

Data Acquisition Toolbox™

Reference



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Data Acquisition Toolbox™ Reference

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Base Properties — Alphabetical List

ActiveEdge

Rising or falling edges of EdgeCount signals

Description

When working with the session-based interface, use the `ActiveEdge` property to represent rising or falling edges of a `EdgeCount` signal.

Values

You can set the Active edge of a counter input channel to `Rising` or `Falling`.

Examples

```
s = daq.createSession('ni');
ch = addCounterInputChannel(s, 'cDAQ1Mod5', 0, 'EdgeCount')
```

```
ch =
```

```
Data acquisition counter input edge count channel 'ctr0' on device 'Dev2':
```

```
    ActiveEdge: Rising
  CountDirection: Increment
  InitialCount: 0
    Terminal: 'PFI8'
      Name: empty
      ID: 'ctr0'
    Device: [1x1 daq.ni.DeviceInfo]
  MeasurementType: 'EdgeCount'
```

Change the `Active Edge` property to `'Falling'`:

```
ch.ActiveEdge = 'Falling'
```

```
ch =
```

```
Data acquisition counter input edge count channel 'ctr0' on device 'Dev2':
```

```
    ActiveEdge: Falling
  CountDirection: Increment
  InitialCount: 0
    Terminal: 'PFI8'
```



```
Name: empty  
ID: 'ctr0'  
Device: [1x1 daq.ni.DeviceInfo]  
MeasurementType: 'EdgeCount'
```

See Also

Functions

`addCounterInputChannel`, `addCounterOutputChannel`

ActivePulse

Active pulse measurement of PulseWidth counter channel

Description

When working with the session-based interface , the ActivePulse property displays the pulse width measurement in seconds of your counter channel, with PulseWidth measurement type.

Values

Active pulse measurement values include:

- 'High'
- 'Low'

Examples

Create a session object, add a counter input channel, with the 'EdgeCount ' MeasurementType.

```
s = daq.createSession('ni');  
ch = addCounterInputChannel(s, 'cDAQ1Mod5', 0, 'PulseWidth')
```

```
ch =
```

Data acquisition counter input pulse width channel 'ctr0' on device 'cDAQ1Mod5':

```
    ActivePulse: High  
    Terminal: 'PFI4'  
    Name: empty  
    ID: 'ctrl'  
    Device: [1x1 daq.ni.DeviceInfo]  
    MeasurementType: 'PulseWidth'
```

Change the ActiveEdge property to Low.

```
ch.ActivePulse = 'Low'
```

```
ch =
```

Data acquisition counter input pulse width channel 'ctr0' on device 'cDAQ1Mod5':

```
ActivePulse: Low
Terminal: 'PFI4'
Name: empty
ID: 'ctr1'
Device: [1x1 daq.ni.DeviceInfo]
MeasurementType: 'PulseWidth'
```

See Also

`addCounterInputChannel`

ADCTimingMode

Set channel timing mode

Description

When working with the session-based interface, use the `ADCTimingMode` property to specify if the timing mode in of all channels in the device is high resolution or high speed.

Note The `ADCTimingMode` must be the same for all channels on the device.

Values

You can set the `ADCTimingMode` to:

- 'HighResolution'
- 'HighSpeed'
- 'Best50HzRejection'
- 'Best60HzRejection'

Examples

Create a session and add an analog input channel:

```
s = daq.createSession('ni');
ch = addAnalogInputChannel(s, 'cDAQ1Mod1', 'ai1', 'Voltage');

ch
ans =

Data acquisition analog input voltage channel 'ai1' on device 'cDAQ1Mod1':

    Coupling: DC
TerminalConfig: SingleEnded
    Range: -10 to +10 Volts
    Name: ''
```

```
        ID: 'ai1'  
        Device: [1x1 daq.ni.CompactDAQModule]  
MeasurementType: 'Voltage'  
    ADCTimingMode: ''
```

Set the `ADCTimingMode` property to `'HighResolution'`:

```
ch.ADCTimingMode = 'HighResolution';
```

See Also

`addAnalogInputChannel`

AutoSyncDSA

Automatically Synchronize DSA devices

Description

Use this property to enable or disable automatic synchronization between DSA (PXI or PCI) devices in the same session. By default the sessions automatic synchronization capability is disabled.

Examples

To enable automatic synchronization, create a session and add channels from a DSA device:

```
s = daq.createSession('ni')
addAnalogInputChannel(s, 'PXI1Slot2', 0, 'Voltage');
addAnalogInputChannel(s, 'PXI1Slot3', 1, 'Voltage');
```

Enable automatic synchronization and acquire data”

```
s.AutoSyncDSA = true;
startForeground(s);
```

See Also

[addAnalogInputChannel](#)

BitsPerSample

Display bits per sample

Description

This property displays the maximum value of bits per sample of the device, based on the device specifications. By default this read-only value is 24.

Example

View BitsPerSample Property

Create an audio input session and display session properties.

```
s = daq.createSession('directsound')
```

```
s =
```

```
Data acquisition session using DirectSound hardware:  
  Will run for 1 second (44100 scans) at 44100 scans/second.  
  No channels have been added.
```

Properties, Methods, Events

Click on the **Properties** link.

```
UseStandardSampleRates: true  
    BitsPerSample: 24  
    StandardSampleRates: [1x15 double]  
    NumberOfScans: 44100  
    DurationInSeconds: 1  
    Rate: 44100  
    IsContinuous: false  
    NotifyWhenDataAvailableExceeds: 4410  
IsNotifyWhenDataAvailableExceedsAuto: true  
    NotifyWhenScansQueuedBelow: 22050  
IsNotifyWhenScansQueuedBelowAuto: true
```

```
ExternalTriggerTimeout: 10
  TriggersPerRun: 1
    Vendor: DirectSound
    Channels: ''
    Connections: ''
    IsRunning: false
    IsLogging: false
    IsDone: false
IsWaitingForExternalTrigger: false
  TriggersRemaining: 1
    RateLimit: ''
    ScansQueued: 0
  ScansOutputByHardware: 0
  ScansAcquired: 0
```

See Also

[StandardSampleRates](#) | [UseStandardSampleRates](#) | [addAudioInputChannel](#) | [addAudioOutputChannel](#)

BridgeMode

Specify analog input device bridge mode

Description

Use this property in the session-based interface to specify the bridge mode, which represents the active gauge of the analog input channel.

The bridge mode is 'Unknown' when you add a bridge channel to the session. Change this value to a valid mode to use the channel. Valid bridge modes are:

- 'Full' — All four gauges are active.
- 'Half' — Only two bridges are active.
- 'Quarter' — Only one bridge is active.

Examples

Set BridgeMode Property

Set the BridgeMode property of an analog input Bridge measurement type channel.

Create a session and add an analog input Bridge channel.

```
s = daq.createSession('ni');  
ch = addAnalogInputChannel(s, 'cDAQ1Mod7', 0, 'Bridge');
```

Set the BridgeMode property to 'Full' and view the channel properties.

```
ch.BridgeMode = 'Full'
```

```
ch =
```

```
Data acquisition analog input channel 'ai0' on device 'cDAQ1Mod7':
```

```
    BridgeMode: Full  
    ExcitationSource: Internal
```

```
ExcitationVoltage: 2.5
NominalBridgeResistance: 'Unknown'
    Range: -0.063 to +0.063 VoltsPerVolt
    Name: ''
    ID: 'ai0'
    Device: [1x1 daq.ni.CompactDAQModule]
MeasurementType: 'Bridge'
ADCTimingMode: HighResolution
```

See Also

`addAnalogInputChannel`

Channels

Array of channel objects associated with session object

Description

This session object property contains and displays an array of channels added to the session. For more information on the session-based interface, see “Hardware Discovery and Session Setup”.

Tip You cannot directly add or remove channels using the Channels object properties. Use `addAnalogInputChannel` and `addAnalogOutputChannel` to add channels. Use `removeChannel` to remove channels.

Values

The value is determined by the channels you add to the session object.

Example

Access Channels Property

Create both analog and digital channels in a session and display the Channels property.

Create a session object, add an analog input channel, and display the session Channels property.

```
s = daq.createSession('ni');
aich = addAnalogInputChannel(s, 'cDAQ1Mod7', 0, 'Bridge');

aich =
```

```
Data acquisition analog input channel 'ai0' on device 'cDAQ1Mod7':
```

```
    BridgeMode: Unknown
```

```
ExcitationSource: Internal
ExcitationVoltage: 2.5
NominalBridgeResistance: 'Unknown'
    Range: -0.025 to +0.025 VoltsPerVolt
    Name: ''
    ID: 'ai0'
    Device: [1x1 daq.ni.CompactDAQModule]
MeasurementType: 'Bridge'
ADCTimingMode: HighResolution
```

Add an analog output channel and view the Channels property.

```
aoch = addAnalogOutputChannel(s, 'cDAQ1Mod2', 'ao1', 'Voltage')
```

```
aoch =
```

```
Data acquisition analog output voltage channel 'ao1' on device 'cDAQ1Mod2':
```

```
TerminalConfig: SingleEnded
    Range: -10 to +10 Volts
    Name: ''
    ID: 'ao1'
    Device: [1x1 daq.ni.CompactDAQModule]
MeasurementType: 'Voltage'
```

Add a digital channel with 'InputOnly'.

```
dich = addDigitalChannel(s, 'dev1', 'Port0/Line0:1', 'InputOnly')
```

```
dich =
```

```
Number of channels: 2
```

| index | Type | Device | Channel | MeasurementType | Range | Name |
|-------|------|--------|-------------|-----------------|-------|------|
| 1 | dio | Dev1 | port0/line0 | InputOnly | n/a | |
| 2 | dio | Dev1 | port0/line1 | InputOnly | n/a | |

Change the TerminalConfig property of the input channel to 'SingleEnded'.

```
aich.TerminalConfig = 'SingleEnded';
```

You can use the channel object to access and edit the Channels property.

See Also

Functions

`addAnalogInputChannel`, `addAnalogOutputChannel`

Connections

Array of connections in session

Description

This session property contains and displays all connections added to the session.

Tip You cannot directly add or remove connections using the `Connections` object properties. Use `addTriggerConnection` and `addClockConnection` to add connections. Use `removeConnection` to remove connections.

Values

The value is determined by the connections you add to the session.

Examples

Remove Synchronization Connection

This example shows you how to remove a synchronization connection.

Create a session and add analog input channels and trigger and clock connections.

```
s = daq.createSession('ni')
addAnalogInputChannel(s, 'Dev1', 0, 'voltage');
addAnalogInputChannel(s, 'Dev2', 0, 'voltage');
addAnalogInputChannel(s, 'Dev3', 0, 'voltage');
addTriggerConnection(s, 'Dev1/PFI4', 'Dev2/PFI0', 'StartTrigger');
addTriggerConnection(s, 'Dev1/PFI4', 'Dev3/PFI0', 'StartTrigger');
addClockConnection(s, 'Dev1/PFI5', 'Dev2/PFI1', 'ScanClock');
```

Examine the session `Connections` property.

```
s.Connections
```

```
ans =
```

```
Start Trigger is provided by 'Dev1' at 'PFI4' and will be received by:
  'Dev2' at terminal 'PFI0'
  'Dev3' at terminal 'PFI0'
Scan Clock is provided by 'Dev1' at 'PFI5' and will be received by:
  'Dev2' at terminal 'PFI1'
  'Dev3' at terminal 'PFI1'
```

| index | Type | Source | Destination |
|-------|--------------|-----------|-------------|
| 1 | StartTrigger | Dev1/PFI4 | Dev2/PFI0 |
| 2 | StartTrigger | Dev1/PFI4 | Dev3/PFI0 |
| 3 | ScanClock | Dev1/PFI5 | Dev2/PFI1 |
| 4 | ScanClock | Dev1/PFI5 | Dev3/PFI1 |

Remove the last clock connection at index 4 and display the session connections.

```
removeConnection(s,4)
s.Connections
```

```
ans =
```

```
Start Trigger is provided by 'Dev1' at 'PFI4' and will be received by:
  'Dev2' at terminal 'PFI0'
  'Dev3' at terminal 'PFI0'
Scan Clock is provided by 'Dev1' at 'PFI5' and will be received by 'Dev2' at terminal 'PFI1'.
```

| index | Type | Source | Destination |
|-------|--------------|-----------|-------------|
| 1 | StartTrigger | Dev1/PFI4 | Dev2/PFI0 |
| 2 | StartTrigger | Dev1/PFI4 | Dev3/PFI0 |
| 3 | ScanClock | Dev1/PFI5 | Dev2/PFI1 |

See Also

Function

addTriggerConnection, addClockConnection,

CountDirection

Specify direction of counter channel

Description

When working with the session-based interface, use the `CountDirection` property to set the direction of the counter. Count direction can be 'Increment', in which case the counter operates in incremental order, or 'Decrement', in which the counter operates in decrements.

Examples

Create a session object, add a counter input channel, and change the `CountDirection`.

```
s = daq.createSession('ni');
ch = addCounterInputChannel(s, 'cDAQ1Mod5', 0, 'EdgeCount')
ch =
```

```
Data acquisition counter input edge count channel 'ctr0' on device 'cDAQ1Mod5':
```

```
    ActiveEdge: Rising
    CountDirection: Increment
    InitialCount: 0
    Terminal: 'PFI8'
      Name: empty
      ID: 'ctr0'
    Device: [1x1 daq.ni.DeviceInfo]
    MeasurementType: 'EdgeCount'
```

Change `CountDirection` to 'Decrement':

```
ch.CountDirection = 'Decrement'
```

```
ch =
```

```
Data acquisition counter input edge count channel 'ctr0' on device 'cDAQ1Mod5':
```

```
    ActiveEdge: Rising
    CountDirection: Decrement
    InitialCount: 0
    Terminal: 'PFI8'
      Name: empty
      ID: 'ctr0'
    Device: [1x1 daq.ni.DeviceInfo]
    MeasurementType: 'EdgeCount'
```


See Also

`addCounterInputChannel`

Destination

Indicates trigger destination terminal

Description

When working with the session-based interface, the `Destination` property indicates the device and terminal to which you connect a trigger.

Example

Examine a Trigger Connection Destination

Create a session with a trigger connection and examine the connection properties.

Create a session and add 2 analog input channels from different devices.

```
s = daq.createSession('ni');
addAnalogInputChannel(s, 'Dev1', 0, 'voltage');
addAnalogInputChannel(s, 'Dev2', 0, 'voltage');
```

Add a trigger connection and examine the connection properties.

```
addTriggerConnection(s, 'Dev1/PFI4', 'Dev2/PFI0', 'StartTrigger')
```

```
ans =
```

```
Start Trigger is provided by 'Dev1' at 'PFI4' and will be received by 'Dev2' at terminal 'PFI0'.
```

```
    TriggerType: 'Digital'
  TriggerCondition: RisingEdge
        Source: 'Dev1/PFI4'
  Destination: 'Dev2/PFI0'
           Type: StartTrigger
```

See Also

Source, `addTriggerConnection`

Device

Channel device information

Description

When working with the session-based interface, the read-only Device property displays device information for the channel.

Examples

Create a session object, add a counter input channel, and view the Device property.

```
s = daq.createSession('ni');
ch = addCounterInputChannel(s, 'cDAQ1Mod5', 0, 'EdgeCount');
ch.Device

ans =

ni cDAQ1Mod5: National Instruments NI 9402
Counter input subsystem supports:
  Rates from 0.1 to 80000000.0 scans/sec
  2 channels
  'EdgeCount', 'PulseWidth', 'Frequency', 'Position' measurement types

Counter output subsystem supports:
  Rates from 0.1 to 80000000.0 scans/sec
  3 channels
  'PulseGeneration' measurement type

This module is in chassis 'cDAQ1', slot 5
```

See Also

`addCounterInputChannel`, `addCounterOutputChannel`

Direction

Specify digital channel direction

Description

When you add a digital channel or a group to a session, you can specify the measurement type to be:

- Input
- Output
- Unknown

When you specify the `MeasurementType` as `Bidirectional`, you can use the channel to input and output messages. By default the channel is set to `Unknown`. Change the direction to output signal on the channel.

Example

To change the direction of a bidirectional signal on a digital channel in the session `s`, type:

```
s.Channels(1).Direction='Output';
```

Change the Direction of a Digital Channel

Change the direction of a bidirectional digital channel to `Input`.

Create a session and add a bidirectional digital channel.

```
s = daq.createSession('ni')
ch = addDigitalChannel(s, 'dev6', 'Port0/Line0', 'Bidirectional')
```

```
ch =
```

```
Data acquisition digital bidirectional (unknown) channel 'port0/line0' on device 'Dev6':
```

```
    Direction: Unknown
```

```
Name: ''
ID: 'port0/line0'
Device: [1x1 daq.ni.DeviceInfo]
MeasurementType: 'Bidirectional (Unknown)'
```

Change the channels direction to 'Input'.

```
ch.Direction = 'Input'
```

```
ch =
```

```
Data acquisition digital bidirectional (input) channel 'port0/line0' on device 'Dev6':
```

```
Direction: Input
Name: ''
ID: 'port0/line0'
Device: [1x1 daq.ni.DeviceInfo]
MeasurementType: 'Bidirectional (Input)'
```

```
Properties, Methods, Events
```

DurationInSeconds

Specify duration of acquisition

Description

When working with the session-based interface, use the `DurationInSeconds` property to change the duration of an acquisition.

When the session contains analog, digital, or audio output channels, `DurationInSeconds` is a read-only property whose value is determined by

$$\frac{s.ScansQueued}{s.Rate}$$

If the session contains only counter output channels with `PulseGeneration` measurement type, then `DurationInSeconds` represents the duration of the pulse train signal generation.

Values

In a session with only input channels or counter output channels, you can enter a value in seconds for the length of the acquisition. Changing the duration changes the number of scans accordingly. By default, `DurationInSeconds` is set to 1 second.

Examples

Create a session object, add an analog input channel, and change the duration:

```
s = daq.createSession('ni');
addAnalogInputChannel(s, 'cDAQ1Mod1', 'ai0', 'voltage');
s.DurationInSeconds = 2
```

```
s =
```

```
Data acquisition session using National Instruments hardware:
Will run for 2 seconds (2000 scans) at 1000 scans/second.
Operation starts immediately.
```

```
Number of channels: 1
```

| index | Type | Device | Channel | MeasurementType | Range | Name |
|-------|------|--------|---------|-----------------|-------|------|
|-------|------|--------|---------|-----------------|-------|------|

1 ai cDAQ1Mod1 ai0 Voltage (Diff) -10 to +10 Volts

See Also

Properties

NumberOfScans, Rate

Functions

addCounterInputChannel

DutyCycle

Duty cycle of output channel

Description

When working with the session-based interface, use the `DutyCycle` property to specify the fraction of time that the generated pulse is in active state.

Duty cycle is the ratio between the duration of the pulse and the pulse period. For example, if a pulse duration is 1 microsecond and the pulse period is 4 microseconds, the duty cycle is 0.25. In a square wave, the time the signal is high is equal to the time the signal is low.

For function generation channels using Digilent devices, each waveform adopts the duty cycle

Examples

Specify Duty Cycle

Create a session object and add a 'PulseGeneration' counter output channel:

```
s = daq.createSession('ni');  
ch = addCounterOutputChannel(s, 'cDAQ1Mod5', 'ctr0', 'PulseGeneration')
```

```
ch =
```

```
Data acquisition counter output pulse generation channel 'ctr0' on device 'cDAQ1Mod5':
```

```
    IdleState: Low  
    InitialDelay: 2.5e-08  
    Frequency: 100  
    DutyCycle: 0.5  
    Terminal: 'PFI0'  
    Name: ''  
    ID: 'ctr0'  
    Device: [1x1 daq.ni.CompactDAQModule]  
    MeasurementType: 'PulseGeneration'
```

Change the `DutyCycle` to 0.25 and display the channel:

ch.DutyCycle

ch =

Data acquisition counter output pulse generation channel 'ctr0' on device 'cDAQ1Mod5':

```
IdleState: Low
InitialDelay: 2.5e-08
Frequency: 100
DutyCycle: 0.25
Terminal: 'PFI0'
Name: ''
ID: 'ctr0'
Device: [1x1 daq.ni.CompactDAQModule]
MeasurementType: 'PulseGeneration'
```

You can change the channel duty cycle while the session is running when using counter output channels.

See Also

Functions

`addCounterOutputChannel`

Properties

Gain | Offset | Phase

EncoderType

Encoding type of counter channel

Description

When working with the session-based interface, use the `EncoderType` property to specify the encoding type of the counter input `'Position'` channel.

Encoder types include:

- `'X1'`
- `'X2'`
- `'X4'`
- `'TwoPulse'`

Example

Change Encoder Type Property

Change the `EncoderType` property of a counter input channel with a `Position` measurement type.

Create a session and add a counter input channel with `Position` measurement type.

```
s = daq.createSession('ni');
ch = addCounterInputChannel(s, 'cDAQ1Mod5', 'ctr0', 'Position')
```

```
ch =
```

```
Data acquisition counter input position channel 'ctr0' on device 'cDAQ1Mod5':
```

```
EncoderType: X1
ZResetEnable: 0
ZResetValue: 0
ZResetCondition: BothHigh
TerminalA: 'PFI0'
TerminalB: 'PFI2'
TerminalZ: 'PFI1'
```

```
        Name: ''
        ID: 'ctr0'
        Device: [1x1 daq.ni.CompactDAQModule]
MeasurementType: 'Position'
```

Change the channels encoder type to X2.

```
ch.EncoderType = 'X2'
```

```
ch =
```

```
Data acquisition counter input position channel 'ctr0' on device 'cDAQ1Mod5':
```

```
    EncoderType: X2
    ZResetEnable: 0
    ZResetValue: 0
    ZResetCondition: BothHigh
    TerminalA: 'PFI0'
    TerminalB: 'PFI2'
    TerminalZ: 'PFI1'
    Name: ''
    ID: 'ctr0'
    Device: [1x1 daq.ni.CompactDAQModule]
MeasurementType: 'Position'
```

See Also

`addCounterInputChannel`

EnhancedAliasRejectionEnable

Set enhanced alias rejection mode

Description

Enable or disable the enhanced alias rejection on your DSA device's analog channel. See "Synchronize DSA Devices" for more information. Enhanced alias reject is disabled by default. This property only takes logical values.

```
s.Channels(1).EnhancedAliasRejectionEnable = 1
```

You cannot modify enhanced rejection mode if you are synchronizing your DSA device using AutoSyncDSA.

Example

Enable Enhanced Alias Rejection

Enable enhanced alias rejection on a DSA device.

Create a session and add an analog input voltage channel using a DSA device.

```
s = daq.createSession('ni');  
ch = addAnalogInputChannel(s, 'PXI1Slot2', 0, 'Voltage')
```

```
ch =
```

```
Data acquisition analog input voltage channel 'ai0' on device 'PXI1Slot2':
```

```
    Coupling: DC  
    TerminalConfig: PseudoDifferential  
    Range: -42 to +42 Volts  
    Name: ''  
    ID: 'ai0'  
    Device: [1x1 daq.ni.PXIDSAModule]  
    MeasurementType: 'Voltage'  
    EnhancedAliasRejectionEnable: 0
```

Enable enhanced alias rejection.

```
ch.EnhancedAliasRejectionEnable = 1
```

```
ch =
```

```
Data acquisition analog input voltage channel 'ai0' on device 'PXI1Slot2':
```

```
    Coupling: DC
    TerminalConfig: PseudoDifferential
    Range: -42 to +42 Volts
    Name: ''
    ID: 'ai0'
    Device: [1x1 daq.ni.PXIDSAModule]
    MeasurementType: 'Voltage'
EnhancedAliasRejectionEnable: 1
```

See Also

AutoSyncDSA

ExcitationCurrent

Current of external source of excitation

Description

When working with the session-based interface, the `ExcitationCurrent` property indicates the current in amps that you use to excite an IEPE accelerometer, IEPE microphone, generic IEPE sensors, and RTDs.

The default `ExcitationCurrent` is typically determined by the device. If the device supports a range of excitation currents, the default will be the lowest available value in the range.

Example

Change Excitation Current Value

Change the excitation current value of a microphone channel.

Create a session and add an analog input microphone channel.

```
s = daq.createSession('ni');  
ch = addAnalogInputChannel(s, 'cDAQ1Mod3', 0, 'Microphone')
```

```
ch =
```

```
Data acquisition analog input microphone channel 'ai0' on device 'cDAQ1Mod3':
```

```
    Sensitivity: 'Unknown'  
MaxSoundPressureLevel: 'Unknown'  
ExcitationCurrent: 0.002  
ExcitationSource: Internal  
    Coupling: AC  
    TerminalConfig: PseudoDifferential  
        Range: -5.0 to +5.0 Volts  
        Name: ''  
        ID: 'ai0'  
    Device: [1x1 daq.ni.CompactDAQModule]  
MeasurementType: 'Microphone'  
ADCTimingMode: ''
```

Change the excitation current value to 0.0040.

```
ch.ExcitationCurrent = .0040
```

```
ch =
```

```
Data acquisition analog input microphone channel 'ai0' on device 'cDAQ1Mod3':
```

```
    Sensitivity: 'Unknown'  
MaxSoundPressureLevel: 'Unknown'  
ExcitationCurrent: 0.004  
ExcitationSource: Internal  
    Coupling: AC  
TerminalConfig: PseudoDifferential  
    Range: -5.0 to +5.0 Volts  
    Name: ''  
    ID: 'ai0'  
    Device: [1x1 daq.ni.CompactDAQModule]  
MeasurementType: 'Microphone'  
ADCTimingMode: ''
```

See Also

Properties

ExcitationSource

Functions

addAnalogInputChannel

ExcitationSource

External source of excitation

Description

When working with the session-based interface, the `ExcitationSource` property indicates the source of `ExcitationVoltage` for bridge measurements or `ExcitationCurrent` for IEPE sensors and RTDs. Excitation source can be:

- Internal
- External
- None
- Unknown

By default, `ExcitationSource` is set to `Unknown`.

Example

Change Excitation Source

Change the excitation source of a microphone channel.

Create a session and add an analog input microphone channel.

```
s = daq.createSession('ni');  
ch = addAnalogInputChannel(s, 'cDAQ1Mod3', 0, 'Microphone')
```

```
ch =
```

```
Data acquisition analog input microphone channel 'ai0' on device 'cDAQ1Mod3':
```

```
    Sensitivity: 'Unknown'  
MaxSoundPressureLevel: 'Unknown'  
ExcitationCurrent: 0.004  
ExcitationSource: Unknown  
    Coupling: AC  
TerminalConfig: PseudoDifferential  
    Range: -5.0 to +5.0 Volts
```



```
Name: ''
ID: 'ai0'
Device: [1x1 daq.ni.CompactDAQModule]
MeasurementType: 'Microphone'
ADCTimingMode: ''
```

Change the excitation source value to 'Internal'.

```
ch.ExcitationSource = 'Internal'
```

```
ch =
```

```
Data acquisition analog input microphone channel 'ai0' on device 'cDAQ1Mod3':
```

```
    Sensitivity: 'Unknown'
MaxSoundPressureLevel: 'Unknown'
ExcitationCurrent: 0.004
ExcitationSource: Internal
    Coupling: AC
    TerminalConfig: PseudoDifferential
    Range: -5.0 to +5.0 Volts
    Name: ''
    ID: 'ai0'
    Device: [1x1 daq.ni.CompactDAQModule]
MeasurementType: 'Microphone'
ADCTimingMode: ''
```

See Also

Properties

ExcitationCurrent

ExcitationVoltage

Functions

addAnalogInputChannel

ExcitationVoltage

Voltage of excitation source

Description

When working with RTD measurements in the session-based interface, the `ExcitationVoltage` property indicates the excitation voltage value to apply to bridge measurements.

The default `ExcitationVoltage` is typically determined by the device. If the device supports a range of excitation voltages, the default will be the lowest available value in the range.

See Also

Properties

`ExcitationSource`

ExternalTriggerTimeout

Specify maximum wait time for external trigger

Description

The data acquisition session `ExternalTriggerTimeout` property specifies the maximum amount of time in seconds the session waits for an external trigger before timing out. To disable the timeout, set `ExternalTriggerTimeout` to a value of `Inf`.

Examples

Specify External Trigger Timeout

Specify how long the session waits for an external trigger before timing out.

Create a session and click on the [Properties](#) link to display session properties.

```
s = daq.createSession('ni')
```

```
s =
```

```
Data acquisition session using National Instruments hardware:  
  Will run for 1 second (1000 scans) at 1000 scans/second.  
  No channels have been added.
```

```
Properties, Methods, Events
```

```
          AutoSyncDSA: false  
          NumberOfScans: 1000  
          DurationInSeconds: 1  
              Rate: 1000  
          IsContinuous: false  
  NotifyWhenDataAvailableExceeds: 100  
IsNotifyWhenDataAvailableExceedsAuto: true  
  NotifyWhenScansQueuedBelow: 500  
IsNotifyWhenScansQueuedBelowAuto: true  
  ExternalTriggerTimeout: 10
```

```
TriggersPerRun: 1
  Vendor: National Instruments
  Channels: ''
  Connections: ''
  IsRunning: false
  IsLogging: false
  IsDone: false
IsWaitingForExternalTrigger: false
  TriggersRemaining: 1
  RateLimit: ''
  ScansQueued: 0
  ScansOutputByHardware: 0
  ScansAcquired: 0
```

Change the timeout to 15 seconds.

```
s.ExternalTriggerTimeout = 15;
```

Specify External Trigger with Disabled Timeout

Set an external trigger on a session, without a timeout.

Create a session with an external trigger, then set its `ExternalTriggerTimeout` to `Inf`.

```
s = daq.createSession('ni');
addAnalogInputChannel(s, 'Dev1', 'ai0', 'Voltage');
addTriggerConnection(s, 'External', 'Dev1/PFI0', 'StartTrigger');
s.ExternalTriggerTimeout = Inf;
```

See Also

Functions

`addTriggerConnection`

Frequency

Frequency of generated output

Description

When working with counter input channels, use the `Frequency` property to set the pulse repetition rate of a counter input channel.

When working with function generation channel, data acquisition sessions, the rate of a waveform is controlled by the channel `Frequency` property. To synchronize all operation in the session, set each channel generation rate individually, and change the session `Rate` to match the channel generation rate.

The frequency value must fall within the specified `FrequencyLimit` values.

Values

Specify the frequency in hertz.

