ENE 806
Laboratory Feasibility Studies for Environmental Remediation

Introduction to LabVIEW

By
Ahsan Munir

Instructor: Dr. Syed Hashsham

CIVIL & ENVIRONMENTAL ENGINEERING

NATIONAL INSTRUMENTS **LabVIEW**™
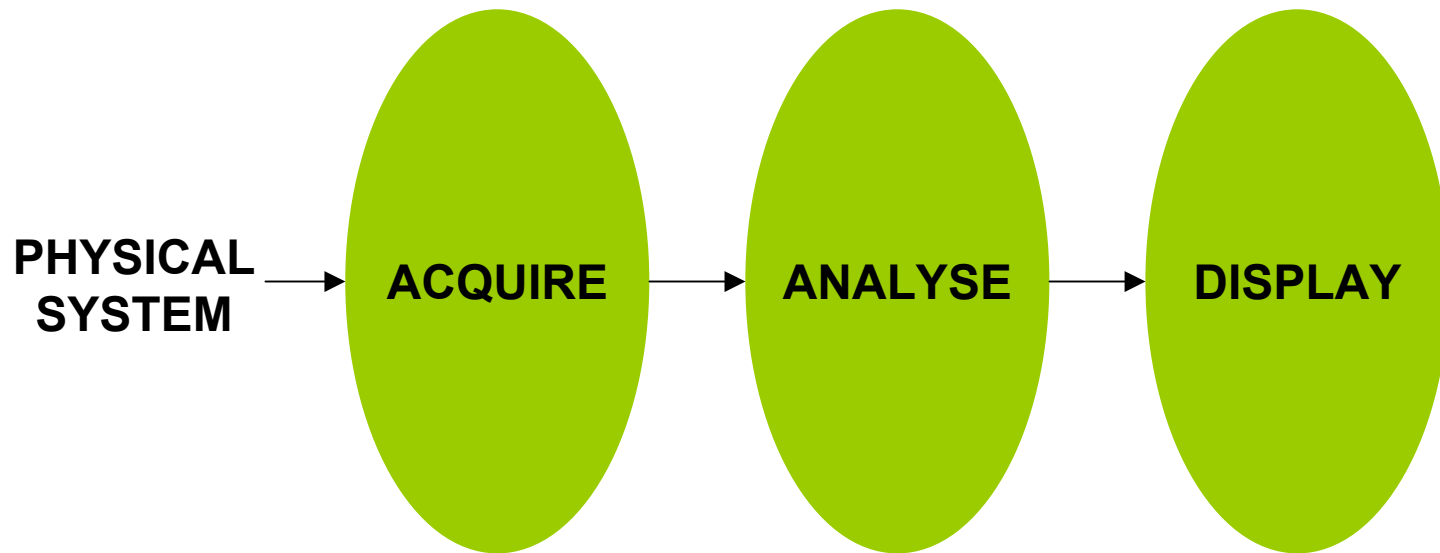
MICHIGAN STATE UNIVERSITY

Introduction to Labview

- Product of National Instruments (NI)
- Software for Virtual Instrumentation
- Data Acquisition (DAQ)
- Graphical Programming
- Data Storage and Analysis for wide Range of Applications
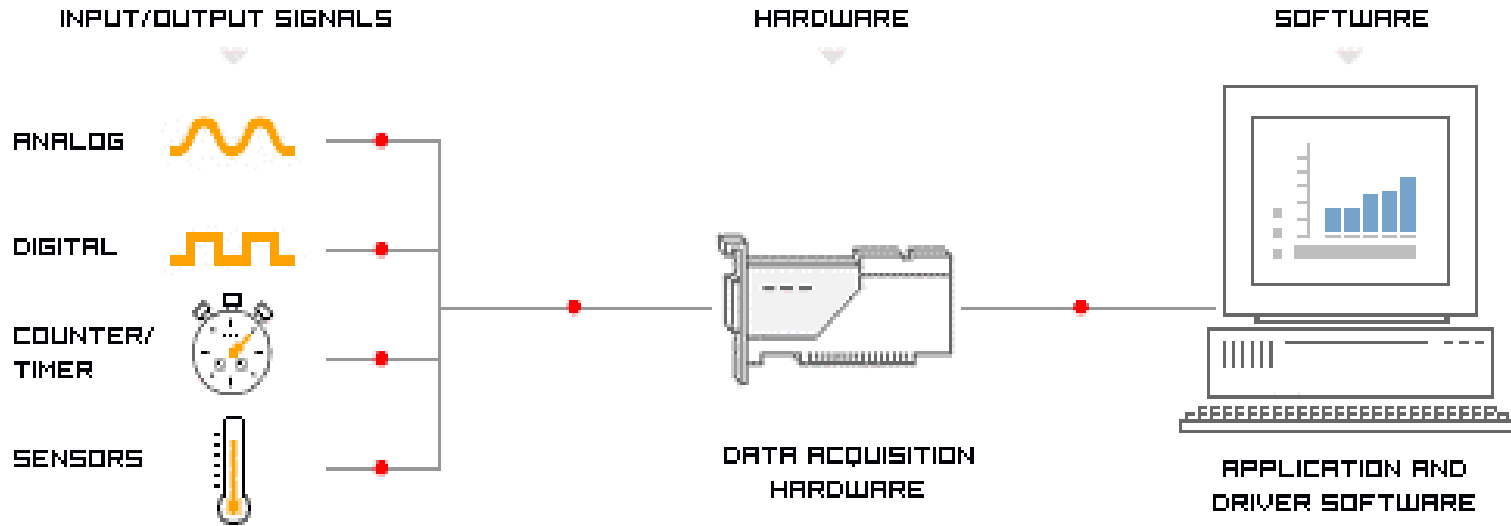
Features of LabVIEW

- **Design**
  - Signal and Image Processing
  - Embedded System Programming
    - (PC, DSP, FPGA, Microcontroller)
  - Simulation and Prototyping
  - And more…
- **Control**
  - Automatic Controls and Dynamic Systems
  - Mechatronics and Robotics
  - And more…
- **Measurements**
  - Circuits and Electronics
  - Measurements and Instrumentation
  - And more…

Things to do…..

PHYSICAL SYSTEM → **ACQUIRE** → **ANALYSE** → **DISPLAY**

Data Acquisition (DAQ)

PC-BASED DATA ACQUISITION

INPUT/OUTPUT SIGNALS	HARDWARE	SOFTWARE

ANALOG

DIGITAL

COUNTER/TIMER

SENSORS

DATA ACQUISITION HARDWARE

APPLICATION AND DRIVER SOFTWARE

"Data acquisition is the process of gathering or generating information in an automated fashion from analog and digital measurement sources such as sensors and devices under test."

Video Tutorial
Build a PC-Based Data Acquisition System in 10 Minutes
http://zone.ni.com/wv/app/doc/p/id/wv-207

(from National Instruments Corporation)

Introduction to Labview

- Creating your first Virtual Instrument
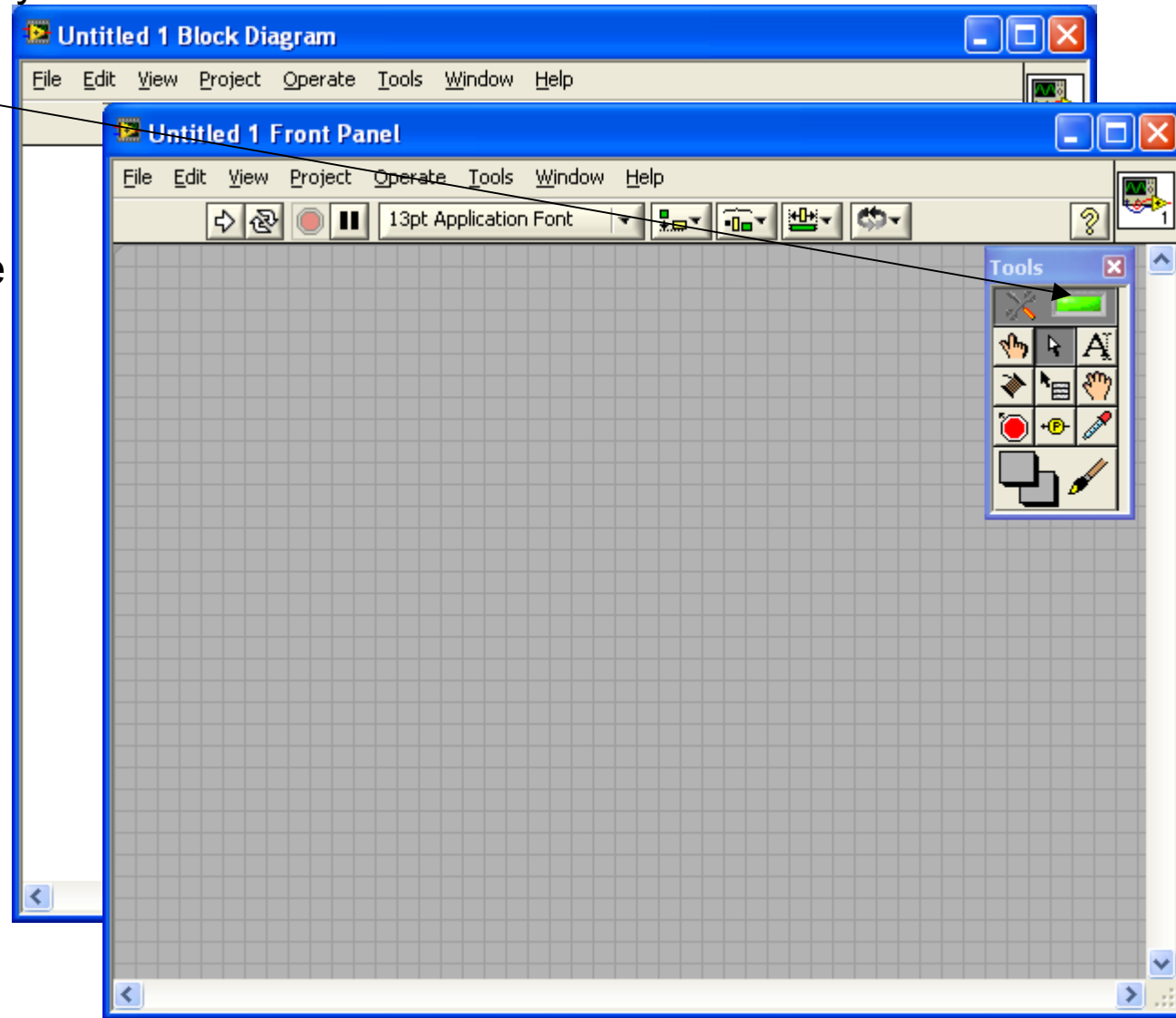- A simple Input/Output VI

