyDevice.SendMessage("CTR{0}:STOP")
    Catch Ex As Exception
    ' handle error
    Label1.Text = Ex.Message
End Try
```

Reading hardware-paced I/O

The basic approach to programming analog input scans is to set the device's scan properties, send the **START** command, and call the **ReadScanData()** method. The following examples show how to program a basic input scan.

C#

```
try
{
   double[,] scanData;
   string[] names = DaqDeviceManager.GetDeviceNames(DeviceNameFormat.NameAndSerno);
   DaqDevice device = DaqDeviceManager.CreateDevice(names[0]);

   device.SendMessage("AISCAN:LOWCHAN=0");
   device.SendMessage("AISCAN:HIGHCHAN=0");
   device.SendMessage("AISCAN:RATE=1000");
   device.SendMessage("AISCAN:SAMPLES=5000");
   device.SendMessage("AISCAN:START");

   scanData = device.ReadScanData(5000, 0);
}
catch (Exception ex)
{
   Console.WriteLine(ex.Message);
}
```

VB

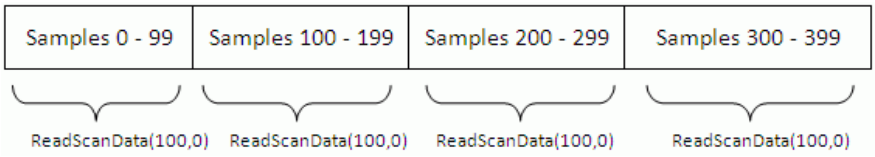
```
Try
   Dim ScanData As Double(,)
   Dim Names As String()
   Dim Device As DaqDevice

   Names = DaqDeviceManager.GetDeviceNames(DeviceNameFormat.NameAndSerno)
   Device = DaqDeviceManager.CreateDevice(Names(0))

   Device.SendMessage("AISCAN:LOWCHAN=0")
   Device.SendMessage("AISCAN:HIGHCHAN=0")
   Device.SendMessage("AISCAN:RATE=1000")
   Device.SendMessage("AISCAN:SAMPLES=5000")
   Device.SendMessage("AISCAN:START")

   ScanData = Device.ReadScanData(5000, 0)
Catch ex As Exception
   Console.WriteLine(ex.Message)
End Try
```

ReadScanData() parameters

- The first parameter to the **ReadScanData** method is the number of samples to read.
- The second parameter is a time out value in milli-seconds. A value of 0 indicates no timeout specified.

The ReadScanData method is synchronous, and will return when the number of requested samples are available for reading. When the number of requested samples are available, the DAQFlex software copies the requested number of samples from an internal buffer to a new array of data. The DAQFlex software keeps track of the buffer index so that multiple calls to ReadScanData always return contiguous data.

Internal buffer



An alternative method for reading scan data is to enable a **user-defined callback method**. When you enable a callback method, the DAQFlex software invokes your user-defined method when a specified number of samples are available for reading, when a scan completes, or if a scan error occurs. This is done using the **EnableCallback** method as shown below:

C#

```
Device.EnableCallback(callbackMethod, callbackType, callbackCount);
```

VB

```
Device.EnableCallback(Addressof CallbackMethod, CallbackType, CallbackCount)
```

The callbackMethod is the name of the method that will be invoked by the DAQFlex software. The callbackMethod is a class method that must have the following form:

C#

```
void CallbackMethod(ErrorCodes errorCode, CallbackType callbackType, object
callbackData)
```

VB

```
Sub CallbackMethod(ByVal errorCode As ErrorCodes, ByVal callbackType As
CallbackType, _ ByVal callbackData As Object)
```

The callbackType is an enumeration that defines when the callback method will be invoked.

CallbackType

Member Name	Description
OnDataAvailable	Specifies that the callback method will be invoked when a specified number of samples becomes available for reading.
OnInputScanComplete	Specifies that the callback method will be invoked when a finite scan has complete or when a continuous scan is stopped.
OnInputScanError	Specifies that the callback method will be invoked when an input scan error occurs.

Only one callback method can be specified for each callback type. When the callback type is set to OnDataAvailable, set the callbackData parameter to the number of samples you wish to receive in the callback method. When the callback type is set to OnInputScanComplete or OnInputScanError, set the callbackData parameter to null or Nothing.

The following are examples of reading scan data using a callback method:

C#

```
try
{
   double[,] scanData;

   string[] names = DaqDeviceManager.GetDeviceNames(DeviceNameFormat.NameAndSerno);
   DaqDevice device = DaqDeviceManager.CreateDevice(names[0]);

   device.EnableCallback(OnReadScanData, CallbackType.OnDataAvailable, 1000);
   device.EnableCallback(OnReadScanData, CallbackType.OnScanComplete, null);

   device.SendMessage("AISCAN:LOWCHAN=0");
   device.SendMessage("AISCAN:HIGHCHAN=0");
   device.SendMessage("AISCAN:RATE=1000");
   device.SendMessage("AISCAN:SAMPLES=5000");
   device.SendMessage("AISCAN:START");
}
catch (Exception ex)
{
   Console.WriteLine(ex.Message);
}

protected void OnReadScanData(ErrorCodes errorCode, CallbackType callbackType,
object callbackData)
{
   try
   {
       int availableSamples = (int)callbackData;
       double[,] scanData = device.ReadScanData(availableSamples, 0);
   }
   catch (Exception ex)
   {
       Console.WriteLine(ex.Message);
   }
}
```

VB

```
Try
   Dim ScanData As Double(,)
   Dim Names As String()
   Dim Device As DaqDevice

   Names = DaqDeviceManager.GetDeviceNames(DeviceNameFormat.NameAndSerno)
   Device = DaqDeviceManager.CreateDevice(Names(0))

   Device.EnableCallback(AddressOf OnReadScanData, CallbackType.OnDataAvailable,
   1000)
   Device.EnableCallback(AddressOf OnReadScanData, CallbackType.OnScanComplete,
   Nothing)

   Device.SendMessage("AISCAN:LOWCHAN=0")
   Device.SendMessage("AISCAN:HIGHCHAN=0")
   Device.SendMessage("AISCAN:RATE=1000")
   Device.SendMessage("AISCAN:SAMPLES=5000")
   Device.SendMessage("AISCAN:START")
Catch ex As Exception
   Console.WriteLine(ex.Message)
End Try

Protected Sub ReadScanData(ByVal errorCode As ErrorCodes, ByVal callbackType As
CallbackType, _ ByVal callbackData As Object)

Try
   Dim AvailableSamples As Integer
   Dim ScanData As Double(,)

   AvailableSamples = DirectCast(callbackData, Integer)
   ScanData = Device.ReadScanData(AvailableSamples, 0)
Catch ex As Exception
   Console.WriteLine(ex.Message)
End Try
```

Writing hardware-paced I/O

The basic approach to programming analog output scans is to set the device's output scan properties, call the **WriteScanData()** method, and send the **START** command. The following examples show how to program a basic output scan.

C#

```
try
{
   double[,] scanData = new double[1, 5000];
   string[] names = DaqDeviceManager.GetDeviceNames(DeviceNameFormat.NameAndSerno);
   DaqDevice device = DaqDeviceManager.CreateDevice(names[0]);


   // fill scanData with data

   device.SendMessage("AOSCAN:LOWCHAN=0");
   device.SendMessage("AOSCAN:HIGHCHAN=0");
   device.SendMessage("AOSCAN:RATE=1000");
   device.SendMessage("AOSCAN:SAMPLES=5000");
   device.SendMessage("AOSCAN:BUFSIZE=5000");


   int timeOut = 0;
   device.WriteScanData(scanData, 5000, timeOut);
   device.SendMessage("AOSCAN:START");
}
```

```
catch (Exception ex)
{
   Console.WriteLine(ex.Message);
}
```

VB

```
Try
   Dim ScanData As Double(,)
   Dim Names As String()
   Dim Device As DaqDevice
   Dim TimeOut As Integer

   Names = DaqDeviceManager.GetDeviceNames(DeviceNameFormat.NameAndSerno)
   Device = DaqDeviceManager.CreateDevice(Names(0))

   Device.SendMessage("AOSCAN:LOWCHAN=0")
   Device.SendMessage("AOSCAN:HIGHCHAN=0")
   Device.SendMessage("AOSCAN:RATE=1000")
   Device.SendMessage("AOSCAN:SAMPLES=5000")
   Device.SendMessage("AOSCAN:BUFSIZE=5000")

   int TimeOut = 0
   Device.WriteScanData(ScanData, 5000, TimeOut)

   Device.SendMessage("AOSCAN:START")
Catch ex As Exception
   Console.WriteLine(ex.Message)
End Try
```

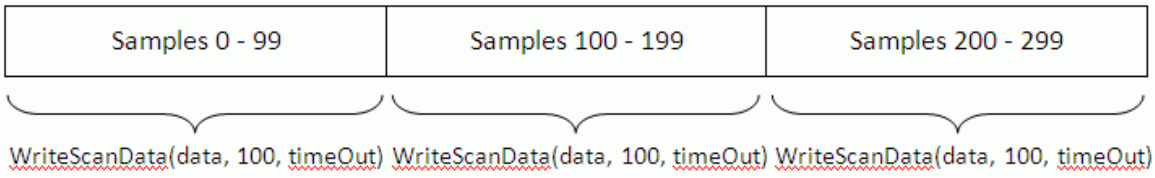
WriteScanData() parameters

- The first parameter to the **WriteScanData** method is the array containing the output scan data.
- The second parameter is the number of samples to write.
- The last parameter is a timeout value in milliseconds.

The WriteScanData method is synchronous, and will return when the number of samples specified have been written to the device's output buffer.

Each time the WriteScanData method is called, the data is written to an internal buffer starting at the point after the last sample was written. When an output scan completes or is stopped, the write index is reset to the beginning of the buffer.

Internal buffer



DAQFlex Software Reference

The DAQFlex Software API is an open source library that implements a simple message-based protocol consisting of text-based commands, or messages. The API is written in C#, is designed for cross platform portability, and does not require a separate configuration utility or a configuration file.

DAQFlex Software API contains two classes:

- DaqDeviceManager class
- DaqDevice class

DaqDeviceManager class

The **DaqDeviceManager** class includes the following methods:

- GetDeviceNames() – gets a list of devices that support the message-based protocol.
- CreateDevice() – creates a DaqDevice object, which contains the methods used to communicate with a DAQ device.
- ReleaseDevice() – frees the resources associated with a DaqDevice object.

DaqDeviceManager.GetDeviceNames()

Gets a list of DAQ devices that support the message-based protocol.

C#:
```
static string[] GetDeviceNames(DeviceNameFormat format);
```

VB:
```
Shared Function GetDeviceNames(ByVal format As DeviceNameFormat) As String()
```

Parameter

format

The format to use for a device name. This parameter is a DeviceNameFormat enumeration. The enumeration values and the format of the return strings are listed below:

Value	Return string format
NameOnly	"Device name"
NameAndSerno	"Device name::Device serial number"
NameAndID	"Device name::Device ID"
NameSernoAndID	"Device name::Device serial number::Device ID"

Return value

An array of strings containing the device names of all DAQ devices that support the message-based protocol.

Remarks

- The values contained in the array can be used to create a **DaqDevice object** for the device that you want to program.

  The DaqDevice object is created using the DaqDeviceManager's **CreateDevice** static method.

  With the DaqDevice object, all DAQ operations are configured using one API method called **SendMessage()** rather than using multiple operation-specific methods.
- The **NameOnly** format is not useful if multiple devices of the same type are connected, since the application won't be able to differentiate between one device and the other. If you are using multiple devices of the same type, then use one of the other formats.

If using a device that does not have an ID assigned, you must use the **NameOnly** or **NameAndSerno** format with the DaqDeviceManager.CreateDevice() method in order to create the device. A device with no ID will not be created when using the **NameAndID** and **NameSernoAndID** format with CreateDevice().

DaqDeviceManager.CreateDevice()

Creates a DaqDevice object. The DaqDevice object contains the methods used to configure, read data from, or write data to a device. With the DaqDevice object, all DAQ operations are configured using one API method called DaqDevice.SendMessage() rather than using multiple operation-specific methods. SendMessage() takes a single parameter called *message*. This parameter is a text-based command that the DAQ device parses to configure a particular operation.

C#: `static CreateDevice(string deviceName);`

VB: `Shared Function CreateDevice(ByVal deviceName As String) As DaqDevice`

Parameter

deviceName

One of the device names returned by the DaqDeviceManager.GetDevicenames() method.

Return value

An instance of a **DaqDevice object**.

Remarks

- Depending on the DeviceNameFormat, the CreateDevice() method creates a DaqDevice object for the device whose name, name and serial number, name and id, or name, serial number and id are contained in the deviceName parameter.
- The resources associated with the DaqDevice object can be freed by calling the ReleaseDevice() method.
- The CreateDevice() method can only be called once for a specific device, unless the ReleaseDevice() method is called.
- If CreateDevice() is called more than once for a specific device without calling ReleaseDevice(), the DaqDevice object **throws an exception**, indicating that a driver handle has already been created for the device.

Refer to the following sample code:

C#

```
try
{
   MyDevice = DaqDeviceManager.CreateDevice(deviceName);
   }
catch (Exception ex)
   {
// handle exception
}
```

VB

```
Try
   MyDevice = DaqDeviceManager.CreateDevice(deviceName)
Catch Ex As Exception
   ' handle exception
End Try
```

DaqDeviceManager.ReleaseDevice()

Frees the resources associated with a DaqDevice object.

C#: `static void ReleaseDevice(DaqDevice device);`

VB: `Shared Sub ReleaseDevice(ByVal device As DaqDevice)`

Parameter

Device

A DaqDevice object created by the CreateDevice() method.

DaqDevice class

The **DaqDevice** class includes the following methods:

- SendMessage() – takes a single text-based command that the DAQ device parses to configure a particular operation
- ReadScanData() – reads scan data.
- WriteScanData() – outputs scan data.
- EnableCallback() – enables a user-defined callback method to be invoked when a certain condition is met. This method is used in conjunction with input scan operations.
- DisableCallback() – the condition that invokes the callback method.
- GetErrorMessage() – gets the error message associated with the error code that is passed to the user-defined callback.
- GetSupportedMessages() – returns a list of messages supported by a DAQ component.

DaqDevice.SendMessage()

Configures DAQ operations. This method takes a single text-based command that the DAQ device parses to configure a particular operation.

C#: `DaqResponse SendMessage (string message);`

VB: `Function SendMessage (ByVal Message as String) As DaqResponse`

Parameter

Message

The text-based message to send to the device.

Return value

The device response as an instance of a **DaqResponse object**.

Remarks

- *Message* is a string containing a text-based command supported by the device, and *Response* is a DaqResponse object containing the device's response.
- The DaqResponse object includes two methods:
- **ToString()**: gets the response as a string, for example "*AI{0}:VALUE=139*".
- **ToValue()**: gets the response as a numeric value, for example "*139.0000*".
- All messages provide a string response, but not all messages provide a numeric response. For those messages that do not provide a numeric response, the numeric value is set to NaN (not a number).

- The ToString method has additional overloads that accept formatting parameters. The overloads are ToString(string format), ToString(IFormatProvider provider) and ToString(string format, IFormatProvider provider). The overloads can be used to format the numeric part of a response, if present. If the response does not contain a numeric, these overloads are ignored.
- If an error occurs while sending a message to a device, the SendMessage method will **throw an exception** rather than returning an error code. This means the application should encapsulate calls to SendMessage within a try/catch block.

Refer to the following sample code.

C#

```
try
{
   DaqResponse response = MyDevice.SendMessage(message);
   label1.Text = response.ToString();
}
Catch (Exception ex)
{
   // handle exception
   label1.Text = ex.Message;
   }
```

VB