Examples

Set the Frequency of a Counter Input Channel

Create a session object and add a 'PulseGeneration' counter output channel:

```
s = daq.createSession('ni');  
ch = addCounterOutputChannel(s, 'cDAQ1Mod5', 'ctr0', 'PulseGeneration')
```

Change the `Frequency` to 200 and display the channel:

```
ch.Frequency = 200;  
  
ch  
  
ans =
```

Data acquisition counter output pulse generation channel 'ctr0' on device 'cDAQ1Mod5':

```
IdleState: Low
InitialDelay: 2.5e-008
Frequency: 200
DutyCycle: 0.5
Terminal: 'PFI12'
Name: empty
ID: 'ctr0'
Device: [1x1 daq.ni.DeviceInfo]
MeasurementType: 'PulseGeneration'
```

Set the Frequency of a Function Generator Channel

Create a waveform generation channel, and change the generation rate to 20000 scans per second.

```
s = daq.createSession('digilent'):
fgenCh = addFunctionGeneratorChannel(s, 'AD1', 1, 'Sine')
fgenCh.Frequency = 20000
```

```
fgenCh =
```

Data acquisition sine waveform generator '1' on device 'AD1':

```
Phase: 0
Range: -5.0 to +5.0 Volts
TerminalConfig: SingleEnded
Gain: 1
Offset: 0
Frequency: 20000
WaveformType: Sine
FrequencyLimit: [0.0 25000000.0]
Name: ''
ID: '1'
Device: [1x1 daq.di.DeviceInfo]
MeasurementType: 'Voltage'
```

Tip You can change the channel frequency while the session is running when using counter output channels.

See Also

Functions

`addCounterInputChannel` | `addFunctionGeneratorChannel`

Properties

`FrequencyLimit`

Gain

Waveform output gain

Description

When using waveform function generation channels, **Gain** represents the value by which the scaled waveform data is multiplied to get the output data.

Values

The waveform gain can be between -5 and 5 . Ensure that $\text{Gain} \times \text{Voltage} + \text{Offset}$ falls within the valid ranges of output voltage of the device.

Example

Change the gain of the waveform function generation channel to 2 volts.

```
s = daq.createSession('digilent');
fgenCh = addFunctionGeneratorChannel(s, 'AD1', 1, 'Sine');
fgenCh.Gain = 2
```

```
fgenCh =
```

```
Data acquisition sine waveform generator '1' on device 'AD1':
```

```
    Phase: 0
    Range: -5.0 to +5.0 Volts
TerminalConfig: SingleEnded
    Gain: 2
    Offset: 0
    Frequency: 4096
    WaveformType: Sine
FrequencyLimit: [0.0 25000000.0]
    Name: ''
    ID: '1'
```



```
Device: [1x1 daq.di.DeviceInfo]  
MeasurementType: 'Voltage'
```

See Also

Functions

`addFunctionGeneratorChannel`

Properties

`DutyCycle` | `Offset` | `Phase`

FrequencyLimit

Limit of rate of operation based on hardware configuration

Description

In the session-based interface, the read-only `FrequencyLimit` property displays the minimum and maximum rates that the function generation channel supports.

Tip `FrequencyLimit` changes dynamically as the channel configuration changes.

Example

View waveform function generation channel's generation rate limit.

```
s = daq.createSession('digilent')
fgenCh = addFunctionGeneratorChannel(s, 'AD1', 1, 'Sine')
fgenCh.FrequencyLimit
```

```
ans =
```

```
[0.0 25000000.0]
```

See Also

Properties

Frequency

ID

ID of channel in session

Description

When working with the session-based interface, the ID property displays the ID of the channel. You set the channel ID when you add the channel to a session object.

Examples

Create a session object, and add a counter input channel with the ID 'ctr0'.

```
s = daq.createSession('ni');  
ch = addCounterInputChannel (s, 'cDAQ1Mod5', 'ctr0', 'EdgeCount')
```

ch=

Data acquisition counter input edge count channel 'ctr0' on device 'cDAQ1Mod5':

```
    ActiveEdge: Rising  
    CountDirection: Increment  
    InitialCount: 0  
    Terminal: 'PFI8'  
        Name: empty  
        ID: 'ctr0'  
    Device: [1x1 daq.ni.DeviceInfo]  
    MeasurementType: 'EdgeCount'
```

Change CountDirection to 'Decrement':

```
ch.CountDirection = 'Decrement'
```

ch=

Data acquisition counter input edge count channel 'ctr0' on device 'cDAQ1Mod5':

```
    ActiveEdge: Rising  
    CountDirection: Decrement  
    InitialCount: 0  
    Terminal: 'PFI8'  
        Name: empty  
        ID: 'ctr0'  
    Device: [1x1 daq.ni.DeviceInfo]  
    MeasurementType: 'EdgeCount'
```

See Also

`addCounterInputChannel`

IdleState

Default state of counter output channel

Description

When working with the session-based interface, the `IdleState` property indicates the default state of the counter output channel with a `'PulseGeneration'` measurement type when the counter is not running.

Values

`IdleState` is either `'High'` or `'Low'`.

Examples

Create a session object and add a `'PulseGeneration'` counter output channel:

```
s = daq.createSession('ni');  
s.addCounterOutputChannel('cDAQ1Mod5', 'ctr0', 'PulseGeneration');
```

Change the `IdleState` property to `'High'` and display the channel:

```
s.Channels.IdleState = 'High';
```

```
s.Channels
```

```
ans =
```

```
Data acquisition counter output pulse generation channel 'ctr0' on device 'cDAQ1Mod5':
```

```
    IdleState: High  
InitialDelay: 2.5e-008  
    Frequency: 100  
    DutyCycle: 0.5  
    Terminal: 'PFI12'  
        Name: empty  
        ID: 'ctr0'  
    Device: [1x1 daq.ni.DeviceInfo]  
MeasurementType: 'PulseGeneration'
```

See Also

`addCounterOutputChannel`

InitialDelay

Delay until output channel generates pulses

Description

When working with the session-based interface, use the `InitialDelay` property to set an initial delay on the counter output channel in which the counter is running but does not generate any pulse.

Example

Specify Initial Delay

Set the initial delay on a counter output channel to 3.

Create a session and add a counter input channel.

```
s = daq.createSession('ni');  
ch = addCounterOutputChannel(s, 'cDAQ1Mod5', 'ctr0', 'PulseGeneration');
```

Set the initial delay.

```
ch.InitialDelay = 3
```

```
ch =
```

```
Data acquisition counter output pulse generation channel 'ctr0' on device 'cDAQ1Mod5':
```

```
  IdleState: Low  
  InitialDelay: 3  
  Frequency: 100  
  DutyCycle: 0.5  
  Terminal: 'PFI0'  
  Name: ''  
  ID: 'ctr0'
```

```
Device: [1x1 daq.ni.CompactDAQModule]  
MeasurementType: 'PulseGeneration'
```

See Also

`addCounterOutputChannel`

InitialCount

Specify initial count point

Description

When working with the session-based interface, use the `InitialCount` property to set the point from which the device starts the counter.

Examples

Create a session object, add counter input channel, and change the `InitialCount`.

```
s = daq.createSession('ni');  
ch = addCounterInputChannel(s, 'cDAQ1Mod5', 0, 'EdgeCount')
```

```
ch =
```

```
Data acquisition counter input edge count channel 'ctr0' on device 'cDAQ1Mod5':
```

```
    ActiveEdge: Rising  
    CountDirection: Increment  
    InitialCount: 0  
    Terminal: 'PFI8'  
    Name: empty  
    ID: 'ctr0'  
    Device: [1x1 daq.ni.DeviceInfo]  
    MeasurementType: 'EdgeCount'
```

Change `InitialCount` to 15:

```
ch.InitialCount = 15
```

```
ch =
```

```
Data acquisition counter input edge count channel 'ctr0' on device 'cDAQ1Mod5':
```

```
    ActiveEdge: Rising  
    CountDirection: Increment  
    InitialCount: 15  
    Terminal: 'PFI8'  
    Name: empty  
    ID: 'ctr0'  
    Device: [1x1 daq.ni.DeviceInfo]  
    MeasurementType: 'EdgeCount'
```

See Also

Functions

`addCounterInputChannel` | `resetCounters`

IsContinuous

Specify if operation continues until manually stopped

Description

When working with the session-based interface, use `IsContinuous` to specify that the session operation runs until you execute `stop`. When set to `true`, the session will run continuously, acquiring or generating data until stopped.

Values

`{false}`

Set the `IsContinuous` property to `false` to make the session operation stop automatically. This property is set to `false` by default.

`true`

Set the `IsContinuous` property to `true` to make the session operation run until you execute `stop`.

Examples

Create a session object, add an analog input channel, and set the session to run until manually stopped:

```
s = daq.createSession('ni');
addAnalogInputChannel(s, 'cDAQ1Mod1', 'ai0', 'voltage');
s.IsContinuous = true
```

`s =`

Data acquisition session using National Instruments hardware:

Will run continuously at 1000 scans/second until stopped.

Operation starts immediately.

Number of channels: 1

| index | Type | Device | Channel | MeasurementType | Range | Name |
|-------|------|-----------|---------|-----------------|------------------|------|
| 1 | ai | cDAQ1Mod1 | ai0 | Voltage (Diff) | -10 to +10 Volts | |

See Also

Properties

IsDone

Functions

stop,startBackground

IsDone

Indicate if session operation is complete

Description

The read-only `IsDone` property indicates that the session operation is complete.

Tip

- `IsRunning` indicates the session has started, but the hardware might not be acquiring or generating data. It is still true while the hardware is waiting for a trigger, and while transferring data in the process of stopping.
 - `IsLogging` indicates the hardware is actively acquiring or generating data.
 - `IsDone` indicates the session object has completed its operation, including all necessary transfer of data.
-

Values

`true`

Value is logical 1 (`true`) when the session operation is complete.

`false`

Value is logical 0 (`false`) while the session operation is not complete.

Examples

Create an acquisition session and see if the operation is complete.

```
s = daq.createSession('ni');  
addAnalogOutputChannel(s, 'cDAQ1Mod2', 'ao1', 'vVoltage');  
s.queueOutputData(linspace(-1, 1, 1000)');  
s.startBackground();  
s.IsDone
```

```
ans =
```

```
    0
```

Issue a wait and see if the operation is complete.

```
wait(s)  
s.IsDone
```

```
ans =
```

```
    1
```

See Also

Properties

IsLogging | IsRunning

Functions

startBackground

IsLogging

Indicate if hardware is acquiring or generating data

Description

The read-only `IsLogging` property indicates if the hardware is actively acquiring or generating data.

Tip

- `IsRunning` indicates the session has started, but the hardware might not be acquiring or generating data. It is still true while the hardware is waiting for a trigger, and while transferring data in the process of stopping.
 - `IsLogging` indicates the hardware is actively acquiring or generating data.
 - `IsDone` indicates the session object has completed its operation, including all necessary transfer of data.
-

Values

`true`

Value is logical 1 (`true`) if the device is acquiring or generating data.

`false`

Value is logical 0 (`false`) if the device is not acquiring or generating data.

Examples

Create and start a session.

```
s = daq.createSession('ni');  
addAnalogOutputChannel(s, 'cDAQ1Mod2', 'ao1', 'Voltage');  
s.queueOutputData(linspace(-1,1,1000)');
```

```
startBackground(s);  
s.IsRunning
```

```
ans =
```

```
1
```

The session is running, so check for device logging.

```
s.IsLogging
```

```
ans =
```

```
0
```

This result might indicate that the device is waiting for an external trigger. After triggering, wait until logging is complete.

```
wait(s)  
s.IsDone
```

```
ans =
```

```
1
```

See Also

Properties

IsDone | IsRunning

Functions

startBackground

IsNotifyWhenDataAvailableExceedsAuto

Control if `NotifyWhenDataAvailableExceeds` is set automatically

Description

When working with the session-based interface, the `IsNotifyWhenDataAvailableExceedsAuto` property indicates if the `NotifyWhenDataAvailableExceeds` property is set automatically, or you have set a specific value.

Tip This property is typically used to set `NotifyWhenDataAvailableExceeds` back to its default behavior.

Values

`{true}`

When the value is `true`, then the `NotifyWhenDataAvailableExceeds` property is set automatically.

`false`

When the value is `false`, when you have set the `NotifyWhenDataAvailableExceeds` property to a specific value.

Example

Enable Data Exceeds Notification

Change the `IsNotifyWhenDataAvailableExceedsAuto` to be able to set the `NotifyWhenDataAvailableExceeds` property to a specific value.

Create a session and display the properties by clicking the `Properties` link.

```
s = daq.createSession('ni')
```

s =

Data acquisition session using National Instruments hardware:
Will run for 1 second (1000 scans) at 1000 scans/second.
No channels have been added.

Properties, Methods, Events

```
                AutoSyncDSA: false
                NumberOfScans: 1000
                DurationInSeconds: 1
                    Rate: 1000
                IsContinuous: false
                NotifyWhenDataAvailableExceeds: 100
IsNotifyWhenDataAvailableExceedsAuto: true
                NotifyWhenScansQueuedBelow: 500
IsNotifyWhenScansQueuedBelowAuto: true
                ExternalTriggerTimeout: 10
                TriggersPerRun: 1
                    Vendor: National Instruments
                    Channels: ''
                Connections: ''
                    IsRunning: false
                    IsLogging: false
                    IsDone: false
IsWaitingForExternalTrigger: false
                TriggersRemaining: 1
                    RateLimit: ''
                ScansQueued: 0
                ScansOutputByHardware: 0
                ScansAcquired: 0
```

Change the `IsNotifyWhenDataAvailableExceedsAuto` to

```
s.IsNotifyWhenDataAvailableExceedsAuto = false
```

s =

Data acquisition session using National Instruments hardware:

Will run for 1 second (1000 scans) at 1000 scans/second.
No channels have been added.

See Also

Properties

NotifyWhenDataAvailableExceeds

Events

DataAvailable

IsNotifyWhenScansQueuedBelowAuto

Control if `NotifyWhenScansQueuedBelow` is set automatically

Description

When working with the session-based interface, the `IsNotifyWhenScansQueuedBelowAuto` property indicates if the `NotifyWhenScansQueuedBelow` property is set automatically, or you have set a specific value.

Values

`{true}`

When the value is `true`, then `NotifyWhenScansQueuedBelow` is set automatically.

`false`

When the value is `false`, you have set `NotifyWhenScansQueuedBelow` property to a specific value.

Example

Enable Notification When Scans Reach Below Specified Range

Change the `IsNotifyWhenScansQueuedBelowAuto` to be able to set the `NotifyWhenScansQueuedBelow` property to a specific value.

Create a session and display the properties by clicking the [Properties](#) link.

```
s = daq.createSession('ni')
```

```
s =
```

```
Data acquisition session using National Instruments hardware:  
Will run for 1 second (1000 scans) at 1000 scans/second.
```

No channels have been added.

Properties, Methods, Events

```

        AutoSyncDSA: false
        NumberOfScans: 1000
        DurationInSeconds: 1
            Rate: 1000
        IsContinuous: false
        NotifyWhenDataAvailableExceeds: 100
IsNotifyWhenDataAvailableExceedsAuto: true
        NotifyWhenScansQueuedBelow: 500
IsNotifyWhenScansQueuedBelowAuto: true
        ExternalTriggerTimeout: 10
        TriggersPerRun: 1
            Vendor: National Instruments
            Channels: ''
            Connections: ''
            IsRunning: false
            IsLogging: false
            IsDone: false
        IsWaitingForExternalTrigger: false
        TriggersRemaining: 1
            RateLimit: ''
        ScansQueued: 0
        ScansOutputByHardware: 0
        ScansAcquired: 0

```

Change the `IsNotifyWhenDataAvailableExceedsAuto` to

```
s.IsNotifyWhenScansQueuedBelowAuto = false
```

```
s =
```

```

Data acquisition session using National Instruments hardware:
  Will run for 1 second (1000 scans) at 1000 scans/second.
  No channels have been added.

```

See Also

Properties

NotifyWhenScansQueuedBelow, ScansQueued

Events

DataRequired

IsRunning

Indicate if session operation is in progress

Description

The read-only `IsRunning` property indicates the session operation is started and in progress, whether or not the hardware is acquiring or generating data at the time.

Tip

- `IsRunning` indicates the session has started, but the hardware might not be acquiring or generating data. It is still true while the hardware is waiting for a trigger, and while transferring data in the process of stopping.
 - `IsLogging` indicates the hardware is actively acquiring or generating data.
 - `IsDone` indicates the session object has completed its operation, including all necessary transfer of data.
-

Values

`true`

Value is logical 1 (`true`) while the session operation is in progress.

`false`

Value is logical 0 (`false`) while the session operation is not in progress, that is, before it starts or after it stops.

Examples

Create an acquisition session, add a `DataAvailable` event listener and start the acquisition.

```
s = daq.createSession('ni');  
addAnalogInputChannel(s, 'cDAQ1Mod1', 'ai0', 'voltage');
```

```
lh = s.addListener('DataAvailable', @plotData);  
  
function plotData(src,event)  
    plot(event.TimeStamps, event.Data)  
end  
startBackground(s);
```

See if the session is in progress.

```
s.IsRunning
```

```
ans =
```

```
1
```

Wait until operation completes and see if session is in progress.

```
wait(s)  
s.IsRunning
```

```
ans =
```

```
0
```

See Also

Properties

IsDone | IsLogging

Functions

startBackground

IsSimulated

Indicate if device is simulated

Description

When working with the session-based interface, the `IsSimulated` property indicates if the session is using a simulated device.

Values

`true`

When the value is `true` if the operation is in progress.

`false`

When the value is `false` if the operation is not in progress.

Examples

Discover available devices.

```
d = daq.getDevices
```

```
d =
```

Data acquisition devices:

| index | Vendor | Device ID | Description |
|-------|--------|-----------|-------------------------------|
| 1 | ni | cDAQ1Mod1 | National Instruments NI 9201 |
| 2 | ni | cDAQ2Mod1 | National Instruments NI 9201 |
| 3 | ni | Dev1 | National Instruments USB-6211 |
| 4 | ni | Dev2 | National Instruments USB-6218 |
| 5 | ni | Dev3 | National Instruments USB-6255 |
| 6 | ni | Dev4 | National Instruments USB-6363 |
| 7 | ni | PXI1Slot2 | National Instruments PXI-4461 |
| 8 | ni | PXI1Slot3 | National Instruments PXI-4461 |

Examine properties of NI 9201, with the device id cDAQ1Mod1 with the index 1.

d(1)

ans =

```
ni: National Instruments NI 9201 (Device ID: 'cDAQ1Mod1')
  Analog input subsystem supports:
    -10 to +10 Volts range
    Rates from 0.1 to 800000.0 scans/sec
    8 channels ('ai0', 'ai1', 'ai2', 'ai3', 'ai4', 'ai5', 'ai6', 'ai7')
    'Voltage' measurement type
```

This module is in slot 4 of the 'cDAQ-9178' chassis with the name 'cDAQ1'.

Properties, Methods, Events

Click the [Properties](#) link to see the properties of the device.

```
ChassisName: 'cDAQ1'
ChassisModel: 'cDAQ-9178'
SlotNumber: 4
IsSimulated: true
  Terminals: [48x1 cell]
  Vendor: National Instruments
    ID: 'cDAQ1Mod1'
    Model: 'NI 9201'
  Subsystems: [1x1 daq.ni.AnalogInputInfo]
  Description: 'National Instruments NI 9201'
RecognizedDevice: true
```

Note that the `IsSimulated` value is `true`, indicating that this device is simulated.

See Also

Properties

IsLogging, IsDone

Functions

startBackground

IsWaitingForExternalTrigger

Indicates if synchronization is waiting for an external trigger

Description

When working with the session-based interface, the `readOnlyIsWaitingForExternalTrigger` property indicates if the acquisition or generation session is waiting for a trigger from an external device. If you have added an external trigger, this property displays `true`, if not, it displays `false`.

See Also

`addTriggerConnection`

MaxSoundPressureLevel

Sound pressure level for microphone channels

Description

When working with the session-based interface, use the `MaxSoundPressureLevel` set the maximum sound pressure of the microphone channel in decibels.

Values

The maximum sound pressure level is based on the sensitivity and the voltage range of your device. When you sent your device `Sensitivity`, the `MaxSoundPressureLevel` value is automatically corrected to match the specified sensitivity value and the device voltage range. You can also specify any acceptable pressure level in decibels. Refer to your microphone specifications for more information.

Example

Change Maximum Sound Pressure of Microphone

Change the `Sensitivity` of a microphone channel and set the maximum sound pressure level to 10.

Create a session and add a microphone channel.

```
s = daq.createSession('ni');  
ch = addAnalogInputChannel(s, 'cDAQ1Mod3', 0, 'Microphone')
```

```
ch =
```

```
Data acquisition analog input microphone channel 'ai0' on device 'cDAQ1Mod3':  
    Sensitivity: 'Unknown'  
    MaxSoundPressureLevel: 'Unknown'  
    ExcitationCurrent: 0.002  
    ExcitationSource: Internal
```

```
Coupling: AC
TerminalConfig: PseudoDifferential
  Range: -5.0 to +5.0 Volts
  Name: ''
  ID: 'ai0'
  Device: [1x1 daq.ni.CompactDAQModule]
MeasurementType: 'Microphone'
ADCTimingMode: ''
```

Set the channel's sensitivity to 30.037.

```
ch.Sensitivity = 0.037
```

```
ch =
```

```
Data acquisition analog input microphone channel 'ai0' on device 'cDAQ1Mod3':
```

```
  Sensitivity: 0.037
MaxSoundPressureLevel: 136
ExcitationCurrent: 0.002
ExcitationSource: Internal
  Coupling: AC
  TerminalConfig: PseudoDifferential
    Range: -135 to +135 Pascals
    Name: ''
    ID: 'ai0'
    Device: [1x1 daq.ni.CompactDAQModule]
MeasurementType: 'Microphone'
ADCTimingMode: ''
```

Set the channel's maximum sound pressure to 10 db.

```
ch.MaxSoundPressureLevel = 10
```

```
ch =
```

```
Data acquisition analog input microphone channel 'ai0' on device 'cDAQ1Mod3':
```

```
  Sensitivity: 0.037
MaxSoundPressureLevel: 10
ExcitationCurrent: 0.002
ExcitationSource: Internal
  Coupling: AC
  TerminalConfig: PseudoDifferential
    Range: -135 to +135 Pascals
    Name: ''
    ID: 'ai0'
    Device: [1x1 daq.ni.CompactDAQModule]
MeasurementType: 'Microphone'
ADCTimingMode: ''
```

MeasurementType

Channel measurement type

Description

When working with the session-based interface, the `MeasurementType` property displays the selected measurement type for your channel.

Values

You can only use `Audio` measurement type with multichannel audio devices.

Counter measurement types include:

- `'EdgeCount'` (input)
- `'PulseWidth'` (input)
- `'Frequency'` (input)
- `'Position'` (input)
- `'PulseGeneration'` (output)

Analog measurement types include:

- `'Voltage'` (input and output)
- `'Thermocouple'` (input)
- `'Current'` (input and output)
- `'Accelerometer'` (input)
- `'RTD'` (input)
- `'Bridge'` (input)
- `'Microphone'` (input)
- `'IEPE'` (input)

Examples

Create a session object, add a counter input channel, with the 'EdgeCount' MeasurementType.

```
s = daq.createSession('ni');  
ch = addCounterInputChannel (s, 'cDAQ1Mod5', 0, 'EdgeCount')
```

```
ch =
```

```
Data acquisition counter input edge count channel 'ctr0' on device 'cDAQ1Mod5':
```

```
    ActiveEdge: Rising  
    CountDirection: Increment  
    InitialCount: 0  
    Terminal: 'PF18'  
    Name: empty  
    ID: 'ctr0'  
    Device: [1x1 daq.ni.DeviceInfo]  
    MeasurementType: 'EdgeCount'
```

See Also

[addAnalogInputChannel](#), [addAnalogOutputChannel](#), [addCounterInputChannel](#), [addCounterOutputChannel](#),

Name

Specify descriptive name for the channel

Description

When you add a channel, a descriptive name is stored in `Name`. By default there is no name assigned to the channel. You can change the value of `Name` at any time.

Values

You can specify a character vector value for the name.

Examples

Change the name of an analog input channel

Create a session and add an analog input channel.

```
s = daq.createSession('ni');  
ch = addAnalogInputChannel(s, 'Dev1', 0, 'Voltage')
```

```
ch =
```

```
Data acquisition analog input voltage channel 'ai0' on device 'Dev1':
```

```
    Coupling: DC  
    TerminalConfig: Differential  
        Range: -10 to +10 Volts  
        Name: ''  
        ID: 'ai0'  
        Device: [1x1 daq.ni.DeviceInfo]  
    MeasurementType: 'Voltage'
```

Change Name to 'AI-Voltage'.

```
ch.Name = 'AI-Voltage'
```

```
ch =  
  
Data acquisition analog input voltage channel 'ai0' on device 'Dev1':  
  
    Coupling: DC  
    TerminalConfig: Differential  
        Range: -10 to +10 Volts  
        Name: 'AI-Voltage'  
        ID: 'ai0'  
        Device: [1x1 daq.ni.DeviceInfo]  
MeasurementType: 'Voltage'
```

See Also

`addAnalogInputChannel`

NominalBridgeResistance

Resistance of sensor

Description

When working with the session-based interface, the `NominalBridgeResistance` property displays the resistance of a bridge-based sensor in ohms. This value is used to calculate voltage.

You can specify any accepted positive value in ohms. The default value is 0 until you change it. You must set the resistance to use the channel.

See Also

`addAnalogInputChannel`

NotifyWhenDataAvailableExceeds

Control firing of `DataAvailable` event

Description

The `DataAvailable` event is triggered when the number of scans available to the session object exceeds the quantity specified in the `NotifyWhenDataAvailableExceeds` property.

You cannot set the `NotifyWhenDataAvailableExceeds` property when the session is in the prepared state, which can happen after running `startForeground`. In this case, call `release` on the session before setting this property value.

Values

By default the `DataAvailable` event triggers when 1/10 second worth of data is available for analysis. To specify a different threshold, change the value of `NotifyWhenDataAvailableExceeds`.

Examples

Control Firing of Data Available Event

Add an event listener to display the total number of scans acquired and fire the event when the data available exceeds specified amount.

Create the session and add an analog input voltage channel.

```
s = daq.createSession('ni');
addAnalogInputChannel(s, 'Dev4', 1, 'Voltage');
lh = addlistener(s, 'DataAvailable', ...
    @(src, event) disp(s.ScansAcquired));
```

The default the `Rate` is 1000 scans per second. The session is automatically configured to fire the `DataAvailable` notification 10 times per second.

Increase the Rate to 800,000 scans per second, while the DataAvailable notification automatically fires 10 times per second.

```
s.Rate = 800000;  
s.NotifyWhenDataAvailableExceeds
```

```
ans =  
    80000
```

Running the acquisition causes the number of scans acquired to be displayed by the callback 10 times.

```
data = startForeground(s);
```

```
80000  
160000  
240000  
320000  
400000  
480000  
560000  
640000  
720000  
800000
```

Increase NotifyWhenDataAvailableExceeds to 160,000. NotifyWhenDataAvailableExceeds is no longer configured automatically when the Rate changes.

```
s.NotifyWhenDataAvailableExceeds = 160000;  
s.IsNotifyWhenDataAvailableExceedsAuto
```

```
ans =  
    0
```

Start the acquisition. The `DataAvailable` event is fired only five times per second.

```
data = startForeground(s);  
  
          160000  
          320000  
          480000  
          640000  
          800000
```

Set `IsNotifyWhenDataAvailableExceedsAuto` back to `true`.

```
s.IsNotifyWhenDataAvailableExceedsAuto = true;  
s.NotifyWhenDataAvailableExceeds  
  
ans =  
          80000
```

This causes `NotifyWhenDataAvailableExceeds` to set automatically when `Rate` changes.

```
s.Rate = 50000;  
s.NotifyWhenDataAvailableExceeds  
  
ans =  
          5000
```

See Also

Properties

`IsNotifyWhenDataAvailableExceedsAuto`

Events

`DataAvailable`

Functions

addListener, startBackground

NotifyWhenScansQueuedBelow

Control firing of `DataRequired` event

Description

When working with the session-based interface to generate output signals continuously, the `DataRequired` event is fired when you need to queue more data. This occurs when the `ScansQueued` property drops below the value specified in the `NotifyWhenScansQueuedBelow` property.

Values

By default the `DataRequired` event fires when 1/2 second worth of data remains in the queue. To specify a different threshold, change this property value to control when the event is fired.

Example

Control When `DataRequired` Event Is Fired

Specify a threshold below which the `DataRequired` event fires.

Create a session and add an analog output channel.

```
s = daq.createSession('ni')
addAnalogOutputChannel(s, 'cDAQ1Mod2', 0, 'Voltage')
```

Queue some output data.

```
outputData = (linspace(-1,1,1000))';
s.queueOutputData(outputData);
```

Set the threshold of scans queued to 100.

```
s.NotifyWhenScansQueuedBelow = 100;
```


Add an anonymous listener and generate the signal in the background:

```
lh = s.addListener('DataRequired', ...  
@(src,event) src.queueOutputData(outputData));  
startBackground(s);
```

See Also

Properties

ScansQueued, IsNotifyWhenScansQueuedBelowAuto

Events

DataRequired

NumberOfScans

Number of scans for operation when starting

Description

When working with the session-based interface, use the `NumberOfScans` property to specify the number of scans the session will acquire during the operation. Changing the number of scans changes the duration of an acquisition. When the session contains output channels, `NumberOfScans` becomes a read only property and the number of scans in a session is determined by the amount of data queued.

Tips

- To specify length of the acquisition, use `DurationInSeconds`.
 - To control length of the output operation, use `queueOutputData`.
-

Values

You can change the value only when you use input channels.

Example

Change Number of Scans

Create an acquisition session, add an analog input channel, and display the `NumberOfScans`.

```
s = daq.createSession('ni');  
addAnalogInputChannel(s, 'cDAQ1Mod1', 'ai0', 'Voltage');  
s.NumberOfScans
```

```
ans =
```

```
1000
```

Change the NumberOfScans property.

```
s.NumberOfScans = 2000
```

```
s =
```

```
Data acquisition session using National Instruments hardware:
```

```
Will run for 2000 scans (2 seconds) at 1000 scans/second.
```

```
Operation starts immediately.
```

```
Number of channels: 1
```

| index | Type | Device | Channel | MeasurementType | Range | Name |
|-------|------|-----------|---------|-----------------|------------------|------|
| 1 | ai | cDAQ1Mod1 | ai0 | Voltage (Diff) | -10 to +10 Volts | |

See Also

Properties

ScansQueued, DurationInSeconds

Functions

startForeground, startBackground, queueOutputData

Offset

Specify DC offset of waveform

Description

When using waveform function generation channels, `Offset` represents offsetting of a signal from zero, or the mean value of the waveform.

Values

The waveform offset can be between -5 and 5 . Ensure that $\text{Gain} \times \text{Voltage} + \text{Offset}$ falls within the valid ranges of output voltage of the device.