Start Labview

Create a Blank VI
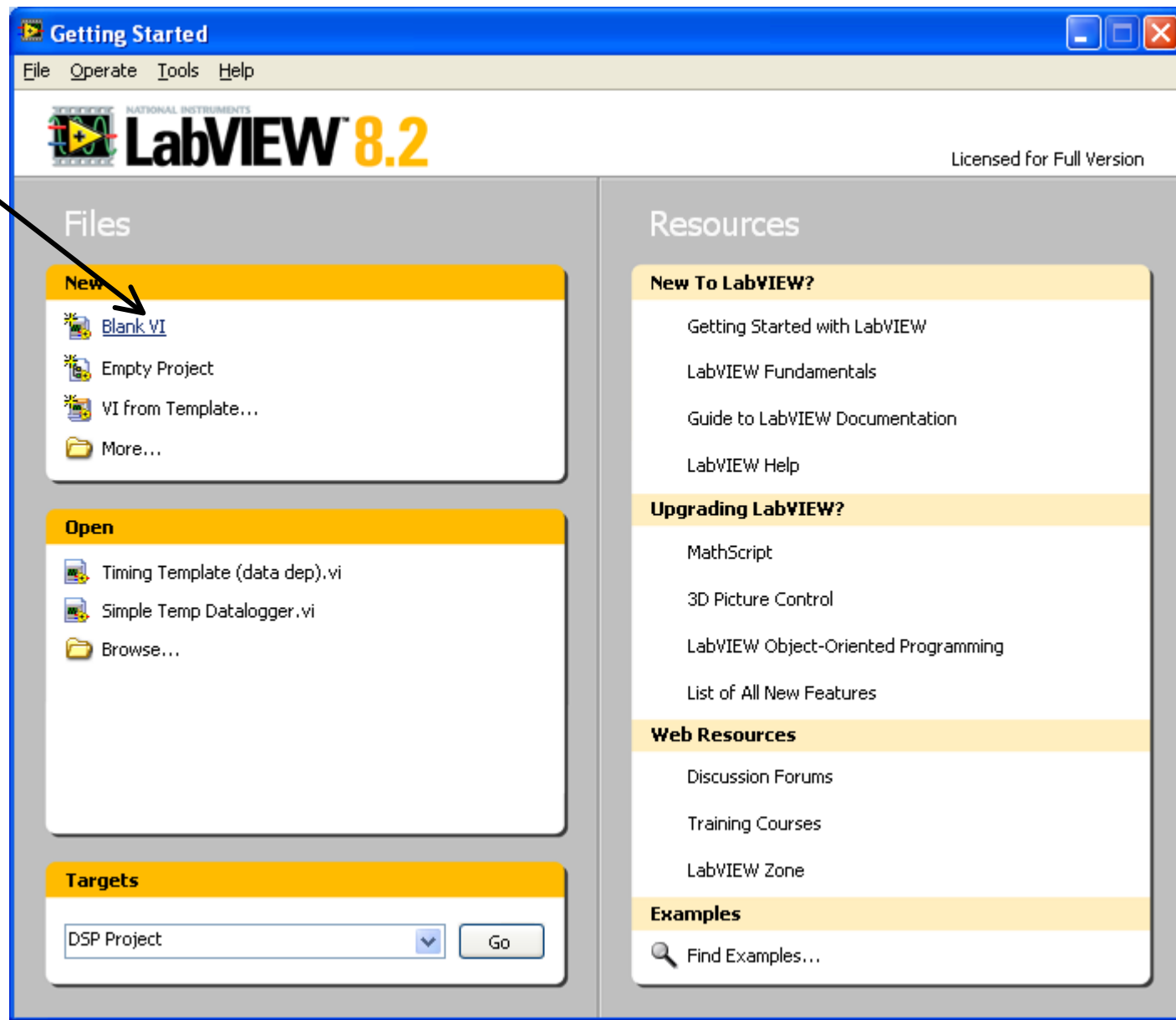
You should see the **Front Panel**.

Close any open palettes or menus to simplify the look.

Use the View menu to display the **Tools Palette**. Notice it is set to automatically choose the correct tool.

You can switch between the

Front Panel and the
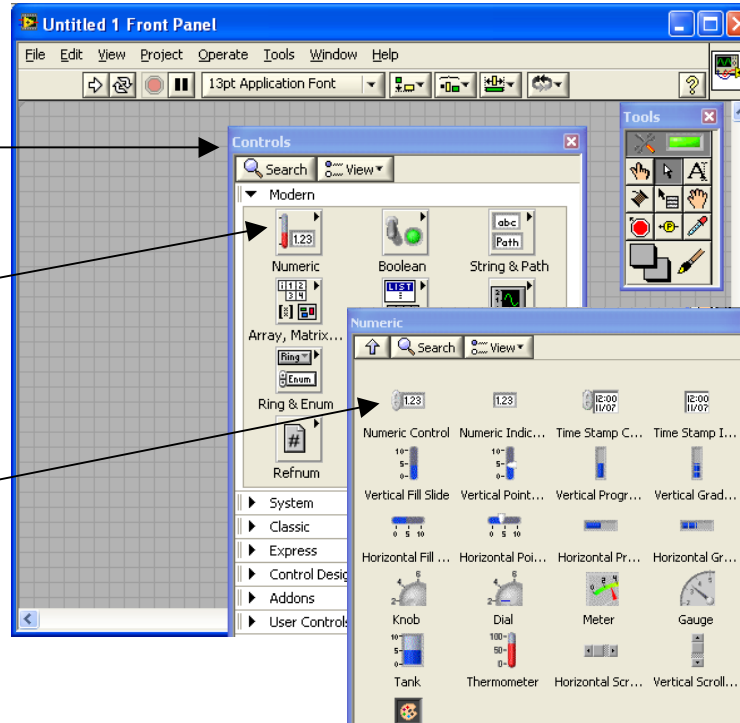
Block Diagram by using

the Ctrl-E command.

You can also use the

Window menu.

Right-click anywhere in the **Front Panel** to bring up the **Controls Palette.**

Hover over the **Numeric Controls** to see what is available.

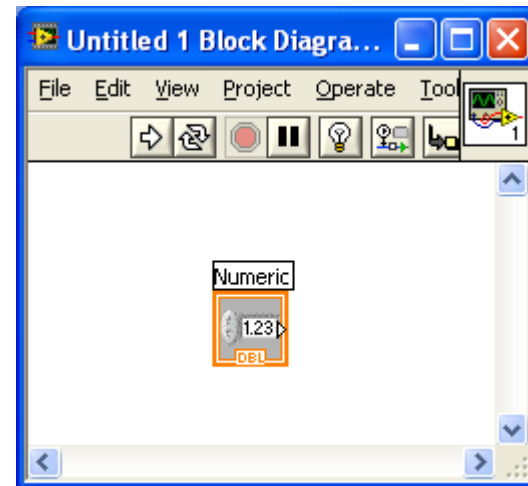Choose a simple Numeric Control with a left-click and place it on the Front Panel with another left-click.

The control icon (an input) should show up on the **Front Panel**

It's corresponding icon will show up on the **Block Diagram.**
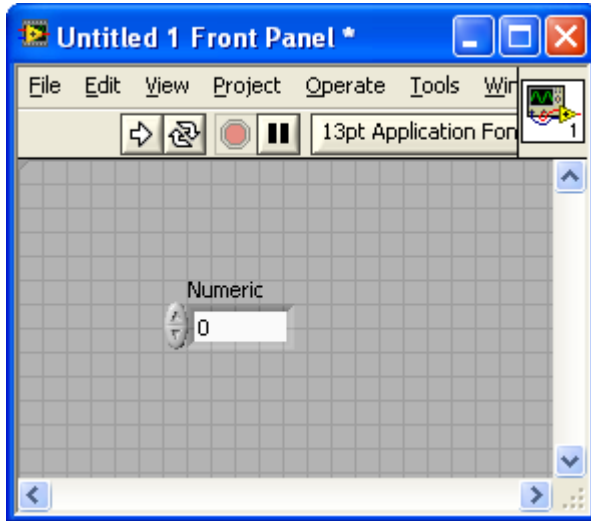
This is what a User will see to operate the program.

Change the name of the Numeric Control to "Input 1"

Use left-clicks to select and change the name.

