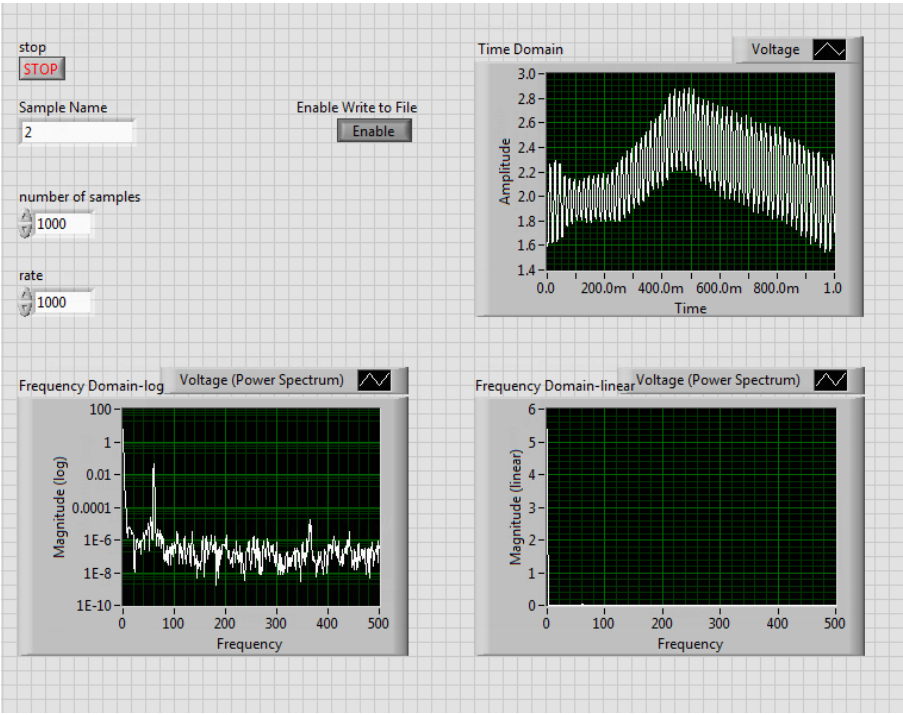
Vibration Measurement Laboratory

LabVIEW Program Construction Tutorial

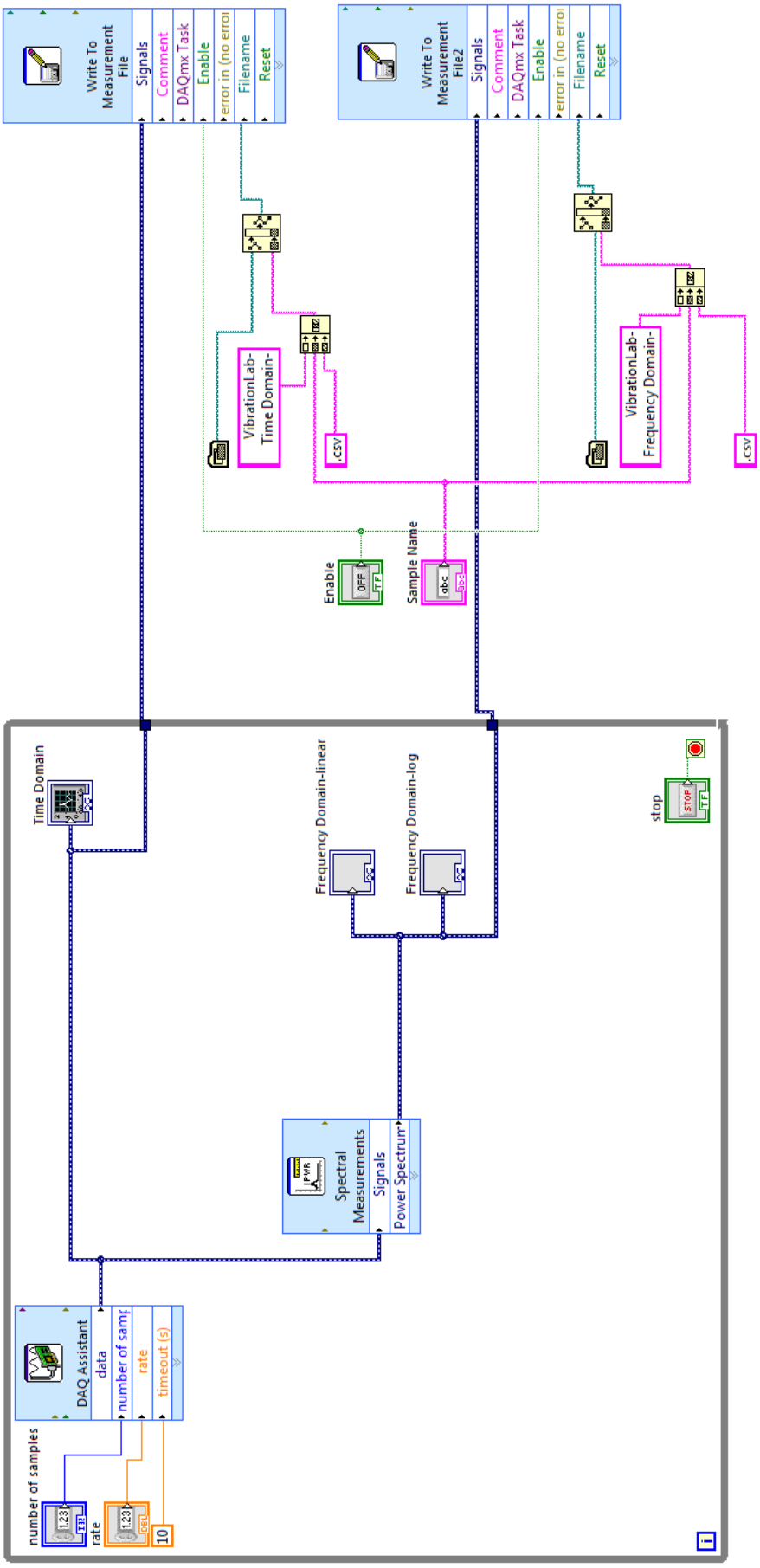
This sample LabVIEW program for the Vibration Laboratory acquires the voltage input from connected NI DAQ device, performs spectral analysis of the input over a specified time period, then saves data in both time domain and frequency domain to separate .csv files in the same folder where the LabVIEW program is saved. Around 1kHz acquisition rate is used for the experiment. This is a basic program to complete the experiment; there are many other ways to write an advanced VI.

The front panel of the program is shown below. The block diagram is shown on page 2. This document walks through the steps of constructing this program.



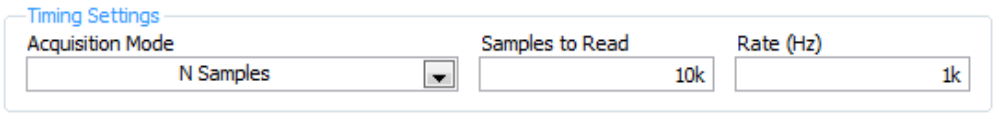
Before opening LabVIEW program, make sure that the NI DAQ device is probably connected to the desktop and turned on.

On *Tools Palette*, make sure that *Automatic Tools Selection* is enabled (the box/button on top of the palette). This setting automatically selects the appropriate pointer tools from the palette based on the mouse-over object.