Example

Change the offset of the waveform function generation channel to 2 volts.

```
s = daq.createSession('digilent');
fgenCh = addFunctionGeneratorChannel(s, 'AD1', 1, 'Sine');
fgenCh.Offset = 2
```

```
fgenCh =
```

```
Data acquisition sine waveform generator '1' on device 'AD1':
```

```
    Phase: 0
    Range: -5.0 to +5.0 Volts
TerminalConfig: SingleEnded
    Gain: 0
    Offset: 2
    Frequency: 4096
    WaveformType: Sine
FrequencyLimit: [0.0 25000000.0]
    Name: ''
    ID: '1'
```

```
Device: [1x1 daq.di.DeviceInfo]  
MeasurementType: 'Voltage'
```

See Also

Functions

addFunctionGeneratorChannel

Properties

DutyCycle | Gain | Phase

Phase

Waveform phase

Description

In a function generation channel, the Phase property specifies the period of waveform cycle from its point of origin. Specify the values for Phase in time units.

Example

Set the phase of a waveform function generation channel to 33.

```
s = daq.createSession('digilent')
fgenCh = addFunctionGeneratorChannel(s, 'AD1', 1, 'Sine')
fgenCh.Phase = 33
```

```
fgenCh =
```

```
Data acquisition sine waveform generator '1' on device 'AD1':
```

```
        Phase: 33
        Range: -5.0 to +5.0 Volts
TerminalConfig: SingleEnded
        Gain: 1
        Offset: 0
        Frequency: 4096
        WaveformType: Sine
FrequencyLimit: [0.0 25000000.0]
        Name: ''
        ID: '1'
        Device: [1x1 daq.di.DeviceInfo]
MeasurementType: 'Voltage'
```

See Also

Functions

`addFunctionGeneratorChannel`

Properties

DutyCycle | Gain | Offset

R0

Specify resistance value

Description

Use this property to specify the resistance of the device.

You can specify any acceptable value in ohms. When you add an RTD Channel, the resistance is unknown and the R0 property displays Unknown. You must change this value to set the resistance of this device to the temperature you want.

Example

Set RTD Channels Resistance

Create a session and add an RTD channel.

```
s = daq.createSession('ni');  
ch = addAnalogInputChannel(s, 'cDAQ1Mod7', 3, 'RTD');
```

Change the channels resistance to 100°C.

```
ch.R0 = 100
```

```
ch =
```

```
Data acquisition analog input RTD channel 'ai3' on device 'cDAQ1Mod7':
```

```
          Units: Celsius  
          RTDType: Unknown  
    RTDConfiguration: Unknown  
              R0: 100  
ExcitationCurrent: 0.0005  
ExcitationSource: Internal  
          Coupling: DC  
    TerminalConfig: Differential  
          Range: -200 to +660 Celsius
```



```
Name: ''  
ID: 'ai3'  
Device: [1x1 daq.ni.CompactDAQModule]  
MeasurementType: 'RTD'  
ADCTimingMode: HighResolution
```

See Also

Properties

RTDConfiguration, RTDType

Range

Specify channel measurement range

Description

When working with the session-based interface, use the Range property to indicate the measurement range of a channel.

Values

Range is not applicable for counter channels. For analog channels, value is dependent on the measurement type. This property is read-only for all measurement types except 'Voltage'. You can specify a range in volts for analog channels.

Examples

Set Channel Range

Specify the range of an analog input voltage channel.

Create a session and add an analog input channel.

```
s = daq.createSession('ni');  
ch = addAnalogInputChannel(s, 'cDAQ1Mod7', 3, 'voltage');
```

Set a range of -60 to +60 volts.

```
ch.Range = [-60, 60];
```

Display Ranges Available

See what ranges your channel supports before you set the channel range.

Create a session and add an analog input channel.

```
s = daq.createSession('ni');
ch = addAnalogInputChannel(s, 'Dev1', 3, 'voltage');
```

Display channel device.

```
ch.Device
```

```
ans =
```

```
ni: National Instruments USB-6211 (Device ID: 'Dev1')
  Analog input subsystem supports:
    4 ranges supported
    Rates from 0.1 to 250000.0 scans/sec
    16 channels ('ai0' - 'ai15')
    'Voltage' measurement type

  Analog output subsystem supports:
    -10 to +10 Volts range
    Rates from 0.1 to 250000.0 scans/sec
    2 channels ('ao0', 'ao1')
    'Voltage' measurement type

  Digital subsystem supports:
    8 channels ('port0/line0' - 'port1/line3')
    'InputOnly', 'OutputOnly' measurement types

  Counter input subsystem supports:
    Rates from 0.1 to 80000000.0 scans/sec
    2 channels ('ctr0', 'ctr1')
    'EdgeCount', 'PulseWidth', 'Frequency', 'Position' measurement types

  Counter output subsystem supports:
    Rates from 0.1 to 80000000.0 scans/sec
    2 channels ('ctr0', 'ctr1')
    'PulseGeneration' measurement type
```

Create a subsystems object.

```
sub = ch.Device.Subsystems
```

```
sub =
```

```
Analog input subsystem supports:
  4 ranges supported
  Rates from 0.1 to 250000.0 scans/sec
```

```
    16 channels ('ai0' - 'ai15')
    'Voltage' measurement type
    Properties, Methods, Events

Analog output subsystem supports:
    -10 to +10 Volts range
    Rates from 0.1 to 250000.0 scans/sec
    2 channels ('ao0', 'ao1')
    'Voltage' measurement type
    Properties, Methods, Events

Digital subsystem supports:
    8 channels ('port0/line0' - 'port1/line3')
    'InputOnly', 'OutputOnly' measurement types
    Properties, Methods, Events

Counter input subsystem supports:
    Rates from 0.1 to 80000000.0 scans/sec
    2 channels ('ctr0', 'ctr1')
    'EdgeCount', 'PulseWidth', 'Frequency', 'Position' measurement types
    Properties, Methods, Events

Counter output subsystem supports:
    Rates from 0.1 to 80000000.0 scans/sec
    2 channels ('ctr0', 'ctr1')
    'PulseGeneration' measurement type
    Properties, Methods, Events
```

Display the ranges available on the analog input subsystem.

```
sub(1).RangesAvailable
```

```
ans =
```

```
-0.20 to +0.20 Volts, -1.0 to +1.0 Volts, -5.0 to +5.0 Volts, -10 to +10 Volts
```

See Also

```
daq.createSession, addAnalogInputChannel
```

Rate

Rate of operation in scans per second

Description

When working with the session-based interface, use the Rate property to set the number of scans per second.

Note Many hardware devices accept fractional rates.

Tip On most devices, the hardware limits the exact rates that you can set. When you set the rate, Data Acquisition Toolbox sets the rate to the next higher rate supported by the hardware. If the exact rate affects your analysis of the acquired data, obtain the actual rate after you set it, and then use that in your analysis.

Values

You can set the rate to any positive nonzero scalar value supported by the hardware in its current configuration.

Examples

Change Session Rate

Create a session and add an analog input channel.

```
s = daq.createSession('ni');  
addAnalogInputChannel(s, 'cDAQ1Mod1', 'ai1', 'Voltage');
```

Change the rate to 10000.

```
s.Rate = 10000
```

s =

Data acquisition session using National Instruments hardware:

Will run for 1 second (10000 scans) at 10000 scans/second.

Operation starts immediately.

Number of channels: 1

| index | Type | Device | Channel | MeasurementType | Range | Name |
|-------|------|-----------|---------|-----------------|------------------|------|
| 1 | ai | cDAQ1Mod1 | ai1 | Voltage (Diff) | -10 to +10 Volts | |

See Also

Properties

[DurationInSeconds](#) | [NumberOfScans](#) | [RateLimit](#) | [StandardSampleRates](#) |

[UseStandardSampleRates](#)

Topics

[“Multichannel Audio Session Rate”](#)

RateLimit

Limit of rate of operation based on hardware configuration

Description

In the session-based interface, the read-only `RateLimit` property displays the minimum and maximum rates that the session supports, based on the device configuration for the session.

Tip `RateLimit` changes dynamically as the session configuration changes.

Example

Display Sessions Rate Limit

Create session and add an analog input channel.

```
s = daq.createSession('ni');  
addAnalogInputChannel(s, 'cDAQ1Mod1', 'ai1', 'Voltage');
```

Examine the session's rate limit.

```
s.RateLimit
```

```
ans =
```

```
1.0e+05 *
```

0.0000 2.5000

See Also

Properties

Rate

RTDConfiguration

Specify wiring configuration of RTD device

Description

Use this property to specify the wiring configuration for measuring resistance.

When you create an RTD channel, the wiring configuration is unknown and the `RTDConfiguration` property displays `Unknown`. You must change this to one of the following valid configurations:

- `TwoWire`
- `ThreeWire`
- `FourWire`

Example

Specify Channel's RTD Configuration

Specify an RTD channels wiring configuration.

Create a session and add an RTD channel to it.

```
s = daq.createSession('ni');  
ch = addAnalogInputChannel(s, 'cDAQ1Mod7', 3, 'RTD');
```

Change the `RTDConfiguration` to `ThreeWire`.

```
ch.RTDConfiguration = 'ThreeWire'
```

```
ch =
```

```
Data acquisition analog input RTD channel 'ai3' on device 'cDAQ1Mod7':
```

```
Units: Celsius  
RTDType: Unknown
```

```
RTDConfiguration: ThreeWire
                   R0: 'Unknown'
ExcitationCurrent: 0.0005
ExcitationSource: Internal
                   Coupling: DC
TerminalConfig: Differential
                   Range: -200 to +660 Celsius
                   Name: ''
                   ID: 'ai3'
                   Device: [1x1 daq.ni.CompactDAQModule]
MeasurementType: 'RTD'
ADCTimingMode: HighResolution
```

See Also

Properties

R0, RTDType

RTDType

Specify sensor sensitivity

Description

Use this property to specify the sensitivity of a standard RTD sensor in the session-based interface. A standard RTD sensor is defined as a 100-ohm platinum sensor.

When you create an RTD channel, the sensitivity is unknown and the RTDType property displays Unknown. You must change this to one of these valid values:

- Pt3750
- Pt3851
- Pt3911
- Pt3916
- Pt3920
- Pt3928

Example

Set RTD Sensor Type

Set an RTD sensor's sensitivity type.

Create a session and add an RTD channel.

```
s = daq.createSession('ni');  
ch = addAnalogInputChannel(s, 'cDAQ1Mod7', 3, 'RTD');
```

Set the RTDType to Pt3851.

```
ch.RTDType = 'Pt3851'
```

```
ch =
```

Data acquisition analog input RTD channel 'ai3' on device 'cDAQ1Mod7':

```
    Units: Celsius
    RTDType: Pt3851
    RTDConfiguration: ThreeWire
        R0: 'Unknown'
    ExcitationCurrent: 0.0005
    ExcitationSource: Internal
    Coupling: DC
    TerminalConfig: Differential
        Range: -200 to +660 Celsius
        Name: ''
        ID: 'ai3'
        Device: [1x1 daq.ni.CompactDAQModule]
    MeasurementType: 'RTD'
    ADCTimingMode: HighResolution
```

See Also

`addAnalogInputChannel`

Properties

`RTDConfiguration`, `RTDType`

ScansAcquired

Number of scans acquired during operation

Description

In the session-based interface, the `ScansAcquired` property displays the number of scans acquired after you start the operation using `startBackground`.

Values

The read-only value represents the number of scans acquired by the hardware. This value is reset each time you call `startBackground`.

Example

Display Number of Scans Acquired

Acquire analog input data and display the number of scans acquired.

Create a session, add an analog input channel,

```
s = daq.createSession('ni');  
ch = addAnalogInputChannel(s, 'Dev1', 'ai1', 'voltage');
```

See how many scan the session had acquired.

```
s.ScansAcquired
```

```
ans =
```

```
0
```

Start the acquisition and see how many scans the session has acquired

```
startForeground(s);  
s.ScansAcquired
```

ans =

1000

See Also

Properties

NumberOfScans, ScansOutputByHardware

Functions

startBackground

ScansOutputByHardware

Indicate number of scans output by hardware

Description

In the session-based interface, the `ScansOutputByHardware` property displays the number of scans output by the hardware after you start the operation using `startBackground`.

Tip The value depends on information from the hardware.

Values

This read-only value is based on the output of the hardware configured for your session.

Example

Display Scans Output by Hardware

Generate data on an analog output channel and to see how many scans are output by the hardware.

Create a session and add an analog output channel.

```
s = daq.createSession('ni');  
ch = addAnalogOutputChannel(s, 'Dev1', 'aol', 'voltage');
```

Queue some output data and start the generation.

```
s.queueOutputData(linspace(-1, 1, 1000)');  
startForeground(s);
```

Examine the `ScansOutputByHardware` property.

s.ScansOutputByHardware

ans =

1000

See Also

Properties

ScansAcquired, ScansQueued

Functions

queueOutputData, startBackground

ScansQueued

Indicate number of scans queued for output

Description

In the session-based interface, the `ScansQueued` property displays the number of scans queued for output `queueOutputData`. The `ScansQueued` property increases when you successfully call `queueOutputData`. The `ScansQueued` property decreases when the hardware reports that it has successfully output data.

Values

This read-only value is based on the number of scans queued.

Example

Display Scans Queued

Queue some output data to an analog output channel and examine the session properties to see how many scans are queued.

Create a session and add an analog output channel.

```
s = daq.createSession('ni');  
ch = addAnalogOutputChannel(s, 'Dev1', 'ao1', 'voltage');
```

Queue some output data and call the `ScansQueued` property to see number of data queued.

```
s.queueOutputData(linspace(-1,1,1000)');  
s.ScansQueued  
  
s.ScansQueued
```

ans =

1000

See Also

Properties

ScansOutputByHardware

Functions

queueOutputData

Sensitivity

Sensitivity of an analog channel

Description

When working with the session-based interface, the `Sensitivity` property to set the accelerometer or microphone sensor channel.

Sensitivity in an accelerometer channel is expressed as $\frac{v}{g}$, or volts per gravity.

Sensitivity in a microphone channel is expressed as $\frac{v}{pa}$, or volts per pascal.

Examples

Create a session object, add an analog input channel, with the 'accelerometer' `MeasurementType`.

```
s = daq.createSession('ni');
s.addAnalogInputChannel('Dev4', 'ai0', 'accelerometer')
```

```
Data acquisition session using National Instruments hardware:
Will run for 1 second (2000 scans) at 2000 scans/second.
```

```
Number of channels: 1
```

| index | Type | Device | Channel | MeasurementType | Range | Name |
|-------|------|--------|---------|----------------------------|--------------------|------|
| 1 | ai | Dev4 | ai0 | Accelerometer (PseudoDiff) | -5.0 to +5.0 Volts | |

Change the `Sensitivity` to `10.2e-3 V/G`:

```
ch1 = s.Channels(1)
ch1.Sensitivity = 10.2e-3
```

```
s =
```

```
Data acquisition session using National Instruments hardware:
Will run for 1 second (2000 scans) at 2000 scans/second.
```

```
Number of channels: 1
```

| index | Type | Device | Channel | MeasurementType | Range | Name |
|-------|------|--------|---------|----------------------------|------------------------|------|
| 1 | ai | Dev4 | ai0 | Accelerometer (PseudoDiff) | -490 to +490 Gravities | |

See Also

`addAnalogInputChannel`

ShuntLocation

Indicate location of channel's shunt resistor

Description

When working with the session-based interface, `ShuntLocation` on the analog input current channel indicates if the shunt resistor is located internally on the device or externally. Values are:

- `'Internal'`: when the shunt resistor is located internally.
- `'External'`: when the shunt resistor is located externally.

If your device supports an internal shunt resistor, this property is set to `Internal` by default. If the shunt location is external, you must specify the shunt resistance value.

Example

Specify Shunt Location

Set the shunt location of an analog input current channel.

Create a session and add an analog input current channel.

```
s = daq.createSession('ni')
ch = addAnalogInputChannel(s, 'cDAQ1Mod7', 0, 'Current');
```

Set the `ShuntLocation` to `Internal`.

```
ch.ShuntLocation = 'Internal'
```

```
ch =
```

```
Data acquisition analog input current channel 'ai0' on device 'cDAQ1Mod7':
```

```
    ShuntLocation: Internal
ShuntResistance: 20
      Coupling: DC
TerminalConfig: Differential
```

```
Range: -0.025 to +0.025 A
Name: ''
ID: 'ai0'
Device: [1x1 daq.ni.CompactDAQModule]
MeasurementType: 'Current'
ADCTimingMode: HighResolution
```

See Also

ShuntResistance

ShuntResistance

Resistance value of channel's shunt resistor

Description

When working with the session-based interface, the analog input current channel's `ShuntResistance` property indicates resistance in ohms. This value is automatically set if the shunt resistor is located internally on the device and is read only.

Note Before starting an analog output channel with an external shunt resistor, specify the shunt resistance value.

Example

Specify Shunt Resistance

Set the shunt resistance of an analog input current channel.

Create a session and add an analog input current channel.

```
s = daq.createSession('ni')
ch = addAnalogInputChannel(s, 'cDAQ1Mod7', 0, 'Current');
```

Set the `ShuntLocation` to `External` and the `ShuntResistance` to 20.

```
ch.ShuntLocation = 'External';
ch.ShuntResistance = 20
```

```
ch =
```

```
Data acquisition analog input current channel 'ai0' on device 'cDAQ1Mod7':
```

```
    ShuntLocation: External
ShuntResistance: 20
    Coupling: DC
TerminalConfig: Differential
    Range: -0.025 to +0.025 A
    Name: ''
```

```
ID: 'ai0'  
Device: [1x1 daq.ni.CompactDAQModule]  
MeasurementType: 'Current'  
ADCTimingMode: HighResolution
```

See Also

ShuntLocation

Source

Indicates trigger source terminal

Description

When working with the session-based interface, the Source property indicates the device and terminal to which you added a trigger.

Example

View Clock Connection Source

Create an external clock connection and view the connection properties.

Create a session and add a digital input channel.

```
s = daq.createSession('ni');  
ch = addDigitalChannel(s, 'Dev1', 'Port0/Line2', 'InputOnly');
```

Add an external scan clock connection.

```
s.addClockConnection('External', 'Dev1/PFI0', 'ScanClock')
```

```
ans =
```

Scan Clock is provided externally and will be received by 'Dev1' at terminal 'PFI0'.

```
    Source: 'External'  
Destination: 'Dev1/PFI0'  
    Type: ScanClock
```

See Also

DestinationaddTriggerConnection

StandardSampleRates

Display standard rates of sampling

Description

This property displays the standard sample rates supported by your audio device. You can choose to use the standard rates or use values within the given range. See `UseStandardSampleRates` for more information.

Standard sample rates for DirectSound audio devices are:

- 8000
- 8192
- 11025
- 16000
- 22050
- 32000
- 44100
- 47250
- 48000
- 50000
- 88200
- 96000
- 176400
- 192000
- 352800

Example

Set Rate of an Audio Session

Specify a nonstandard sample rate for a session with multichannel audio devices.

Create a session and add an audio channel.

```
s = daq.createSession('directsound')
ch = addAudioInputChannel(s, 'Audio1', 1);
```

Specify the session to use nonstandard sample rates.

```
s.UseStandardSampleRates = false
```

Data acquisition session using DirectSound hardware:

Will run for 1 second (44100 scans) at 44100 scans/second.

Number of channels: 1

| index | Type | Device | Channel | MeasurementType | Range | Name |
|-------|------|--------|---------|-----------------|--------------|------|
| 1 | audi | Audio1 | 1 | Audio | -1.0 to +1.0 | |

Change the session rate to 85000.

```
s.Rate = 85000
```

```
s =
```

Data acquisition session using DirectSound hardware:

Will run for 1 second (85000 scans) at 85000 scans/second.

Number of channels: 1

| index | Type | Device | Channel | MeasurementType | Range | Name |
|-------|------|--------|---------|-----------------|--------------|------|
| 1 | audi | Audio1 | 1 | Audio | -1.0 to +1.0 | |

See Also

[BitsPerSample](#) | [Rate](#) | [UseStandardSampleRates](#) | [addAudioInputChannel](#) | [addAudioOutputChannel](#)

Topics

“Multichannel Audio Session Rate”

Terminal

PFI terminal of counter subsystem

Description

The `Terminal` property indicates the counter subsystem's corresponding PFI terminal.

Example

Determine Counter Input Channel Terminal

Determine the terminal on the counter channel connected to your input signal.

Create a session and add a counter input channel.

```
s = daq.createSession('ni');  
ch = addCounterInputChannel(s, 'cDAQ1Mod5', 'ctr0', 'PulseWidth');
```

Examine the `Terminal` property of the channel.

```
ch.Terminal
```

```
ans =
```

```
PFI1
```

See Also

`addCounterInputChannel`, `addCounterOutputChannel`

TerminalConfig

Specify terminal configuration

Description

Use the `TerminalConfig` to change the configuration of your analog channel. The property displays the hardware default configuration. You can change this to

- `SingleEnded`
- `SingleEndedNonReferenced`
- `Differential`
- `PseudoDifferential`

Example

Change Analog Channel Terminal Configuration

Change the terminal configuration of an analog input channel.

Create a session and add an analog input voltage channel.

```
s = daq.createSession('ni');  
ch = addAnalogInputChannel(s, 'dev5', 0, 'voltage')
```

```
ch =
```

```
Data acquisition analog input voltage channel 'ai0' on device 'Dev5':
```

```
    Coupling: DC  
    TerminalConfig: Differential  
        Range: -10 to +10 Volts  
        Name: ''  
        ID: 'ai0'  
        Device: [1x1 daq.ni.DeviceInfo]  
    MeasurementType: 'Voltage'
```

Change the TerminalConfig of the channel to SingleEnded.

```
ch.TerminalConfig = 'SingleEnded'
```

```
ch =
```

```
Data acquisition analog input voltage channel 'ai0' on device 'Dev5':
```

```
    Coupling: DC  
    TerminalConfig: SingleEnded  
    Range: -10 to +10 Volts  
    Name: ''  
    ID: 'ai0'  
    Device: [1x1 daq.ni.DeviceInfo]  
    MeasurementType: 'Voltage'
```

See Also

[addAnalogInputChannel](#) | [addAnalogOutputChannel](#)

Terminals

Terminals available on device or CompactDAQ chassis

Description

When working with the session-based interface, the `Terminals` on the device or the CompactDAQ chassis lists all available terminals. The list includes terminals available for trigger and clock connections. When you access the `Terminals` property on modules on a CompactDAQ chassis, the terminals are on the chassis, not on the module.

Examples

Display Device Terminals

Discover available devices.

```
d = daq.getDevices
```

```
d =
```

```
Data acquisition devices:
```

| index | Vendor | Device ID | Description |
|-------|--------|-----------|------------------------------|
| 1 | ni | cDAQ1Mod1 | National Instruments NI 9205 |
| 2 | ni | cDAQ1Mod2 | National Instruments NI 9263 |
| 3 | ni | cDAQ1Mod3 | National Instruments NI 9234 |
| 4 | ni | cDAQ1Mod4 | National Instruments NI 9201 |
| 5 | ni | cDAQ1Mod5 | National Instruments NI 9402 |
| 6 | ni | cDAQ1Mod6 | National Instruments NI 9213 |
| 7 | ni | cDAQ1Mod7 | National Instruments NI 9219 |
| 8 | ni | cDAQ1Mod8 | National Instruments NI 9265 |

Access the `Terminals` property of NI 9205 with index 1.

```
d(1).Terminals
```



```
ans =  
    'cDAQ1/PFI0'  
    'cDAQ1/PFI1'  
    'cDAQ1/20MHzTimebase'  
    'cDAQ1/80MHzTimebase'  
    'cDAQ1/ChangeDetectionEvent'  
    'cDAQ1/AnalogComparisonEvent'  
    'cDAQ1/100kHzTimebase'  
    'cDAQ1/SyncPulse0'  
    'cDAQ1/SyncPulse1'  
    .  
    .  
    .
```

See Also

Functions

daq.getDevices, addTriggerConnection, addClockConnection

ThermocoupleType

Select thermocouple type

Description

When working with the session-based interface, use the `ThermocoupleType` property to select the type of thermocouple you will use to make your measurements. Select the type based on the temperature range and sensitivity you need, according to the NIST Thermocouple Types Definitions.

Values

You can set the `ThermocoupleType` to:

- 'J'
- 'K'
- 'N'
- 'R'
- 'S'
- 'T'
- 'B'
- 'E'

By default the thermocouple type is 'Unknown'.

Example

Specify Thermocouple Type

Create a session and add an analog input channel with 'Thermocouple' measurement type.

```
s = daq.createSession('ni');
ch = addAnalogInputChannel(s, 'cDAQ1Mod6', 'ai1', 'Thermocouple')

ch =

Data acquisition analog input thermocouple channel 'ai1' on device 'cDAQ1Mod6':

    Units: Celsius
ThermocoupleType: Unknown
    Range: 0 to +750 Celsius
    Name: ''
    ID: 'ai1'
    Device: [1x1 daq.ni.CompactDAQModule]
MeasurementType: 'Thermocouple'
ADCTimingMode: HighResolution
```

Set the `ThermocoupleType` property to `'J'`.

```
ch.ThermocoupleType = 'J'

ch =

Data acquisition analog input thermocouple channel 'ai1' on device 'cDAQ1Mod6':

    Units: Celsius
ThermocoupleType: J
    Range: 0 to +750 Celsius
    Name: ''
    ID: 'ai1'
    Device: [1x1 daq.ni.CompactDAQModule]
MeasurementType: 'Thermocouple'
ADCTimingMode: HighResolution
```

See Also

Functions

`addAnalogInputChannel`

External Websites

NIST ITS-90 Thermocouple Database

TriggerCondition

Specify condition that must be satisfied before trigger executes

Description

When working with the session-based interface, use the `TriggerCondition` property to specify the signal condition that executes the trigger, which synchronizes operations on devices in a session. For more information, see “Synchronization”.

Values

Set the trigger condition to `RisingEdge` or `FallingEdge`.

Examples

Specify Session Connection Trigger Condition

Create a session and add channels and trigger to the session.

```
s = daq.createSession('ni');
addAnalogInputChannel(s, 'Dev1', 0, 'voltage');
addAnalogInputChannel(s, 'Dev2', 0, 'voltage');
addTriggerConnection(s, 'Dev1/PFI4', 'Dev2/PFI0', 'StartTrigger');
```

Change the trigger condition to `FallingEdge`.

```
connection = s.Connections(1)
connection.TriggerCondition = 'FallingEdge'
```

```
s =
```

```
Data acquisition session using National Instruments hardware:
  Will run for 1 second (1000 scans) at 1000 scans/second.
```

```
  Trigger Connection added. (Details)
```

```
Number of channels: 2
  index Type Device Channel MeasurementType      Range      Name
-----
  1     ai  Dev1  ai0    Voltage (Diff) -10 to +10 Volts
  2     ai  Dev2  ai0    Voltage (Diff) -10 to +10 Volts
```

Click on **(Details)** to see the connection details.

Start Trigger is provided by 'Dev1' at 'PFI4' and will be received by 'Dev2' at terminal 'PFI0'.

```
TriggerType: 'Digital'
TriggerCondition: FallingEdge
Source: 'Dev1/PFI4'
Destination: 'Dev2/PFI0'
Type: StartTrigger
```

See Also

`addTriggerConnection`

Properties

`TriggerType`

TriggersPerRun

Indicate the number of times the trigger executes in an operation

Description

When working with the session-based interface, the `TriggersPerRun` property indicates the number of times the specified trigger executes for one acquisition or generation session.

Examples

Specify Number of Triggers Per Operation

Create a session and add channels and trigger to the session.

```
s = daq.createSession('ni');
addAnalogInputChannel(s, 'Dev1', 0, 'voltage');
addAnalogInputChannel(s, 'Dev2', 0, 'voltage');
addTriggerConnection(s, 'Dev1/PFI4', 'Dev2/PFI0', 'StartTrigger');
```

Display Session's `TriggersPerRun` Property.

```
s.TriggersPerRun
```

```
ans =
```

```
1
```

Set the trigger to run twice during the operation.

```
s.TriggersPerRun = 2
```

```
s =
```

```
Data acquisition session using National Instruments hardware:
  Will run 2 times for 1 second (1000 scans) at 1000 scans/second.
```

Trigger Connection added. (Details)

Number of channels: 2

| index | Type | Device | Channel | MeasurementType | Range | Name |
|-------|------|--------|---------|-----------------|------------------|------|
| 1 | ai | Dev1 | ai0 | Voltage (Diff) | -10 to +10 Volts | |
| 2 | ai | Dev2 | ai0 | Voltage (Diff) | -10 to +10 Volts | |

See Also

`addTriggerConnection`

TriggersRemaining

Indicates the number of trigger to execute in an operation

Description

When working with the session-based interface, the `TriggersRemaining` property indicates the number of trigger remaining for this acquisition or generation session. This value depends on the number of triggers set using `TriggersPerRun`.

Examples

Display Number of Triggers Remaining in Operation

Create a session and add channels and trigger to the session.

```
s = daq.createSession('ni');  
addAnalogInputChannel(s, 'Dev1', 0, 'voltage');  
addAnalogInputChannel(s, 'Dev2', 0, 'voltage');  
addTriggerConnection(s, 'Dev1/PFI4', 'Dev2/PFI0', 'StartTrigger');
```

Display Session's `TriggersRemaining` Property.

```
s.TriggersRemaining
```

```
ans =
```

```
1
```

See Also

`addTriggerConnection`

TriggerType

Type of trigger executed

Description

This read-only property displays the type of trigger that the source device executes to synchronize operations in the session. Currently all trigger types are `digital`.

See Also

Functions

`addTriggerConnection`

Properties

`TriggerCondition`

Units

Specify unit of RTD measurement

Description

Use this property to specify the temperature unit of the analog input channel with RTD measurement type in the session-based interface.

You can specify temperature values as:

- Celsius (Default)
- Fahrenheit
- Kelvin
- Rankine

Example

Change RTD Unit

Change the unit of an RTD channel.