Notice that the correct tool is chosen for you as you change the name. The name will change on both the **Front Panel** and the **Block Diagram**.
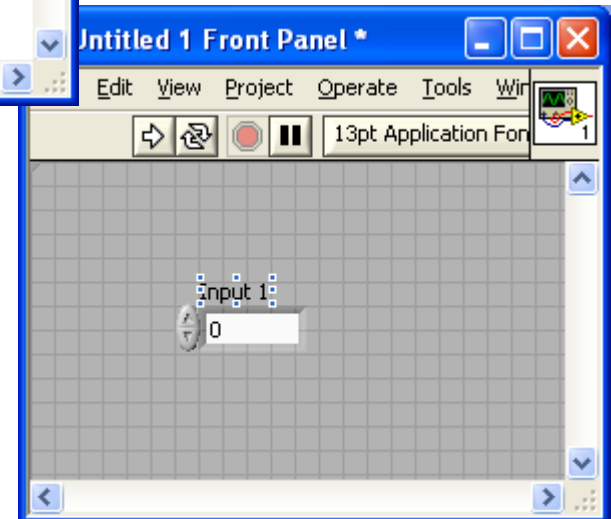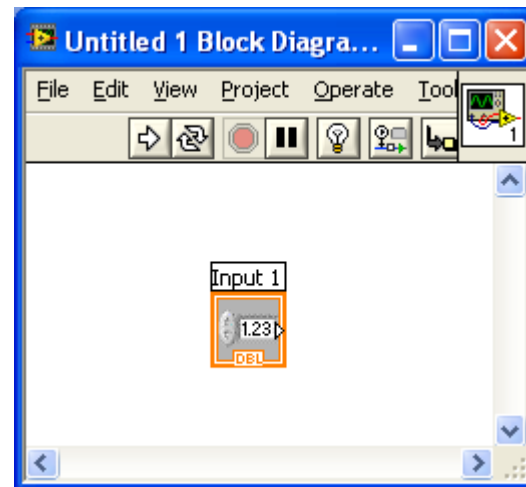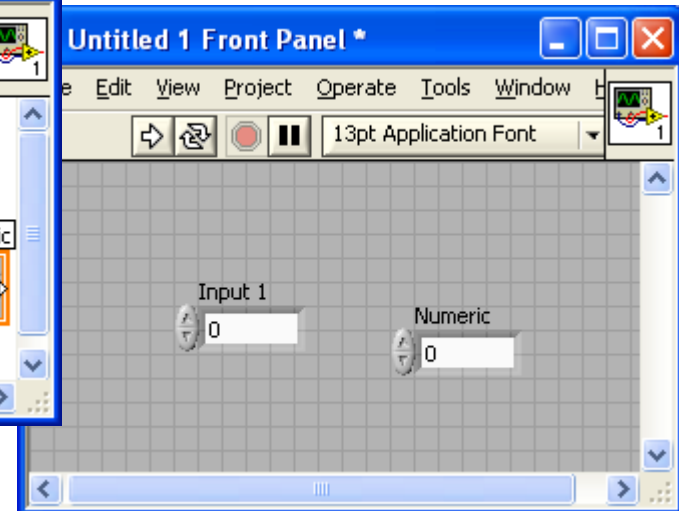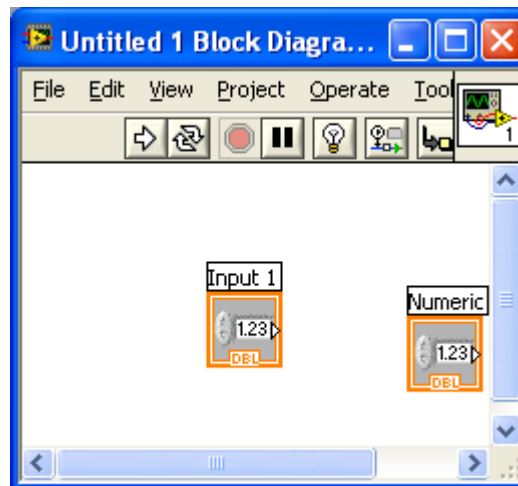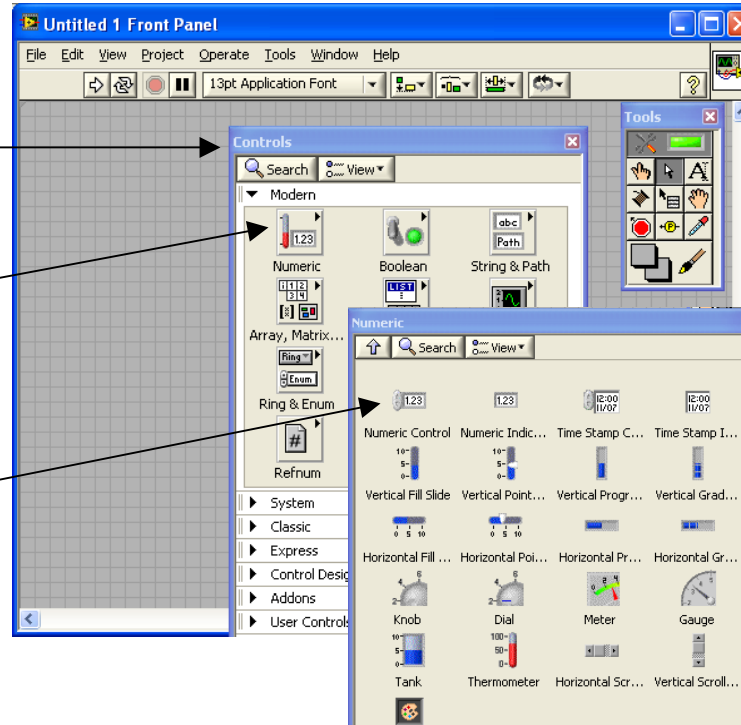
Choose the wrong Control

- You will now make your first mistake in a Labview program. This is so that you can learn how to fix a mistake.

- Go back to the **Front Panel** and create another Numeric Control

- You are smart enough to know that you may want a Numeric Indicator (an output) to pair up with the Control (the input). This is correct. But we will make the mistake and then learn a way to quickly fix the mistake which is easy to make.

Right-click on the **Front Panel** to bring up the **Controls Palette.**

Hover over the **Numeric Controls** to see what is available.

Choose a simple Numeric Control with a left-click and place it on the Front Panel with another left-click.
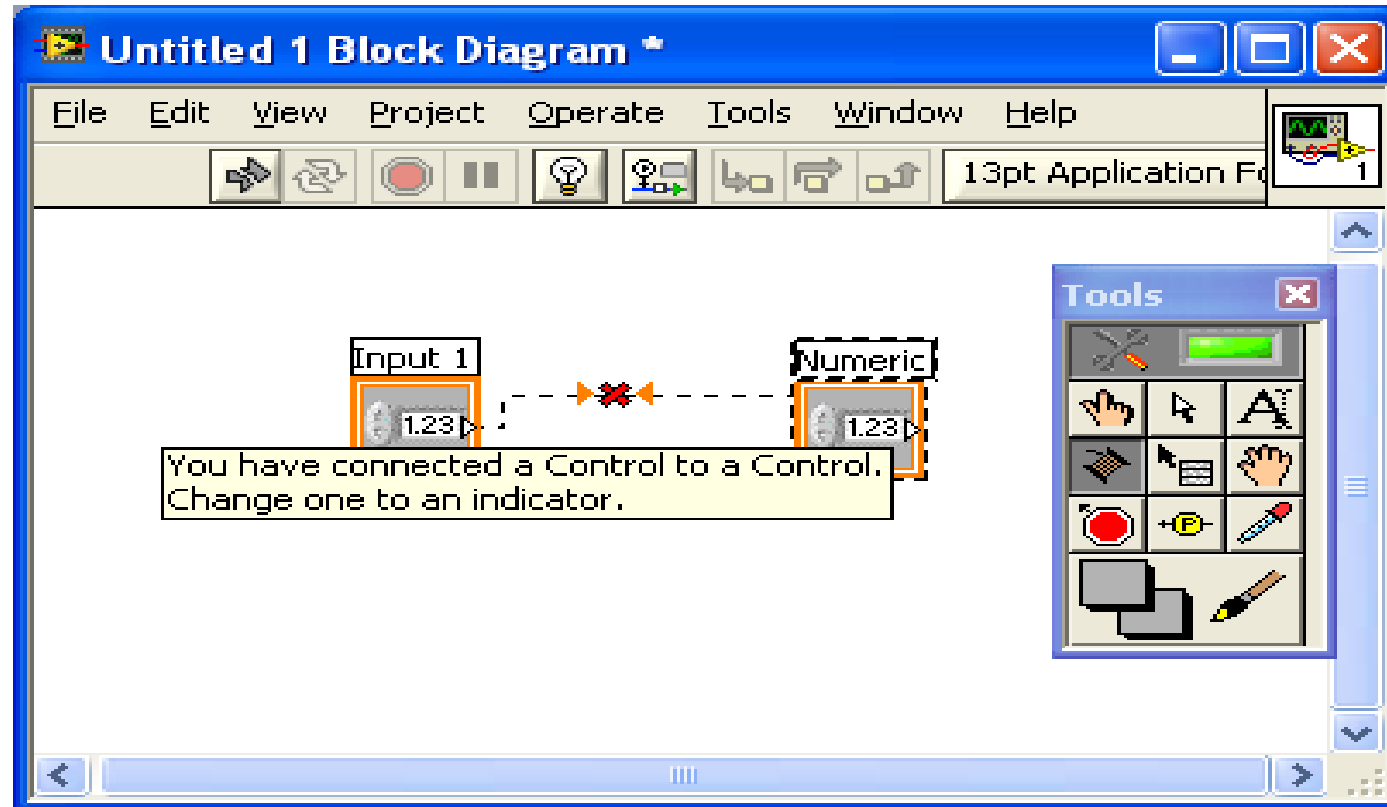
The second Numeric Control should show up both places.

Go to the **Block Diagram**

Try to wire the Input 1 to the new Numeric Control.

You do not have to choose the wire tool. It should be done automatically.

You will see a broken wire because it can not be done.

Untitled 1 Block Diagram *

File Edit View Project Operate Tools Window Help

13pt Application Fo

Input 1

1.23

Numeric

1.23

You have connected a Control to a Control.
Change one to an indicator.

Tools

Right-click on the bad Control you just created and **Change to Indicator**

The wiring should work now.

