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Computer programming with LabView

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Outline of the lecture

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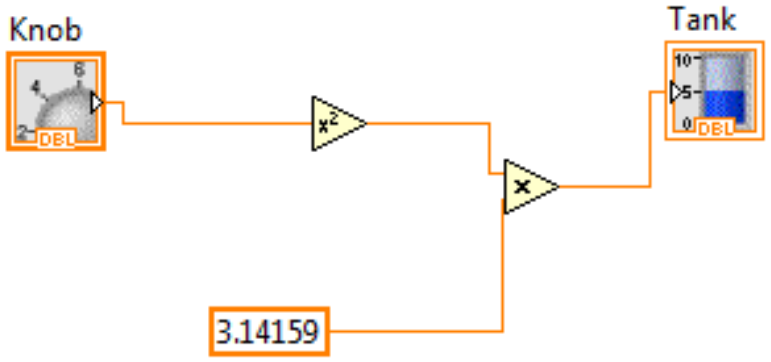
- **What is LabView and why should I know about it?**
- Starting LabView
- Input and output
- Basic mathematics
- Case statements
- For loops
- While loops
- Making an LED display segment.
- Embedding code in VIs
- Controlling instruments

The difference between a normal programming language and LabView

Matlab

```
>r=2.0
>a=3.1415*r*r
```

LabView

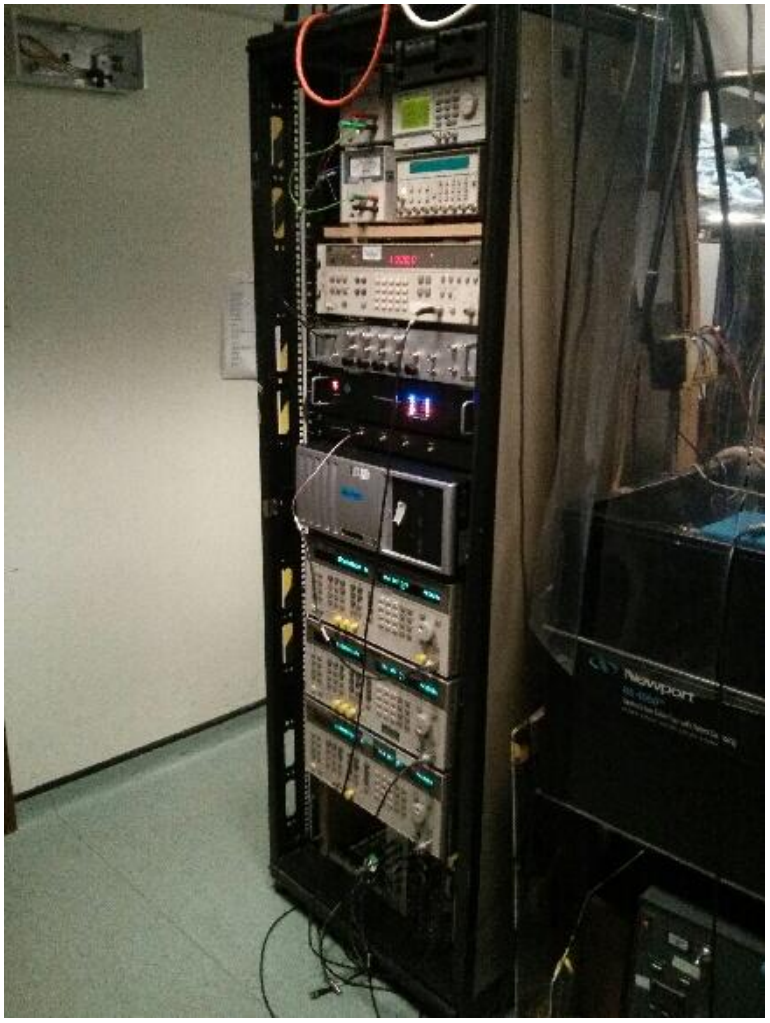


LabView is **visual** its all drag and drop and programmed with the mouse.

LabView is used to control equipment

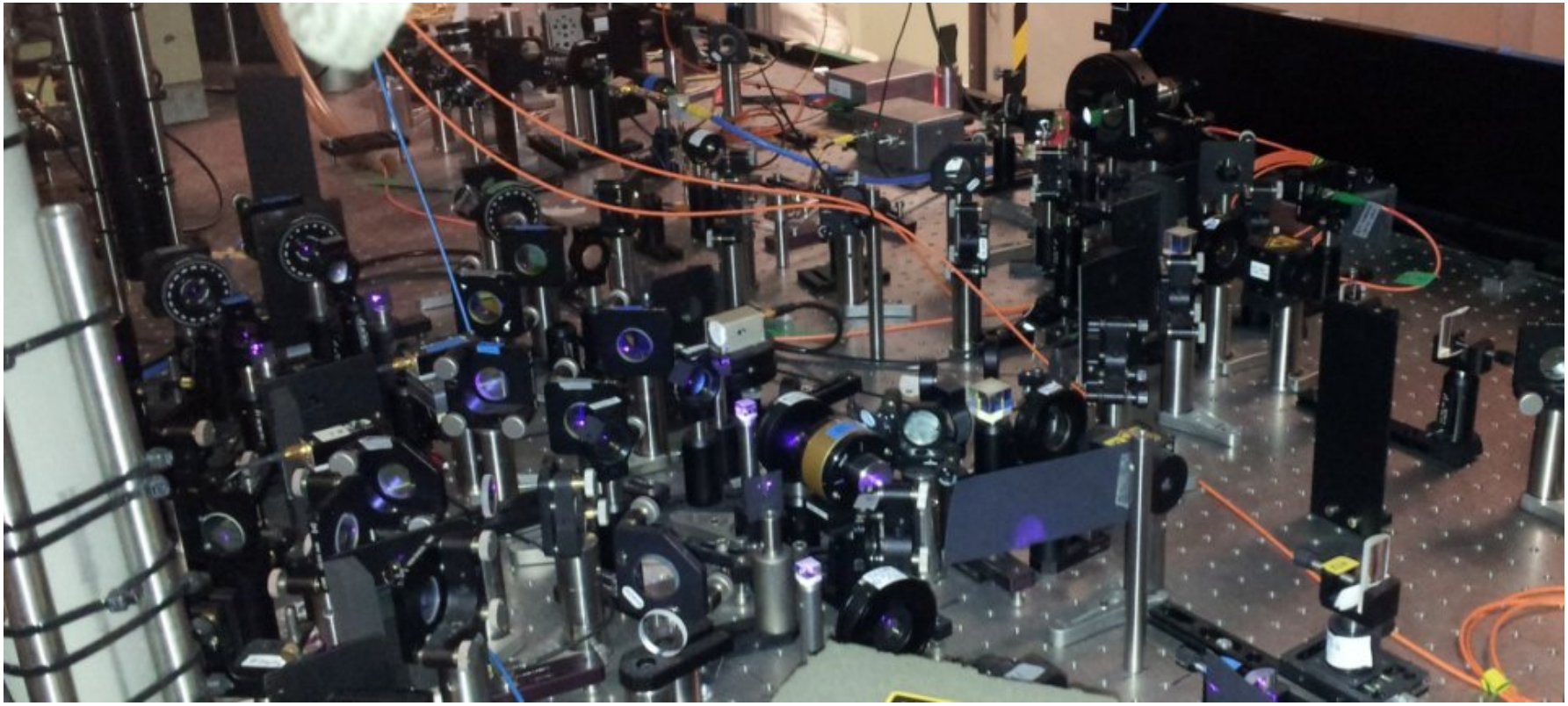
computer

USB->GPIB



To measurement system

And equipment is used to control a lab



Taking measurements in industrial settings.

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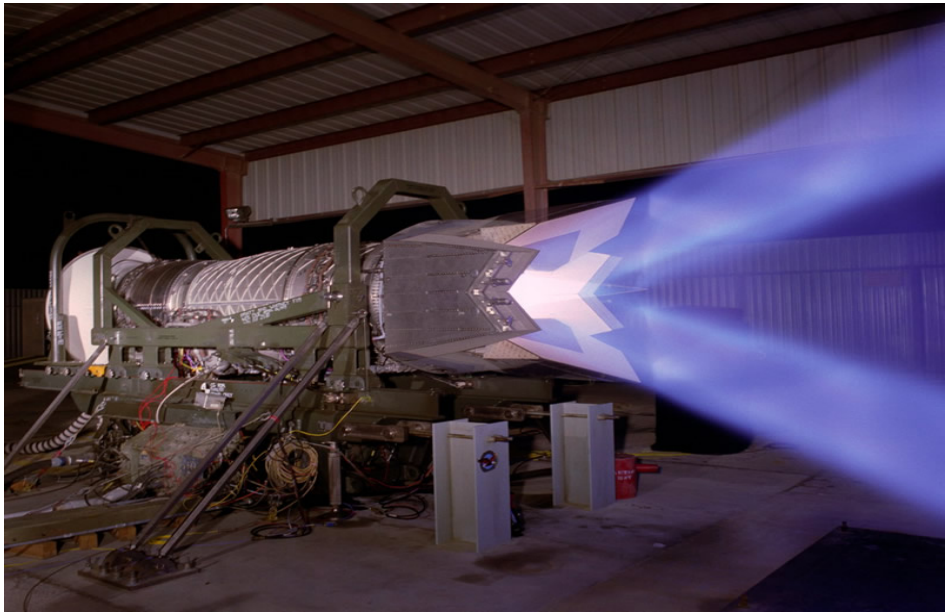
It’s also used to control measurement equipment



A more simplistic example of using LabView

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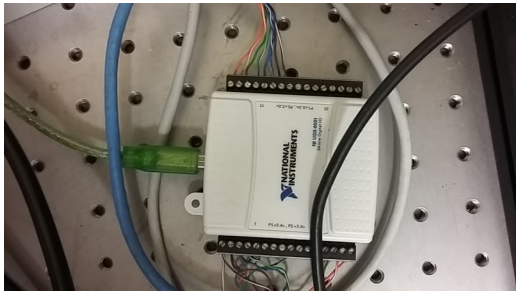
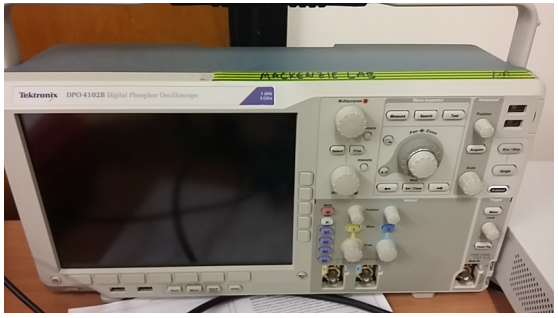
D to A



Voltage source

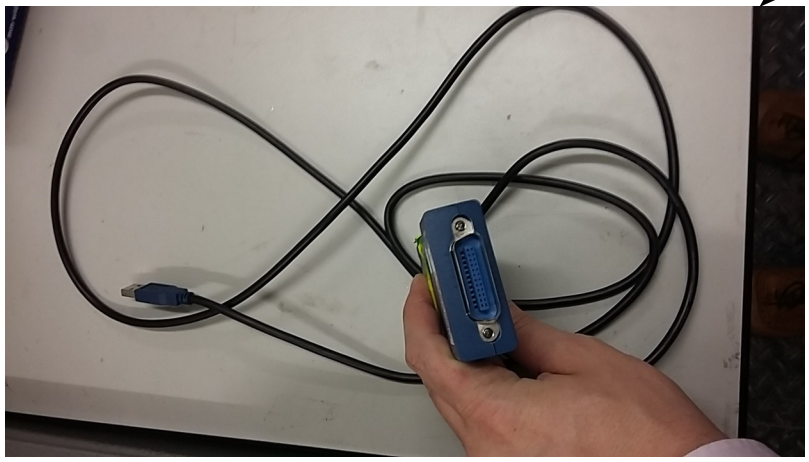
Oscilloscope



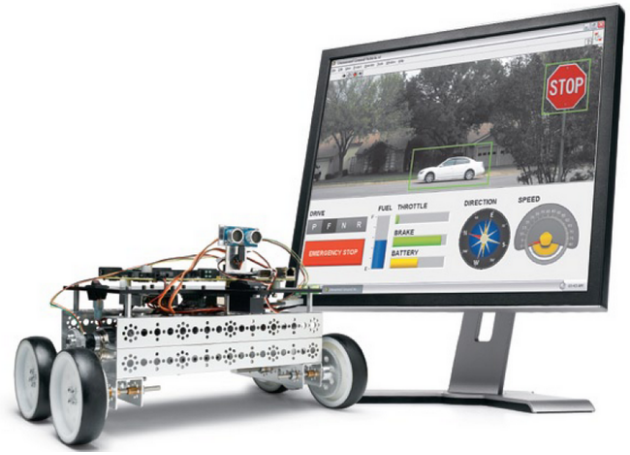
Bi-directional

Control

Data



It can control factories, robots, basically everything



This Lego vehicle has a lightweight grasping hand in front.

All without having to write a line of code because it's visual

Advantages/Disadvantages of LabView

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Advantages

- It's super handy to control stuff.
- You don't really need to write computer code.
- Manufactures of ALL industrial/lab equipment provide LabView drivers.
- Super easy to interface with experimental kit.

Disadvantages

- For some tasks it can be really good, and for some tasks it can be really bad.
- Controlling robots, good processing text, bad.
- It's expensive 3k for one license.

What ***will*** I learn today?

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- The real basics of LabView.

- I want to give you ***exposure to it***, so that if you find your self in a lab with LabView running it, you will be able to edit the code.

- The class will be totally practical based

  no theory.

- If you become a manager, and never program LabView your self, I expect you will supervise people who do use it. So, it's a good idea to know what it is.

What ***will I not*** learn today?

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- You are not going to be an expert in LabView
  - This would take me 2-3 days of lectures.
  - NI do run LabView courses with accreditation, look out for these.

- Due to the size of the class/time we can't actually control hardware today. But it's only a really tiny step from what we are doing today to controlling real hardware.

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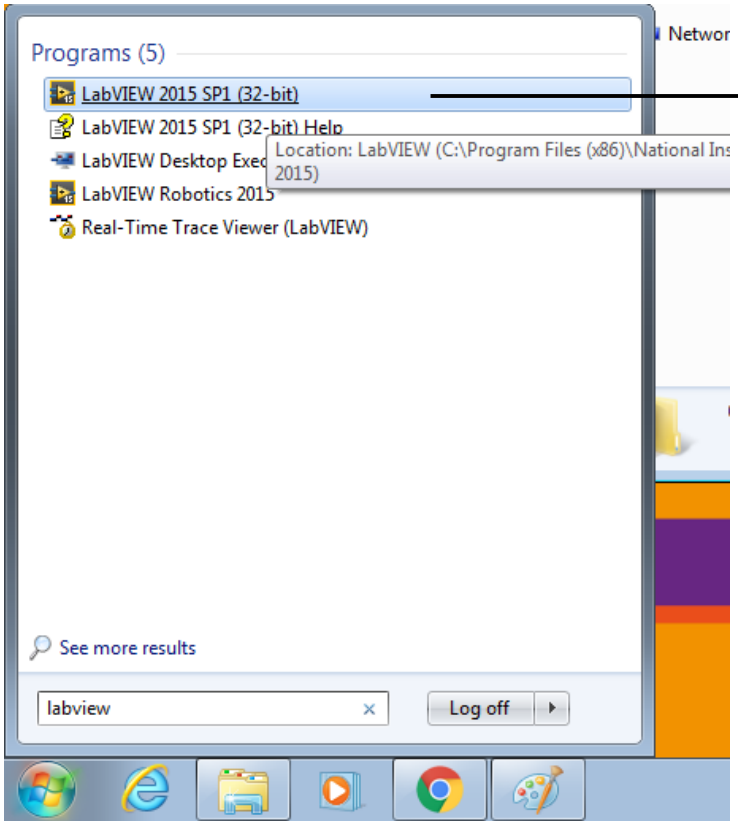
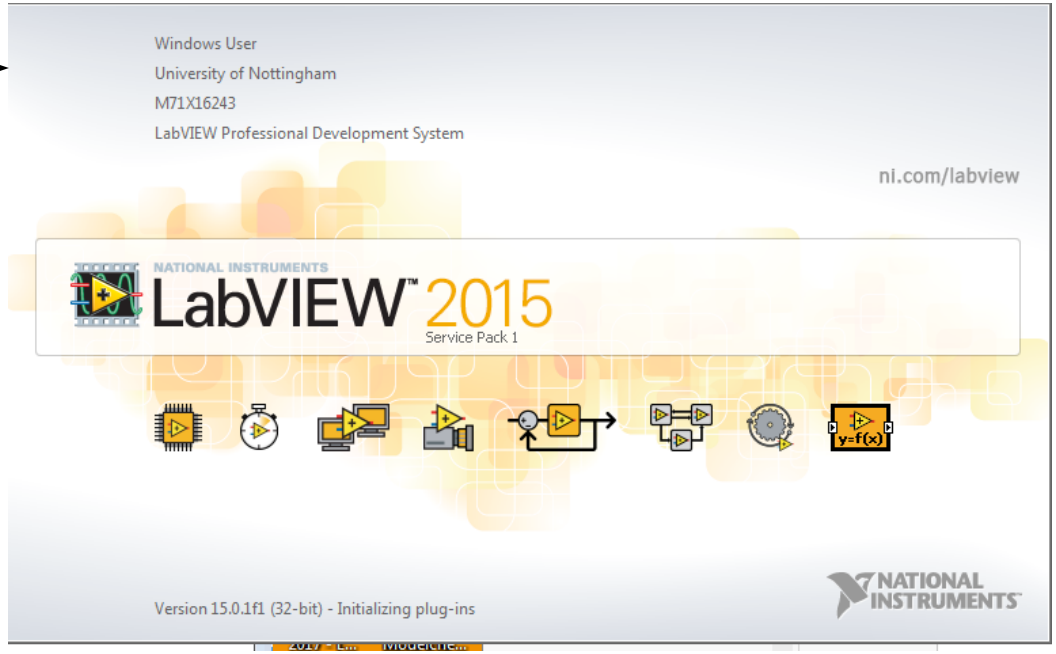
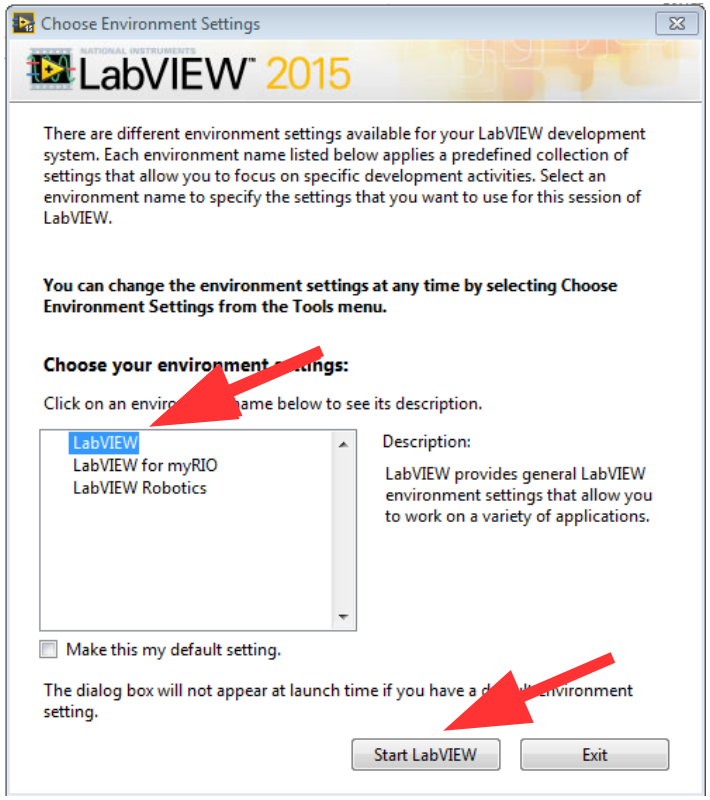
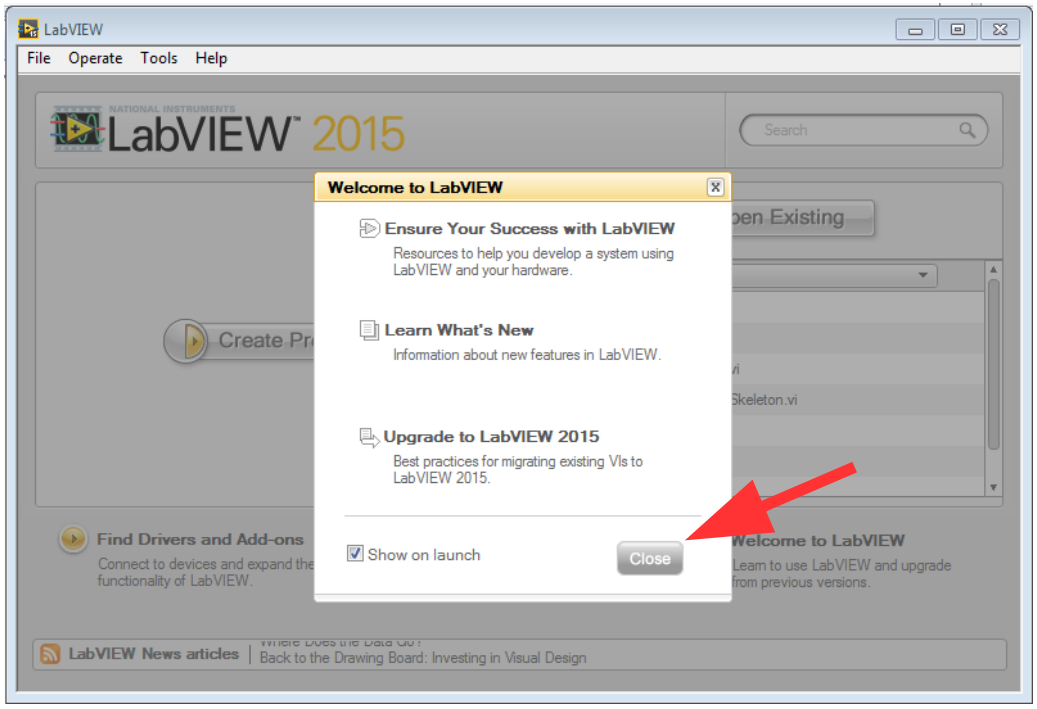
Starting LabView.



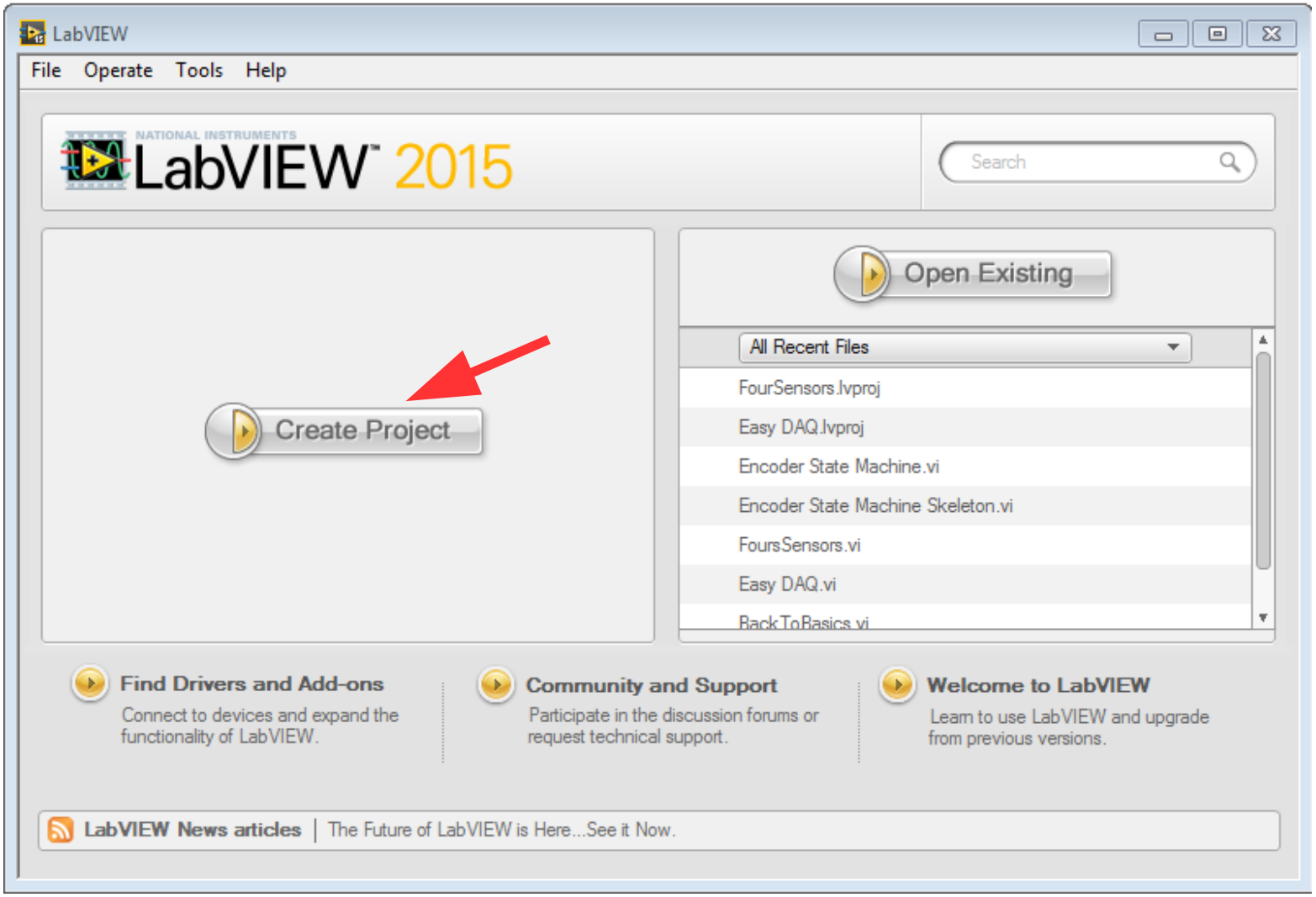


Starting LabView.

