LabVIEW Lesson 1 – Introduction to LabVIEW

Lesson Overview
- How to access LabView.
- How to create a new blank VI.
- How to create a front panel with the available controls and indicators.
- How to create a block diagram that corresponds to the front panel.
- How to use the tools palette and available "house-cleaning" functions on the toolbar.

I. Accessing LabVIEW 7.1

    a. Logon on to computer

    b. From the **Start** menu, Select **Programs** → **National Instruments** → **LabVIEW 7.1** (or whatever version is on your computer) → **LabVIEW**

   c. Select **OK** for the Security Notice and **Continue** on the LabVIEW window

II. Creating a new blank VI (Virtual Instrument)

    a. What's a VI?

        i. A virtual instrument or LabVIEW program

        ii. It is referred to as a VI because its appearance and operation resembles physical instruments (i.e. oscilloscopes and multimeters)
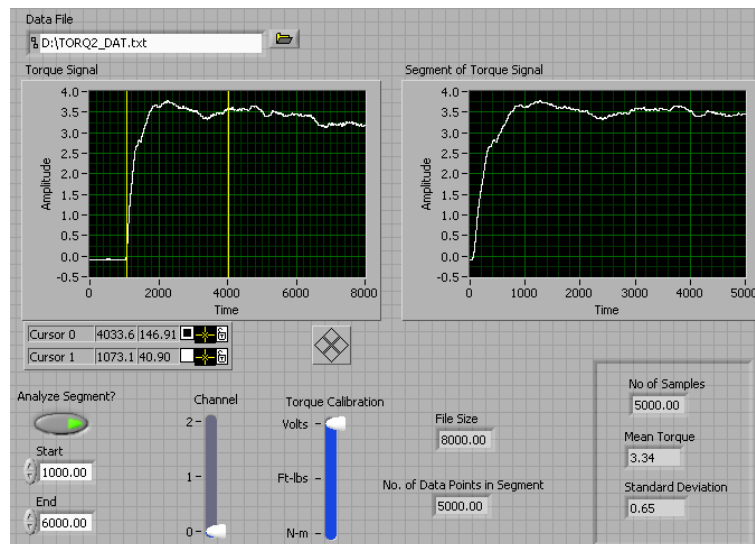
   b. Opening a new blank VI

        i. The following screen will appear and the majority of the time, you will either choose **New** or **Open**:
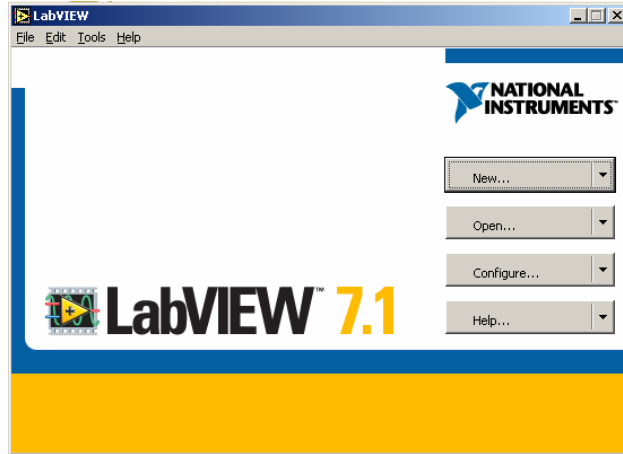
1. The **New** button allows you to create a new VI

2. The **Open** button allows you to open an existing VI

ii. Click on the **New** button to create a new VI.

iii. On the next screen, make sure that under the **Create New:** menu **Blank VI** is highlighted and then, click on **OK**.

iv. You will now have two main windows on your desktop, a front panel (gray grid background) and a block diagram (white background).

