LabVIEW Basics

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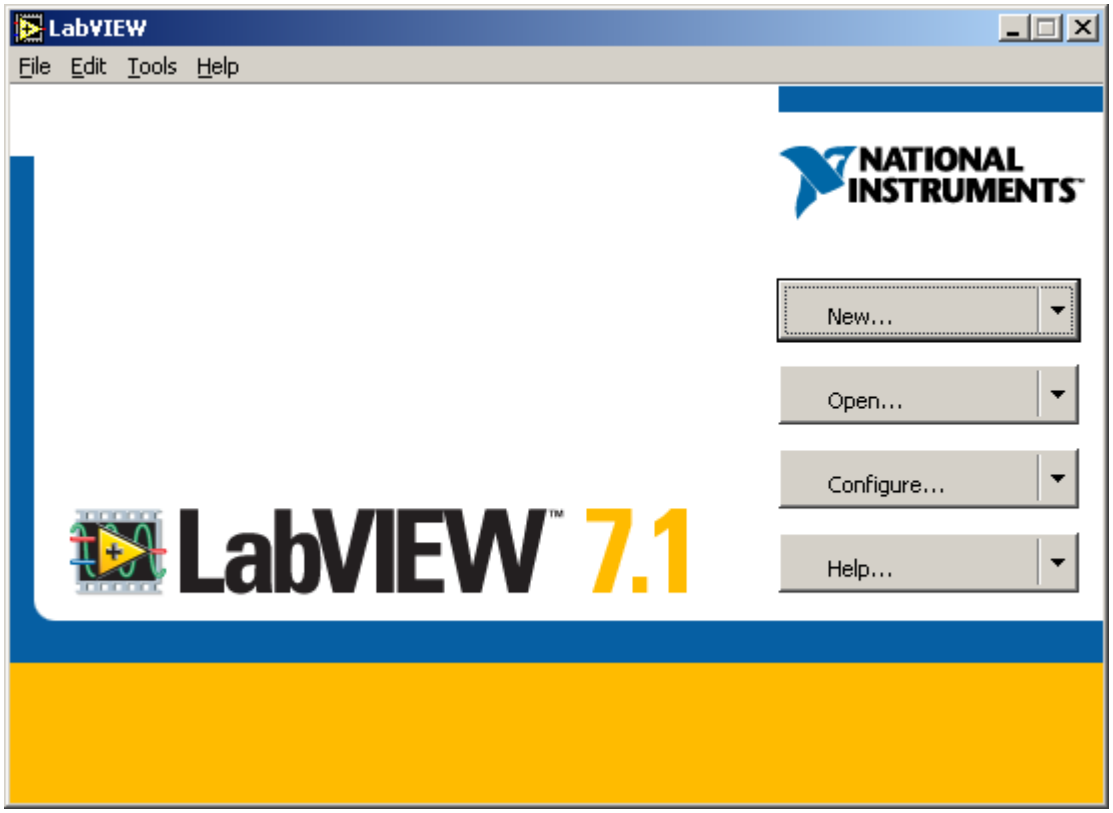
LabVIEW

LabVIEW is a data acquisition software package commonly used with hardware acquisition boards

LabVIEW has many features for data acquisition and processing of either measured data or simulated signals.

LabVIEW – Start Up

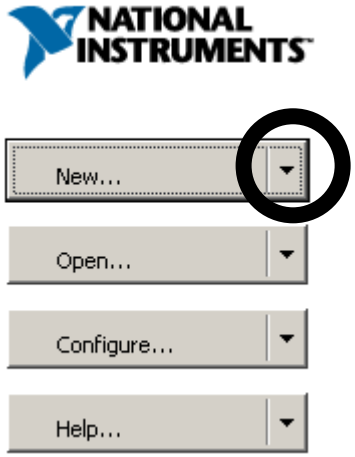
LabVIEW will be explored using some simple signals