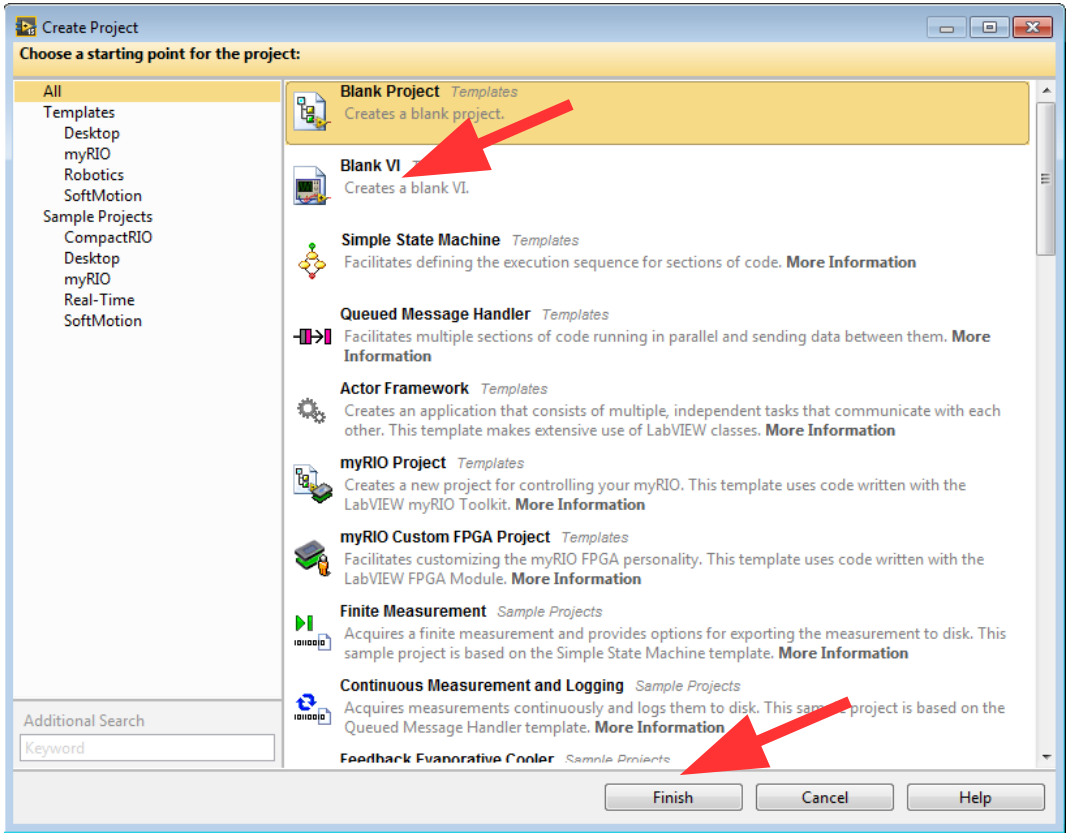




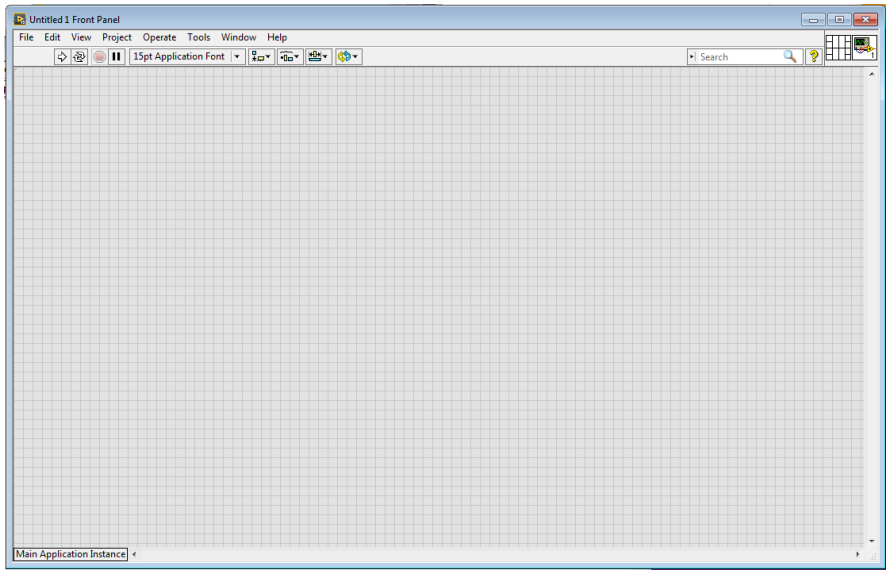
Starting LabView.

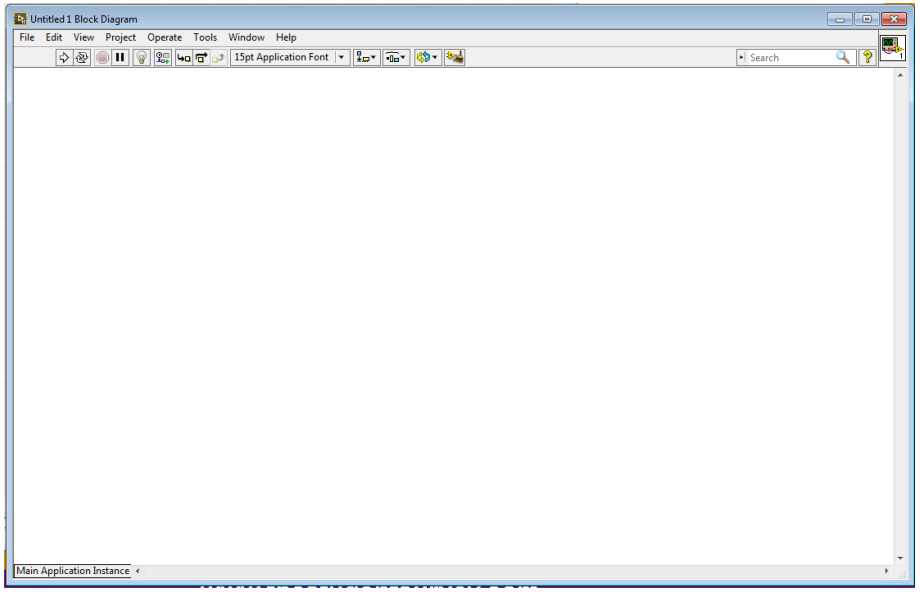


Making a new program (these are called VIs in LabView)



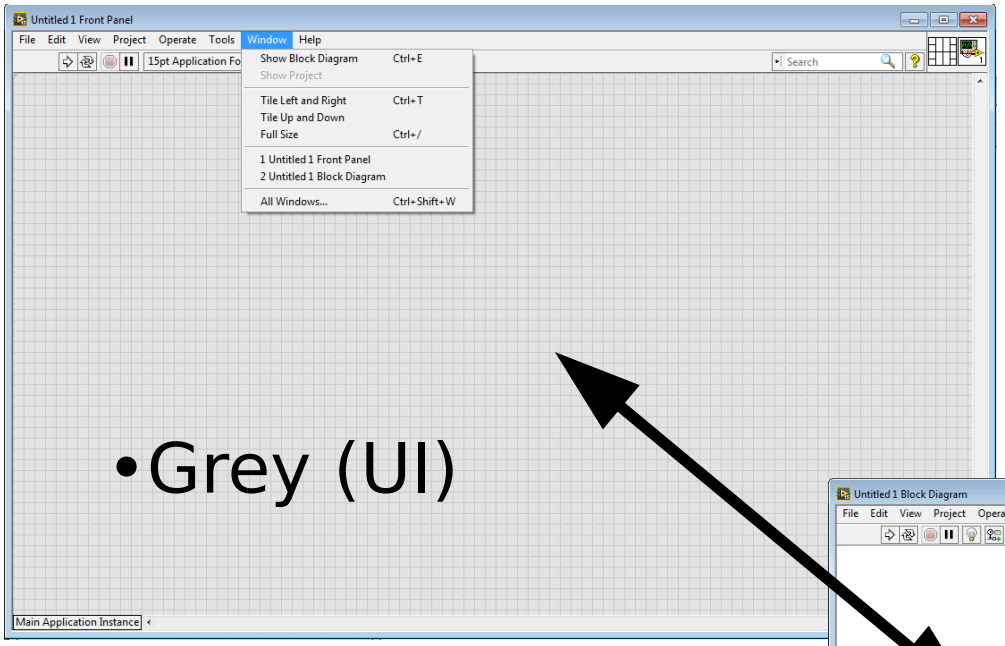
You should get two windows



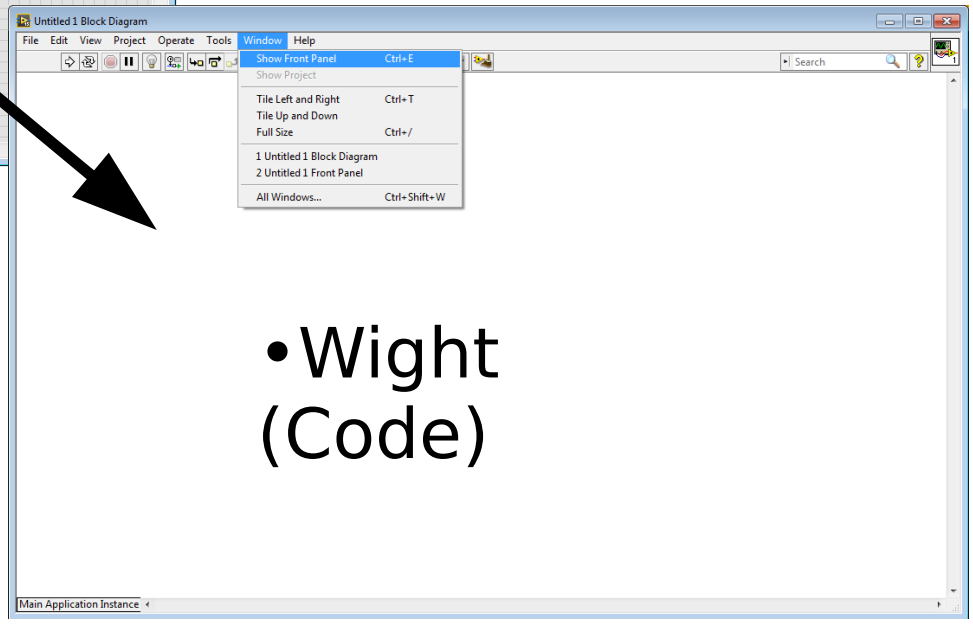


- This is where the user interface goes.
- And this as the front end
- This is where the ‘code’ goes.
- You can think of this as the back end.

If you close one window you can get to the other through the Window menu.



•Grey (UI)



•Wight (Code)

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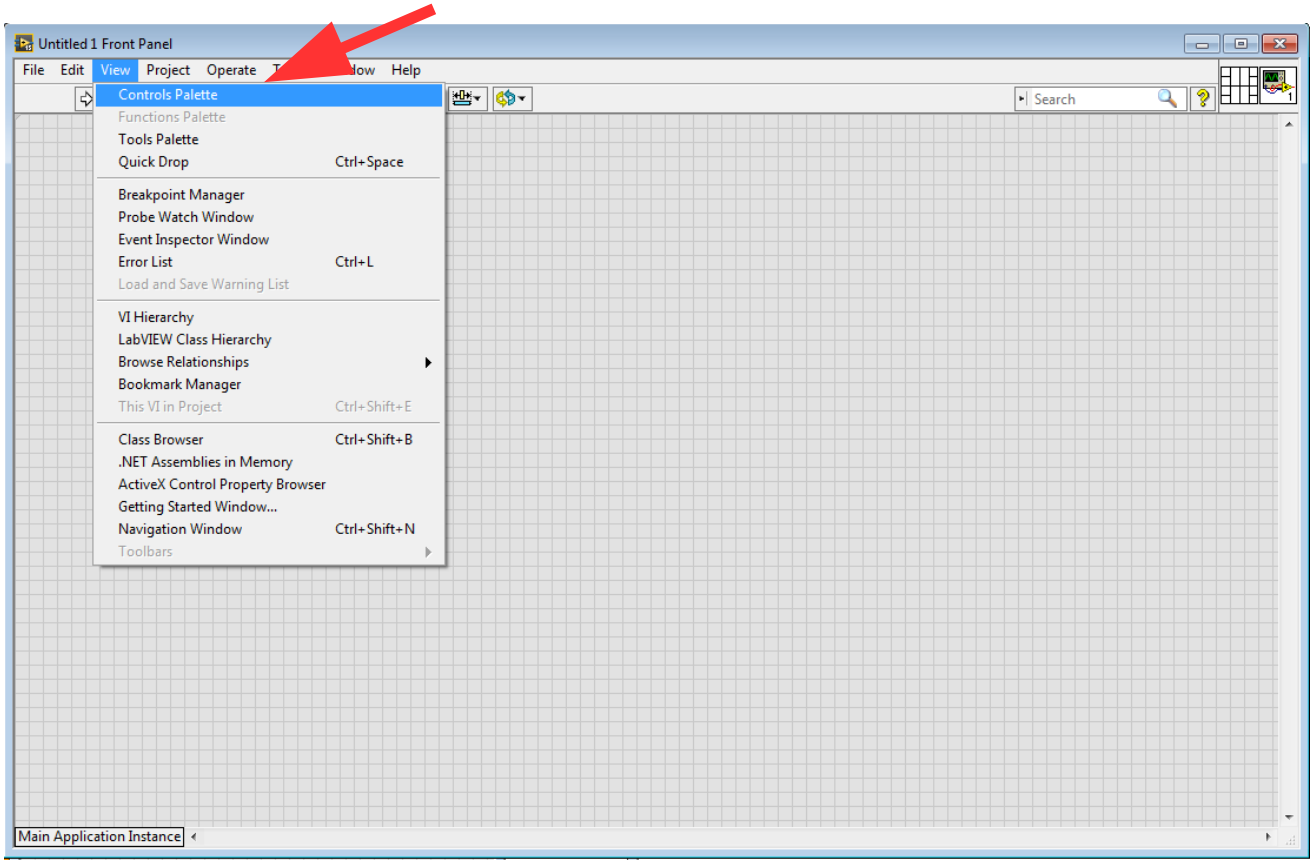
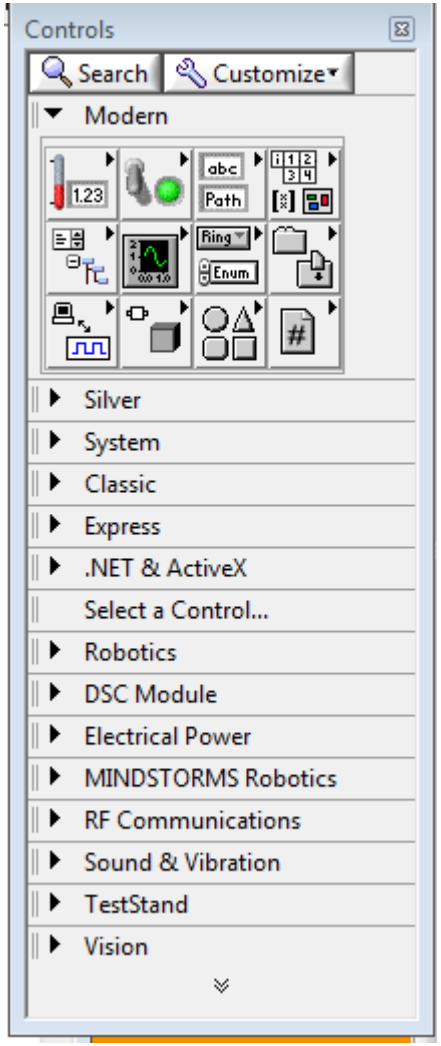
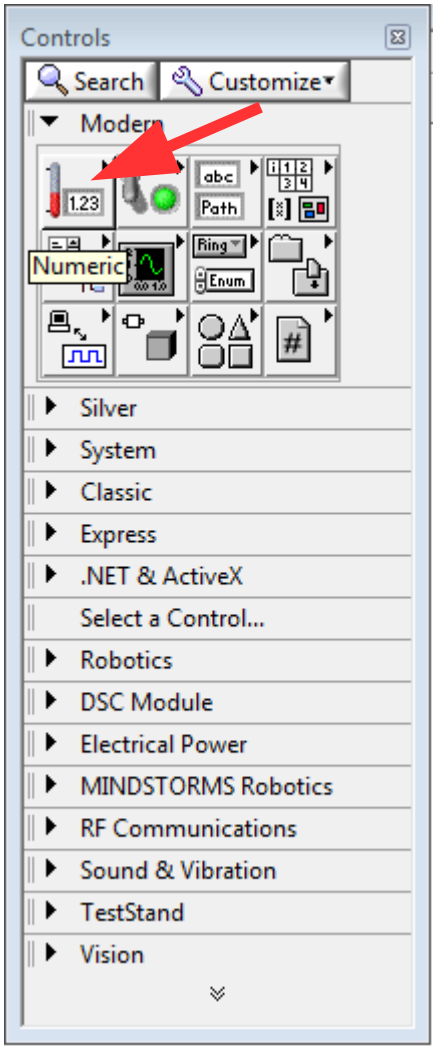
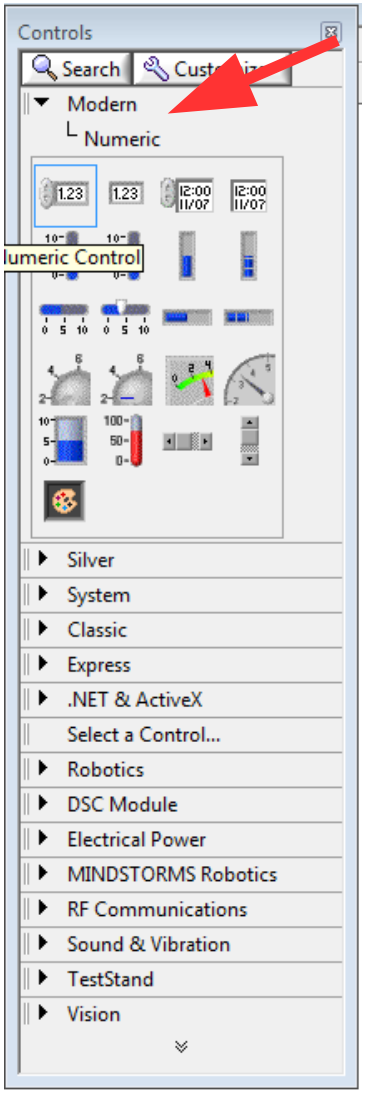
Bringing up the tools menu for the user interface.



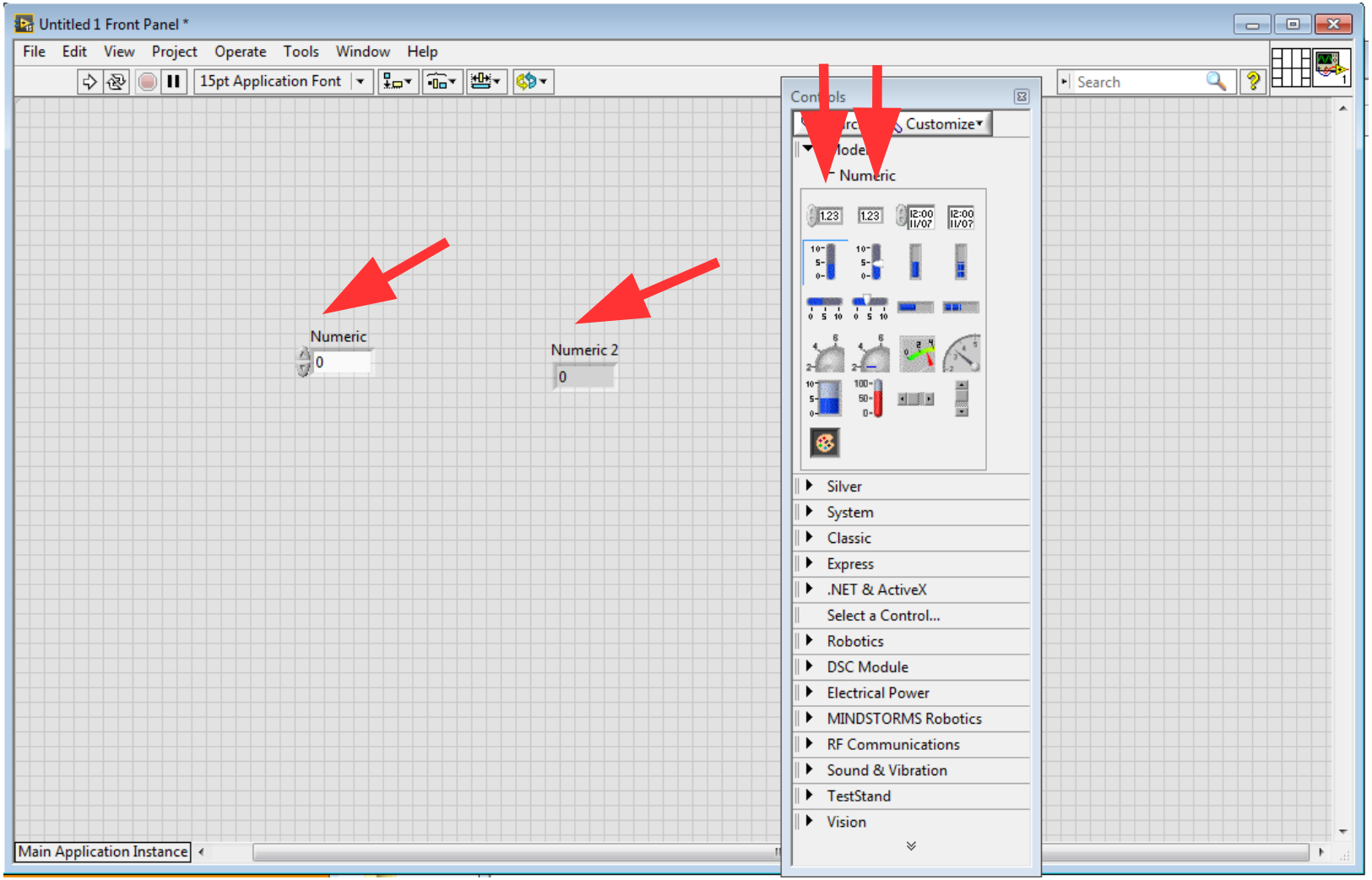


Selecting the user interface component you want to use.

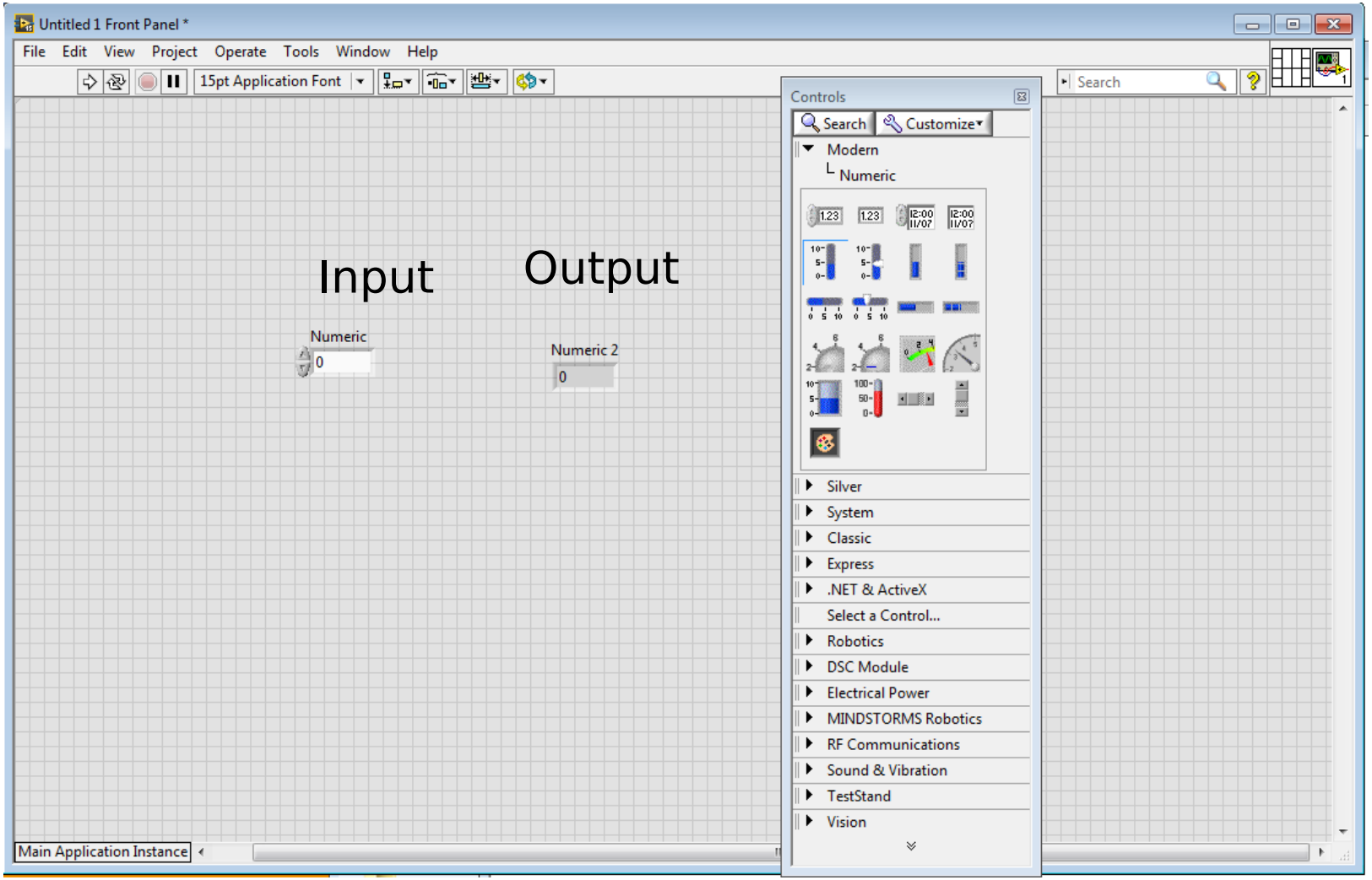




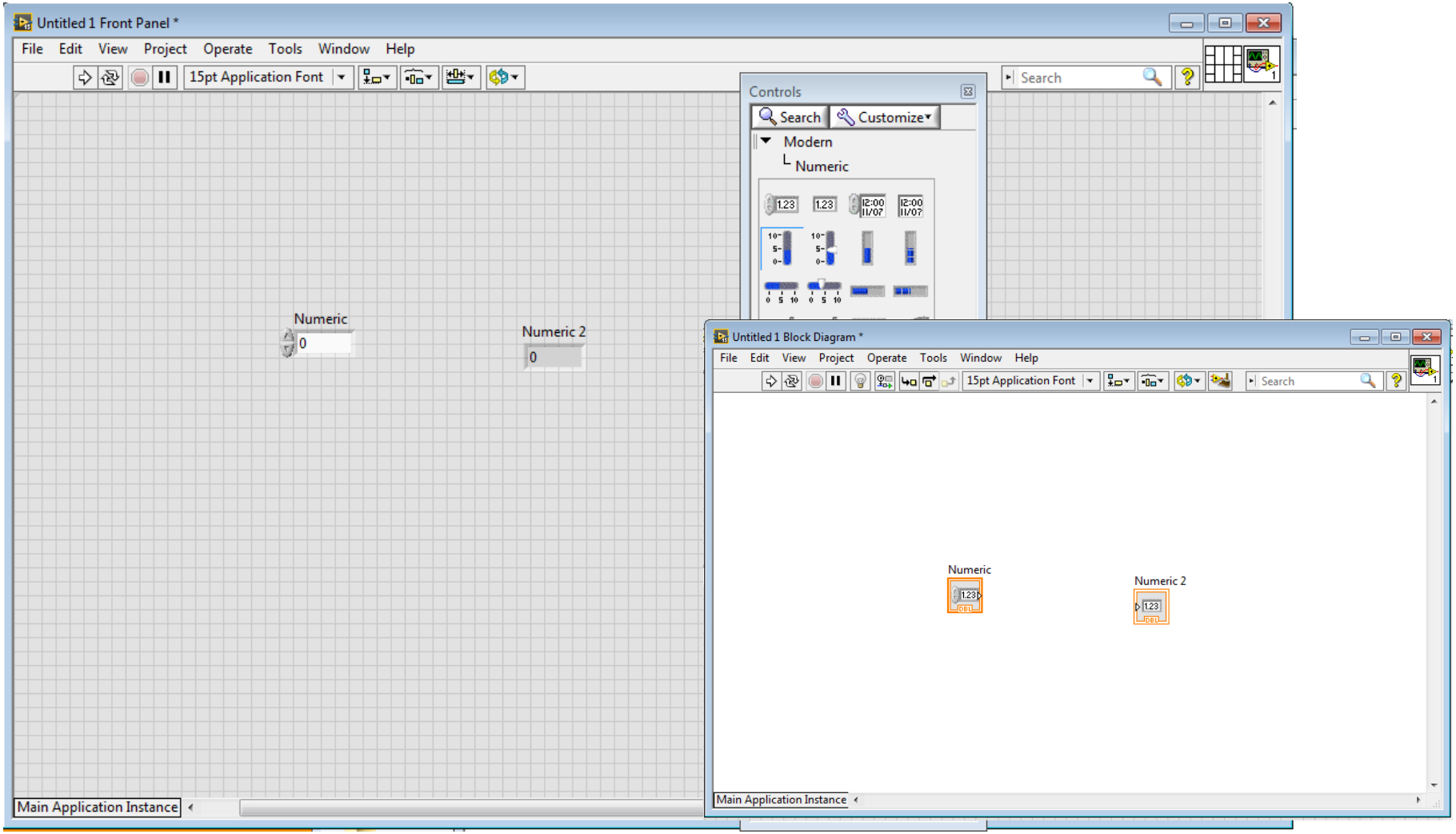
LabView has input (controls) and outputs (indicators)