1. The **Front Panel** is similar to the dashboard instrument panel in your car as it will contain all the visual indicators and inputs.

a. The controls and indicators that may be placed on the front panel are located in the **Controls Palette** (if not already displayed, **Right-Click** on the **Front Panel** and to make it stay on the screen, **Left-Click** on the **Push-Pin** in the upper left corner).
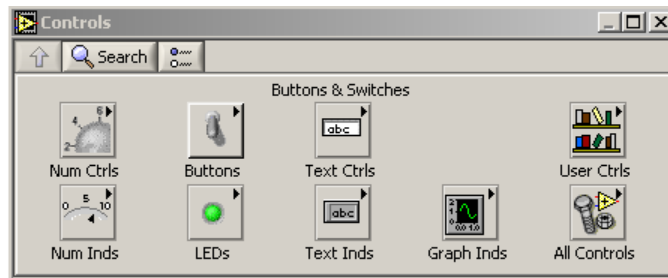

b. The **Controls Palette** may only be used for the front panel and is where you will select different controls (inputs) and indicators (outputs).

i. **Controls** will have knobs, push buttons, dials, and other input devices.

ii. **Indicators** will be graphs, LEDs, numeric display, and other output displays.

1- Increment/Decrement Buttons
2- Numerical Control
3- Numerical Indicator
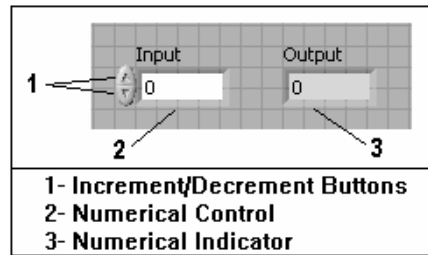
2. The **Block Diagram** is a graphical source code, much like a circuit board, used control the front panel objects.

   a. The **Block Diagram** includes objects such as terminals (representing the front panel objects) and those items that don't show on the front panel such as functions, constants, and wires to connect all of the objects.

   b. The palette that contains all of these objects is the **Functions Palette**, which again can only be used in conjunction with the **Block Diagram** (if not already displayed on your screen, **Right-Click** on the **Block Diagram** and to make it stay on the screen, **Left-Click** on the **Push-Pin** in the upper left corner).
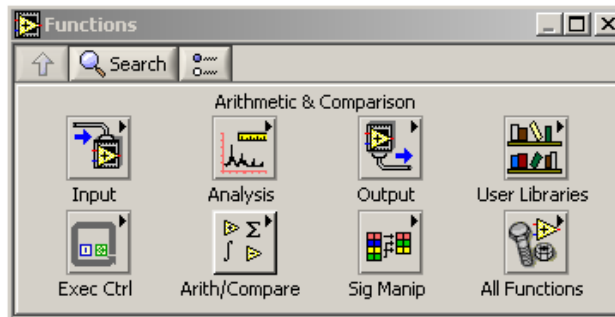
3. To switch from the **Front Panel** to the **Block Diagram**, either use the mouse and **Left-Click** on whichever window you would like or press **Ctrl-E**.

4. In addition to the **Controls** and **Functions Palettes**, the **Tools Palette** is a universal palette that can be used to perform operations on both the **Front Panel** and **Block Diagram.**

    a. To access the **Tools Palette** if not already displayed, go to **Window → Show Tool Palette**; if not an option, **Click** on the ⌄ arrow.

    b. Use the **Tools Palette** to switch cursor operation modes (i.e. wiring, creating text, selecting items, entering values).

III. **EXAMPLE 1.1:** Creating a Simple Addition VI

    a. This VI will add two numbers or input values (**A and B**) and return the sum, **C**.

    b. Beginning with the **Front Panel**,

       i. Insert a **Numerical Control** by …
- **Controls Palette → Num Ctrls → Num Ctrl → Front Panel** (to place the numerical control).

      ii. Copy the first **Numerical Input** by …
- Choose the ⬉ **Arrow** from the **Tools Palette** → Hold down **Ctrl** and **Left-Click** on the **Numerical Control** → **Drag** to the second input's desired position (right below the first).

     iii. Insert a **Numerical Indicator** by …
- **Left-Click** on the ⬆ **Arrow** to go back to the main **Controls Palette → Num Inds → Num Ind → Front Panel** to place the **Numerical Indicator** in its desired position.

     iv. Change the titles of the inputs and outputs by changing from the ⬉ arrow to the text editor 𝐀.
- **Left-Click** on each title → **Highlight** the previous text and **Delete**, → **Type** in new text.

     v. Horizontally align the inputs and vertically align one of the inputs with the output.