```
Try
   DaqResponse Response = MyDevice.SendMessage(Message)
   Label1.Text = Response.ToString()
Catch Ex As Exception
   ' handle exception
   Label1.Text = Ex.Message;
End Try
```

DaqDevice.ReadScanData()

Reads data for a scan operation.

C#: `double[,] ReadScanData(int samplesRequested, int timeOut);`

VB: `Function ReadScanData(ByVal samplesRequested As Integer, ByVal timeOut As Integer) As Double(,)`

Parameter

samplesRequested

The number of samples per channel to read.

timeOut

The number of milliseconds to wait for the samples requested to become available.

Return value

An array of data samples read from the device.

Remarks

- The DAQFlex library always performs scan operations in the background, but ReadScanData() always runs in the foreground. When called, ReadScanData() returns control to the application that called it when the number of samples requested has been read. When timeOut is non-zero, if the number of samples requested isn't available within the time specified by timeOut, an exception is thrown. The DAQFlex library manages all memory allocation and array indexing so the application doesn't have to.

DaqDevice.WriteScanData()

Outputs scan data.

C#:
```
void WriteScanData(double[,] scanData, int numberOfSamplesPerChannel,
int timeOut);
```

VB:
```
Sub WriteScanData(ByVal ScanData(,) As Double, ByVal
NumberOfSamplesPerChannel As Integer, ByVal TimeOut As Integer)
```

Parameter

scanData

Array of data samples to output.

numberOfSamplesPerChannel

The number of data samples per channel to transfer from the scanData array to the device's output buffer.

timeOut

The number of milliseconds to wait for available space in the buffer to write to. This only takes effect when an output scan is running.

Remarks

- WriteScanData may be called while a scan is running. However, the maximum number of total samples must be less than or equal to half the number of samples for which the buffer is allocated. Set the buffer size with the "AOSCAN:BUFSIZE" message.

DaqDevice.EnableCallback()

Enables a user-defined callback method to be invoked when a certain condition is met.

C#:
```
void EnableCallback(ErrorCodes errorCode, InputScanCallbackDelegate callback,
CallbackType callbackType, Object callbackData
```

VB:
```
Sub EnableCallback(ByVal errorCode as ErrorCodes, ByVal callback as
InputScanCallbackDelegate, ByVal callbackType As CallbackType, ByVal
callbackData As Object)
```

Parameter

callback

The method to be invoked when the condition specified by callbackType is met. Refer to the InputScanCallback Delegate below for the format of the method.

callbackType

The condition that invokes the callback method. Callback types are defined by the CallbackType enumeration. The supported types are:

- CallbackType.OnDataAvailable – Invokes the callback method when the number of samples available for reading data is ≥ the number of samples specified by the callbackData parameter.
- CallbackType.OnInputScanComplete – Invokes the callback method when an input scan completes or is stopped.
- `CallbackType.OnInputScanError` – Invokes the callback method when an input scan error occurs.

callbackData

When callbackType is set to OnDataAvailable, set callbackData to the number of samples per channel to acquire before invoking the user-defined callback method. When callbackType is set to OnInputScanComplete or OnInputScanError, set callbackData to null or Nothing.

Return value

The value of callbackType.

Remarks

- This method is used in conjunction with input scan operations.
- EnableCallback may be called once for each callback type. If it is called more than once for the sample callback type, a DaqException is thrown.

InputScanCallback Delegate

A delegate is a data structure that refers either to a static method, or to a class instance and an instance method of that class. You call the delegate by passing either its address or a pointer to the delegate to the callback parameter of the EnableCallback() method.

C#:
```
public delegate void
InputScanCallbackDelegate(MeasurementComputing.DAQFlex.ErrorCodes errorCode,
MeasurementComputing.DAQFlex.CallbackType callbackType, object callbackData)
```

VB:
```
Public Delegate Sub InputScanCallbackDelegate(ByVal errorCode As
MeasurementComputing.DAQFlex.ErrorCodes, ByVal callbackType As
MeasurementComputing.DAQFlex.CallbackType, ByVal callbackData As Object)
```

DaqDevice.DisableCallback()

Disables the invocation of the user-defined callback method associated with the callback type.

C#:
```
void DisableCallback(CallbackType callbackType)
```

VB:
```
Sub DisableCallback(ByVal callbackType As CallbackType)
```

Parameter

callbackType

The callback type to disable.

DaqDevice.GetErrorMessage()

Gets the error message associated with the error code that is passed to the user-defined callback.

C#:
```
string GetErrorMessage(ErrorCodes errorCode)
```

VB:
```
Function GetErrorMessage(ByVal errorCode As ErrorCodes)
```

Parameter

errorCode

The error code that was passed to the user-defined callback method.

Return value

The error message associated with the error code passed to the user-defined callback method.

DaqDevice.GetSupportedMessages()

Gets the messages supported by a DAQ component.

C#: `public List<string> GetSupportedMessages(string daqComponent);`

VB: `Function GetSupportedMessages(ByVal daqComponent As String) As List(Of String)`

Parameter

daqComponent

A DAQ component, such as AISCAN, DEV, TMR, and so on.

Return value

A list of messages supported by the *daqComponent* parameter.

DAQFlex Message Reference

The software messages that you send to a DAQFlex supported device are text-based commands. Each message pertains to a specific *DAQ component*. A DAQ component is a device element that encapsulates a DAQ subsystem which has multiple properties or commands associated with it.

DAQFlex components

A DAQ component is a device element that encapsulates a DAQ subsystem which has multiple properties or commands associated with it. The DAQFlex API defines the following DAQ components:

- DEV — encapsulates device-level operations
- AI — encapsulates single-point analog input operations
- AICAL — encapsulates analog input self-calibration
- AIQUEUE — encapsulates analog input gain queue operations
- AISCAN — encapsulates analog input scanning operations
- AITRIG — encapsulates analog input triggering operations
- AO — encapsulates single-point analog output operations
- AOCAL — encapsulates analog output self-calibration
- AOSCAN — encapsulates analog output scanning operations
- AOTRIG — encapsulates analog output triggering operations
- DIO — encapsulates digital I/O operations
- CTR — encapsulates counter input operations
- TMR — encapsulates timer output operations

Each component has one or more properties associated with it. Each property supports one or more text-based commands, or *messages*. These messages are used to communicate with DAQFlex-supported hardware.

DAQFlex supports two types of messages:

- Device programming messages configure or retrieve a device property value.
- Device reflection messages retrieve information about a device capability, such as the maximum scan rate or support for an external clock.

Programming messages

Device programming messages are used to get and set device properties. Programming messages that query a device property always start with the **?** character.

Click on a component name below for the string messages, device responses, and property values supported by the component.

Components for programming a device	Description
AI	Sets and gets property values for analog input channels.
AICAL	Sets and gets property values for the device's analog input self-calibration.
AIQUEUE	Sets and gets property values for the analog input gain queue.
AISCAN	Sets and gets property values when scanning analog input channels.
AITRIG	Sets and gets analog input trigger property values.

Components for programming a device	Description
AO	Sets and gets property values for analog output channels
AOCAL	Sets and gets property values for the device's analog output self-calibration.
AOSCAN	Sets and gets property values when scanning analog output channels.
DEV	Sets and gets device property values.
DIO	Sets and gets property values for digital I/O channels.
CTR	Sets and gets property values for counter channels.
TMR	Sets and gets property values for timer output channels.

AI

Sets and gets property values for analog input channels.

Refer to the device-specific information in the *Hardware Reference* section for the component properties and commands supported by each DAQ device.

Properties

ADCAL, CAL, CHMODE, CJC, DATARATE, OFFSET, RANGE, RES, SCALE, SENSOR, SLOPE, STATUS, VALUE

(Component only)

- Get the number of analog input channels on a device.

  Message "?AI"

  Response "AI=*value*"

  value The number of A/D channels on the device.

ADCAL

- Start the A/D internal calibration.

  Message "AI:ADCAL/START"

  Response "AI:ADCAL/START"

- Get the status of the A/D internal calibration.

  Message "?AI:ADCAL/STATUS"

  Response "AI:ADCAL/STATUS=*value*"

  value RUNNING, IDLE

CAL

- Enable or disable calibration of all A/D channels.

  Message "AI:CAL=*value*"

  Response "AI:CAL"

  value ENABLE, DISABLE

  Example "AI:CAL=ENABLE"

Note This message is processed by the DAQFlex Software library, and is not sent to the device.

- Get a value indicating whether the calibration coefficients will be applied to the raw A/D data.

  Message "?AI:CAL"

  Response "AI:CAL=*value*"

  value ENABLE, DISABLE

  Note This message is processed by the DAQFlex Software library, and is not sent to the device.

CJC

- Get the CJC value in the specified format.

  Message "?AI{*ch*}:CJC/*format*"

  Response "AI{*ch*}:CJC/*format*=*value*"

  format DEGC, DEGF, KELVIN

  value The measured temperature.

  Example "?AI{0}:CJC/DEGC"

CHMODE

- Set the analog input mode to single-ended or differential.

  Message "AI:CHMODE=*value*"

  Response "AI:CHMODE"

  value SE, DIFF

  Example "AI:CHMODE=SE"

- Set the analog input mode for a specified channel to single-ended or differential.

  Message "AI:CHMODE{*ch*}=*value*"

  Response "AI{*ch*}:CHMODE"

  ch The channel number.

  value SE, DIFF,TC/OTD, TC/NOOTD

  Example "AI{0}:CHMODE=SE"

- Get the input mode that is set for the analog inputs.

  Message "?AI:CHMODE"

  Response "AI:CHMODE=*value*"

  value SE, DIFF, MIXED

DATARATE

- Set the A/D data rate in samples per channel for all channels.

  Message "AI:DATARATE=*value*"

  Response "AI:DATARATE"

  value The data rate in S/s.

  Example "AI:DATARATE=100"

- Set the A/D data rate in samples per channel for a specified channel.

  Message "AI:DATARATE{*ch*}=*value*"

  Response "AI{*ch*}:DATARATE"

  ch The channel number.

  value The data rate in S/s.

  Example "AI{0}:DATARATE=10"

- Get the A/D data rate in samples per channel for all channels.

  Message "?AI:DATARATE"

  Response "AI:DATARATE=*value*"

  value The data rate in S/s.

- Get the A/D data rate in samples per channel for a specified channel.

  Message "?AI{ch}:DATARATE"

  Response "AI{ch}:DATARATE=*value*"

  ch The channel number.

  value The data rate in S/s.

  Example "?AI{0}:DATARATE"

OFFSET

- Get the calibration offset coefficient for the specified channel.

  Message "?AI{*ch*}:OFFSET"

  Response "AI{*ch*}:OFFSET=*value*"

  ch The channel number.

  value The calibration offset.

  Example "?AI{0}:OFFSET"

RANGE

- Set the range value for a specified channel.

  Message "AI{*ch*}:RANGE=*value*"

  Response "AI{*ch*}:RANGE"

  ch The channel number.

  value The range value.

  Example "AI{0}RANGE=

  Note Call an AI:RANGES Reflection message to get the supported ranges. If the message returned does not include PROG%, then the message does not apply to the device.

  If RANGE is not specified, the device's power up default value is used.

- Get the range value for a specified channel.

  Message "?AI{*ch*}:RANGE"

  Response "AI{ch}:RANGE=*value*"

  ch The channel number.

  value The range value.

  Example "?AI{0}:RANGE"

  Note Call an AI:RANGES Reflection message to get the supported ranges. If the message returned does not include PROG%, then the message does not apply to the device.

RES

- Get the resolution of the A/D converter.

  Message "?AI:RES"

  Response "AI:RES=*value*"

  value ADC resolution, for example S24

  Note The first character indicates if the value is signed (S) or unsigned (U). The second value indicates the resolution in bits.

SCALE

- Enable or disable scaling of A/D channels.

  Message "AI:SCALE=*value*"

  Response "AI:SCALE"

  value ENABLE, DISABLE

  Example "AI:SCALE=

  Note This message is processed by the DAQFlex Software library, and is not sent to the device.

- Get a value indicating whether scaling will be applied to the A/D channels.

  Message "?AI:SCALE"

  Response "AI:SCALE=*value*"

  value ENABLE, DISABLE

  Note This message is processed by the DAQFlex Software library, and is not sent to the device.

SENSOR

- Set the thermocouple sensor type.

  Message "AI{ch}:SENSOR=TC/*value*"

  Response " AI:{ch}:SENSOR"

  value The thermocouple type.

  Example "AI{0}:SENSOR=TC/K"

  Note Thermocouple types B, E, J, K, N, R, S, and T are supported.

- Get the thermocouple sensor type.

  Message "?AI{ch}:SENSOR"

  Response " AI:{ch}:SENSOR=TC/*value*"

  value The thermocouple type.

  Example "?AI{0}:SENSOR"

  Note Thermocouple types B, E, J, K, N, R, S, and T are supported.

SLOPE

- Get the calibration slope coefficient for the specified channel.

  Message "?AI{ch}:SLOPE"

  Response "AI{ch}:SLOPE=*value*"

  ch The channel number.

  value The calibration slope.

  Example "?AI{0}:SLOPE"

STATUS

- Get the current ADC status of the AI operation.

  Message "?AI:STATUS"

  Response "AI:STATUS=*value*"

  value BUSY, ERROR, READY

VALUE

- Get the calibrated A/D count of a specified channel.

  Message "?AI{ch}:VALUE"

  Response "AI{ch}:VALUE=*value*"

  ch The channel number.

  value The calibrated A/D count.

  Example "?AI{0}:VALUE"

- Get the A/D value in the specified format.

  Message "?AI{ch}:VALUE/format"

  Response "AI{*ch*}:VALUE/*format*=*value*"

  ch The channel number.

  format The data format of the measurement:
  - RAW: returns uncalibrated A/D counts
  - VOLTS: returns a calibrated A/D voltage
  - DEGC: returns a calibrated temperature value in °C
  - DEGF: returns a calibrated temperature value in °F
  - KELVIN: returns a calibrated temperature value in Kelvin

  value The A/D value.

  Example "?AI{0}:VALUE/DEGC"

  Note This message is processed by the DAQFlex Software library, and is not sent to the device.

Working with the CAL and SCALE properties

The ENABLE/DISABLE setting of the CAL and SCALE properties affect the kind of data that is returned:

- CAL=DISABLE, SCALE=DISABLE

  If CAL and SCALE are both disabled, the data returned will be raw A/D integer values within the range of 0 to $2^{resolution}$ -1 of the device. If the calibration factors are stored on the device and applied to the data by the application software, the data range may be limited to well within these values.

- CAL=ENABLE, SCALE=DISABLE

  When CAL is enabled and SCALE is disabled, the format of the analog data returned will depend on the type of calibration implemented. If the calibration factors are stored on the device and applied to the data by the application software, the data will be floating point values, not integer values, and may exceed the theoretical limits and include negative values and values above $2^{resolution}$ -1.

- SCALE=ENABLE

  When SCALE is enabled, scaled floating point values are returned. The limits of the data will depend on the implementation of calibration, as described above. Data range limits may be a small percentage less than or greater than the full scale range selected for devices for which the calibration factors are stored on the device and applied to the data by the application software.