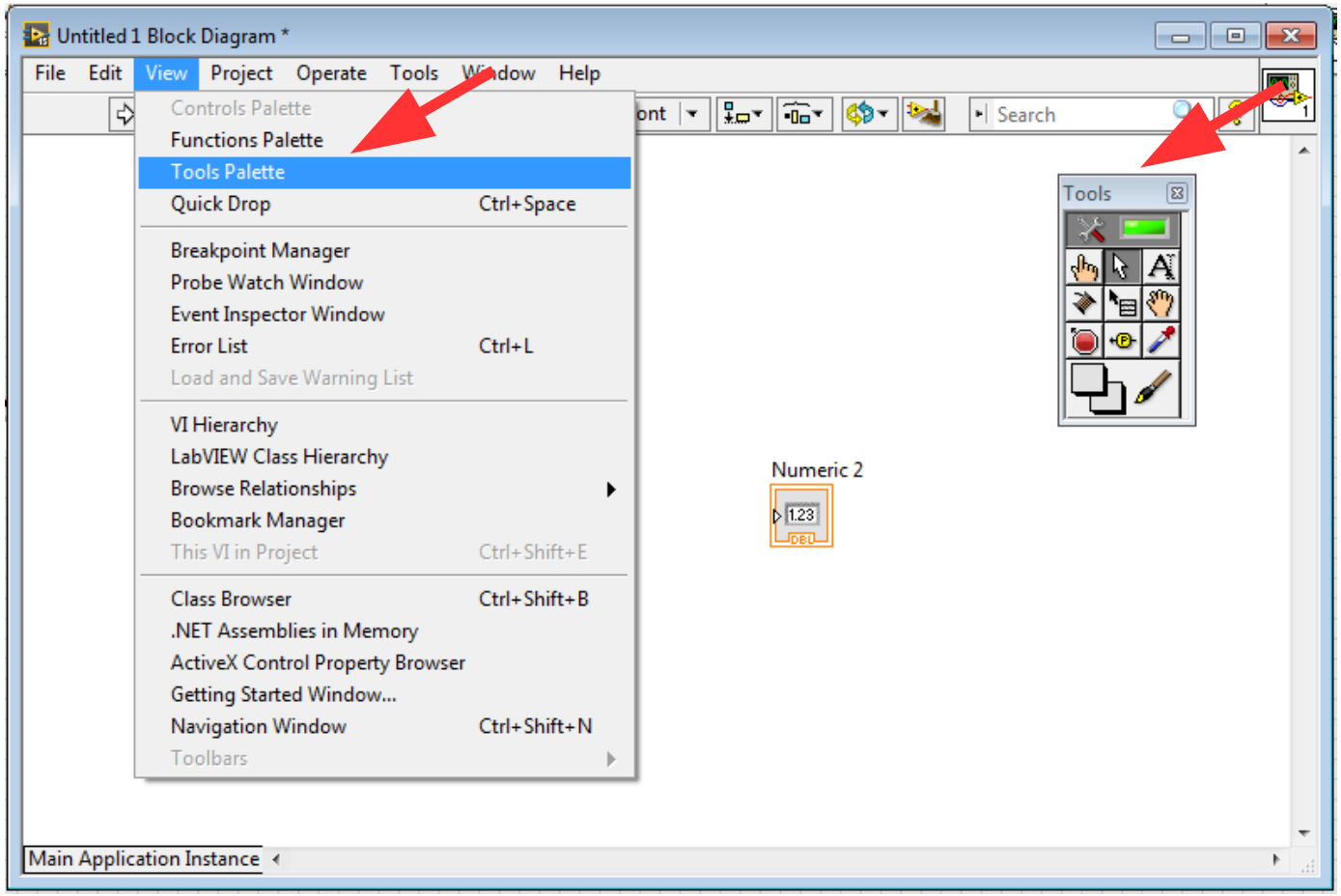
LabView has input (controls) and outputs (indicators)



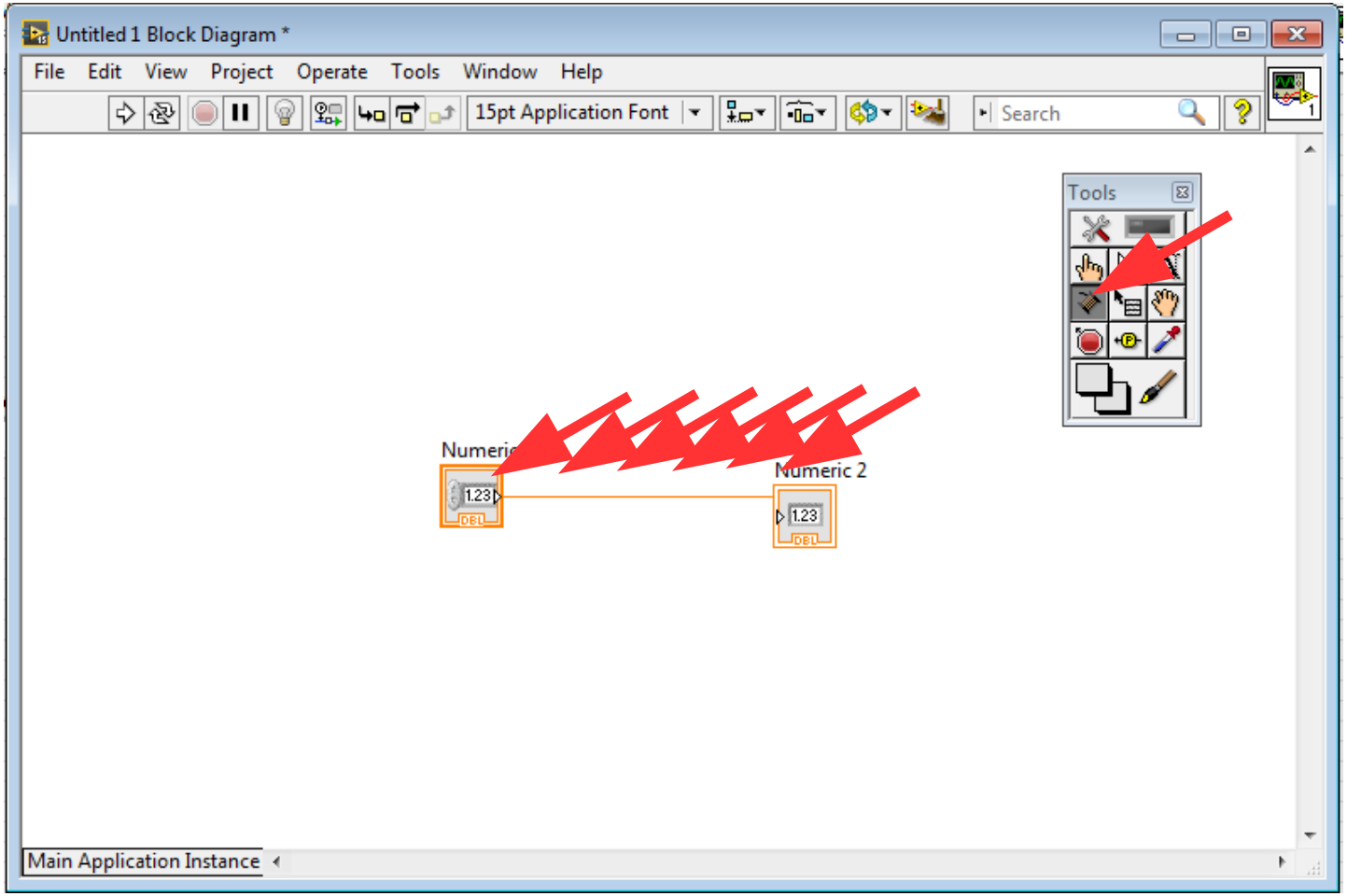
If you now look in the block diagram you will see that two little boxes have been made.



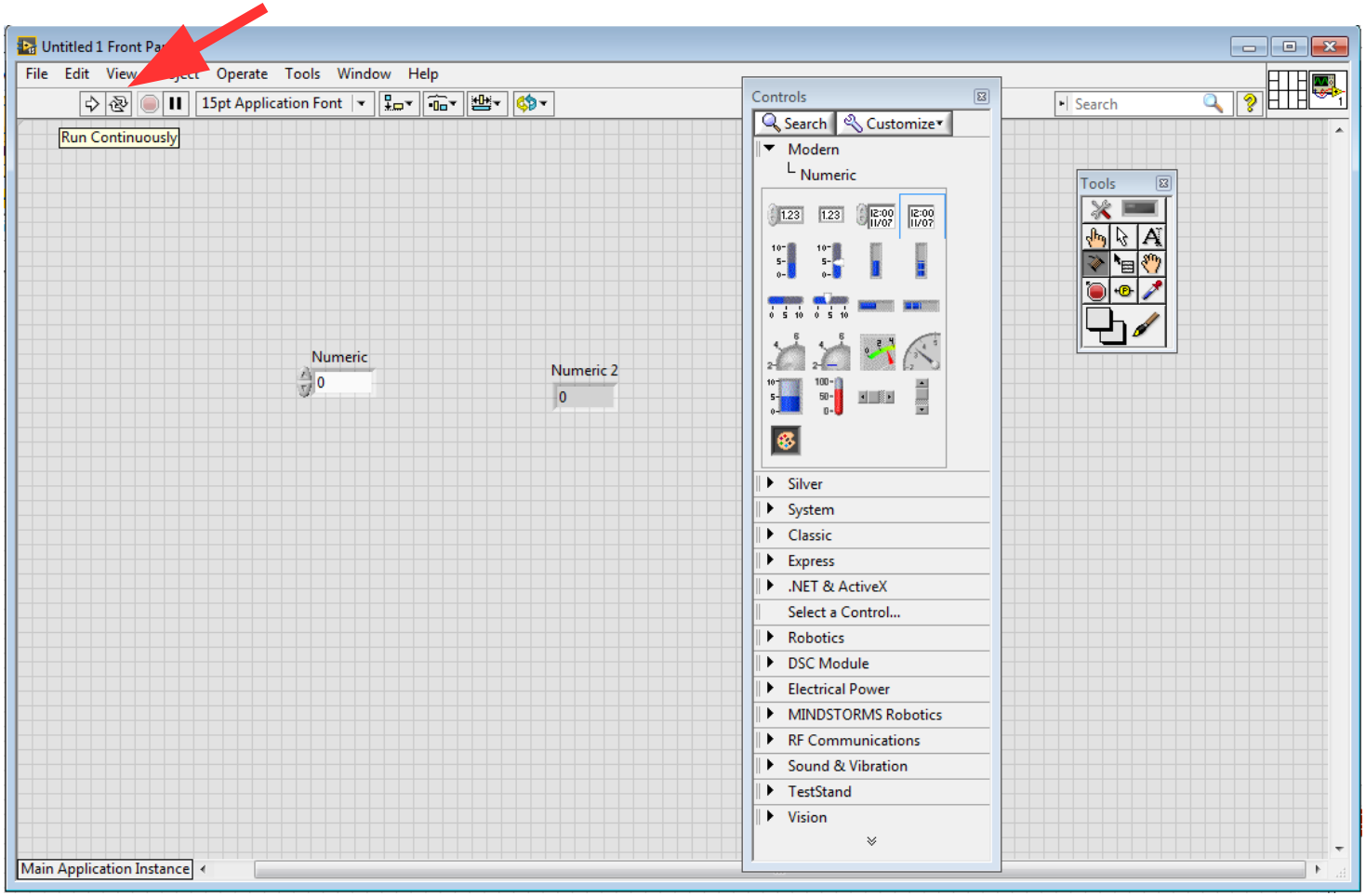
In the block diagram editor, bring up the tools palet.



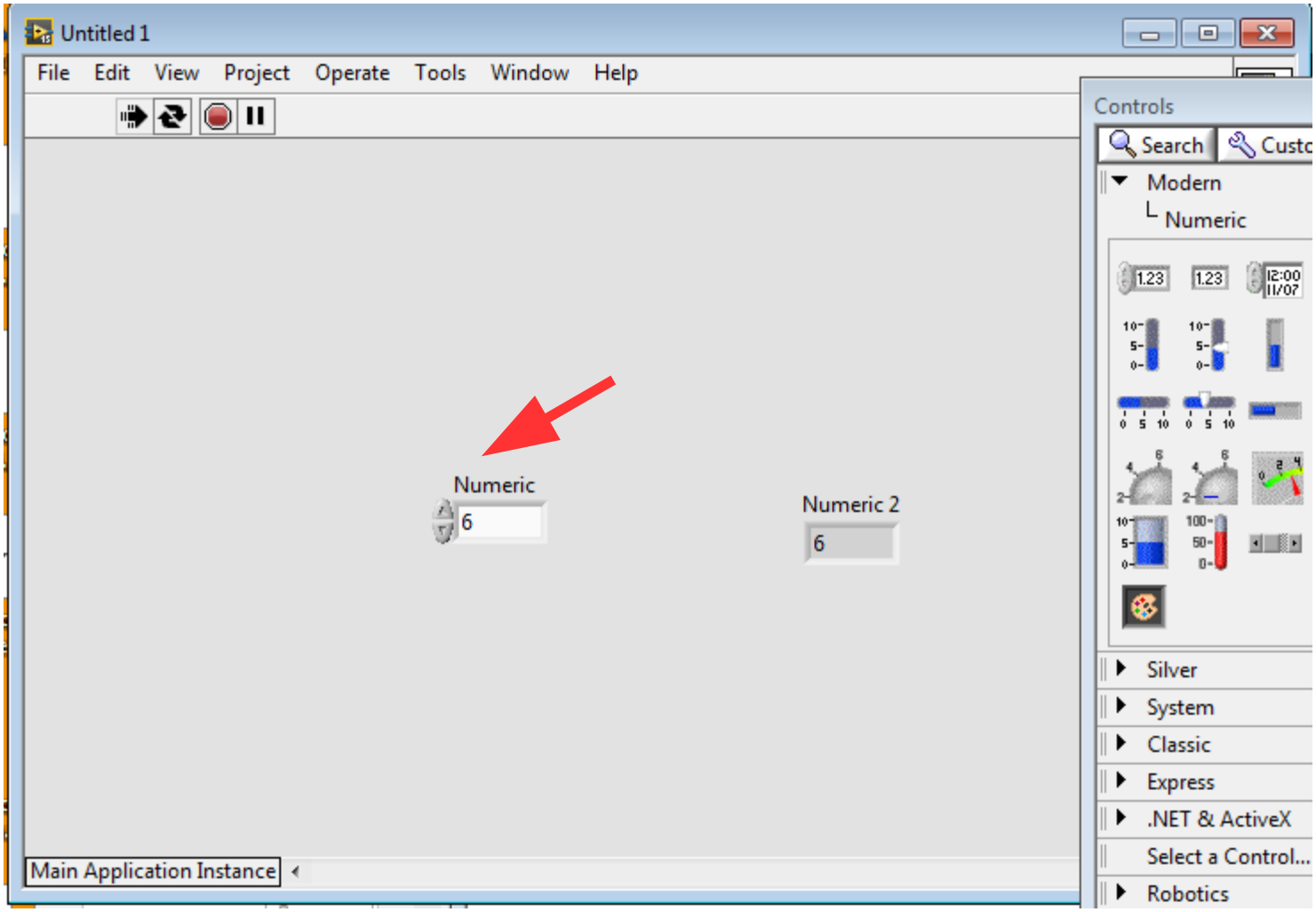
Click on the little spool of wire and join the two components.



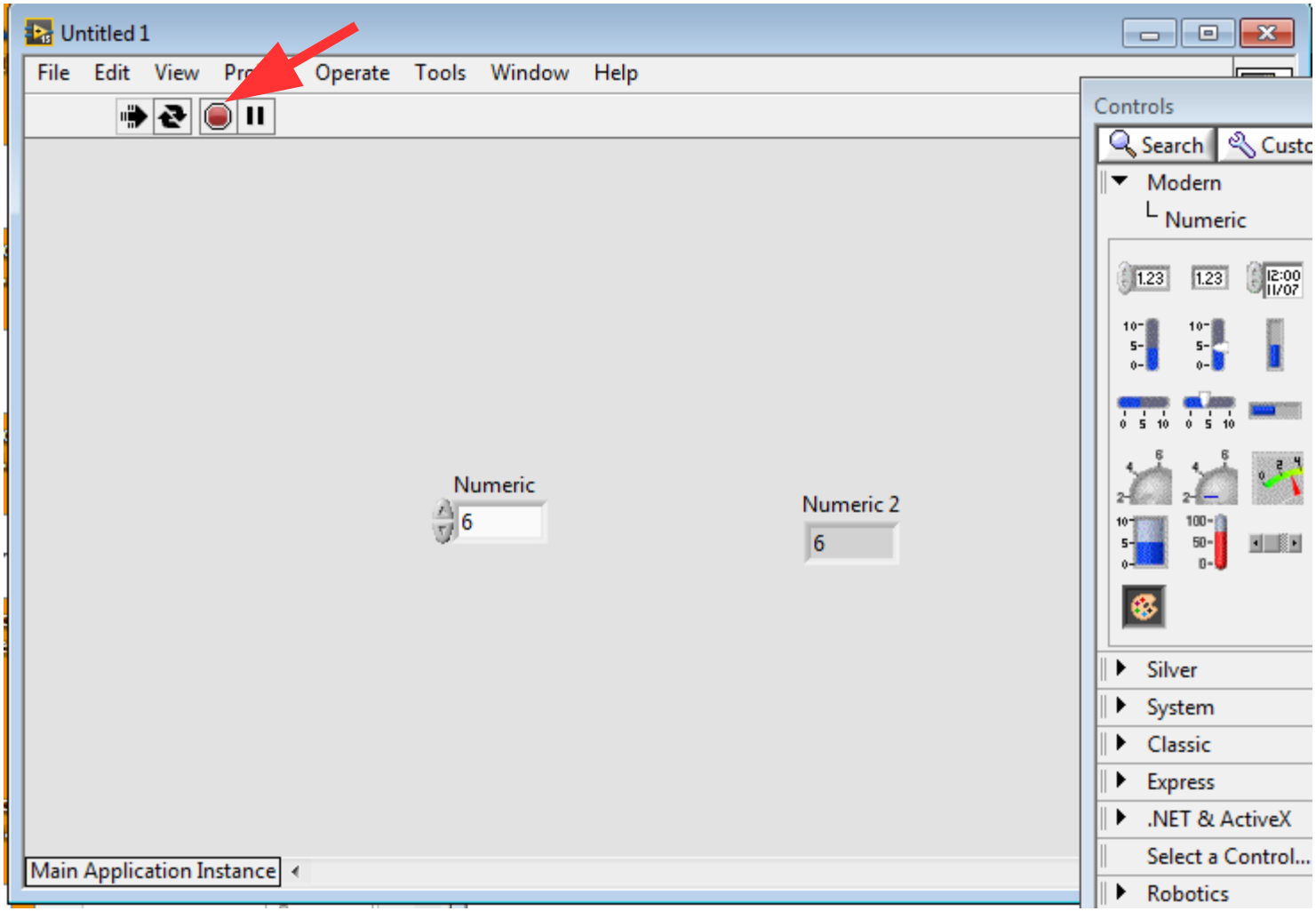
Now on the front panel, click ***run for ever***. 



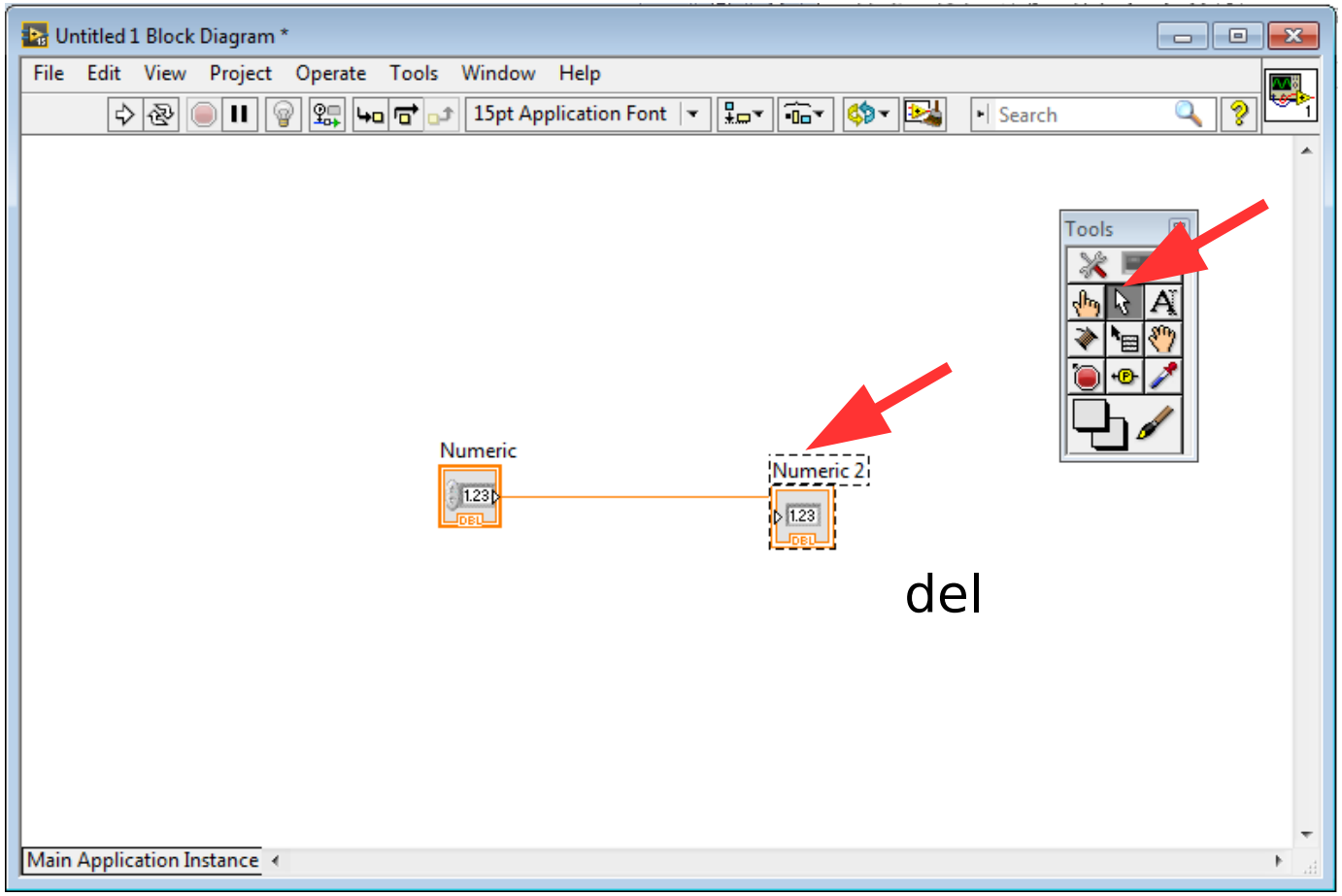
Now play with the number in the left hand box, what happens?