        1. Change back to ⬉ in the **Tools Box** and **Highlight** the two inputs (A and B) by **Dragging** a box around them → **Left-Click** 🔳 **Icon** at the top of the **Front Panel** → **Left Edges Icon** 🔳.

2. **Drag** a box around one of the inputs and the output to select both → ![icon] **Icon** → **Top Edges Icon** ![icon].

c. **Ctrl-E** to switch to the **Block Diagram** (three terminals should be displayed, two for the inputs and one for the output).

    i. Insert an **Add Function** ![icon] by …
- **Left-Click** on **Arith/Compare** in the **Functions Palette** → **Numeric** → **Add** → **Block Diagram** to place the **Add Function**.

    ii. Connect each **Input** to an **Input Terminal** on the **Add Function** triangle by …
- Select the **Wire Icon** ![icon] from the **Tools Palette** → **Left-Click** on one of the **Inputs** → one of the **Add Function** terminals (wire will turn orange when connected).

- Do the same for the other input and output.

    iii. Check if the VI is complete by …
- Observing whether a **Broken Arrow** ![icon] or a **Solid Arrow** ![icon] is displayed at the top left on either the **Front Panel** or the **Block Diagram**.

- A **Broken Arrow** ![icon] indicates that an error is present or everything is not wired correctly.

- A **Solid Arrow** ![icon] indicates that the VI is completed and ready to run.

d. If a **Solid Arrow** is displayed, **Ctrl-E** back to the **Front Panel** and input a **4** and a **7** in the two **Numerical Controls** (inputs) by using the **Finger Icon** ![icon] to either **Left-Click** the buttons on the control or **Left-Click** where the numbers are and type in the appropriate number.

e. Finally, **Left-Click** on the **Solid Arrow** ![icon] to run the VI and ensure that the **Numerical Indicator** (output) reads **11**.

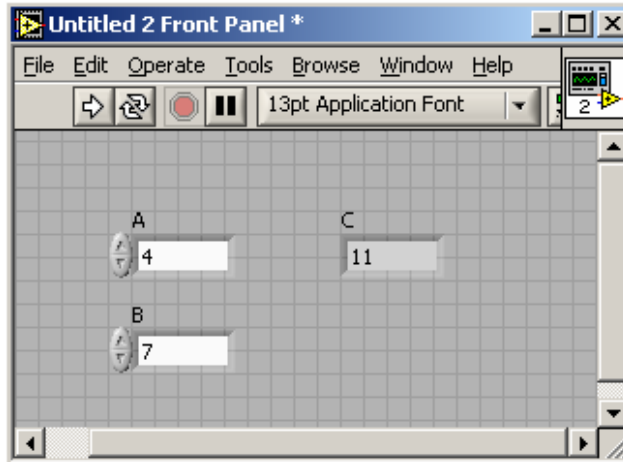f. The VI should look similar to the Figures 1.1 and 1.2 on the next page:
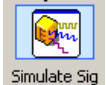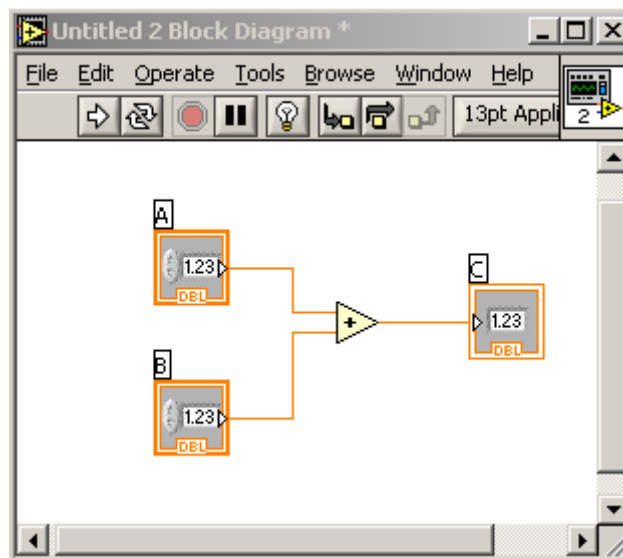
Figure 1.1: Front Panel of Simple Addition VI

