Exercise 8-5: Extracting a Subset of an N-Channel Data Array (Optional)

Goal

- Extract a single channel of data using the Index Array function. Extract multiple channels of data using the Array Subset function.

Scenario

In this exercise, the acquisition data is a 1D waveform array containing the following data.

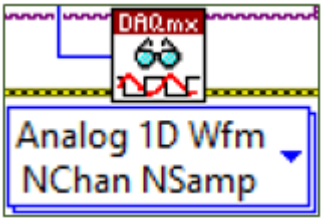
1D Waveform Array Index	Signal Description
0	Temperature Reference / Simulated Input 1
1	Sine Wave Function / Simulated Input 2
2	TTL Square Wave Function / Simulated Input 3

Hardware Setup

(BNC-2120) Make sure that you have Sine/Triangle BNC Connector connected to the Analog Input 2 and the TTL Square Wave BNC Connector connected to the Analog input 3, also make sure that the Sine/Triangle Waveform Switch is set to Sine.

Explore acquisition data in an existing VI

1. Open `C:\Exercises\LabVIEW Core 1\Extract Data from N-Channel Array\Extract Data from N-Channel Array.lvproj`.
2. From the **Project Explorer** window, open the Extract Data from *N*-Channel Array (1D Waveform) VI.
3. Explore the front panel and the block diagram. The block diagram code performs a continuous acquisition. By clicking **polymorphic VI selector** of the DAQmx Read VI and exploring the selected instance you can determine that this VI reads *N*-samples from *N*-channels and returns the data as a 1D waveform array.



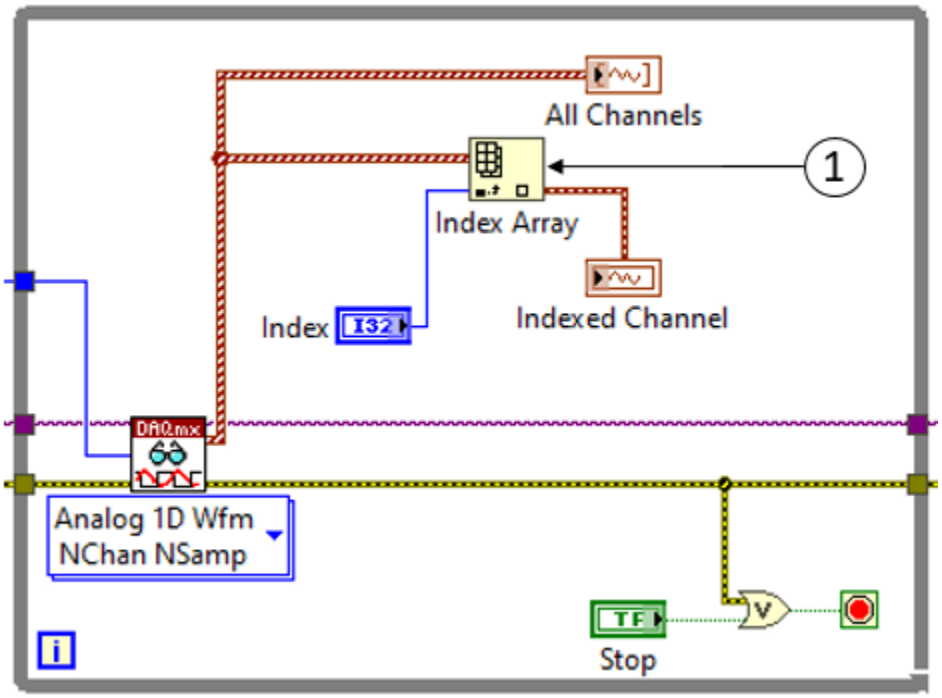
4. Examine the behavior of the VI.
    - On the front panel, set the **Physical Channels** control to **PCI-6221/ai0, PCI-6221/ai2:3**. This creates a DAQmx task that includes PCI-6221 analog input channels 0, 2, and 3.
    - Set **Desired Sample Rate (Hz)** to `2560`.
    - Set **Number of Samples** to `256`.

Note: Set the **Physical Channel, Rate**, and **Number of Samples** controls to values that are appropriate for your DAQ device.