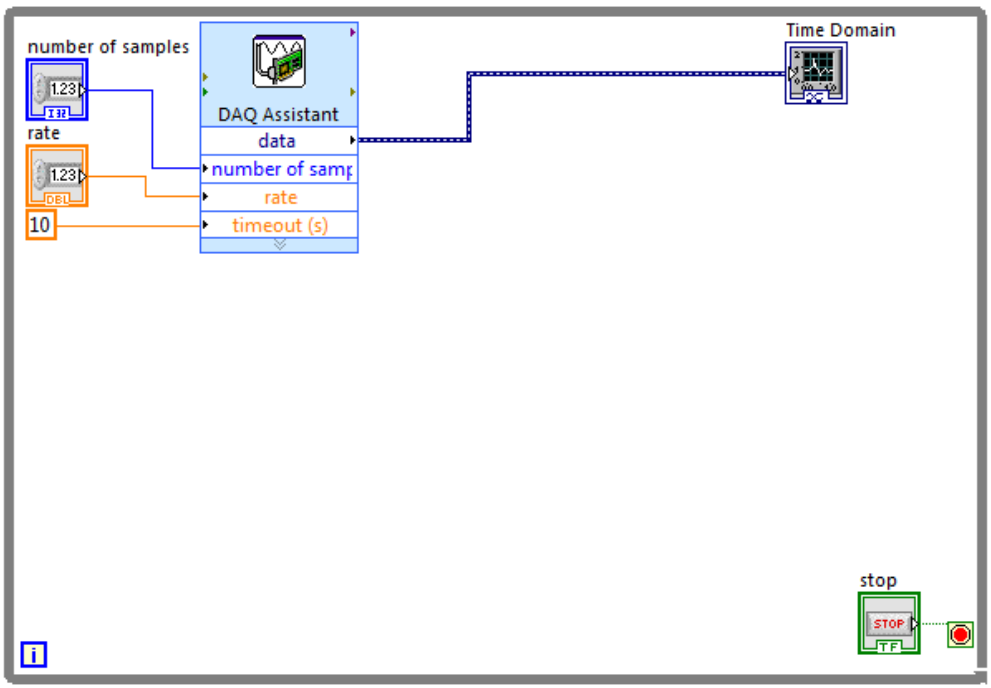

Write To Measurement File
Signals
Comment
DAQmx Task
Enable
error in (no error)
Filename
Reset
Write To Measurement File2
VibrationLab-Time Domain-
.csv
VibrationLab-Frequency Domain-
Enable
Sample Name
Time Domain
Frequency Domain-linear
Frequency Domain-log
stop
Spectral Measurements
Power Spectrum
DAQ Assistant
data
number of samp
rate
timeout (s)
number of samples
rate
10

Add a *While Loop* and connect the (already created) *Stop Button* with the *Loop Condition* icon. (*Functions Palette* ➔ *Programming* ➔ *Structures* ➔*While Loop*). The modules can also be accessed by *Search* toolbox in *Function Palette*.