Figure 1.2: Block Diagram of Simple Addition VI

IV. **EXAMPLE 1.2:** Exploring Signal Generation and Processing

    a. This example shows how to create/simulate a sinusoidal input signal, use numerical controls to change the amplitude and frequency of the sinusoidal waveform, and display the sinusoidal waveform.

    b. To create a signal:

        i. **Left-Click** on **Controls → Simulate → Simulate Signal** Simulate Sig and place on block diagram. (*This should bring up a setup screen as shown on the next page in Figure 1.3 to configure the type of input signal you want to simulate.*)
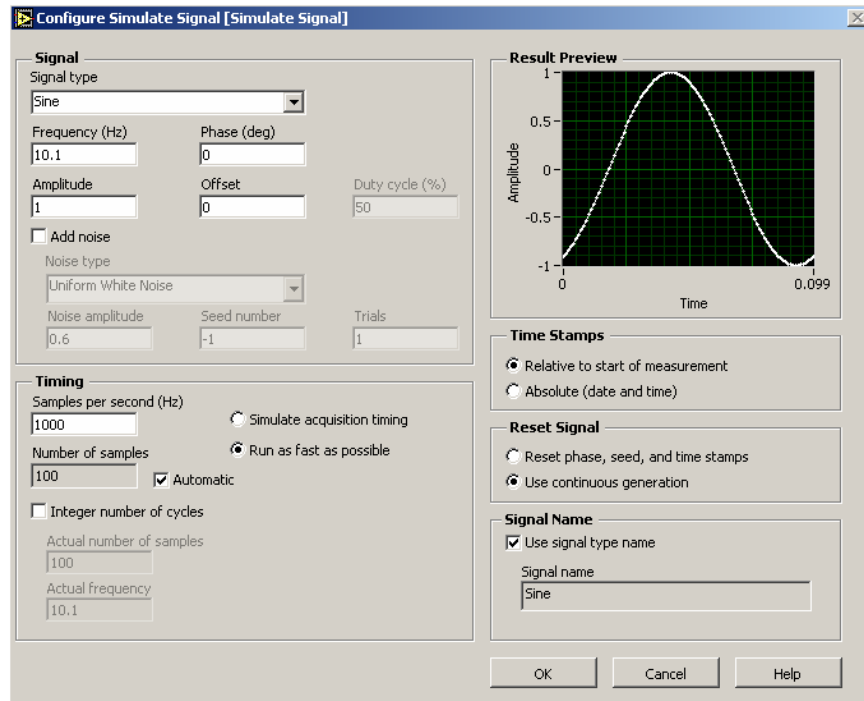
Figure 1.3: Configuration Window for Signal Simulation

You can choose the type of signal you want (sinusoidal, square, triangular, etc.) as well as the frequency, amplitude, phase, offset, and noise if desired.

ii. Click **OK** when you have all the parameters set as desired (we will just leave them as is for now).

iii. Now we need to add an output graph so that we can see our signal.
- Go to the **Front Panel** and choose from the **Controls Palette** →

  Graph Inds → **Waveform Graph** .