Create a session, add an analog input RTD channel, and display channel properties.

```
s = daq.createSession('ni');
ch = addAnalogInputChannel(s, 'cDAQ1Mod7', 0, 'RTD')
ch =
```

Data acquisition analog input RTD channel 'ai0' on device 'cDAQ1Mod7':

```
Units: Celsius
RTDType: Unknown
RTDConfiguration: Unknown
R0: 'Unknown'
ExcitationCurrent: 0.0005
ExcitationSource: Internal
```

```
Coupling: DC
TerminalConfig: Differential
  Range: -200 to +660 Celsius
  Name: ''
  ID: 'ai0'
  Device: [1x1 daq.ni.CompactDAQModule]
MeasurementType: 'RTD'
ADCTimingMode: HighResolution
```

Change the Units property from Celsius to Fahrenheit.

```
ch.Units = 'Fahrenheit'
```

```
ch =
```

Data acquisition analog input RTD channel 'ai0' on device 'cDAQ1Mod7':

```
Units: Fahrenheit
RTDType: Unknown
RTDConfiguration: Unknown
  R0: 'Unknown'
ExcitationCurrent: 0.0005
ExcitationSource: Internal
  Coupling: DC
  TerminalConfig: Differential
  Range: -328 to +1220 Fahrenheit
  Name: ''
  ID: 'ai0'
  Device: [1x1 daq.ni.CompactDAQModule]
MeasurementType: 'RTD'
ADCTimingMode: HighResolution
```

See Also

Class

`addAnalogInputChannel`

UserData

Custom data

Description

Manipulate custom data for a data acquisition session object using the `UserData` property. The property is never read-only. Its value can be any MATLAB® data type and format.

Examples

Create a session and define its `UserData` property fields.

```
s = daq.createSession('ni');  
s.UserData.Data = [];  
s.UserData.TimeStamps = [];  
s.UserData.StartTime = [];
```

Set the start time, and append event information to the log fields stored in `UserData`.

```
s.UserData.StartTime = eventData.TriggerTime;  
s.UserData.Data = [s.UserData.Data; eventData.Data];  
s.UserData.TimeStamps = [s.UserData.TimeStamps; eventData.TimeStamps];
```

See Also

Functions

`daq.createSession`

UseStandardSampleRates

Configure session to use standard sample rates

Description

Use this property to specify if your audio channel uses standard sample rates supported by your device or a user-specified value. To use non-standard sample rates, set the value to `false` and set the session's `Rate` to the desired value.

Example

Change Acquisition Rate

Add an audio channel to a session and change the `UseStandardSampleRates` property.

```
s = daq.createSession('directsound');
addAudioInputChannel(s,Audiol,1);
s.UseStandardSampleRates = false
```

s =

Data acquisition session using DirectSound hardware:

Will run for 1 second (44100 scans) at 44100 scans/second.

Number of channels: 1

| index | Type | Device | Channel | MeasurementType | Range | Name |
|-------|------|--------|---------|-----------------|--------------|------|
| 1 | audi | Audiol | 1 | Audio | -1.0 to +1.0 | |

Specify a different scan rate.

```
s.Rate = 8500
```

s =

Data acquisition session using DirectSound hardware:

Will run for 1 second (8500 scans) at 8500 scans/second.

Number of channels: 1

| index | Type | Device | Channel | MeasurementType | Range | Name |
|-------|------|--------|---------|-----------------|--------------|------|
| 1 | audi | Audio3 | 1 | Audio | -1.0 to +1.0 | |

See Also

Rate | StandardSampleRates | [addAudioInputChannel](#) | [addAudioOutputChannel](#)

Topics

“Multichannel Audio Session Rate”

Vendor

Vendor information associated with session object

Description

In the session-based interface, the `Vendor` property displays information about the vendor.

Values

a `daq.Vendor` object that represents the vendor associated with the session.

Examples

Use the `daq.getVendors` to get information about vendors.

```
s = daq.createSession('ni');  
v = s.Vendor
```

```
v =
```

```
Data acquisition vendor 'National Instruments':
```

```
    ID: 'ni'  
    FullName: 'National Instruments'  
    AdaptorVersion: '3.3 (R2013a)'  
    DriverVersion: '9.2.3 NI-DAQmx'  
    IsOperational: true
```

Properties, Methods, Events

Additional data acquisition vendors may be available as downloadable support packages. Open the Support Package Installer to install additional vendors.

See Also

`daq.createSession`

WaveformType

Function generator channel waveform type

Description

This read-only property displays the channel waveform type that you specified while creating a function generator channel in a session. Supported waveform types are:

- 'Sine'
- 'Square'
- 'Triangle'
- 'RampUp'
- 'RampDown'
- 'DC'
- 'Arbitrary'

Example

Display the channel's waveform type.

```
fgenCh.WaveformType
```

```
ans =
```

```
    Sine
```

ZResetCondition

Reset condition for Z-indexing

Description

When working with the session-based interface, use the `ZResetCondition` property to specify reset conditions for Z-indexing of counter Input 'Position' channels. Accepted values are:

- 'BothHigh'
- 'BothLow'
- 'AHigh'
- 'BHigh'

Example

Change Counter Channel Z Reset Condition

Create a session and add a counter input Position channel.

```
s = daq.createSession('ni');  
ch = addCounterInputChannel(s, 'cDAQ1Mod5', 0, 'Position')
```

```
ch =
```

```
Data acquisition counter input position channel 'ctr0' on device 'cDAQ1Mod5':
```

```
EncoderType: X1  
ZResetEnable: 0  
ZResetValue: 0  
ZResetCondition: BothHigh  
TerminalA: 'PFI0'  
TerminalB: 'PFI2'  
TerminalZ: 'PFI1'  
Name: ''  
ID: 'ctr0'  
Device: [1x1 daq.ni.CompactDAQModule]  
MeasurementType: 'Position'
```

Change the ZResetCondition to BothLow.

```
ch.ZResetCondition = 'BothLow'
```

```
ch =
```

```
Data acquisition counter input position channel 'ctr0' on device 'cDAQ1Mod5':
```

```
EncoderType: X1
ZResetEnable: 0
ZResetValue: 0
ZResetCondition: BothLow
TerminalA: 'PFI0'
TerminalB: 'PFI2'
TerminalZ: 'PFI1'
Name: ''
ID: 'ctr0'
Device: [1x1 daq.ni.CompactDAQModule]
MeasurementType: 'Position'
```

See Also

`addCounterInputChannel`

ZResetEnable

Enable reset for Z-indexing

Description

Use the ZResetEnable property to allow the Z-indexing to be reset on a counter input 'Position' channel.

Example

Reset Z Indexing on Counter Channel

Create a session and add a counter input Position channel.

```
s = daq.createSession('ni');  
ch = addCounterInputChannel(s, 'cDAQ1Mod5', 0, 'Position')
```

```
ch =
```

```
Data acquisition counter input position channel 'ctr0' on device 'cDAQ1Mod5':
```

```
    EncoderType: X1  
    ZResetEnable: 0  
    ZResetValue: 0  
    ZResetCondition: BothHigh  
    TerminalA: 'PFI0'  
    TerminalB: 'PFI2'  
    TerminalZ: 'PFI1'  
    Name: ''  
    ID: 'ctr0'  
    Device: [1x1 daq.ni.CompactDAQModule]  
    MeasurementType: 'Position'
```

Change the ZResetEnable property value to 1.

```
ch.ZResetEnable = 1
```

```
ch =
```

```
Data acquisition counter input position channel 'ctr0' on device 'cDAQ1Mod5':
```

```
EncoderType: X1
ZResetEnable: 1
ZResetValue: 0
ZResetCondition: BothHigh
  TerminalA: 'PFI0'
  TerminalB: 'PFI2'
  TerminalZ: 'PFI1'
  Name: ''
  ID: 'ctr0'
  Device: [1x1 daq.ni.CompactDAQModule]
MeasurementType: 'Position'
```

See Also

Class

addCounterInputChannel

ZResetValue

Reset value for Z-indexing

Description

When working with the session-based interface, use the `ZResetValue` property to specify the reset value for Z-indexing on a counter input 'Position' channel.

Example

Specify Z Indexing Value

Create a session and add a counter input `Position` channel.

```
s = daq.createSession('ni');  
ch = addCounterInputChannel(s, 'cDAQ1Mod5', 0, 'Position')
```

```
ch =
```

```
Data acquisition counter input position channel 'ctr0' on device 'cDAQ1Mod5':
```

```
    EncoderType: X1  
    ZResetEnable: 0  
    ZResetValue: 0  
    ZResetCondition: BothHigh  
    TerminalA: 'PFI0'  
    TerminalB: 'PFI2'  
    TerminalZ: 'PFI1'  
    Name: ''  
    ID: 'ctr0'  
    Device: [1x1 daq.ni.CompactDAQModule]  
    MeasurementType: 'Position'
```

Change the `ZResetValue` to 62.

```
ch.ZResetValue = 62
```

```
ch =
```

```
Data acquisition counter input position channel 'ctr0' on device 'cDAQ1Mod5':
```

```
EncoderType: X1
ZResetEnable: 1
ZResetValue: 62
ZResetCondition: BothHigh
  TerminalA: 'PFI0'
  TerminalB: 'PFI2'
  TerminalZ: 'PFI1'
  Name: ''
  ID: 'ctr0'
  Device: [1x1 daq.ni.CompactDAQModule]
MeasurementType: 'Position'
```

See Also

Class

`addCounterInputChannel`

Device-Specific Properties — Alphabetical List

Coupling

Specify input coupling mode

Description

The `Coupling` property indicates the coupling mode used for the analog input signal connection. You cannot change the value for devices that support only one mode. For devices that support both AC and DC coupling, you can specify the mode by changing this property value.

If `Coupling` is set to `'DC'`, the signal input is connected directly to the amplifier, allowing measurement of the complete signal including its DC bias component. This is typically used with slowly changing signals such as temperature, pressure, or voltage readings.

If `Coupling` is set to `'AC'`, a series capacitor is inserted between the input connector and the amplifier, filtering out the DC bias component of the measured signal. This is typically used with dynamic signals such as audio.

Values

- | | |
|-------------------|---|
| <code>'DC'</code> | Direct input connection to amplifier. Default for any device that supports DC coupling. |
| <code>'AC'</code> | Series capacitor inserted between the input connector and the amplifier. Default for any device that supports only AC coupling. |

Examples

Create a session and add an analog input channel. Then change the coupling mode to `'AC'`.

```
s = daq.createSession('ni');  
ch = addAnalogInputChannel(s, 'Dev4', 'ai1', 'Voltage')
```

```
ch.Coupling = 'AC'
```

See Also

Functions

[addAnalogInputChannel](#)

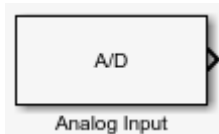
Properties

[Range](#) | [TerminalConfig](#)

Block Reference

Analog Input

Acquire data from multiple analog channels of data acquisition device



Library

Data Acquisition Toolbox

Note Some devices are not supported by the Simulink® blocks in Data Acquisition Toolbox. To see if your device supports Simulink, refer to Supported Hardware.

Description

The Analog Input block opens, initializes, configures, and controls an analog data acquisition device. The opening, initialization, and configuration of the device occur once at the start of the model execution. During the model run time, the block acquires data either synchronously (deliver the current block of data the device is providing) or asynchronously (stream buffered incoming data).

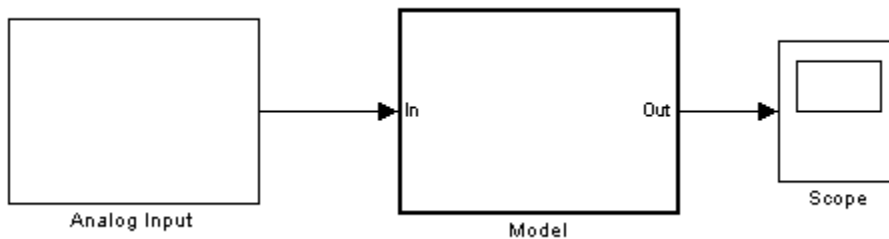
The block has no input ports. It has one or more output ports, depending on the configuration you choose in its dialog box.

Use the Analog Input block to incorporate live measured data into Simulink for:

- System characterization
- Algorithm verification
- System and algorithm modeling
- Model and design validation
- Controller design

The following diagram shows the basic analog input usage configuration, with which you can:

- Acquire data at each time step or once per model execution.
- Analyze the data, or use it as input to a system in the model.
- Optionally display results.



Notes To use this block, you need both Data Acquisition Toolbox and Simulink software.

You can use the Analog Input block only with devices that support clocked acquisition. To acquire data using devices that do not support clocking, use the Analog Input (Single Sample) block.

Other Supported Features

- If you have DSP System Toolbox™, you can use this block for signal applications.
- This block supports the use of Simulink Accelerator™ mode, but not Rapid Accelerator or code generation.
- The block supports the use of model referencing, so that your model can include other Simulink models as modular components.

For more information on these features, see the “Simulink” documentation.

Dialog Box

Use the Block Parameters dialog box to select your acquisition mode and to set other configuration options.

Block Parameters: Analog Input

Analog Input

Acquire block of data from multiple analog channels of a data acquisition device. Every simulation time step, a column vector of samples with size specified in Block size field would be acquired from each channel.

Parameters

Device:

Acquisition Mode

Asynchronous - Initiates the acquisition when simulation starts. The simulation runs while data is acquired into a FIFO buffer.

Synchronous - Initiates the acquisition at each time step. The simulation will not continue until all data is acquired.

Channels:

| Channel ID | Name | Module | Measurement Type | Terminal Config | Input Range | Coupling |
|-------------------------------------|------|-----------|------------------|-----------------|------------------|----------|
| <input checked="" type="checkbox"/> | ai0 | cDAQ2Mod5 | Voltage | Differential | -60 to +60 Volts | DC |
| <input checked="" type="checkbox"/> | ai1 | cDAQ2Mod5 | Voltage | Differential | -60 to +60 Volts | DC |
| <input checked="" type="checkbox"/> | ai2 | cDAQ2Mod5 | Voltage | Differential | -60 to +60 Volts | DC |
| <input checked="" type="checkbox"/> | ai3 | cDAQ2Mod5 | Voltage | Differential | -60 to +60 Volts | DC |
| <input checked="" type="checkbox"/> | ai0 | cDAQ2Mod8 | Voltage | SingleEnded | -10 to +10 Volts | DC |
| <input checked="" type="checkbox"/> | ai1 | cDAQ2Mod8 | Voltage | SingleEnded | -10 to +10 Volts | DC |
| <input checked="" type="checkbox"/> | ai2 | cDAQ2Mod8 | Voltage | SingleEnded | -10 to +10 Volts | DC |
| <input checked="" type="checkbox"/> | ai3 | cDAQ2Mod8 | Voltage | SingleEnded | -10 to +10 Volts | DC |
| <input checked="" type="checkbox"/> | ai4 | cDAQ2Mod8 | Voltage | SingleEnded | -10 to +10 Volts | DC |
| <input checked="" type="checkbox"/> | ai5 | cDAQ2Mod8 | Voltage | SingleEnded | -10 to +10 Volts | DC |
| <input checked="" type="checkbox"/> | ai6 | cDAQ2Mod8 | Voltage | SingleEnded | -10 to +10 Volts | DC |
| <input checked="" type="checkbox"/> | ai7 | cDAQ2Mod8 | Voltage | SingleEnded | -10 to +10 Volts | DC |

Number of ports:

Input sample rate (samples/second):

Actual rate will be 100 samples per second.

Block size:

Output relative timestamps

Device

The device from which you want to acquire data. The items in the list vary, depending on which devices you have connected to your system. Devices in the list are specified by adaptor or vendor name and unique device ID, followed by the model name of the device, for example, `ni Dev1 (USB-6255)`. The first available device is selected by default. CompactDAQ chassis would be shown as a single device; vendor name, chassis ID, and chassis model would be shown in the list, for example, `ni cDAQ2 (cDAQ-9172)`.

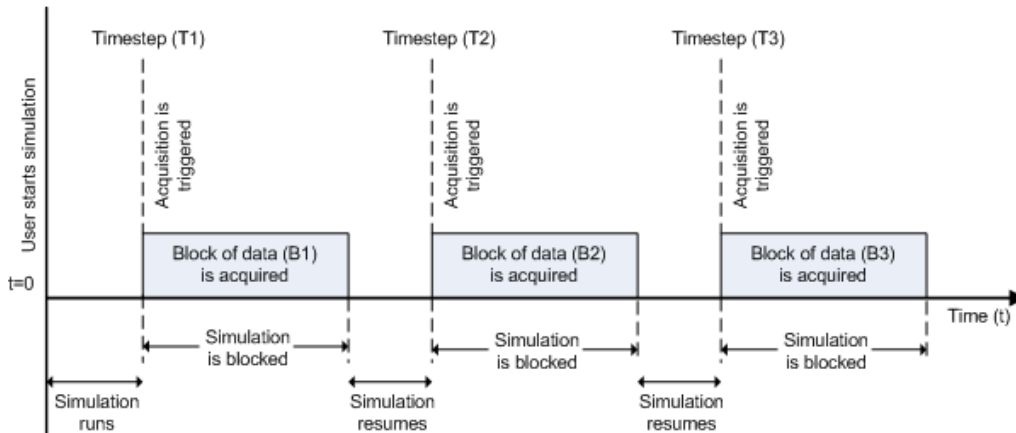
Acquisition Mode

Asynchronous — In asynchronous mode, the data acquisition from the device and the simulation happen in parallel. The model initiates the acquisition from the device when the simulation starts. Data from the device is continuously acquired into a FIFO (first in, first out) buffer in parallel as the simulation runs. At each time step, the model fetches data from the FIFO buffer and outputs a block of data. The data in the FIFO buffer is contiguous according to the hardware acquisition clock.

Synchronous — In synchronous mode, the simulation is blocked while acquiring data from the device. The model initiates the acquisition from the device at each time step and immediately enters a wait state until the acquisition request has completed. This is unbuffered input; the block outputs the latest block of data at each time step.

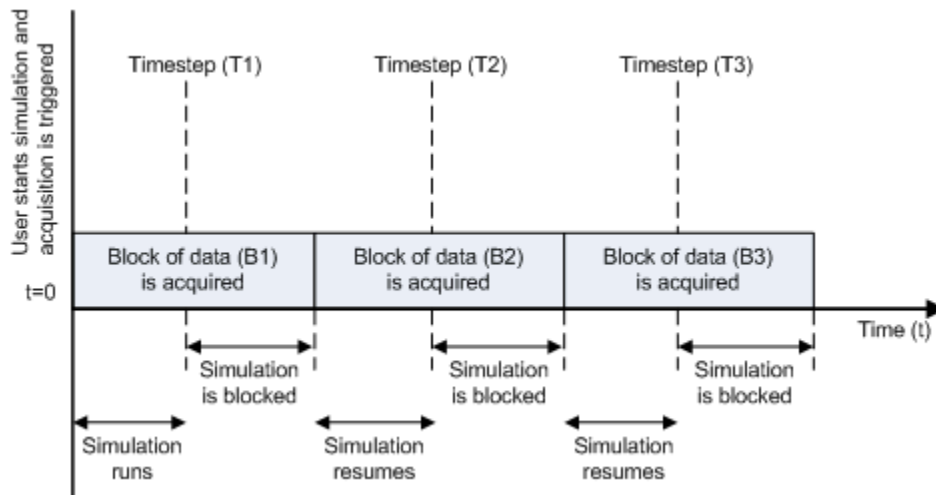
The following diagrams show the difference between synchronous and asynchronous modes for the Analog Input block.

Synchronous Analog Input



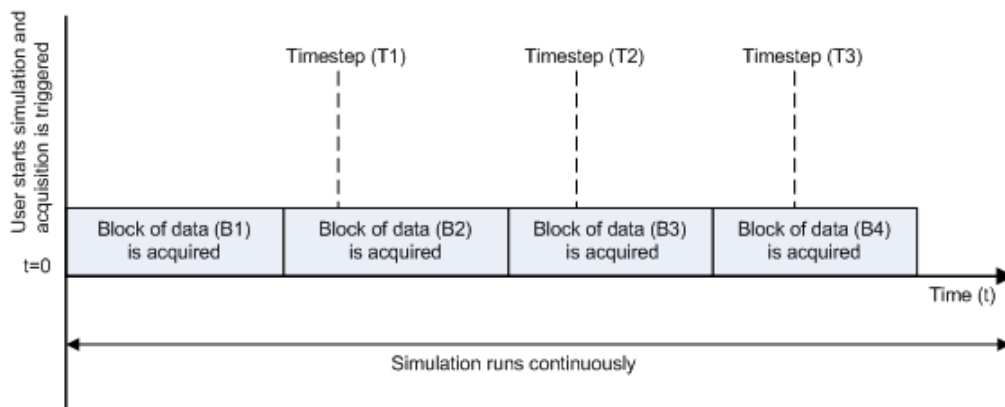
At the first time step (T1), the acquisition is initiated for the required block of data (B1). The simulation does not continue until B1 is completely acquired.

Asynchronous Analog Input - Scenario 1



Scenario 1 shows the case when simulation speed outpaces data acquisition speed. At the first time step (T1), the required block of data (B1) is still being acquired. Therefore, the simulation does not continue until B1 is completely acquired.

Asynchronous Analog Input - Scenario 2



Scenario 2 shows the case when data acquisition speed outpaces simulation speed. At the first time step (T1), the required block of data (B1) has been completely acquired. Therefore, the simulation runs continuously.

Note Several factors, including device hardware and model complexity, can affect the simulation speed, causing both scenarios 1 and 2 to occur within the same simulation.

Channels

The channel configuration table lists the hardware channels of your device, and lets you configure them. Specify which channels to acquire data from (by default all the channels are selected). These parameters are specified for each selected channel:

Channel ID — Hardware channel ID specified by the device. The Channel ID column is read-only, and the parameters are defined when the device is selected.

Name — Channel name. By default the table displays any names provided by the hardware, but you can edit the names. For example, if the device is a sound card with two channels, you can name them `Left` and `Right`.

Module — Device ID the channel belongs to. The Module column is read-only. If compactDAQ chassis is selected, it shows the ID of the compactDAQ module which the channel belongs to; otherwise the ID of the device.

Measurement Type — Measurement type of the channel. This block supports only voltage measurement types. (For other measurement types, use a data acquisition session in MATLAB.)

Input Range — Input ranges available for each channel supported by the hardware, defined when a device is selected.

Terminal Configuration — Specifies the hardware terminal configuration, such as single-ended, differential, etc. The terminal configuration options are defined by the capabilities of the selected channel.

Coupling — Hardware coupling configuration, such as AC or DC. The coupling type is defined when a device is selected

Number of ports

1 for all channels (default) — Output data from a single port as a matrix, with a size of blocksize by number of channels selected.

1 per channel — Output data from N ports, where N is equal to the number of selected channels. Each output port is a column vector with a size of blocksize-by-1. For naming, each output port uses the channel name if one was specified, otherwise the channel ID, for example, `ai0`.

Input sample rate

The rate at which samples are acquired from the device, in samples per second. This is the sampling rate for the hardware. The sample rate must be a positive real number within the range supported by the selected hardware.

Block size

The number of data samples to output at each time step for each channel. It must be a positive integer greater than or equal to 2, within the range supported by the selected hardware.

Output relative timestamps

Select this option to output the relative data timestamps, one for each sample. This option adds a new output port to the block. The data type of this port is double, and corresponds to the time offset in seconds of the sample related to the start of acquisition. For asynchronous acquisition, the acquisition is initiated once at the start of model execution, the relative timestamp is a monotonically-increasing number relative to the start of simulation. For synchronous acquisition, an acquisition is initiated at every time step; as a result, the relative timestamp is reset to zero every time an acquisition is initiated.

See Also

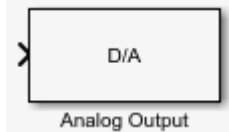
Blocks

Analog Input (Single Sample) | Analog Output | Analog Output (Single Sample) | Digital Input (Single Sample) | Digital Output (Single Sample)

Introduced in R2016b

Analog Output

Output data to multiple analog channels of data acquisition device



Library

Data Acquisition Toolbox

Note Some devices are not supported by the Simulink blocks in Data Acquisition Toolbox. To see if your device supports Simulink, refer to Supported Hardware.

Description

The Analog Output block opens, initializes, configures, and controls an analog data acquisition device. The opening, initialization, and configuration of the device occur once at the start of the model execution. During the model run time, the block outputs data to the hardware synchronously (outputs the block of data as it is provided). On every time step, the block performs a blocking synchronous write to the hardware, outputting the entire input data.

The block has one or more input ports, depending on the option you choose in its dialog box. It has no output ports.

The Analog Output block inherits the sample time from the driving block connected to the input port. The valid data types of the signal at the input port are double or native data types supported by the hardware.

Notes To use this block, you need both Data Acquisition Toolbox and Simulink software.

You can use the Analog Output block only with devices that support clocked generation. To generate data using devices that do not support clocking, use the Analog Output (Single Sample) block.

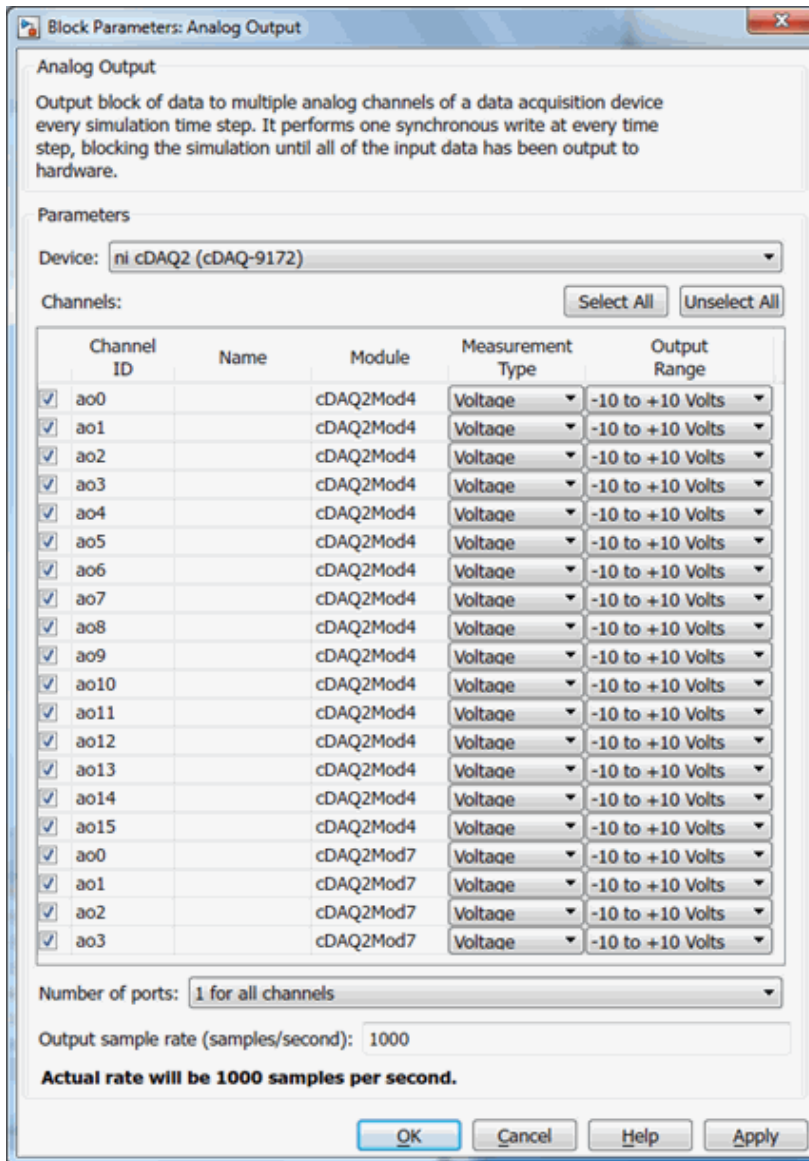
Other Supported Features

- This block supports the use of Simulink Accelerator mode, but not Rapid Accelerator or code generation.
- The block supports the use of model referencing, so that your model can include other Simulink models as modular components.

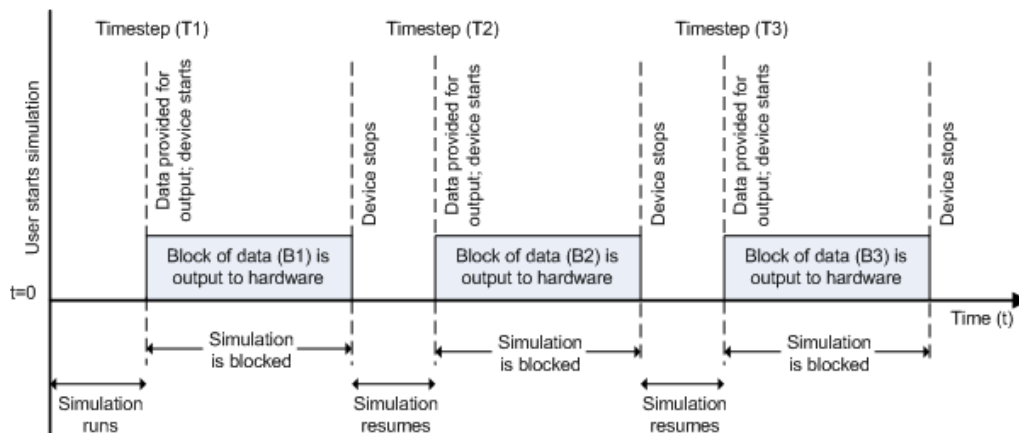
For more information on these features, see the “Simulink” documentation.

Dialog Box

Use the Block Parameters dialog box to set the block configuration options.



The following diagram shows the timing of the synchronous analog output.



At the first time step (T1), data output is initiated and the corresponding block of data (B1) is output to the hardware. The simulation does not continue until B1 is output completely.

Device

The device from which you want to generate data. The items in the list vary, depending on which devices you have connected to your system. Devices in the list are specified by adaptor/vendor name and unique device ID, followed by the model name of the device, for example, `ni Dev1 (USB-6255)`. The first available device is selected by default. CompactDAQ chassis would be shown as a single device; vendor name, chassis ID, and chassis model would be shown in the list, for example, `ni cDAQ2 (cDAQ-9172)`.

Channels

The channel configuration table lists your device hardware channels and lets you configure them. Specify these parameters for each selected channel:

Channel ID — Hardware channel ID specified by the device. The Channel ID column is read-only, and the parameters are defined when the device is selected.

Name — Channel name. By default the table displays any names provided by the hardware, but you can edit the names. For example, if the device is a sound card with two channels, you can name them `Left` and `Right`.

Module — Device ID the channel belongs to. The Module column is read-only. If a CompactDAQ chassis is selected, it shows the ID of the CompactDAQ module which the channel belongs to; otherwise it shows the ID of the device.

Measurement Type — Measurement type of the channel. This block supports only voltage measurement types. (For other measurement types, use a data acquisition session in MATLAB.)

Output Range — Output ranges available for each channel supported by the hardware, defined when a device is selected.

Number of ports

1 for all channels (default) — One input port on the block for all channels. Provide data as a matrix, with a size of blocksize by number of channels.

1 per channel — N input ports on the block, where N is equal to the number of selected channels. Provide each port's data as a column vector with a size of blocksize-by-1. For naming, each output port uses the channel name if one was specified, otherwise the channel ID, for example, `ai0`.