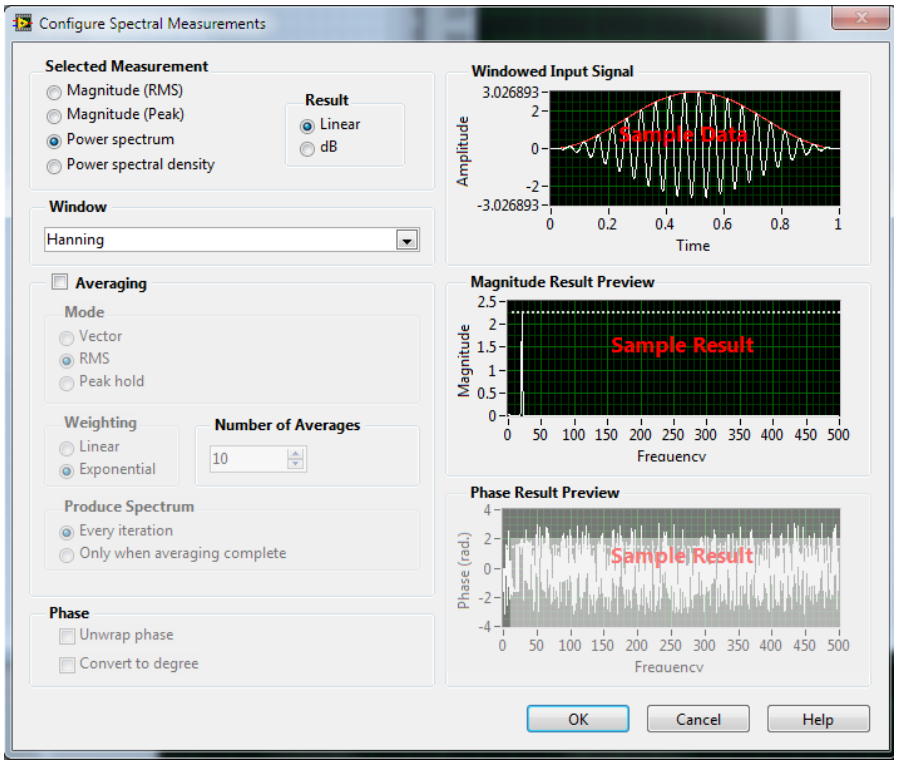
Add a *DAQ Assistant* in the *While Loop* and configure the subVI with the wizard. (*Functions Palette* ➔ *Measurement I/O*➔ *NI DAQ mx* ➔ *DAQ Assistant*). For the measurement type, select *Acquire Signals* ➔ *Analog Input* ➔ *Voltage*. For the physical channel, select the channel of incoming signal. Since channel AI0 of NI 6229 is connected to the input, select this specific channel. Next, configure the channel settings: *N Samples* for acquisition mode. Note that the DAQ box needs to be connected to the computer and turned on before starting of LabVIEW program. Save the work and restart the program if the module fails to initialize.

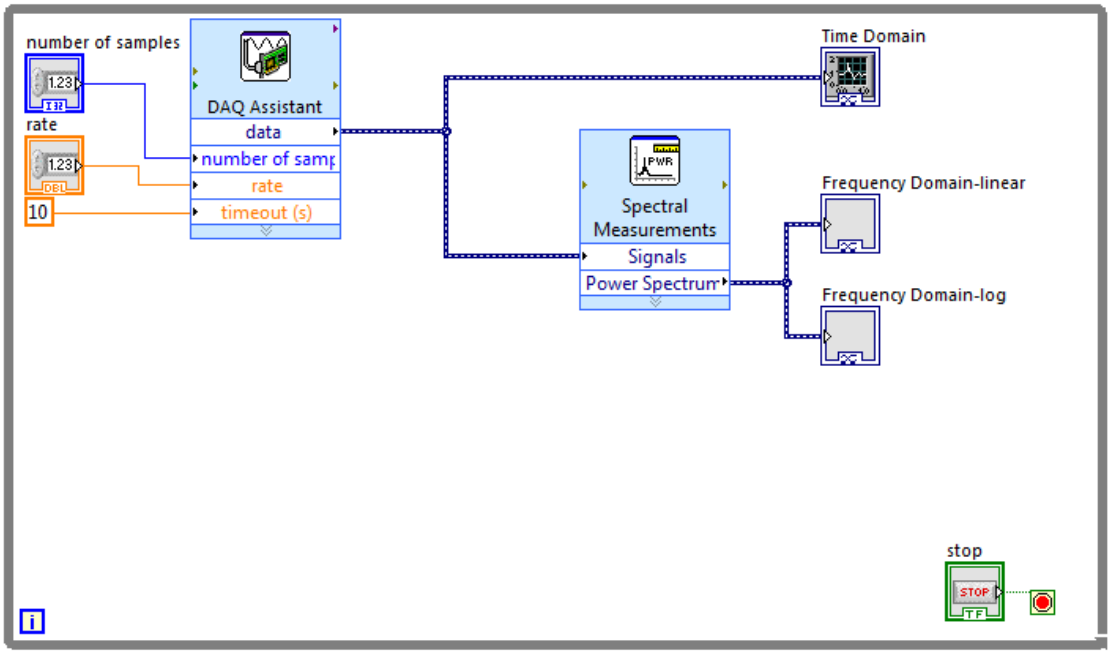


Drag down the downward arrow on the icon and create *Numeric Controls* for "number of samples" (samples to read) and "rate" (Rate Hz). The calculated timeout is the number of seconds for recorded data. Create a *Graphical Indicator* for data output of the *DAQ Assistant* and change the label of the graph into "Time Domain".