LabVIEW – Start Up

LabVIEW will be explored using some simple signals

NEW – template selector



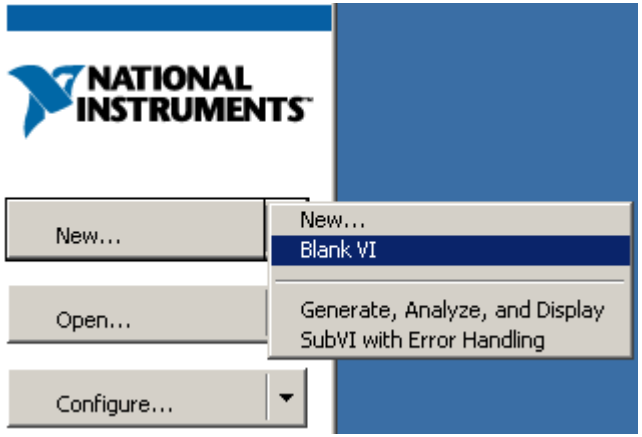
or click on arrow for either

NEW,

blank vi,

or

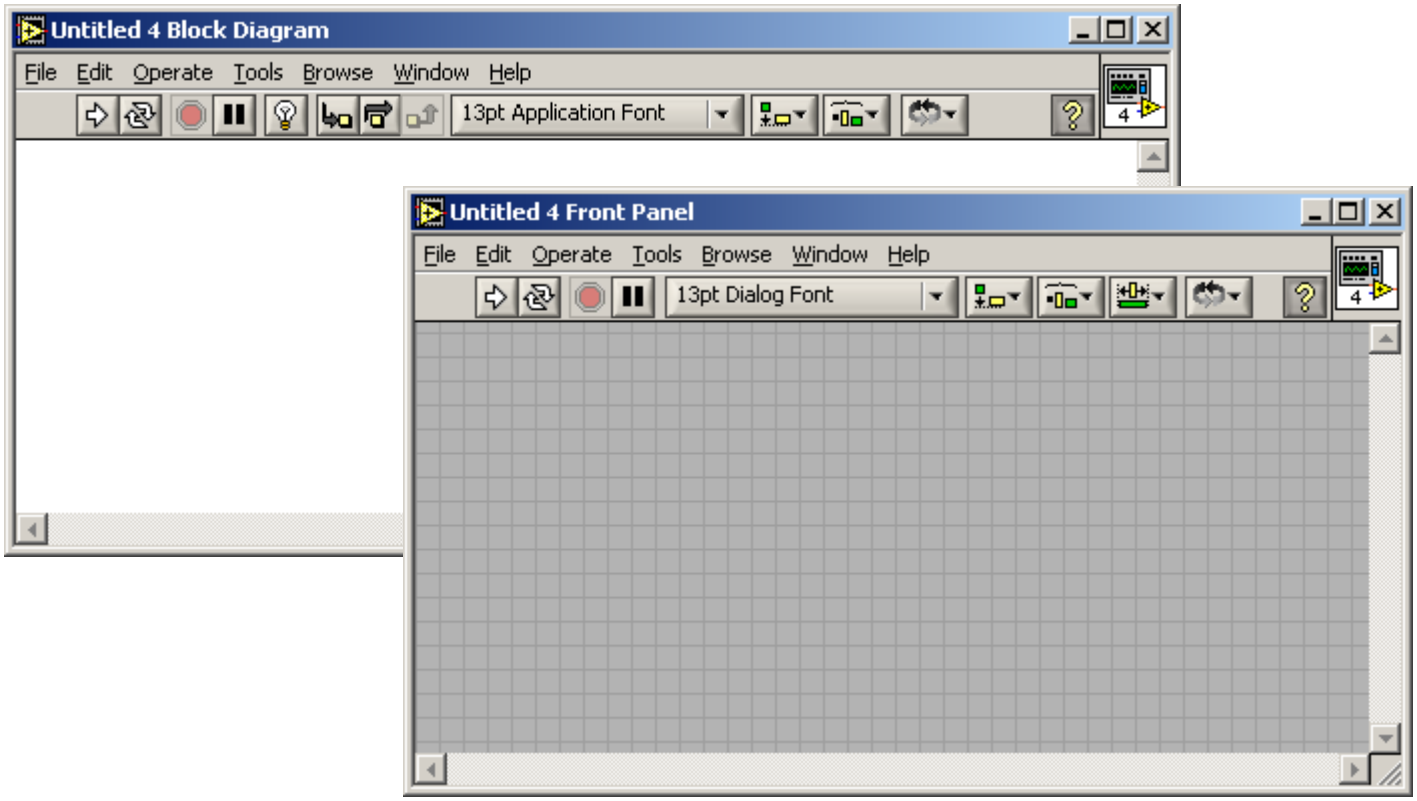
recently accessed



LabVIEW – Blank vi

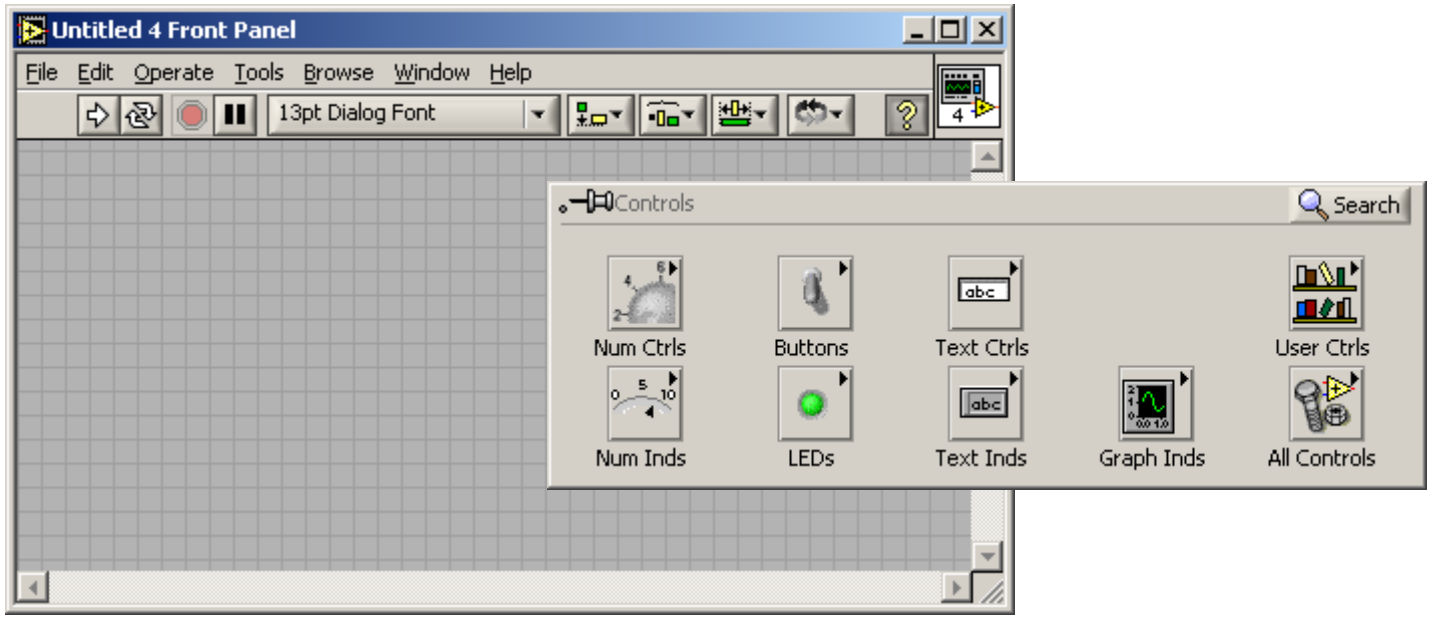
Two windows appear –

'Block Diagram' & 'Front Panel'



LabVIEW – Front Panel

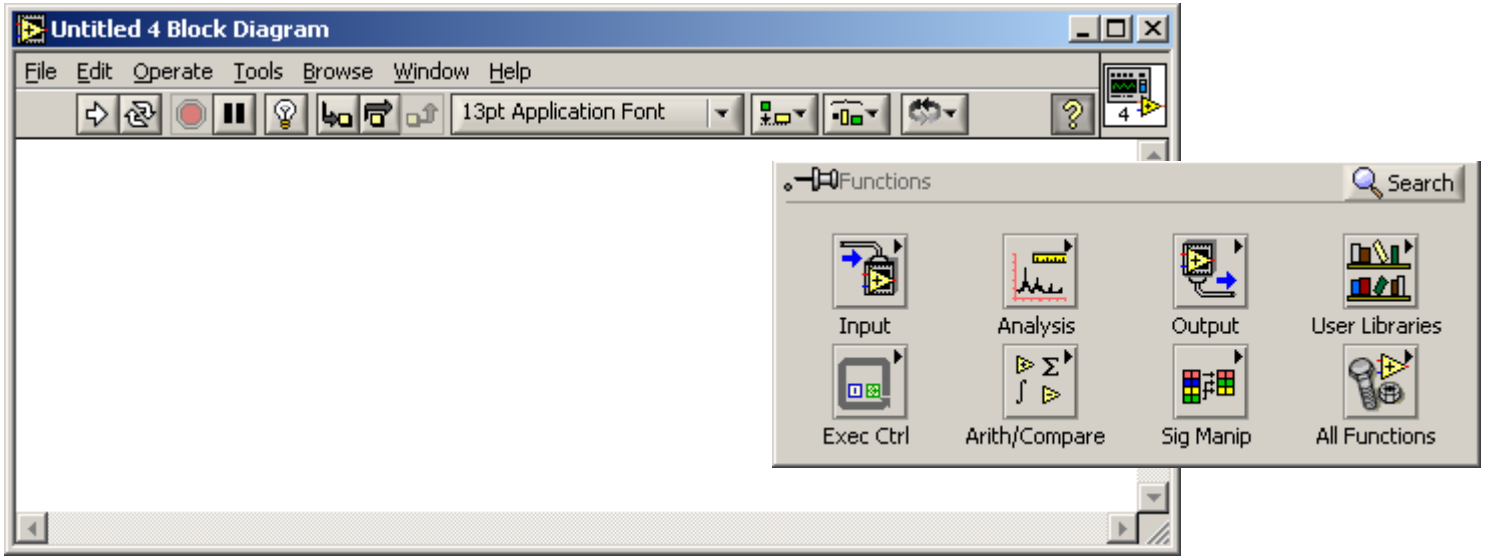
Right mouse click to open important 'Controls' palette



These include graphical controls, knobs, sliders, text boxes,LEDs, switches, and other specialty items
NOTE: Sub-categories may be available for each layer

LabVIEW– Block Diagram

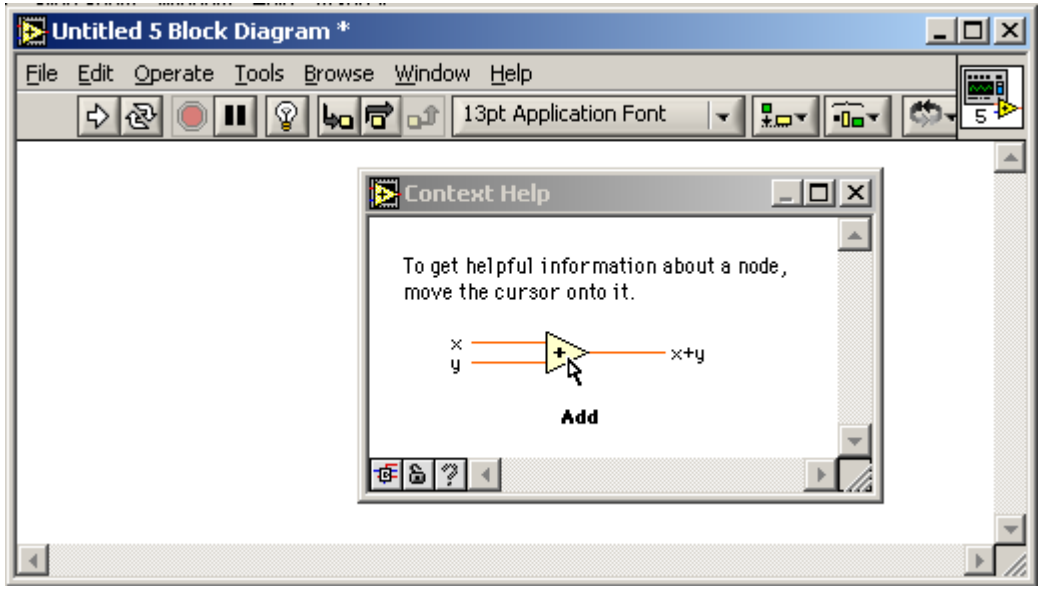
Right mouse click to open important 'Functions' palette



These include acquisition tools, signal analysis, output devices, programming tools, arithmetic operators, and other processing tools
NOTE: Sub-categories may be available for each layer