Output sample rate

The rate at which samples are output from Simulink to the device, in samples per second. This is the sampling rate for the hardware. The default is defined when a device is selected. The sample rate must be a positive real number within the range allowed for the selected hardware.

See Also

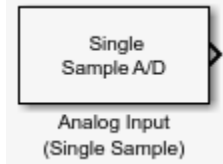
Blocks

Analog Input | Analog Input (Single Sample) | Analog Output (Single Sample) | Digital Input (Single Sample) | Digital Output (Single Sample)

Introduced in R2016b

Analog Input (Single Sample)

Acquire single sample from multiple analog channels of data acquisition device



Library

Data Acquisition Toolbox

Note Some devices are not supported by the Simulink blocks in Data Acquisition Toolbox. To see if your device supports Simulink, refer to Supported Hardware.

Description

The Analog Input (Single Sample) block opens, initializes, configures, and controls an analog data acquisition device. The opening, initialization, and configuration of the device occur once at the start of the model execution. The block acquires a single sample every time step, synchronously from the device, during the model run time.

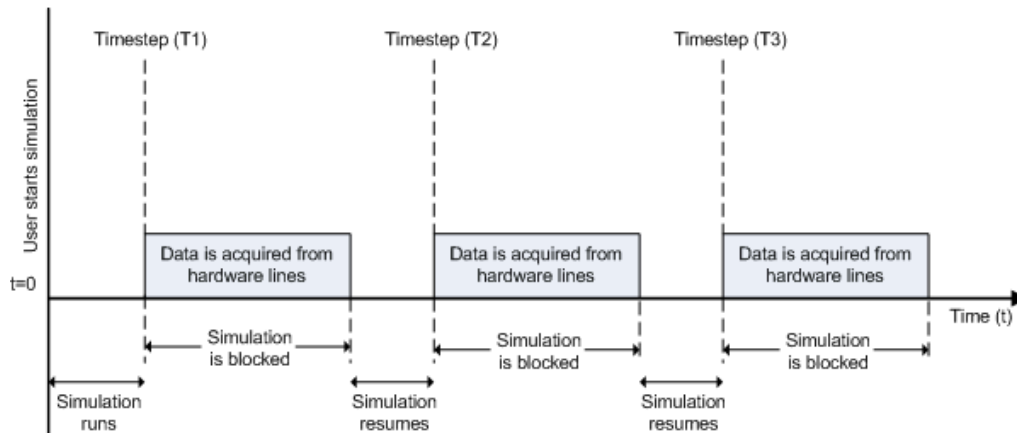
The block has no input ports. It has one or more output ports, depending on the configuration you choose in its dialog box.

Use the Analog Input (Single Sample) block to incorporate live measured data into Simulink for:

- System characterization
- Algorithm verification
- System and algorithm modeling
- Model and design validation

- Controller design

Analog input acquisition is done synchronously, according to the following diagram.



At the first time step (T1), data is acquired from the selected hardware channels. The simulation does not continue until data is read from all channels.

Notes To use this block, you need both Data Acquisition Toolbox and Simulink software.

You can use Analog Input (Single Sample) block only with devices that support single sample acquisition. If the device does not support single sample acquisition, the model generates an error. To acquire data from devices that do not support acquisition of a single sample (such as devices designed for sound and vibration), use the Analog Input block.

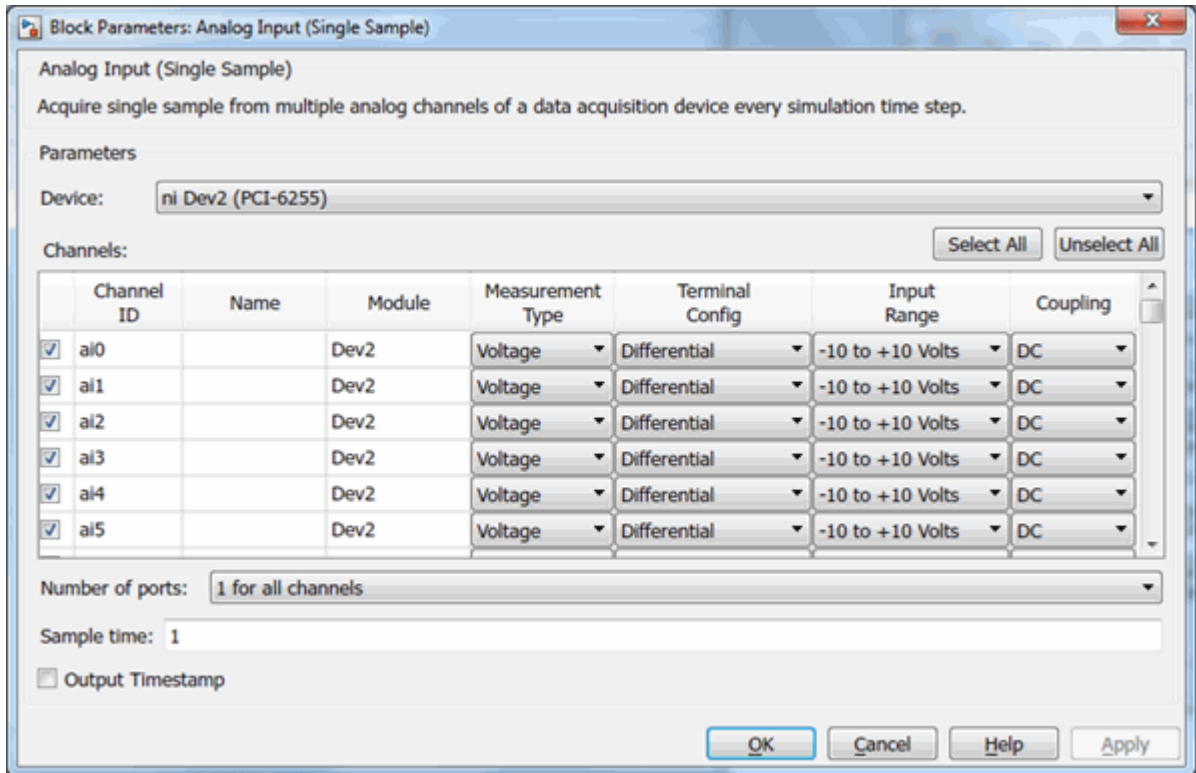
Other Supported Features

- If you have DSP System Toolbox, you can use this block for signal applications.
- This block supports the use of Simulink Accelerator mode, but not Rapid Accelerator or code generation.
- The block supports the use of model referencing, so that your model can include other Simulink models as modular components.

For more information on these features, see the “Simulink” documentation.

Dialog Box

Use the Block Parameters dialog box to select your device and to set other configuration options.



Device

The device from which you want to acquire data. The items in the list vary, depending on which devices you have connected to your system. Devices in the list are specified by adaptor/vendor name and unique device ID, followed by the name of the device. The first available device is selected by default.

Channels

The channel configuration table lists your device hardware channels and lets you configure them. Specify these parameters for each selected channel:

Channel ID — Hardware channel ID specified by the device. The Channel ID column is read-only and the parameters are defined when the device is selected.

Name — Channel name. By default the table displays any names provided by the hardware, but you can edit the names. For example, if the device is a sound card with two channels, you can name them `Left` and `Right`.

Module — Device ID the channel belongs to. The Module column is read-only. If a compactDAQ chassis is selected, it shows the ID of the compactDAQ module which the channel belongs to; otherwise it shows the ID of the device.

Measurement Type — Measurement type of the channel. This block supports only voltage measurement types. (For other measurement types, use a data acquisition session in MATLAB.)

Input Range — Input ranges available for each channel supported by the hardware, defined when a device is selected.

Terminal Configuration — Hardware terminal configuration, such as single-ended, differential, etc. The terminal configuration options are defined by the capabilities of the selected channel.

Coupling — Hardware coupling configuration, such as AC or DC. The coupling type is defined when a device is selected

Number of ports

1 for all channels (default) — Outputs data from a single port as a vector with an element for each selected channel.

1 per channel — Outputs data from N ports, where N is equal to the number of selected channels. The output for each port is a scalar value. For naming, each output port uses the channel name if one was specified, otherwise the channel ID, for example, `ai0`.

Sample time

Specifies the sample time of the block during the simulation. This is the rate at which the block is executed during simulation. The default value is 1 (seconds). For more information, see “What Is Sample Time?” (Simulink).

Output Timestamp

Select this option to output the absolute timestamp. This option adds a new output port to the block. The data type of this port is double (`datenum`), which corresponds to

a serial date number. You can convert the data into a datetime array with the `datetime` function.

See Also

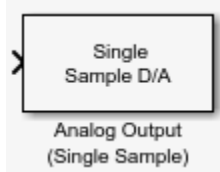
Blocks

[Analog Input](#) | [Analog Output](#) | [Analog Output \(Single Sample\)](#) | [Digital Input \(Single Sample\)](#) | [Digital Output \(Single Sample\)](#)

Introduced in R2016b

Analog Output (Single Sample)

Output single sample to multiple analog channels of data acquisition device



Library

Data Acquisition Toolbox

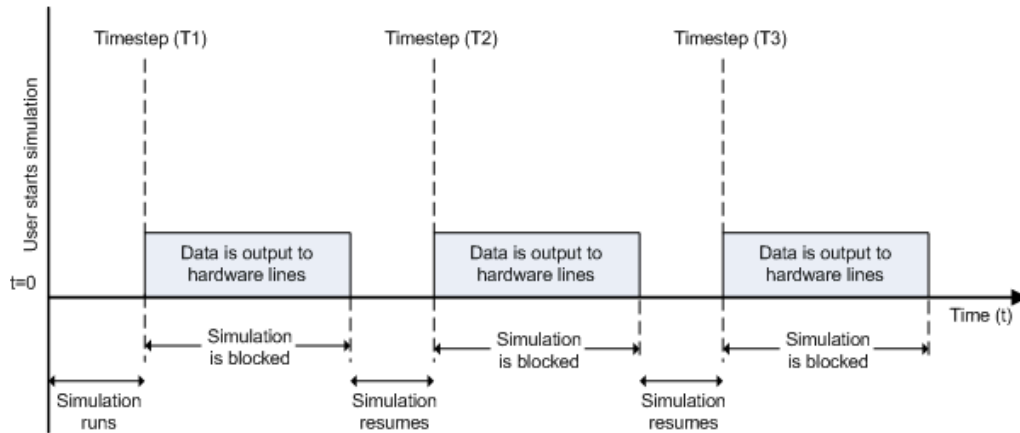
Note Some devices are not supported by the Simulink blocks in Data Acquisition Toolbox. To see if your device supports Simulink, refer to Supported Hardware.

Description

The Analog Output (Single Sample) block opens, initializes, configures, and controls an analog data acquisition device. The opening, initialization, and configuration of the device occur once at the start of the model execution. The block outputs a single sample every time step, synchronously to the hardware, during the model run time.

The block has one or more input ports, depending on the option you choose in its dialog box. It has no output ports. The valid data type of the signal at the input port is double.

The Analog Output (Single Sample) block inherits the sample time from the driving block connected to the input port. Analog output is done synchronously, according to the following diagram.



At the first time step (T1), data is output to the selected hardware channels. The simulation does not continue until data is output to all channels.

Notes To use this block, you need both Data Acquisition Toolbox and Simulink software.

You can use the Analog Output (Single Sample) block only with devices that support single sample output. To send data using devices that do not support acquisition of a single sample (such as devices designed for sound and vibration), use the Analog Output block.

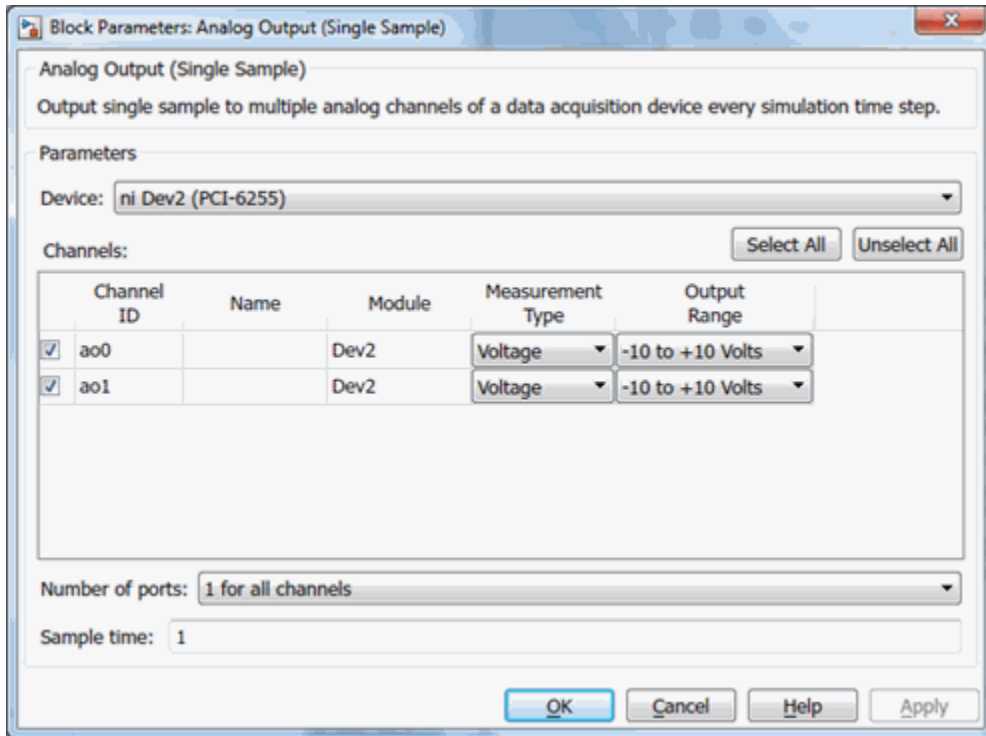
Other Supported Features

- This block supports the use of Simulink Accelerator mode, but not Rapid Accelerator or code generation.
- The block supports the use of model referencing, so that your model can include other Simulink models as modular components.

For more information on these features, see the “Simulink” documentation.

Dialog Box

Use the Block Parameters dialog box to select your device and to set other configuration options.



Device

The data acquisition device from which you want to acquire data. The items in the list vary, depending on which devices you have connected to your system. Devices in the list are specified by adaptor/vendor name and unique device ID, followed by the model name of the device, for example, ni Dev1 (USB-6255). The first available device is selected by default. CompactDAQ chassis would be shown as a single device; vendor name, chassis ID, and chassis model would be shown in the list, for example, ni cDAQ2 (cDAQ-9172).

Channels

The channel configuration table lists your device's hardware channels and lets you configure them. These parameters are specified for each selected channel:

Channel ID — Hardware channel ID specified by the device. The Channel ID column is read-only, and the parameters are defined when the device is selected.

Name — Channel name. By default the table displays any names provided by the hardware, but you can edit the names. For example, if the device is a sound card with two channels, you can name them `Left` and `Right`.

Module — Displays the Device ID the channel belongs to. The Module column is read-only. If a CompactDAQ chassis is selected, it will show the ID of the CompactDAQ module which the channel belongs to; otherwise it will show the ID of the device.

Measurement Type — Specifies the measurement type of the channel. This block supports only voltage measurement types. (For other measurement types, use a data acquisition session in MATLAB.)

Output Range — Specifies the output ranges available for each channel supported by the hardware, and is defined when a device is selected.

Number of ports

1 for all channels (default) — One input port on the block for all channels. Provide data as a column vector with size number of channels by 1

1 per channel — N input ports on the block, where N is equal to the number of selected channels. Provide each port's data size as 1-by-1. For naming, each output port uses the channel name if one was specified, otherwise the channel ID, for example, `ai0`.

Sample time

Specifies the sample time of the block during the simulation. This is the rate at which the block is executed during simulation. The default value is 1. For more information, see "What Is Sample Time?" (Simulink).

See Also

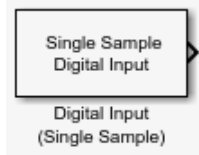
Blocks

Analog Input | Analog Input (Single Sample) | Analog Output | Digital Input (Single Sample) | Digital Output (Single Sample)

Introduced in R2016b

Digital Input (Single Sample)

Acquire single sample from multiple digital lines of data acquisition device



Library

Data Acquisition Toolbox

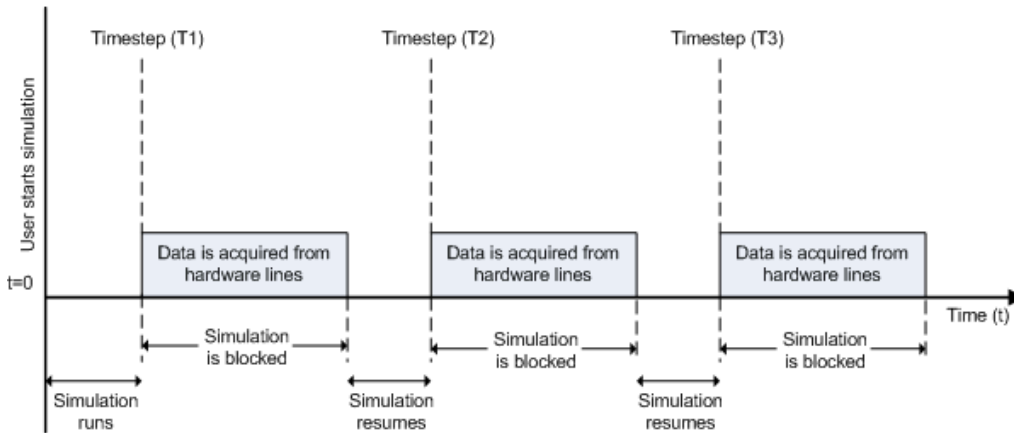
Note Some devices are not supported by the Simulink blocks in Data Acquisition Toolbox. To see if your device supports Simulink, refer to Supported Hardware.

Description

The Digital Input (Single Sample) block synchronously outputs the latest scan of data available from the digital lines selected at each simulation time step. It acquires unbuffered digital data, and delivers this as a vector of boolean values.

The block has no input ports. It has one or more output ports, depending on the option you choose in its dialog box.

The block inherits the sample time of the model. Digital input acquisition is done synchronously, according to the following diagram.



At the first time step (T1), data is acquired from the selected hardware lines. The simulation does not continue until data is read from all lines.

Note To use this block, you need both Data Acquisition Toolbox and Simulink software.

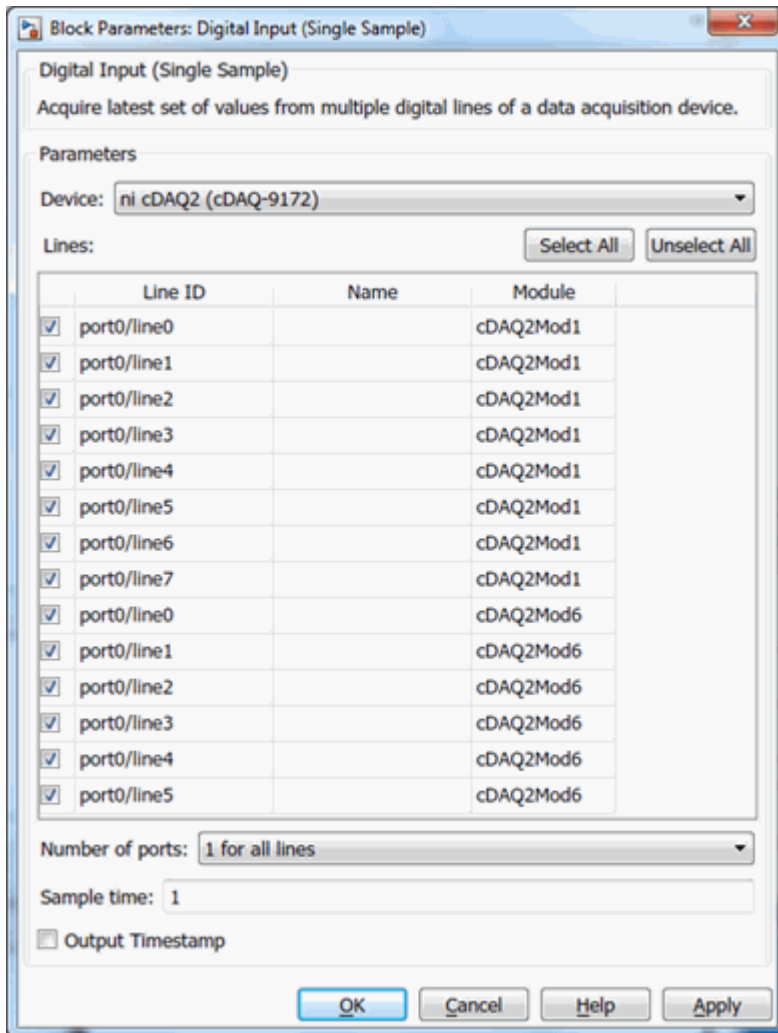
Other Supported Features

- This block supports the use of Simulink Accelerator mode, but not Rapid Accelerator or code generation.
- The block supports the use of model referencing, so that your model can include other Simulink models as modular components.

For more information on these features, see the “Simulink” documentation.

Dialog Box

Use the Block Parameters dialog box to select a device and set configuration options.



Device

The data acquisition device from which you want to acquire data. The items in the list vary, depending on which devices you have connected to your system. Devices in the list are specified by adaptor/vendor name and unique device ID, followed by the name of the device. The first available device is selected by default.

Lines

The line configuration table lists your device's lines and lets you configure them. The table lists all the lines that can be configured for input. Use the check boxes and selection buttons to specify which lines to acquire data from.

Line ID — ID of the hardware line (for example, port0/line0). This is automatically detected and filled in by the selected device, and is read-only.

Name — Hardware line name. This is automatically detected and filled in from the hardware, though you can edit the name.

Module — Device ID that the channel belongs to. The Module column is read-only. If a CompactDAQ chassis is selected, it shows the ID of the CompactDAQ module which the channel belongs to; otherwise it shows the ID of the device.

Number of ports

1 for all lines (default) — The block has only one output port for all of the lines that are selected in the table. Acquired data is a vector of boolean values, whose size is the number of lines.

1 per line — The block has one output port per selected line. The name of each output port is the name specified in the table for each line. If no name is provided, the name is the Line ID. For example, if line 2 of hardware port 3 is selected, and you did not specify a name in the line table, `port3/line2` appears in the block. Data size for each line is 1-by-1.

Sample time

Specifies the sample time of the block during the simulation. This is the rate at which the block is executed during simulation. The default value is 1. For more information, see "What Is Sample Time?" (Simulink).

Output Timestamp

Select this option to output the absolute timestamp. This option adds a new output port to the block. The data type of this port is double (datenum), which corresponds to a serial date number. You can convert the data into a datetime array with the `datetime` function.

See Also

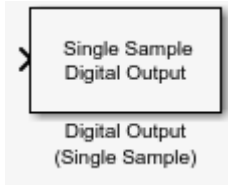
Blocks

Analog Input | Analog Input (Single Sample) | Analog Output | Analog Output (Single Sample) | Digital Output (Single Sample)

Introduced in R2016b

Digital Output (Single Sample)

Output single sample to multiple digital lines of data acquisition device



Library

Data Acquisition Toolbox

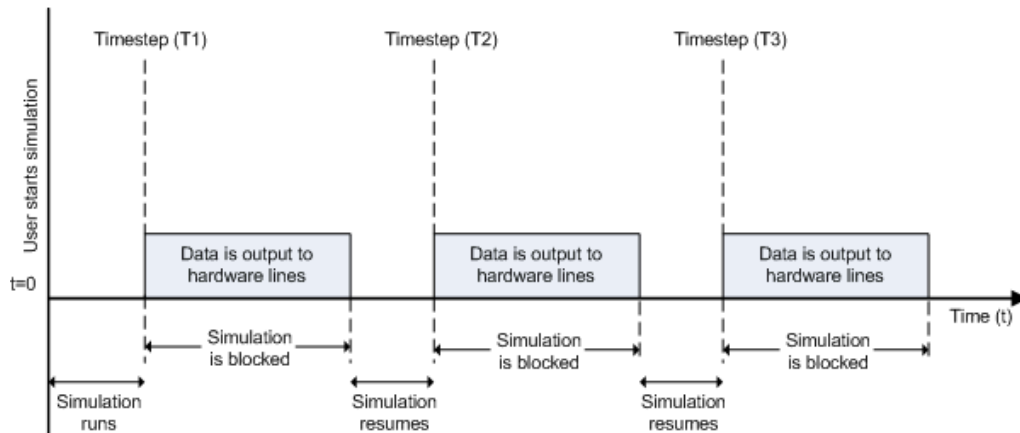
Note Some devices are not supported by the Simulink blocks in Data Acquisition Toolbox. To see if your device supports Simulink, refer to Supported Hardware.

Description

The Digital Output (Single Sample) block synchronously outputs the latest set of data to the hardware at each simulation time step. It outputs unbuffered digital data. Specify the output data as a vector of boolean values.

The block has no output ports. It can have one or more input ports, depending on the option you choose in its dialog box. The data type of the signal at the input port must be a logical data type.

The Digital Output (Single Sample) block inherits the sample time from the driving block connected to the input port. Digital output is done synchronously, according to the following diagram.



At the first time step (T1), data is output to the selected hardware lines. The simulation does not continue until data is output to all lines.

Note To use this block, you need both Data Acquisition Toolbox and Simulink software.

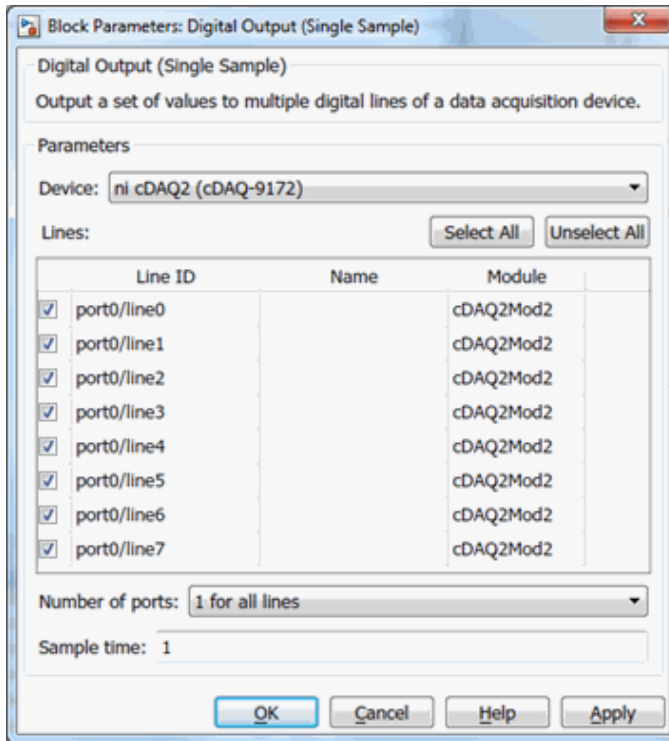
Other Supported Features

- This block supports the use of Simulink Accelerator mode, but not Rapid Accelerator or code generation.
- The block supports the use of model referencing, so that your model can include other Simulink models as modular components.

For more information on these features, see the “Simulink” documentation.

Dialog Box

Use the Block Parameters dialog box to set configuration options.



Device

The device to which you want to output data. The items in the list vary, depending on which devices you have connected to your system. Devices in the list are specified by adaptor/vendor name and unique device ID, followed by the name of the device. The first available device is selected by default.

Lines

The line configuration table lists your device lines and lets you configure them. The table lists all the lines that can be configured for input.

Line ID — ID of the hardware line (for example, port0/line0). This is automatically detected and filled in by the selected device, and is read-only.

Name — Hardware line name. This is automatically detected and filled in from the hardware, but you can edit the name.

Module — Device ID that the channel belongs to. The Module column is read-only. If a CompactDAQ chassis is selected, it shows the ID of the CompactDAQ module which the channel belongs to; otherwise it shows the ID of the device.

Number of ports

1 for all lines (default) — The block has only one input port for all of the lines that are selected in the table. Data must be a vector of boolean values, whose size is the number of lines.

1 per line — The block has one input port per selected line. The name of each input port is the name specified in the table for each line. If no name is provided, the name is the Line ID. For example, if line 2 of hardware port 3 is selected, and you did not specify a name in the line table, `port3/line2` appears in the block. Data for each line must be a 1-by-1 boolean.

Sample time

Specifies the sample time of the block during the simulation. This is the rate at which the block is executed during simulation. The default value is 1. For more information, see “What Is Sample Time?” (Simulink).

See Also

Blocks

Analog Input | Analog Input (Single Sample) | Analog Output | Analog Output (Single Sample) | Digital Input (Single Sample)

Introduced in R2016b

Functions — Alphabetical List

addAnalogInputChannel

Add analog input channel

Syntax

```
addAnalogInputChannel(s,deviceID,channelID,measurementType)
ch = addAnalogInputChannel(s,deviceID,channelID,measurementType)
[ch,idx] = addAnalogInputChannel(s,deviceID,channelID,
measurementType)
```

Description

`addAnalogInputChannel(s,deviceID,channelID,measurementType)` adds a channel on the device represented by `deviceID`, with the specified `channelID`, and channel measurement type represented by `measurementType`, to the session `s`. Measurement types are vendor-specific.

- Use `daq.createSession` to create a session object before you use this method.
- To use counter channels, see `addCounterInputChannel`.

`ch = addAnalogInputChannel(s,deviceID,channelID,measurementType)` creates and returns the channel object `ch`.

`[ch,idx] = addAnalogInputChannel(s,deviceID,channelID,measurementType)` creates and returns the object `ch`, representing the channel that was added, and the index `idx`, which is an index into the array of the session object `Channels` property.

Examples

Add an Analog Input Current Channel

```
s = daq.createSession('ni')
addAnalogInputChannel(s, 'cDAQ1Mod3', 'ai0', 'Current');
```

Add an Analog Input Channel and Return Its Index

```
s = daq.createSession('ni')
[ch, idx] = addAnalogInputChannel(s, 'cDAQ2Mod6', 'ai0', 'Thermocouple')
```

Add a Range of Analog Input Channels

```
s = daq.createSession('ni')
ch = addAnalogInputChannel(s, 'cDAQ1Mod1', [0 2 4], 'Voltage');
```

Input Arguments

s — Data acquisition session

session object handle

Data acquisition session specified as a session object handle, created using `daq.createSession`. Use the data acquisition session for acquisition and generation operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

For a list of relevant session object properties, see the following “Tips” on page 4-5.

deviceID — Device ID

character vector or string

Device ID specified as a character vector or string, as defined by the device vendor. Obtain the device ID by calling `daq.getDevices`.