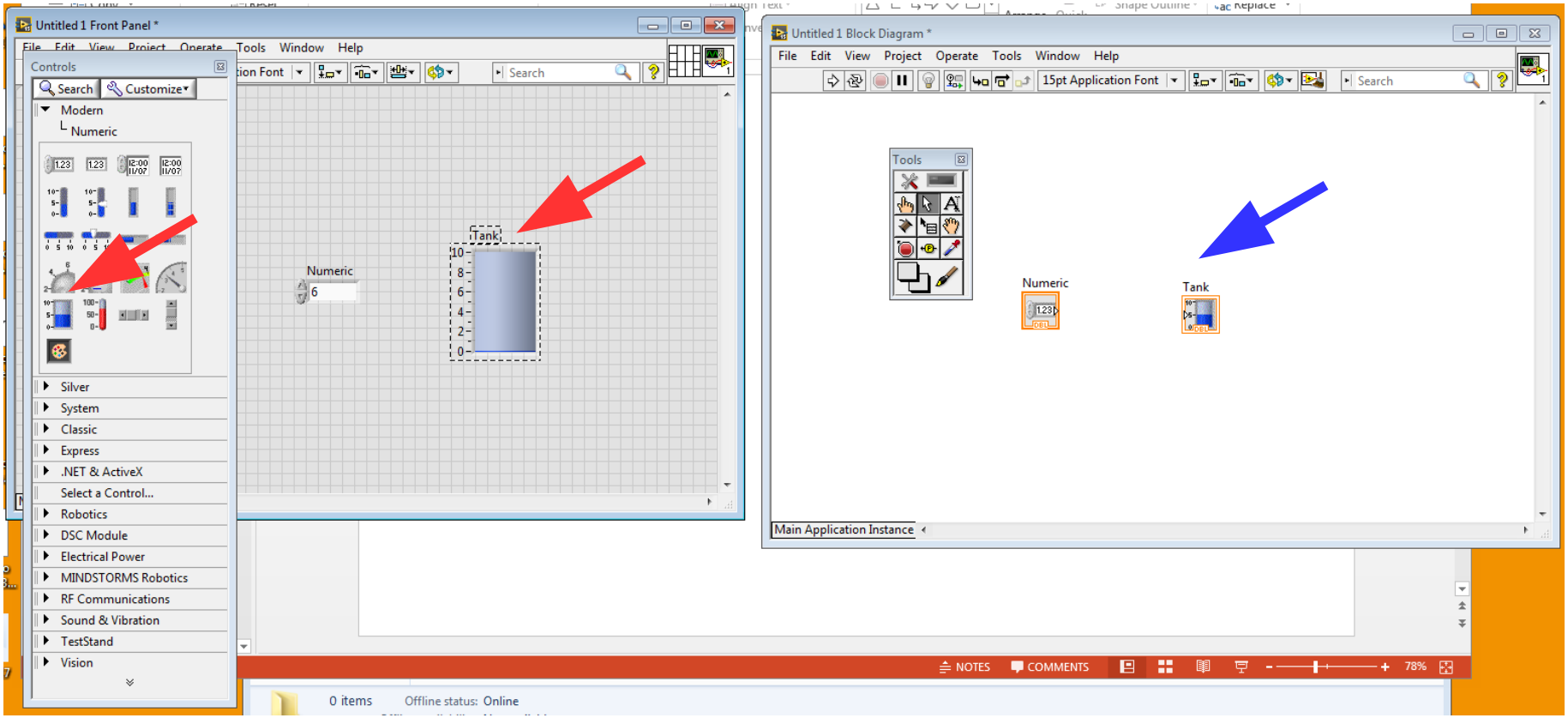
Click on the stop button when you want to stop the program.



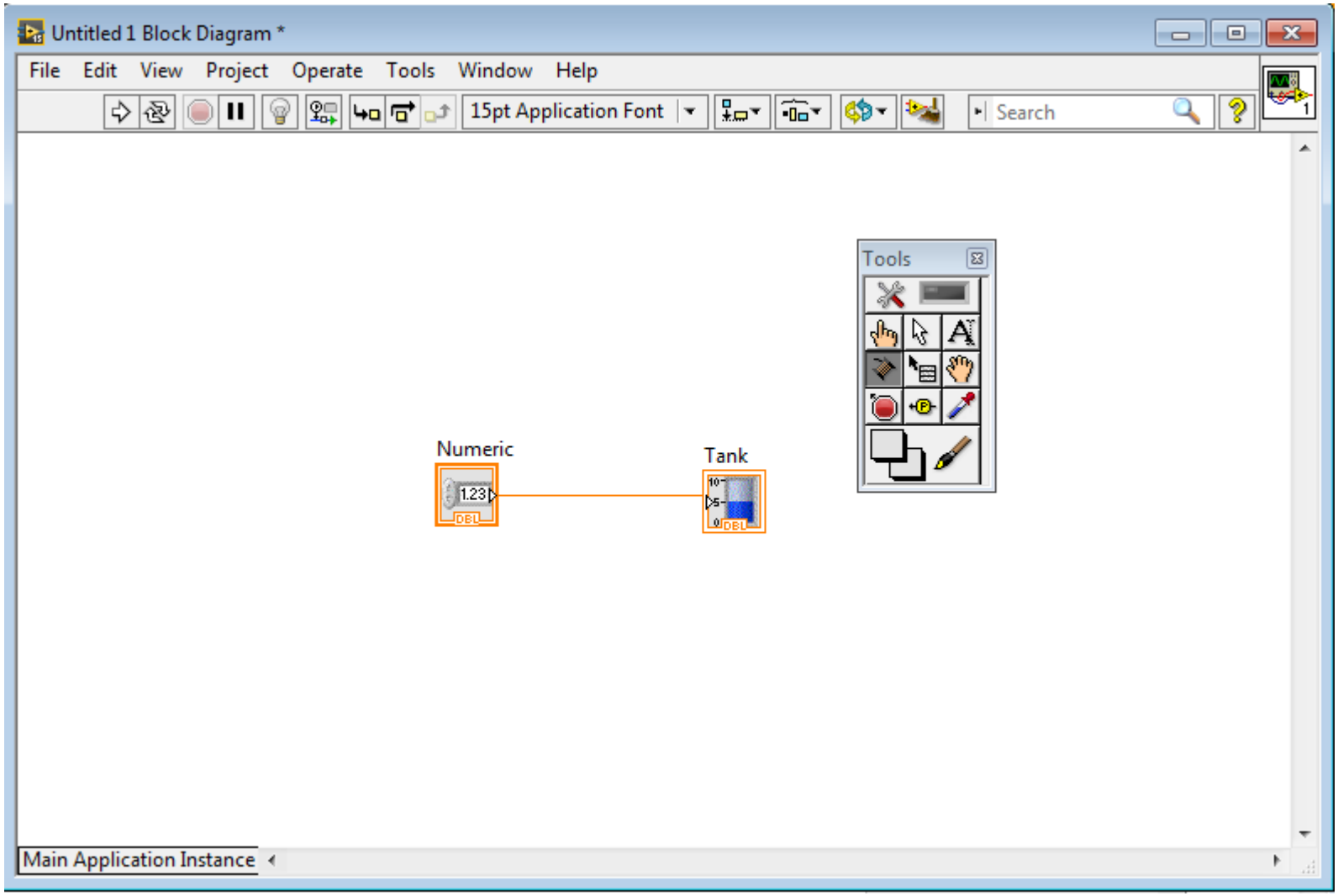
Select the pointer in the tool box, click on “Numeric 2”, and hit the delete key.



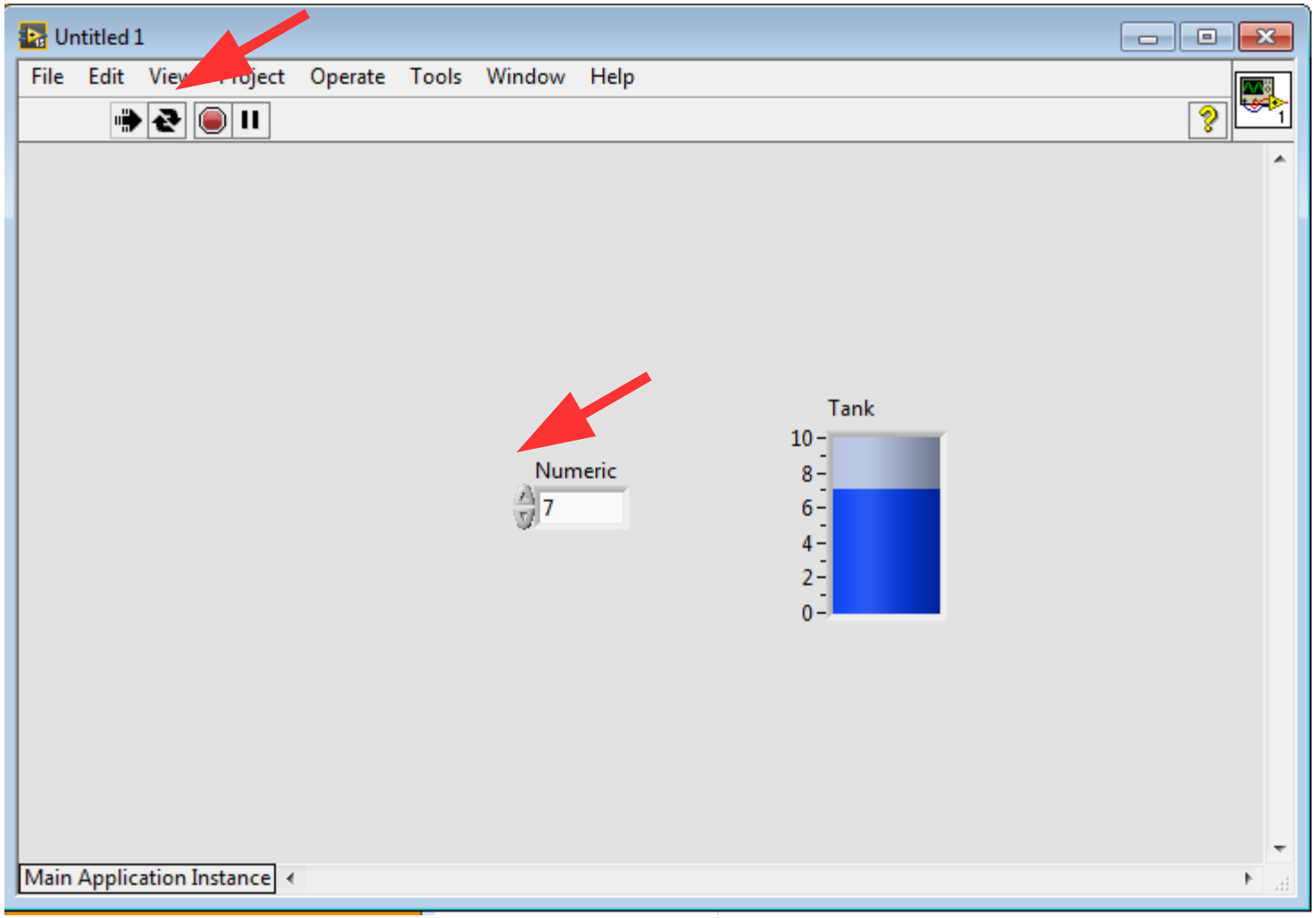
Find the “tank”, indicator from the toolbox and drag it to the front panel.



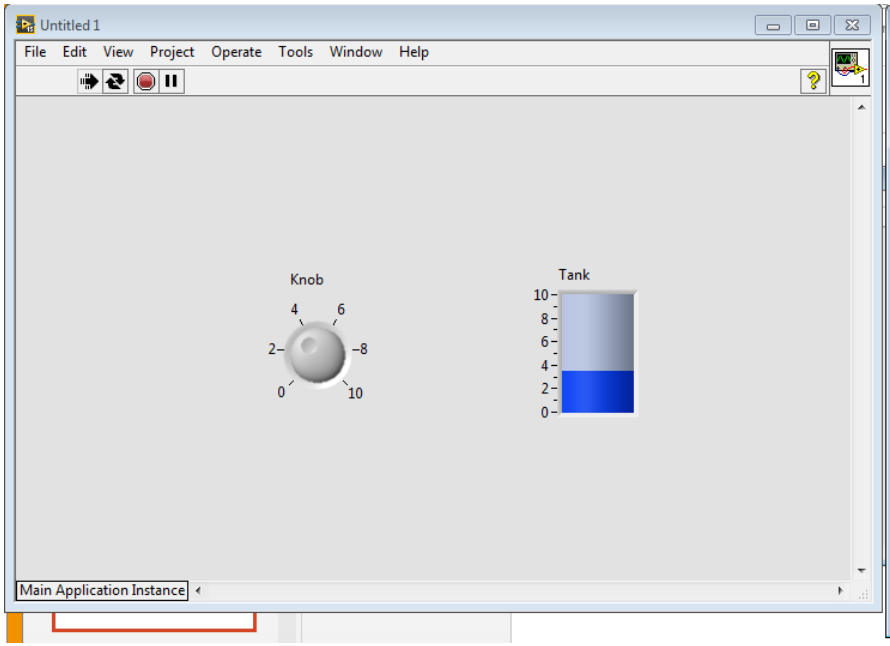
Then using the spool tool again, connect the two items with a wire.

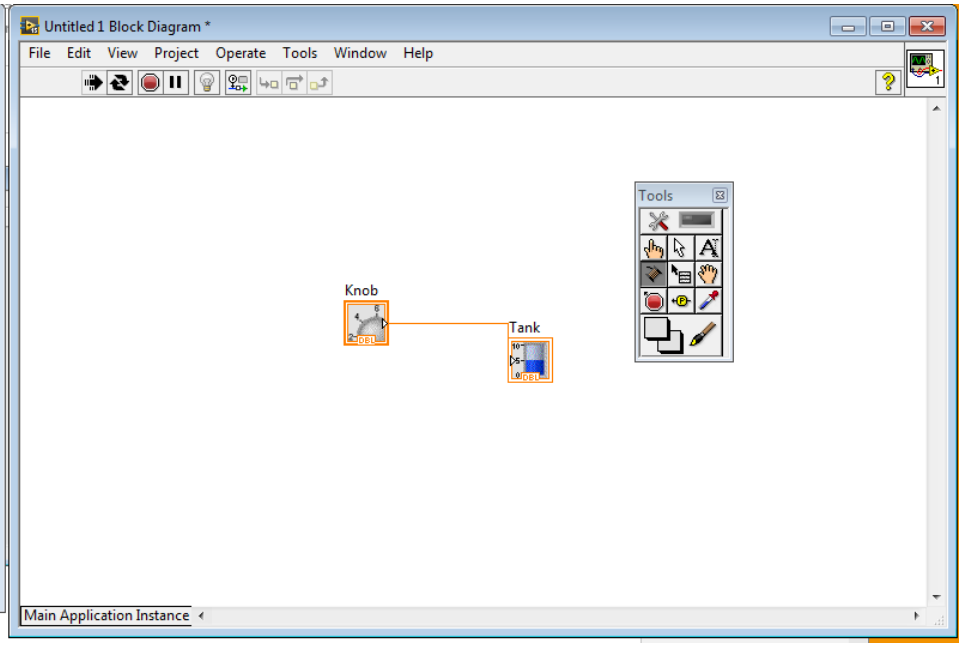


Click run forever again and have a play with the value again.



Try and replace the number with a Knob from the tools menu. Try to do this your self.





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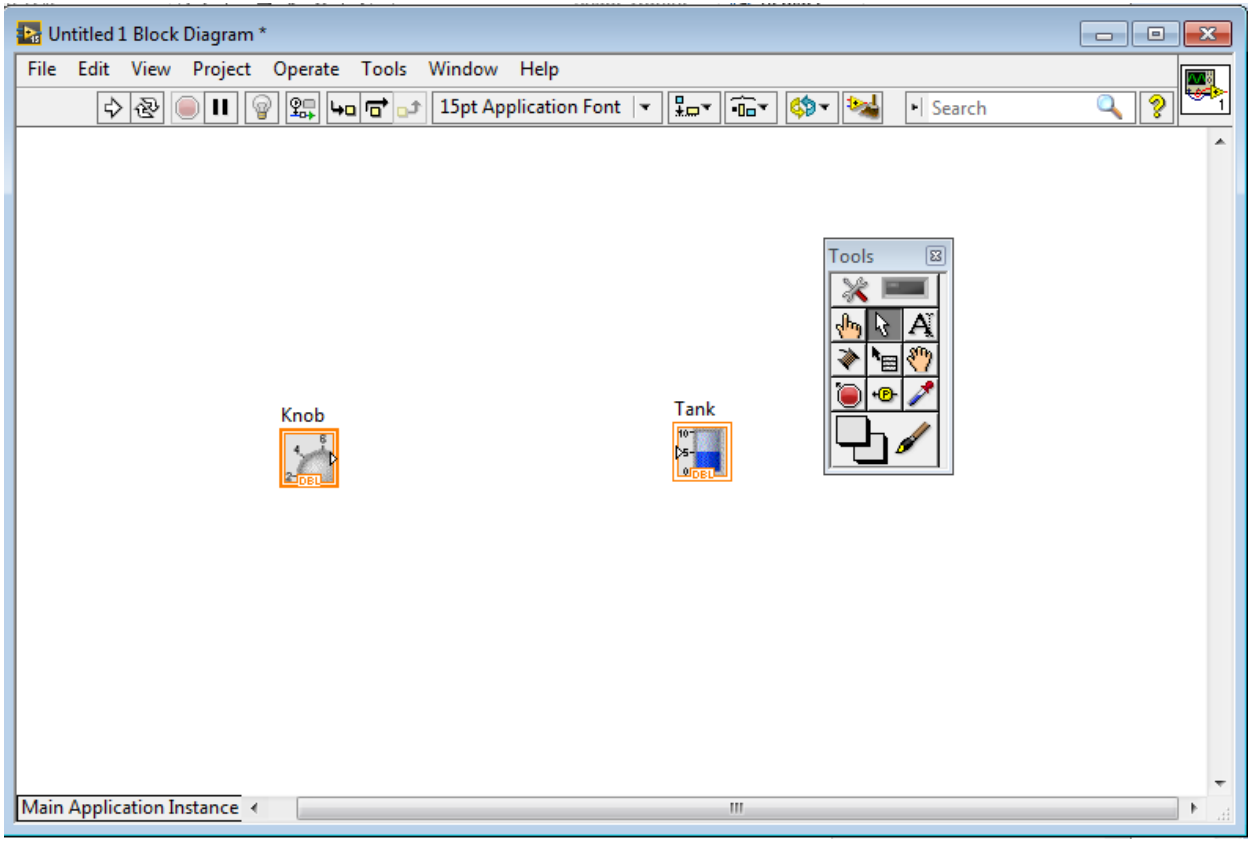
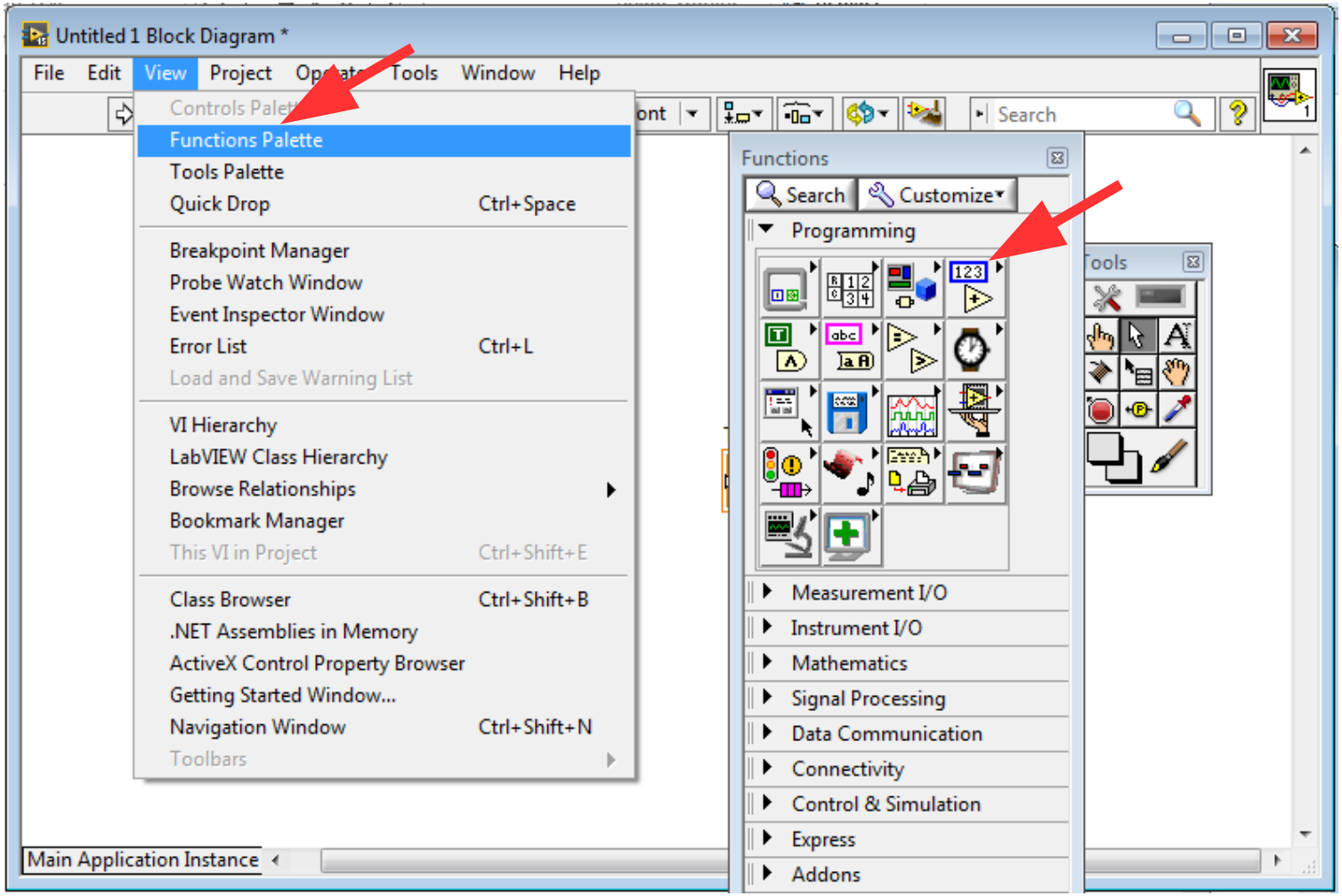
Now delete the line joining the components, using the arrow.

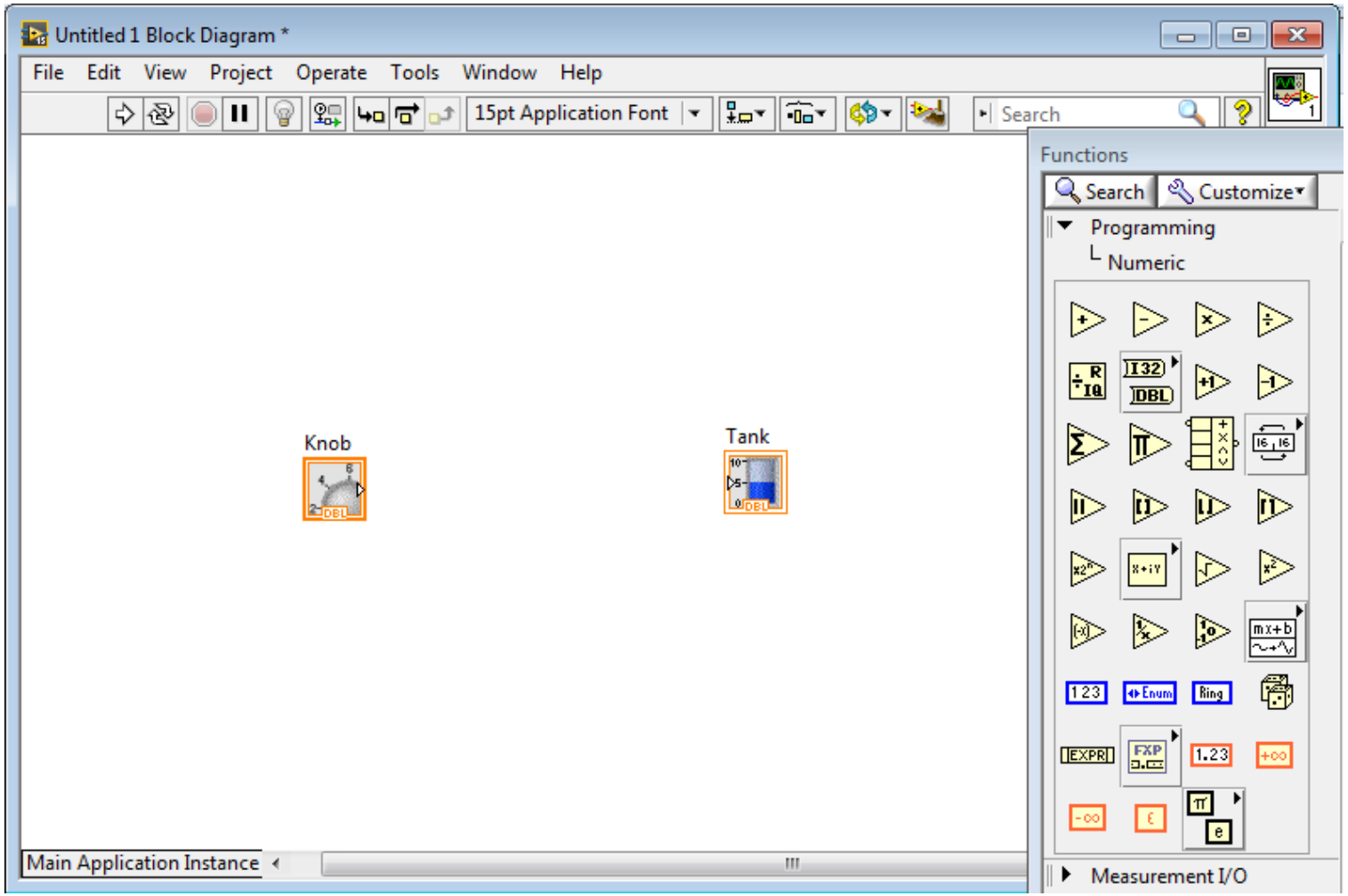


On the block diagram click View→Functions pallet

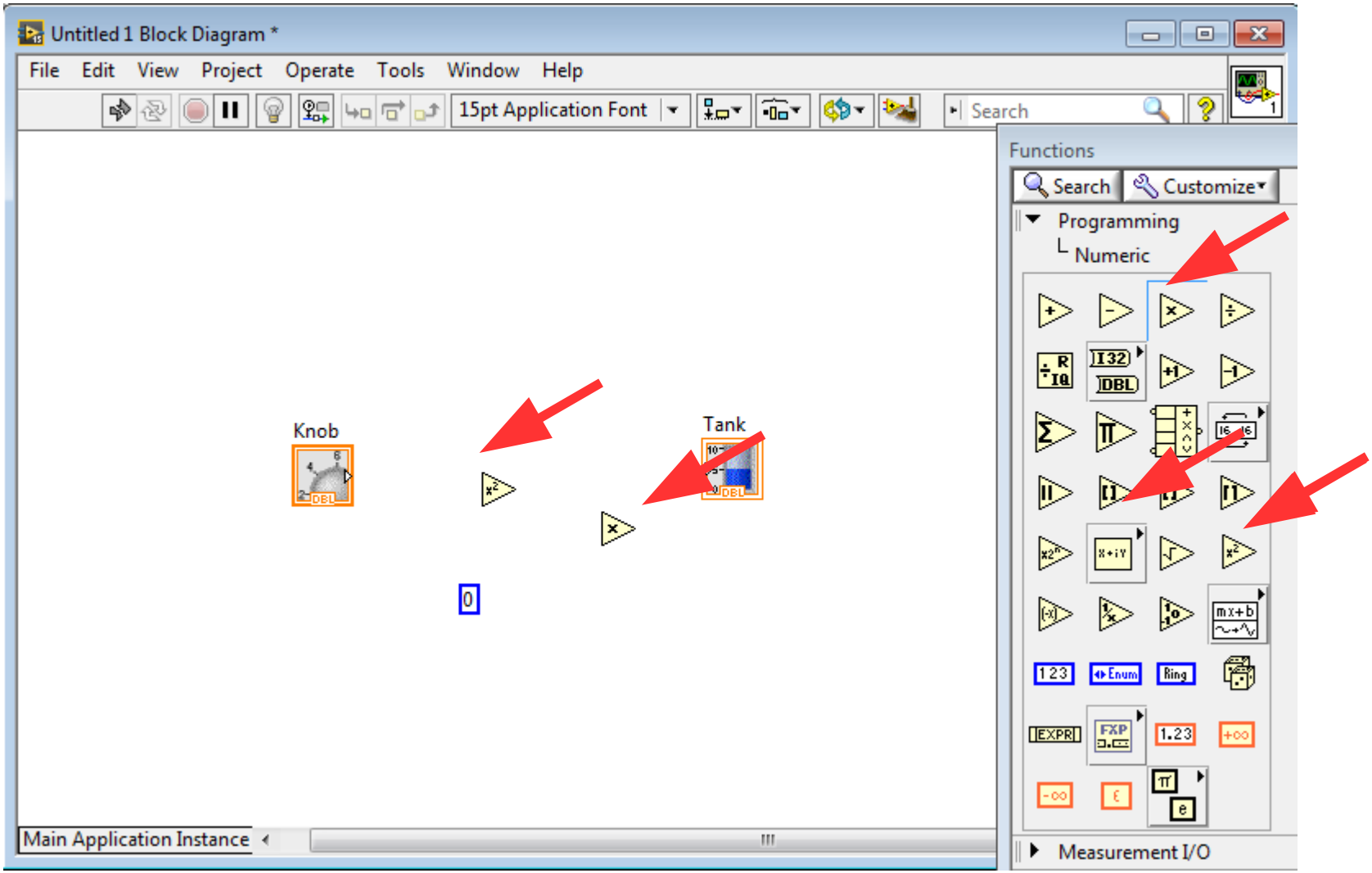


- Then click on the mathematics button.