LabVIEW – HELP - Exists in several forms

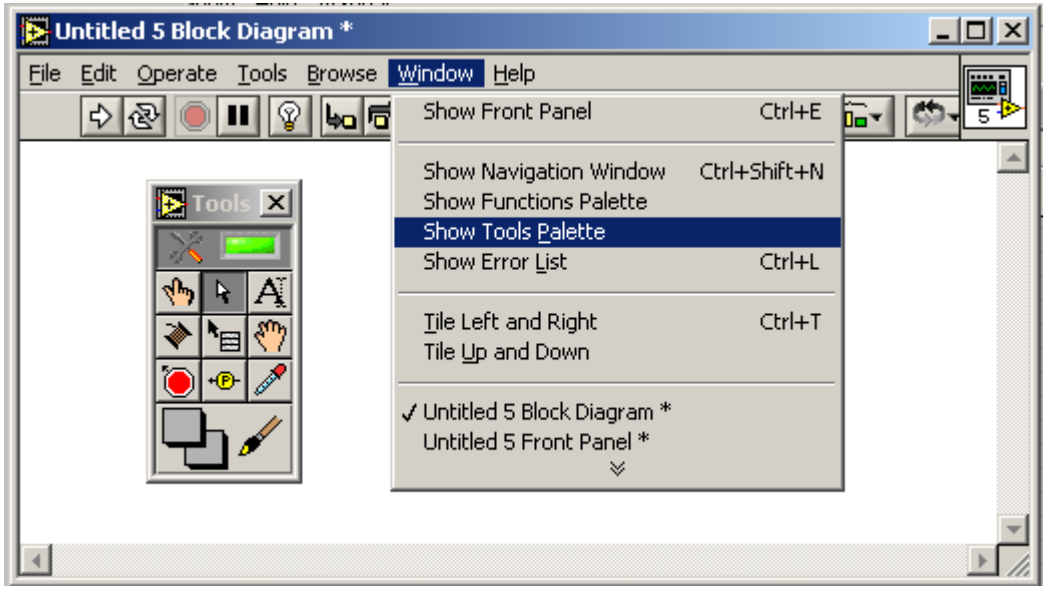
HELP -> Show Context HELP



Window reports general use characteristics for each icon the mouse passes over

LabVIEW – HELP - Exists in several forms

WINDOWS -> Show Tools Palette



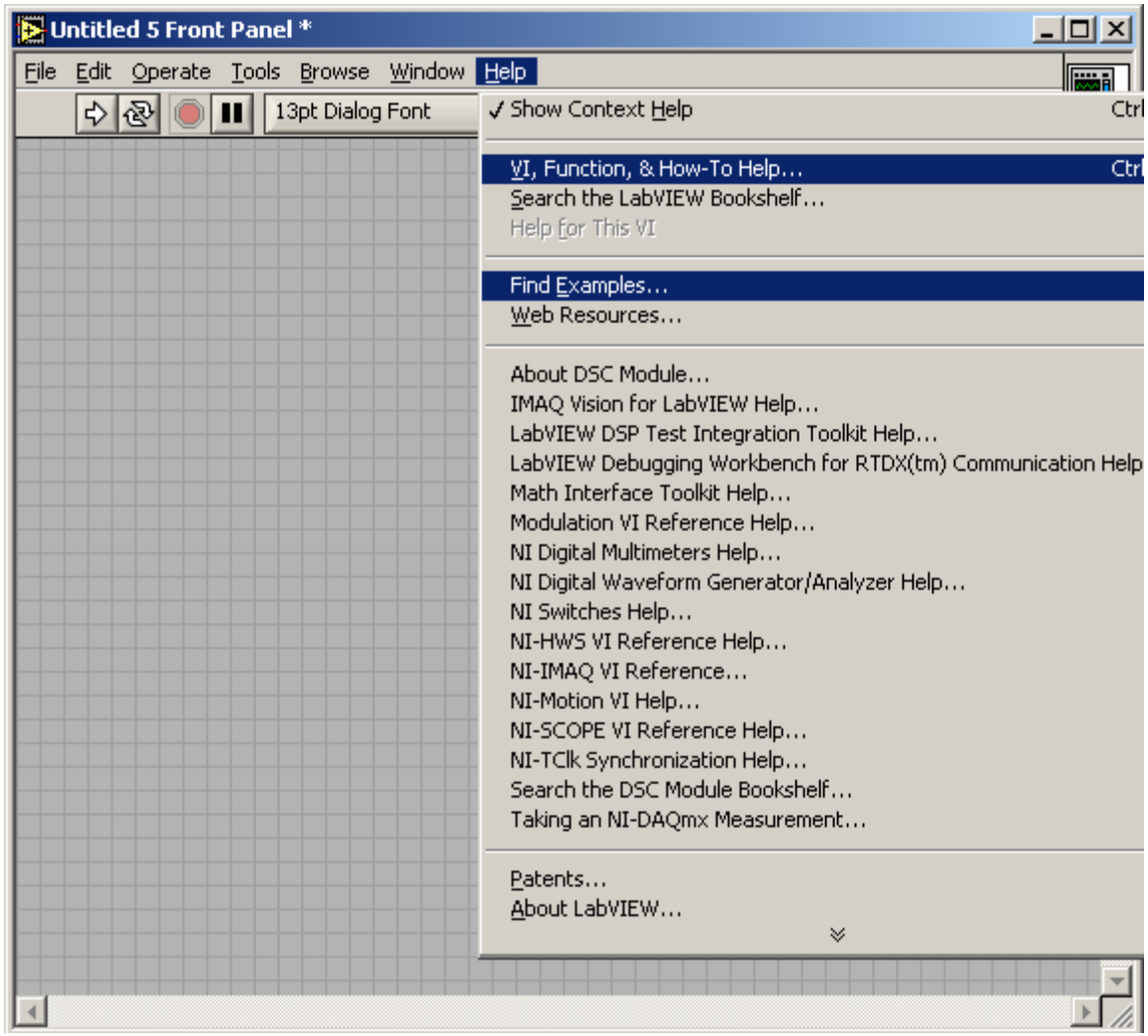
Extremely useful panel for assigning a specific tool function to the mouse.

LabVIEW – HELP - Exists in several forms

HELP ->

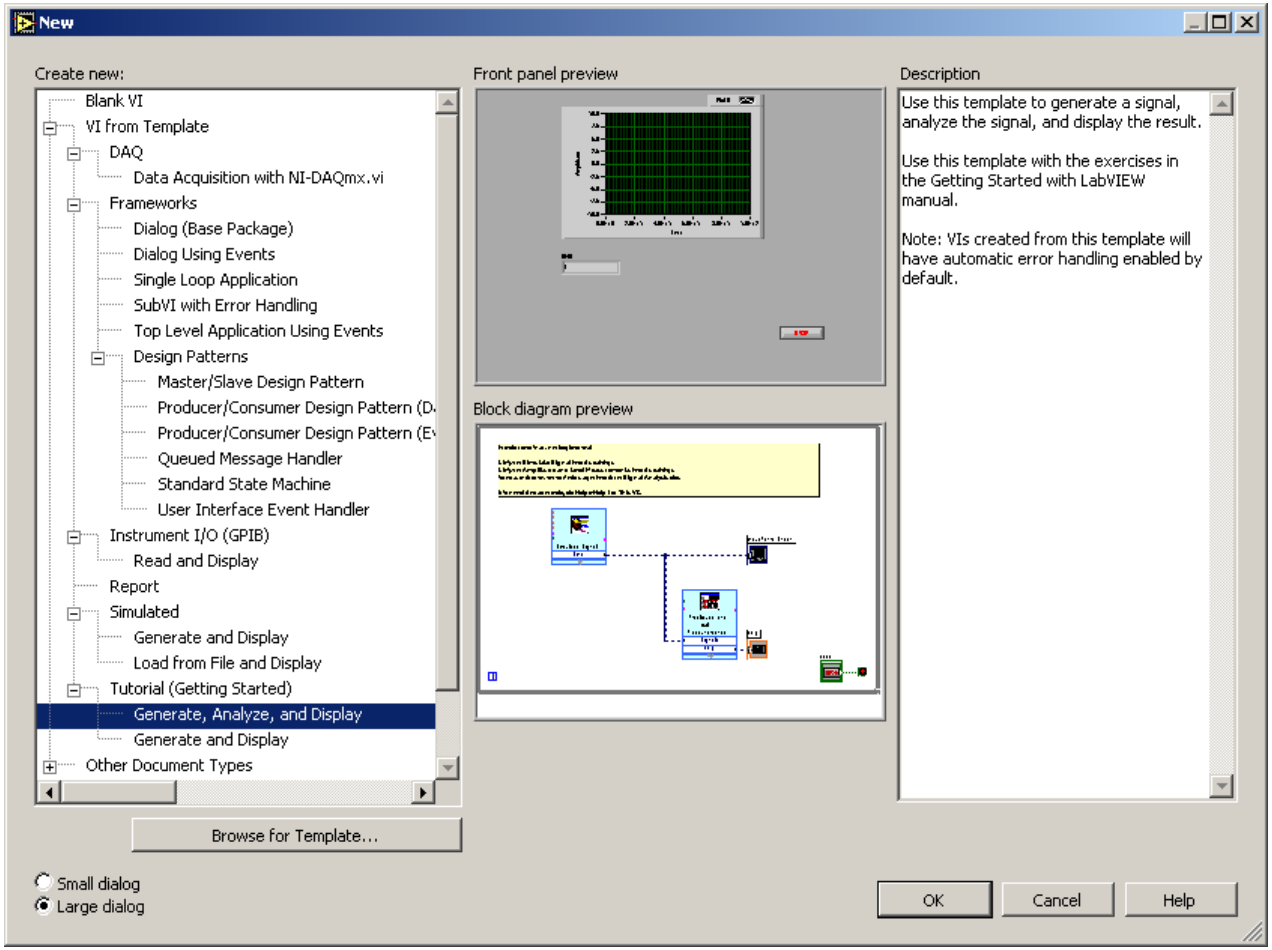
VI, function & how to

Find examples



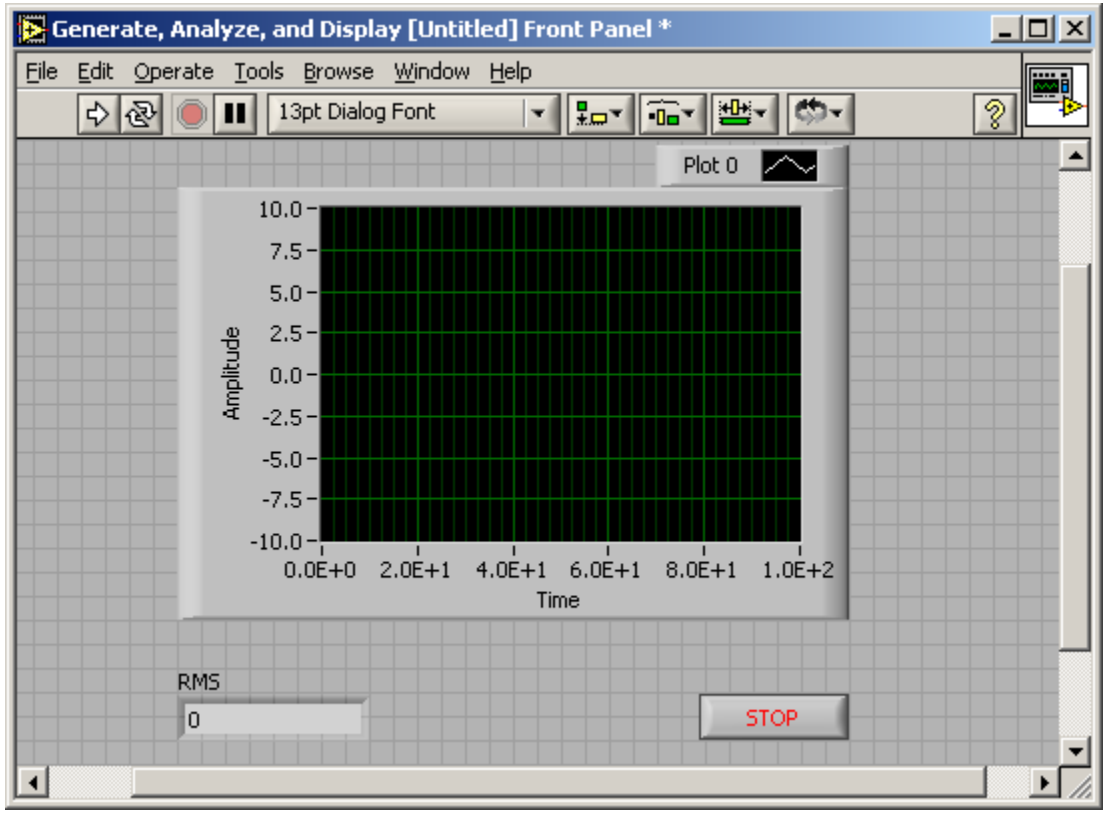
LabVIEW – Tutorial (Getting Started)