Notice the Control is thick and the Indicator is thin. Also notice the wire comes out of the right and into the left.
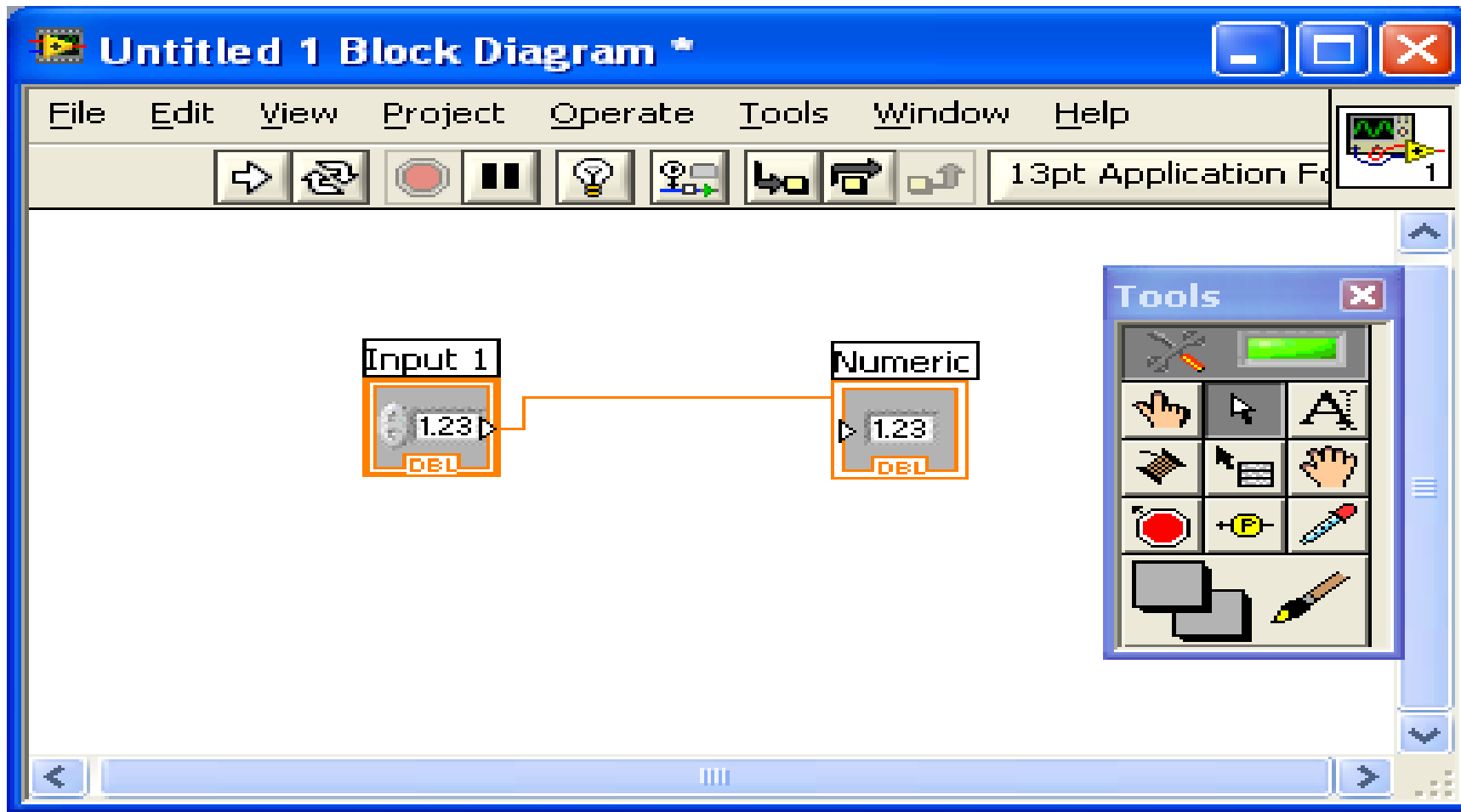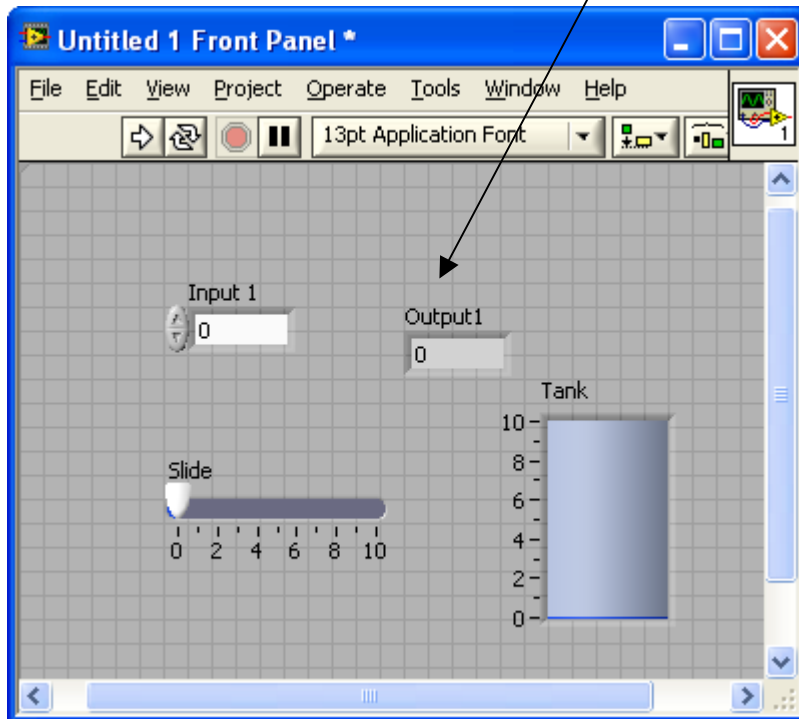
Change the name of the Indicator to Output1

Add some more Indicators to the **Front Panel** and wire them up in the **Block Diagram**. Now do it without mistakes. Choose an Indicator.
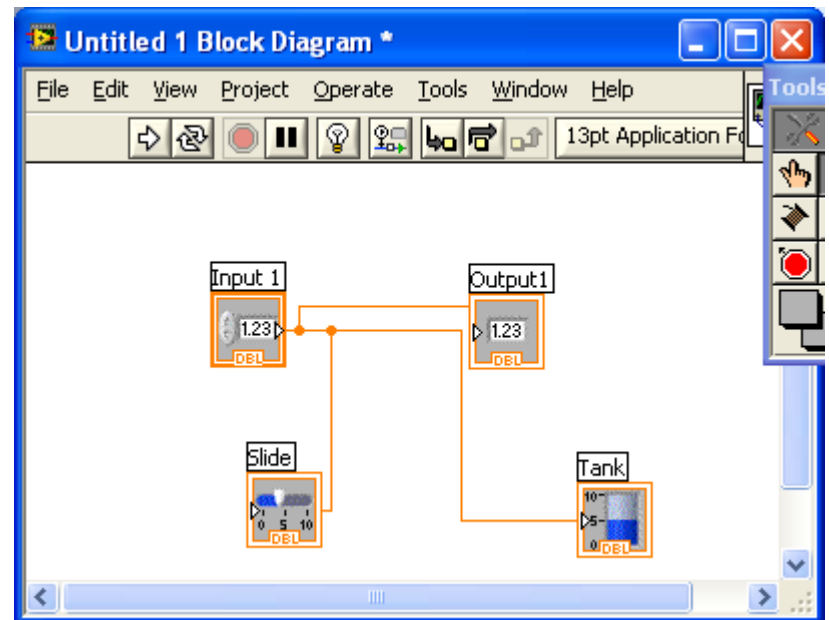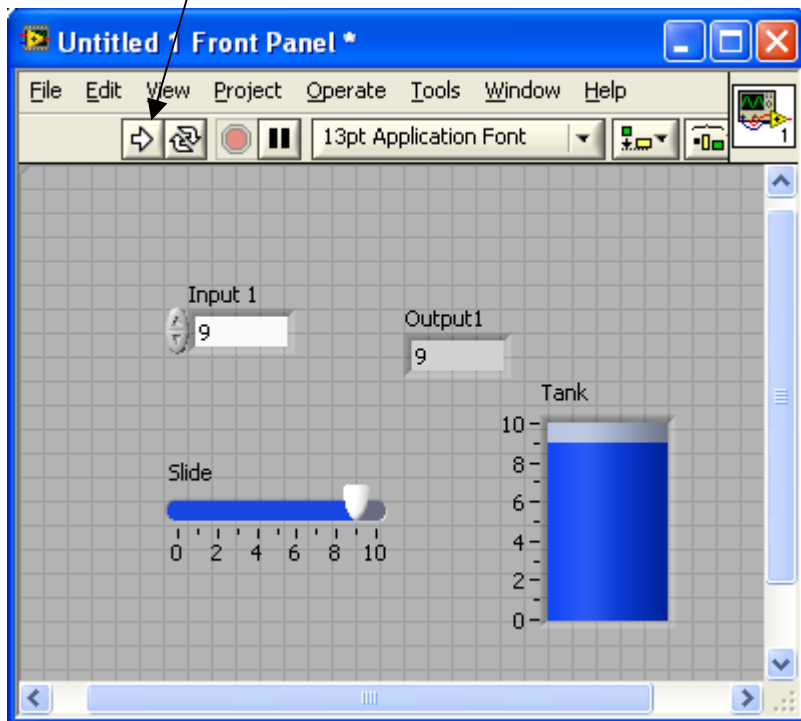
You should only have 1 Control. Input 1 should be putting its value into all the other Outputs.