Data Types: `char` | `string`

channelID — Channel ID

numeric value, character vector, or string

Channel ID specified as a numeric value, character vector, or string; or the physical location of the channel on the device. Supported values are specific to the vendor and

device. You can add multiple channels by specifying the channel ID as a numeric vector, or an array of character vectors or strings. The *index* for this channel in the session display indicates the position of this channel in the session. This channel ID is not the same as channel index in the session: if you add a channel with ID 2 as the first channel in a session, the session channel index is 1.

measurementType — Channel measurement type

character vector or string

Channel measurement type specified as a character vector or string. `measurementType` represents a vendor-defined measurement type. Valid measurement types include:

- 'Voltage'
- 'Thermocouple'
- 'Current'
- 'Accelerometer'
- 'RTD'
- 'Bridge'
- 'Microphone'
- 'IEPE'

Not all devices support all types of measurement.

Data Types: `char` | `string`

Output Arguments

ch — Analog input channel object

1-by-n array

Analog input channel that you add, returned as an object containing a 1-by-n array of vendor-specific channel information. Use this channel object to access device and channel properties.

idx — Channel index

numeric

Channel index returned as a numeric value. With this index, you can access the array of the session object `Channels` property.

Tips

The relevant properties of the data acquisition session are:

| | |
|-------------------------|--|
| ADCTimingMode | Set channel timing mode |
| BridgeMode | Specify analog input device bridge mode |
| Device | Channel device information |
| ExcitationCurrent | Current of external source of excitation |
| ExcitationSource | External source of excitation |
| ExcitationVoltage | Voltage of excitation source |
| ExternalTriggerTimeout | Specify maximum wait time for external trigger |
| ID | ID of channel in session |
| MaxSoundPressureLevel | Sound pressure level for microphone channels |
| MeasurementType | Channel measurement type |
| Name | Specify descriptive name for the channel |
| NominalBridgeResistance | Resistance of sensor |
| R0 | Specify resistance value |
| Range | Specify channel measurement range |
| RTDConfiguration | Specify wiring configuration of RTD device |
| RTDType | Specify sensor sensitivity |
| ScansAcquired | Number of scans acquired during operation |
| Sensitivity | Sensitivity of an analog channel |
| ShuntLocation | Indicate location of channel's shunt resistor |
| ShuntResistance | Resistance value of channel's shunt resistor |
| TerminalConfig | Specify terminal configuration |
| ThermocoupleType | Select thermocouple type |
| Units | Specify unit of RTD measurement |
| Coupling | Specify input coupling mode |

See Also

Functions

`addAnalogOutputChannel` | `daq.createSession` | `inputSingleScan` |
`removeChannel` | `startBackground` | `startForeground`

Introduced in R2010b

addAnalogOutputChannel

Add analog output channel to session

Syntax

```
addAnalogOutputChannel(s,deviceName,channelID,measurementType)
ch = addAnalogOutputChannel(s,deviceName,channelID,measurementType)
[ch,idx] = addAnalogOutputChannel(s,deviceName,channelID,
measurementType)
```

Description

`addAnalogOutputChannel(s,deviceName,channelID,measurementType)` adds an analog output channel on the device represented by `deviceID`, with the specified `channelID`, and channel measurement type defined by `measurementType`, on the session object `s`. Measurement types are vendor-specific.

- Use `daq.createSession` to create a session object before you use this method.
- To use counter channels, see `addCounterInputChannel`.

`ch = addAnalogOutputChannel(s,deviceName,channelID,measurementType)` creates and returns the channel object `ch`, representing the channel that was added.

`[ch,idx] = addAnalogOutputChannel(s,deviceName,channelID,measurementType)` creates and returns the object `ch`, representing the channel that was added, and the object `idx`, representing the index into the array of the session object `Channels` property.

Examples

Add an Analog Output Voltage Channel

```
s = daq.createSession('ni')
addAnalogOutputChannel(s, 'cDAQ1Mod2', 'ao0', 'Voltage');
```

Add Analog Output Channel and Return Its Index

```
s = daq.createSession('ni')
[ch,idx] = addAnalogOutputChannel(s, 'cDAQ1Mod2', 'ao0', 'Voltage');
```

Add a Range of Analog Output Channels

```
s = daq.createSession('ni')
ch = addAnalogOutputChannel(s, 'cDAQ1Mod8', 0:3, 'Current');
```

Input Arguments

s — Data acquisition session

session object handle

Data acquisition session specified as a session object handle, created using `daq.createSession`. Create one session per vendor, and use that vendor session to perform all data acquisition and generation operations.

For a list of relevant session object properties, see “Tips” on page 4-9.

deviceName — Device ID

character vector or string

Device ID specified as a character vector or string, as defined by the device vendor. Obtain the device ID by calling `daq.getDevices`.

Data Types: `char` | `string`

channelID — Channel ID

numeric value, character vector, or string

Channel ID specified as a numeric value, character vector, or string; or the physical location of the channel on the device. Supported values are specific to the vendor and

device. You can add multiple channels by specifying the channel ID as a numeric vector, or an array of character vectors or strings. The *index* for this channel indicates its position in the session display. The channel ID is not the same as the channel index in the session: if you add a channel with ID 2 as the first channel in a session, the session channel index is 1.

measurementType — Channel measurement type

character vector or string

Channel measurement type specified as a character vector or string. `measurementType` represents a vendor-defined measurement type. Supported measurement types include:

- 'Voltage'
- 'Current'

Data Types: `char` | `string`

Output Arguments

ch — Analog output channel object

1-by-n array

Analog output channel, returned as an object containing a 1-by-n array of vendor-specific channel information. Use this channel object to access device and channel properties.

idx — Channel index

numeric

Channel index, returned as a numeric value. With this index, you can access the array of the session object `Channels` property.

Tips

The relevant properties of the data acquisition session are:

| | |
|------------------------|--|
| Device | Channel device information |
| ExcitationCurrent | Current of external source of excitation |
| ExcitationSource | External source of excitation |
| ExternalTriggerTimeout | Specify maximum wait time for external trigger |
| ID | ID of channel in session |
| MaxSoundPressureLevel | Sound pressure level for microphone channels |
| MeasurementType | Channel measurement type |
| Name | Specify descriptive name for the channel |
| Range | Specify channel measurement range |
| ScansOutputByHardware | Indicate number of scans output by hardware |
| ScansQueued | Indicate number of scans queued for output |
| Sensitivity | Sensitivity of an analog channel |
| TerminalConfig | Specify terminal configuration |

See Also

Functions

`addAnalogInputChannel` | `daq.createSession` | `outputSingleScan` | `removeChannel` | `startBackground` | `startForeground`

Introduced in R2010b

addAudioInputChannel

Add audio input channel to session

Syntax

```
ch = addAudioInputChannel(s,deviceName,channelID)
[ch,idx] = addAudioInputChannel(s,deviceName,channelID)
```

Description

`ch = addAudioInputChannel(s,deviceName,channelID)` creates and displays the object `ch` representing a channel added to the session `s` using the device represented by `deviceName`, with the specified `channelID`. The channel object is stored in the variable `ch`.

Tips

- Use `daq.createSession` to create a session object before you use this method.
 - To use analog channels, see `addAnalogInputChannel`.
-

`[ch,idx] = addAudioInputChannel(s,deviceName,channelID)` additionally assigns to `idx` the index into the array of the session object's `Channels` property.

Examples

Add an Audio Input Channel

```
s = daq.createSession('directsound');
addAudioInputChannel(s,'Audio1',1);
```

Add Multiple Audio Input Channels

Add two audio input channels and specify output arguments to represent the channel object and the index.

```
s = daq.createSession('directsound');  
[ch,idx] = addAudioInputChannel(s,'Audio1',1:2);
```

Input Arguments

s — Data acquisition session

session object

Data acquisition session specified as a session object created using `daq.createSession`. Use the data acquisition session for acquisition and generation operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

deviceName — Device ID

character vector or string

Device ID specified as a character vector or string, as defined by the device vendor. Obtain the device ID by calling `daq.getDevices`. The channel specified for this device is created for the session object.

Data Types: `char` | `string`

channelID — Channel ID

numeric value

Channel ID, or the physical location of the channel on the device, added to the session, specified as numeric value. Supported values are specific to the vendor and device. You can also add a range of channels. The index for this channel displayed in the session indicates this channels position in the session. If you add a channel with channel ID 1 as the first channel in a session, the session index is 1.

Output Arguments

ch — Audio input channel

channel object

Audio input channel that you add, returned as a channel object containing vendor specific channel information. Use this channel object to access device and channel properties. The channel object has the following properties.

| | |
|------------------------|--|
| BitsPerSample | Display bits per sample |
| Device | Channel device information |
| ID | ID of channel in session |
| MeasurementType | Channel measurement type |
| Name | Specify descriptive name for the channel |
| Range | Specify channel measurement range |
| StandardSampleRates | Display standard rates of sampling |
| UseStandardSampleRates | Configure session to use standard sample rates |

idx — Channel index

numeric

Channel index returned as a numeric value. Through the index you can access the array of the session object's Channels property.

See Also

Functions

`addAudioOutputChannel` | `daq.createSession` | `removeChannel` | `startBackground` | `startForeground`

Topics

“Hardware Discovery and Session Setup”

Introduced in R2014a

addAudioOutputChannel

Add audio output channel to session

Syntax

```
ch = addAudioOutputChannel(s,deviceName,channelID)
[ch,idx] = addAudioOutputChannel(s,deviceName,channelID)
```

Description

`ch = addAudioOutputChannel(s,deviceName,channelID)` creates and displays the object `ch` representing a channel added to the session `s` using the device represented by `deviceName`, with the specified `channelID`. The channel is stored in the variable `ch`.

Tips

- Use `daq.createSession` to create a session object before you use this method.
 - To use analog channels, see `addAnalogInputChannel`.
-

`[ch,idx] = addAudioOutputChannel(s,deviceName,channelID)` additionally assigns `idx` with the index into the array of the session object's `Channels` property.

Examples

Add an Audio Output Channel

Create a session and add an audio output channel to it.

```
s = daq.createSession ('directsound');
ch = addAudioOutputChannel(s, 'Audio1', 1);
```

Add Multiple Audio Output Channels

Add several audio output channels to a session, and assign the index array.

Add two audio output channels to a session and assign output arguments to represent the channel objects and their indices.

```
s = daq.createSession ('directsound');  
[ch,idx] = addAudioOutputChannel(s,'Audio3',1:2);
```

Input Arguments

s — Data acquisition session

session object

Data acquisition session specified as a session object created using `daq.createSession`. Use the data acquisition session for acquisition and generation operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

deviceName — Device ID

character vector or string

Device ID as defined by the device vendor, specified as a character vector or string. Obtain the device ID by calling `daq.getDevices`. The channel specified for this device is created for the session object.

Data Types: `char` | `string`

channelID — Channel ID

numeric value

Channel ID, or the physical location of the channel on the device, added to the session, specified as a numeric value. Supported values are specific to the vendor and device. You can also add a range of channels. The index for this channel displayed in the session indicates this channel's position in the session. If you add a channel with channel ID 1 as the first channel in a session, the session index is 1.

Output Arguments

ch — Audio output channel

channel object

Audio output channel that you add, returned as a channel object containing vendor specific channel information. Use this channel object to access device and channel properties. The channel object has the following properties.

| | |
|------------------------|--|
| BitsPerSample | Display bits per sample |
| Device | Channel device information |
| ID | ID of channel in session |
| MeasurementType | Channel measurement type |
| Name | Specify descriptive name for the channel |
| Range | Specify channel measurement range |
| StandardSampleRates | Display standard rates of sampling |
| UseStandardSampleRates | Configure session to use standard sample rates |

idx — Channel index

numeric

Channel index returned as a numeric value. Through the index you can access the array of the session object's Channels property.

See Also

Functions

`addAudioInputChannel` | `daq.createSession` | `removeChannel` | `startBackground` | `startForeground`

Topics

“Hardware Discovery and Session Setup”

Introduced in R2014a

addClockConnection

Add clock connection

Syntax

```
addClockConnection(s,source,destination,type)
cc = addClockConnection(s,source,destination,type)
[cc,idx] = addClockConnection(s,source,destination,type)
```

Description

`addClockConnection(s,source,destination,type)` adds a clock connection from the specified source device and terminal to the specified destination device and terminal, of the specified connection type.

Tip Before adding clock connections, create a session using `daq.createSession`, and add channels to the session.

`cc = addClockConnection(s,source,destination,type)` adds a clock connection from the specified source device and terminal to the specified destination device and terminal, of the specified connection type and displays it in the variable `cc`.

`[cc,idx] = addClockConnection(s,source,destination,type)` adds a clock connection from the specified source device and terminal to the specified destination device and terminal, of the specified connection type and displays the connection in the variable `cc` and the connection index, `idx`.

Examples

Add External Scan Clock

Create a session and add an analog input channel from Dev1 to the session.

```
s = daq.createSession('ni')
addAnalogInputChannel(s, 'Dev1', 'ai0', 'Voltage');
```

Add a clock connection from an external device to terminal PFI1 on Dev1 using the 'ScanClock' connection type and save the connection settings to a variable.

```
cc = addClockConnection(s, 'external', 'Dev1/PFI1', 'ScanClock');
```

Export Scan Clock to External Device

To add a clock connection going to an external destination, create a session and add an analog input channel from Dev1 to the session.

```
s = daq.createSession('ni')
addAnalogInputChannel(s, 'Dev1', 'ai0', 'Voltage');
```

Add a clock from terminal PFI0 on Dev1 to an external device using the 'ScanClock' connection type.

```
addClockConnection(s, 'Dev1/PFI1', 'external', 'ScanClock');
```

Input Arguments

s — Data acquisition session

session object

Data acquisition session, specified as a session object. Create the session object using `daq.createSession`. Use the data acquisition session for acquisition and generation operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

source — Source of clock connection

character vector or string

Source for the clock connection, specified as a character vector or string. Valid values are:

- 'external' — When your clock is based on an external event.

- `'deviceID/terminal'` — When your clock source is on a specific terminal on a device in your session, for example, `'Dev1/PFI1'`. For more information on device ID see Device. For more information on terminal see Terminals.
- `'chassisId/terminal'` — When your clock source is on a specific terminal on a chassis in your session, for example, `'cDAQ1/PFI1'`. For more information on terminal see Terminals.

You can have only one clock source in a session.

Data Types: `char` | `string`

destination — Destination of clock connection

character vector or string

Destination for the clock connection, specified as a character vector or string. Valid values are:

- `'external'` — When your clock source is connected to an external device.
- `'deviceID/terminal'` — When your clock source is connected to another device in your session, for example, `'Dev1/PFI1'`. For more information on device ID see Device. For more information on terminal see Terminals.
- `'chassisId/terminal'` — When your clock source is connected to a chassis in your session, for example, `'cDAQ1/PFI1'`. For more information on terminal see Terminals.

You can also specify multiple destination devices as an array, for example, `{'Dev1/PFI1', 'Dev2/PFI1'}`.

Data Types: `char` | `string` | `cell`

type — Clock connection type

character vector or string

The clock connection type, specified as a character vector or string. `'ScanClock'` is the only connection type available for clock connections at this time.

Data Types: `char` | `string`

Output Arguments

cc — Clock connection

1-by-n object array

The added clock connection, returned as a ScanClockConnection object containing clock connection information.

idx — Channel index

numeric

Channel index returned as a numeric value. Through the index you can access the array of the session object Channels property.

See Also

`addTriggerConnection` | `daq.createSession` | `removeConnection`

Topics

“Clock Connections”

“Synchronization”

“Import Scan Clock from External Source”

“Acquire Digital Data Using an External Clock”

“Export Scan Clock to External System”

“Acquire Digital Data Using a Shared Clock”

“Acquire Digital Data Using a Counter Output Channel as External Clock”

“Multiple-Device Synchronization Using USB or PXI Devices”

“Multiple-Chassis Synchronization with CompactDAQ Devices”

Introduced in R2012a

addCounterInputChannel

Add counter input channel

Syntax

```
addCounterInputChannel(s,deviceID,channelID)
ch = addCounterInputChannel(s,deviceID,channelID,measurementType)
[ch,idx] = addCounterInputChannel(s,deviceID,channelID,
measurementType)
```

Description

`addCounterInputChannel(s,deviceID,channelID)` adds a counter channel on the device represented by `deviceID` with the specified `channelID`, and channel measurement type, represented by `measurementType`, to the session `s`. Measurement types are vendor specific.

`ch = addCounterInputChannel(s,deviceID,channelID,measurementType)` returns the object `ch`.

`[ch,idx] = addCounterInputChannel(s,deviceID,channelID,measurementType)` returns the object `ch`, representing the channel that was added and the index, `idx`, which is an index into the array of the session object's `Channels` property.

Examples

Add a Counter Input Edgecount Channel

```
s = daq.createSession('ni')
ch = addCounterInputChannel(s,'cDAQ1Mod5','ctr0','EdgeCount');
ch.Terminal % View device signal name for pin mapping.
```

Add a Counter Input Frequency Channel

Specify output arguments to represent the channel object and the index.

```
s = daq.createSession('ni')
[ch,idx] = addCounterInputChannel(s,'cDAQ1Mod5',1,'Frequency');
ch.Terminal % View device signal name for pin mapping.
```

Add Multiple Counter Input Channels

```
s = daq.createSession('ni')
ch = addCounterInputChannel(s,'cDAQ1Mod5',[0 1 2],'EdgeCount');
```

Input Arguments

s — Data acquisition session

session object

Data acquisition session, specified as a session object. Create the session object using `daq.createSession`. Use the data acquisition session for acquisition and generation operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

deviceID — Device ID

character vector or string

Device ID as defined by the device vendor, specified as a character vector or string. Obtain the device ID by calling `daq.getDevices`. The channel specified for this device is created for the session object.

Data Types: `char` | `string`

channelID — Channel ID

numeric value, character vector, or string

Channel ID specified as a numeric value, character vector, or string, corresponding to the specific counter channel on the device added to the session. Channel ID 0 corresponds to the device counter 'ctr0', Channel ID 1 to 'ctr1', and so on. For the related device signal names and physical pins, see the pinout for your particular device.

You can add a range of channels by specifying the channel ID with a numeric array, or an array of character vectors or strings.

The index for a channel displayed in the session indicates the channel's position in the session. The first channel you add in a session has session index 1, and so on.

Data Types: `char` | `string` | `cell`

measurementType — Channel measurement type

character vector or string

Channel measurement type, specified as a character vector or string. `measurementType` represents a vendor-defined measurement type, and can include:

- `'EdgeCount'`
- `'PulseWidth'`
- `'Frequency'`
- `'Position'`

Data Types: `char` | `string`

Output Arguments

ch — Counter input channel object

1-by-n array

Counter input channel that you add, returned as an object containing a 1-by-n array of vendor specific channel specific information. Use this channel object to access device and channel properties. For more information on the properties, see “Properties” on page 4-24.

idx — Channel index

numeric

Channel index returned as a numeric value. Through the index you can access the array of the session object `Channels` property.

Properties

The properties of the channel object are:

| | |
|-----------------|--|
| ActiveEdge | Rising or falling edges of EdgeCount signals |
| ActivePulse | Active pulse measurement of PulseWidth counter channel |
| CountDirection | Specify direction of counter channel |
| Device | Channel device information |
| EncoderType | Encoding type of counter channel |
| ID | ID of channel in session |
| InitialCount | Specify initial count point |
| MeasurementType | Channel measurement type |
| Name | Specify descriptive name for the channel |
| Terminal | PFI terminal of counter subsystem |
| ZResetCondition | Reset condition for Z-indexing |
| ZResetEnable | Enable reset for Z-indexing |
| ZResetValue | Reset value for Z-indexing |

See Also

Functions

`addCounterOutputChannel` | `inputSingleScan` | `removeChannel` | `resetCounters`
| `startBackground` | `startForeground`

Properties

Terminal

Topics

“Acquire Counter Input Data”

Introduced in R2011a

addCounterOutputChannel

Add counter output channel

Syntax

```
addCounterOutputChannel(s,deviceID,channelID)
ch = addCounterOutputChannel(s,deviceID,channelID,measurementType)
[ch,idx] = addCounterOutputChannel(s,deviceID,channelID,
measurementType)
```

Description

`addCounterOutputChannel(s,deviceID,channelID)` adds a counter channel on the device represented by `deviceID` with the specified `channelID`, and channel measurement type, represented by `measurementType`, to the session `s`. Measurement types are vendor specific.

Tip Use `daq.createSession` to create a session object before you use this method.

`ch = addCounterOutputChannel(s,deviceID,channelID,measurementType)` returns the object `ch`.

`[ch,idx] = addCounterOutputChannel(s,deviceID,channelID, measurementType)` returns the object `ch`, representing the channel that was added and the index, `idx`, which is an index into the array of the session object's `Channels` property.

Examples

Add a Counter Output PulseGeneration Channel

```
s = daq.createSession('ni');  
ch = addCounterOutputChannel(s, 'cDAQ1Mod3', 'ctr0', 'PulseGeneration');  
ch.Terminal % View device signal name for pin mapping.
```

Add Two Counter Output PulseGeneration Channels

```
s = daq.createSession('ni')  
ch = addCounterOutputChannel(s, 'cDAQ1Mod3', 0:1, 'PulseGeneration')
```

Input Arguments

s — Data acquisition session

session object

Data acquisition session, specified as a session object. Create the session object using `daq.createSession`. Use the data acquisition session for acquisition and generation operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

deviceID — Device ID

character vector

Device ID as defined by the device vendor specified as a character vector. Obtain the device ID by calling `daq.getDevices`. The channel specified for this device is created for the session object.

channelID — Channel ID

numeric value, character vector, or string

Channel ID, specified as a numeric value, character vector, or string, corresponding to the specific counter channel on the device added to the session. Channel ID 0 corresponds to the device counter 'ctr0', Channel ID 1 to 'ctr1', and so on. For the related device signal names and physical pins, see the pinout for your particular device.

You can add a range of channels by specifying the channel ID with a numeric array, or an array of character vectors or strings.

The index for a channel displayed in the session indicates the channel's position in the session. The first channel you add in a session has session index 1, and so on.

Data Types: `char` | `string` | `cell`

measurementType — Channel measurement type

character vector or string

Channel measurement type, specified as a character vector or string. `measurementType` represents a vendor-defined measurement type. A valid output measurement type is 'PulseGeneration'.

Output Arguments

ch — Counter output channel object

1-by-n array

Counter output channel that you add, returned as an object containing a 1-by-n array of vendor specific channel information. Use this channel object to access device and channel properties.

| | |
|-----------------|---|
| Device | Channel device information |
| DutyCycle | Duty cycle of output channel |
| Frequency | Frequency of generated output |
| ID | ID of channel in session |
| IdleState | Default state of counter output channel |
| InitialDelay | Delay until output channel generates pulses |
| MeasurementType | Channel measurement type |
| Name | Specify descriptive name for the channel |

idx — Channel index

numeric

Channel index returned as a numeric value. Through the index you can access the array of the session object's Channels property.

See Also

Functions

addCounterInputChannel | removeChannel | startBackground | startForeground

Properties

Terminal

Topics

“Generate Pulses on a Counter Output Channel”

Introduced in R2011a

addDigitalChannel

Add digital channel

Syntax

```
addDigitalChannel(s,deviceID,channelID,measurementType)
ch = addDigitalChannel(s,deviceID,channelID,measurementType)
[ch,idx] = addDigitalChannel(s,deviceID,channelID,measurementType)
```

Description

`addDigitalChannel(s,deviceID,channelID,measurementType)` adds one or more digital channels to the session `s`, on the device represented by `deviceID`, with the specified port and single-line combination and channel measurement type.

Tips

- Before adding digital channels, create a session using `daq.createSession`.
- Change the `Direction` property value of bidirectional channels before you read or write digital data.
- To input and output decimal or hexadecimal values, use these conversion functions:
 - `decimalToBinaryVector`
 - `binaryVectorToDecimal`
 - `hexToBinaryVector`
 - `binaryVectorToHex`

`ch = addDigitalChannel(s,deviceID,channelID,measurementType)` creates and displays the digital channels assigned to `ch`.

`[ch,idx] = addDigitalChannel(s,deviceID,channelID,measurementType)` additionally creates and displays `idx`, which is an index into the array of the session object `Channels` property.

Examples

Add Digital Channels

Discover available digital devices on your system, then create a session with digital channels.

Find all installed devices.

```
d = daq.getDevices
```

```
d =
```

```
Data acquisition devices:
```

| index | Vendor | Device ID | Description |
|-------|--------|-----------|-------------------------------|
| 1 | ni | Dev1 | National Instruments USB-6255 |
| 2 | ni | Dev2 | National Instruments USB-6363 |

Get detailed subsystem information for NI USB-6255:

```
d(1)
```

```
ans =
```

```
ni: National Instruments USB-6255 (Device ID: 'Dev1')
```

```
  Analog input subsystem supports:
```

```
    7 ranges supported
```

```
    Rates from 0.1 to 1250000.0 scans/sec
```

```
    80 channels ('ai0' - 'ai79')
```

```
    'Voltage' measurement type
```

```
  Analog output subsystem supports:
```

```
    -5.0 to +5.0 Volts, -10 to +10 Volts ranges
```

```
    Rates from 0.1 to 2857142.9 scans/sec
```

```
    2 channels ('ao0', 'ao1')
```

```
    'Voltage' measurement type
```

```

Digital subsystem supports:
  24 channels ('port0/line0' - 'port2/line7')
  'InputOnly','OutputOnly','Bidirectional' measurement types

Counter input subsystem supports:
  Rates from 0.1 to 80000000.0 scans/sec
  2 channels ('ctr0','ctr1')
  'EdgeCount','PulseWidth','Frequency','Position' measurement types

Counter output subsystem supports:
  Rates from 0.1 to 80000000.0 scans/sec
  2 channels ('ctr0','ctr1')
  'PulseGeneration' measurement type

```

Create a session with input, output, and bidirectional channels using 'Dev1':

```

s = daq.createSession('ni');
addDigitalChannel(s,'dev1','Port0/Line0:1','InputOnly');
ch = addDigitalChannel(s,'dev1','Port0/Line2:3','OutputOnly');
[ch,idx] = addDigitalChannel(s,'dev1','Port2/Line0:1','Bidirectional')

```

ans =

```

Data acquisition session using National Instruments hardware:
  Clocked operations using startForeground and startBackground are disabled.
  Only on-demand operations using inputSingleScan and outputSingleScan can be done.
  Number of channels: 6

```

| index | Type | Device | Channel | MeasurementType | Range | Name |
|-------|------|--------|-------------|-------------------------|-------|------|
| 1 | dio | Dev1 | port0/line0 | InputOnly | n/a | |
| 2 | dio | Dev1 | port0/line1 | InputOnly | n/a | |
| 3 | dio | Dev1 | port0/line2 | OutputOnly | n/a | |
| 4 | dio | Dev1 | port0/line3 | OutputOnly | n/a | |
| 5 | dio | Dev1 | port2/line0 | Bidirectional (Unknown) | n/a | |
| 6 | dio | Dev1 | port2/line1 | Bidirectional (Unknown) | n/a | |

Input Arguments

s — Data acquisition session

session object

Data acquisition session specified as a session object created using `daq.createSession`. Use the data acquisition session for acquisition and generation operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

deviceID — Device ID

character vector

Device ID as defined by the device vendor specified as a character vector. Obtain the device ID by calling `daq.getDevices`. The channel specified for this device is created for the session object.

Data Types: `char`

channelID — Channel ID

character vector or string

Channel ID, or the physical location of the channel on the device, specified as a character vector or string. Supported values are specific to the vendor and device. You can add a range of channels using colon syntax, or an array of character vectors or strings. The index for this channel in the session display indicates this channel's position in the session. If you add a channel with channel ID 'Dev1' as the first channel in a session, its session index is 1.

Data Types: `cell` | `char` | `string`

measurementType — Channel measurement type

character vector or string

Channel measurement type specified as a character vector or string. `measurementType` represents a vendor-defined measurement type. Supported measurements are:

- 'InputOnly'
- 'OutputOnly'
- 'Bidirectional'

Data Types: `char` | `string`

Output Arguments

ch — Digital channels

array of channel objects

Digital channels, returned as an array of channel objects. `ch` is a 1-by-n array, in which each element is a channel object with vendor-specific device and channel properties. See also the properties in “Digital Input and Output”.

idx — Channel index

numeric

Channel index returned as a numeric value. Use this index to access the channels in the array of the session Channels property.

See Also

Functions

binaryVectorToDecimal | binaryVectorToHex | daq.createSession |
decimalToBinaryVector | hexToBinaryVector | inputSingleScan |
outputSingleScan | removeChannel | startBackground | startForeground

Topics

“Digital Subsystem Channels”

“Acquire Non-Clocked Digital Data”

“Generate Non-Clocked Digital Data”

“Acquire Digital Data Using an External Clock”

“Acquire Digital Data Using a Shared Clock”

“Acquire Digital Data Using a Counter Output Channel as External Clock”

Introduced in R2012b

addFunctionGeneratorChannel

Add function generator channel

Before you work with function generator channels, see “Supported Hardware” and “Create a Session”.

Syntax

```
addFunctionGeneratorChannel(s,deviceID,channelID,waveformType)
[ch,idx] = addFunctionGeneratorChannel(s,deviceID,channelID,
waveformType)
```

Description

`addFunctionGeneratorChannel(s,deviceID,channelID,waveformType)` adds a channel on the device represented by `deviceID`, with the specified `channelID` and `waveformType` to the session `s`.

`[ch,idx] = addFunctionGeneratorChannel(s,deviceID,channelID,waveformType)` creates and displays the object `ch`, representing the channel that was added and the index, `idx`, which is an index into the array of the session object `Channels` property.

Examples

Add a Function Generator Channel

Add a channel on a Digilent device with a sine waveform type.