Tutorial Name: 'Generate, Analyze, and Display'



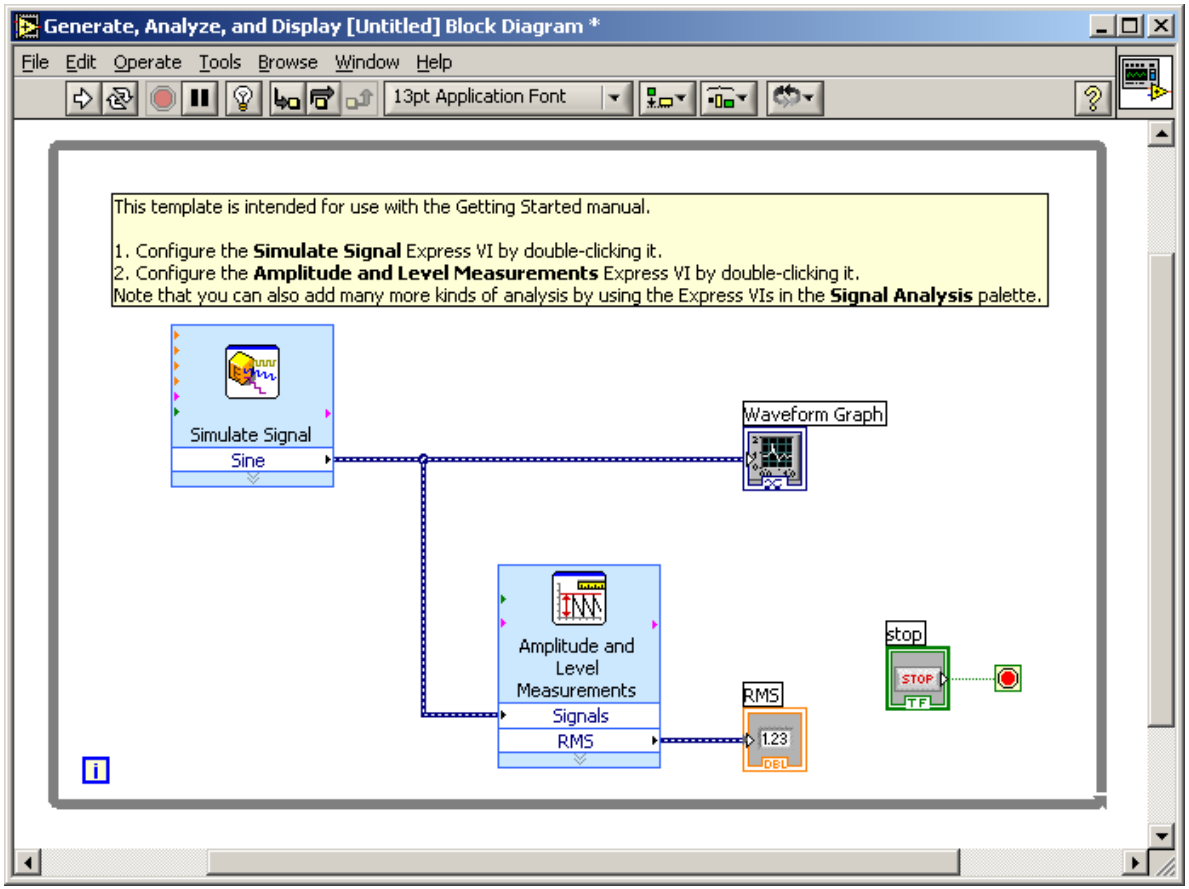
LabVIEW – Starting Front Panel

Front Panel has a display for output



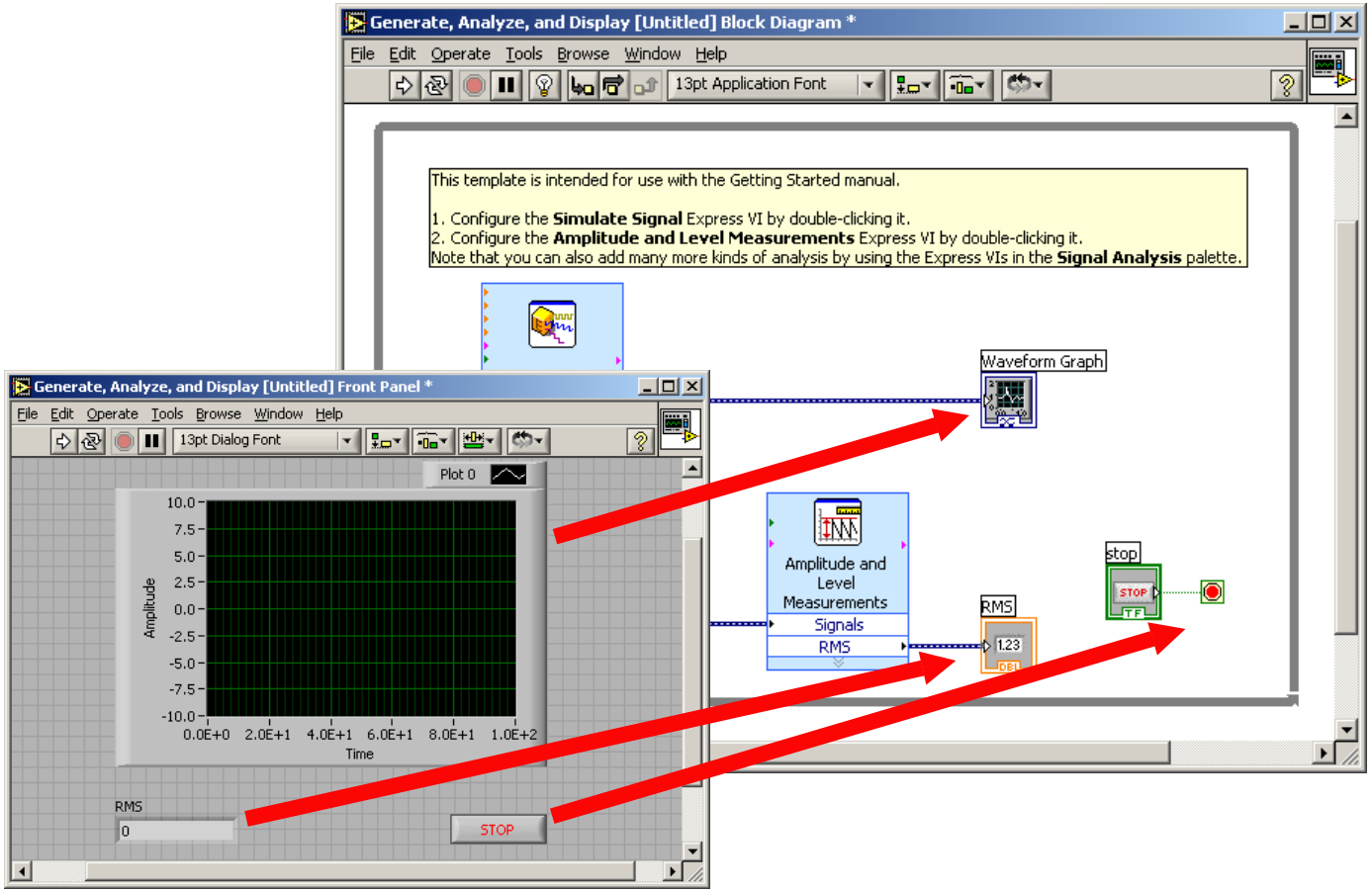
LabVIEW – Starting Block Diagram

Block Diagram illustrates how system is assembled.