No broken wires means you are ready to run.
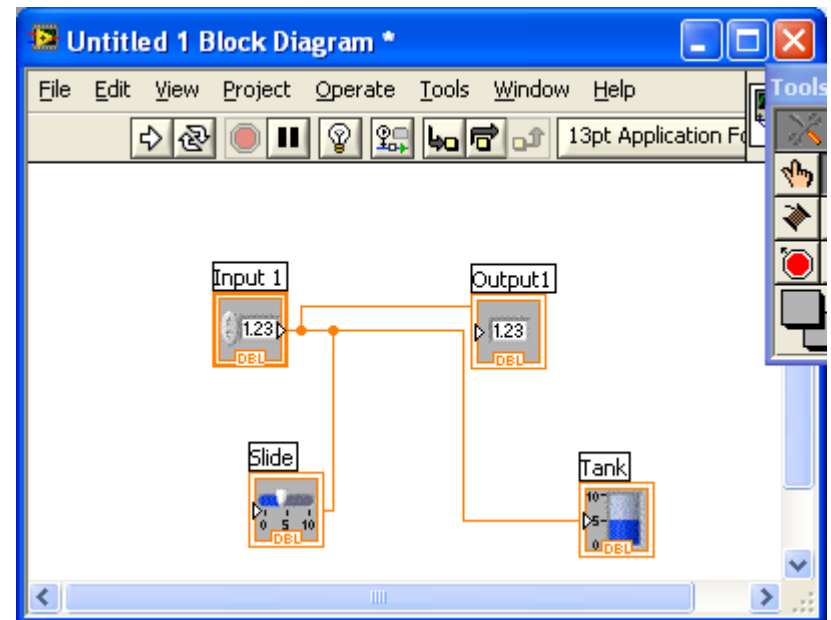
Type a number into the Input. Or use the arrows on the input to
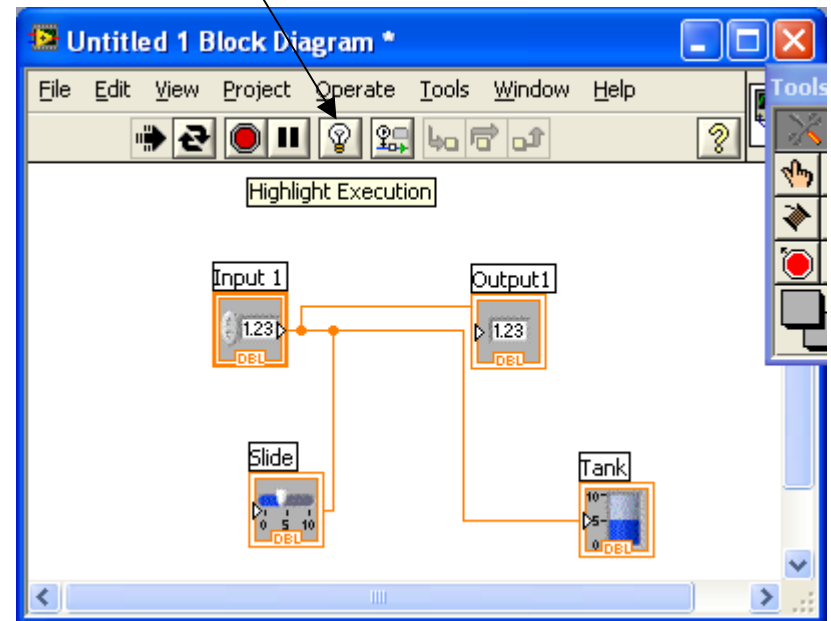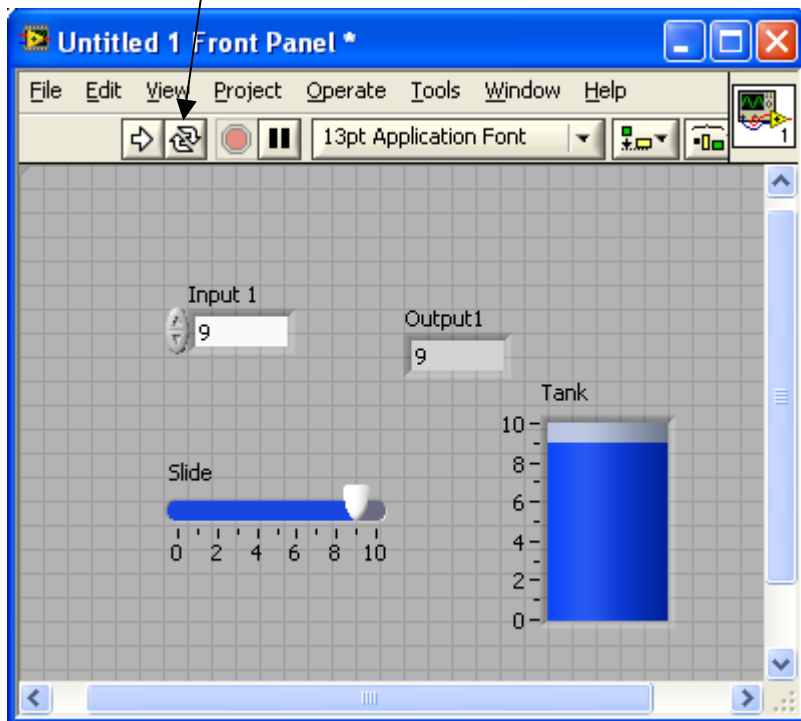select a value.

Hit the Run button on the **Control Panel**

For a more meaningful Labview experience. Hit the Run Continuously button. You should be able to figure out how to stop it.

Change the value of the input and watch the output.

Go to the **Block Diagram** and hit the Highlight Execution button. This helps in debugging programs to show the data flow through the diagram. Turn this off to speed up program execution.
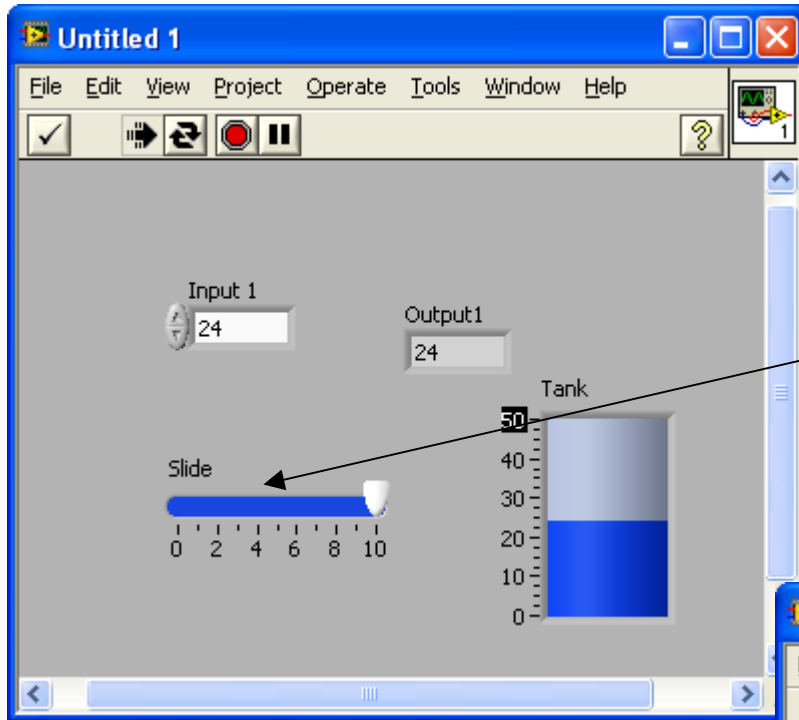
Fixing a small problem on the Indicators can be done
while the program is running.
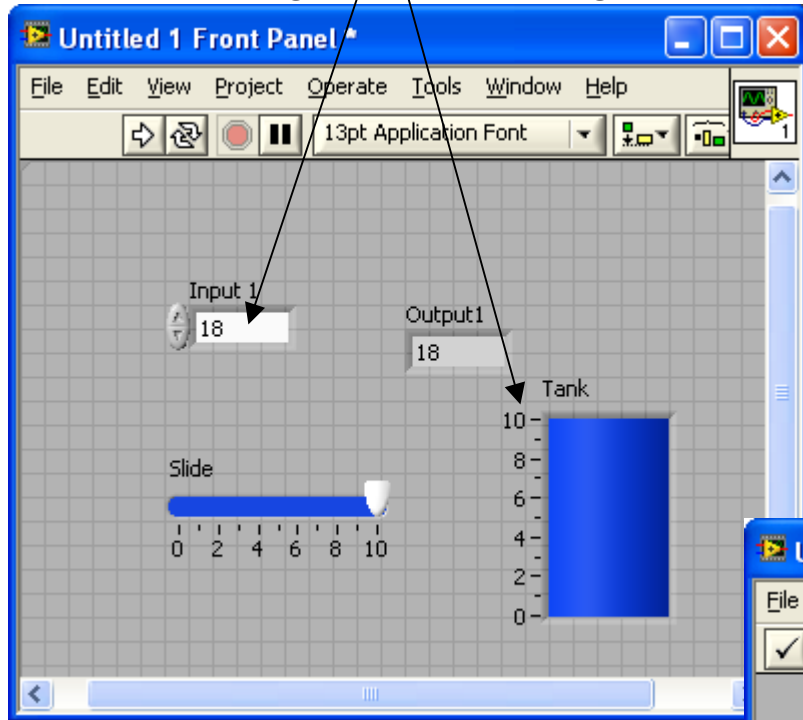
Double left-click to
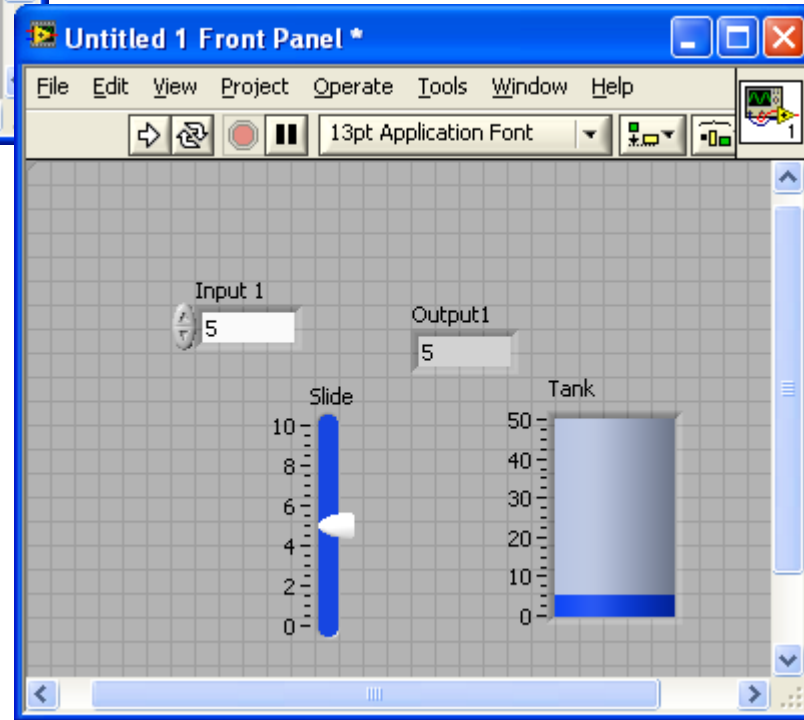select and change
values of indicators.
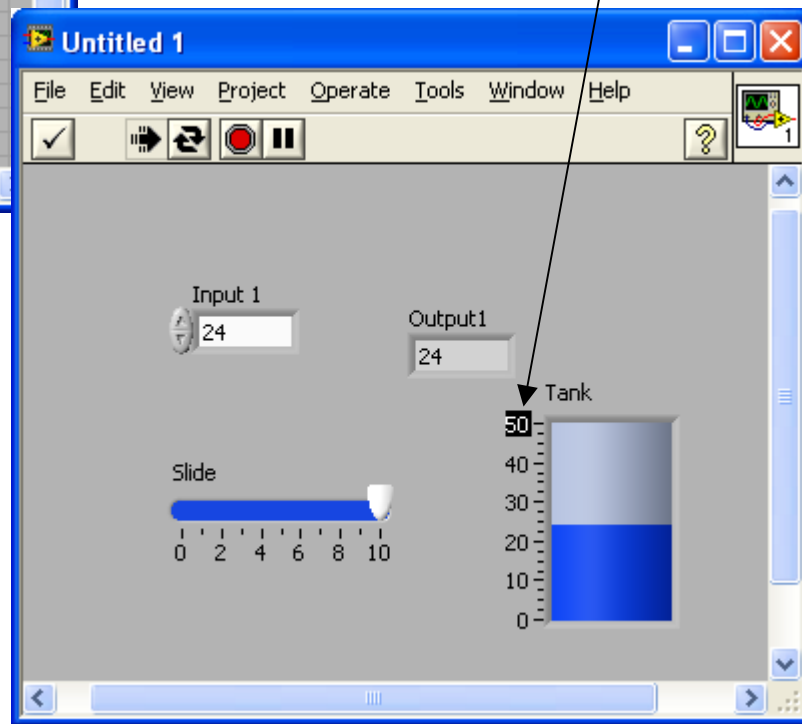
If you don't like the horizontal slide.