AICAL

Sets and gets property values for analog input self-calibration.

Refer to the device-specific information in the *Hardware Reference* section for the component properties and commands supported by each DAQ device.

Properties

START, STATUS

START

- Start the device's analog input self-calibration.

  Message "AICAL:START"

  Response "AICAL:START"

  Note Once the "AICAL:START" message is sent, no other messages other than the "?AICAL:STATUS" message may be sent until the calibration process is complete.

STATUS

- Get the status of the calibration process.

  Message "?AICAL:STATUS"

  Response "AICAL:STATUS=*value*"

  value RUNNING, IDLE

AIQUEUE

Sets and gets property values for the analog input gain queue.

Refer to the device-specific information in the *Hardware Reference* section for the component properties and commands supported by each DAQ device.

Properties

CHAN, CHANMODE, CLEAR, COUNT, DATARATE, RANGE, RESET

CHAN

- Set the channel number for a specified queue element.

  Message "AIQUEUE{*element*}:CHAN=*value*"

  Response "AIQUEUE:CHAN"

  element The number of the element in the gain queue.

  value The channel number.

  Example "AIQUEUE{0}:CHAN=0"

- Get the channel number for a specified queue element.

  Message "?AIQUEUE{*element*}:CHAN"

  Response "AIQUEUE{*element*}:CHAN=*value*"

  element The number of the element in the gain queue.

  value The channel number.

Example "?AIQUEUE{0}:CHAN"

CHMODE

- Set the channel mode for a specified queue element.

  Message "AIQUEUE{*element*}:CHMODE=*value*"

  Response "AIQUEUE{*element*}:CHMODE"

  element The number of the element in the gain queue.

  value SE, DIFF

  Example "AIQUEUE{0}:CHMODE=DIFF"

- Get the channel mode for a specified queue element.

  Message "?AIQUEUE{*element*}:CHMODE"

  Response "AIQUEUE{*element*}:CHMODE=*value*"

  element The number of the element in the gain queue.

  value SE, DIFF

  Example "?AIQUEUE{0}:CHMODE"

CLEAR

- Removes the elements in the analog input gain queue.

  Message "AIQUEUE:CLEAR"

  Response "AIQUEUE:CLEAR"

COUNT

- Get the number of elements set in the gain queue.

  Message "?AIQUEUE:COUNT"

  Response "AIQUEUE:COUNT=*value*"

  value The number of elements set in the gain queue.

  Example "AIQUEUE:COUNT=15"

DATARATE

- Set the A/D data rate in samples per second for one or all channels.

  Message "AIQUEUE{*ch*}:DATARATE=*value*"

  Response "AIQUEUE{*ch*}:DATARATE"

  value The data rate in S/s.

  ch The channel number. If *ch* is omitted the rate is set for all channels.

  Example "AIQUEUE{0}:DATARATE=10"

- Get the A/D data rate in samples per second for a specified channel.

  Message "?AIQUEUE{ch}:DATARATE"

  Response "AIQUEUE{ch}:DATARATE=*value*"

  value The data rate in S/s.

  ch The channel number.

  Note If all channels are not set to the same range the device returns "MIXED".

RANGE

- Set the range for a specified queue element.

  Message "AIQUEUE{*element*}:RANGE=*value*"

  Response "AIQUEUE:RANGE"

  element The number of the element in the gain queue.

  value The range value.

  Example "AIQUEUE{0}:RANGE=BIP10V"

- Get the range for a specified queue element.

  Message "?AIQUEUE{*element*}:RANGE"

  Response "AIQUEUE{*element*}:RANGE=*value*"

  element The number of the element in the gain queue.

  value The range value.

  Example "?AIQUEUE{0}:RANGE"

RESET

- Reset the analog input gain queue.

  Message "AIQUEUE:RESET"

  Response "AIQUEUE:RESET"

Note

When running the FlexTest utility, AIQUEUE messages are listed on the AISCAN tab.

AISCAN

Sets and gets property values when scanning analog input channels.

Refer to the device-specific information in the *Hardware Reference* section for the component properties and commands supported by each DAQ device.

Properties

BUFSIZE, BURSTMODE, CAL, COUNT, DEBUG, EXTPACER, HIGHCHAN, INDEX, LOWCHAN, QUEUE, RANGE, RATE, RESET, SAMPLES, SCALE, START, STATUS, STOP, TEMPUNITS, TRIG, XFRMODE

BUFSIZE

- Set the size in bytes of the buffer to be used for AISCAN.

  Message "AISCAN:BUFSIZE=*value*"

  Response "AISCAN:BUFSIZE"

  value The size in bytes of the buffer.

  Example "AISCAN:BUFSIZE=131072"

  Note
  - The default buffer size 1024000 bytes. This should be sufficient for most applications. The actual buffer size will always be an integer multiple of the device's maximum packet size.
  - If this value is set, it should be at least (the number of bytes per sample) x (number of channels) x (sample count) for finite mode. In continuous mode, a circular buffer is used, so the size needs to be sufficient to allow reading the data before it is overwritten.

- Get the size of the buffer used for AISCAN.

  Message "?AISCAN:BUFSIZE"

  Response "AISCAN:BUFSIZE=*value*"

  value The size in bytes of the buffer.

BURSTMODE

- Enable or disable the Burst mode scan option.

  Message "AISCAN:BURSTMODE=*value*"

  Response "AISCAN:BURSTMODE"

  value ENABLE, DISABLE

  Example "AISCAN:BURSTMODE=ENABLE"

  Note If not set, BURSTMODE is set to DISABLE by default.

- Get the state of the Burst mode operation.

  Message "?AISCAN:BURSTMODE"

  Response "AISCAN:BURSTMODE=*value*"

  value ENABLE, DISABLE

CAL

- Enable or disable calibration of the A/D data.

  Message "AISCAN:CAL=*value*"

  Response "AISCAN:CAL"

  value ENABLE, DISABLE

  Example "AISCAN:CAL=ENABLE"

  Note This message is processed by the DAQFlex Software library, and is not sent to the device.

- Get a value indicating whether calibration coefficients will be applied to the raw A/D data.

  Message "?AISCAN:CAL"

  Response "AISCAN:CAL=*value*"

  value ENABLE, DISABLE

  Example "?AISCAN:CAL"

  Note This message is processed by the DAQFlex Software library, and is not sent to the device.

COUNT

- Get the number of samples per channel that have been acquired by the AISCAN operation.

  Message "?AISCAN:COUNT"

  Response "AISCAN:COUNT=*value*"

  value The number of samples per channel acquired.

  Example "AISCAN:COUNT=64"

  Note This message is processed by the DAQFlex Software library, and is not sent to the device.

DEBUG

- Enable or disable the debug option.

  Message "AISCAN:DEBUG=*value*"

  Response "AISCAN:DEBUG"

  value ENABLE, DISABLE

  Example "AISCAN:DEBUG=ENABLE"

  Note When DEBUG is enabled, the data returned by ReadScanData() is an incrementing count from 0 to the maximum value of the device's A/D. The count is reset to 0 when the maximum value is reached. The maximum value is 65535 for 16-bit A/Ds.

- Get the debug status.

  Message "?AISCAN:DEBUG"

  Response "AISCAN:DEBUG=*value*"

  value ENABLE, DISABLE

EXTPACER

- Set the configuration of the device's external pacer pin.

  Message "AISCAN:EXTPACER=*value*"

  Response "AISCAN:EXTPACER"

  value ENABLE (for most devices), DISABLE

  Example "AISCAN:EXTPACER= ENABLE"

  Note
  - Some devices support ENABLE/MASTER, ENABLE/SLAVE, or ENABLE/GSLAVE.
  - For devices which do not support a master and slave configuration, the /MASTER and /SLAVE designation is ignored.
  - For devices which do not support disabling of the pacer or SYNC input (for example, the terminal is always enabled as either input or output), the DISABLE designation is invalid.
  - Set to *ENABLE* if the device is paced using a continuous clock source, such as a generator. In this mode, the first clock pulse after setting up the scan is ignored in order to ensure adequate setup time for the first conversion.
  - Set to *ENABLE/GSLAVE* if the device is paced from a DAQFlex supported device. In this mode, the first clock pulse after setting up the scan is held off to ensure adequate setup time for the first conversion. No pulses are ignored.
  - When the external pacer is enabled, the AISCAN:RATE property should be set to approximately what the external pacer rate will be, because internal transfer sizes are calculated using the rate and channel count.
  - When not specified, the default is DISABLE.

- Get the configuration of the device's external pacer pin.

  Message "?AISCAN:EXTPACER"

  Response "AISCAN:EXTPACER=*value*"

  ch The channel number.

  value ENABLE (for most devices).

  Note Some devices support ENABLE/MASTER, ENABLE/SLAVE, ENABLE/GSLAVE, DISABLE/MASTER, or DISABLE/SLAVE.

HIGHCHAN

- Set the last channel to include in the hardware-paced scan operation.

  Message "AISCAN:HIGHCHAN=*value*"

  Response "AISCAN:HIGHCHAN"

  value The channel number.

  Example "AISCAN:HIGHCHAN=3"

- Get the last channel to include in the hardware-paced scan operation.

  Message "?AISCAN:HIGHCHAN"

  Response "AISCAN:HIGHCHAN=*value*"

  value The channel number.

INDEX

- Get the current location of the pointer in the buffer.

  Message "AISCAN:INDEX=

  Response "AISCAN:INDEX"

  value The current location of the pointer in the buffer.

  Example "AISCAN:COUNT=765"

  Note INDEX tracks COUNT in finite mode, and recycles at buffersize in continuous mode; this accounts for sample size, number of channels, and so on.

LOWCHAN

- Set the first channel to include in the hardware-paced scan operation.

  Message "AISCAN:LOWCHAN=*value*"

  Response "AISCAN:LOWCHAN"

  value The channel number.

  Example "AISCAN:LOWCHAN=0"

- Get the first channel to include in the hardware-paced scan operation.

  Message "?AISCAN:LOWCHAN"

  Response "AISCAN:LOWCHAN=*value*"

  value The channel number.

QUEUE

- Enable or disable the analog input gain queue.

  Message "AISCAN:QUEUE=*value*"

  Response "AISCAN:QUEUE"

  value ENABLE, DISABLE, or RESET

  Example "AISCAN:QUEUE=ENABLE"

  Note RESET resets the queue count to 0, and disables the gain queue.

- Read whether the gain queue is used in the scanning operation.

  Message "?AISCAN:QUEUE"

  Response "AISCAN:QUEUE=*value*"

  value ENABLE, DISABLE

RANGE

- Set the range for all analog input channels to be scanned.

  Message "AISCAN:RANGE=*value*"

  Response "AISCAN:RANGE"

  value The range value.

  Note Call an AI:RANGES Reflection message to get the supported ranges. If the message returned does not include PROG%, then the message does not apply to the device.

- Get the range that is set for the analog input channels to be scanned.

  Message "?AISCAN:RANGE"

  Response "AISCAN:RANGE=*value*"

  value The range value.

  Note If all channels are not set to the same range the device returns "MIXED".

- Add the range value as the next element in the gain queue, or set the range value for a specified channel (depending on the queue setting).

  Message "AISCAN:RANGE{*ch*}=*value*"

  Response "AISCAN:RANGE{*qcnt*/*ch*}" (when QUEUE is enabled)
  "AISCAN:RANGE{*ch*}" (when QUEUE is disabled.)

  The response behavior is dependent on the QUEUE setting:
  - When QUEUE is enabled, an element is added to the queue and the specified channel is set to the range specified.
  - When QUEUE is disabled, the specified channel is set to the range specified.

  qcnt The element's position in the gain queue. This number increments by 1 for each successive message sent.

  ch The channel number.

  value The range value (see values listed above).

  Example "AISCAN:RANGE{2}=BIP20V"

- Set a specified element in the queue to a specified range (*value*) and channel (*ch*)

  Message "AISCAN:RANGE{*element*/*ch*}=*value*"

  Response "AISCAN:RANGE{*element*/*ch*}"

  element The element's position in the gain queue.

  ch The channel number.

  value The range value.

  Example "AISCAN:RANGE{0/1}=BIP20V"

  Note If element is greater than the size of the queue, the size of the queue is expanded to *element + 1*.

- Get the range value for a specified element or channel.

  Message "?AISCAN:RANGE{*x*}"

  Response "AISCAN:RANGE{*element*/*ch*}=*value*" when QUEUE is enabled, or
  "AISCAN:RANGE{*ch*}=*value*" when QUEUE is disabled.

  When QUEUE is disabled, *x* denotes the channel for which the range is returned.
  When QUEUE is enabled, *x* denotes the element in the queue for which the range is returned.

  value The range value.
  If all channels are not set to the same range, *value* returns MIXED.

  ch The channel number.

  element The element's position in the gain queue

RATE

- Set the A/D pacer rate in Hz.

  Message "AISCAN:RATE=*value*"

  Response "AISCAN:RATE"

  value 0 to N

  Example "AISCAN:RATE=1000"

  Note If *value* is set is less than the device's minimum sampling rate, the minimum rate is used. If *value* is set is greater than the device's maximum sampling rate, the maximum rate is used.
  Check the actual scan rate set using the "?AISCAN:RATE" query after setting the RATE.

- Get the A/D pacer rate in Hz.

  Message "?AISCAN:RATE"

  Response "AISCAN:RATE=*value*"

  value A value between the device's minimum and maximum rate.

  Note The *value* returned may not match the value requested using the "AISCAN:RATE=*value*" message due to device limitations.
  If the *value* returned is at or near the device's maximum sampling rate, you should keep to a minimum other messages sent to the device. Otherwise, a data overrun may occur. A data overrun occurs when the device fills its buffer with data faster than it is read back.

RESET

- Reset the status of the AISCAN operation.

  Message "AISCAN:RESET"

  Response "AISCAN:RESET"

SAMPLES

- Set the number of samples/channel to acquire in the scan.

  Message "AISCAN:SAMPLES=*value*"

  Response "AISCAN:SAMPLES"

  value 0 to N

  Example "AISCAN:SAMPLES=1000"

  Note A value of 0 results in a continuous scan.

- Get the number of samples/channel acquired.

  Message "?AISCAN:SAMPLES"

  Response "AISCAN:SAMPLES=*value*"

  value 0 to N

  Note A value of 0 indicates a continuous scan.

SCALE

- Enable or disable scaling of the A/D data.

  Message "AISCAN:SCALE=*value*"

  Response "AISCAN:SCALE"

  value ENABLE, DISABLE

  Example "AISCAN:SCALE=ENABLE"

  Note This message is processed by the DAQFlex Software library, and is not sent to the device.

- Get a value indicating whether scaling will be applied to the A/D data.

  Message "?AISCAN:SCALE"

  Response "AISCAN:SCALE=*value*"

  value ENABLE, DISABLE

  Note This message is processed by the DAQFlex Software library, and is not sent to the device.

START

- Start an analog input scan.

  Message "AISCAN:START"

  Response "AISCAN:START"

STATUS

- Get the status of the analog input scan operation.

  Message "?AISCAN:STATUS"

  Response "AISCAN:STATUS=*value*"

  value IDLE, RUNNING, or OVERRUN

STOP

- Stop an analog input scan operation.

  Message "AISCAN:STOP"

  Response "AISCAN:STOP"

TEMPUNITS

- Set the unit used for temperature measurements.

  Message "AISCAN:TEMPUNITS=*value*"

  Response "AISCAN:TEMPUNITS"

  value DEGC, DEGF, KELVIN

  Example "AISCAN:TEMPUNITS=DEGC"

- Get the unit used for temperature measurements.

  Message "?AISCAN:TEMPUNITS"

  Response "AISCAN:TEMPUNITS=*value*"

  value DEGC, DEGF, KELVIN

TRIG

- Enable or disable the external trigger option.

  Message "AISCAN:TRIG=*value*"

  Response "AISCAN:TRIG"

  value ENABLE, DISABLE

  Example "AISCAN:TRIG=ENABLE"

  Note If not set, TRIG is set to DISABLE by default.

- Get the trigger status.

  Message "?AISCAN:TRIG"

  Response "AISCAN:TRIG=*value*"

  value ENABLE, DISABLE

XFRMODE

- Set the transfer mode for analog input scan data.

  Message "AISCAN:XFRMODE=*value*"

  Response "AISCAN:XFRMODE"

  value SINGLEIO, BLOCKIO, BURSTIO

  Example "AISCAN:XFRMODE=BURSTIO"

  Note For SINGLEIO, the device transfers data after one sample per channel is acquired. For BURSTIO, the number of samples is limited to the size of the device FIFO.

- Get the transfer mode that is set for the scan.

  Message "?AISCAN:XFRMODE"

  Response "AISCAN:XFRMODE=*value*"

  value SINGLEIO, BLOCKIO, BURSTIO

Working with the CAL and SCALE properties

The ENABLE/DISABLE setting of the CAL and SCALE properties affect the kind of data that is returned:

- CAL=DISABLE, SCALE=DISABLE