LabVIEW – Tutorial (Getting Started)

Relationship between Block Diagram and Front Panel

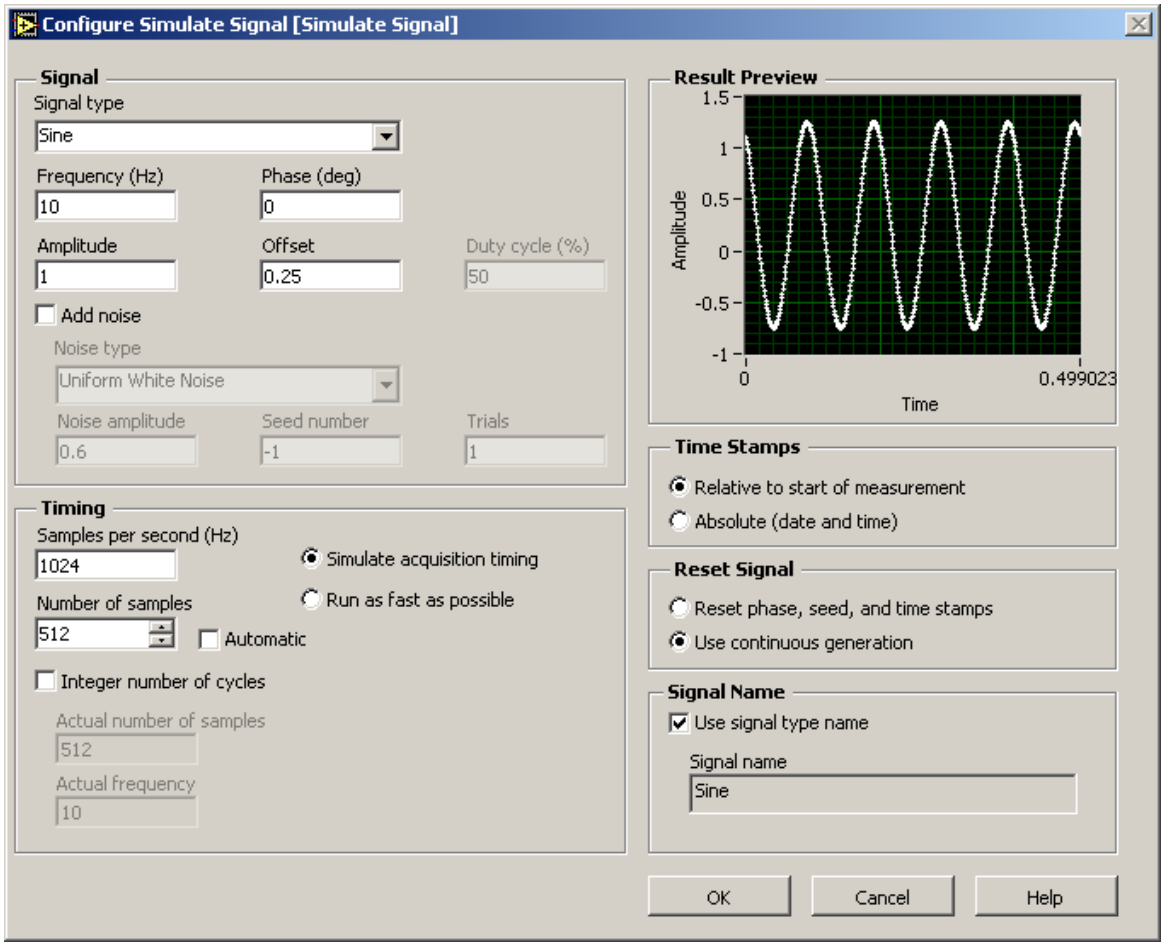


LabVIEW – Simulate Signal

A sine signal is generated using

Simulate Signal

Double click for properties

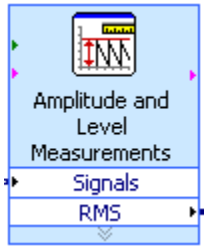


Sine at 10 Hz with 1 volt peak and offset at 0.25
Sampling 1024 samples per second and 512 samples

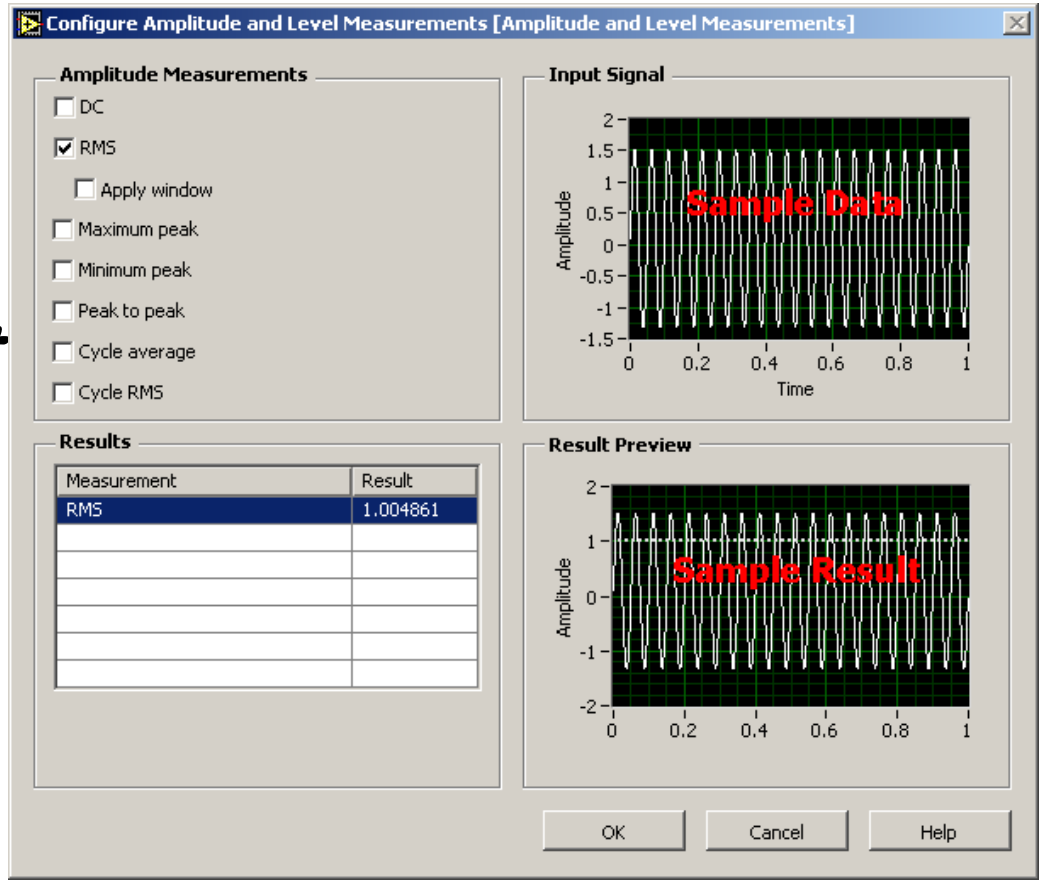
LabVIEW – Amplitude and Level Measurements

Signals can be interrogated

Amplitude Level Measurement



Double click for properties



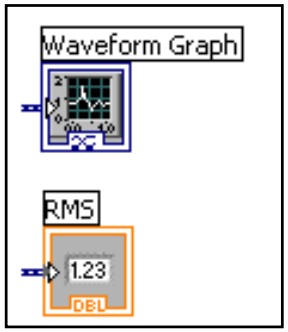
Measurements of DC, RMS, peak, etc can be obtained

LabVIEW – Amplitude and Level Measurements

Operators

These have selectable elements based on desired parameters of interest

Indicators



Are used to export output to the front panel

Many tools available

LabVIEW – Amplitude and Level Measurements

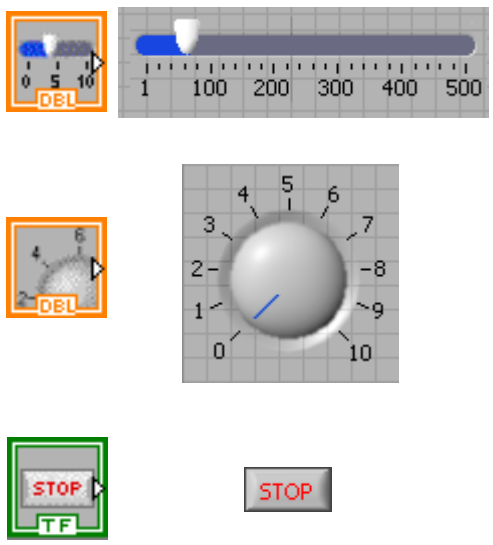
As items are added to each of the Functions, Indicators and Controls, these selected items will appear in the Front Panel and/or Block Diagram.

These need to be wired into the diagram and initial parameters identified.

LabVIEW – Amplitude and Level Measurements

Controls

These have selectable elements used for changing parameters of interest



Operators

These have selectable elements based on desired parameters of interest

You can change the data range of the control by right-clicking on control and selecting 'Properties'. Adjust 'Data Range' and 'Scale' tabs.