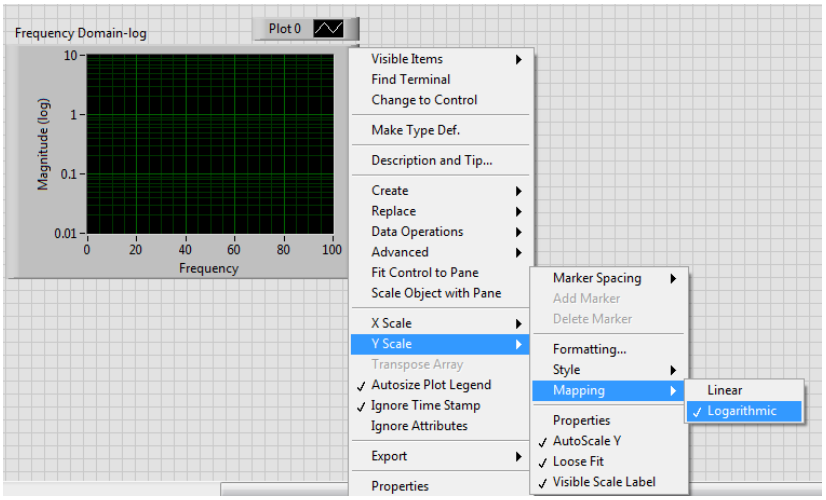


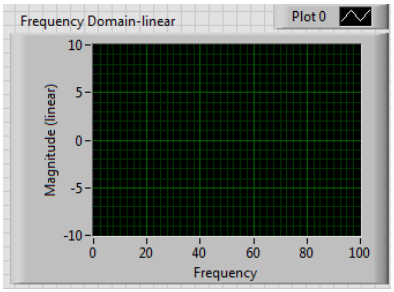
Create a *Spectral Measurement* for the data output of *DAQ Assistant* and create two *Graphical Indicators* for the power spectrum output of the function. In the configuration wizard, select "Power spectrum" as measurement. Change the labels of the *Graphical Indicators* into "Frequency Domain – Linear" and "Frequency Domain – Log".

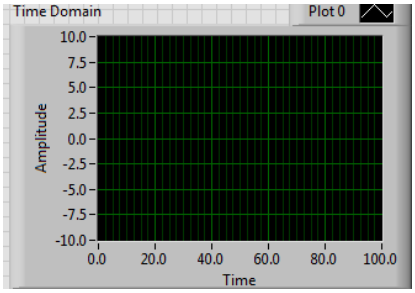




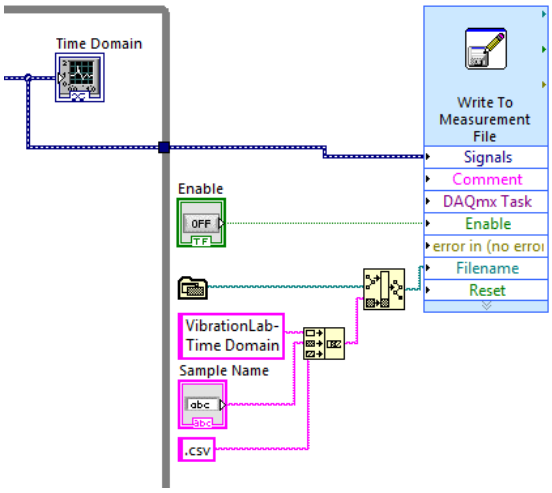
Go to *Front Panel* and configure the three *Waveform Graphs*. Replace the default axis labels with appropriate names (left clicking on the label texts enables editing). Make the mapping of Y axis on the Frequency Domain-Log graph “Logarithmic”; the menu is accessed by right clicking anywhere on the module.