Create a session for Digilent devices.

```
s = daq.createSession('digilent');
```

Add a channel with a sine waveform type.

```
addFunctionGeneratorChannel(s, 'AD1',1, 'Sine')  
  
ans =  
  
Data acquisition sine waveform generator '1' on device 'AD1':  
  
    Phase: 0  
    Range: -5.0 to +5.0 Volts  
TerminalConfig: SingleEnded  
    Gain: 1  
    Offset: 0  
    SampleRate: 4096  
WaveformType: Sine  
    Name: ''  
    ID: '1'  
    Device: [1x1 daq.di.DeviceInfo]  
MeasurementType: 'Voltage'
```

Save the Channel Information and the Channel Index of a Function Generator Channel

Create a session for Digilent devices.

```
s = daq.createSession('digilent');
```

Add a channel with a sine waveform type.

```
[ch,idx] = addFunctionGeneratorChannel(s, 'AD1',1, 'Sine')
```

```
ch =
```

```
Data acquisition sine waveform generator '1' on device 'AD1':  
  
    Phase: 0  
    Range: -5.0 to +5.0 Volts  
TerminalConfig: SingleEnded  
    Gain: 1  
    Offset: 0  
    SampleRate: 4096  
WaveformType: Sine  
    Name: ''  
    ID: '1'  
    Device: [1x1 daq.di.DeviceInfo]
```

MeasurementType: 'Voltage'

Properties, Methods, Events

idx =

1

Input Arguments

s — Data acquisition session

session object

Data acquisition session, specified as a session object. Create the session object using `daq.createSession`. Use the data acquisition session for acquisition and generation operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

deviceID — Device ID

character vector or string

Device ID as defined by the device vendor, specified as a character vector or string. Obtain the device ID by calling `daq.getDevices`. The channel specified for this device is created for the session object.

channelID — Channel ID

numeric value, character array, or string

Channel ID or the physical location of the channel on the device, added to the session, specified as a numeric value, character vector, or string. You can add a range of channels with an array. The index for this channel displayed in the session indicates this channel's position in the session. If you add a channel with channel ID 1 as the first channel in a session, the session index is 1 because of position, not ID.

waveformType — Function generator waveform type

character vector or string

Function generator waveform type specified as a character vector or string. Valid waveform types include:

- 'Sine'
- 'Square'
- 'Triangle'
- 'RampUp'
- 'RampDown'
- 'DC'
- 'Arbitrary'

Data Types: `char` | `string`

Output Arguments

ch — Analog input channel object

1-by-n array

Analog input channel that you add, returned as an object containing a 1xn array of vendor specific channel specific information. Use this channel object to access device and channel properties.

idx — Channel index

numeric value

Channel index returned as a numeric value. Through the index you can access the array of the session object's Channels property.

See Also

Functions

`addAnalogInputChannel` | `daq.createSession` | `startForeground`

Topics

“Generate a Standard Waveform Using Waveform Function Generation Channels”

“Digilent Analog Discovery Devices”

“Digilent Waveform Function Generation Channels”

“Waveform Types”

Introduced in R2014b

addlistener

Create event listener

Syntax

```
lh = addlistener(s,eventName,@callback)
lh = addlistener(s,eventName,@(src,event) expr)
```

Description

`lh = addlistener(s,eventName,@callback)` creates a listener for the specified event, `eventName`, to execute the callback function, `callback` at the time of the event. `lh` is the variable in which the listener handle is stored. Create a callback function that executes when the listener detects the specified event. The callback can be any MATLAB function.

Tip Delete the listener once the operation is complete.

```
delete(lh)
```

`lh = addlistener(s,eventName,@(src,event) expr)` creates a listener for the specified event, `eventName`, and fires an anonymous callback function. The anonymous function uses the specified input arguments and executes the operation specified in the expression `expr`. Anonymous functions provide a quick means of creating simple functions without storing them in a file. For more information, see Anonymous Functions (MATLAB).

Examples

Add a Listener to an Acquisition Session

Creating a session and add an analog input channel.

```
s = daq.createSession('ni');  
addAnalogInputChannel(s, 'cDAQ1Mod1', 'ai0', 'Voltage');
```

Add a listener for the `DataAvailable` event.

```
lh = addlistener(s, 'DataAvailable', @plotData);
```

Create the `plotData` callback function and save it as `plotData.m`.

```
function plotData(src,event)  
    plot(event.TimeStamps,event.Data)  
end
```

Acquire data in the background.

```
startBackground(s);
```

Wait for the operation to complete, and delete the listener.

```
wait(s)  
delete(lh)
```

Add a Listener to a Signal Generation Session Using an Anonymous Function

Create a session and set the `IsContinuous` property to `true`.

```
s = daq.createSession('ni');  
s.IsContinuous = true;
```

Add two analog output channels and create output data for the two channels.

```
addAnalogOutputChannel(s, 'cDAQ1Mod2', 0:1, 'Voltage');  
outputData0 = linspace(-1,1,1000)';  
outputData1 = linspace(-2,2,1000)';
```

Queue the output data.

```
queueOutputData(s, [outputData0 outputData1]);
```

Add a listener to call an anonymous function.

```
lh = addlistener(s, 'DataRequired', @(src,event)...  
    src.queueOutputData([outputData0 outputData1]));
```

Generate signals in the background.

```
startBackground(s);
```

Perform other MATLAB operations, and then stop the session. If the interim tasks do not allow enough time for the signal generation, use a `pause` before stopping.

```
pause(5)  
stop(s)
```

Delete the listener.

```
delete(lh)
```

Input Arguments

s — Data acquisition session

session object

Data acquisition session, specified as a session object. Create the session object using `daq.createSession`. Use the data acquisition session for acquisition and generation operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

eventName — Event name

'DataAvailable' | 'DataRequired' | 'ErrorOccurred'

Name of the event to listen for, specified as a character vector or string. Supported events include:

- 'DataAvailable'
- 'DataRequired'
- 'ErrorOccurred'

Data Types: `char` | `string`

callback — Callback function

function handle

The callback function to execute, specified as a function handle. The function executes when the specified event occurs.

src — Session input argument

variable name

Session input argument to the anonymous function, specified as a variable name. `addListener` sends the data acquisition session object handle into the anonymous function as this variable.

event — Event input argument

variable name

Event input argument to the anonymous function, specified as a variable name. `addListener` sends the triggering event object handle into the anonymous function as this variable.

expr — Body of anonymous function

executable text

Body of anonymous function, specified as a line of executable text. The expression can include the input argument variables names `src` and `event`.

Output Arguments

lh — Listener event

event object handle

The event listener returned as an event object handle. Delete the listener once the operation completes.

See Also

Functions

`addAnalogInputChannel` | `addAnalogOutputChannel` | `daq.createSession` | `startBackground`

Properties

`DataAvailable Event` | `DataRequired Event` | `ErrorOccurred Event`

Topics

“Session Creation Workflow”

Introduced in R2010b

addTriggerConnection

Add trigger connection

Syntax

```
addTriggerConnection(s,source,destination,type)
tc = addTriggerConnection(s,source,destination,type)
[tc,idx] = addTriggerConnection(s,source,destination,type)
```

Description

`addTriggerConnection(s,source,destination,type)` establishes a trigger connection from the specified source device and terminal to the specified destination device and terminal, of the specified connection type.

Note You cannot use triggers with audio devices.

Tip Before adding trigger connections, create a session using `daq.createSession`, and add channels to the session.

`tc = addTriggerConnection(s,source,destination,type)` establishes a trigger connection from the specified source and terminal to the specified destination device and terminal, of the specified connection type and displays it in the variable `tc`.

`[tc,idx] = addTriggerConnection(s,source,destination,type)` establishes a trigger connection from the specified source device and terminal to the specified destination device and terminal of the specified connection type, and displays the connection in the variable `tc` and the connection index in `idx`.

Examples

Add External Start Trigger Connection

Create a session and add an analog input channel from Dev1 to the session.

```
s = daq.createSession('ni')
addAnalogInputChannel(s, 'Dev1', 'ai0', 'Voltage');
```

Add a trigger connection from an external device to terminal PFI1 on Dev1 using the 'StartTrigger' connection type.

```
addTriggerConnection(s, 'external', 'Dev1/PFI1', 'StartTrigger')
```

Export Trigger to External Device

To Add trigger connection going to an external destination, create a session and add an analog input channel from Dev1 to the session.

```
s = daq.createSession('ni')
addAnalogInputChannel(s, 'Dev1', 'ai0', 'Voltage');
```

Add a trigger from terminal PFI1 on Dev1 to an external device using the 'StartTrigger' connection type.

```
addTriggerConnection(s, 'Dev1/PFI1', 'external', 'StartTrigger')
```

Save Trigger Connection

Add a trigger connection from terminal PFI1 on Dev1 to terminal PFI0 on Dev2 using the 'StartTrigger' connection type and store it in tc.

To display a trigger connection in a variable, create a session and add an analog input channel from Dev1 and Dev2 to the session.

```
s = daq.createSession('ni')
addAnalogInputChannel(s, 'Dev1', 'ai0', 'Voltage');
addAnalogInputChannel(s, 'Dev2', 'ai1', 'Voltage');
```

Save the trigger connection in tc.

```
tc = addTriggerConnection(s, 'Dev1/PFI1', 'Dev2/PFI0', 'StartTrigger');
```

Input Arguments

s — Data acquisition session

session object

Data acquisition session, specified as a session object. Create the session object using `daq.createSession`. Use the data acquisition session for acquisition and generation operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

source — Source of trigger connection

character vector or string

Source for the trigger connection, specified as a character vector or string. Valid values are:

- `'external'` — for a trigger based on an external event. A session with an external trigger source has a timeout determined by the `ExternalTriggerTimeout` property; to disable the timeout, set the `ExternalTriggerTimeout` value to `Inf`.
- `'deviceID/terminal'` — for a trigger sourced on a specific terminal on a device in your session. For example, `'Dev1/PFI1'`, for more information on device ID see `Device`. For more information on terminal see `Terminals`.
- `'chassisId/terminal'` — for a trigger sourced on a specific terminal on a chassis in your session, for example, `'cDAQ1/PFI1'`. For more information on terminal see `Terminals`.

You can have only one trigger source in a session.

destination — Destination of trigger connection

character vector or string

Destination for the trigger connection, specified as a character vector or string. Valid values are:

- `'external'` — for a trigger source connected to an external device.
- `'deviceID/terminal'` — for a trigger source connected to another device in your session, for example, `'Dev1/PFI1'`. For more information on device ID see `Device`. For more information on terminal see `Terminals`.

- `'chassisId/terminal'` — for a trigger source connected to a chassis in your session, for example, `'cDAQ1/PFI1'`. For more information on terminal see [Terminals](#).

You can also specify multiple destination devices as an array, for example, `{'Dev1/PFI1', 'Dev2/PFI1'}`.

type — Trigger connection type

character vector or string

The trigger connection type, specified as a character vector or string. `'StartTrigger'` is the only connection type available for trigger connections at this time.

Output Arguments

tc — Trigger connection

1-by-n object array

The trigger connection that you add, returned as an object of trigger connection information. The object contains the following properties.

| | |
|-----------------------------|---|
| Destination | Indicates trigger destination terminal |
| ExternalTriggerTimeout | Specify maximum wait time for external trigger |
| IsWaitingForExternalTrigger | Indicates if synchronization is waiting for an external trigger |
| Source | Indicates trigger source terminal |
| Terminals | Terminals available on device or CompactDAQ chassis |
| TriggerCondition | Specify condition that must be satisfied before trigger executes |
| TriggersPerRun | Indicate the number of times the trigger executes in an operation |
| TriggersRemaining | Indicates the number of trigger to execute in an operation |
| TriggerType | Type of trigger executed |

idx — Channel index

numeric

Channel index returned as a numeric value. Through the index you can access the array of the session object Channels property.

See Also

Functions

`addClockConnection` | `daq.createSession` | `removeConnection`

Topics

“Trigger Connections”

“Synchronization”

“Acquire Voltage Data Using a Digital Trigger”

“Multiple-Device Synchronization Using USB or PXI Devices”

“Multiple-Chassis Synchronization with CompactDAQ Devices”

Introduced in R2012a

Analog Input Recorder

Acquire and visualize analog input signals

Description

The Analog Input Recorder provides a graphical interface to data acquisition devices.

Using this app, you can:

- Configure device channels and acquisition properties.
- Preview signals on several analog input channels for a selected device.
- Record analog input data for a finite period (foreground) or continuously (background).
- Generate MATLAB code that can perform the equivalent acquisition.

Open the Analog Input Recorder App

- MATLAB Toolstrip: On the **Apps** tab, under **Test and Measurement**, click the app.
- MATLAB command prompt: Enter `analogInputRecorder`.

Note Opening the Analog Input Recorder deletes all your existing data acquisition sessions in MATLAB.

The session created by the Analog Input Recorder is not accessible from the MATLAB command line.

See Also

Topics

“Acquire Data with the Analog Input Recorder”

Introduced in R2017b

binaryVectorToDecimal

Convert binary vector value to decimal value

Syntax

```
binaryVectorToDecimal(binaryVector)  
binaryVectorToDecimal(binaryVector, bitOrder)
```

Description

`binaryVectorToDecimal(binaryVector)` converts a binary vector to a decimal.

`binaryVectorToDecimal(binaryVector, bitOrder)` converts a binary vector with the specified bit orientation to a decimal .

Examples

Convert a Binary Vector to a Decimal Value

```
binaryVectorToDecimal([1 1 0])
```

```
ans =
```

```
6
```

Convert a Binary Vector Array to a Decimal Value

```
binaryVectorToDecimal([1 0 0 0; 0 1 0 0])
```

```
ans =
```

```
8  
4
```

Convert a Binary Vector with LSB First

```
binaryVectorToDecimal([1 0 0 0; 0 1 0 0], 'LSBFirst')
```

```
ans =
```

```
1  
2
```

Convert a Binary Vector Array with LSB First

```
binaryVectorToDecimal([1 1 0], 'LSBFirst')
```

```
ans =
```

```
6
```

Input Arguments

binaryVector — Binary vector to convert to decimal

binary Vectors

Binary vector to convert to a decimal specified as a single binary vector or a row or column-based array of binary vectors.

bitOrder — Bit order for binary vector representation

'MSBFirst' (default) | 'LSBFirst'

Bit order for the binary vector representation, specified as a character vector or string. Accepted values are:

- 'MSBFirst' — The first element of the binary vector is the most significant bit.
- 'LSBFirst' — The first element of the binary vector is the least significant bit.

Data Types: char | string

See Also

Functions

`binaryVectorToHex` | `decimalToBinaryVector` | `hexToBinaryVector`

Topics

“Generate Signals Using Decimal Data Across Multiple Lines”

Introduced in R2012b

binaryVectorToHex

Convert binary vector value to hexadecimal

Syntax

```
hexval = binaryVectorToHex(binaryVector)
hexval = binaryVectorToHex(binaryVector,bitOrder)
```

Description

`hexval = binaryVectorToHex(binaryVector)` converts the input binary vector to a hexadecimal.

`hexval = binaryVectorToHex(binaryVector,bitOrder)` converts the input binary vector using the specified bit orientation.

Examples

Convert a Binary Vector to a Hexadecimal

```
hexval = binaryVectorToHex([0 0 1 1 1 1 0 1])
hexval =
    3D
```

Convert an Array of Binary Vectors to a Hexadecimal

```
hexval = binaryVectorToHex([1 1 0 0 0 1 0 0 ; 0 0 0 0 1 0 1 0])
hexval =
    'C4'
    '0A'
```

The output is appended with 0s to make all hex values the same length character vectors.

Convert a Binary Vector with LSB First

```
hexval = binaryVectorToHex([0 0 1 1 1 1 0 1], 'LSBFirst')
```

```
hexval =
```

```
    BC
```

Convert a Binary Vector Array with LSB First

```
hexval = binaryVectorToHex([1 1 0 0 0 1 0 0 ; 0 0 0 0 1 0 1 0], 'LSBFirst')
```

```
hexval =
```

```
    '23'
```

```
    '50'
```

If necessary, the output is appended with 0s to make all hex values the same length character vectors.

Note The binary vector array is converted to a cell array of hexadecimal numbers. If you input a single binary vector, it is converted to a hexadecimal character vector.

Input Arguments

binaryVector — Binary vector to convert to hexadecimal

numeric vector of 1s and 0s

The binary vector to convert to hexadecimal specified as a numeric vector with 0s and 1s. The vector can be a column or row vector.

bitOrder — Bit order for binary vector representation

'MSBFirst' (default) | 'LSBFirst'

Bit order for the binary vector representation, specified as a character vector or string. Accepted values are:

- `'MSBFirst'` — The first element of the binary vector is the most significant bit.
- `'LSBFirst'` — The first element of the binary vector is the least significant bit.

Data Types: `char` | `string`

Output Arguments

hexval — Hexadecimal value

character vector

Hexadecimal value returned as a character vector.

See Also

Functions

`binaryVectorToDecimal` | `decimalToBinaryVector` | `hexToBinaryVector`

Topics

“Acquire Digital Data in Hexadecimal Values”

Introduced in R2012b

daq.createSession

Create data acquisition session for specific vendor hardware

Syntax

```
session = daq.createSession(vendor)
```

Description

`session = daq.createSession(vendor)` creates a session object for configuring and operating data acquisition devices from the specified vendor.

Examples

Create Data Acquisition Session for National Instruments Devices

Create a data acquisition session object `s`, for National Instruments® devices.

```
s = daq.createSession('ni')
```

```
s =
```

```
Data acquisition session using National Instruments hardware:  
Will run for 1 second (1000 scans) at 1000 scans/second.  
No channels have been added.
```

Input Arguments

vendor — Vendor name

character vector or string

Vendor name for the device you want to create a session for, specified as a character vector. Valid vendors are:

- 'ni'
- 'diligent'
- 'directsound'
- 'adi'
- 'mcc'

Data Types: char | string

Output Arguments

session — Data acquisition session

session object

Data acquisition session, returned as a session object. Use the data acquisition session for acquisition and generation operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

The session has the following properties:

| | |
|--------------------------------------|---|
| Channels | Array of channel objects associated with session object |
| Connections | Array of connections in session |
| DurationInSeconds | Specify duration of acquisition |
| IsContinuous | Specify if operation continues until manually stopped |
| IsDone | Indicate if session operation is complete |
| IsLogging | Indicate if hardware is acquiring or generating data |
| IsNotifyWhenDataAvailableExceedsAuto | Control if <code>NotifyWhenDataAvailableExceeds</code> is set automatically |
| IsNotifyWhenScansQueuedBelowAuto | Control if <code>NotifyWhenScansQueuedBelow</code> is set automatically |
| NotifyWhenDataAvailableExceeds | Control firing of <code>DataAvailable</code> event |
| NotifyWhenScansQueuedBelow | Control firing of <code>DataRequired</code> event |
| NumberOfScans | Number of scans for operation when starting |
| Range | Specify channel measurement range |
| Rate | Rate of operation in scans per second |
| RateLimit | Limit of rate of operation based on hardware configuration |
| ScansAcquired | Number of scans acquired during operation |
| ScansOutputByHardware | Indicate number of scans output by hardware |
| ScansQueued | Indicate number of scans queued for output |
| UserData | Custom data |
| Vendor | Vendor information associated with session object |

See Also

Functions

addAnalogInputChannel | addAnalogOutputChannel | addAudioInputChannel |
addAudioOutputChannel | addCounterInputChannel |
addCounterOutputChannel | addDigitalChannel | daq.getDevices |
daq.getVendors

Introduced in R2010b

daq.getDevices

Display available data acquisition devices

Syntax

```
daq.getDevices
device = daq.getDevices
```

Description

daq.getDevices lists devices available to your system.

device = daq.getDevices stores this list in the variable *device*.

Tips Devices not supported by the toolbox are denoted with an *. For a complete list of supported CompactDAQ devices, see <https://www.mathworks.com/hardware-support/data-acquisition-software.html>.

Examples

Get a List of Devices

Get a list of all devices available to your system and store it in the variable *d*.

```
d = daq.getDevices
```

```
d =
```

| index | Vendor | Device ID | Description |
|-------|-------------|-----------|---|
| 1 | directsound | Audio0 | DirectSound Primary Sound Capture Driver |
| 2 | directsound | Audio1 | DirectSound Digital Audio (S/PDIF) (High Definition Audio Device) |
| 3 | directsound | Audio3 | DirectSound HP 4120 (2- HP 4120) |
| 4 | ni | cDAQ1Mod1 | National Instruments NI 9205 |
| 5 | ni | cDAQ1Mod2 | National Instruments NI 9263 |
| 6 | ni | cDAQ1Mod3 | National Instruments NI 9234 |
| 7 | ni | cDAQ2Mod1 | National Instruments NI 9402 |

```
8   ni      cDAQ2Mod2 National Instruments NI 9205
9   ni      cDAQ2Mod3 National Instruments NI 9375
10  ni      Dev1      National Instruments USB-6211
11  ni      Dev2      National Instruments USB-6218
12  ni      Dev3      National Instruments PCI-6255
13  ni      PXI1Slot2 National Instruments PXI-4461
14  ni      PXI1Slot3 National Instruments PXI-4461
```

To get detailed information about a module on the chassis, type `d(index)`. For example, to get information about NI 9265, which has the index 13, type:

```
d(13)
ans =
ni: National Instruments NI 9402 (Device ID: 'cDAQ1Mod5')
Counter input subsystem supports:
  Rates from 0.1 to 80000000.0 scans/sec
  4 channels ('ctr0','ctr1','ctr2','ctr3')
  'EdgeCount','PulseWidth','Frequency','Position' measurement types

Counter output subsystem supports:
  Rates from 0.1 to 80000000.0 scans/sec
  4 channels ('ctr0','ctr1','ctr2','ctr3')
  'PulseGeneration' measurement type

This module is in slot 5 of the 'cDAQ-9178' chassis with the name 'cDAQ1'.
```

You can also click on the name of the device in the list to access detailed device information, which includes:

- subsystem type
- rate
- number of available channels
- measurement type

Output Arguments

device — Device list

array of DeviceInfo objects

Device list, returned as an array of DeviceInfo objects.

See Also

Functions

`daq.createSession` | `daq.getVendors`

Topics

“Hardware Discovery and Session Setup”

Introduced in R2010b

daq.getVendors

Display available vendors

Syntax

```
daq.getVendors  
vendor = daq.getVendors
```

Description

daq.getVendors lists vendors available to your machine and MATLAB.

vendor = daq.getVendors assigns the output list to the variable vendor.

Examples

Get the List of Available Vendors

Get a list of all vendors available to your machine and MATLAB, and store it in the variable `v`.

```
v = daq.getVendors
```

```
v =
```

```
Number of vendors: 5
```

| index | ID | Operational | Comment |
|-------|-------------|-------------|-----------------------------|
| 1 | ni | true | National Instruments |
| 2 | adi | true | Analog Devices Inc. |
| 3 | directsound | true | DirectSound |
| 4 | digilent | true | Digilent Inc. |
| 5 | mcc | true | Measurement Computing Corp. |

Programmatically determine if 'adi' is an operational vendor.

```
for idx = 1:length(v)  
    if strcmp(v(idx).ID,'adi')
```

```
        v(idx).IsOperational
    end
end
ans =
    logical
    1
```

Output Arguments

vendor — Vendor list

array of VendorInfo objects

Vendor list, returned as an array of VendorInfo objects. This represents the vendor information available to your system.

For a list of vendors currently supported by Data Acquisition Toolbox, and instructions for installing necessary support packages, see “Data Acquisition Toolbox Supported Hardware”. For information on using the SDK to extend support for other vendors, see “Build Custom Adaptors”.

See Also

Functions

daq.createSession | daq.getDevices

Topics

“Hardware Discovery and Session Setup”

“Data Acquisition Toolbox Supported Hardware”

“Build Custom Adaptors”

Introduced in R2010b

daqhelp

Help for toolbox interface

Syntax

```
daqhelp
daqhelp('functionname')
helptext = daqhelp('functionname')
```

Description

`daqhelp` displays a comprehensive listing of Data Acquisition Toolbox functions along with a brief description of each. Links in the output provide access to more detailed information.

`daqhelp('functionname')` returns help for the function specified as a character vector or string.

`helptext = daqhelp('functionname')` assigns the help text output to the variable `out`.

Examples

Get Toolbox Help

Get overview help for Data Acquisition Toolbox.

```
daqhelp
```

```
Data Acquisition Toolbox
Version 3.12 (R2018a Prerelease) 08-Aug-2017
Data Acquisition Toolbox Session-Based Interface Support
```

```
To control these data acquisition devices, you use a daq.Session object
to configure and control one or more devices.
```

In a typical workflow,

- (1) Discover hardware devices using `daq.getDevices`
- (2) Create a daq Session using `daq.createSession`
- (3) Add device channels
- (4) Add device connections
- (5) Set session and channel properties
- (6) Perform on demand operations using `inputSingleScan/outputSingleScan`
- (7) Perform clocked operations using `startForeground/startBackground`

(1) Device enumeration and discovery:

- `daq.getDevices` - Show data acquisition devices available
- `daq.getVendors` - Show known data acquisition vendors
- `daq.reset` - Reinitialize all data acquisition devices and sessions.

This represents only a partial view of the total output.

Get Function Help

Get help for a specified function.

```
daqhelp('daq.createSession')
```

```
daq.createSession Create a data acquisition session for a given vendor
Returns a daq.Session object that represents a session with hardware
from the specific vendor.
```

```
SESSION = daq.createSession(VENDOR_ID) returns a session object specific
to the vendor ID specified by the string VENDOR_ID that you can configure to
perform operations. Type daq.getVendors() for a list of available
vendors.
```

```
Example:
s = daq.createSession('ni');
s.addAnalogInputChannel('cDAQ1Mod1', 'ai0', 'Voltage');
s.startForeground();
```

See also `daq.getDevices`, `daq.getVendors`, `daq.reset`

Return Function Help Text to Variable

Get help for a specified function, assigning the help text to a variable.

```
helptext = daqhelp('daq.createSession');
```

Input Arguments

'functionname' — Function for which you want help

char vector or string

Function for which you want help, specified as a character vector or string.

Example: 'daq.createSession'

Data Types: char | string

Output Arguments

helptext — Help text

char vector

Help text, returned as a character vector.

Introduced before R2006a

daqreset

Reset Data Acquisition Toolbox

Syntax

```
daqreset
```

Description

daqreset resets Data Acquisition Toolbox and deletes all data acquisition session and device objects.

Examples

Reset the Toolbox

Create a data acquisition session, then reset the toolbox.

```
s = daq.createSession('adi');  
resetdaq  
s
```

```
s =
```

```
handle to deleted Session
```

See Also

Functions

daq.createSession

Introduced before R2006a

decimalToBinaryVector

Convert decimal value to binary vector

Syntax

```
decimalToBinaryVector(decimalNumber)  
decimalToBinaryVector(decimalNumber, numberOfBits)  
decimalToBinaryVector(decimalNumber, numberOfBits, bitOrder)  
decimalToBinaryVector(decimalNumber, [], bitOrder)
```

Description

`decimalToBinaryVector(decimalNumber)` converts a positive decimal number to a binary vector, represented using the minimum number of bits.

`decimalToBinaryVector(decimalNumber, numberOfBits)` converts a decimal number to a binary vector with the specified number of bits.

`decimalToBinaryVector(decimalNumber, numberOfBits, bitOrder)` converts a decimal number to a binary vector with the specified number of bits in the specified bit ordering.

`decimalToBinaryVector(decimalNumber, [], bitOrder)` converts a decimal number to a binary vector with default number of bits in the specified bit ordering.

Examples

Convert a Decimal to a Binary Vector

```
decimalToBinaryVector(6)
```

```
ans =
```

```
    1    1    0
```

Convert an Array of Decimals to a Binary Vector Array

```
decimalToBinaryVector(0:4)
```

```
ans =
```

```
    0    0    0
    0    0    1
    0    1    0
    0    1    1
    1    0    0
```

Convert a Decimal into a Binary Vector of Specific Bits

```
decimalToBinaryVector(6, 8, 'MSBFirst')
```

```
ans =
```

```
    0    0    0    0    0    1    1    0
```

Convert a Decimal into a Binary Vector with LSB First

```
decimalToBinaryVector(6, [], 'LSBFirst')
```

```
ans =
```

```
    0    1    1
```

Convert an Array of Decimals into a Binary Vector Array with LSB First

```
decimalToBinaryVector(0:4, 4, 'LSBFirst')
```

```
ans =
```

```
0    0    0    0
1    0    0    0
0    1    0    0
1    1    0    0
0    0    1    0
```

Input Arguments

decimalNumber — Number to convert to binary vector

numeric

The number to convert to a binary vector specified as a positive integer scalar.

Data Types: `single` | `double` | `int8` | `int16` | `int32` | `int64` | `uint8` | `uint16` | `uint32` | `uint64`

numberOfBits — Number of bits required to correctly represent the decimal number

numeric

The number of bits required to correctly represent the decimal. This is an optional argument. If you do not specify the number of bits, the number is represented using the minimum number of bits needed. By default minimum number of bits needed to represent the value is specified, unless you specify a value

bitOrder — Bit order for binary vector representation

'MSBFirst' (default) | 'LSBFirst'

Bit order for the binary vector representation, specified as a character vector or string. Accepted values are:

- 'MSBFirst' — The first element of the binary vector is the most significant bit.
- 'LSBFirst' — The first element of the binary vector is the least significant bit.

Data Types: `char` | `string`

See Also

Functions

`binaryVectorToDecimal` | `binaryVectorToHex` | `hexToBinaryVector`

Topics

“Generate Signals Using Decimal Data Across Multiple Lines”

Introduced in R2012b

hexToBinaryVector

Convert hexadecimal value to binary vector

Syntax

```
hexToBinaryVector(hexNumber)
hexToBinaryVector(hexNumber,numberOfBits)
hexToBinaryVector(hexNumber,numberOfBits,bitOrder)
```

Description

`hexToBinaryVector(hexNumber)` converts hexadecimal numbers to a binary vector.

`hexToBinaryVector(hexNumber,numberOfBits)` converts hexadecimal numbers to a binary vector with the specified number of bits.

`hexToBinaryVector(hexNumber,numberOfBits,bitOrder)` converts hexadecimal numbers to a binary vector with the specified number of bits in the specified bit ordering.

Examples

Convert a hexadecimal to a binary vector

```
hexToBinaryVector('A1')
```

```
ans=
```

```
1 0 1 0 0 0 0 1
```

Convert a hexadecimal with a leading 0 to a binary Vector

```
hexToBinaryVector('0xA')
```

```
ans=
```

```
    1    0    1    0
```

Convert an Array of Hexadecimal Numbers to a Binary Vector

```
hexToBinaryVector(['A1'; 'B1'])
```

```
ans=
```

```
    1    0    1    0    0    0    0    1
    1    0    1    1    0    0    0    1
```

Convert a Hexadecimal Number into a Binary Vector of Specific Bits

```
hexToBinaryVector('A1',12, 'MSBFirst')
```

```
ans=
```

```
    0    0    0    0    1    0    1    0    0    0    0    1
```

Convert a Cell Array of Hexadecimal Numbers into a Binary Vector of Specific Bits

```
hexToBinaryVector({'A1';'B1'},8)
```

```
ans=
```

```
    1    0    1    0    0    0    0    1
    1    0    1    1    0    0    0    1
```

Convert a Hexadecimal into a Binary Vector with LSB First

```
hexToBinaryVector('A1', [], 'LSBFirst')
```

ans=

1 0 0 0 0 1 0 1

Input Arguments

hexNumber — Hexadecimal to convert to binary vector

hexadecimal value

Hexadecimal number to convert to a binary vector, specified as a character vector or string.