Many tools available

LabVIEW – Amplitude and Level Measurements

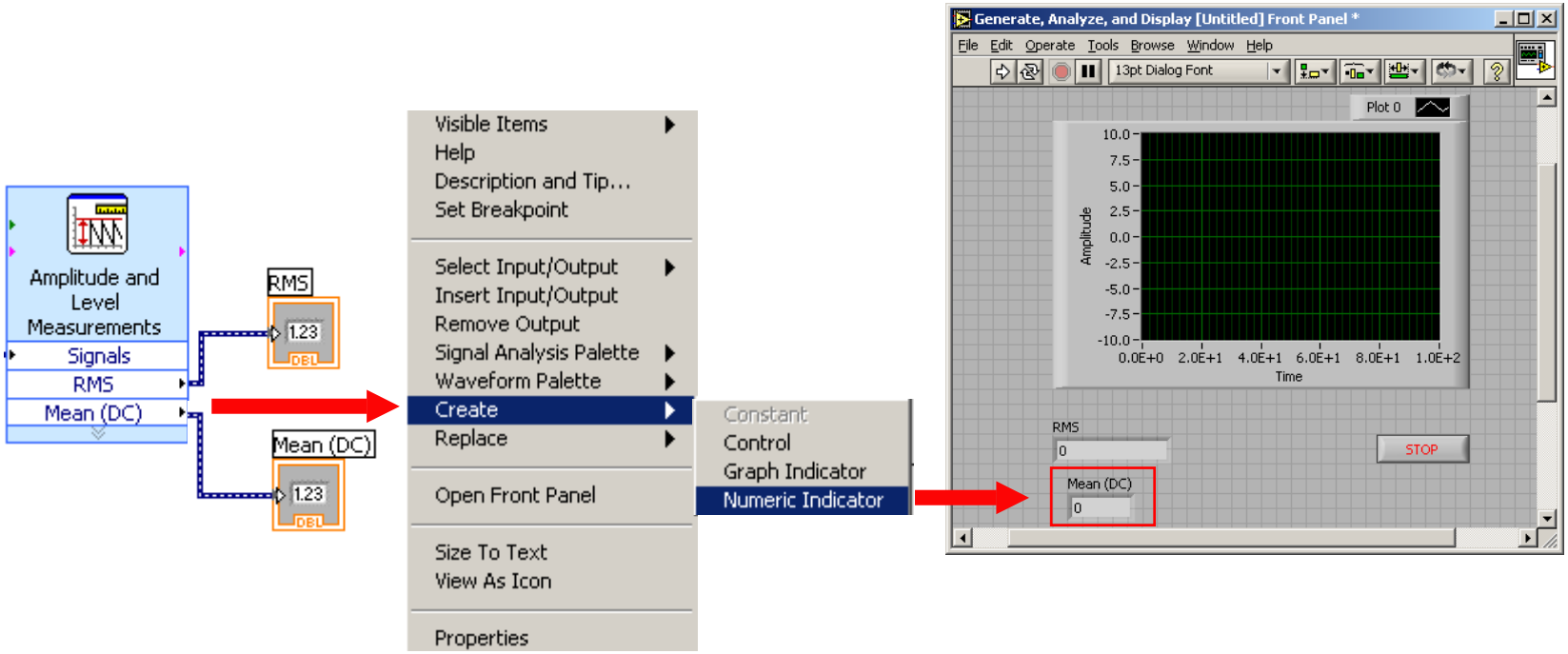
Add several features such as

- Input Box for DC offset of sine wave
- Dial for Frequency Controls
- Slider for Amplitude

LabVIEW – Amplitude and Level Measurements

Select another output parameter such as DC

Notice RMS is already hooked up but DC needs to be attached to some output device

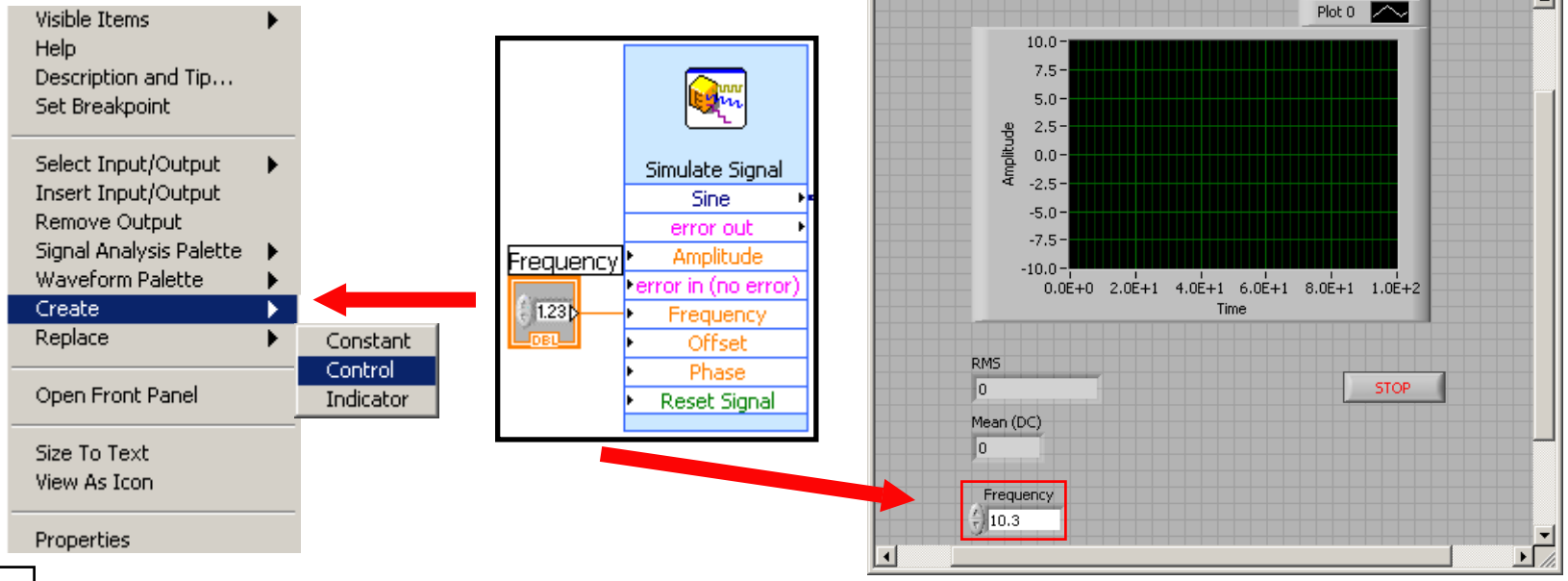


LabVIEW – Amplitude and Level Measurements

Create a dial to change frequency.

Expand the simulate signal VI by clicking and dragging the gray arrow on the bottom of the icon.

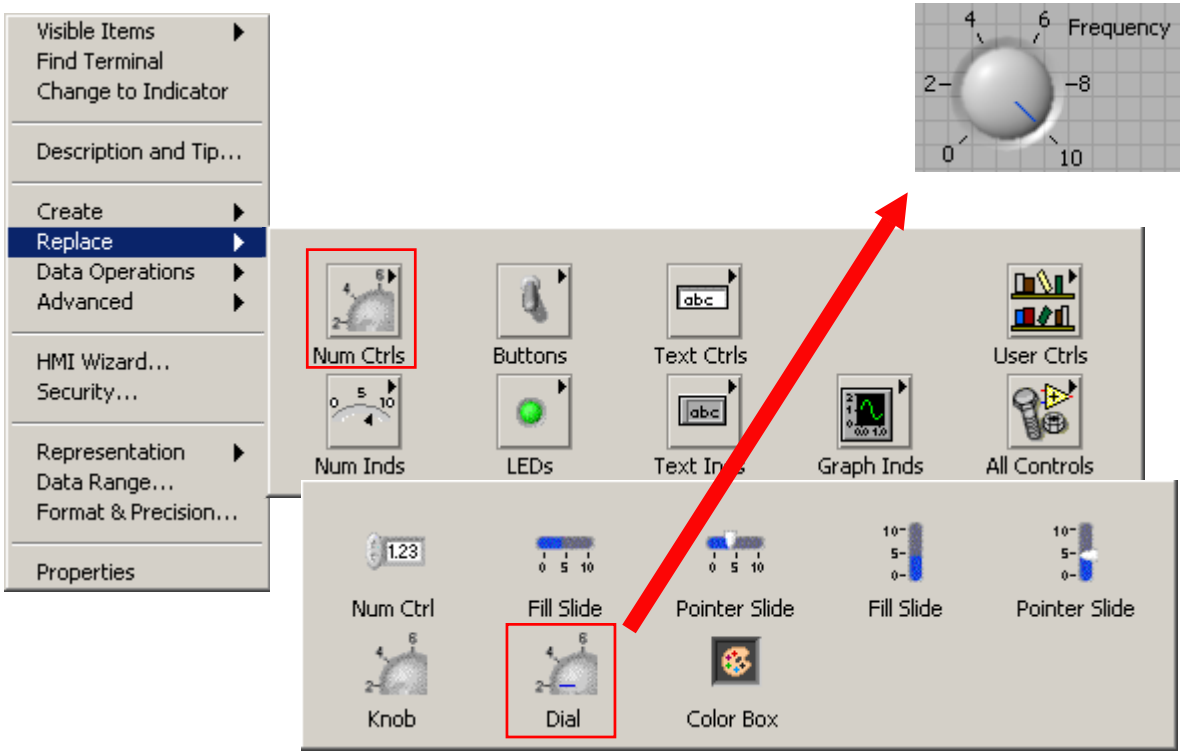
Create control



LabVIEW – Amplitude and Level Measurements

Create a dial to change frequency.

To change to a dial, right-click on control and:



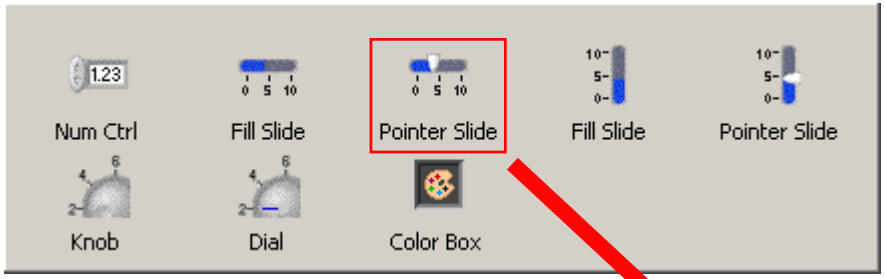
Can change range, scale, precision, etc. by right-clicking on dial, and selecting properties

LabVIEW – Amplitude and Level Measurements

Create a slider to change amplitude.