  If CAL and SCALE are both disabled, the data returned will be raw A/D integer values within the range of 0 to $2^{resolution}$ -1 of the device. If the calibration factors are stored on the device and applied to the data by the application software, the data range may be limited to well within these values.

- CAL=ENABLE, SCALE=DISABLE

  When CAL is enabled and SCALE is disabled, the format of the analog data returned will depend on the type of calibration implemented. If the calibration factors are stored on the device and applied to the data by the application software, the data will be floating point values, not integer values, and may exceed the theoretical limits and include negative values and values above $2^{resolution}$ –1.

- SCALE=ENABLE

  When SCALE is enabled, scaled floating point values are returned. The limits of the data will depend on the implementation of calibration, as described above. Data range limits may be a small percentage less than or greater than the full scale range selected for devices for which the calibration factors are stored on the device and applied to the data by the application software.

AITRIG

Sets and gets analog input trigger property values.

Refer to the device-specific information in the *Hardware Reference* section for the component properties and commands supported by each DAQ device.

Properties

REARM, TYPE

REARM

- Set the state of the retrigger mode.

  Message "AITRIG:REARM=*value*"

  Response "AITRIG:REARM"

  value ENABLE, DISABLE

  Example "AITRIG:REARM=ENABLE"

- Get the state of the retrigger mode.

  Message "?AITRIG:REARM"

  Response "AITRIG:REARM=*value*"

  value ENABLE, DISABLE

TYPE

- Set the edge trigger type and condition.

  Message "AITRIG:TYPE=*value*"

  Response "AITRIG:TYPE"

  value *type/condition*

  type EDGE, LEVEL

  condition RISING, FALLING when *type* is EDGE
  HIGH, LOW when *type* is LEVEL

  Example "AITRIG:TYPE=EDGE/RISING"

- Get the trigger type and condition.

  Message "?AITRIG:TYPE"

  Response "AITRIG:TYPE=*value*"

  value EDGE/RISING, EDGE/FALLING

Note

- When running the FlexTest utility, AITRIG messages are listed on the AISCAN tab.

AO

Sets and gets property values for analog output channels.

Refer to the device-specific information in the *Hardware Reference* section for the component properties and commands supported by each DAQ device.

Properties

OFFSET, RANGE, REG, RES, SCALE, SLOPE, UPDATE, VALUE

(Component only)

- Get the number of analog output channels on the device.

  Message "?AO"

  Response "AO=*value*"

  value The number of D/A channels on the device.

OFFSET

- Get the calibration offset for a specified channel, currently set range and channel mode.

  Message "?AO{*ch*}:OFFSET"

  Response "AO{*ch*}:OFFSET=*value*"

  ch The D/A channel number.

  value The value of the calibration offset.

  Example "?AO{0}:OFFSET"

RANGE

- Get the range value for a specified channel.

  Message "?AO{*ch*}:RANGE"

  Response "AO{*ch*}RANGE=*value*"

  ch The D/A channel number.

  value The range value.

  Example "?AO{0}:RANGE"

REG

- Set the value of a DAC channel that supports simultaneous output without updating the output.

  Message "AO{ch}:REG=*value*"

  Response "AO{ch}:REG"

  ch 0, 1

  value 0 to 65535

  Example "AO{0}:REG=1455"

  Note This message is only supported by devices with simultaneous DAC output capability. Use with AO:UPDATE to simultaneous update the DAC outputs.

  Use AO:VALUE to set the DAC value on devices with non-simultaneous output.

- Get the value of a DAC channel that supports simultaneous output.

  Message "?AO{ch}:REG "

  Response "AO{ch}:REG=*value* "

  ch 0, 1

  value 0 to 65535

  Example "?AO{1}:REG"

RES

- Get the resolution of the D/A converter.

  Message "?AO:RES"

  Response "AO:RES=*value*"

  value U16

  Note The first character indicates if the value is signed (S) or unsigned (U). The second value indicates the resolution in bits.

SCALE

- Enable or disable scaling of all D/A channels.

  Message "AO:SCALE=*value*"

  Response "AO:SCALE"

  value ENABLE, DISABLE

  Example "AO:SCALE=ENABLE"

  Note This message is processed by the DAQFlex Software library, and is not sent to the device.

- Get a value indicating whether scaling will be applied to the D/A channels.

  Message "?AO:SCALE"

  Response "AO:SCALE=*value*"

  ch The channel number.

  value ENABLE, DISABLE

  Note This message is processed by the DAQFlex Software library, and is not sent to the device.

SLOPE

- Get the calibration slope for a specified channel, currently set range and channel mode.

  Message "?AO{*ch*}:SLOPE"

  Response "AO{*ch*}:SLOPE=*value*"

  ch The D/A channel number.

  value The value of the calibration slope.

  Example "?AO{0}:SLOPE"

UPDATE

- Simultaneously update DAC channels.

  Message "AO:UPDATE"

  Response "AO:UPDATE"

  Note Use AO{ch}:REG to set the value of each DAC channel.

VALUE

- Set the value of an analog output channel.

  Message "AO{*ch*}:VALUE=*value*"

  Response "AO{*ch*}:VALUE"

  ch The D/A channel number.

  value The channel value.

  Example "AO{0}:VALUE=1455"

AOCAL

Sets and gets property values for analog output self-calibration.

Refer to the device-specific information in the *Hardware Reference* section for the component properties and commands supported by each DAQ device.

Properties

START, STATUS

START

- Start the device's analog output self-calibration.

  Message "AOCAL:START"

  Response "AOCAL:START"

  Note Once the "AOCAL:START" message is sent, no other messages other than the "?AOCAL:STATUS" message may be sent until the calibration process is complete.

STATUS

- Get a value that indicates the status of the calibration process.

  Message "?AOCAL:STATUS"

  Response "AOCAL:STATUS=*value*"

  value RUNNING, IDLE

AOSCAN

Sets and gets property values when scanning analog output channels.

Refer to the device-specific information in the *Hardware Reference* section for the component properties and commands supported by each DAQ device.

Properties

BUFSIZE, COUNT, EXTPACER, HIGHCHAN, INDEX, LOWCHAN, RANGE, RATE, SAMPLES, SCALE, START, STATUS, STOP

BUFSIZE

- Set the size in bytes of the buffer used for analog output scanning operations.

  Message "AOSCAN:BUFSIZE=*value*"

  Response "AOSCAN:BUFSIZE"

  value The size in bytes of the output buffer.

Example "AOSCAN:BUFSIZE=65536"

Notes The default buffer size is 65536 bytes. This should be sufficient for most applications. The actual buffer size will always be an integer multiple of the device's maximum packet size.

- Get the size of the buffer used for AOSCAN.

  Message "?AOSCAN:BUFSIZE"

  Response "AOSCAN:BUFSIZE=*value*"

  value The size in bytes of the output buffer.

  Example "?AOSCAN:BUFSIZE"

COUNT

- Get the number of samples per channel that have been sent to the device by the AOSCAN operation.

  Message "?AOSCAN:COUNT"

  Response "AOSCAN:COUNT=*value*"

  value The number of samples per channel sent to the device buffer.

  Example "AOSCAN:COUNT=64"

  Note This message is processed by DAQFlex Software library, and is not sent to the device.

EXTPACER

- Set the source of the D/A clock.

  Message "AOSCAN:EXTPACER=*value*"

  Response "AOSCAN:EXTPACER"

  value ENABLE, DISABLE

  Example "AOSCAN:EXTPACER=ENABLE"

- Set the source of the D/A clock.

  Message "?AOSCAN:EXTPACER"

  Response "AOSCAN:EXTPACER=*value*"

  ch The channel number.

  value ENABLE, DISABLE

HIGHCHAN

- Set the last D/A channel to include in the analog output scan operation.

  Message "AOSCAN:HIGHCHAN=*value*"

  Response "AOSCAN:HIGHCHAN"

  value The channel number.

  Example "AOSCAN:HIGHCHAN=1"

- Get the last D/A channel to include in the analog output scan operation.

  Message "?AOSCAN:HIGHCHAN"

  Response "AOSCAN:HIGHCHAN=*value*"

  value The channel number.

  Example "?AOSCAN:HIGHCHAN"

INDEX

- Get the current location of the output pointer in the buffer.

  Message "?AOSCAN:INDEX"

  Response "AOSCAN:INDEX=*value*"

  value The current location of the pointer in the buffer.

  Example "AOSCAN:COUNT=765"

  Note This message is processed by the DAQFlex Software library, and is not sent to the device.

LOWCHAN

- Set the first D/A channel to include in the analog output scan operation.

  Message "AOSCAN:LOWCHAN=*value*"

  Response "AOSCAN:LOWCHAN"

  value The channel number.

  Example "AOSCAN:LOWCHAN=0'

- Get the first D/A channel to include in the analog output scan operation.

  Message "?AOSCAN:LOWCHAN"

  Response "AOSCAN:LOWCHAN=*value*"

  value The channel number.

  Example "?AOSCAN:LOWCHAN"

RANGE

- Get the analog output range set for the D/A channels.

  Message "?AOSCAN:RANGE{*ch*}"

  Response "AOSCAN:RANGE{*ch*}=*value*"

  ch The D/A channel number.

  value The range value.
  If the D/A channels are not set to the same range *value* returns MIXED.

  Example "AOSCAN:RANGE{0}=BIP10V"

RATE

- Set the D/A pacer rate in Hz.

  Message "AOSCAN:RATE=*value*"

  Response "AOSCAN:RATE"

  value >0 (float)

  Example "AOSCAN:RATE=1000"

- Get the D/A pacer rate in Hz.

  Message "?AOSCAN:RATE"

  Response "?AOSCAN:RATE=*value*"

  value 1 to the maximum rate of the device.

  Example "?AOSCAN:RATE"

SAMPLES

- Set the number of samples per channel to output.

  Message "AOSCAN:SAMPLES=*value*"

  Response "AOSCAN:SAMPLES"

  value 0 to N

  Example "AOSCAN:SAMPLES=1000"

  Note Set *value* to 0 for a continuous scan.

- Get the number of samples per channel to output.

  Message "?AOSCAN:SAMPLES"

  Response "AOSCAN:SAMPLES=*value*"

  value A numeric value.

  Example "?AOSCAN:SAMPLES"

SCALE

- Enable or disable scaling of the D/A data.

  Message "AOSCAN:SCALE=*value*"

  Response "AOSCAN:SCALE"

  value ENABLE, DISABLE

  Example "AOSCAN:SCALE=ENABLE"

  Note This message is processed by the DAQFlex Software library, and is not sent to the device.

- Get a value indicating whether scaling will be applied to the D/A data.

  Message "?AOSCAN:SCALE"

  Response "AOSCAN:SCALE=*value*"

  value ENABLE, DISABLE

  Note This message is processed by the DAQFlex Software Software library, and is not sent to the device.

START

- Start an analog output scan.

  Message "AOSCAN:START"

  Response "AOSCAN:START"

STATUS

- Get the status of the AOSCAN operation.

  Message "?AOSCAN:STATUS"

  Response "AOSCAN:STATUS=*value*"

  value IDLE, RUNNING, or UNDERRUN

  Example "AOSCAN:STATUS=RUNNING"

STOP

- Stop an analog output scan.

  Message "AOSCAN:STOP"

  Response "AOSCAN:STOP"

AOTRIG

Sets and gets analog output trigger property values.

Refer to the device-specific information in the *Hardware Reference* section for the component properties and commands supported by each DAQ device.

Properties

TYPE

TYPE

- Set the trigger edge.

  Message "AOTRIG:TYPE=*value*"

  Response "AOTRIG:TYPE"

  value EDGE/RISING, EDGE/FALLING

  Example "AOTRIG:TYPE=EDGE/RISING"

- Get the trigger edge.

  Message "?AOTRIG:TYPE"

  Response "AOTRIG:TYPE=*value*"

  value EDGE/RISING, EDGE/FALLING

CTR

Sets and gets property values for counter channels.

Refer to the device-specific information in the *Hardware Reference* section for the component properties and commands supported by each DAQ device.

Properties

START, STOP, VALUE

(Component only)

- Get the number of counter channels on a device.

  Message "?CTR"

  Response "CTR=*value*"

  value The number of counter channels on a device.

START

- Start a specified counter channel.

  Message "CTR{ch}:START"

  Response "CTR{ch}:START"

  ch The number of the counter channel.

  Example "CTR{0}:START"

STOP

- Stop a specified counter channel.

  Message "CTR{ch}:STOP"

  Response "CTR{ch}:STOP"

  ch The number of the counter channel.

  Example "CTR{0}:STOP"

VALUE

- Load the specified counter channel with a value.

  Message "CTR{ch}:VALUE=*value*"

  Response "CTR{ch}:VALUE"

  ch The number of the counter channel.

  value The value to load onto the counter channel (0 to $2^{32} - 1$).

  Example "CTR{0}:VALUE=0"

Note Setting a value of 0 resets the counter to 0.

- Get the value of the specified counter channel.

  Message "?CTR{ch}:VALUE"

  Response "CTR{ch}:VALUE=*value*"

  ch The number of the counter channel.

  value The value of the counter channel.

  Example "?CTR{0}:VALUE"

DEV

Sets and gets device property values.

Refer to the device-specific information in the *Hardware Reference* section for the component properties and commands supported by each DAQ device.

Properties

FLASHLED, FPGACFG, FPGAV, FWV, ID, MFGCAL, MFGSER, RESET, STATUS/ISO, TEMP

FLASHLED

- Flash the device LED.

  Message "DEV:FLASHLED/{n}"

  Response "DEV:FLASHLED"

  n A number indicating how many times to flash the device LED.

  Example "DEV:FLASHLED/5"

FPGACFG

- Put the device into FPGA configuration mode.

  Message "DEV:FPGACFG/<unlock code>"

  Response "DEV:FPGACFG"

  unlock code Device-specific hex value.

  Example "DEV:FPGACFG/0xAD"

  Note The device must be in FPGA configuration mode in order to update the device's FPGA configuration.

- Get the status of the device's FPGA.

  Message "?DEV:FPGACFG"

  Response "DEV:FPGACFG=*value*"

  value CONFIGURED, CONFIGMODE

  Note *CONFIGURED* indicates that the device's FPGA is currently configured.
  CONFIGMODE indicates that the device's FPGA is not currently configured.

FPGAV

- Get the firmware version of the device's FPGA.

  Message "?DEV:FPGAV"

  Response "DEV:FPGAV=*value*"

  value The firmware version of the device's FPGA.

  Example "DEV:FPGAV=2.05"

FWV

- Get the firmware version of the device.

  Message "?DEV:FWV"

  Response "DEV:FWV=*value*"

  value The firmware version of the device.

  Example "DEV:FWV=01.02" or "DEV:FWV=01.01.00f00"

ID

- Set the device ID.

  Message "DEV:ID=*value*"

  Response "DEV:ID"

  value The ID set for the device. ID is set to MYDEVICE by default.

  Example "DEV:ID=MYDEVICE"

  Note *value* can be up to 57 characters.

- Get the device ID.

  Message "?DEV:ID"

  Response "DEV:ID=*value*"

  value The ID set for the device.

MFGCAL

- Get the date and time in which the device was last calibrated.

  Message "?DEV:MFGCAL"

  Response "DEV:MFGCAL=*value*"

  value The calibration date and time.

  Example "DEV:MFGCAL=2009-03-14 13:56:27"

- Get the year in which the device was last calibrated.

  Message "?DEV:MFGCAL{YEAR}"

  Response "DEV:MFGCAL{YEAR}=*value*"

  YEAR The calibration year.

Example "DEV:MFGCAL{YEAR}=2010"

- Get the month in which the device was last calibrated.
  Message "?DEV:MFGCAL{MONTH}"

  Response "DEV:MFGCAL{MONTH}=*value*"

  MONTH The calibration month.

  Example "DEV:MFGCAL{MONTH}=03"

- Get the day in which the device was last calibrated.
  Message "?DEV:MFGCAL{DAY}"

  Response "DEV:MFGCAL{DAY}=*value*"

  DAY The calibration day.

  Example "DEV:MFGCAL{DAY}=14"

- Get the hour in which the device was last calibrated.
  Message "?DEV:MFGCAL{HOUR}"

  Response "DEV:MFGCAL{HOUR}=*value*"

  HOUR The calibration hour.

  Example "DEV:MFGCAL{HOUR}=15"

- Get the minute in which the device was last calibrated.
  Message "?DEV:MFGCAL{MINUTE}"

  Response "DEV:MFGCAL{MINUTE}=*value*"

  MINUTE The calibration minute.

  Example "DEV:MFGCAL{MINUTE}=56"

- Get the second in which the device was last calibrated.
  Message "?DEV:MFGCAL{SECOND}"

  Response "DEV:MFGCAL{SECOND}=*value*"

  SECOND The calibration second.

  Example "DEV:MFGCAL{SECOND}=26"

MFGSER

- Get the manufacturer's device serial number.
  Message "?DEV:MFGSER"

  Response "DEV:MFGSER=*value*"

  value The serial number of the device.

  Example "DEV:MFGSER=00000001"

RESET

- Reset the device or the default parameters.

  Message "DEV:RESET/*value*"

  Response "The device is not responding" when *value* is set to SYSTEM.
  (SYSTEM resets the USB interface to the device, and the device cannot send a response; this value is not recommended for use through the software).

  "DEV:RESET" when *value* is set to DEFAULT.
  (*DEFAULT* resets all device parameters to the default value.)