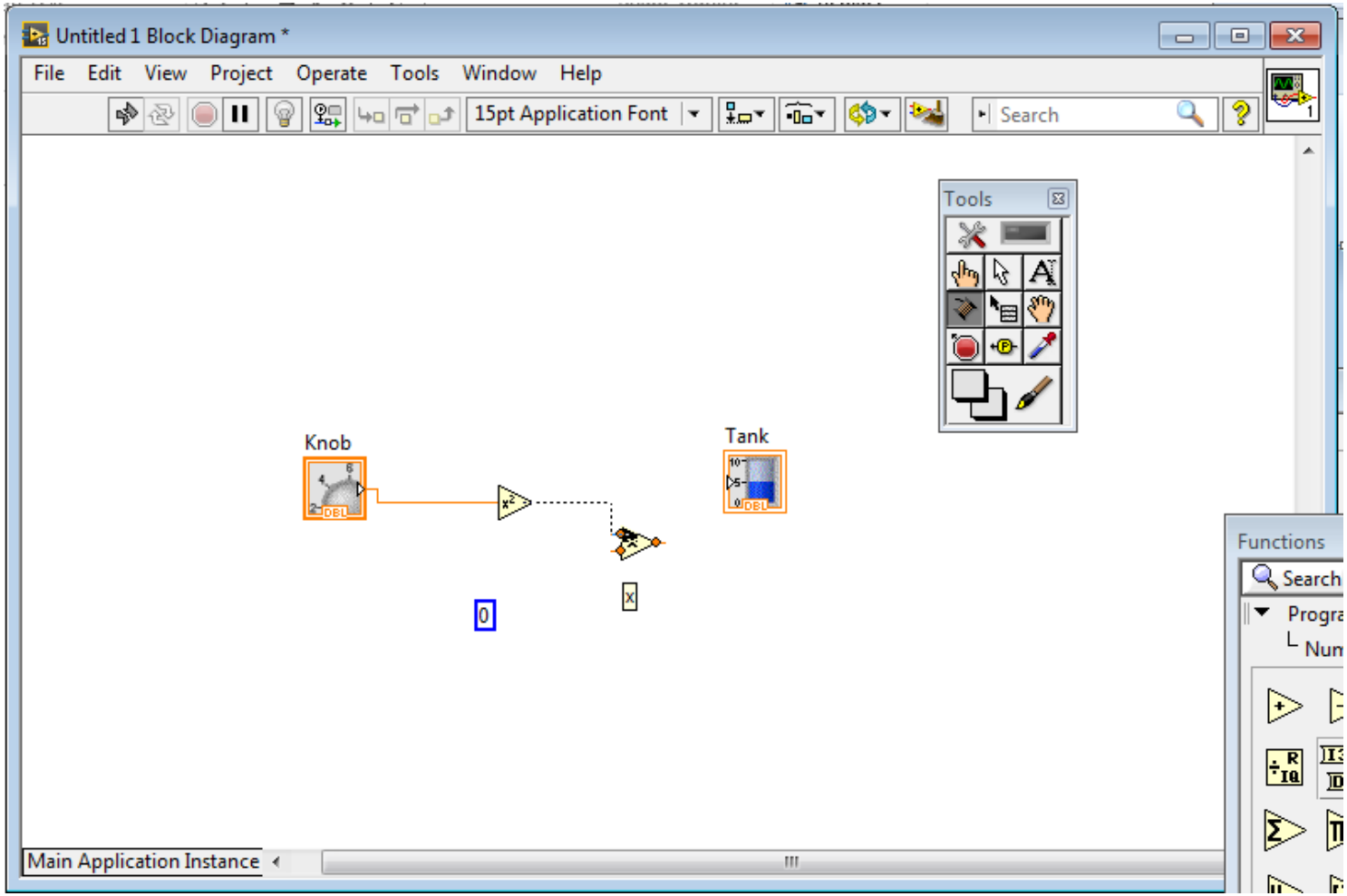
And the window should look like this..



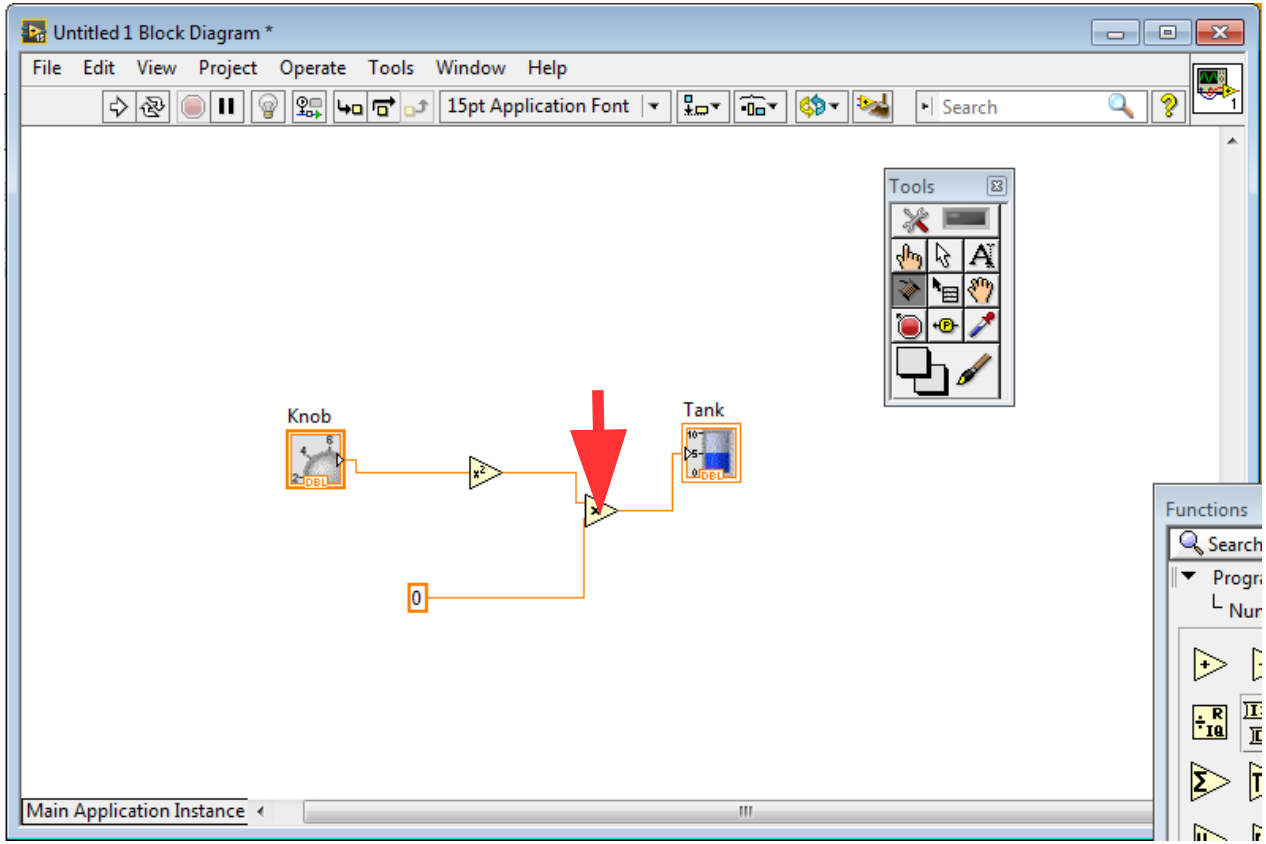
Drag and drop and x^2 and a x to the block diagram.



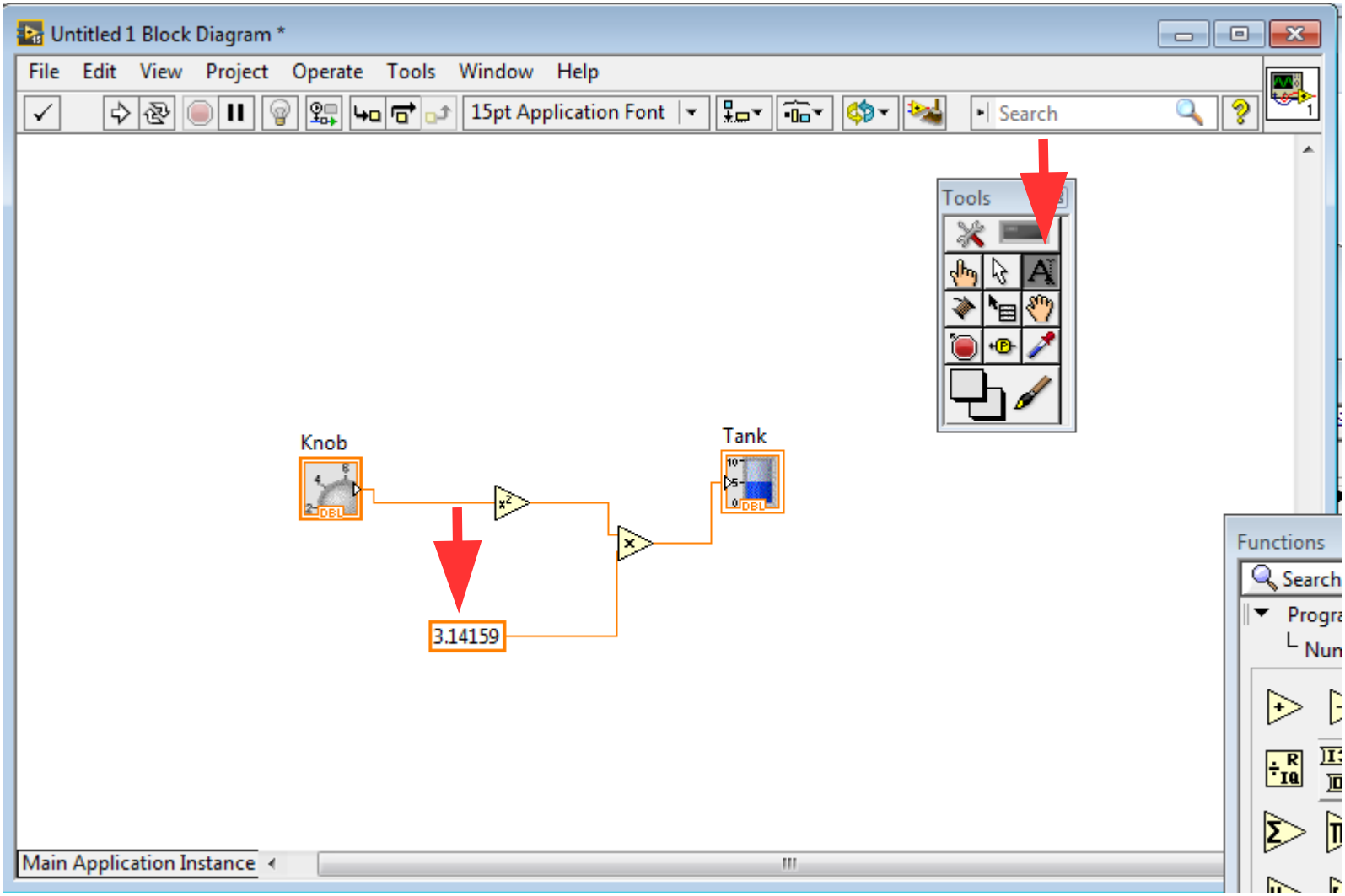
Then again with the spool tool join the knob to the x^2 and the x^2 to the x.



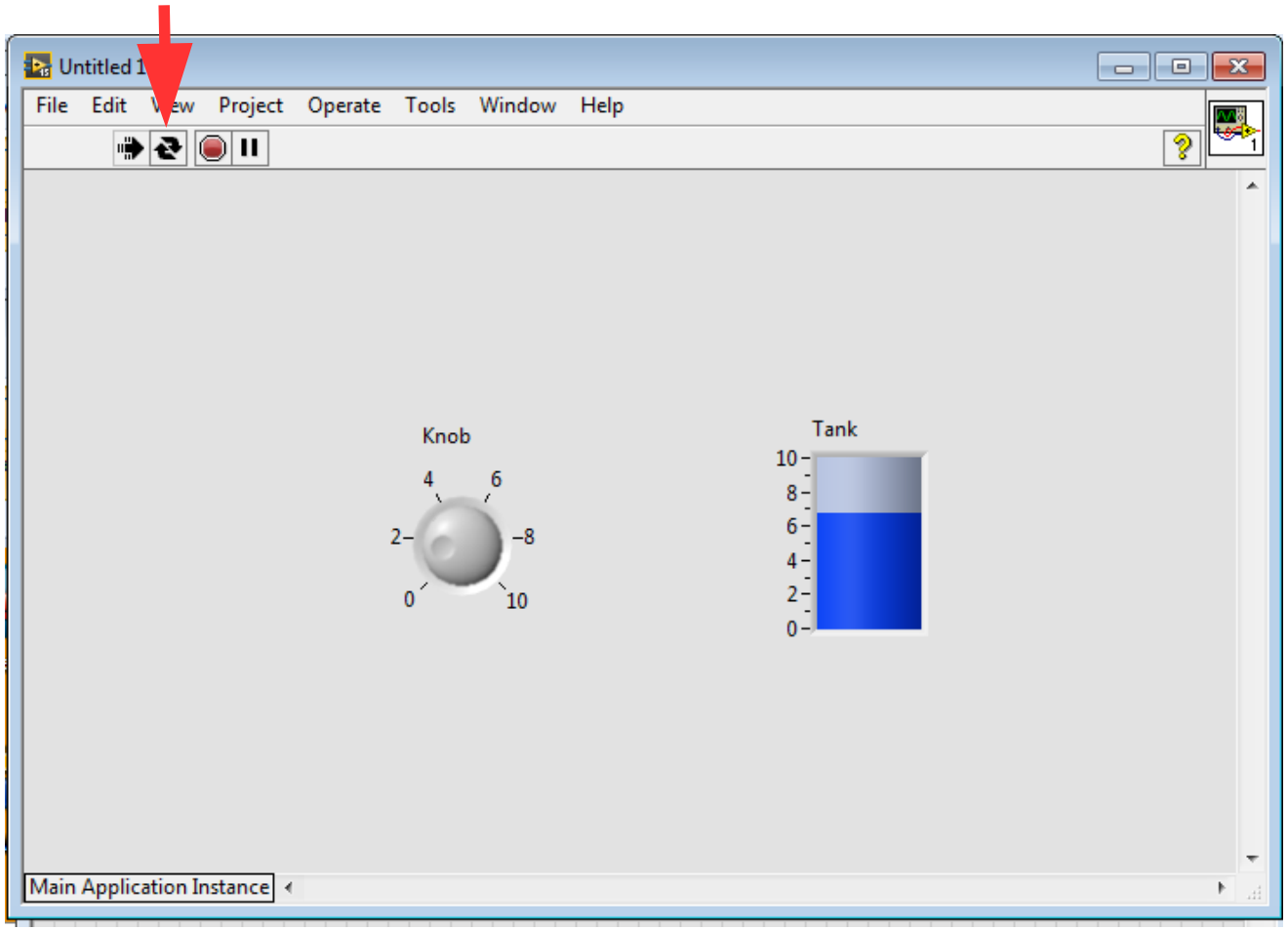
Right click on the bottom terminal of the x and click “create constant”.



Click on the edit tool, then click on the constant and type 3.14159

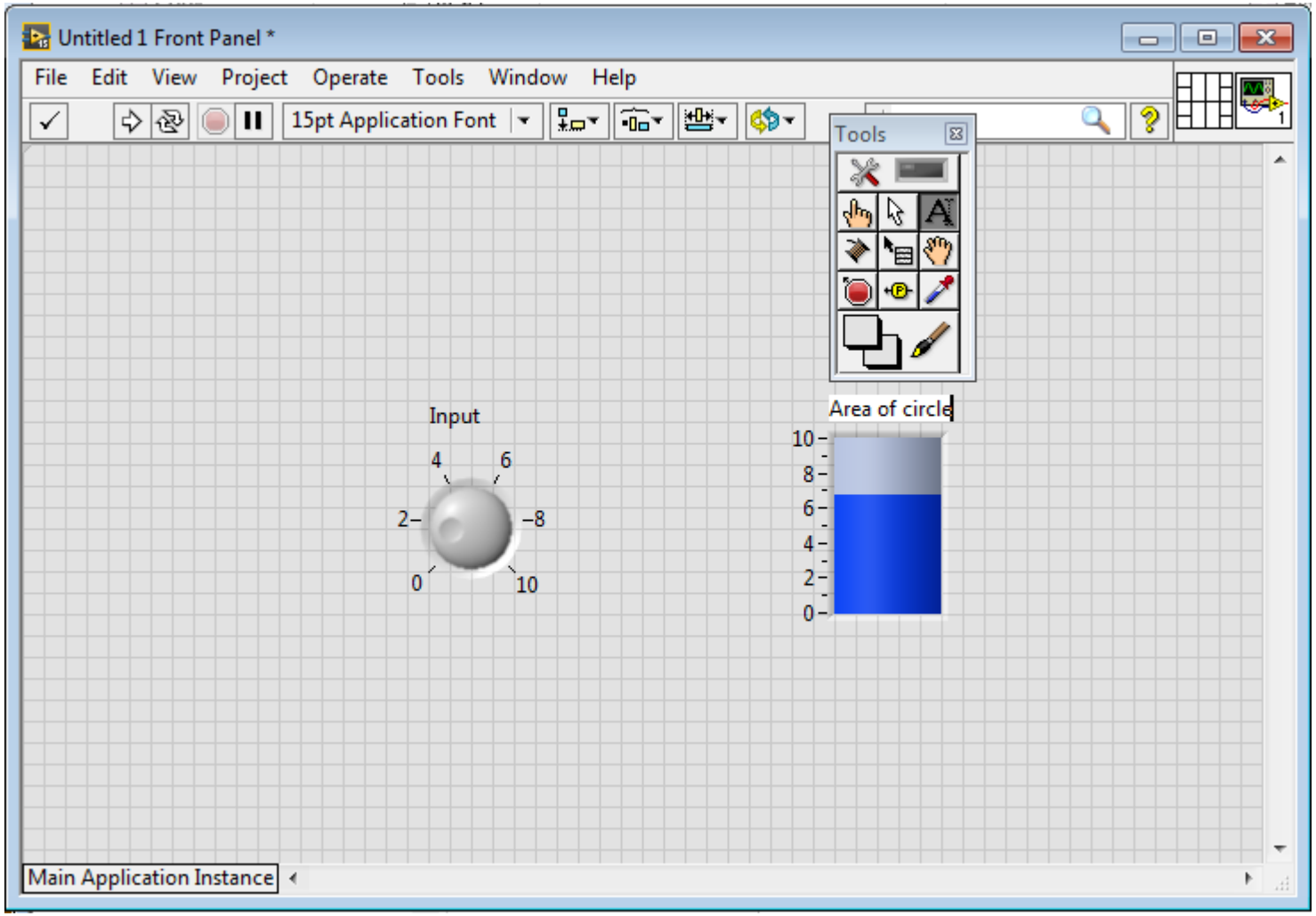


Now run the program and play with the knob.

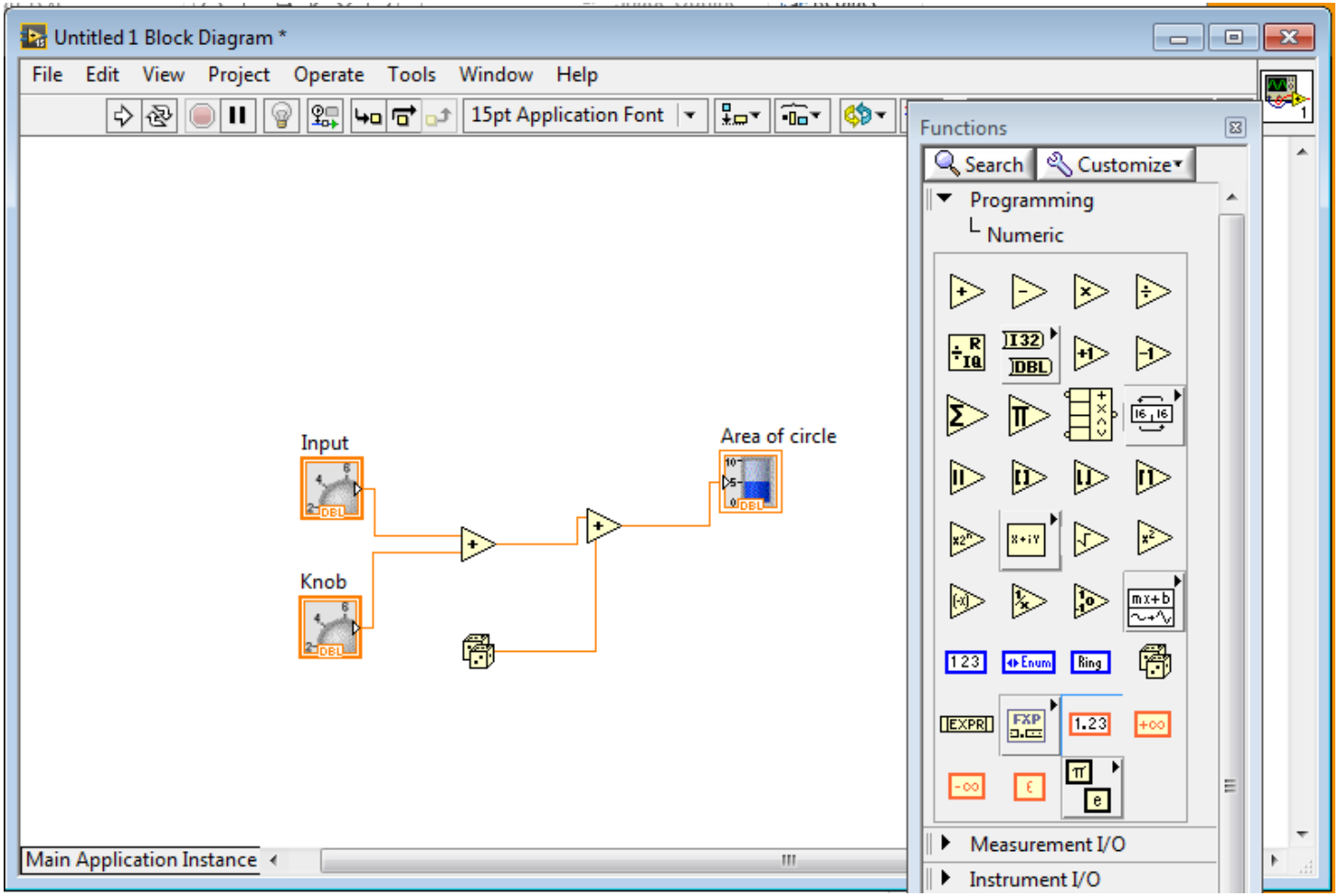


What value comes out in the indicator?