5. Run the VI.
    - Notice that the **All Channels** indicator displays data for the three channels specified by the **Physical Channels** control:
        - AI0 channel
        - AI2 channel
        - AI3 channel
6. In this exercise, we are going to separate these three channels into different data sets.

Extract Data for a Single Channel

1. Modify the block diagram, as shown in the following figure, to extract data for a single channel.



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1. **Index Array function** – When you pass this function a 1D waveform array and an index value, this function will return a single waveform element at the specified index in the 1D waveform array.

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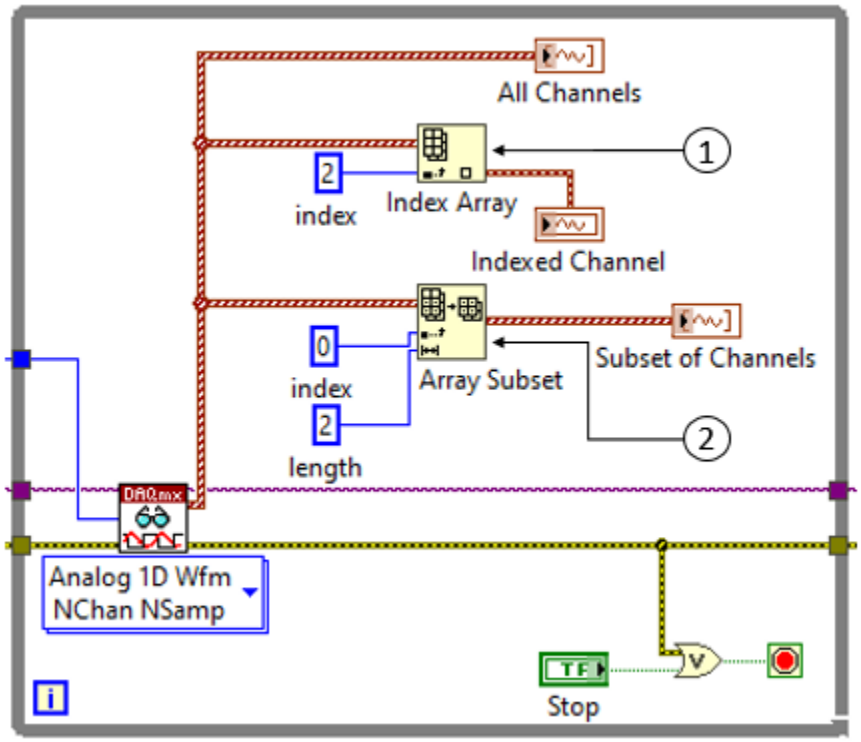
2. Use the context help and *LabVIEW Help* to learn about the Index Array function.
3. Test the VI.
   - On the front panel, set the following values.

Physical Channel	`PCI-6221/ai0, PCI-6221/ai2:3`
Rate	`2560`
Number of Samples	`256`

   - Run the VI.
   - Change the value of the index control to `0`, `1`, and `2`. Notice that this control determines which channel is extracted and displayed in the **Indexed Channel** indicator.
   - Stop the VI when finished.
4. Save the VI.

Extract a Subset of Channels

1. Modify the block diagram, as shown in the following figure, to extract a subset of channels.



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1. **Index Array** function – Use this function to extract the third channel (index 2). Right-click the **Index** control, select **Change to Constant**. Set the constant value to `2`.
2. **Array Subset** function – Use this function to extract the first and second channels (indices 0 and 1).
    a. Right-click the **index** input and select **Create Constant**. Set the constant value to `0`.
    b. Right-click the **length** input and select **Create Constant**. Set the constant value to `2`.
    c. Right-click the **subarray** output and select **Create Indicator**. Rename the indicator as `Subset of Channels`.

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2. Use the context help and detailed **LabVIEW Help** to learn about the Array Subset function.