Follow the previous steps for creating a dial, only this time do it for the amplitude property of the simulate signal VI.

Also select 'Pointer Slide' instead of 'Dial'

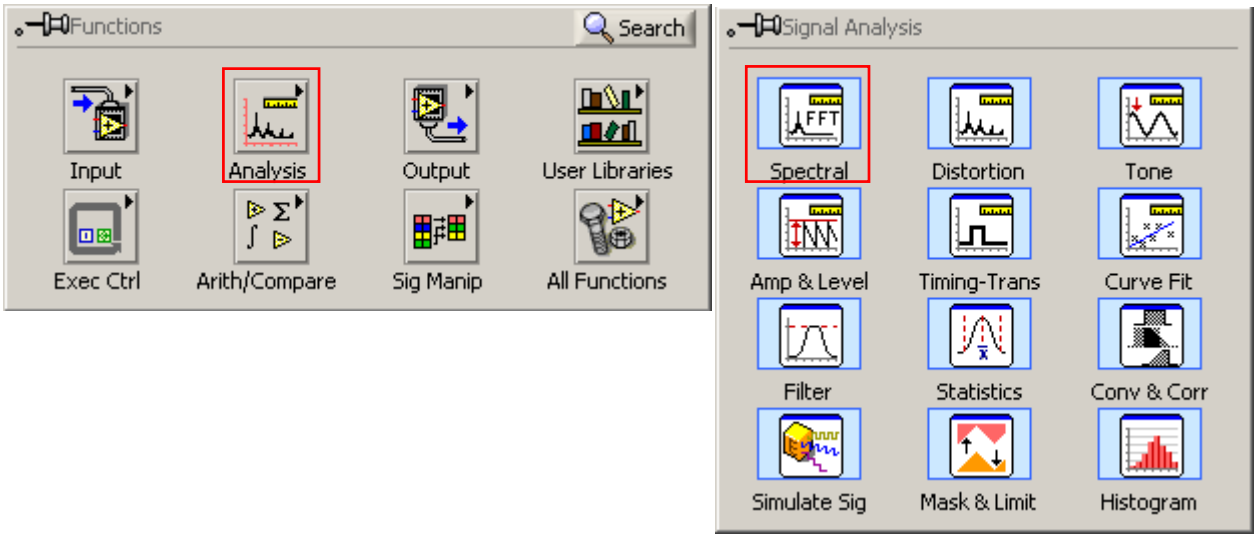


Can change range, scale, precision, etc. by right-clicking on slider, and selecting properties

LabVIEW – FFT Express VI

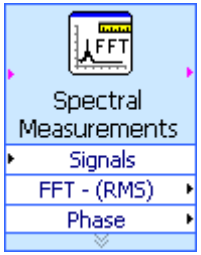
Now the time signal can be converted to the frequency domain using the 'Spectral Measurements Block'

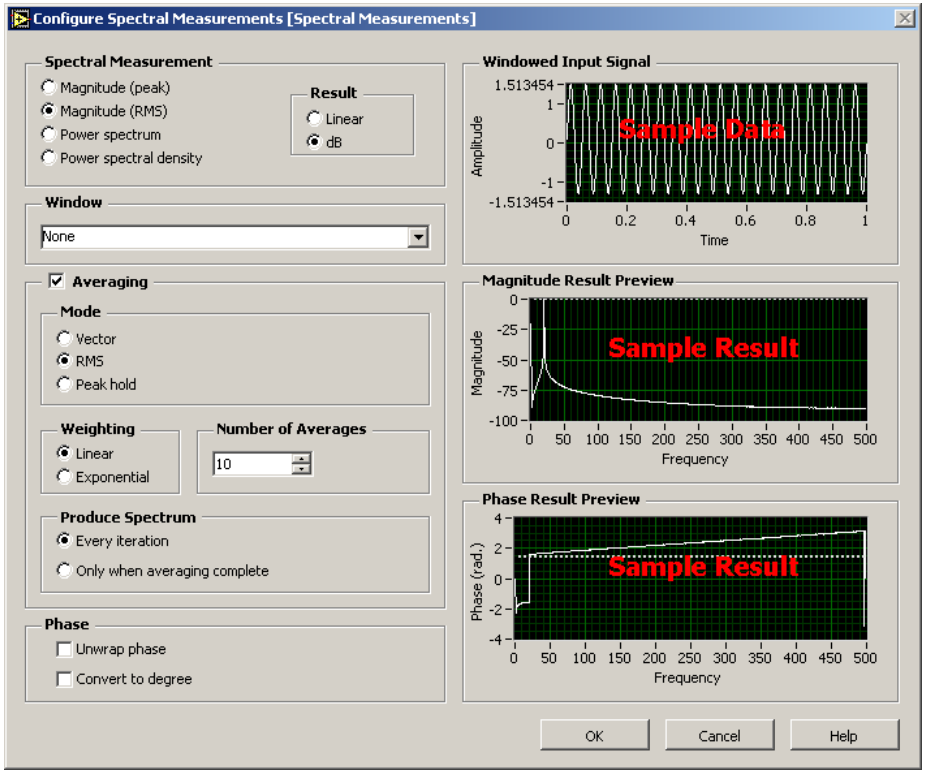
It can by found in:



LabVIEW – FFT Express VI

A parameter window will appear once VI is placed on wire diagram. Here you can set desired output formats, windows, averages, etc.

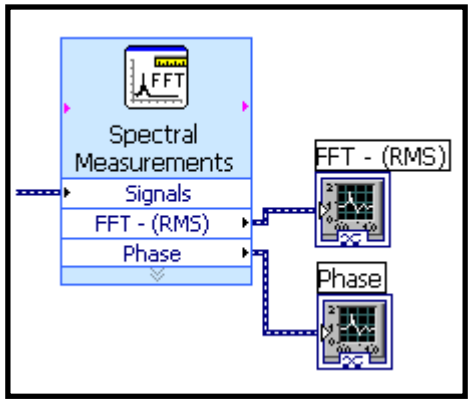




LabVIEW – FFT Express VI

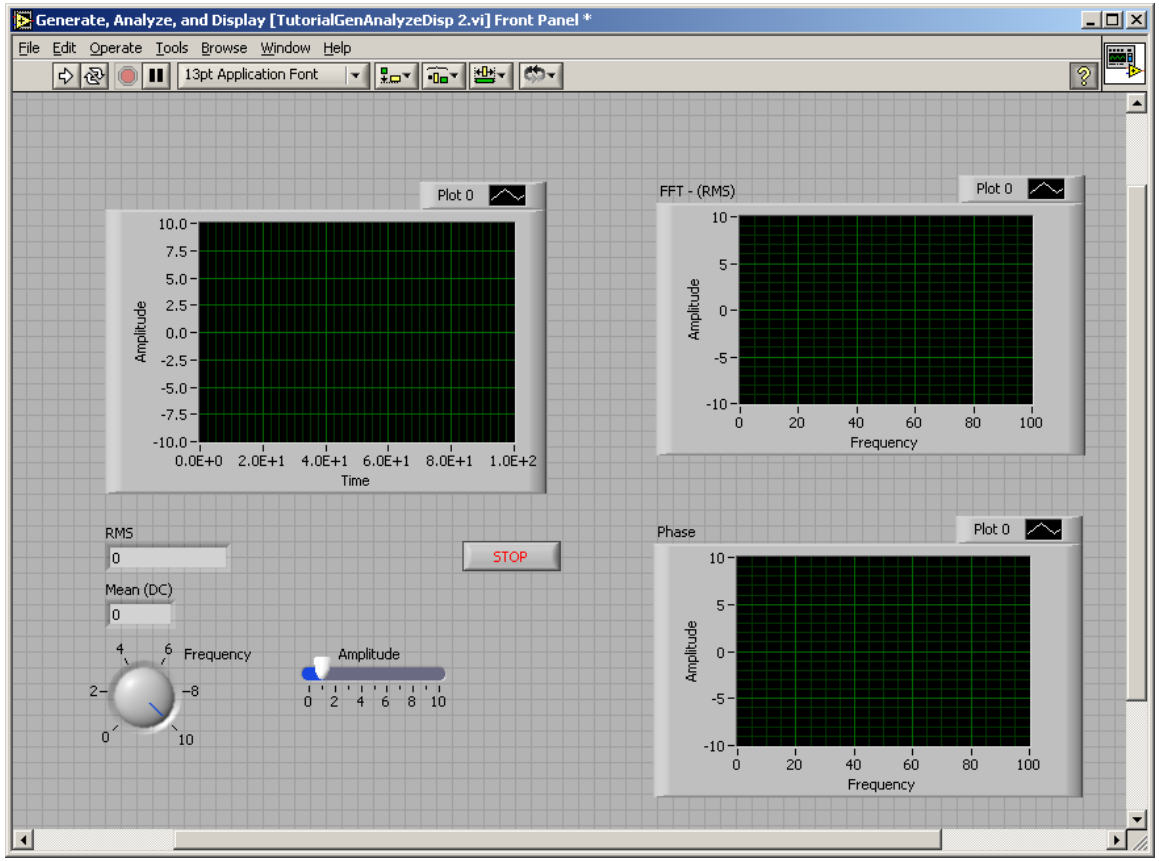
Wire in the signal to be analyzed, and wire out graph indicators to display amplitude and phase.