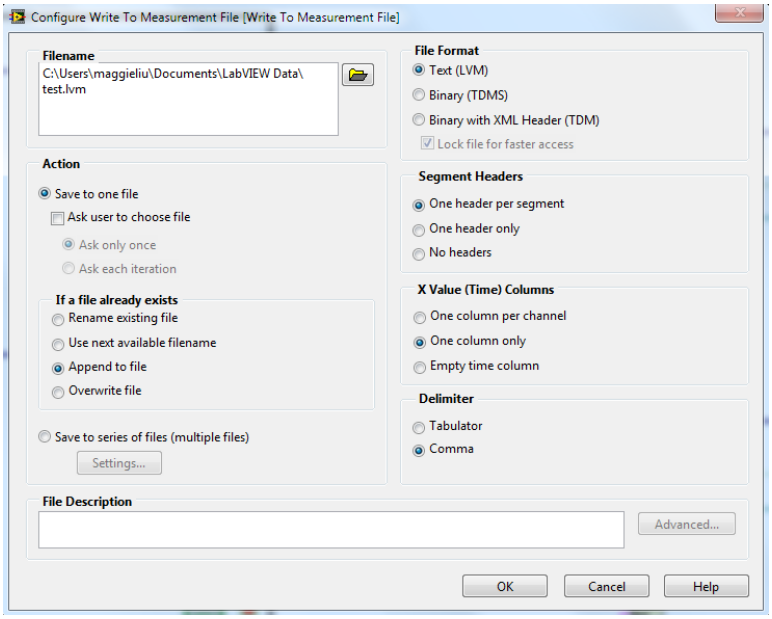




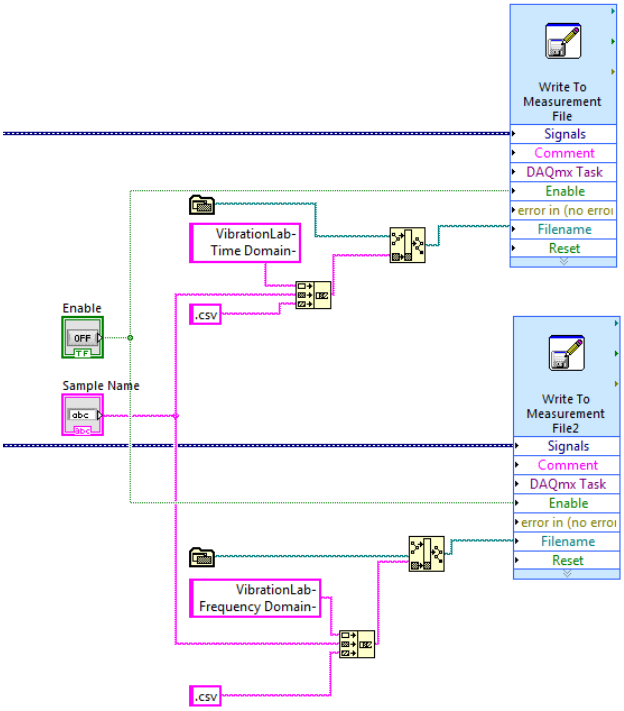
Create a *Write to Measurement File* module outside of the *While Loop*. Drag down the downward arrow to show the input and outputs of the module. Extend the *Dynamic Data* wire for the time domain data out of the *While Loop* and connect it to the signals input. Create a control for the "*Enable*" input, and rename the button "Enable Write to File". The *Filename* can be constructed with *Build Path* function. It builds the file path with an *Application Directory* function, which points to the folder where the VI is saved, and a Concatenated String (Use *Concatenate String* function in *String Palette*) which consists of the lab name, the text "time domain data", the user inputted sample name, and a ".csv" (comma separated values) as file extension, so that the data file can be opened with Microsoft Excel.