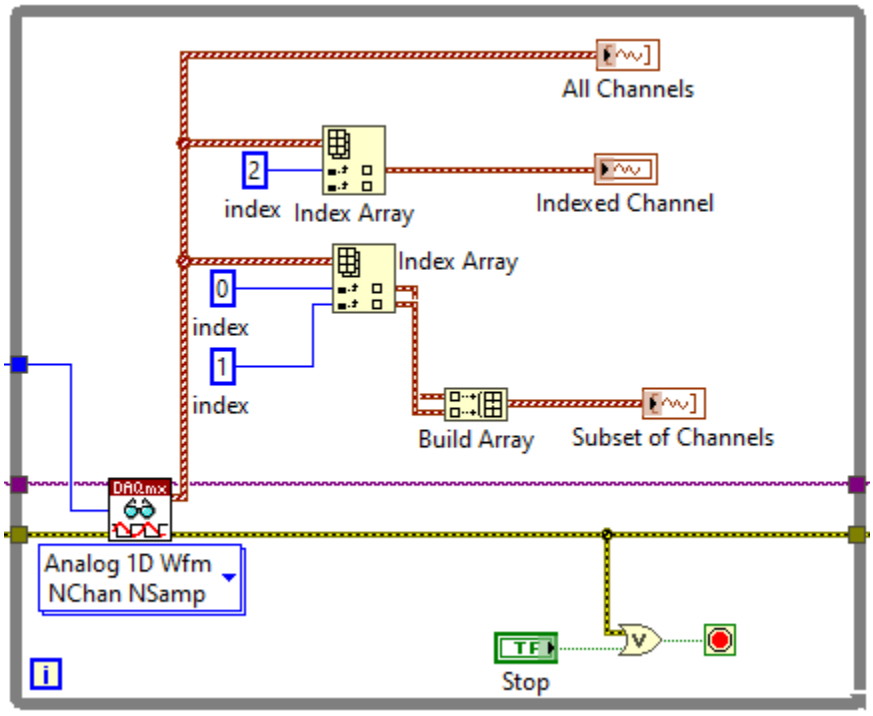
3. Test the VI.
   - On the front panel, set the following values.

Physical Channel	PCI-6221/ai0, PCI-6221/ai2:3
Rate	2560
Number of Samples	256

   - Run the VI.
   - Notice that the **Indexed Channel** indicator displays the AI3 channel.
   - Notice that the **Subset of Channels** indicator displays the AI0 and AI2 channels.
   - Stop the VI when finished.
4. Save the VI.

Extract a Subset of Channels—Alternate Approach Using Index Array and Build Array

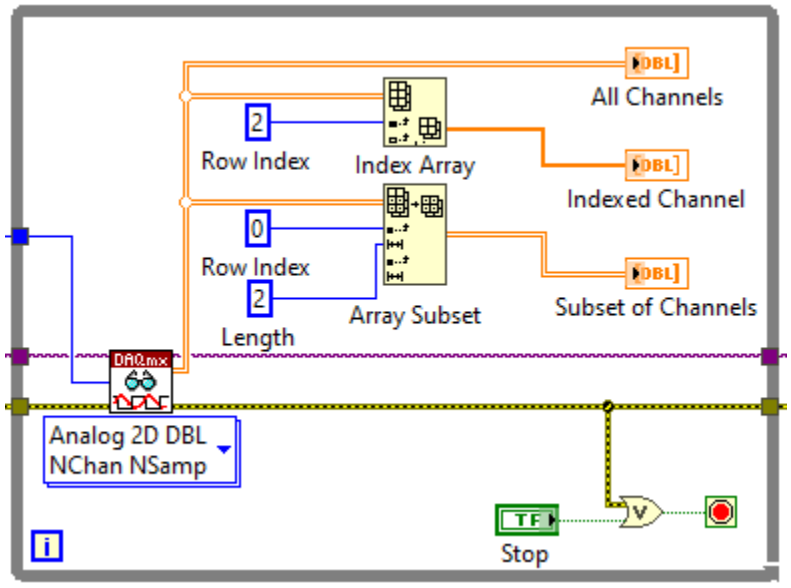
1. From the **Project Explorer** window, open the [Alternate Method] Extract Data from *N*-Channel Array (1D Waveform) VI.
    - Notice how this VI uses the Index Array function to extract multiple channels and then group them together into a new array using the Build Array function.