Again, use the edit tool to rename the controls.



Add in some random numbers. See if you can do this your self!



You will need a second knob.

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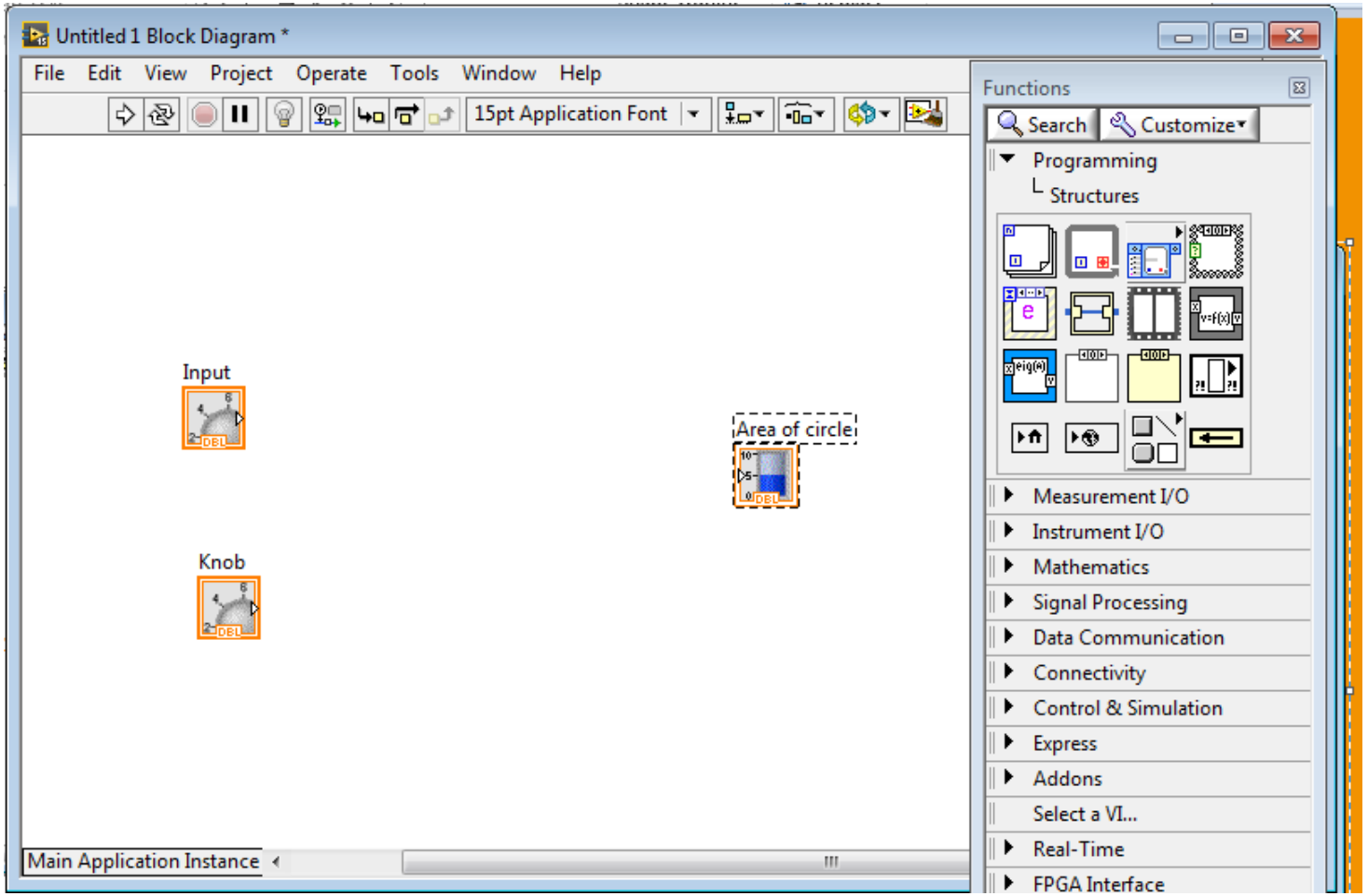
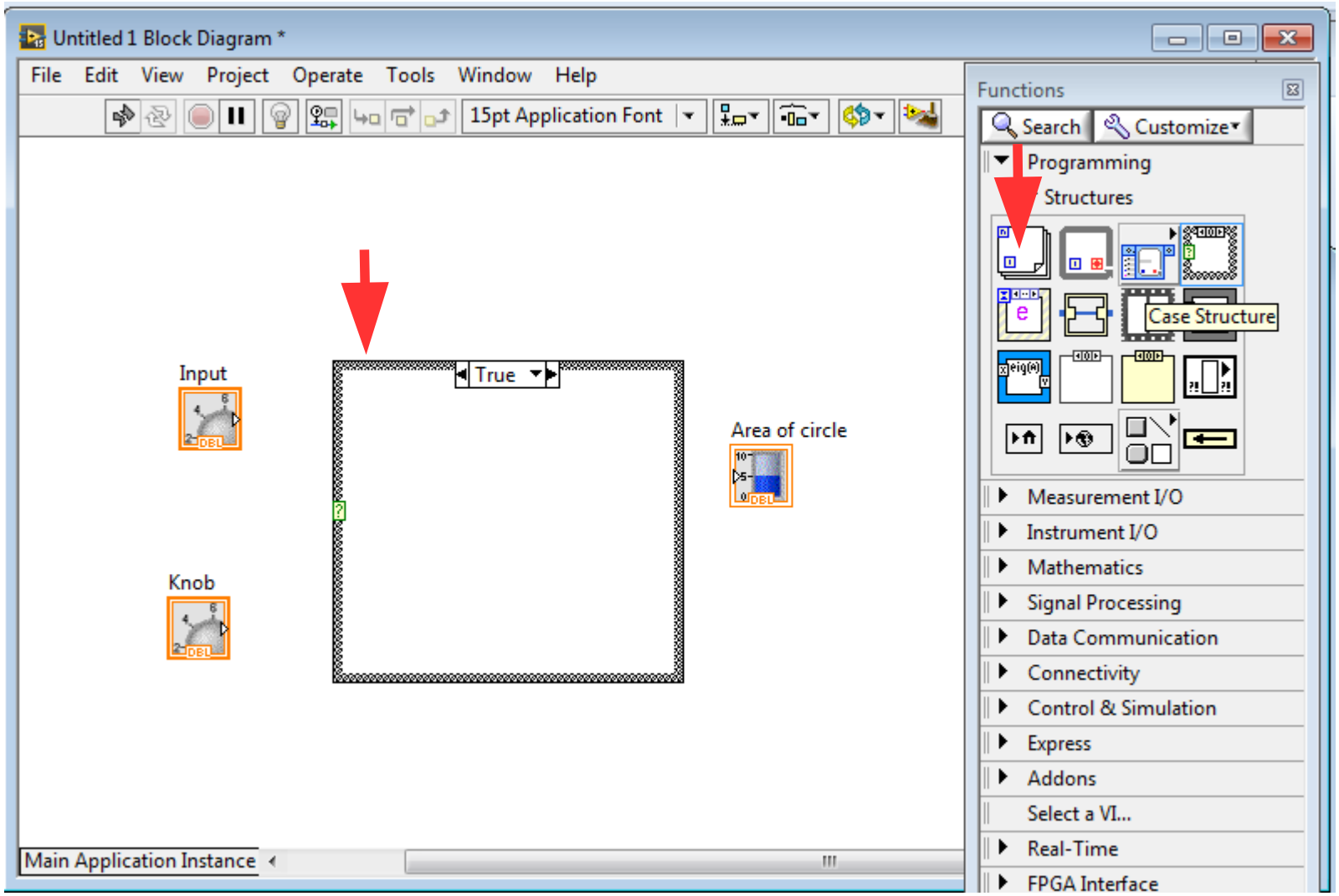
Now delete all the wires, so the diagram looks like this:

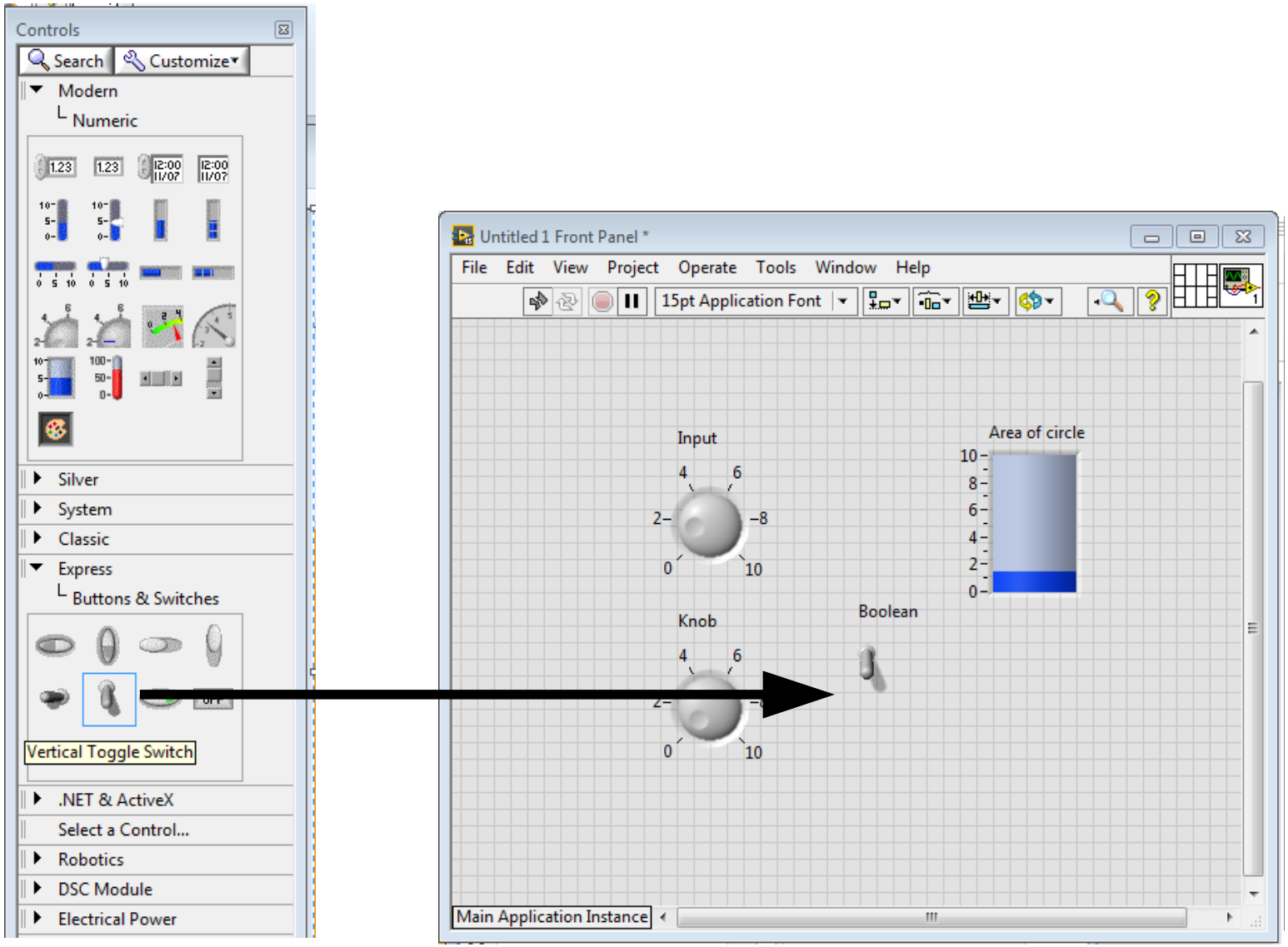


Case statements are used to make decisions

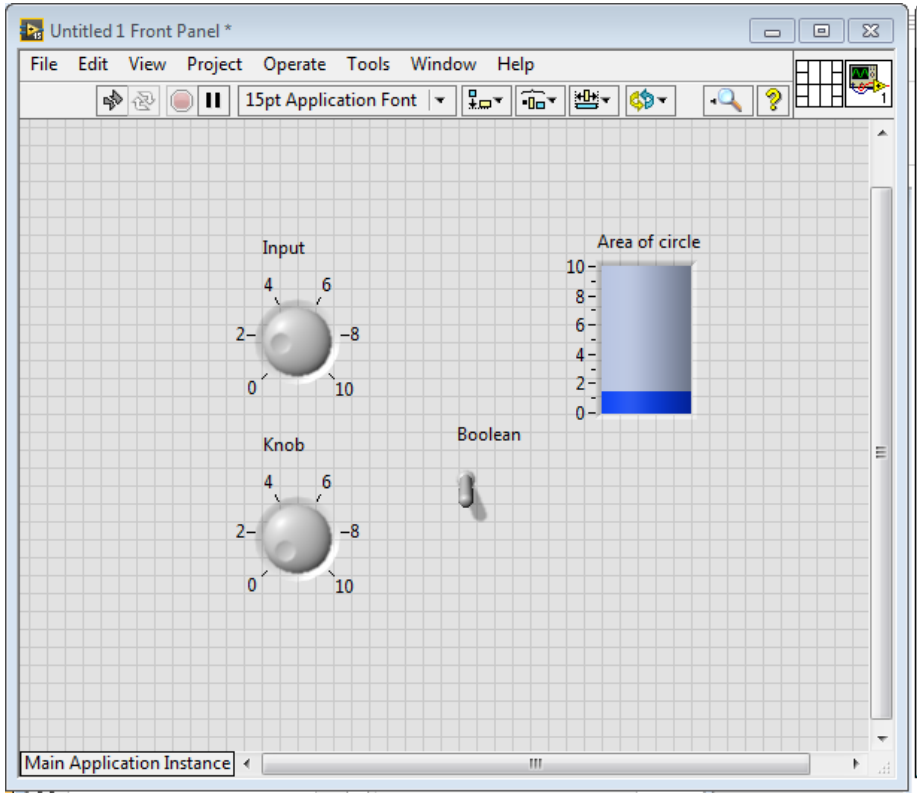


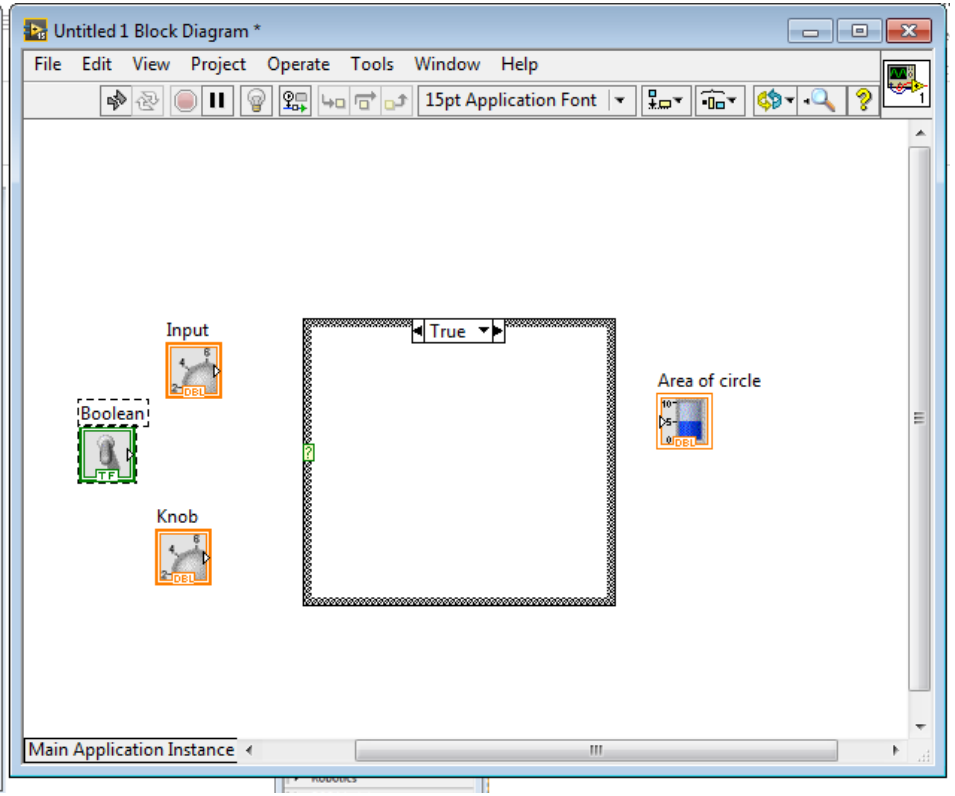
- Make your window look like this using drag and drop

Now from the block diagram editor window, make a toggle switch.

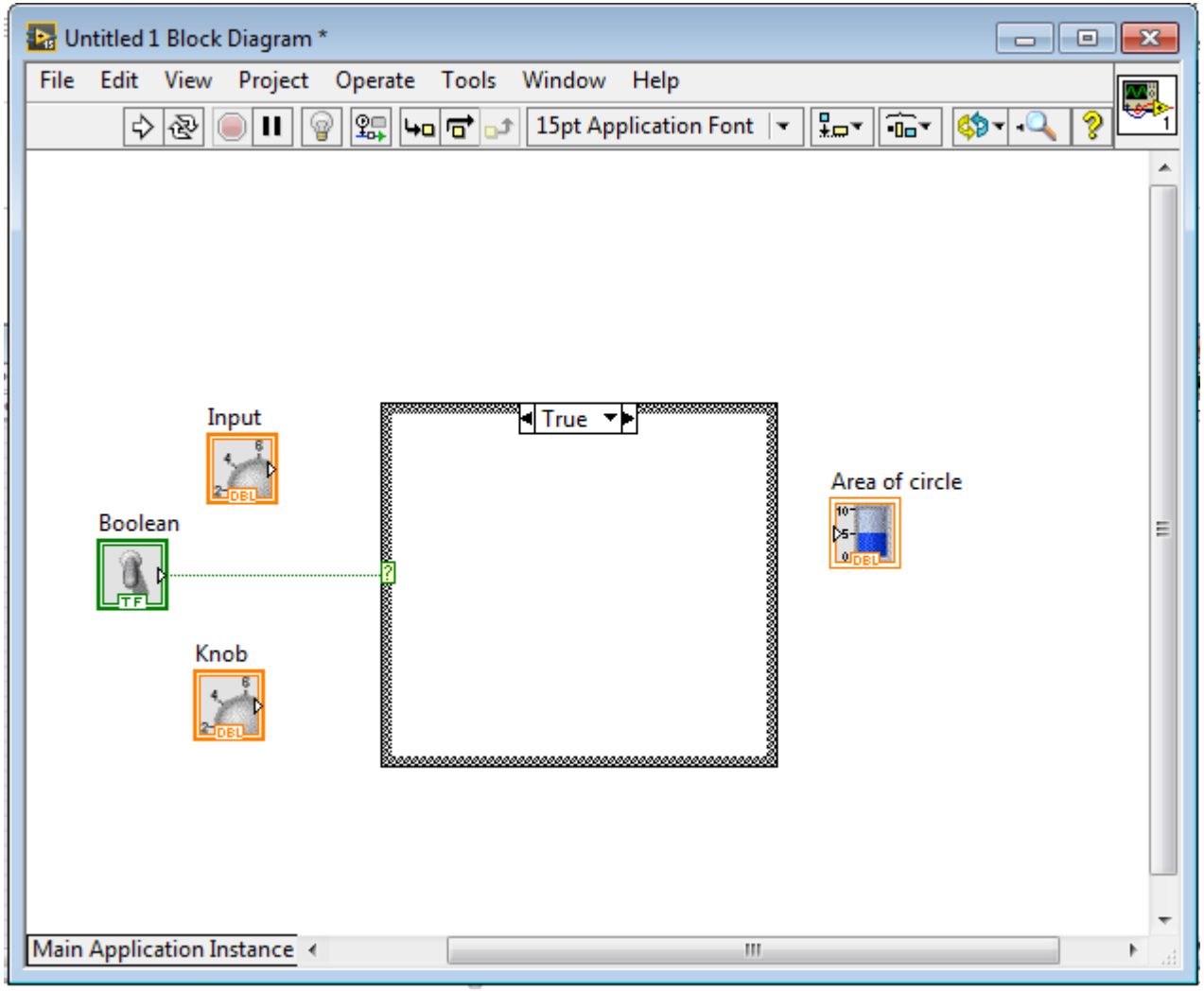


You should have something that looks like this.

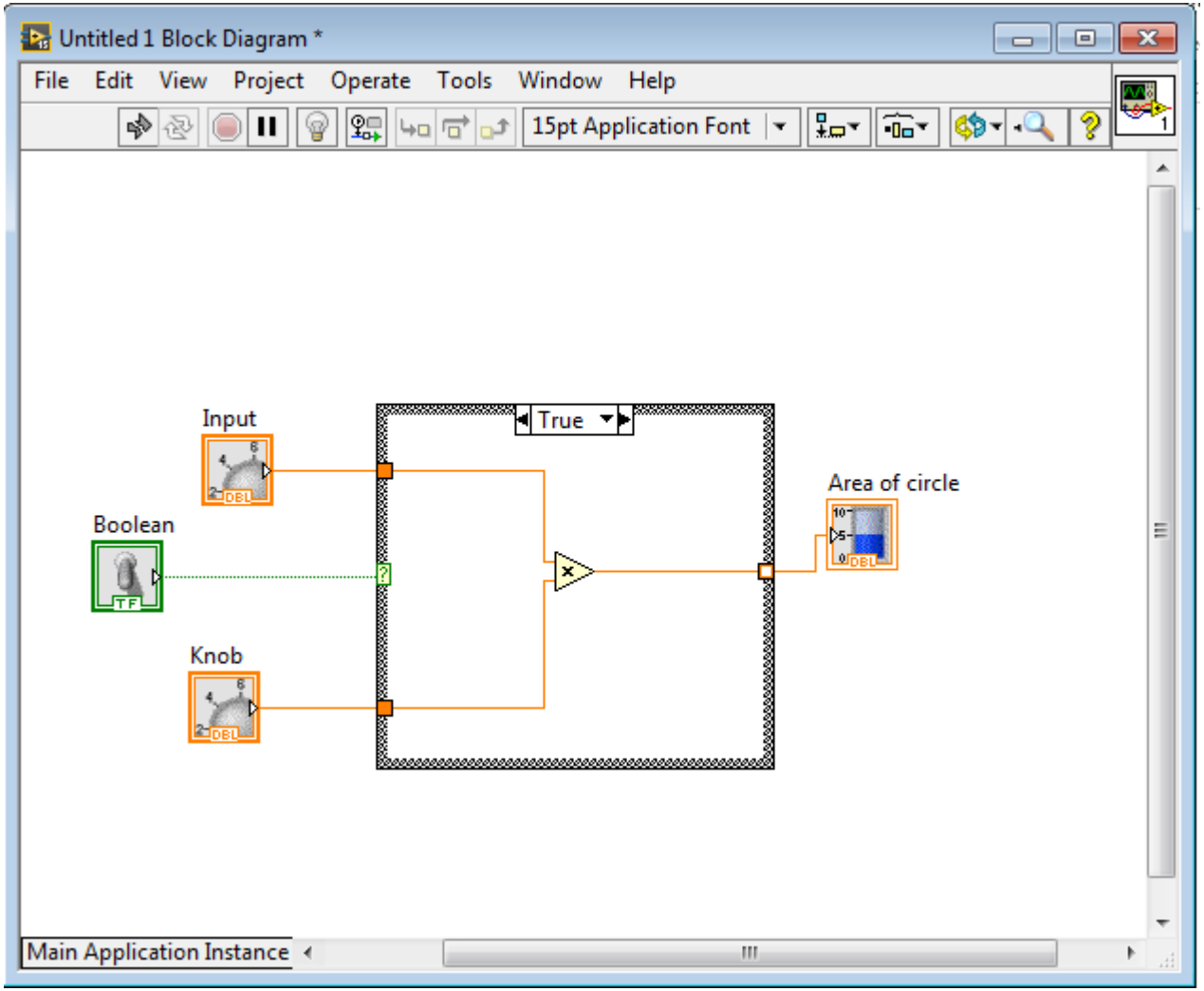




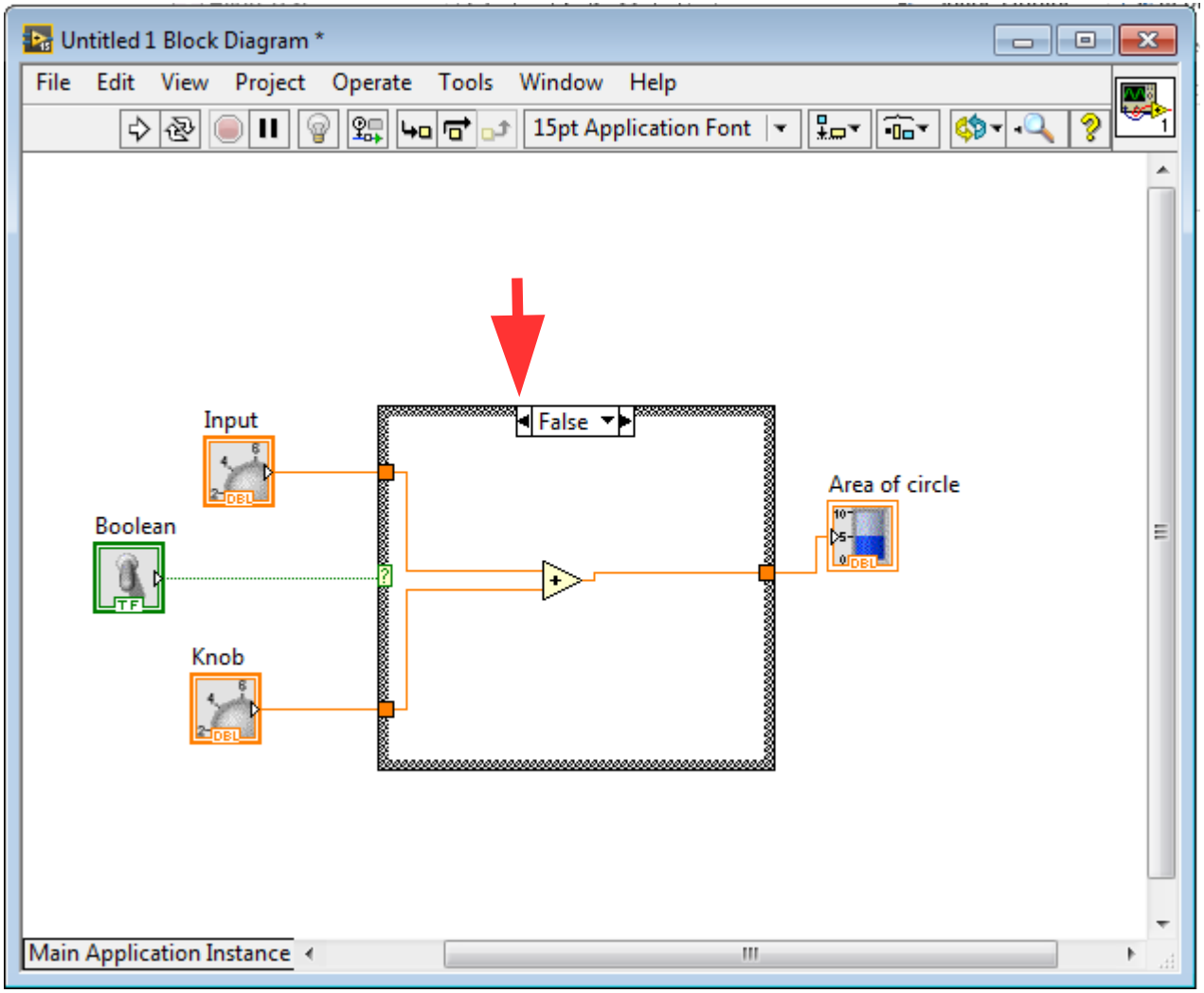
Again using the wiring tool join up the button to the case statement.