  value SYSTEM, DEFAULT

  Example "DEV:RESET/DEFAULT"

STATUS/ISO

- Get the status of the isolated microcontroller.

  Message "?AI:STATUS/ISO"

  Response "AI:STATUS=*value*"

  value READY, NOTREADY

TEMP

- Get the device's internal temperature in °C.

  Message "?DEV:TEMP{tempnum}"

  Response "DEV:TEMP{tempnum}=*value*"

  tempnum The number of the temperature sensor on the device.

  value The internal temperature in °C.

  Example "DEV:TEMP{0}=21"

DIO

Sets and gets property values for digital I/O channels.

Refer to the device-specific information in the *Hardware Reference* section for the component properties and commands supported by each DAQ device.

Properties

DIR, LATCH, VALUE

(Component only)

- Get the number of digital ports on a device.

  Message "?DIO"

  Response "DIO=*value*"

  value The number of digital ports.

- Get the number of bits on a port.

  Message "?DIO{port}"

  Response "DIO{port}=*value*"

  value The number of bits on the port.

  Example "?DIO{0}"

DIR

- Set the direction of a port.

  Message "DIO{port}:DIR=*value*"

  Response "DIO{port}:DIR"

  port The port number.

  value IN, OUT

  Example "DIO{0}:DIR=IN"

  Note For devices that support this message, the default power up value is "IN".

- Get the direction of a port.

  Message "?DIO{port}:DIR"

  Response "DIO{port}:DIR=*value*"

  port The port number.

  value IN, OUT, or a number between 0 and 2*n* -1, where *n* is the number of bits in the port.

  Note If the digital bits are not individually configurable, the value returned is either "IN" or "OUT."
  If each digital bit is individually configurable, *value* is a bit mask, in which *1* indicates that the bit is configured for input, and *0* indicates that the bit is configured for output.

- Set the direction of a bit.

  Message "DIO{port/bit}:DIR=*value*"

  Response "DIO{port/bit}:DIR"

  port The port number.

  bit The bit number.

  value IN, OUT

  Example "DIO{0/1}:DIR=IN"

  Note For devices that support this message, the default power up value is "IN".

- Get the direction of a bit.

  Message "?DIO{port/bit}:DIR"

  Response "DIO{port/bit}:DIR=*value*"

  port The port number.

  bit The bit number.

  value IN, OUT

  Example "?DIO{0/1}:DIR"

LATCH

- Set the latch value of a port.

  Message "DIO{port}:LATCH=*value*"

  Response "DIO{port}:LATCH"

  port The port number (0).

  value The port value (0 to 255).

  Example "DIO{0}:LATCH=128"

- Get the latch value of a port.

  Message "?DIO{port}:LATCH"

  Response "DIO{port}:LATCH=*value*"

  port The port number.

  value The port value.

  Example "?DIO{0}:LATCH"

- Set the latch value of a bit.

  Message "DIO{port/bit}:LATCH=*value*"

  Response "DIO{port/bit}:LATCH"

  port The port number.

  bit The bit number.

  value The bit value.

  Example "DIO{0/1}:LATCH=1"

- Get the latch value of a bit.

  Message "?DIO{port/bit}:LATCH"

  Response "DIO{port/bit}:LATCH=*value*"

  port The port value.

  bit The bit number.

  value The bit value.

  Example "?DIO{0/1}:LATCH"

VALUE

- Set the value of a port.

  Message "DIO{port}:VALUE=*value*"

  Response "DIO{port}:VALUE"

  port The port number.

  value The value of the port.

  Example "DIO{0}:VALUE=128"

  Note Performing an output operation on a programmable port that has not been configured for output will generate an error.

- Get the value of a port.

  Message "?DIO{port}:VALUE"

  Response "DIO{port}:VALUE=*value*"

  port The port number.

  value The value of the port.

  Example "?DIO{0}:VALUE"

- Set the value of a bit.

  Message "DIO{port/bit}:VALUE=*value*"

  Response "DIO{port/bit}:VALUE"

  port The port number.

  bit The bit number.

  value The value of the bit.

  Example "DIO{0/1}:VALUE=1"

  Note Performing an output operation on a programmable port that has not been configured for output will generate an error.

- Get the value of a bit.

  Message "?DIO{port/bit}:VALUE"

  Response "DIO{port/bit}:VALUE=*value*"

  port The port number.

  bit The bit number.

  value The value of the bit.

  Example "?DIO{0/1}:VALUE"

TMR

Sets and gets property values for a timer output channel.

Refer to the device-specific information in the *Hardware Reference* section for the component properties and commands supported by each DAQ device.

Properties

DELAY, DUTYCYCLE, IDLESTATE, PERIOD, PULSE, PULSECOUNT, START, STOP

(Component only)

- Get the number of timer output channels on the device.

  Message "?TMR"

  Response "TMR=*value*"

  value The number of timer output channels.

DELAY

- Set the amount of time in mS to delay before starting the output.

  Message "TMR{*ch*}:DELAY=*value*"

  Response "TMR{*ch*}:DELAY"

  ch The channel number.

  value The time in milliseconds (mS).

  Example "TMR{0}:DELAY=100"

- Get the amount of time in mS to delay before starting the output.

  Message "?TMR{*ch*}:DELAY"

  Response "TMR{*ch*}:DELAY=*value*"

  ch The channel number.

  value The time in milliseconds (mS).

  Example "?TMR{0}:DELAY"

DUTYCYCLE

- Set the value in percent of the duty cycle for a specified channel.

  Message "TMR{*ch*}:DUTYCYCLE=*value*"

  Response "TMR{*ch*}:DUTYCYCLE"

  ch The channel number.

  value The duty cycle in percent (%).
  When not specified *value* is set to 50%.

  Example "TMR{0}:DUTYCYCLE=100"

- Get the value of the duty cycle in percent for a specified channel.

  Message "?TMR{*ch*}:DUTYCYCLE"

  Response "TMR{*ch*}:DUTYCYCLE=*value*"

  ch The channel number.

  value The duty cycle in percent (%).

  Example "?TMR{0}:DUTYCYCLE"

IDLESTATE

- Set the state of the timer channel.

  Message "TMR{*ch*}:IDLESTATE=*value*"

  Response "TMR{*ch*}:IDLESTATE"

  ch The channel number.

  value LOW, HIGH

  Example "TMR{0}:IDLESTATE=HIGH"

  Note When *value* is High the timer output is inverted.

- Get the state of the timer channel.

  Message "?TMR{*ch*}:IDLESTATE"

  Response "TMR{*ch*}:IDLESTATE=*value*"

  ch The channel number.

  value LOW, HIGH

  Example "?TMR{0}:IDLESTATE"

PERIOD

- Set the period in milliseconds (mS) of the specified timer output.

  Message "TMR{*ch*}:PERIOD=*value*"

  Response "TMR{*ch*}:PERIOD"

  ch The channel number.

  value The period in mS.

  Example "TMR{0}:PERIOD=100"

  Note The PERIOD is required for timer output operations.

- Get the period in milliseconds (mS) of the specified timer output.

  Message "?TMR{*ch*}:PERIOD"

  Response "TMR{*ch*}:PERIOD=*value*"

  ch The channel number.

  value The period in mS.

  Example "?TMR{0}:PERIOD"

PULSE

- Set the value in Hz of the pulse frequency for a specified channel.

  Message "TMR{*ch*}:PULSE=*value*"

  Response "TMR{*ch*}:PULSE"

  ch The channel number.

  value The pulse frequency in Hz.

  Example "TMR{0}:PULSE=1000"

- Get the value in Hz of the pulse frequency for a specified channel.

  Message "?TMR{*ch*}:PULSE"

  Response "TMR{*ch*}:PULSE=*value*"

  ch The channel number.

  value The pulse frequency in Hz.

  Example "?TMR{0}:PULSE"

PULSECOUNT

- Set the number of pulses to generate.

  Message "TMR{*ch*}:PULSECOUNT=*value*"

  Response "TMR{*ch*}:PULSECOUNT"

  ch The channel number.

  value The number of pulses to generate.
  A value of 0 generates pulses continuously until the TMR:STOP message is sent.

  Example "TMR{0}:PULSE=100"

- Get the number of pulses to generate.

  Message "?TMR{*ch*}:PULSECOUNT"

  Response "TMR{*ch*}:PULSECOUNT=*value*"

  ch The channel number.

  value The number of pulses to generate.
  A value of 0 indicates continuous pulse generation.

  Example "?TMR{0}:PULSECOUNT"

START

- Start the timer output.

  Message "TMR:START"

  Response "TMR:START"

STOP

- Stop the timer output.

  Message "TMR:STOP"

  Response "TMR:STOP"

Reflection messages

Device reflection messages get information about the capabilities of a device, such as the maximum scan rate or support for an external clock. Device reflection messages always start with the **@** character.

Device features are stored on the device in EEPROM.

Click on a component below for the string messages, device responses, and property values supported by the component.

Components for retrieving device information	Description
AI	Gets the analog input properties of a device.
AISCAN	Gets the analog input scanning properties of a device.
AITRIG	Gets the analog input triggering properties of a device.
AO	Gets the analog output properties of a device.
AOSCAN	Gets the analog output scanning properties of a device.
CTR	Gets the counter input properties of a device.
DIO	Gets the digital I/O properties of a device.
TMR	Gets the timer output properties of a device.

AI

Gets the analog input properties of a device.

Properties

CJC, CHANNELS, CHMODES, FACCAL, INPUTS, MAXCOUNT, MAXRATE, RANGES, SELFCAL, SENSORS, SENSORCONFIG, TCTYPES

CJC

- Get the CJC channel number associated with an analog input channel.

  Message "@AI{*ch*}:CJC"

  Response "AI{*ch*}:CJC=*implementation*>*value*"

ch	Channel number.
implementation	FIXED%, PROG% (programmable), HWSEL% (hardware selectable), or not specified if value is NOT_SUPPORTED
value	Channel number for the CJC associated with the specified channel, or returns NOT_SUPPORTED if the device doesn't support CJCs or the value of {ch} is not valid for the device.

  Example "AI{0}:CJC=FIXED%0"

CHANNELS

- Get the number of analog input channels on a device.

  Message "@AI:CHANNELS"

  Response

implementation	FIXED%, PROG% (programmable), or not specified if value is NOT_SUPPORTED
value	The number of A/D channels on a device, or returns NOT_SUPPORTED if the device doesn't support analog input.

  Example "AI:CHANNELS=FIXED%8"

  Note On some devices, the values returned may be dependent on channel configuration settings.

CHMODES

- Get the analog input channel modes that are supported by the device.

  Message "@AI:CHMODES"

  Response "AI:CHMODES=*implementation*>*value*<*dependent properties*>"

implementation	FIXED%, PROG% (programmable), HWSEL% (hardware selectable), or not specified if value is NOT_SUPPORTED
value	SE or DIFF, or returns NOT_SUPPORTED if the device doesn't support analog input.
dependent properties	One or more property that is dependent on the value of another property. For example, the CHANNELS property is dependent on whether the CHMODES *value* property is set to SE or DIFF.

  Example "AI:CHMODES=PROG%SE,DIFF<CHANNELS, RANGES>"

FACCAL

- Get a value indicating if the device supports factory calibration for analog inputs.

  Message "@AI:FACCAL"

  Response "AI:FACCAL=*implementation*>*value*"

implementation	FIXED%, or not specified if value is NOT_SUPPORTED
value	SUPPORTED, NOT_SUPPORTED

  Example "AI:FACCAL=FIXED%SUPPORTED"

INPUTS

- Get the analog input signal types that are supported by the device or specified channel.

  Message "@AI:INPUTS"

  "@AI{ch}:INPUTS"

  Response "AI{ch}:INPUTS=*implementation*>*value*"

ch	Channel number (if {*ch*} format is used).

implementation FIXED%, PROG% (programmable), HWSEL% (hardware selectable), or not specified if value is NOT_SUPPORTED

value VOLTS, TEMP, CUR (current), or RES (resistance), or returns NOT_SUPPORTED if the device doesn't support analog input or if the value of {ch} is not valid for the device.

Example "AI{0}:INPUTS=PROG%VOLTS,TEMP"

MAXCOUNT

- Get the maximum count of the device's A/D converter.

  Message "@AI:MAXCOUNT"

  Response

  implementation FIXED%, or not specified if value is NOT_SUPPORTED

  value The maximum count of the A/D converter, or returns NOT_SUPPORTED if the device doesn't support analog input.

  Example "AI:MAXCOUNT=FIXED%65535"

MAXRATE

- Get the maximum rate for software paced analog input operations.

  Message "@AI:MAXRATE"

  Response "AI:MAXRATE=*implementation*>*value*"

RANGES

- Get the analog input ranges that are supported by the device.

  Message "@AI:RANGES"

  "@AI{ch}:RANGES"

  Response "AI{ch}:RANGES=*implementation*>*value*"

  ch Channel number (if {*ch*} format is used).

  implementation FIXED%, PROG% (programmable), or HWSEL% (hardware selectable), or not specified if value is NOT_SUPPORTED

  value A list of all valid ranges for the specified channel (using the {*ch*} format) or device, or returns NOT_SUPPORTED if the device doesn't support analog input, or the value of {ch} is not valid for the device.

  Example "AI{0}:RANGES=PROG%BIP10V,BIP5V"

  Note On some devices, the values returned may be dependent on channel configuration settings.
  Some devices require the {*ch*} format.

SELFCAL

- Get a value indicating if the the device supports self-calibration for analog inputs.

  Message "@AI:SELFCAL"

  Response "AI:SELFCAL=<*implementation*>*value*"

implementation	PROG% (programmable), or not specified if value is NOT_SUPPORTED
value	SUPPORTED, NOT_SUPPORTED

  Example "AI:SELFCAL=PROG%SUPPORTED"

SENSORS

- Get the analog input sensor types that are supported by the device or specified channel.

  Message "@AI:SENSORS"

  "@AI{ch}:SENSORS"

  Response "AI{ch}:SENSORS=*implementation*>*value*"

ch	Channel number (if {ch} format is used).
implementation	FIXED%, PROG% (programmable), HWSEL% (hardware selectable), or not specified if value is NOT_SUPPORTED
value	TC, RTD, THERM (thermistor), or SEMI (semiconductor), or returns NOT_SUPPORTED if the device doesn't support analog input sensors or the value of {ch} is not valid for the device.

  Example "AI{0}:SENSORS=FIXED%TC"

SENSORCONFIG

- Get the analog sensor configurations that are supported by the specified channel.

  Message "@AI{ch}:SENSORCONFIG"

  Response "AI{ch}:SENSORCONFIG=*implementation*>*value*"

ch	Channel number.
implementation	FIXED%, PROG% (programmable), HWSEL% (hardware selectable), or not specified if value is NOT_SUPPORTED
value	2WIRE, 3WIRE, 4WIRE, FULLBRG, HALFBRG, QTRBRG, or returns NOT_SUPPORTED if the device doesn't support configuration of sensors or the value of {ch} is not valid for the device.

  Example "AI{0}:SENSORCONFIG=PROG%2WIRE,3WIRE,4WIRE"

TCTYPES

- Get the thermocouple sensor types that are supported by the device or specified channel.

  Message "@AI:TCTYPES"

  "@AI{ch}:TCTYPES"

  Response "AI{ch}:TCTYPES=*implementation*>*value*"

ch	Channel number (if {ch} format is used).
implementation	FIXED%, PROG% (programmable), HWSEL% (hardware selectable), or not specified if value is NOT_SUPPORTED
value	B, E, J, K, N, R, S, T, or returns NOT_SUPPORTED if the device doesn't support thermocouples or the value of {ch} is not valid for the device.

  Example "AI{0}:TCTYPES=PROG%B,E,J,K,N,R,S,T"

AISCAN

Get the analog input scan properties of a device.

Properties

EXTPACER, FIFOSIZE, MAXBURSTRATE, MAXBURSTTHRUPUT, MAXSCANRATE, MAXSCANTHRUPUT, MINSCANRATE, MINBURSTRATE, QUEUECONFIG, QUEUELEN, QUEUESEQ, TRIG, XFRMODES, XFRSIZE

EXTPACER

- Get a value indicating which A/D pacing sources are supported by the device.

  Message "@AISCAN:EXTPACER"

  Response "AISCAN:EXTPACER=*implementation*>*value*"

implementation	FIXED%, PROG% (programmable), HWSEL% (hardware selectable), or not specified if value is NOT_SUPPORTED.
value	DISABLE, ENABLE/MASTER, ENABLE/SLAVE, ENABLE/GSLAVE, or returns NOT_SUPPORTED if the device doesn't support pacing analog input externally.

  Example "AISCAN:EXTPACER=PROG%DISABLE, ENABLE/MASTER, ENABLE/SLAVE"

FIFOSIZE

- Get the size in bytes of the device's FIFO.

  Message "@AISCAN:FIFOSIZE"

  Response "AISCAN:FIFOSIZE=*implementation*>*value*"

implementation	FIXED%
value	The size, in bytes, of the device's analog input FIFO or returns NOT_SUPPORTED if the device doesn't support analog input scan.

  Example "AISCAN:FIFOSIZE=FIXED%4096"

MAXBURSTRATE

- Get the maximum hardware-paced input scan rate for BURSTIO mode operations.

  Message "@AISCAN:MAXBURSTRATE"

  Response "AISCAN:MAXBURSTRATE=*implementation*>*value*"

  implementation FIXED%, or not specified if value is NOT_SUPPORTED

  value The maximum scan rate for BURSTIO mode operations or returns NOT_SUPPORTED if the device doesn't support analog input BURSTIO operations.