iv. We also want the user to be able to control the frequency and amplitude of the sinusoidal waveform without having to open up the configuration screen.
- Add **Two Numerical Controls** to the **Front Panel** and label them **"Frequency"** and **"Amplitude"**. Your **Front Panel** should now look similar to Figure 1.4 on top of the next page.
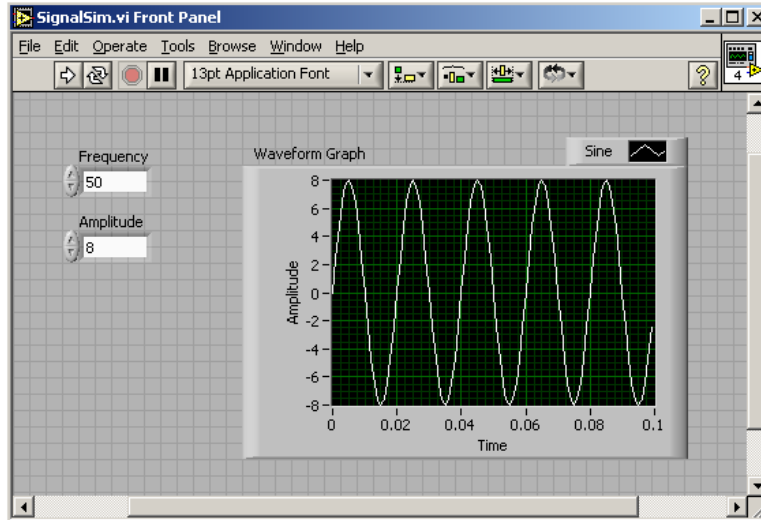
Figure 1.4: Front Panel of Signal Generation VI

    v.   Now switch back to the **Block Diagram** and now we need to connect the two controls to the **Simulate Signal** block. Wire the controls to the **Simulate Signal** block (the **Frequency Terminal** is the second one from the top and the **Amplitude Terminal** is right below it.)

    vi.   Next you will need to **Wire** from the **Sine** output terminal to the **Waveform Graph** block. Your final **Block Diagram** should look similar to Figure 1.5 below.
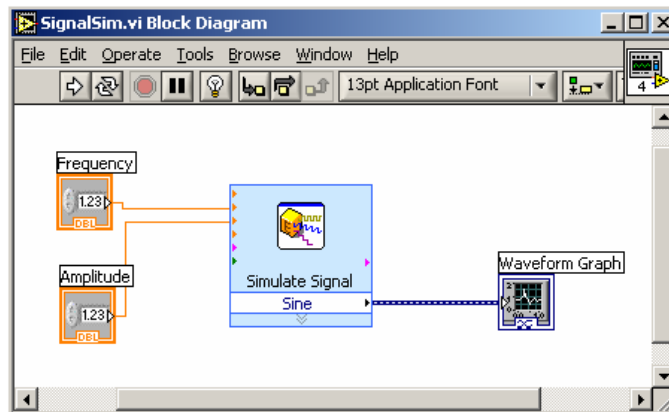

Figure 1.5: Block Diagram of Signal Generation VI

    vii.   Switch back to the **Front Panel** and change the **Frequency** value to **50** and the **Amplitude** value to **8** and then **Run** the VI.

V. Exploring the **Front Panel Toolbar**

    a. Many of the executable and "house-cleaning" commands are located in the toolbar.

    b. First, the executable commands from left to right *(these are also available on the block diagram as well)*.

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i. - **Run Command** – Will be a solid arrow when the VI is correctly wired together and no errors exist, if errors exist or the VI is incomplete, the arrow will be broken as noted earlier. Click on this command to begin running the VI.

ii. - **Continuously Run Command** – Use this command to continuously run the VI until the user stops it or it reaches a terminate condition.

iii. - **Abort Command** – Use this command to stop execution of a VI instantaneously. Useful when a VI is running continuously and you need to stop it.

iv. - **Pause Command** – Use this command to pause execution with intentions of continuing execution from that point.

c. Secondly, the "house-cleaning" commands *(which are also available on the block diagram)*.