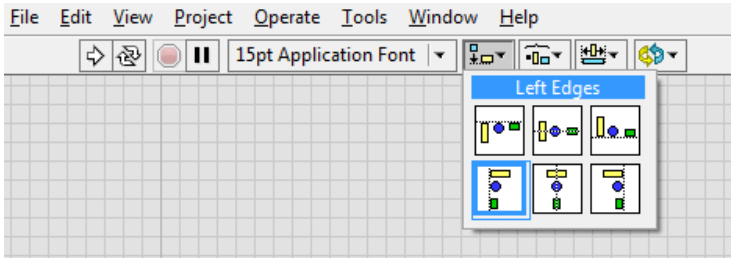
The *Write to Measurement File* should be configured as shown below. The filename in this wizard will be overwritten by the input; it should "save to one file"; the format should be text, with one header only or no headers; there should be only one time column; and the delimiter should be comma.



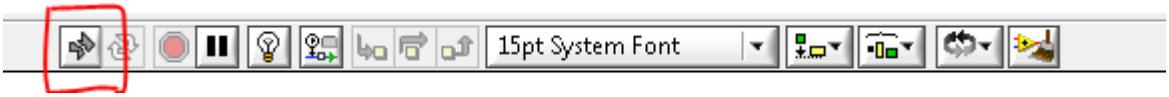
Create a second *Write to Measurement File* module for frequency domain data. The steps are the same as the other *Write to Measurement File*, so one could simple select all elements connected to the previous module and edit the elements later. The two modules should share the "Sample name" and Enable button. The filename of the second module should say frequency domain.

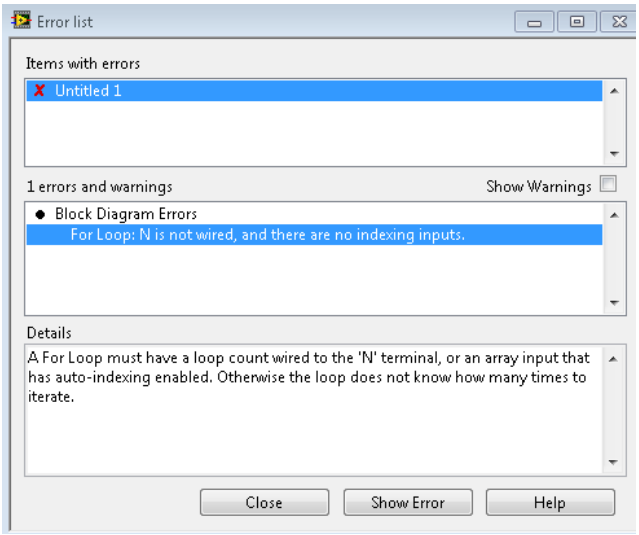


Rearrange the objects for a desirable layout. Drag the icon and drop them at appropriate locations. The objects can be arranged with the tools on the top tool bar, alignment, distribution and resizing tools can be used on selected objects.



Now we have completed constructing the VI. If there is any error in the program, the run button will appear "broken" as shown in the figure below. Click on the button to view the error list, the "details" should explain the error. Debug until all errors are resolved; use other debugging functions on the menu bar if needed.





When the run button appears as a rightward arrow, enter appropriate parameters on the *Front Panel*, connect a BNC cable to AI0 of the DAQ device with two idle clips (this will provide some varied voltage inputs), and test run the program. Use *Edit* ➔ *Make current values default* to save the entered parameters as default values. If there is no error interrupting the run, we can check the data file under the specified directory for satisfactory results. Trouble shoots until the program is ready for use.

Now the VI is ready for the Vibration Measurement Laboratory. Can you make it better?