  Example "AISCAN:MAXBURSTRATE=FIXED%200000"

MAXBURSTTHRUPUT

- Get the maximum analog input throughput for BURSTIO mode operations.

  Message "@AISCAN:MAXBURSTTHRUPUT"

  Response "AISCAN:MAXBURSTTHRUPUT=*implementation*>*value*"

  implementation FIXED%, or not specified if value is NOT_SUPPORTED

  value The maximum analog input throughput for BURSTIO operations, or returns NOT_SUPPORTED if the device doesn't support analog input BURSTIO operations.

  Example "AISCAN:MAXBURSTTHRUPUT=FIXED%2000"

MAXSCANRATE

- Get the maximum hardware-paced input scan rate in samples per second.

  Message "@AISCAN:MAXSCANRATE"

  Response "AISCAN:MAXSCANRATE=*implementation*>*value*"

  implementation FIXED%, or not specified if value is NOT_SUPPORTED

  value The maximum input scan rate, or returns NOT_SUPPORTED if the device doesn't support analog input scan.

  Example "AISCAN:MAXSCANRATE=FIXED%1000"

MAXSCANTHRUPUT

- Get the maximum analog input throughput in samples per second.

  Message "@AISCAN:MAXSCANTHRUPUT"

  Response "AISCAN:MAXSCANTHRUPUT=*implementation*>*value*"

  implementation FIXED%, or not specified if value is NOT_SUPPORTED

  value The maximum throughput rate, or returns NOT_SUPPORTED if the device doesn't support analog input scan

  Example "AISCAN:MAXSCANTHRUPUT=FIXED%200000"

MINBURSTRATE

- Get the minimum hardware-paced input scan rate for BURSTIO mode operations.

  Message "@AISCAN:MINBURSTRATE"

  Response "AISCAN:MINBURSTRATE=*implementation*>*value*"

  implementation FIXED%, or not specified if value is NOT_SUPPORTED

  value The minimum scan rate for BURSTIO mode operations, or returns NOT_SUPPORTED if the device doesn't support analog input BURSTIO operations.

  Example "AISCAN:MINBURSTRATE=FIXED%20"

MINSCANRATE

- Get the minimum hardware-paced input scan rate in samples per second.

  Message "@AISCAN:MINSCANRATE"

  Response "AISCAN:MINSCANRATE=*implementation*>*value*"

  implementation FIXED%, or not specified if value is NOT_SUPPORTED

  value The minimum input scan rate, or returns NOT_SUPPORTED if the device doesn't support analog input scan.

  Example "AISCAN:MINSCANRATE=FIXED%0.569"

QUEUECONFIG

- Get a value indicating which properties can be programmed using the AIQUEUE component.

  Message "@AISCAN:QUEUECONFIG"

  Response "AISCAN:QUEUECONFIG=<*implementation*>*value*"

  implementation PROG%, or not specified if value is NOT_SUPPORTED

  value CHAN, CHMODE, RANGE, DATARATE, or NOT_SUPPORTED.

  Example "AISCAN:QUEUECONFIG=PROG% CHAN, CHMODE, RANGE"

QUEUELEN

- Determine the device's analog input queue storage capabilities.

  Message "@AISCAN:QUEUELEN"

  Response "AISCAN:QUEUELEN=*implementation*>*value*"

  implementation FIXED%, PROG%, or not specified if value is NOT_SUPPORTED

  value The maximum number of elements that can be stored in the queue, or returns NOT_SUPPORTED if the device doesn't support analog input queue.

  Example "AISCAN:QUEUELEN=8"

QUEUESEQ

- Get the channel sequence format for the device's analog input channel queue.

  Message "@AISCAN:QUEUESEQ"

  Response "AISCAN:PROG%QUEUESEQ=*implementation*>*value*"

  implementation FIXED%, PROG%, or not specified if value is NOT_SUPPORTED

  value The channel format capability for the channel queue. Possible values: SEQUENTIAL, DUPLICATE, or returns NOT_SUPPORTED if the device doesn't support analog input queue.

  Example "AISCAN: QUEUESEQ=FIXED%DUPLICATE"

  Note Queue sequence format limitations:
  - *None* – any channel in any element can be in the sequence.
  - *Duplicate* – a channel may appear twice in the sequence. For example, a sequence of 2,3,3,4 is valid.
  - *Sequential* with no duplicates – a channel may only appear once in the sequence. For example, sequences of 2,3,3,4 or 2,3,5 are not valid.

TRIG

- Get a value indicating whether the device supports external triggering of analog input channels.

  Message "@AISCAN:TRIG"

  Response "AISCAN:TRIG=*implementation*>*value*"

  implementation PROG%, HWSEL% (hardware selectable), or not specified if value is NOT_SUPPORTED.

  value ENABLE, DISABLE, or returns NOT_SUPPORTED if the device doesn't support triggering analog input externally.

  Example "AISCAN:EXTTRIG=PROG%ENABLE, DISABLE"

XFRMODES

- Get the input transfer modes supported by a device.

  Message "@AISCAN:XFRMODES"

  Response "AISCAN:XFRMODES=*implementation*>*value*"

  implementation FIXED%, PROG% (programmable), or not specified if value is NOT_SUPPORTED.

  value BLOCKIO, SINGLEIO, BURSTAD, BURSTIO, or returns NOT_SUPPORTED if the device doesn't support transfer modes.

  Example "AISCAN:XFRMODES=PROG%BLOCKIO,SINGLEIO,BURSTIO"

XFRSIZE

- Get the number of bytes used in the transfer of each data sample.

  Message "@AISCAN:XFRSIZE"

  Response "AISCAN:XFRSIZE=<*implementation*>*value*"

  implementation FIXED%, or not specified if *value* is NOT_SUPPORTED

  value The number of bytes, or NOT_SUPPORTED

  Example "AISCAN:XFRSIZE=FIXED%2"

AITRIG

Get the analog input trigger properties of a device.

Properties

RANGES, REARM, SRCS, TYPES

RANGES

- Get the supported ranges for a device's analog input trigger circuit.

  Message "@AITRIG:RANGES"

  Response "AITRIG:RANGES=*implementation*>*value*"

  implementation FIXED%, PROG% (programmable), HWSEL% (hardware selectable), or not specified if value is NOT_SUPPORTED

  value A list of all valid ranges for the specified analog trigger source or device, or returns NOT_SUPPORTED if the device doesn't support analog triggering of analog input or the trigger source is not valid for the device.

  Example "AITRIG:RANGES=PROG%BIP10V,BIP5V"

  Note On some devices, the values returned may be dependent on channel configuration settings.

REARM

- Get a value indicating whether the device supports continuous triggering of the analog input.

  Message "@AITRIG:REARM"

  Response "AITRIG:REARM=*implementation*>*value*"

  implementation FIXED%, PROG%, or not specified if value is NOT_SUPPORTED

  value ENABLE, DISABLE, or returns NOT_SUPPORTED if the device doesn't support continuous triggering of analog input.

  Example "AITRIG:REARM=PROG%ENABLE,DISABLE"

SRCS

- Set the edge trigger type.

  Message "@AITRIG:SRCS"

  Response "AITRIG:SRCS=*implementation*>*value*"

  implementation FIXED%, PROG% (programmable), HWSEL% (hardware selectable), or not specified if value is NOT_SUPPORTED

  value HW/DIG, HW/ANLG, or returns NOT_SUPPORTED if the device doesn't support triggering analog input scans.

  Example "AITRIG:SRCS=PROG%HW/DIG,HW/ANLG"

TYPES

- Get the types of trigger sensing that are supported by the device.

  Message "@AITRIG:TYPES"

  Response "AITRIG:TYPES=*implementation*>*value*"

  implementation FIXED%, PROG% (programmable), HWSEL% (hardware selectable), or not specified if value is NOT_SUPPORTED

  value <type>/<condition> or returns NOT_SUPPORTED if the device doesn't support triggering analog input scans.

  type EDGE, LEVEL

  condition RISING, FALLING, if type is EDGE.
  HIGH, LOW if type is LEVEL.

  Example "AITRIG:TYPES=PROG%EDGE/RISING,EDGE/FALLING"

AO

Gets the analog output properties of a device.

Properties

CHANNELS, FACCAL, MAXCOUNT, MAXRATE, OUTPUTS, RANGES, SELFCAL

CHANNELS

- Get the number of analog output channels on a device.

  Message "@AO:CHANNELS"

  Response "AO:CHANNELS=<*implementation*>*value*"

  implementation FIXED%, PROG%, or not specified if value is NOT_SUPPORTED

  value The number of D/A channels on a device, or returns NOT_SUPPORTED if the device doesn’t support analog output.

  Example "AO:CHANNELS=FIXED%4"

FACCAL

- Get a value indicating if the device supports factory calibration for analog outputs.

  Message "@AO:FACCAL"

  Response "AO:FACCAL=<*implementation*>*value*"

  implementation FIXED%, or not specified if value is NOT_SUPPORTED

  value NOT_SUPPORTED or SUPPORTED

  Example "AO:FACCAL=FIXED%SUPPORTED"

MAXCOUNT

- Get the maximum count of the device's D/A converter.

  Message "@AO:MAXCOUNT"

  Response "AO:MAXCOUNT=<*implementation*>*value*"

  implementation FIXED%, or not specified if value is NOT_SUPPORTED

  value The maximum count of the D/A converter or returns NOT_SUPPORTED if the device doesn't support analog output.

  Example "AO:MAXCOUNT=FIXED%65535"

MAXRATE

- Get the maximum rate for software paced analog output operations.

  Message "@AO:MAXRATE"

  Response "AO:MAXRATE=<*implementation*>*value*"

  implementation FIXED%, or not specified if value is NOT_SUPPORTED

  value The maximum output rate of the device, or returns NOT_SUPPORTED if the device doesn't support analog output.

  Example "AO:MAXRATE=FIXED%100"

  Note The maximum rate is based on the device's ability to perform single-point I/O.

OUTPUTS

- Get the analog output signal types that are supported by the device or specified channel.

  Message "@AO:OUTPUTS"

  "@AO{ch}:OUTPUTS"

  Response "AO{ch}:OUTPUTS=<*implementation*>*value*"

  ch Channel number (if {ch} format is used).

  implementation FIXED%, PROG% (programmable), HWSEL% (hardware selectable), or not specified if value is NOT_SUPPORTED

  value VOLTS, CUR, or returns NOT_SUPPORTED if the device doesn't support analog output or the value of {ch} is not valid for the device.

Example "AO{0}:OUTPUTS=PROG%VOLTS,CUR"

RANGES

- Get the analog output ranges supported by a device.

  Message "@AO:RANGES"

  "@AO{ch}:RANGES"

  Response " AO{ch}: RANGES=<*implementation*>*value* "

  implementation FIXED%, PROG%, or not specified if value is NOT_SUPPORTED

  value The AO ranges supported by a device, or returns NOT_SUPPORTED if the device doesn't support analog output or the value of {ch} isn't valid for the device.

  Example " AO:RANGES=FIXED%BIP10V"

SELFCAL

- Get a value indicating if the device supports self-calibration for analog outputs.

  Message "@AO:SELFCAL"

  Response "AO:SELFCAL=<*implementation*>*value*"

  implementation PROG% (programmable), or not specified if value is NOT_SUPPORTED

  value SUPPORTED, NOT_SUPPORTED

  Example "AO:SELFCAL=PROG%SUPPORTED"

AOSCAN

Gets the analog output scan properties of a device.

Properties

ADCLKTRIG, EXTPACER, FIFOSIZE, MAXSCANRATE, MAXSCANTHRUPUT, MINSCANRATE, SIMUL, TRIG, XFRSIZE

ADCLKTRIG

- Get a value indicating whether analog output channels can be triggered by the device's A/D clock.

  Message "@AOSCAN:ADCLKTRIG"

  Response "AOSCAN:ADCLKTRIG=<*implementation*>*value*"

  implementation FIXED%, PROG% (programmable), or not specified if value is NOT_SUPPORTED

  value ENABLE , DISABLE or returns NOT_SUPPORTED if the device doesn't support pacing analog output scan from the A/D pacer.

  Example "AOSCAN:ADCLKTRIG=PROG%ENABLE, DISABLE"

EXTPACER

- Get a value indicating which D/A pacing sources are supported by the device.

  Message "@AOSCAN:EXTPACER"

  Response "AOSCAN: EXTPACER=<*implementation*>*value*"

  implementation FIXED%, PROG% (programmable), HWSEL% (hardware selectable), or not specified if value is NOT_SUPPORTED

  value DISABLE, ENABLE/MASTER, ENABLE/SLAVE, ENABLE/GSLAVE or returns NOT_SUPPORTED if the device doesn't support pacing analog input externally.

  Example "AOSCAN: EXTPACER=PROG%ENABLE/MASTER"

FIFOSIZE

- Get the size in bytes of the device's analog output FIFO.

  Message "@AOSCAN:FIFOSIZE"

  Response "AOSCAN: FIFOSIZE=<*implementation*>*value*"

  implementation FIXED%, or not specified if value is NOT_SUPPORTED

  value The size, in bytes, of the device's analog output FIFO, or returns NOT_SUPPORTED if the device doesn't support buffering of the analog output.

  Example "AOSCAN:FIFOSIZE=FIXED%4096"

MAXSCANRATE

- Get the maximum hardware-paced output scan rate in samples per second.

  Message "@AOSCAN:MAXSCANRATE"

  Response "AOSCAN:MAXSCANRATE=<*implementation*>*value*"

  implementation FIXED%, or not specified if value is NOT_SUPPORTED

  value The maximum output scan rate, or returns NOT_SUPPORTED if the device doesn't support analog output scan.

  Example "AOSCAN:MAXSCANRATE=FIXED%1000"

MAXSCANTHRUPUT

- Get the maximum analog output throughput in samples per second.

  Message "@AOSCAN:MAXSCANTHRUPUT"

  Response "AOSCAN: MAXSCANTHRUPUT=<*implementation*>*value*"

  implementation FIXED%, or not specified if value is NOT_SUPPORTED

  value The maximum throughput rate, or returns NOT_SUPPORTED if the device doesn't support analog output scan.

  Example "AOSCAN: MAXSCANTHRUPUT=FIXED%200000"

MINSCANRATE

- Get the minimum hardware-paced output scan rate in samples per second.

  Message "@AOSCAN:MINSCANRATE"

  Response "AOSCAN:MINSCANRATE=<*implementation*>*value*"

  implementation FIXED%, or not specified if value is NOT_SUPPORTED

  value The minimum output scan rate, or returns NOT_SUPPORTED if the device doesn't support analog output scan.

  Example "AOSCAN:MINSCANRATE=FIXED%1"

SIMUL

- Get a value indicating whether analog output channels can be updated simultaneously.

  Message "@AOSCAN:SIMUL"

  Response "AOSCAN:SIMUL=<*implementation*>*value*"

  implementation FIXED%, PROG% (programmable), or not specified if value is NOT_SUPPORTED

  value PROG%ENABLE , DISABLE or returns NOT_SUPPORTED if the device doesn't support simultaneous update of the analog output.

  Example "AOSCAN:SIMUL=PROG%ENABLE, DISABLE"

TRIG

- Get a value indicating whether analog output channels can be externally triggered.

  Message "@AOSCAN: TRIG"

  Response "AOSCAN: TRIG=<*implementation*>*value*"

  implementation FIXED%, PROG% (programmable), or not specified if value is NOT_SUPPORTED

  value ENABLE, DISABLE, or returns NOT_SUPPORTED if the device doesn't support triggering analog output scan.

  Example "AOSCAN: TRIG=PROG%ENABLE,DISABLE"

XFRSIZE

- Get the number of bytes used in the transfer of each data sample.

  Message "@AOSCAN:XFRSIZE"

  Response " AOSCAN:XFRSIZE=<*implementation*>*value*"

  implementation FIXED%, or not specified if *value* is NOT_SUPPORTED

  value The number of bytes, or NOT_SUPPORTED

  Example " AOSCAN:XFRSIZE=FIXED%2"

CTR

Gets the counter channel properties of a device.

Properties

CHANNELS, EDGE, LDMAX, LDMIN, MAXCOUNT, TYPE

CHANNELS

- Get the number of counter channels on a device.

  Message "@CTR:CHANNELS"

  Response "CTR:CHANNELS=<*implementation*>*value*"

implementation	FIXED%, or not specified if value is NOT_SUPPORTED
Value	The number of counter channels on a device, or returns NOT_SUPPORTED if the device has no counters.

  Example "CTR:CHANNELS=FIXED%3"

EDGE

- Get a value indicating whether a counter's edge detection is programmable.

  Message "@CTR{ch}:EDGE"

  Response "CTR{ch}:EDGE=<*implementation*><*value*>"

ch	The counter number.
implementation	FIXED%, PROG% (programmable), HWSEL% (hardware selectable) , or not specified if value is NOT_SUPPORTED.
value	RISING, FALLING, or returns NOT_SUPPORTED if the device has no counters.

  Example "CTR{0}:EDGE=PROG%RISING,FALLING"

LDMAX

- Get the maximum count value that can be set using the "CTR{ch}:VALUE=" message.

  Message "@CTR{ch}:LDMAX"

  Response "CTR{ch}:LDMAX=<*implementation*>*value*"

ch	The number of the counter channel.
implementation	FIXED%, or not specified if value is NOT_SUPPORTED
value	The maximum count that can be used for the VALUE property, or NOT_SUPPORTED.

  Example "CTR{0}:LDMAX=FIXED%65535"

LDMIN

- Get the minimum count value that can be set using the "CTR{ch}:VALUE=" message.

  Message "@CTR{ch}:LDMIN"

  Response "CTR{ch}:LDMIN=<*implementation*>*value*"

ch	The number of the counter channel.
implementation	FIXED%, or not specified if value is NOT_SUPPORTED
value	The minimum count that can be used for the VALUE property, or NOT_SUPPORTED.

  Example "CTR{0}:LDMIN=FIXED%0"

MAXCOUNT

- Get the maximum count of the specified counter.

  Message "@CTR{ch}:MAXCOUNT"

  Response "CTR{ch}:MAXCOUNT=<*implementation*>*value*"

ch	The number of the counter channel.
implementation	FIXED%, or not specified if value is NOT_SUPPORTED