From Simulate Signal



LabVIEW – FFT Express VI

The resulting front panel display is:



LabVIEW – Task to be performed

Start a new VI and generate a sine wave with both amplitude and frequency input controls – take the FFT of the sine wave (select the sine wave to satisfy the periodicity requirements of the Fourier Transform)

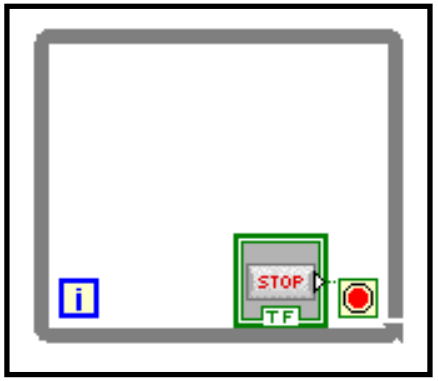
Generate harmonics of that sine wave to ultimately form a representation of a square wave in both the time and frequency domain

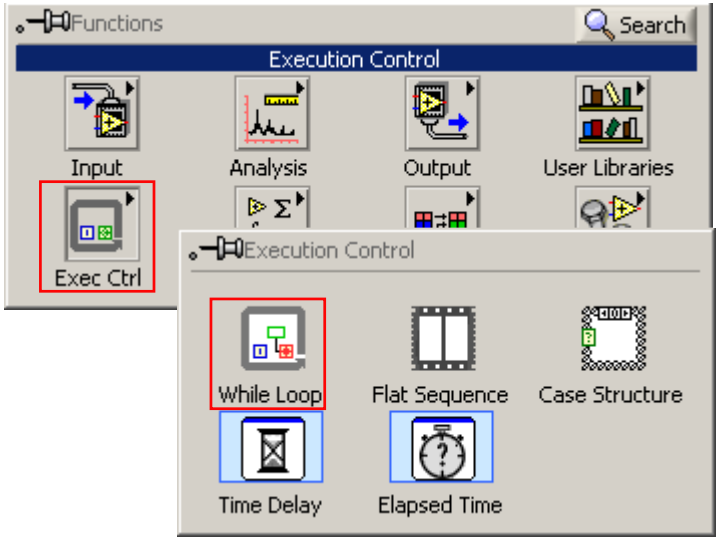
Create a square wave that represents the true time and frequency of the signal for comparison

(Here are a few extra things you'll need to know)

LabVIEW – Extras – While Loop

In order to have a program that will continue running and stop when a 'stop button' is pressed, a while loop can be used.



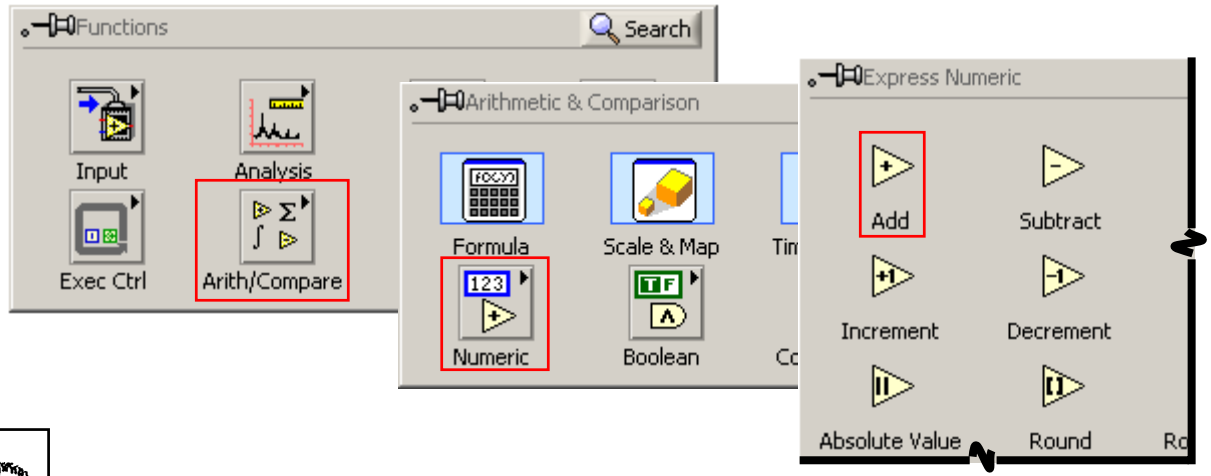


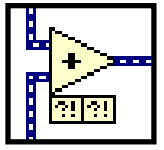
Note: Unless in emergency situations, never use the 'abort button'. Always program in a 'stop button'.

LabVIEW – Extras – Summing Signals

In order to sum signals together:

- *Make sure each signal has the same number of samples*
- *Limited to only adding to signals together at a time*

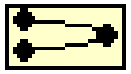




'Add Block'

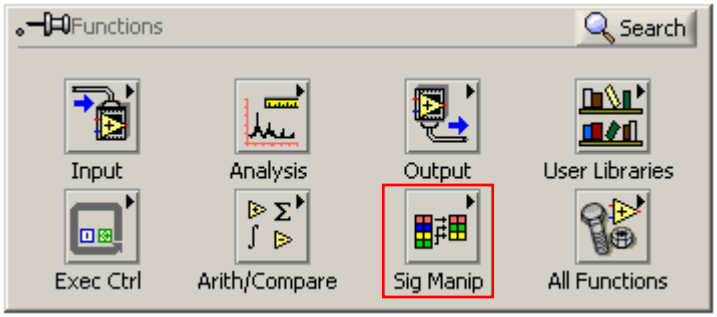
LabVIEW – Extras – Manipulating Multiple Signals

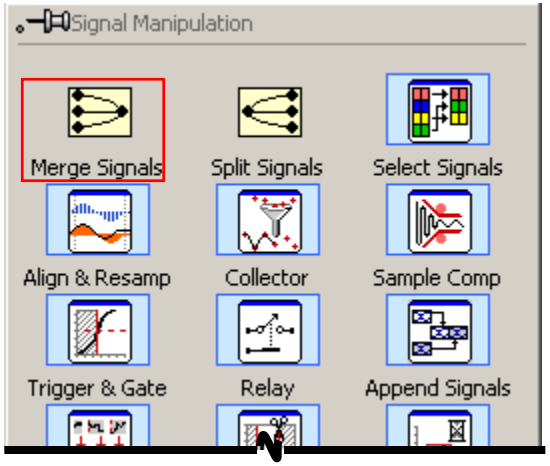
In order to run multiple signals through a VI (FFT, Waveform Graph…) signals must be run through a merge block.



'Merge Block'

The block can be resized to allow for more than two signals





LabVIEW – Task to be performed

Generate a low pass filter (1st order Butterworth) and apply it to your square wave approximation. You may want to investigate higher order filters as well.

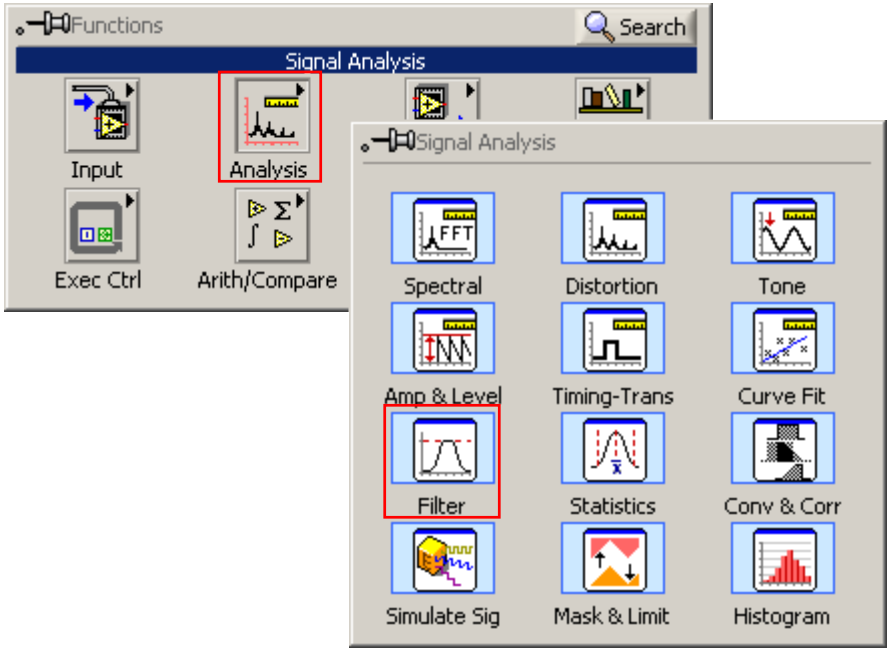
Select a cutoff frequency (that is variable via a control) to filter the higher frequencies of the summed Fourier series of sine waves.

Modify the low pass filter to make it a band pass filter for viewing tight bands around each sine wave that makes up the terms of the Fourier series. Note the effects of the filter on both the time and frequency signals.

(Here are a few extra things you'll need to know)

LabVIEW – Extras – Filter block

Filtering of input signals can be done by using the 'Filter Block' found in:



LabVIEW – Extras – Filter block

A parameter window will appear once VI is placed on wire diagram. Here you can set desired filter type, cutoff frequencies, topologies, etc.