i. **Font Command** – Use this drop-down menu to choose the type, size, and color of font you want to use. The drop-down menu looks similar to what is shown below.
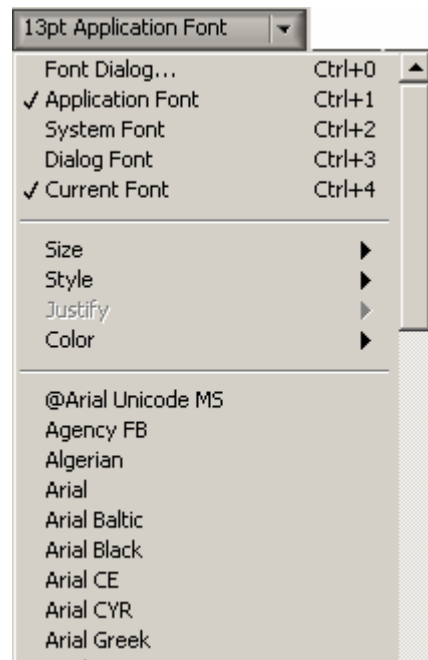

ii. **Align Objects Command** – Select a group of objects that you want aligned and then use this drop-down menu to choose exactly how you want your objects aligned (horizontally by left edge, vertically by centers, etc.)
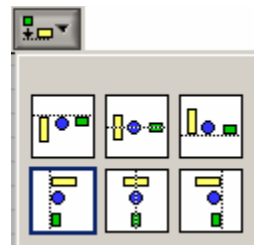
iii. **Distribute Objects Command** - Select a group of objects that you want distributed evenly and then use this drop-down menu to choose exactly how you want your objects distributed (equidistance according to distance between first two objects, all edges touching, etc.)
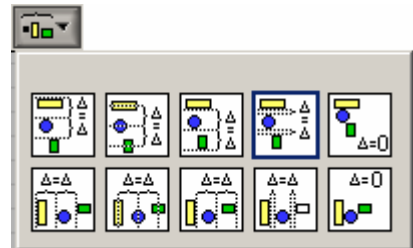
iv. **Resize Objects Command** – Select a group of objects that you want to resize and then use the drop-down menu to choose the desired resizing option.
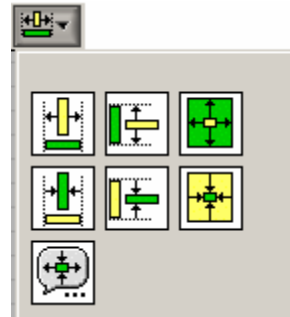
v. **Reorder Command** – Allows you to group objects together as well as ungroup them. The lock function allows you to fix an object in its position so that it cannot be moved and the unlock function allows you to free a fixed object. The other move functions allow you to control the placement of overlaying objects with reference to one another.
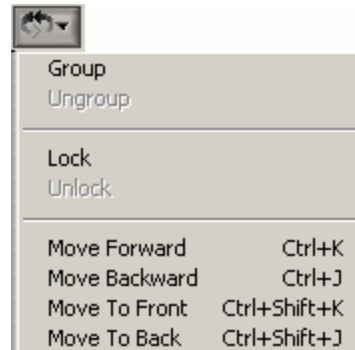
d. Lastly, a couple of commands available only on the block diagram toolbar.

   i. ⊡ - **Highlight Command** – Use this command to see the values passing through the block diagram.

   ii. ⊡ - **Signal Stepping Commands** – Use these commands to go through your block diagram one step at a time. Often used for debugging your VI if output values are not correct.

   iii. **Clean Up Wiring** – This is not a command on the toolbar; however, it is very useful in making your VI more readable or easier to follow. To access this command, **Right-Click** on the wire that needs fixing with the **Arrow** tool selected and then, select **Clean Up Wire** from the menu.

VI. The best way to familiarize yourself with this program is to just explore all the available options it provides and practice using these options.