Stop the Program.
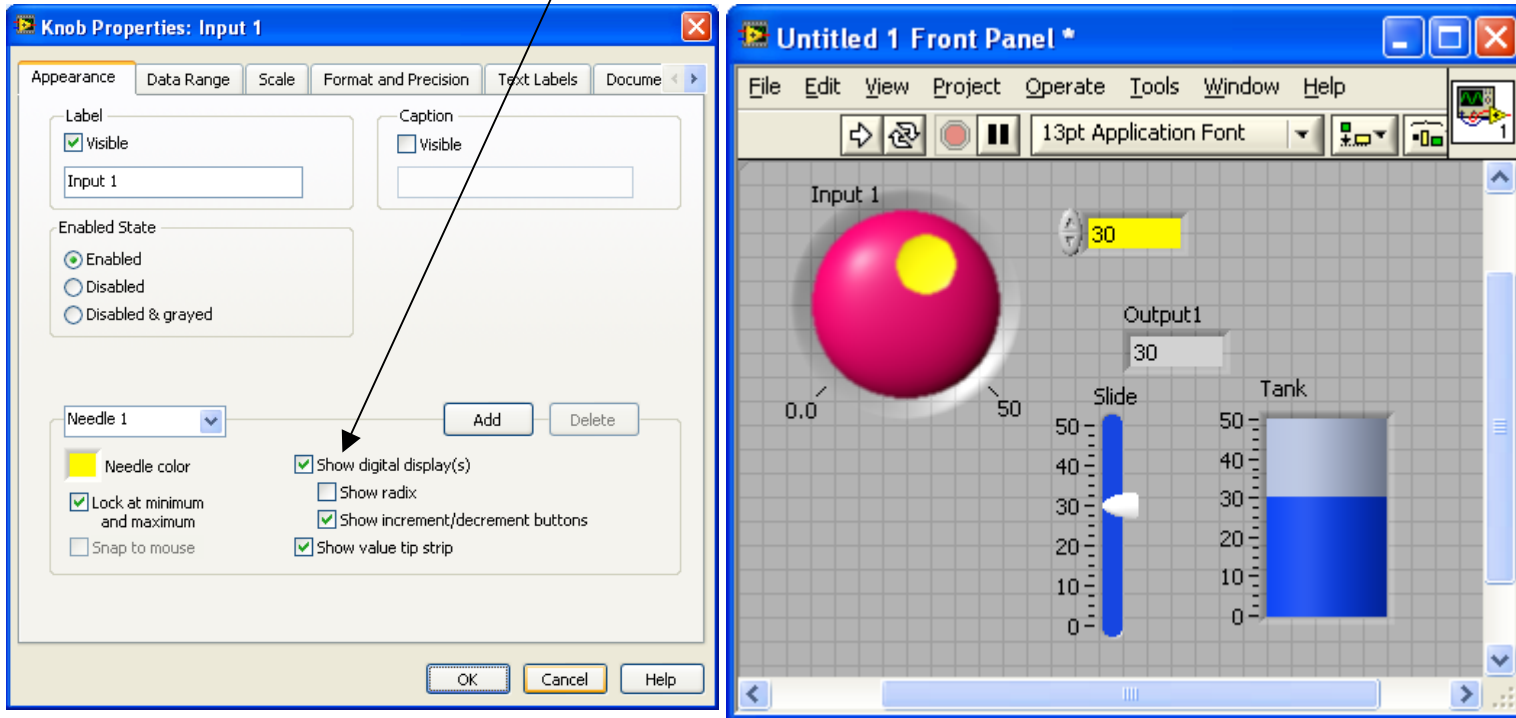
Right-click on the slide.

Replace with the item you chose.

Replace the Input Control with a Knob.

Right-click gives many options. Take some time to explore the format and precision options to make it look nice.
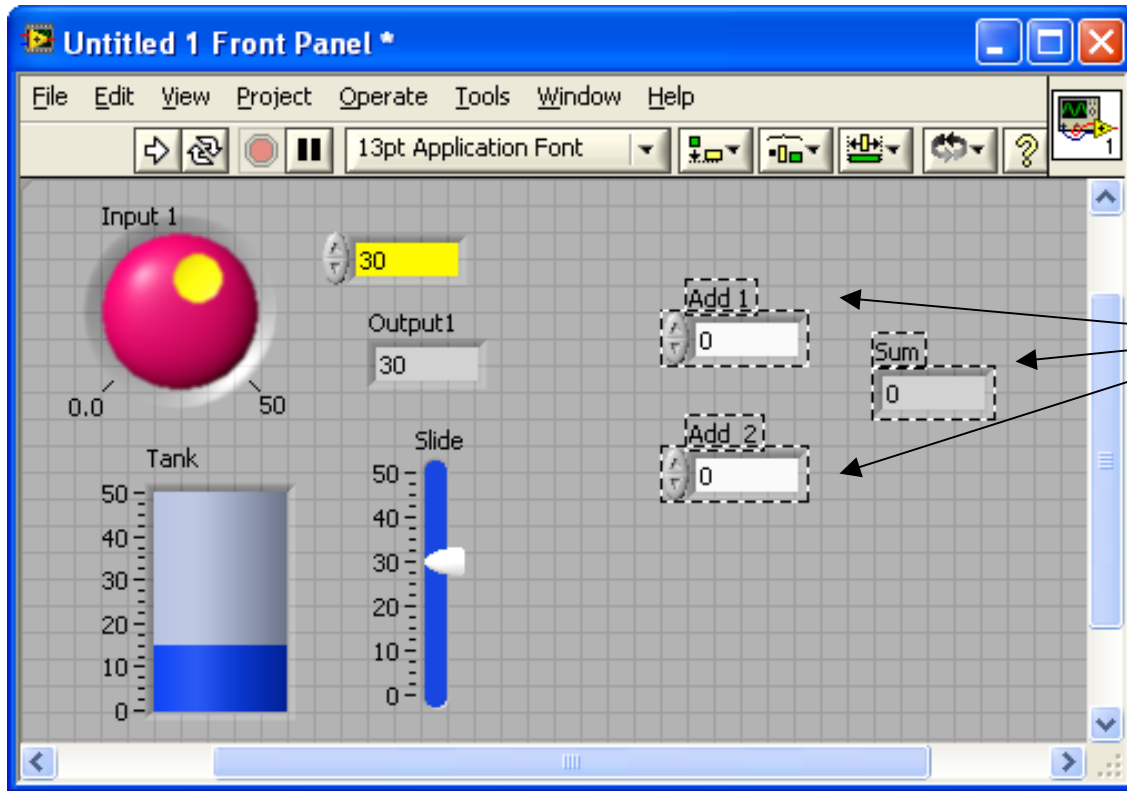
Showing the digital display is a nice option. It gives two ways to input the value for the Control.

Adding Two Inputs

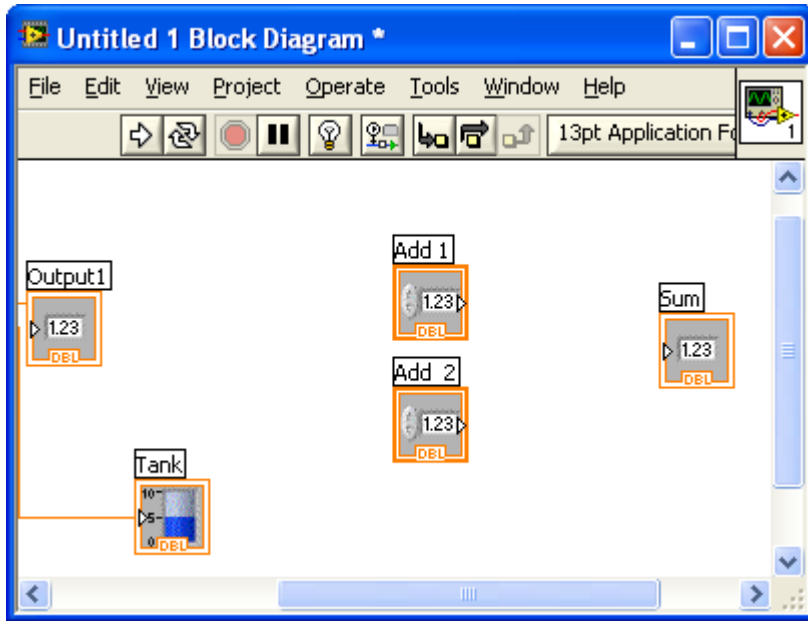On the Front Panel, create two new numeric controls (inputs) and one new numeric indicator (an output)

You will be adding the two inputs together and putting the result into the output. You will be creating a $2500 adding machine.