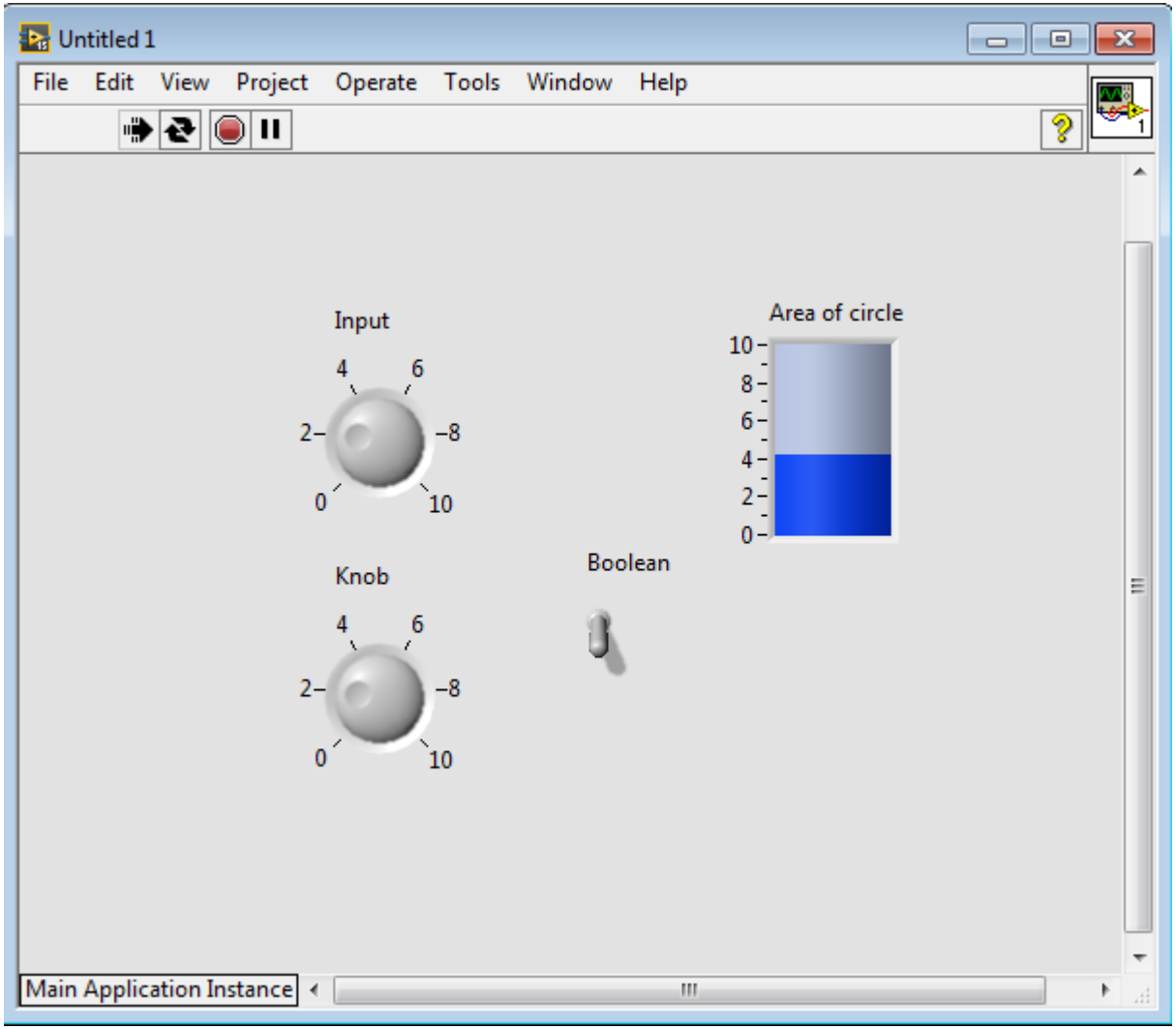
Now using the wiring tool and the x from the tool box make your diagram look like this.



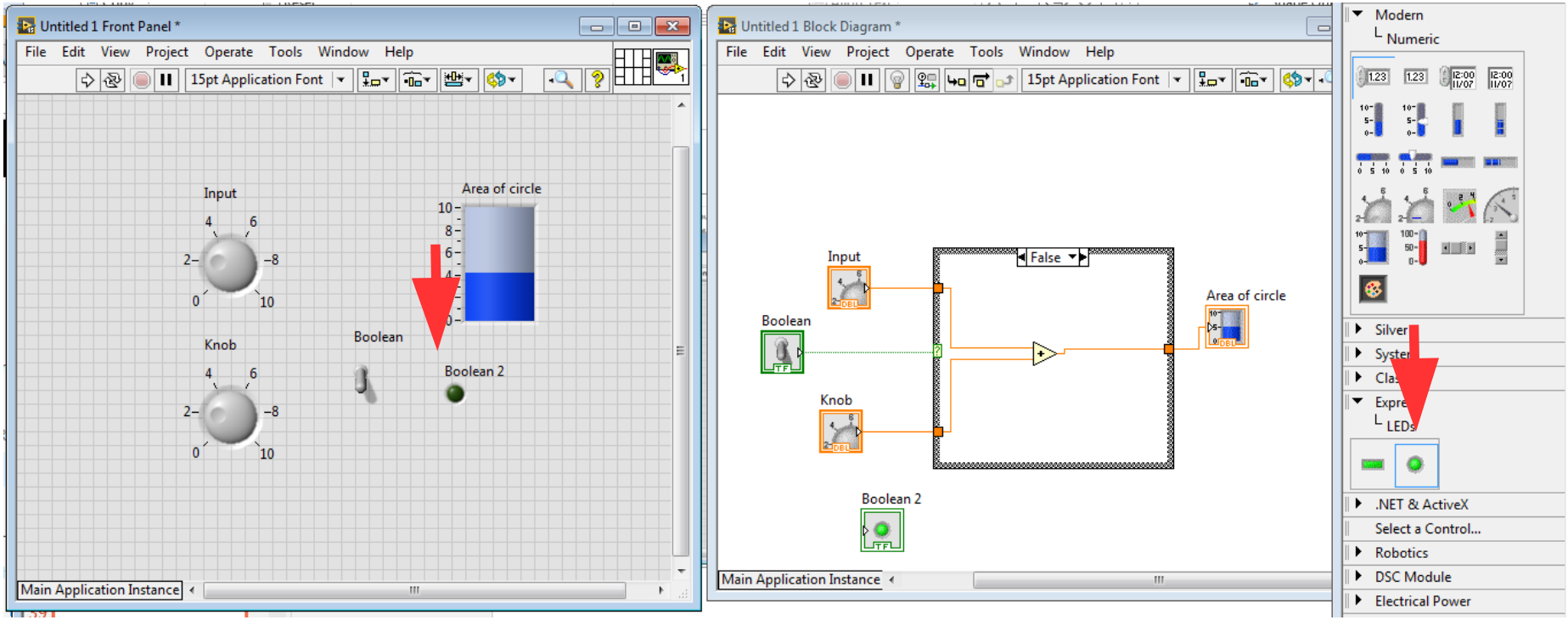
Now click here to look at the code which runs when the false conditions is met.



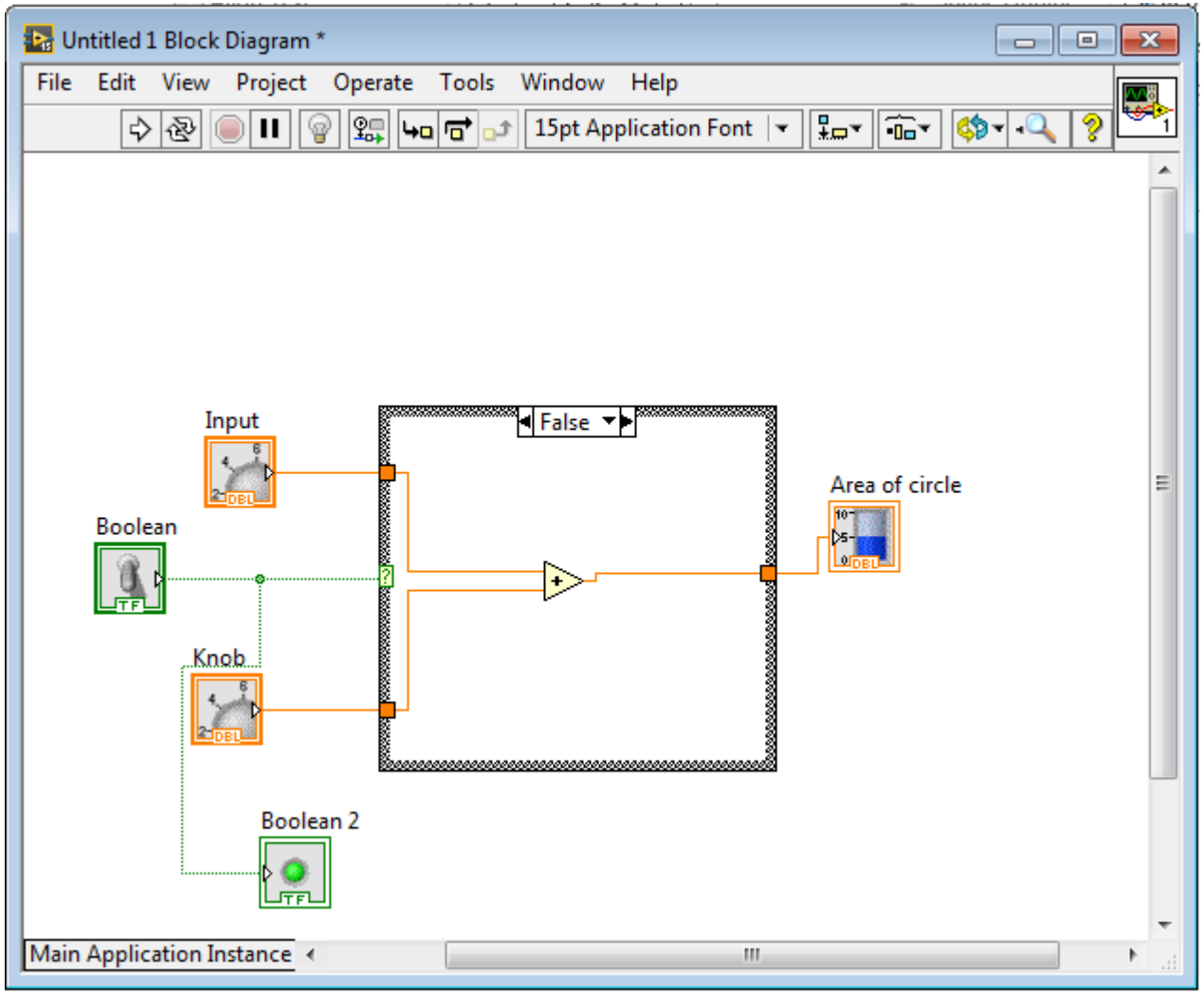
Now run the code and have a play with it.



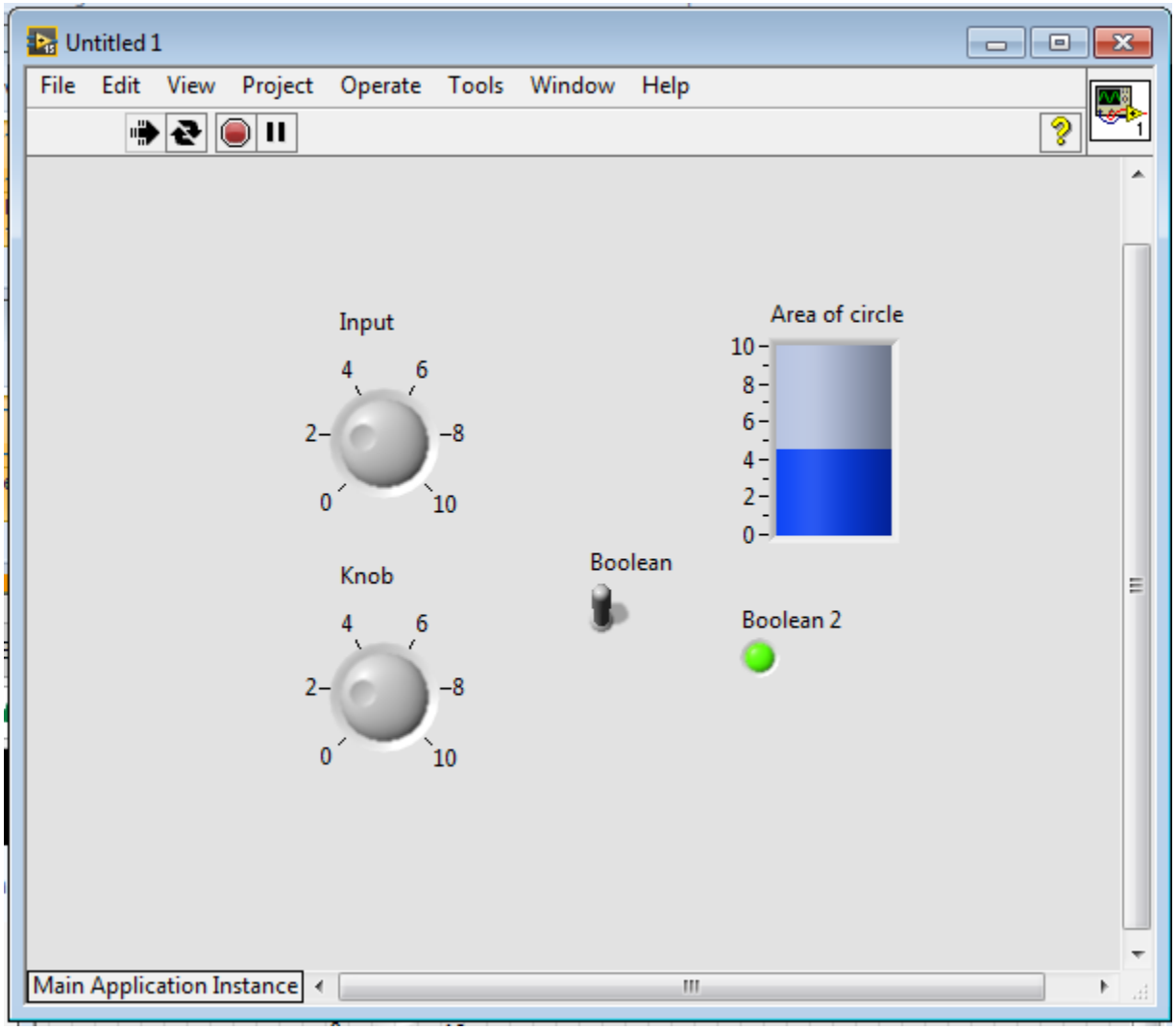
Let’s add an LED indicator just for fun.



And now wire it up with the bobbin again!



And run it and have a play!



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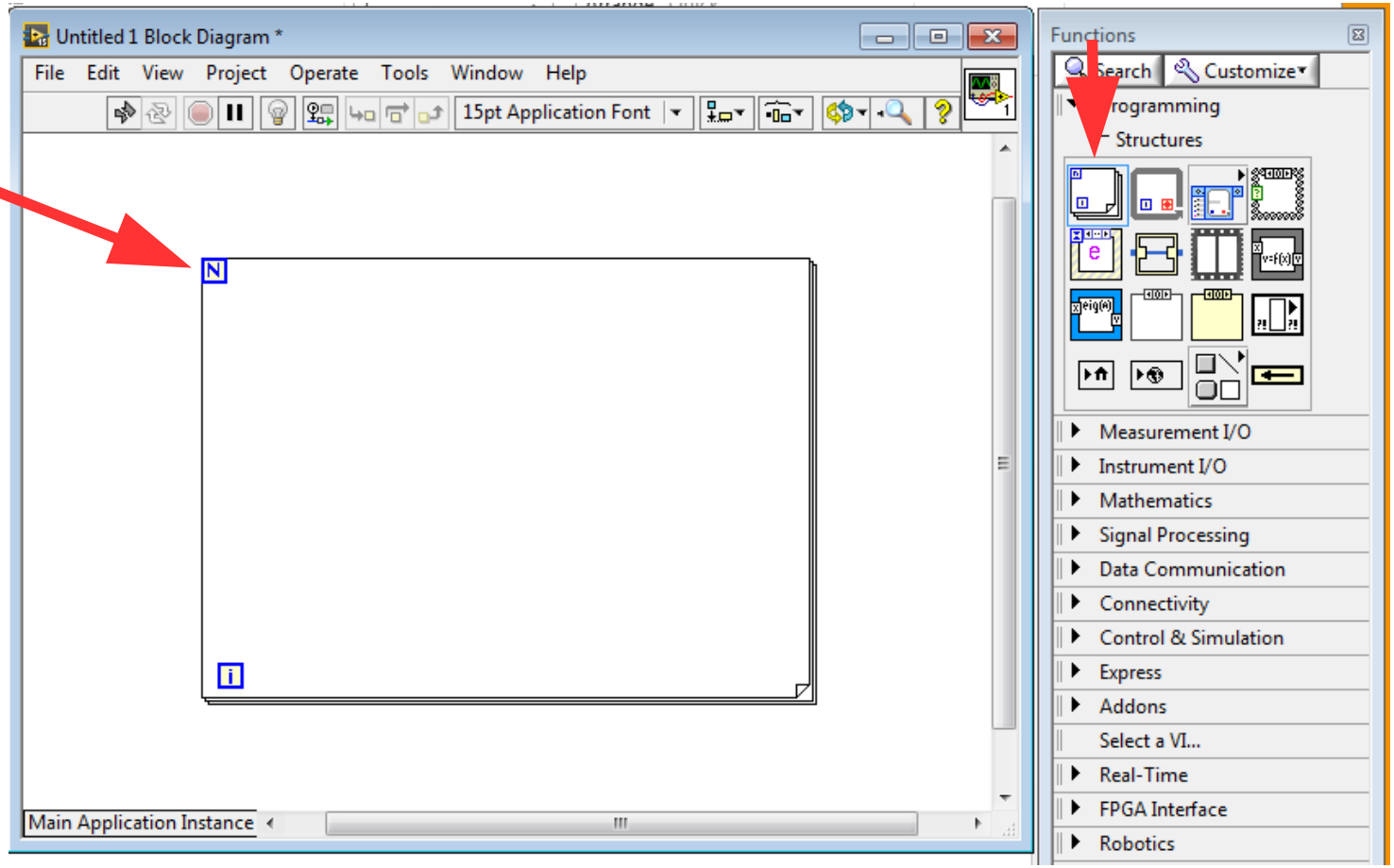
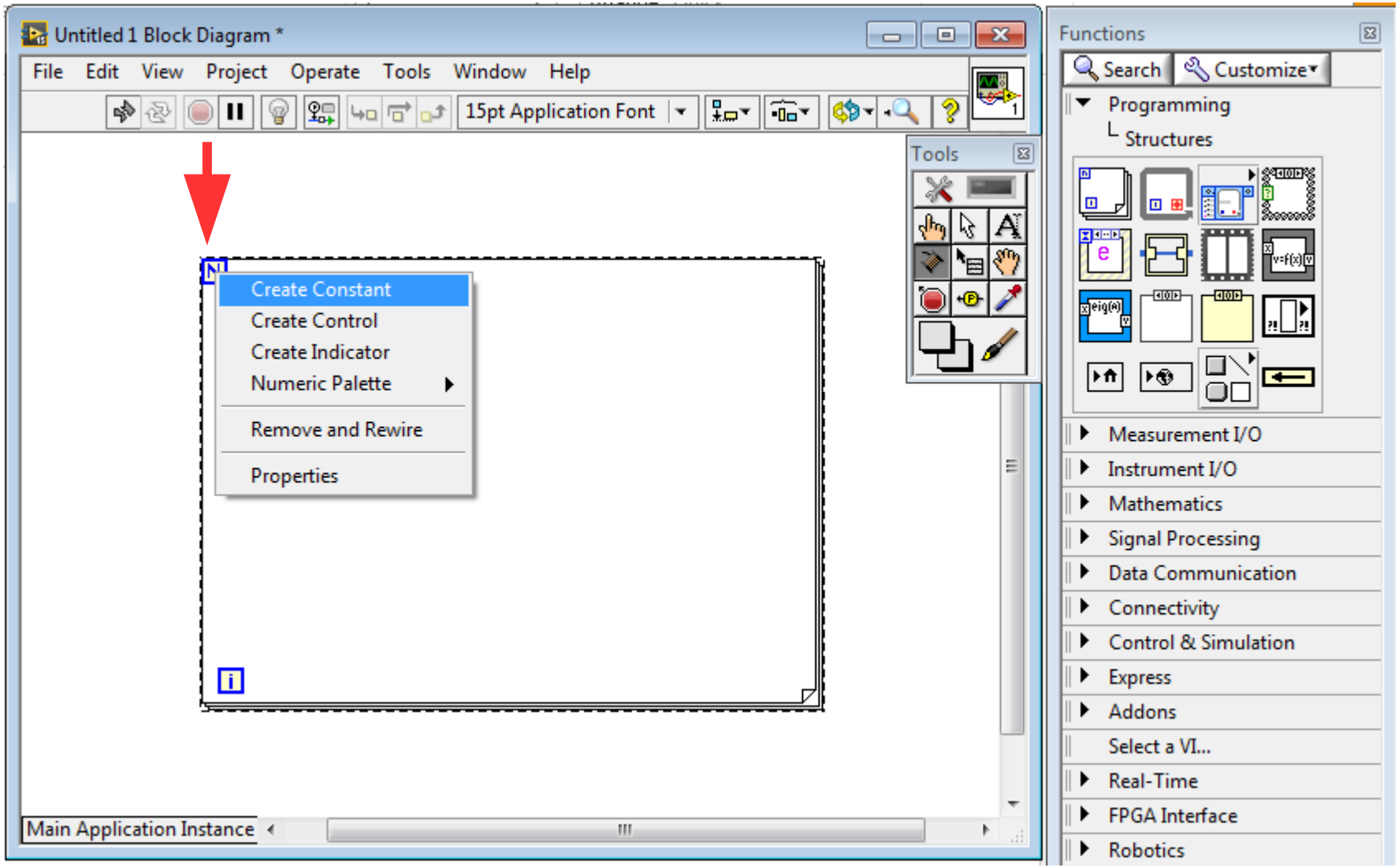
For loops in matlab

Indicates the number of times the code runs.