Data Types: `char` | `string`

numberOfBits — Number of bits to represent the decimal number

numeric

Number of bits to represent the decimal number, specified as a numeric value. This is an optional argument. If you do not specify the number of bits, the number is represented using the minimum number of bits needed.

bitOrder — Bit order for binary vector representation

'MSBFirst' (default) | 'LSBFirst'

Bit order for the binary vector representation, specified as a character vector or string. Accepted values are:

- 'MSBFirst' — The first element of the binary vector is the most significant bit.
- 'LSBFirst' — The first element of the binary vector is the least significant bit.

Data Types: `char` | `string`

See Also

Functions

`binaryVectorToDecimal` | `binaryVectorToHex` | `decimalToBinaryVector`

Topics

“Acquire Digital Data in Hexadecimal Values”

Introduced in R2012b

inputSingleScan

Acquire single scan from all input channels

Syntax

```
data = inputSingleScan(s);  
[data,triggerTime] = inputSingleScan(s);
```

Description

`data = inputSingleScan(s)`; returns an immediately acquired single scan from each input channel in the session as a 1-by-n array of doubles. The value is stored in `data`, where `n` is the number of input channels in the session.

Tip To acquire more than a single scan, use `startForeground`.

`[data,triggerTime] = inputSingleScan(s)`; returns an immediately acquired single scan from each input channel in the session as a 1-by-n array of doubles. The value is stored in `data`, where `n` is the number of input channels in the session and the MATLAB serial date timestamp representing the time the data is acquired is returned in `triggerTime`.

Examples

Acquire Single Analog Input Scan

Acquire a single input from an analog channel.

Create a session and add two analog input channels:

```
s = daq.createSession('ni');  
addAnalogInputChannel(s,'cDAQ1Mod1',1:2,'Voltage');
```

Input a single scan:

```
data = inputSingleScan(s)
data =
    -0.1495    0.8643
```

Acquire Single Digital Input Scan

Acquire a single input from a digital channel and get data and the trigger time of the acquisition.

Create a session and add two digital channels with `InputOnly` measurement type:

```
s = daq.createSession('ni');
addDigitalChannel(s, 'dev1', 'Port0/Line0:1', 'InputOnly');
```

Input a single scan:

```
[data,triggerTime] = inputSingleScan(s)
```

Acquire Single Counter Input Scan

Acquire a single input from a counter channel.

Create a session and add a counter input channel with `EdgeCount` measurement type:

```
s = daq.createSession('ni');
addCounterInputChannel(s, 'Dev1', 0, 'EdgeCount');
```

Input a single edge count:

```
data = inputSingleScan(s)
```

Input Arguments

s — Data acquisition session
session object

Data acquisition session, specified as a session object. Create the session object using `daq.createSession`. Use the data acquisition session for acquisition and generation operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

Output Arguments

data — Value from acquired data

array of double

Value from acquired data, returned as a 1-by-n array of doubles.

triggerTime — Timestamp of acquired data

numeric

Timestamp of acquired data which is a MATLAB serial date timestamp representing the absolute time when `timeStamps = 0`.

See Also

Functions

`addAnalogInputChannel` | `addCounterInputChannel` | `addDigitalChannel` | `daq.createSession` | `startForeground`

Topics

“Acquire Non-Clocked Digital Data”

“Acquire Counter Input Data”

Introduced in R2010b

outputSingleScan

Generate single scan on all output channels

Syntax

```
outputSingleScan(s,data)
```

Description

`outputSingleScan(s,data)` outputs a single scan of data on one or more analog output channels.

Examples

Analog Output

Output a single scan on two analog output voltage channels

Create a session and add two analog output channels.

```
s = daq.createSession('ni');  
addAnalogOutputChannel(s,'cDAQ1Mod2',0:1, 'Voltage');
```

Create an output value and output a single scan for each channel added.

```
outputSingleScan(s,[1.5 4]);
```

Digital Output

Output one value on each of two lines on a digital channel

Create a session and add two digital channels from port 0 that measures output only:

```
s = daq.createSession('ni');  
addDigitalChannel(s, 'dev1', 'Port0/Line0:1', 'OutputOnly')
```

Output one value each on the two lines:

```
outputSingleScan(s, [0 1])
```

Input Arguments

s — Data acquisition session

session object

Data acquisition session, specified as a session object. Create the session object using `daq.createSession`. Use the data acquisition session for acquisition and generation operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

data — Data to output

doubles

Data to output, represented as a 1-by-n matrix of doubles, where n is the number of output channels in the session.

See Also

Functions

`addAnalogOutputChannel` | `addDigitalChannel` | `daq.createSession` | `inputSingleScan`

Introduced in R2010b

prepare

Prepare session for operation

Syntax

```
prepare(s)
```

Description

`prepare(s)` configures and allocates hardware resources for the session `s` and reduces the latency of `startBackground` and `startForeground` functions. There must be at least one channel in the session before you can call this function. Use of this function is optional; it is automatically called as needed.

Examples

Prepare Session

Create a session with one channel, and prepare it for operation.

```
s = daq.createSession('directsound');  
ch = addAudioInputChannel(s, 'Audio1', 1);  
prepare(s)
```

Input Arguments

s — Data acquisition session

session object

Data acquisition session, specified as a session object. Create the session object using `daq.createSession`. Use the data acquisition session for acquisition and generation operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

See Also

Functions

`daq.createSession` | `release` | `startBackground` | `startForeground`

Introduced in R2010b

queueOutputData

Queue data to be output

Syntax

```
queueOutputData(s,data)
```

Description

`queueOutputData(s,data)` queues data to be output. When generating output signals, you must queue data before you call `startForeground` or `startBackground`.

Examples

Queue Output Data for a Single Channel

Create a session, add an analog output channel, and queue some data to output.

```
s = daq.createSession('ni');  
addAnalogOutputChannel(s,'cDAQ1Mod2','ao0','Voltage');  
queueOutputData(s,linspace(-1,1,1000)');  
startForeground(s)
```

Queue Output Data for Multiple Channels

```
s = daq.createSession('ni');  
addAnalogOutputChannel(s,'cDAQ1Mod2',0:1,'Voltage');  
data0 = linspace(-1,1,1000)';  
data1 = linspace(-2,2,1000)';
```

```
queueOutputData(s,[data0 data1]);  
startBackground(s);
```

Input Arguments

s — Data acquisition session

session object handle

Data acquisition session, specified as a session object handle. Create the session object using `daq.createSession`. Use the data acquisition session for acquisition and generation operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

data — Output data values

array of doubles

Output data values, specified as an m -by- n matrix of doubles, where m is the number of scans to generate, and n is the number of output channels in the session.

See Also

Functions

`addAnalogOutputChannel` | `addDigitalChannel` | `daq.createSession` | `startBackground` | `startForeground`

Introduced in R2010b

release

Release session hardware resources

Syntax

```
release(s)
```

Description

`release(s)` releases all reserved hardware resources in the session `s`, and flushes any data you have queued in the hardware in that session.

A session might reserve exclusive access to the hardware associated with it. If you need to use the hardware in another session or by applications other than MATLAB, use `release(s)` to unreserve the hardware and clear its data.

Hardware resources associated with a session are automatically released when you delete the session object or assign a different value to the variable containing the session object.

Examples

Release Session Hardware

Create a session and add an analog input voltage channel and acquire data in the foreground:

```
s1 = daq.createSession('ni');  
addAnalogInputChannel(s1, 'cDAQ3Mod1', 'ai0', 'Voltage');  
startForeground(s1)
```

Release the session hardware and create another session object with an analog input voltage channel on the same device as the previous session. Acquire in the foreground:

```
release(s1);  
s2 = daq.createSession('ni');
```

```
addAnalogInputChannel(s2, 'cDAQ3Mod1', 'ai2', 'Voltage');  
startForeground(s2);
```

Input Arguments

s — Data acquisition session

session object

Data acquisition session, specified as a session object. Create the session object using `daq.createSession`. Use the data acquisition session for acquisition and generation operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

See Also

Functions

`daq.createSession` | `prepare` | `startBackground` | `startForeground`

Introduced in R2010b

removeChannel

Remove channel from session object

Syntax

```
removeChannel(s,idx);
```

Description

`removeChannel(s,idx)`; removes the channel specified by `idx` from the session object `s`.

Examples

Remove Channels from a Session

Start with a session `s`, to which you add two analog input and two analog output voltage channels and display the channel information.

```
s
```

```
s =
```

```
Data acquisition session using National Instruments hardware:
```

```
No data queued. Will run at 1000 scans/second.
```

```
Operation starts immediately.
```

```
Number of channels: 4
```

| index | Type | Device | Channel | MeasurementType | Range | Name |
|-------|------|-----------|---------|---------------------|------------------|------|
| 1 | ai | cDAQ1Mod4 | ai0 | Voltage (SingleEnd) | -10 to +10 Volts | |
| 2 | ai | cDAQ1Mod4 | ai1 | Voltage (SingleEnd) | -10 to +10 Volts | |
| 3 | ao | cDAQ1Mod2 | ao0 | Voltage (Diff) | -10 to +10 Volts | |
| 4 | ao | cDAQ1Mod2 | ao1 | Voltage (Diff) | -10 to +10 Volts | |

Remove channel 'ai0' with the index 1 from the session:

```
removeChannel(s,1)
```

To see how the indices shift after you remove a channel, type:

S

s =

```
Data acquisition session using National Instruments hardware:
No data queued. Will run at 1000 scans/second.
All devices synchronized using cDAQ1 CompactDAQ chassis backplane. (Details)
Number of channels: 3
  index Type Device Channel MeasurementType Range Name
-----
  1 ai cDAQ1Mod4 ai1 Voltage (SingleEnd) -10 to +10 Volts
  2 ao cDAQ1Mod2 ao0 Voltage (Diff) -10 to +10 Volts
  3 ao cDAQ1Mod2 ao1 Voltage (Diff) -10 to +10 Volts
```

Remove the first output channel 'ao0' at index 2:

```
removeChannel(s,2);
```

The session now displays one input and one output channel:

s.Channels

ans =

```
Number of channels: 2
  index Type Device Channel MeasurementType Range Name
-----
  1 ai cDAQ1Mod4 ai1 Voltage (SingleEnd) -10 to +10 Volts
  2 ao cDAQ1Mod2 ao1 Voltage (Diff) -10 to +10 Volts
```

Input Arguments

s — Data acquisition session

session object

Data acquisition session, specified as a session object. Create the session object using `daq.createSession`. Use the data acquisition session for acquisition and generation operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

idx — Index of channel

numeric

Channel index, specified as a numeric value. Use the index of the channel that you want to remove from the session.

See Also

Functions

addAnalogInputChannel | addAnalogOutputChannel | addAudioInputChannel |
addAudioOutputChannel | addCounterInputChannel |
addCounterOutputChannel | addDigitalChannel

Introduced in R2010b

removeConnection

Remove clock or trigger connection

Syntax

```
removeConnection(s,idx)
```

Description

`removeConnection(s,idx)` removes the specified clock or trigger with the index `idx`, from the session. The connected device remains in the session, but is no longer synchronized with other connected devices in the session.

Examples

Remove a Clock and Trigger Connection

Create clock and trigger connection in the session `s`.

```
s = daq.createSeion('ni');
addAnalogInputChannel(s,'Dev1','ai0','Voltage')
addAnalogInputChannel(s,'Dev2','ai0','Voltage')
addAnalogInputChannel('Dev3','ai0','Voltage')
addTriggerConnection(s,'Dev1/PFI0',{ 'Dev2/PFI0','Dev3/PFI0'},'StartTrigger');
addClockConnection(s,'Dev1/PFI1',{ 'Dev2/PFI1','Dev3/PFI1'},'ScanClock');
```

View existing synchronization connection .

```
s.Connections
```

```
ans=
```

```
Start Trigger is provided by 'Dev1' at 'PFI0' and will be received by:
    'Dev2' at terminal 'PFI0'
    'Dev3' at terminal 'PFI0'
```


Scan Clock is provided by 'Dev1' at 'PFI1' and will be received by:
 'Dev2' at terminal 'PFI1'
 'Dev3' at terminal 'PFI1'

| index | Type | Source | Deination |
|-------|--------------|-----------|-----------|
| 1 | StartTrigger | Dev1/PFI0 | Dev2/PFI0 |
| 2 | StartTrigger | Dev1/PFI0 | Dev3/PFI0 |
| 3 | ScanClock | Dev1/PFI1 | Dev2/PFI1 |
| 4 | ScanClock | Dev1/PFI1 | Dev3/PFI1 |

Remove the trigger connection with the index 2 from Dev3/PFI0 to Dev1/PFI0:

```
removeConnection(s,2);
```

View updated connection

```
s.Connections
```

```
an=
```

Start Trigger is provided by 'Dev1' at 'PFI0' and will be received by
 'Dev2' at terminal 'PFI0'.
 Scan Clock is provided by 'Dev1' at 'PFI1' and will be received by:
 'Dev2' at terminal 'PFI1'
 'Dev3' at terminal 'PFI1'

| index | Type | Source | Deination |
|-------|--------------|-----------|-----------|
| 1 | StartTrigger | Dev1/PFI0 | Dev2/PFI0 |
| 2 | ScanClock | Dev1/PFI1 | Dev2/PFI1 |
| 3 | ScanClock | Dev1/PFI1 | Dev3/PFI1 |

Notice that the connections are re-indexed.

Input Arguments

s — Data acquisition session

session object

Data acquisition session, specified as a session object. Create the session object using `daq.createSession`. Use the data acquisition session for acquisition and generation

operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

idx — Index of connection

numeric value

Index of the connection you want to remove, specified as a numeric value.

See Also

Functions

`addClockConnection` | `addTriggerConnection` | `daq.createSession`

Topics

“Trigger Connections”

“Clock Connections”

“Synchronization”

Introduced in R2012a

resetCounters

Reset counter channel to initial count

Syntax

```
resetCounters(s)
```

Description

`resetCounters(s)` resets the current value of counter channels configured in the session object, `s`, to the value specified by the `InitialCount` property on each channel.

Tips

- Reset counters only if you are performing on-demand operations using `inputSingleScan` or `outputSingleScan`.
 - Create an acquisition session and add a channel before you use this function. See `daq.createSession` for more information.
-

Examples

Reset Counters

Create a session, then add a counter channel with an `EdgeCount` measurement type and acquire data.

```
s = daq.createSession ('ni');  
addCounterInputChannel(s, 'cDAQ1Mod5', 0, 'EdgeCount');  
inputSingleScan(s)
```

```
ans =
```

```
756
```

Reset the counter to the default value, 0, and acquire data again.

```
resetCounters(s)  
inputSingleScan(s)
```

```
ans =
```

```
    303
```

Input Arguments

s — Data acquisition session

session object

Data acquisition session, specified as a session object. Create the session object using `daq.createSession`. Use the data acquisition session for acquisition and generation operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

See Also

Functions

`addCounterInputChannel` | `daq.createSession` | `inputSingleScan`

Topics

“Acquire Counter Input Data”

“Generate Pulse Data on a Counter Channel”

Introduced in R2011a

startBackground

Start background operations

Syntax

```
startBackground(s);
```

Description

`startBackground(s)`; starts the operation of the session object, `s`, without blocking MATLAB command line and other code. To block MATLAB execution, use `startForeground`.

When you use `startBackground(s)` with analog input channels, the operation uses the `DataAvailable` event to deliver the acquired data. This event is fired periodically while an acquisition is in progress. For more information, see “Event and Listener Concepts” (MATLAB).

When you add analog output channels to the session, you must call `queueOutputData()` before calling `startBackground()`.

During a continuous generation, the `DataRequired` event is fired periodically to request additional data to be queued to the session. See `DataRequired` for more information.

By default, the `IsContinuous` property is set to `false` and the operation stops automatically. If you have set it to `true`, use `stop` to stop background operations explicitly.

Use `wait` to block MATLAB execution until a background operation is complete.

Tips

- Create an acquisition session and add a channel before you use this method. See `daq.createSession` for more information.
- If your session has analog input channels, you must use a `DataAvailable` event to receive the acquired data in a background acquisition.

- If your session has analog output channels and is continuous, you can use a `DataRequired` event to queue additional data during background generations.
 - Call `prepare` to reduce the latency associated with startup and to preallocate resources.
 - Use an `ErrorOccurred` event to display errors during an operation.
-

Examples

Acquire Data in the Background

Create a session and add a listener. Use the listener callback function to access the acquired data.

```
s = daq.createSession('ni');  
addAnalogInputChannel(s, 'cDAQ1Mod1', 'ai0', 'Voltage');  
lh = addlistener(s, 'DataAvailable', @plotData);
```

```
function plotData(src, event)  
    plot(event.TimeStamps, event.Data)  
end
```

Start the session and perform other MATLAB operations.

```
startBackground(s);
```

Perform other MATLAB operations.

Generate Data Continuously

For a continuous background generation, add a listener event to queue additional data to be output.

```
s = daq.createSession('ni');  
addAnalogOutputChannel(s, 'cDAQ1Mod2', 0, 'Voltage');  
s.IsContinuous = true;  
s.Rate=10000;  
data=linspace(-1,1,5000)';  
lh = addlistener(s, 'DataRequired', ...
```

```
@(src,event) src.queueOutputData(data);  
queueOutputData(s,data)  
startBackground(s);
```

Perform other MATLAB operations during the generation.

Input Arguments

s — Data acquisition session

session object

Data acquisition session, specified as a session object. Create the session object using `daq.createSession`. Use the data acquisition session for acquisition and generation operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

See Also

`DataAvailable` | `DataRequired` | `ErrorOccurred` | `addAnalogInputChannel` | `addAnalogOutputChannel` | `addAudioInputChannel` | `addDigitalChannel` | `addListener` | `daq.createSession` | `queueOutputData` | `startForeground`

Topics

“Acquire Data in the Background”

“Generate Signals in the Background”

“Generate Signals in the Background Continuously”

Introduced in R2010b

startForeground

Start foreground operations

Syntax

```
startForeground(s);  
data = startForeground(s);  
[data,timeStamps,triggerTime] = startForeground(s);
```

Description

`startForeground(s)`; starts operations of the session object, `s`, and blocks MATLAB command line and other code until the session operation is complete.

`data = startForeground(s)`; returns the data acquired in the output parameter, `data`.

`[data,timeStamps,triggerTime] = startForeground(s)`; returns the data acquired, timestamps relative to the time the operation is triggered, and a trigger time indicating the absolute time the operation was triggered.

Examples

Acquire Analog Data

Acquire data by creating a session with an analog input channel.

```
s = daq.createSession('ni');  
addAnalogInputChannel(s,'cDAQ1Mod1','ai0','Voltage');
```

Start the acquisition and save the acquired data into the variable `data`:

```
data = startForeground(s);
```


Generate Analog Data

Generate a signal by creating a session with an analog output channel.

```
s = daq.createSession('ni');  
addAnalogOutputChannel(s, 'cDAQ1Mod2', 'ao0', 'Voltage');
```

Create and queue an output signal and start the generation:

```
outputSignal = linspace(-1,1,1000)';  
queueOutputData(s,outputSignal);  
startForeground(s);
```

Acquire Analog Input Data and Timestamps

```
s = daq.createSession('ni');  
addAnalogInputChannel(s, 'cDAQ1Mod1', 'ai0', 'Voltage');
```

Start the acquisition and save the acquired data in the variable `data`, the acquisition timestamp in `timestamps`, and the trigger time in `triggerTime`:

```
[data,timestamps,triggerTime] = startForeground(s);
```

Input Arguments

s — Data acquisition session

session object

Data acquisition session, specified as a session object. Create the session object using `daq.createSession`. Use the data acquisition session for acquisition and generation operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

Output Arguments

data — Values of acquired data

array of doubles

Values of acquired data, returned as an m-by-n array of doubles, where m is the number of scans acquired, and n is the number of input channels in the session.

timeStamps — Recorded timestamp

numeric

Recorded timestamp relative to the time the operation is triggered, returned as an m-by-1 array, where m is the number of scans.

triggerTime — Timestamp of acquired data

numeric

Timestamp of acquired data which is a MATLAB serial date timestamp representing the absolute time when `timeStamps = 0`.

See Also

`addAnalogInputChannel` | `addAnalogOutputChannel` | `addDigitalChannel` | `daq.createSession` | `startBackground`

Topics

“Acquire Data in the Foreground”

“Generate Pulse Data on a Counter Channel”

“Hardware Discovery and Session Setup”

Introduced in R2010b

stop

Stop background operation

Syntax

```
stop(s);
```

Description

`stop(s)`; stops the session and all associated hardware operations in progress. Stopping the session flushes all undelivered data that is below the threshold defined by the property `NotifyWhenDataAvailableExceeds`, and will not fire any more `DataAvailable` events.

Examples

Stop Background Data Generation

Generate continuous background data until stopped.

Generate output data.

```
s = daq.createSession('ni');  
addAnalogOutputChannel(s,'cDAQ1Mod2',0,'Voltage');  
s.IsContinuous = true;  
s.Rate=10000;  
data=linspace(-1,1,5000)';  
queueOutputData(s,data)  
startBackground(s);
```

Perform other MATLAB operations during the generation, then stop the session.

```
stop(s);
```

Input Arguments

s — Data acquisition session

session object

Data acquisition session, specified as a session object. Create the session object using `daq.createSession`. Use the data acquisition session for acquisition and generation operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

See Also

Functions

`startBackground` | `startForeground` | `wait`

Introduced in R2010b

wait

Block MATLAB until background operation completes

Syntax

```
wait(s)
wait(s,timeout)
```

Description

`wait(s)` blocks MATLAB until the background operation completes. To abort the wait, press **Ctrl+C**.

Tips You cannot call `wait` if you have set the session `IsContinuous` property to `true`. To terminate the operation in this case, use the `stop` function.

`wait(s,timeout)` blocks MATLAB until the operation completes or the specified timeout occurs. If the session operation does not complete before this timeout occurs, MATLAB is unblocked, an error is thrown, and the data acquisition session operation continues running.

Examples

Wait for Session to Complete Data

Create a session and add an analog output channel.

```
s = daq.createSession('ni');
addAnalogOutputChannel(s, 'cDAQ1Mod2', 'ao0', 'Voltage');
```

Queue some output data.

```
queueOutputData(s, zeros(10000,1));
```

Start the session, then issue a `wait`. This blocks MATLAB until all data is output.

```
startBackground(s);  
% Perform other MATLAB operations.  
wait(s)
```

Queue more data and wait for up to 15 seconds.

```
queueOutputData(s, zeros(10000,1));  
startBackground(s);  
% Perform other MATLAB operations.  
wait(s,15)
```

Input Arguments

s — Data acquisition session

session object

Data acquisition session, specified as a session object. Create the session object using `daq.createSession`. Use the data acquisition session for acquisition and generation operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

timeout — Session timeout value

numeric

Session timeout value in seconds, specified as a numeric value. This value is the maximum time in seconds to wait.

See Also

Functions

`startBackground` | `stop`

Introduced in R2010b

DataAvailable

Notify when acquired data is available to process

Syntax

```
lh = addlistener(session,'DataAvailable',callbackfct);  
lh = addlistener(session,'DataAvailable',@(src,event) expr)
```

Description

`lh = addlistener(session,'DataAvailable',callbackfct);` creates a listener for the `DataAvailable` event. When data is available to process, the callback executes. The callback can be any MATLAB function with the `(src,event)` signature.

Tip The frequency with which the `DataAvailable` event is fired, is controlled by `NotifyWhenDataAvailableExceeds`

`lh = addlistener(session,'DataAvailable',@(src,event) expr)` creates a listener for the `DataAvailable` event and fires an anonymous callback function. The anonymous function requires the specified input arguments and executes the operation specified in the expression `expr`. Anonymous functions provide a quick means of creating simple functions without storing your function in a separate file. For more information see [Anonymous Functions \(MATLAB\)](#).

The callback has two required parameters: `src` and `event`. `src` is the session object for the listener and `event` is a `daq.DataAvailableInfo` object containing the data associated and timing information. Properties of `daq.DataAvailableInfo` are:

Data

An m -by- n matrix of doubles where m is the number of scans acquired, and n is the number of input channels in the session.

TimeStamps

The timestamps relative to `TriggerTime` in an m -by-1 array where m is the number of scans acquired.

TriggerTime

A MATLAB serial date time stamp representing the absolute time the acquisition trigger occurs.

Examples

Create DataAvailable Function

This example shows how to create an event that triggers a callback function to plot data.

Create a session, add an analog input channel, and change the duration of the acquisition.

```
s = daq.createSession('ni');  
addAnalogInputChannel(s, 'cDAQ1Mod1', 'ai0', 'Voltage');  
s.DurationInSeconds = 5;
```

Add a listener for the `DataAvailable` event to trigger the plotting callback.

```
lh = addlistener(s, 'DataAvailable', @plotData);
```

Create a function that plots the data when the event occurs.

```
function plotData(src, event)  
    plot(event.TimeStamps, event.Data)  
end
```

Start the acquisition and wait.

```
startBackground(s);  
wait(s)
```

Delete the listener.

```
delete(lh)
```


Create Anonymous DataAvailable Function

This example shows how to create an event using an anonymous function call to plot data when an event occurs.

Create a session, add an analog input channel, and change the duration of the acquisition.

```
s = daq.createSession('ni');  
addAnalogInputChannel(s, 'cDAQ1Mod1', 'ai0', 'Voltage');  
s.DurationInSeconds = 5;
```

Add a listen with an anonymous function call.

```
lh = s.addlistener('DataAvailable', ...  
    @(src,event) plot(event.TimeStamps, event.Data));
```

Acquire data.

```
s.startBackground();
```

Delete the listener.

```
delete(lh)
```

Input Arguments

session — Data acquisition session

session object

Data acquisition session, specified as a session object. Create the session object using `daq.createSession`. Use the data acquisition session for acquisition and generation operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

callbackfct — Callback function

function handle

Callback function, specified as a function handle.

expr — Anonymous callback function

MATLAB operation

Anonymous callback function, specified as a MATLAB operation. The expression executes when the trigger occurs.

See Also

Functions

`addlistener` | `daq.createSession` | `startBackground`

Properties

`IsNotifyWhenDataAvailableExceedsAuto` | `NotifyWhenDataAvailableExceeds`

Topics

“Acquire Data in the Background”

Introduced in R2010b

DataRequired Event

Notify when additional data is required for output on continuous generation

Syntax

```
lh = addlistener(session, 'DataRequired', callbackfct);  
lh = addlistener(session, 'DataRequired', @(src,event) expr);
```

Description

`lh = addlistener(session, 'DataRequired', callbackfct);` creates a listener for the `DataRequired` event. When more data is required, the callback is executed. The callback is typically used to queue more data to the device. The callback can be any MATLAB function with the `(src,event)` signature.

Tips Frequency is controlled by `NotifyWhenScansQueuedBelow`.

`lh = addlistener(session, 'DataRequired', @(src,event) expr);` creates a listener for the `DataRequired` event and fires an anonymous function. The anonymous function requires the specified input arguments and executes the operation specified in the expression `expr`. Anonymous functions provide a quick means of creating simple functions without storing your function in a separate file. For more information see [Anonymous Functions \(MATLAB\)](#).

The callback has two required parameters: `src` and `event`. `src` is the session object for the listener and `event` is a `daq.DataRequiredInfo` object.

Examples

Add an Anonymous Listener to a Signal Generation Session

Create a session and add two analog output channels.

```
s = daq.createSession('ni');  
s.IsContinuous = true;  
addAnalogOutputChannel(s, 'cDAQ1Mod2', 0:1, 'Voltage');
```

Create output data for the two channels.

```
outputData0 = (linspace(-1,1,1000))';  
outputData1 = (linspace(-2,2,1000))';
```

Queue the output data, add an anonymous listener, and generate the signal in the background.

```
queueOutputData(s, [outputData0, outputData1]);  
lh = addlistener(s, 'DataRequired', ...  
    @(src,event) src.queueOutputData([outputData0, outputData1]));
```

Generate the output data and pause for up to 15 seconds.

```
startBackground(s);  
pause(15)
```

Delete the listener.

```
delete(lh)
```

Input Arguments

session — Data acquisition session

session object

Data acquisition session, specified as a session object. Create the session object using `daq.createSession`. Use the data acquisition session for acquisition and generation operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

callbackfct — Callback function

function handle

Callback function, specified as a function handle.

expr — Anonymous callback function

MATLAB operation

Anonymous callback function, specified as a MATLAB operation. The expression executes when the trigger occurs.

See Also

Functions

`addlistener` | `daq.createSession` | `startBackground`

Properties

`IsContinuous` | `IsNotifyWhenScansQueuedBelowAuto` | `NotifyWhenScansQueuedBelow`

Introduced in R2010b

ErrorOccurred Event

Notify when device-related errors occur

Syntax

```
lh = addlistener(session, 'ErrorOccurred', callbackfct);  
lh = addlistener(session, 'ErrorOccurred', @(src, event) expr);
```

Description

`lh = addlistener(session, 'ErrorOccurred', callbackfct);` creates a listener for the `ErrorOccurred` event. When an error occurs, the callback is executed. The callback can be any MATLAB function with the `(src, event)` signature.

Note In background mode, errors and exceptions are not displayed by default. Use the `ErrorOccurred` event listener to display the errors.

`lh = addlistener(session, 'ErrorOccurred', @(src, event) expr);` creates a listener for the `ErrorOccurred` event and fires an anonymous function. The anonymous function requires the specified input arguments and executes the operation specified in the expression `expr`. Anonymous functions provide a quick means of creating simple functions without requiring that your function be saved in a separate file. For more information, see [Anonymous Functions \(MATLAB\)](#).

The callback has two required parameters: `src` and `event`. `src` is the session object for the listener, and `event` is a `daq.ErrorOccurredInfo` object. The `daq.ErrorOccurredInfo` object contains the `Error` property, which is the `MException` associated with the error. You can use the `MException.getReport` method to return a formatted message that uses the same format as errors thrown by internal MATLAB code.

Examples

Add a Listener to Display an Error Report

Create a session, and add an analog input channel.

```
s = daq.createSession('ni');  
addAnalogInputChannel(s, 'cDAQ1Mod1', 'ai0', 'Voltage');
```

Get a formatted report of the error.

```
lh = addlistener(s, 'ErrorOccurred', @(src,event) disp(getReport(event.Error)));
```

Acquire data, wait, and delete the listener.

```
startBackground(s);  
wait(s)  
delete(lh)
```

Input Arguments

session — Data acquisition session

session object

Data acquisition session, specified as a session object. Create the session object using `daq.createSession`. Use the data acquisition session for acquisition and generation operations. Create one session per vendor and use that vendor session to perform all data acquisition operations.

callbackfct — Callback function

function handle

Callback function, specified as a function handle.

expr — Anonymous callback function

MATLAB operation

Anonymous callback function, specified as a MATLAB operation. The expression executes when the trigger occurs.

See Also

Functions

`addListener` | `daq.createSession` | `startBackground`

Classes

`MException`

Introduced in R2010b