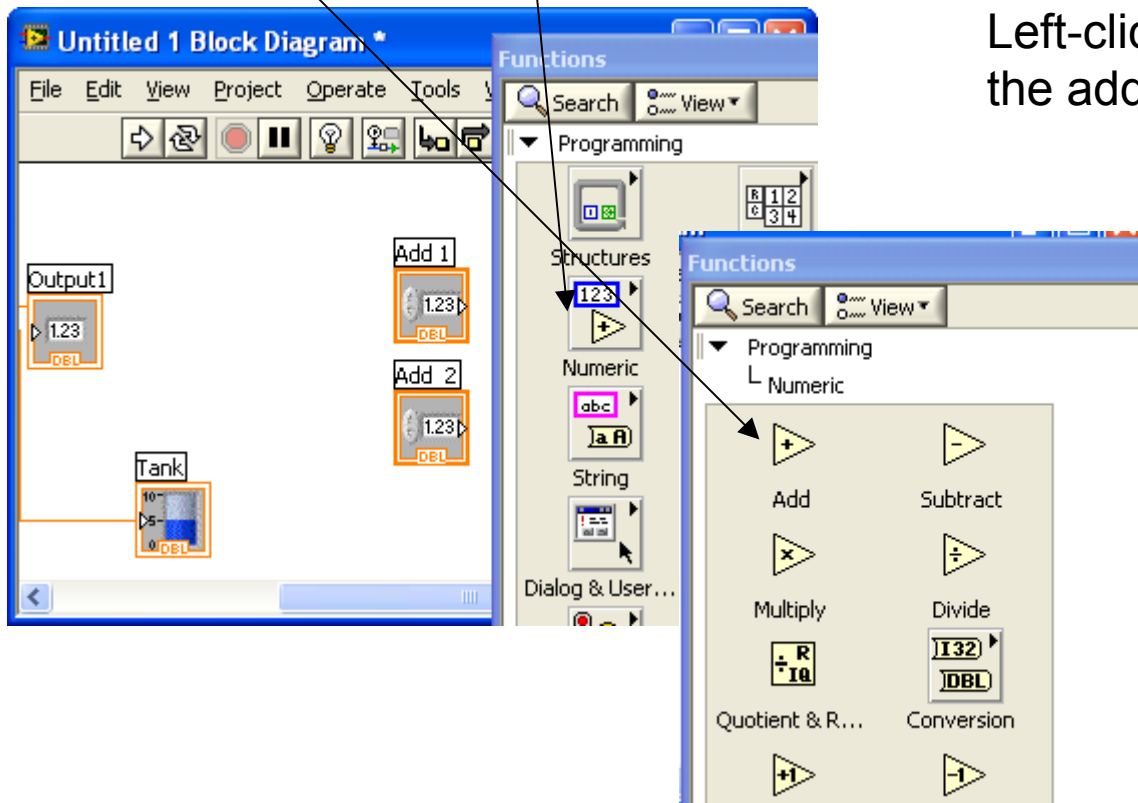Create these three simple items and rename them.

Find the new items on the **Block Diagram**.

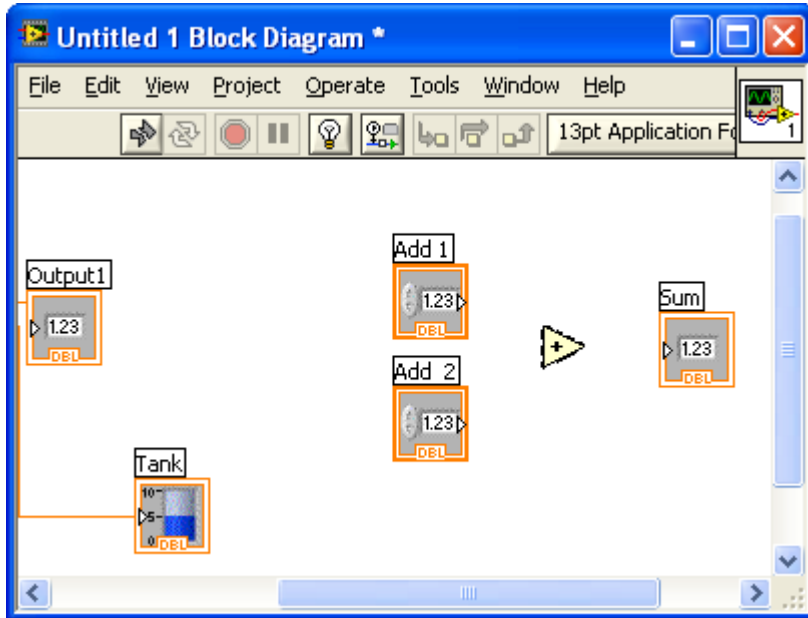They should be named correctly.

Right-click within the **Block Diagram** to bring up the Functions Palette.

Hover above the <u>Numeric</u> structure to bring up the <u>addition</u> Function Block.

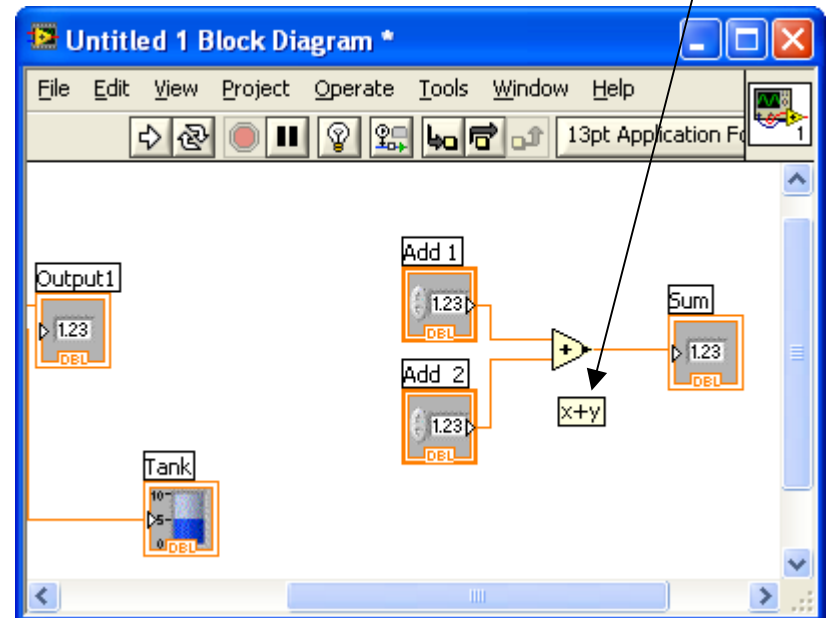Left-click to choose the addition function.

Place the Addition Function in the correct place.

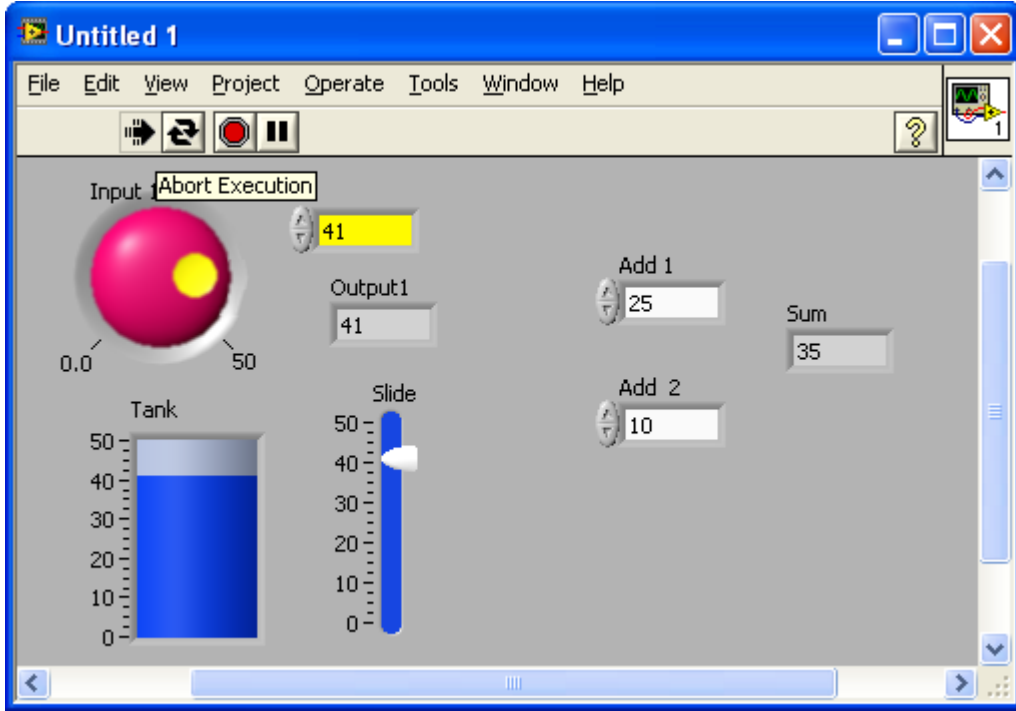

Wire the Block Diagram.

IMPORTANT!