value	The maximum count of the counter, or returns NOT_SUPPORTED if the device has no counters.

  Example "CTR{0}:MAXCOUNT=FIXED%65535"

TYPE

- Get the counter type.

  Message "@CTR{ch}:TYPE"

  Response "CTR{ch}:TYPE=<*implementation*>*value*"

ch	The counter number.
implementation	FIXED%, or not specified if value is NOT_SUPPORTED
value	8254, 9513, EVENT, or returns NOT_SUPPORTED if the device has no counters.

  Example "CTR{0}:TYPE=FIXED%EVENT"

DIO

Gets the digital I/O properties of a device.

Properties

CHANNELS, CONFIG, LATCH, MAXCOUNT

CHANNELS

- Get the number of digital channels (ports) on a device.

  Message "@DIO:CHANNELS"

  Response "DIO:CHANNELS=<*implementation*>*value*"

implementation	FIXED%, or not specified if value is NOT_SUPPORTED
value	The number of digital channels (ports) on a device, or returns NOT_SUPPORTED if the device has no digital channels.

  Example "DIO:CHANNELS=FIXED%3"

CONFIG

- Get the options supported by a specified port in which no configuration is required.

  Message "@DIO{ch}:CONFIG"

  Response "DIO{ch}:CONFIG=<*implementation*>*value*"

ch	The digital port number.
implementation	PROG% (programmable), AUTO%, or not specified if *value* is NOT_SUPPORTED
value	BITIN, BITOUT, PORTIN, PORTOUT, or returns NOT_SUPPORTED if the device has no digital channels.

  Example "DIO{0}: CONFIG= AUTO%BITIN,BITOUT,PORTIN,PORTOUT"

LATCH

- Get a value indicating whether the latch associated with a specified port has read and/or write access.

  Message "@DIO{ch}:LATCH"

  Response "DIO{ch}:LATCH=<*implementation*>*value*"

ch	The digital port number.
implementation	PROG% (programmable), or not specified if *value* is NOT_SUPPORTED
value	READ, WRITE, or returns NOT_SUPPORTED if the device has no digital channels.

  Example "DIO{0}:LATCH=PROG%READ,WRITE"

MAXCOUNT

- Get the maximum count of the specified port.

  Message "@DIO{ch}:MAXCOUNT"

  Response "DIO{ch}:MAXCOUNT=<*implementation*>*value*"

ch	The digital port number.
implementation	FIXED%, or not specified if *value* is NOT_SUPPORTED
value	The maximum count of the digital port, or returns NOT_SUPPORTED if the device has no digital channels.

  Example "DIO{0}:MAXCOUNT=FIXED%65535"

TMR

Gets the timer output properties of a device.

Refer to the device-specific information in the *Hardware Reference* section for the component properties and commands supported by each DAQ device.

Properties

BASEFREQ, CHANNELS, CLKSRC, DELAY, DUTYCYCLE, MAXCOUNT, TYPE

BASEFREQ

- Get the specified timer's internal base frequency in Hertz.

  Message "@TMR{ch}:BASEFREQ"

  Response "TMR{ch}:BASEFREQ=<*implementation*>*value*"

ch	The number of the timer channel.
implementation	FIXED%, or not specified if value is NOT_SUPPORTED
value	The internal clock's base frequency, or returns NOT_SUPPORTED if the device has no timer channels.

  Example "TMR{0}:BASEFREQ=FIXED%64000000

CHANNELS

- Get the number of timer output channels on a device.

  Message "@TMR:CHANNELS"

  Response "TMR:CHANNELS=<*implementation*>*value*"

implementation	FIXED%, or not specified if value is NOT_SUPPORTED
value	The number of timer output channels, or returns NOT_SUPPORTED if the device has no timer outputs.

  Example "TMR:CHANNELS=FIXED%2"

CLKSRC

- Get the clock source for the specified timer channel.

  Message "@TMR{ch}:CLKSRC"

  Response "TMR:CLKSRC=<*implementation*>*value*"

ch	The number of the timer channel, or returns NOT_SUPPORTED if the device has no timer channels.
implementation	FIXED%, PROG% (programmable), HWSEL% (hardware selectable), or not specified if value is NOT_SUPPORTED
value	INT, EXT, or returns NOT_SUPPORTED if the device has no timer channels.

  Example "TMR{0}:CLKSRC=PROG%INT,EXT"

DELAY

- Get a value indicating how the specified timer's delay option is implemented.

  Message "@TMR{ch}:DELAY"

  Response "TMR{ch}:DELAY=<*implementation*>*value*"

ch	The number of the timer channel.
implementation	PROG% (programmable), or not specified if value is NOT_SUPPORTED
value	PULSES, or returns NOT_SUPPORTED if the device has no timer channels.

  Example "TMR{0}:DELAY=PROG%PULSES"

DUTYCYCLE

- Get a value indicating how the duty cycle is supported for the specified counter.

  Message "@TMR{ch}:DUTYCYCLE"

  Response "TMR{ch}:DUTYCYCLE=<*implementation*>*value*"

ch	The number of the timer channel.
implementation	PROG% (programmable), or not specified if value is NOT_SUPPORTED
value	PRCNTHIGH, PRCNTLOW, or returns NOT_SUPPORTED if the device has no timer channels.

  Example "TMR{0}:DUTYCYCLE=PROG%PRCNTHIGH"

MAXCOUNT

- Get the maximum count of a specified timer channel.

  Message "@TMR{ch}:MAXCOUNT"

  Response "TMR{ch}:MAXCOUNT=<*implementation*>*value*"

ch	The number of the timer channel.
implementation	FIXED%, or not specified if value is NOT_SUPPORTED
value	The maximum count of the timer, or returns NOT_SUPPORTED if the device has no timer channels.

  Example "TMR{0}:MAXCOUNT=FIXED%4294967295"

TYPE

- Get the type of timer for the specified timer channel.

  Message "@TMR{ch}:TYPE"

  Response "TMR{ch}:TYPE=<*implementation*>*value*"

ch	The number of the timer channel.
implementation	FIXED%, or not specified if value is NOT_SUPPORTED
value	PULSE, NOT_SUPPORTED

  Example "TMR{0}:TYPE=FIXRD%PULSE"

FlexTest Utility

FlexTest is an interactive GUI-based test utility that demonstrates how to communicate with a device using the DAQFlex communication protocol and software.

This utility automatically recognizes an available DAQFlex device, shows all commands available for this device, and allows users to interact with the device one command at a time. During this interaction, the commands are captured in a log, allowing the user to cut and paste them directly into a program.

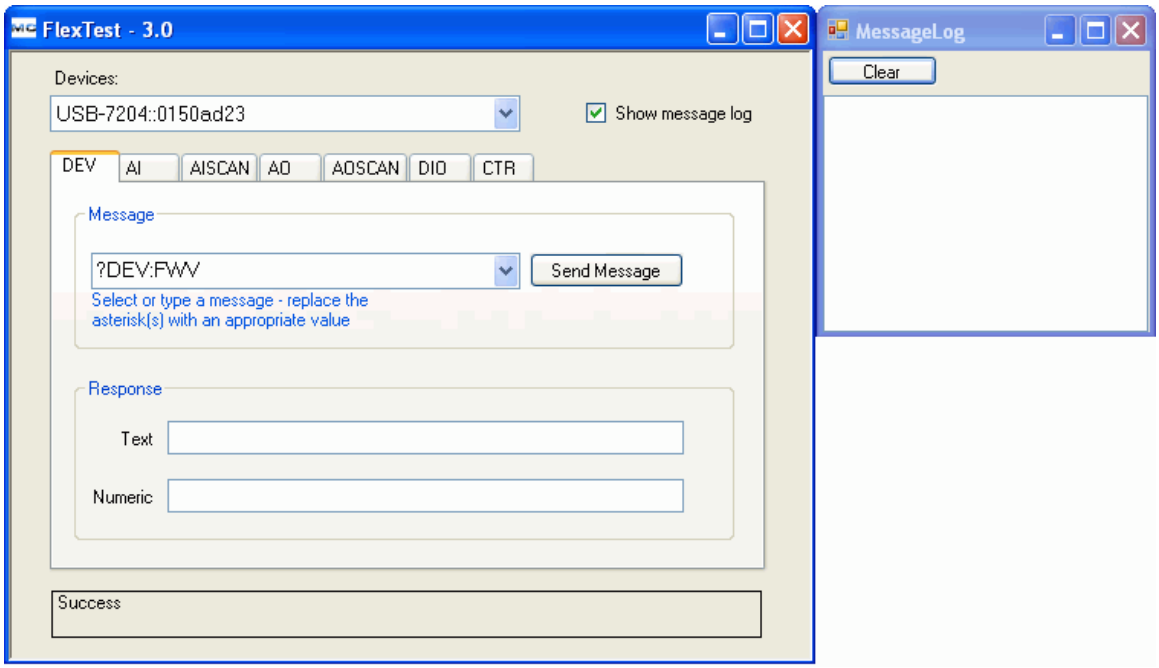
FlexTest is included on the driver CD, and is installed to the following location:

- Windows 7 and Windows Vista — `C:\Users\Public Documents\Measurement Computing\DAQFlex For Windows\FlexTest.exe`.
- Windows XP, FlexTest — `C:\Program Files\Measurement Computing\DAQFlex For Windows\FlexTest.exe`.
- Windows CE — `C:/Program Files/Measurement Computing/DAQFlex For Windows CE/FlexTest.exe`.
- MAC OS X — FlexTest is installed to the `/Applications` folder.
- Linux — FlexTest is extracted to the directory in which the compressed files were extracted.

  To run FlexTest on Linux, do the following:
  - In a terminal window, set the current directory to DAQFlex/Source/DAQFlexTest.
  - As a root user, run the commands $ make and $ make install.
  - From a terminal window, run the FlexTest application using the command $ flextest

Note: Connect a device that supports the DAQFlex protocol before running FlexTest.

When you run FlexTest, the main **FlexTest** window and a **MessageLog** window open:



FlexTest user interface

The FlexTest window features the following controls:

- **Devices** drop-down list: displays the name and serial number of each connected DAQFlex-supported device.
- **Show message log** check box: When checked, the text of each message sent to the device appears in the **MessageLog** window.
- **Component** tabs: the DAQ components that are supported by the DAQFlex-supported device.
- **Message** field and drop down list: displays the text messages that can be sent to the device. The messages are specific to the component selected. An asterisk in the message indicates a variable whose property value must be entered.

  Refer to the DAQFlex Message Reference chapter for more information about the API messages.
- **Send Message** button: click this button to send the selected message to the device.
- **Response** field: Displays the response to the message that is returned from the device.
  - Text messages display in a *Text* field.
  - When a number is returned from the device, for example when reading the value of an analog input channel, the value displays in a *Numeric* field.
  - When multiple values are returned, such as when scanning data, the values display below the message that is returned.
- **Show message log** check box: When checked, the text of each message sent to the device appears in the MessageLog window.
- **Status area**: The bottom of the window displays either a status message or scan count:
  - *Message status*: When a message is successfully sent to a device, "Success" appears in the status area. If a message cannot be sent, such as when a variable is either not set or is set to an unsupported value, an error message appears in the status area.
  - *Scan count*: during a scan operation, the status area updates with the number of samples that are read.

Messagelog window

The **MessageLog** window lists each message that is sent to the device. Note that the **Show message log** checkbox on the FlexTest window must be checked in order to display messages on the Messagelog window.

Click the **Clear** button to remove the messages.

Using FlexTest

The procedures below demonstrate how to read/display scan data, and how to calibrate a device with FlexTest.

Read and display scan data

The following exercise demonstrates how to read and display multiple channel scan data using FlexTest. For this exercise, you set the range of analog channels to scan (1 to 3), set the channel range to ±10 volts, the sample rate to 1000 Hz, and the number of samples to 256. After configuring the scan parameters, you run the operation and view the resulting scan data.
Do the following:

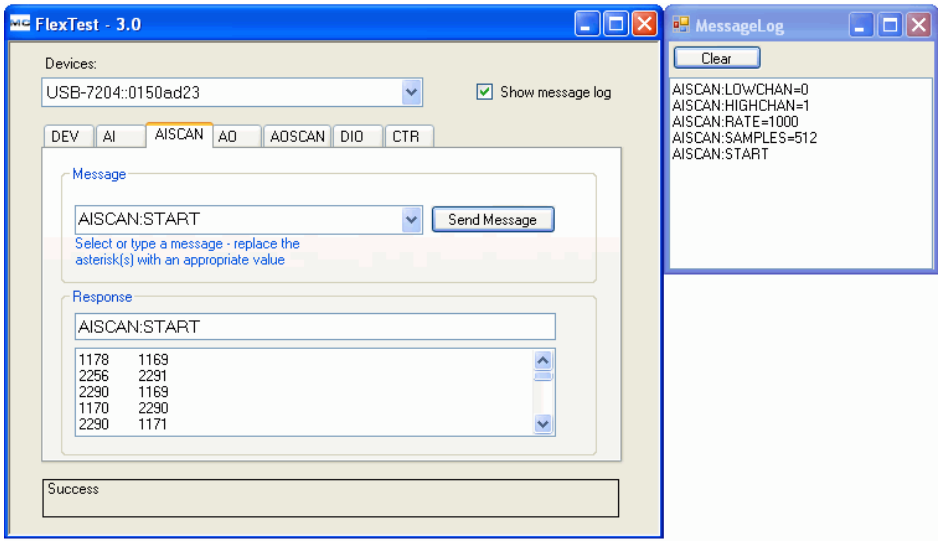
1. Connect a device that supports the DAQFlex protocol to your system and run FlexTest.
2. Click on the **AISCAN** tab.
3. Configure the scan parameters using the text strings in the **Message** drop down list:
   - Select **AISCAN:LOWCHAN=***. Highlight the asterisk and enter "0", then click **Send Message**.
   - Select **AISCAN:HIGHCHAN=***. Highlight the asterisk and enter "1", then click **Send Message**.
   - Select **AISCAN:RANGE=***. Highlight the asterisk and enter "BIP10V", then click **Send Message**.

This field is *not* case-sensitive.

- Select **AISCAN:RATE=***. Highlight the asterisk and enter "1000", then click **Send Message**.
- Select **AISCAN:SAMPLES=***. Highlight the asterisk and enter "512", then click **Send Message**.

4. Start the scan operation: Select **AISCAN:START** and click **Send Message**.

The FlexTest window displays the scan data in the Response area, and the MessageLog window lists the messages sent to the device.



Notes

- String data entered into the Message field is not case sensitive.
- Messages that begin with "?" are query messages. Select a query to read a value.

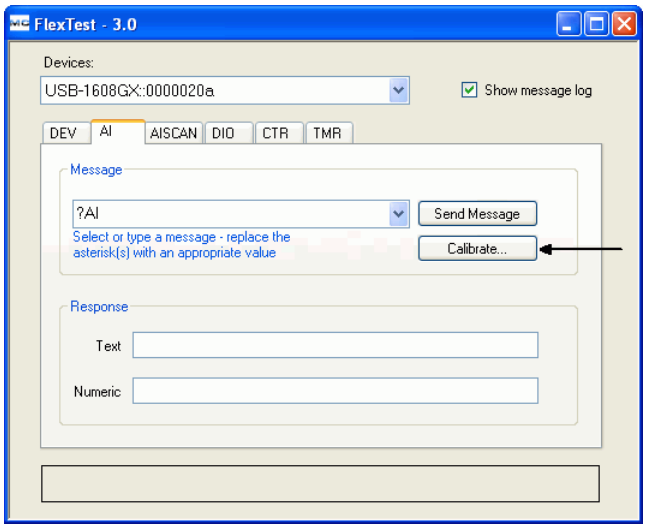
Calibrate a device

For devices that support self-calibration, FlexText displays a **Calibrate** button on the AI tab to calibrate analog inputs. For devices with analog outputs FlexText displays a Calibrate button on the AO tab.

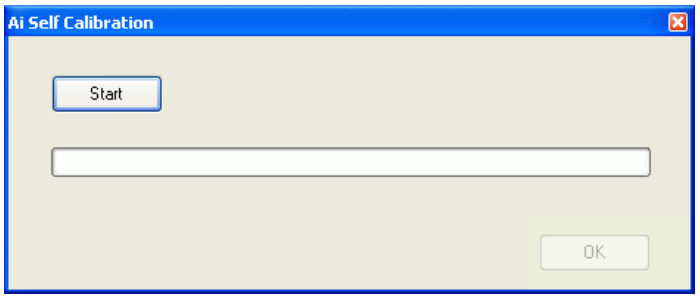
Calibrating analog inputs

To calibrate a device's analog inputs, do the following:

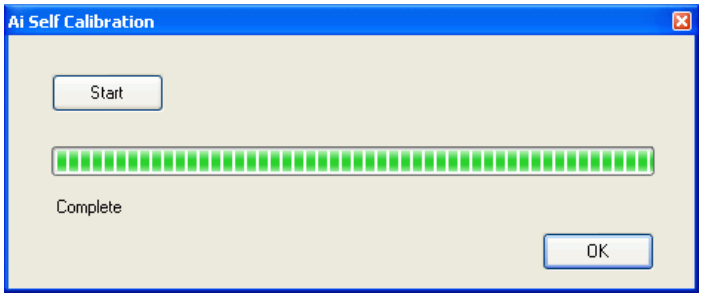
1. Select the **AI tab**.
2. Click the **Calibrate** button.



The **Ai Self Calibration** window opens.



3. Click the **Start** button to start calibrating the analog inputs.
   The progress bar updates as the operation progresses. When calibration is done the window displays **Complete**.



4. Click **OK** to close the window.

Calibrating analog outputs

To calibrate a device's analog outputs, do the following:

1. Select the **AO tab**.
2. Click the **Calibrate** button.
   The **Ao Self Calibration** window opens.
3. Click the **Start** button to start calibrating the analog outputs.
   The progress bar updates as the operation progresses. When calibration is done the window displays **Complete**.
4. Click **OK** to close the window.

DAQFlex message reference

Refer to the *DAQFlex Message Reference* chapter on page 31 for the supported DAQFlex API messages.

Note: FlexTest cannot be run at the same time as the DAQFlex Firmware Loader utility (DAQFlexFWLoader.exe).

C# and VB Example Programs

Complete C# and VB example programs are installed with DAQFlex that demonstrate how to configure DAQFlex-supported devices and perform DAQ operations with the DAQFlex Software API.

Default installation path

- On Windows, the example programs are installed by default to CSharp and VB subfolders:
  - Windows 7 and Windows Vista — `C:\Users\Public Documents\Measurement Computing\DAQFlex For Windows\Examples`.
  - Windows XP — `C:\Program Files\Measurement Computing\DAQFlex For Windows\Examples`.
  - Windows CE — `C:\Program Files\Measurement Computing\DAQFlex For Windows CE\Examples`.
- On Mac OS X, example programs are installed to `Users/Shared/Measurement Computing/DAQFlex/Examples`.
- On Linux, C# example programs are extracted to `DAQFlex/Examples/CSharp`.

Building the DAQFlex example programs

Windows 7/Vista/XP

To run the DAQFlex example programs, do the following:

1. From the Windows Start menu, select `Measurement Computing » DAQFlex » Examples » ExampleBuilder`.
2. Run the ExampleBuilder script to build all CSharp and Visual Basic examples.
3. From the Windows Start menu, select `Measurement Computing » DAQFlex » Examples » Go To Examples`.
   Windows Explorer opens to the example program directory. The example programs are installed by default to CSharp and VB subfolders.
4. Double-click on a *.csproj or *.vbproj file to run the DAQFlex example program.

Windows CE

To run the DAQFlex example programs, do the following:

1. From the Windows Start Menu, select `Measurement Computing » DAQFlex for Windows CE » Examples » Go to Examples`.
   Windows Explorer opens to the example program directory. The example programs are installed by default to CSharp and VB subfolders.
2. Double-click on a *.csproj or *.vbproj file to run the DAQFlex example program.

Mac OS X

To run the DAQFlex example programs, do the following:

1. Go to `Users/Shared/Measurement Computing/DAQFlex/Examples`.
2. Run the ExampleBuilder script to build all CSharp and Visual Basic examples.
3. From a terminal window, go to either `CSharp/<application name>/bin/Debug` or `VB/<application name>/bin/Debug`, and run the following command:
   - `mono <application name>.exe`

Linux

You run the DAQFlex C# example programs using MonoDevelop or the Mono command line interpreter. Do the following:

1. In a terminal window, set the current directory to `DAQFlex/Examples`.
2. Run the following commands as a root user:
   - `make`
   - `make install`

3. Exit the root user shell.
4. From a terminal window, run the example programs as a non-root user by entering the application name as a command, for example:
   - `ainscan`

Refer to the readme.txt file for additional information about running the DAQFlex example programs.

Hardware Reference

Select your DAQFlex-supported device below for the components and programming messages supported by the device.

Note: You can use any of the device reflection messages to retrieve information about the device's capabilities.

- USB-1608G Series
- USB-2001-TC
- USB-2408 Series
- USB-7202
- USB-7204

USB-1608G Series

The USB-1608G Series includes the following devices:

- USB-1608G
- USB-1608GX
- USB-1608GX-2AO

Use the components below to set or get device properties.

Component	Supported Property/Command	Set/Get	Supported Values
AI		Get	Number of analog input channels
	RES	Get	S24 (24-bit signed integer)
AI{ch}	CHMODE	Set/Get	SE, DIFF
	OFFSET	Get	4-byte floating point numeric
	RANGE	Set/Get	BIP10V, BIP5V, BIP2V, BIP1V
	SLOPE	Get	4-byte floating point numeric
	VALUE	Get	Unsigned integer numeric
AICAL	START		
	STATUS	Get	
AIQUEUE	CLEAR	Set	
	COUNT	Get	0 to 16 elements
AIQUEUE{element}	CHAN	Set/Get	0 to 15 single-ended, 0 to 7 differential
	CHANMODE	Set/Get	SE, DIFF
	RANGE	Set/Get	BIP10V, BIP5V, BIP2V, BIP1V

Component	Supported Property/Command	Set/Get	Supported Values
AISCAN	BURSTMODE	Set/Get	ENABLE, DISABLE
	EXTPACER	Set/Get	ENABLE, DISABLE
	HIGHCHAN	Set/Get	0 to 15 single-ended, 0 to 7 differential