2. Add a new Index Array function and a Build Array function.
    - Notice how you can resize the Index Array function to extract multiple array elements. Notice how you can resize the Build Array function to take multiple inputs. Use the context help and detailed *LabVIEW Help* to learn about these two functions.

Explore How to Extract Channels From 2D DBL Array Data Type

1. From the **Project Explorer** window, open the Extract Data from *N*-Channel Array (2D DBL) VI.

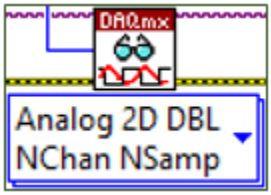


2. Examine the behavior of the VI.
   - On the front panel, set the following values.

Physical Channel	`PCI-6221/ai0, PCI-6221/ai2:3`
Rate	`2560`
Number of Samples	`256`

   - Run the VI.
   - Stop the VI when finished.

3. On the block diagram, click **polymorphic VI selector** of the DAQmx Read VI and explore the selected instance.
   - Notice that the DAQmx Read VI is using the **floating point** data type. Notice that the output data type is 2D DBL array.



4. Notice that the Index Array function is used to extract one channel of data (1D array = 2,560 samples from channel 0).
5. Notice that wiring a 2D array to the Index Array function causes the Index Array function to show both a row index input and column index input.
   - If you want to extract a row (1D array) from a 2D array, only wire the index of the row to the index (row) input and leave the disabled index (col) input unwired.
   - If you want to extract a column (1D array) from a 2D array, only wire the index of the column to the disabled index (col) input and leave the index (row) input unwired.
   - If you want to extract an individual element (single numeric) from a 2D array, then wire the row index to the index (row) input and wire the column index to the disabled index (col) input. In this VI, the 2D array wired to the Index Array function contains 3 rows and 2,560 columns, where each row represents 2,560 samples acquired from one channel. Therefore, to extract one channel of data (represented by 1D array), this VI wires the row index and leaves the column index unwired to extract one row of data from the 2D array.
6. Notice that the Array Subset function is used to extract two channels of data.
   - A row index of 0 and a length of 2 causes this function to extract 2 rows of data starting from row index 0.

Your Turn

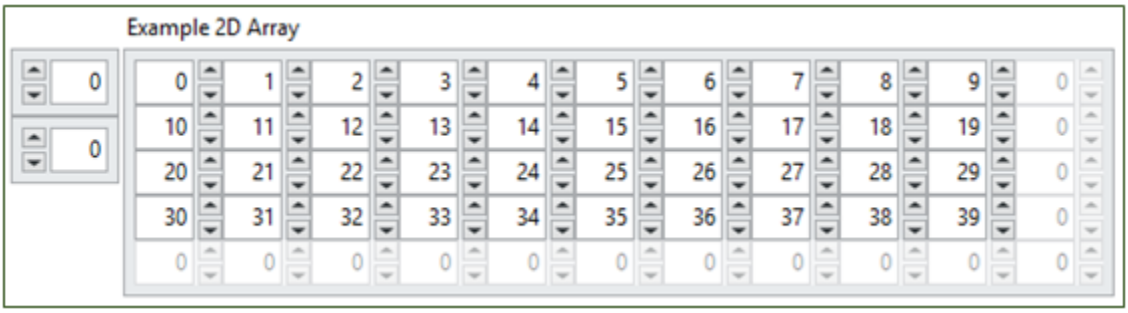
Option 1

1. Create a VI that acquires *N*-channel *N*-sample data and try extracting individual or groups of channels from that acquisition data array.
2. **(Simulated Hardware)** Try acquiring 4 channels (10 samples per channel) of data. Extract an individual channel or groups of channels.

Option 2: Experiment with Index Array and Array Subset functions

1. From the **Project Explorer** window, open [Unguided] Example 2D Array VI.
2. Familiarize yourself with the functionality of the Index Array and Array Subset functions by wiring the 2D array to these functions, experimenting with how the input terminal values of these functions affect their output values, and exploring the *LabVIEW Help.*

You can resize the Index Array function to extract more than one element/row/column.



End of Exercise 8-5