Be careful to get the right parts of the block when you wire. Labels pop up to help, but you have to take the time to actually read them
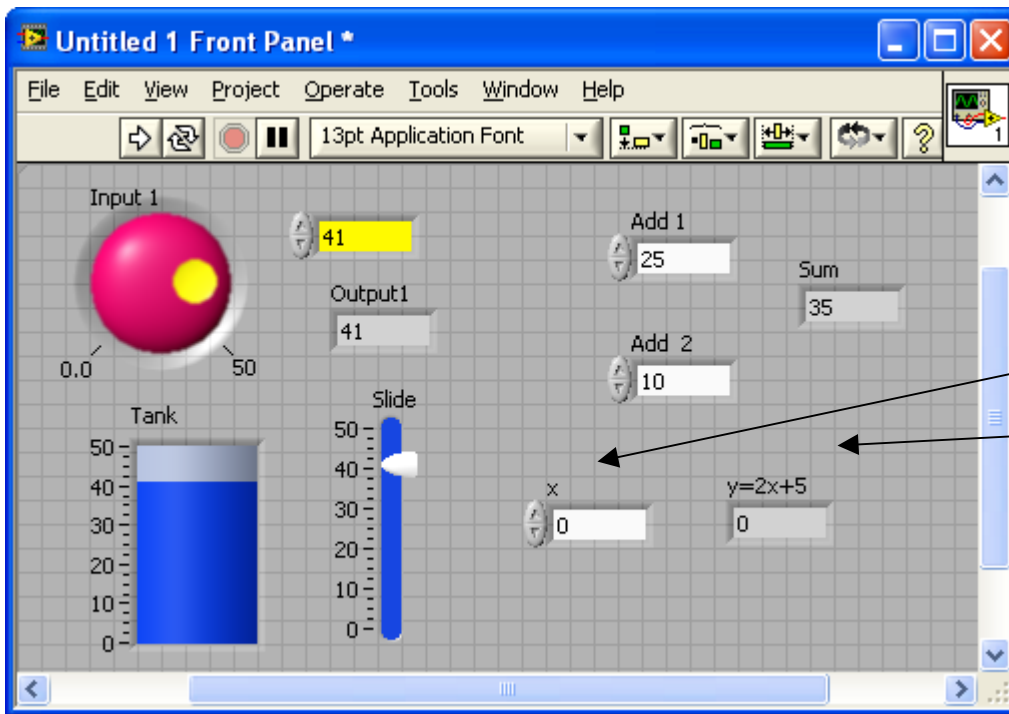
Reminder: Use Ctrl-E to swap between the Front Panel and Block Diagram.

Run your VI and make sure it is working.

Working with constants

Instead of using a control for the input. It is often useful to use a numeric constant in a math operation. Doing the operation y=2x+5 requires 1 variable for the "x" and two constants. The "2" and the "5".


Create one input and one output and label them.

Add in the multiply block and addition block from the Functions Palette. Sometimes a careful placement of the blocks will allow them to be "prewired" as soon as they are dropped in place. Make sure they are wired correctly.
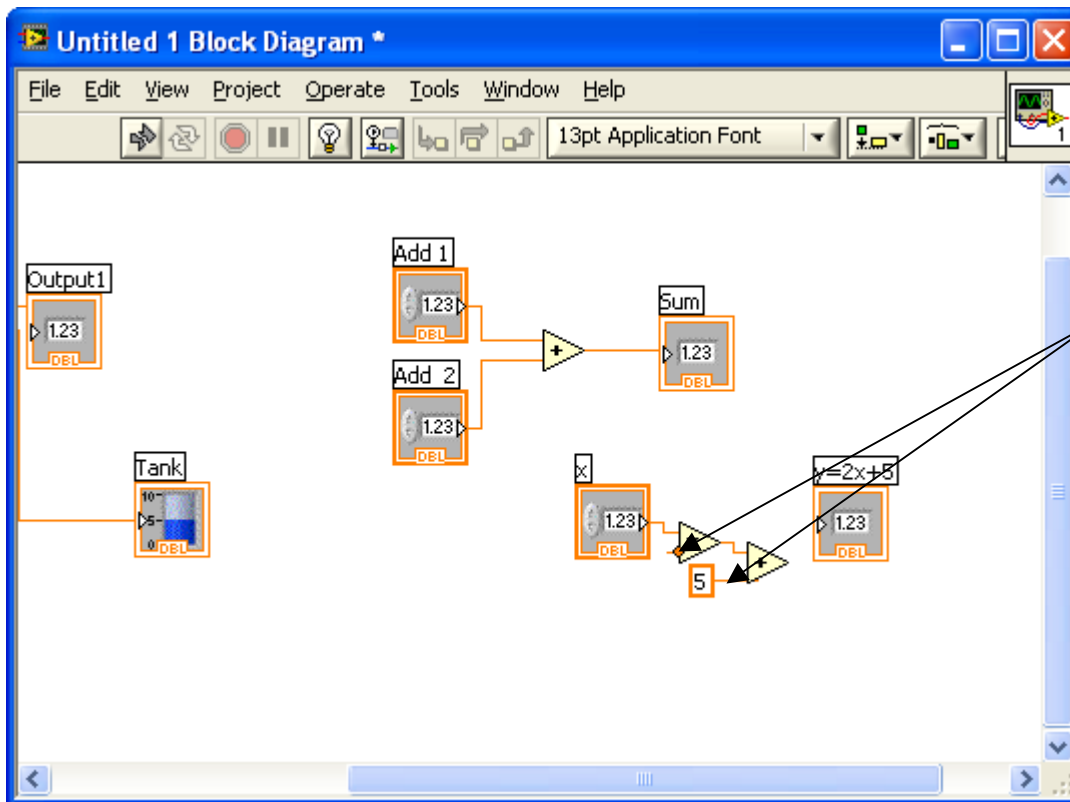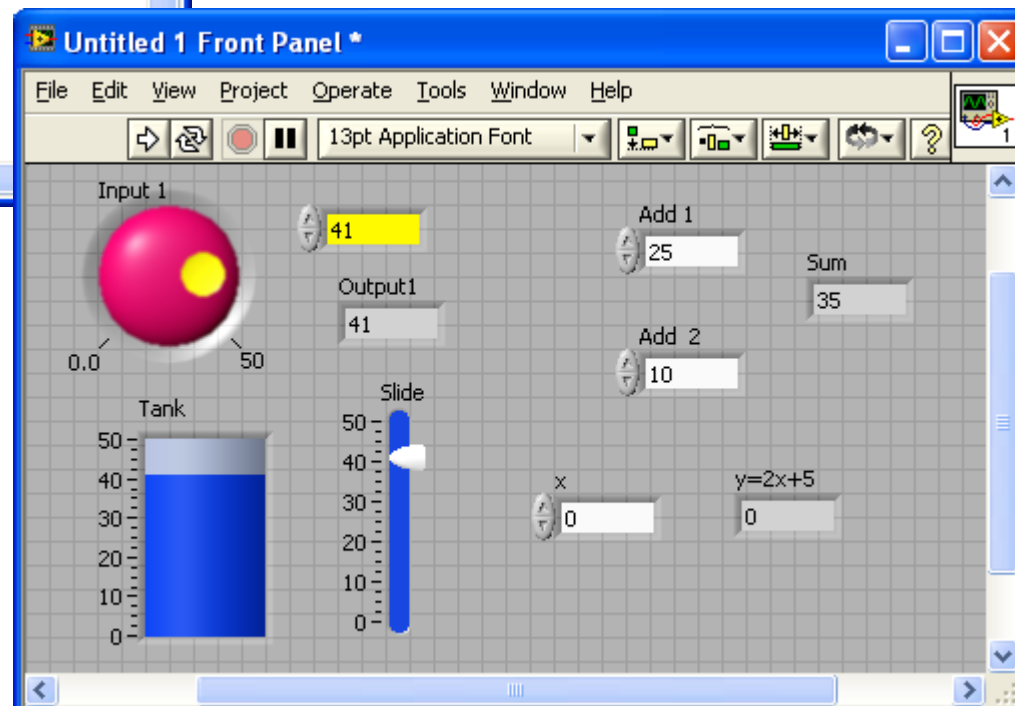

The constants are created by a right-click in the position where the wire node is.

Sorry, I can't get a screen shot of doing this. You'll figure it out.
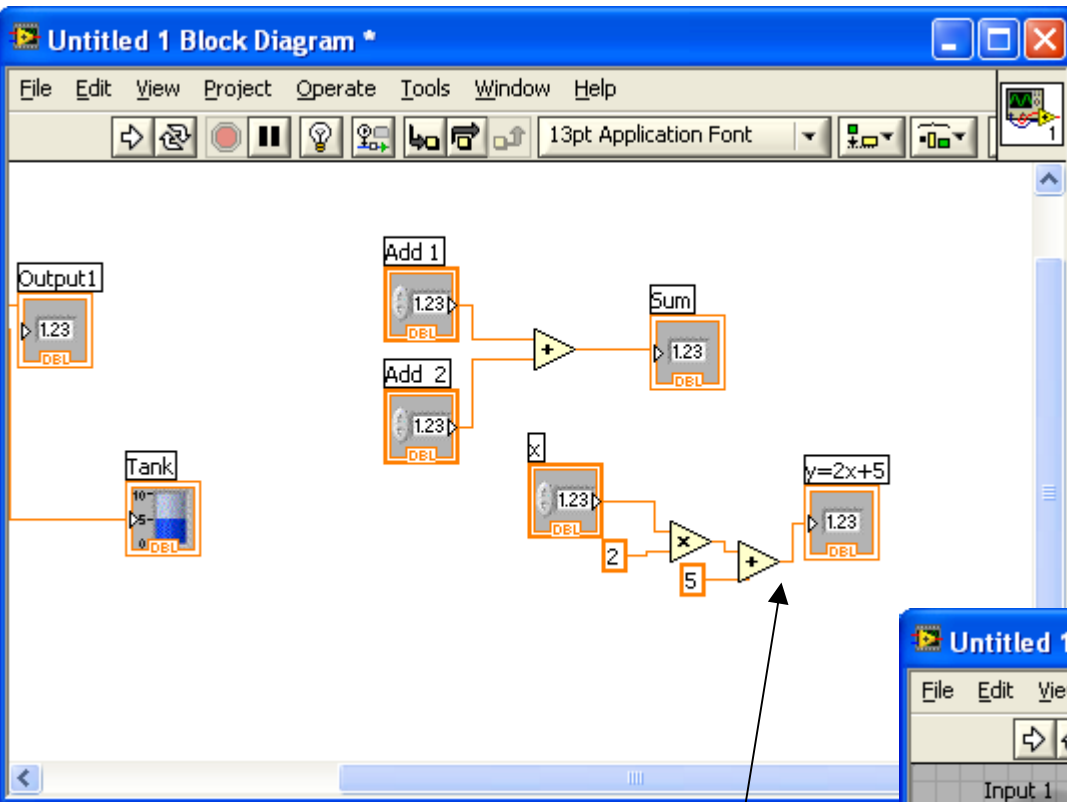
The constants do not show up on the **Front Panel** because they are not going to be changed by the user. If you want variables, you would create a control.

Running this vi should do some simple calculations.

Don't forget to wire the output into the y=2x+5 indicator.

Thanks……