	LOWCHAN	Set/Get	0 to 15 single-ended, 0 to 7 differential
	QUEUE	Set/Get	ENABLE, DISABLE, RESET
	RATE	Set/Get	USB-1608G: 0.01 to 250,000 Hz (1 channel) USB-1608GX: 0.01 to 500,000 Hz (1 channel) USB-1608GX-2AO: 0.01 to 500,000 Hz (1 channel)
	RANGE	Set/Get	BIP10V, BIP5V, BIP2V, BIP1V
	RANGE{ch}		
	RESET	Set	
	SAMPLES	Set/Get	0 to N (0 = continuous scan; N = 32-bit)
	START		
	STATUS	Get	IDLE, RUNNING, OVERRUN
	STOP		
	TRIG	Set/Get	ENABLE, DISABLE
	XFRMODE	Set/Get	BLOCKIO, SINGLEIO
AITRIG	REARM	Set/Get	ENABLE, DISABLE
	TYPE	Set/Get	EDGE/{condition}, LEVEL/{condition} condition: RISING, FALLING when TYPE is EDGE HIGH, LOW when TYPE is LEVEL
AO[1]		Get	Number of analog output channels
	RES	Get	U16 (unsigned 16-bit integer)
AO{ch}[1]	OFFSET	Get	4-byte floating point numeric
	RANGE	Get	BIP10V
	SLOPE	Get	4-byte floating point numeric
	VALUE	Set	BIP10V
AOCAL	START		
	STATUS	Get	
AOSCAN[1]	EXTPACER	Set/Get	ENABLE, DISABLE
	HIGHCHAN	Set/Get	0 to 1
	LOWCHAN	Set/Get	0 to 1
	RANGE	Get	BIP10V
	RATE	Set/Get	1 to 500 kHz (1 channel)
	SAMPLES	Set/Get	0 to N (0 = continuous scan; N = 32-bit)
	START		
	STATUS	Get	IDLE, RUNNING, UNDERRUN

Component	Supported Property/Command	Set/Get	Supported Values
	STOP		
AOTRIG	REARM	Set/Get	ENABLE, DISABLE
	TYPE	Set/Get	EDGE/RISING, EDGE/FALLING
CTR		Get	Number of counter channels
CTR{ch}	START		
	STOP		
	VALUE	Get	0 – 4,294,967,295
		Set	0
DEV	FLASHLED	Set	0 to 255
	FWV	Get	MM.mm (M = major; m = minor)
	ID	Set/Get	Up to 56 characters
	MFGCAL	Get	yyyy-mm-dd HH:MM:SS Year as yyyy; 20xx Month as mm; 01 to 12 Day as dd; 01 to 31 Hour as HH; 01 to 23 Minute as MM; 01 to 59 Second as SS; 01 to 59
	MFGSER	Get	Up to 8 numeric characters
	RESET	Set	DEFAULT
	TEMP	Get	Floating point numeric in ºC
DIO		Get	Number of digital ports
DIO{port}		Get	8
	DIR	Set/Get	IN, OUT
	LATCH	Set/Get	0 to 255
	VALUE	Set/Get	0 to 255
DIO{port/bit}	DIR	Set/Get	IN, OUT
	LATCH	Set/Get	port number: 0 bit number: 0 to 7 port value: 0 to 255 bit value: 0, 1
	VALUE	Set/Get	port number: 0 bit number: 0 to 7 port value: 0 to 255 bit value: 0, 1
TMR		Get	Number of timer channels
TMR{ch}	DELAY	Set/Get	31.25 ns to 67.11 s
	DUTYCYCLE	Set/Get	0 to 100%
	IDLESTATE	Set/Get	LOW, HIGH
	PERIOD	Set/Get	31.25 ns to 67.11 s
	PULSECOUNT	Set/Get	0 to 4294967295
	START		

Component	Supported Property/Command	Set/Get	Supported Values
	STOP		
[1] Analog output is supported on the USB-1608GX-2AO only.			

Hardware features

- 16 analog input channels, numbered 0 to 15.
- Analog input mode is configurable for single-ended (16 channels) or differential (8 channels).
  - Analog input ranges:
  - ±10V
  - ±5V
  - ±2V
  - ±1V
- 2 analog output channels, numbered 0 to 1 (USB-1608GX-2AO only)

  Analog output range is fixed at ±10V.
- 1 digital port (8 bits)

  Each bit is individually configurable as input or output.
- 1 timer output channel
- 1 external trigger input
- External pacer input/output

  This feature allows multiple devices to acquire synchronized samples.
- 1024 bytes of nonvolatile EEPROM memory; used for storing configuration information, calibration data, and user data.
- *RATE* takes a float value

  An error is generated if *value* is set is less than the device's minimum sampling rate or greater than the device's maximum sampling rate.

USB-2001-TC

Use the components below to set or get device properties.

Component	Supported Property/Command	Set/Get	Supported Values
AI	CJC/format	Get	CJC/DEGC, CJC/DEGF, CJC/KELVIN
	OFFSET	Get	Floating point numeric
	RANGE{ch}	Set/Get	BIP73.125E-3V (±0.073125 volts) BIP146.25E-3V (±0.14625 volts)
	SCALE	Set/Get	
	SENSOR	Set/Get	TC/B, TC/E, TC/J, TC/K, TC/N, TC/R, TC/S, TC/T
	SLOPE	Get	Floating point numeric
	STATUS	Get	BUSY, ERROR, READY
	VALUE	Get	Unsigned integer numeric
DEV	FLASHLED	Set	0 to 255
	FWV	Get	Firmware version
	ID	Set/Get	Up to 56 characters
	MFGCAL	Get	yyyy-mm-dd HH:MM:SS Year as yyyy; 20xx Month as mm; 01 to 12 Day as dd; 01 to 31 Hour as HH; 01 to 23 Minute as MM; 01 to 59 Second as SS; 01 to 59
	MFGSER	Get	Up to 8 numeric characters

Hardware features

- One analog input channel, numbered 0
- Supports thermocouple types B, E, J, K, N, R, S, and T
- Possible gain ranges:
  - ±146.25 mV
  - ±73.125 mV
- 512 bytes of nonvolatile FLASH program memory; used for storing configuration information, calibration data, and user data.

USB-2408 Series

The USB-2408 Series includes the following devices:

- USB-2408
- USB-2408-2AO

Use the components below to set or get device properties.

Component	Supported Property/Command	Set/Get	Supported Values
AI		Get	Number of analog input channels
	DATARATE	Set/Get	3750, 2000, 1000, 500, 100, 60, 50, 30, 25, 15, 10, 5, 2.5 (S/s)
	ADCAL/START	Set	
	ADCAL/STATUS	Get	
	RES	Get	S24 (24-bit signed integer)
AI{ch}	CHMODE	Set/Get	SE, DIFF, TC/OTD, TC/NOOTD SE is always returned for channels 8-15.
	CJC	Get	DEGC, DEGF, KELVIN
	DATARATE	Set/Get	3750, 2000, 1000, 500, 100, 60, 50, 30, 25, 15, 10, 5, 2.5 (S/s)
	OFFSET	Get	4-byte floating point numeric
	RANGE	Set/Get	BIP10V, BIP5V, BIP2.5V, BIP1.25V, BIP0.625V, BIP0.312V, BIP0.156V, BIP78.125E-3V
	SENSOR	Set/Get	TC/B, TC/E, TC/J, TC/K, TC/N, TC/R, TC/S, TC/T
	SLOPE	Get	4-byte floating point numeric
	VALUE	Get	Unsigned integer numeric
AICAL	START	Set	
	STATUS	Get	
AIQUEUE	CLEAR	Set	
	COUNT	Get	0 to 64 elements
AIQUEUE{element}	CHAN	Set/Get	element: 0 to 63 value: 0 to 15
	CHANMODE	Set/Get	element: 0 to 63 value: SE, DIFF, TC/OTD, TC/NOOTD
	DATARATE	Set/Get	3750, 2000, 1000, 500, 100, 60, 50, 30, 25, 15, 10, 5, 2.5 (S/s)
	RANGE	Set/Get	element: 0 to 63 value: BIP10V, BIP5V, BIP2.5V, BIP1.25V, BIP0.625V, BIP0.312V, BIP0.156V, BIP78.125E-3V

Component	Supported Property/Command	Set/Get	Supported Values
AISCAN	HIGHCHAN	Set/Get	0 to 15 single-ended, 0 to 7 differential
	LOWCHAN	Set/Get	0-15 single-ended, 0 to 7 differential
	QUEUE	Set/Get	ENABLE, DISABLE
	RATE	Set/Get	2.5 Hz to 1102.94 Hz (1 channel)
	RANGE	Set/Get	BIP10V, BIP5V, BIP2.5V, BIP1.25V, BIP0.625V, BIP0.312V, BIP0.156V, BIP78.125E-3V
	RANGE{ch}		
	RESET	Set	
	SAMPLES	Set/Get	0 to N (0 = continuous scan; N = 32-bit)
	START	Set	
	STATUS	Get	IDLE, RUNNING, OVERRUN
	STOP	Set	
	TEMPUNITS	Set/Get	DEGC, DEGF, KELVIN
	XFRMODE	Set/Get	BLOCKIO, SINGLEIO
AO[1]		Get	Number of analog output channels
	RES	Get	U16 (unsigned 16-bit integer)
	UPDATE		
AO{ch}[1]	OFFSET	Get	4-byte floating point numeric
	RANGE	Get	BIP10V
	REG	Set/Get	0 to 65535
	SLOPE	Get	4-byte floating point numeric
	VALUE	Set	0 to 65535
AOCAL	START	Set	
	STATUS	Get	
AOSCAN[1]	HIGHCHAN	Set/Get	0-1
	LOWCHAN	Set/Get	0-1
	RESET	Set	
	RATE	Set/Get	1 Hz to 1000 Hz (1 channel)
	SAMPLES	Set/Get	0 to N (0 = continuous scan; N = 32-bit)
	START	Set	
	STATUS	Get	IDLE, RUNNING, UNDERRUN
	STOP	Set	
CTR		Get	Number of counter channels
CTR{ch}	START	Set	
	STOP	Set	
	VALUE	Get	0 – 4,294,967,295
		Set	0

Component	Supported Property/Command	Set/Get	Supported Values
DEV	FLASHLED	Set	0 to 255
	FWV	Get	Firmware version of the device MM.mm (M = major; m = minor)
	ID	Set/Get	Up to 57 characters
	MFGCAL	Get	yyyy-mm-dd HH:MM:SS Year as yyyy; 20xx Month as mm; 01 to 12 Day as dd; 01 to 31 Hour as HH; 01 to 23 Minute as MM; 01 to 59 Second as SS; 01 to 59
	MFGSER	Get	Up to 8 numeric characters
	RESET	Set	DEFAULT
	STATUS/ISO	Get	READY, NOTREADY
DIO		Get	Number of digital ports
DIO{port}		Get	8
	DIR	Set/Get	IN, OUT
	LATCH	Set/Get	0 to 255
	VALUE	Set/Get	0 to 255
DIO{port/bit}	DIR	Set/Get	IN, OUT
	LATCH	Set/Get	0 to 1
	VALUE	Set/Get	port number: 0 bit number: 0 to 7 port value: 0 to 255 bit value: 0, 1
[1] Analog output is supported on the USB-2408-2AO only.			

Hardware features

- 16 analog input channels, numbered 0 to 15.
  - Analog input mode is configurable for single-ended (16 channels) or differential (8 channels).
  - Thermocouple mode requires a differential configuration.
  - Analog voltage input ranges:
  - ±10V
  - ±5V
  - ±2.5V
  - ±1.25V
  - ±0.625V
  - ±0.3125V
  - ±0.15625V
  - ±0.078125V
  - Analog thermocouple input range is fixed at ±0.078125V.
- 2 analog output channels, numbered 0 to 1 (USB-2408-2AO only).
  Analog output range is fixed at ±10V
- 1 digital input/output port (8 bits).

- 1024 bytes of nonvolatile EEPROM memory; used for storing configuration information, calibration data, and user data.
- RATE takes a float value. An error is generated if value set is less than the device's minimum sampling rate or greater than the device's maximum sampling rate.

USB-7202

Use the components below to set or get device properties.

Component	Supported Property/Command	Set/Get	Supported Values
AI		Get	Number of analog input channels
	CAL	Set/Get	ENABLE, DISABLE
	SCALE	Set/Get	ENABLE, DISABLE
AI{ch}	OFFSET	Get	4-byte floating point numeric
	RANGE	Set/Get	BIP10V, BIP5V, BIP2V, BIP1V
	SLOPE	Get	4-byte floating point numeric
	VALUE	Get	Unsigned integer numeric
	VALUE/format	Get	RAW, VOLTS
AISCAN	BUFSIZE	Set/Get	
	CAL	Set/Get	ENABLE, DISABLE
	COUNT	Get	
	DEBUG	Set/Get	ENABLE, DISABLE
	EXTPACER	Set/Get	ENABLE/MASTER, ENABLE/SLAVE, DISABLE
	INDEX	Get	
	HIGHCHAN	Set/Get	0 to 7
	LOWCHAN	Set/Get	0 to 7
	RANGE	Set	Sets all channels to a specified range
		Get	Returns the number of samples in the queue
	RATE	Set/Get	0.596 Hz to 50 kHz throughput rate for 1 channel Aggregate throughput: • BLOCKIO mode: 100 kHz • BURSTIO mode: 200 kHz
	SAMPLES	Set/Get	0 to N (0 = continuous scan; N = 32-bit)
	SCALE	Set/Get	ENABLE, DISABLE
	START		
	STATUS	Get	IDLE, RUNNING, OVERRUN
	STOP		
	TRIG	Set/Get	ENABLE, DISABLE
	XFRMODE	Set/Get	SINGLEIO, BLOCKIO, BURSTIO
AISCAN{ch}	RANGE	Set/Get	BIP10V, BIP5V, BIP2V, BIP1V
AITRIG	TYPE	Set/Get	EDGE/RISING, EDGE/FALLING
CTR		Get	Number of counter channels

Component	Supported Property/Command	Set/Get	Supported Values
CTR{ch}	START	Set	Arms the counter channel
	STOP	Set	Disarms the counter channel
	VALUE	Set/Get	0 (Set) 0 – 4,294,967,295 (Get)
DEV	FLASHLED	Set	0 to 255
	FWV	Get	MM.mm (M = major; m = minor)
	ID	Set/Get	Up to 56 characters
	MFGCAL	Get	yyyy-mm-dd HH:MM:SS Year as yyyy; 20xx Month as mm; 01 to 12 Day as dd; 01 to 31 Hour as HH; 01 to 23 Minute as MM; 01 to 59 Second as SS; 01 to 59
	MFGSER	Get	Up to 8 numeric characters
DIO		Get	Number of digital ports
DIO{port}	DIR	Set	IN, OUT
		Get	0 to 255 (bit field: 0 = all output, 255 = all input)
	VALUE	Get	0 to 255 (port) 0 to 1 (bit)
DIO{port/bit}	DIR	Set/Get	IN, OUT
	VALUE	Set/Get	0 or 1 (bit)

Hardware features

- One digital port. All bits are individually configurable as input or output.
- Eight analog input channels, numbered 0 - 7.
- Possible gain ranges:
  - ±10V
  - ±5V
  - ±2V
  - ±1V
- External trigger input
- External pacer input / output. This feature allows multiple devices on a single USB to acquire synchronized samples. One master device is used to drive the signal. Additional devices must be configured as slave devices using the "AISCAN:EXTPACER=*value*" message. Value may be "ENABLE[/MASTER]", "ENABLE[/SLAVE]" or "DISABLE".
- 1024 bytes of nonvolatile EEPROM memory; used for storing configuration information, calibration data, and user data.
- *RATE* takes a float value.

  If the input scan rate requested is less than the slowest rate supported by the device, the device is set to the slowest rate supported by the device. If the input scan rate requested is greater than the fastest rate supported by the device, the device is set to the fastest rate supported by the device.

- BURSTIO mode

  The maximum sampling rate is an aggregate rate. The total acquisition rate is 200 kS/s divided by the number of channels. The maximum rate is 50 kS/s per channel for one, two, or four channels, and 25 kS/s per channel for 8 channels.

  When performing a finite BURSTIO scan, the maximum count is ≤32,768.

  If a CONTROL IN message is sent or a CONTROL OUT message is received during a BURSTIO scan, AINSCAN:STATUS:INTERRUPTED is returned. This property is not returned with BLOCKIO or SINGLEIO scans.

USB-7204

Use the components below to set or get device properties.

Component	Supported Property/Command	Set/Get	Supported Values
AI		Get	Number of analog input channels
	CAL	Set/Get	ENABLE, DISABLE
	CHMODE	Set/Get	SE, DIFF
	SCALE	Set/Get	ENABLE, DISABLE
AI{ch}	OFFSET	Get	4-byte floating point numeric
	RANGE	Set/Get	BIP20V, BIP10V, BIP5V, BIP4V, BIP2PT5V, BIP2V, BIP1PT25V, BIP1V
	SLOPE	Get	4-byte floating point numeric
	VALUE	Get	Unsigned integer numeric
	VALUE/format	Get	RAW, VOLTS
AISCAN	BUFSIZE	Set	Set/Get
	CAL	Set/Get	ENABLE, DISABLE
	COUNT	Get	
	EXTPACER	Set/Get	ENABLE/MASTER, ENABLE/SLAVE, ENABLE/GSLAVE
	HIGHCHAN	Set/Get	0 to 7 single-ended, 0 to 3 differential
	INDEX	Get	
	LOWCHAN	Set/Get	0 to 7 single-ended, 0 to 3 differential (must be ≤ HIGHCHAN)
	QUEUE	Set/Get	ENABLE, DISABLE, RESET
	RATE	Set/Get	0.596 Hz to 50,000 Hz (1 channel)
	SAMPLES	Set/Get	0 to N (0 = continuous scan; N = 32-bit)
	SCALE	Set/Get	ENABLE, DISABLE
	START		
	STATUS	Get	IDLE, RUNNING, OVERRUN
	STOP		
	TRIG	Set/Get	ENABLE, DISABLE
	XFRMODE	Set/Get	BLOCKIO, SINGLEIO
AISCAN{ch}	RANGE	Set/Get	BIP20V, BIP10V, BIP5V, BIP4V, BIP2PT5V, BIP2V, BIP1PT25V, BIP1V

AISCAN{element/ch}	RANGE	Set	Element: 0 to 15 Channel: 0 to 7 single-ended, 0 to 3 differential Range: see the range values above.
AITRIG	Type	Set/Get	EDGE/RISING, EDGE/FALLING
	REARM	Set/Get	ENABLE, DISABLE
AO		Get	Number of analog output channels
	SCALE	Set/Get	ENABLE, DISABLE
AO{ch}	RANGE	Get	UNI4.096V
	VALUE	Set	0 to 4095
AOSCAN	HIGHCHAN	Set/Get	0 to 1
	LOWCHAN	Set/Get	0 to 1
	RANGE	Get	UNI4.096V
	RATE	Set/Get	1 kHz to 10 kHz (1 channel)
	SAMPLES	Set/Get	0 to N (0 = continuous scan; N = 32-bit)
	SCALE	Set/Get	ENABLE, DISABLE
	START		
	STATUS	Get	IDLE, RUNNING, UNDERRUN
	STOP		
	TRIG	Set/Get	ENABLE, DISABLE
CTR		Get	Number of counter channels
CTR{ch}	START		
	STOP		
	VALUE	Get	0 – 4,294,967,295
		Set	0
DEV	FLASHLED	Set	0 to 255
	FWV	Get	MM.mm (M = major; m = minor)
	ID	Set/Get	Up to 56 characters
	MFGCAL	Get	yyyy-mm-dd HH:MM:SS Year as yyyy; 20xx Month as mm; 01 to 12 Day as dd; 01 to 31 Hour as HH; 01 to 23 Minute as MM; 01 to 59 Second as SS; 01 to 59
	MFGSER	Get	Up to 8 numeric characters
DIO		Get	Number of digital ports
DIO{port}	DIR	Set/Get	IN, OUT (port-configurable)
	VALUE	Set/Get	0 to 255
DIO{port/bit}	VALUE	Set/Get	0 or 1

Hardware features

- Two digital ports. Each port is individually configurable as input or output.
- Eight analog input channels, numbered 0 - 7.
- Analog input mode is configurable for single-ended (eight channels) or differential (four channels).
- Possible gain ranges:
  - ±20V (differential mode)
  - ±10V (differential or single–ended mode)
  - ±5V (differential mode)
  - ±4V (differential mode)
  - ±2.5V (differential mode)
  - ±2V (differential mode)
  - ±1.25V (differential mode)
  - ±1V (differential mode)
- External trigger input
- External pacer input / output. This feature allows multiple devices to acquire synchronized samples. One master device is used to drive the signal. Additional devices must be configured as slave devices using the "AISCAN:EXTPACER=*value*" message. Value may be "ENABLE/MASTER," "ENABLE/SLAVE," or "ENABLE/GSLAVE."
  - When set to *ENABLE/SLAVE*, the first clock pulse after setting up the scan is ignored to ensure adequate setup time for the first conversion. Use this mode when the device is paced from a continuous clock source.
  - When set to *ENABLE/GSLAVE*, the first clock pulse after setting up the scan is held off to ensure adequate setup time for the first conversion. No pulses are ignored. Use this mode when the device is paced from another USB-7204.
- 1024 bytes of nonvolatile EEPROM memory; used for storing configuration information, calibration data, and user data.
- *RATE* takes a float value. If the input scan rate requested is less than the slowest rate supported by the device, the device is set to the slowest rate supported by the device. If the input scan rate requested is greater than the fastest rate supported by the device, the device is set to the maximum rate supported by the device.

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