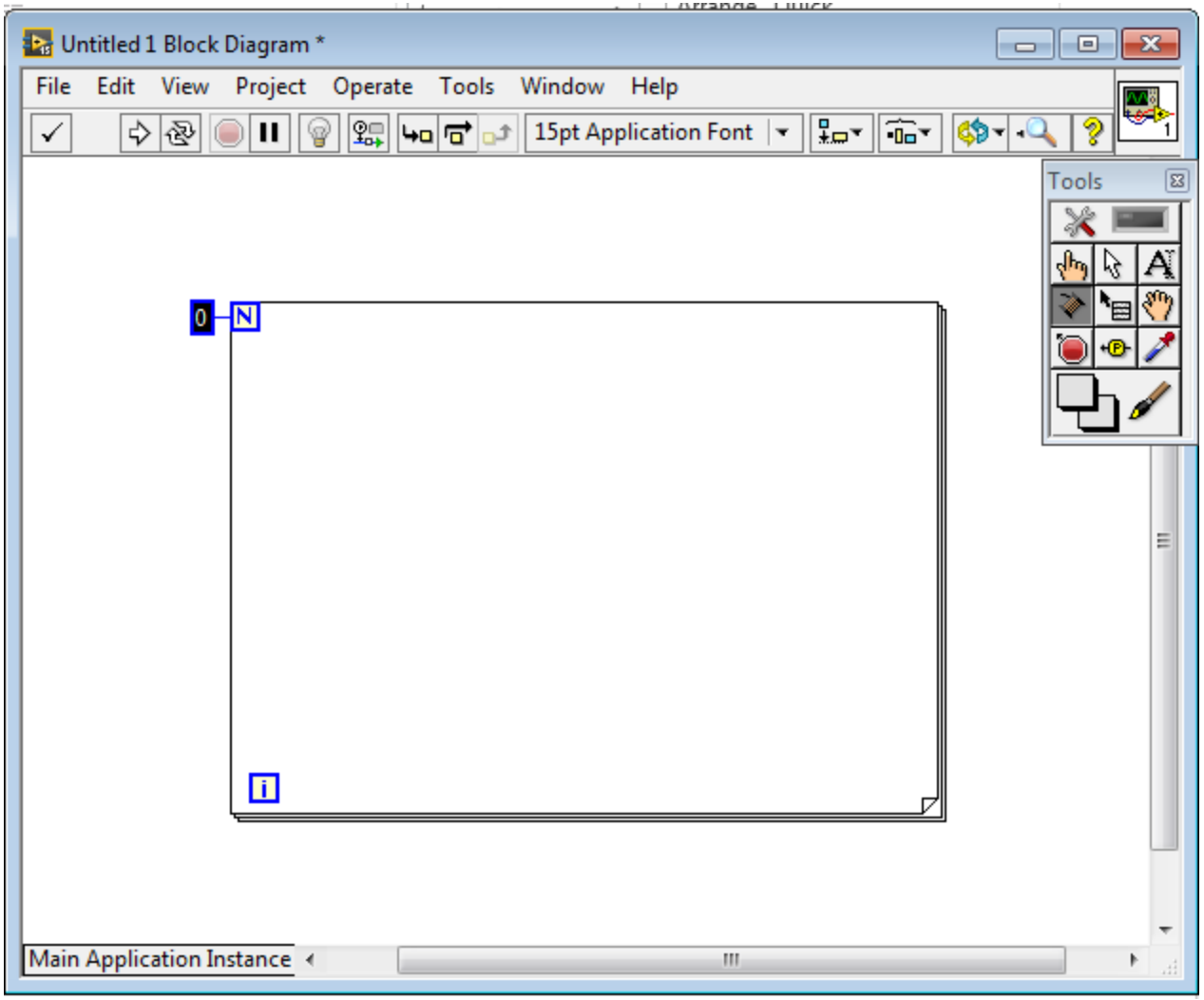


(Maybe go through loops on the board)

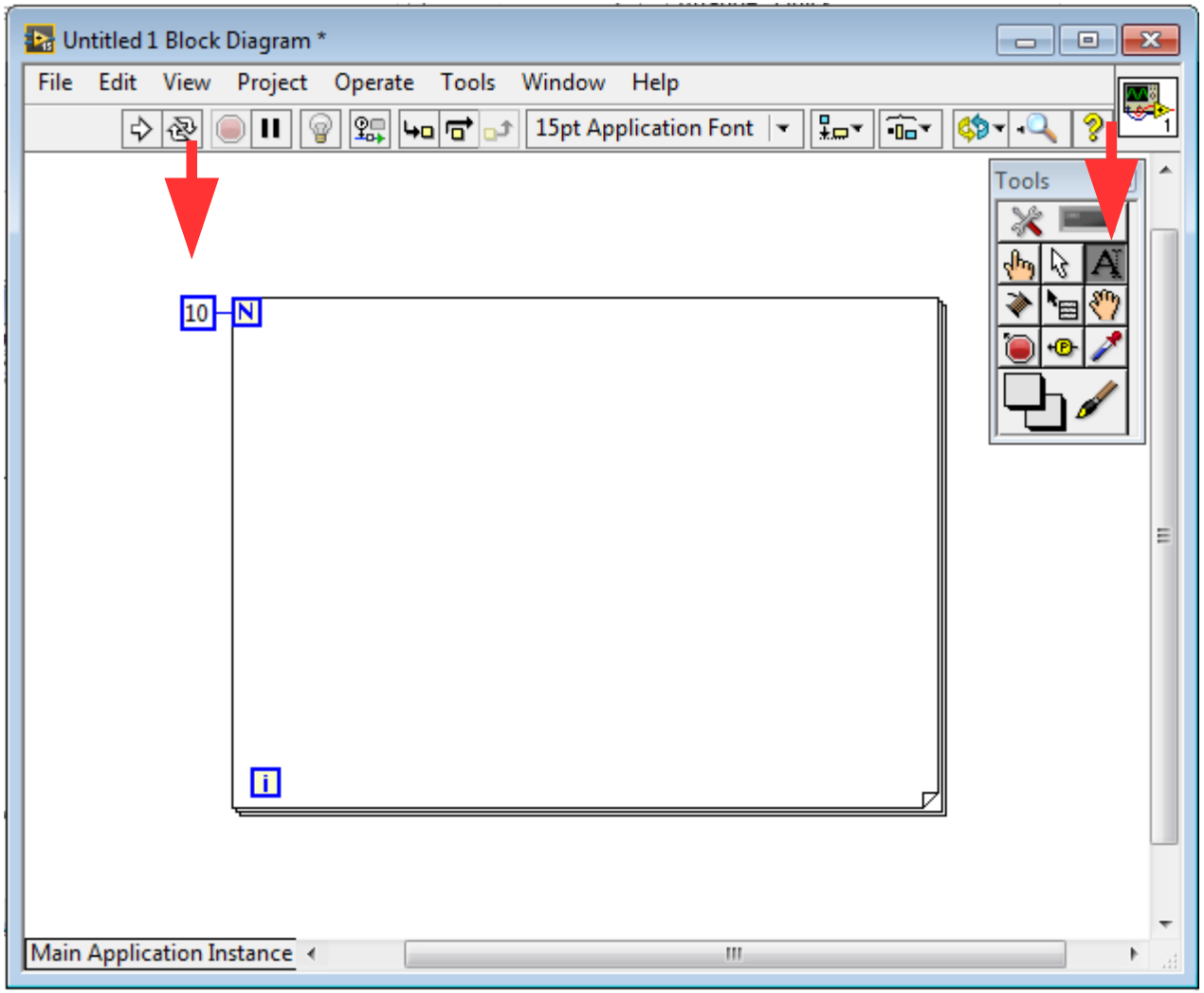
Create a numerical constant, it will tell the computer how many times to run the code.



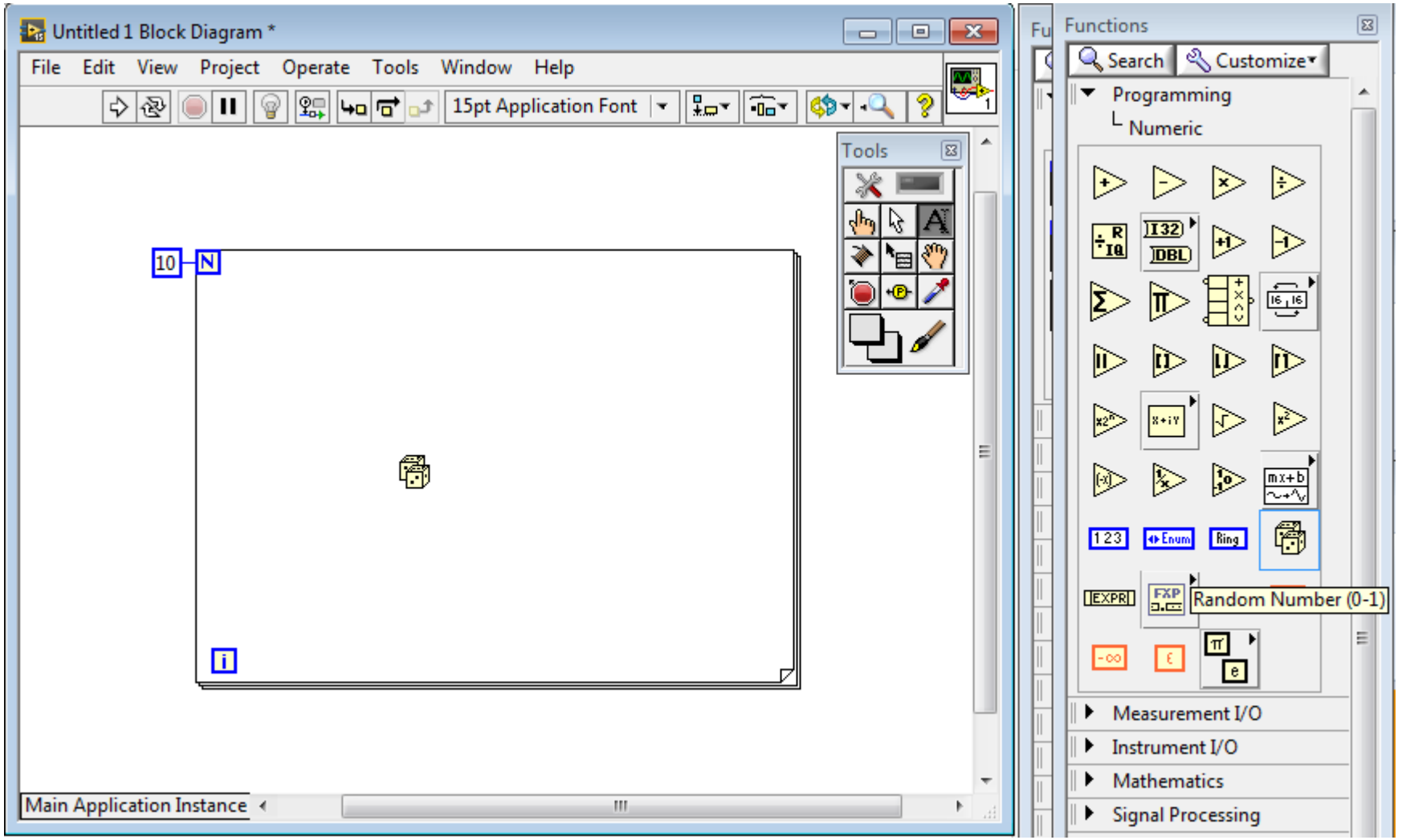
It should look like this



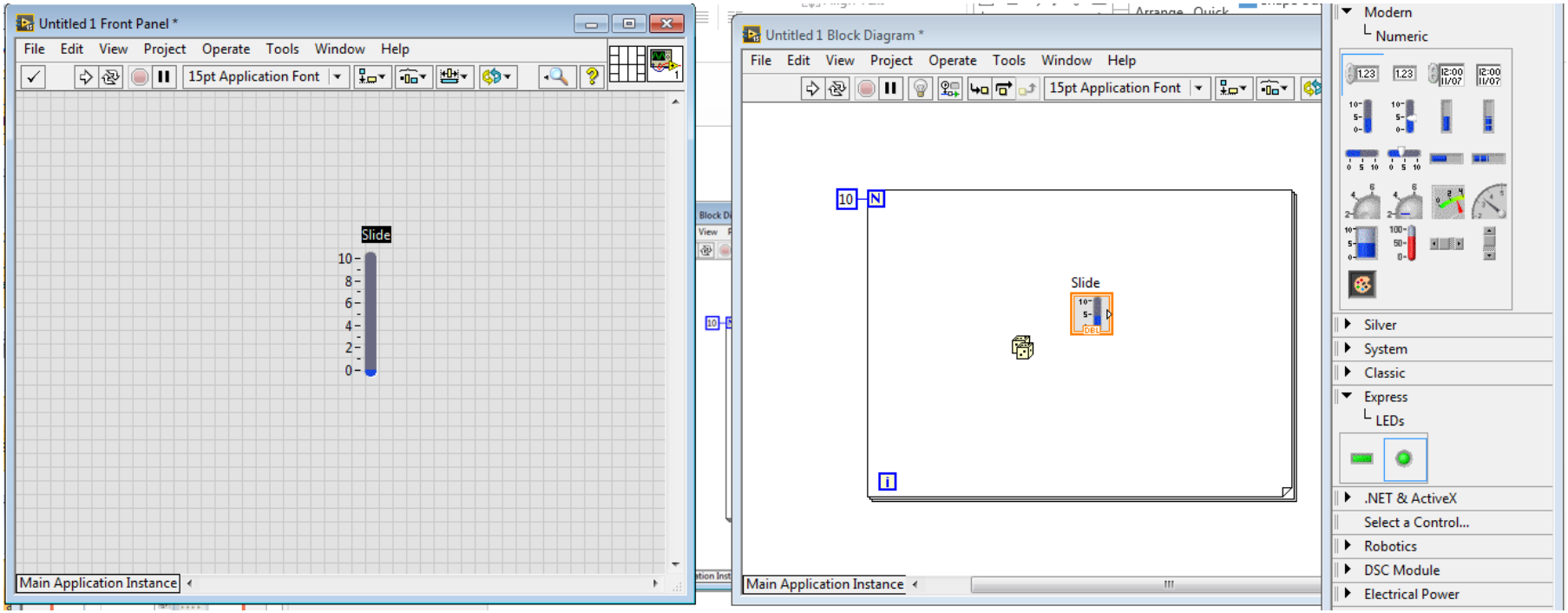
Use the editor to change the value to 10.



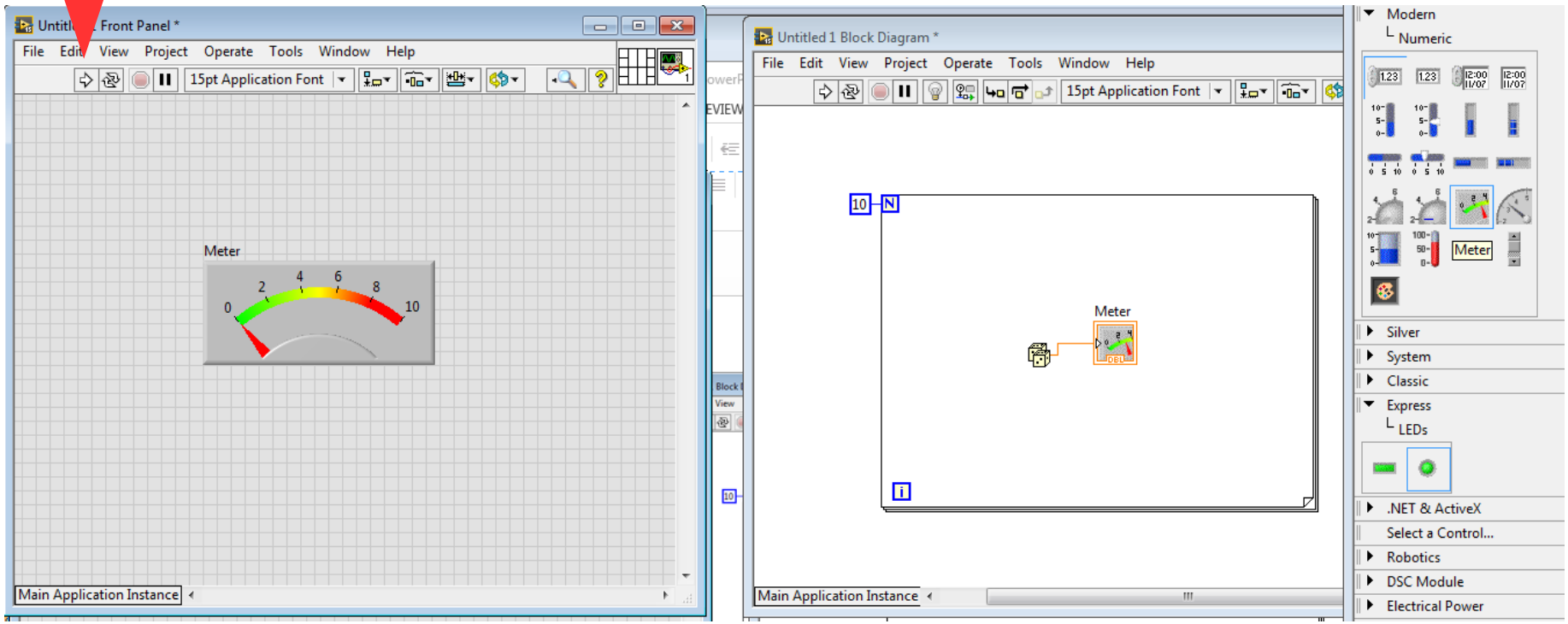
Place a random number generator in the for loop.



Now place a slider in the front panel make sure the icon in the block diagram is in the for loop box.

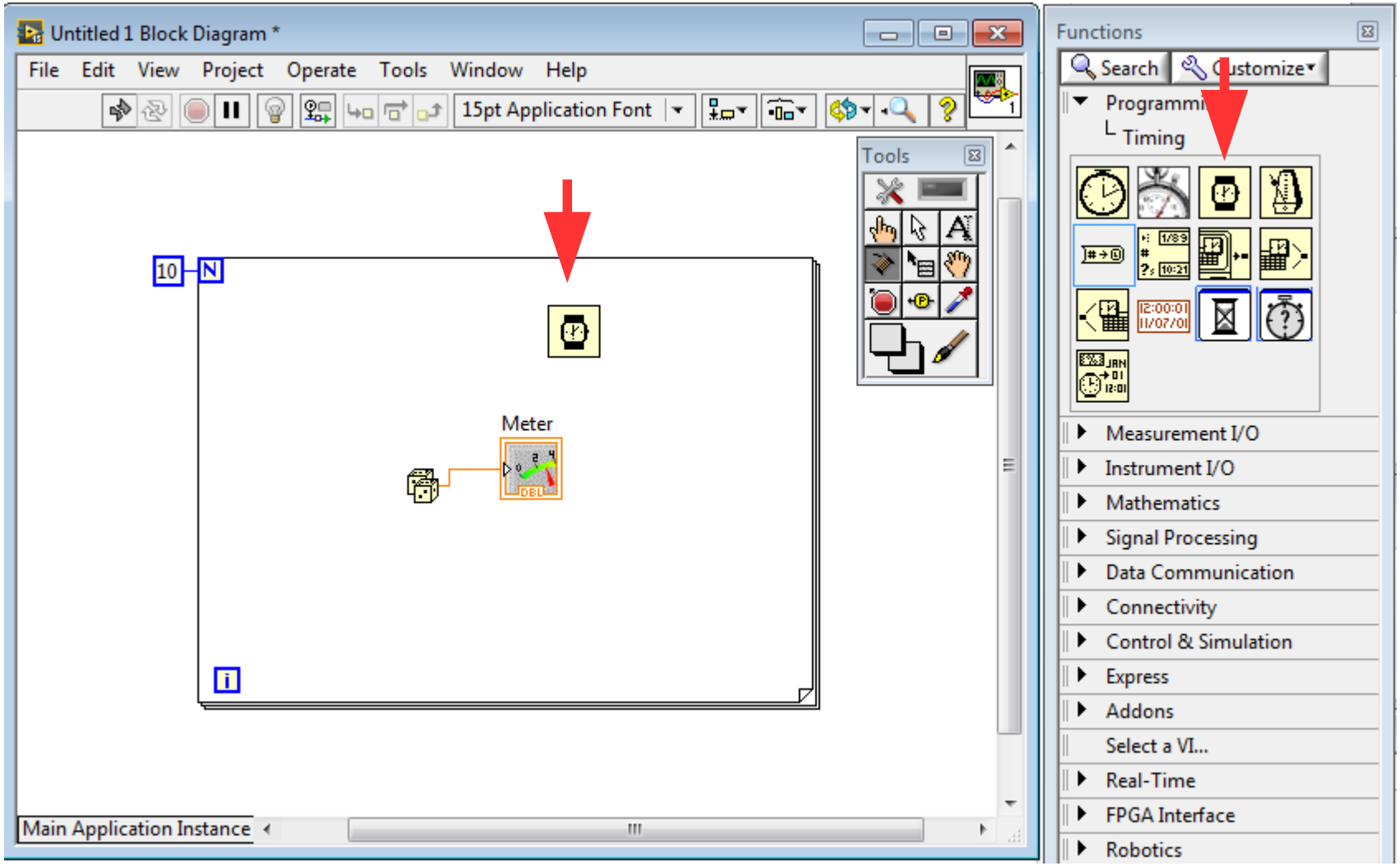


Now connect the random number generator to the indicator.

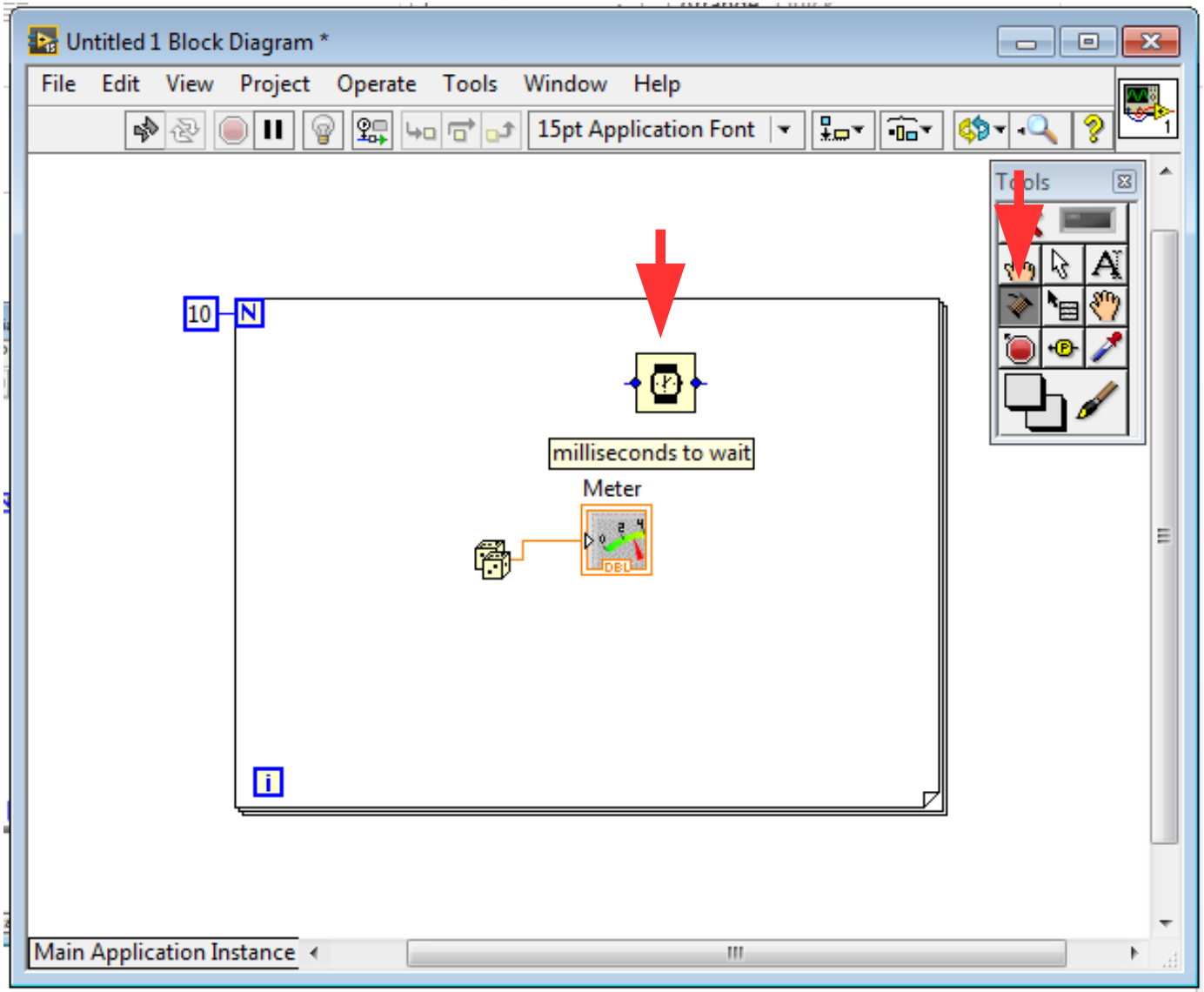


- Note I've changed my indicator to a meter (just for fun!).
- And click Run once.
- What happens?

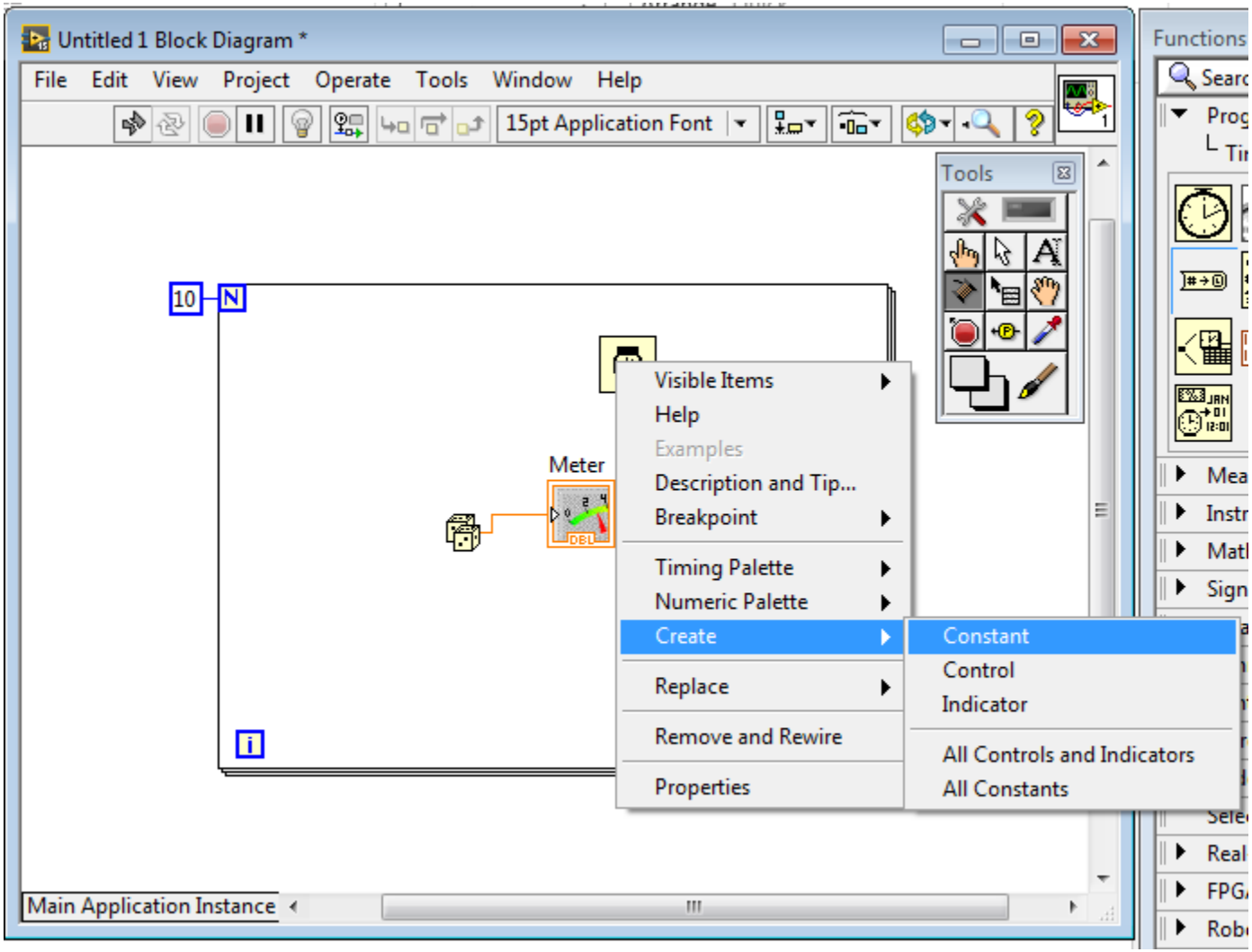
OK so let's add a timer to slow things down.



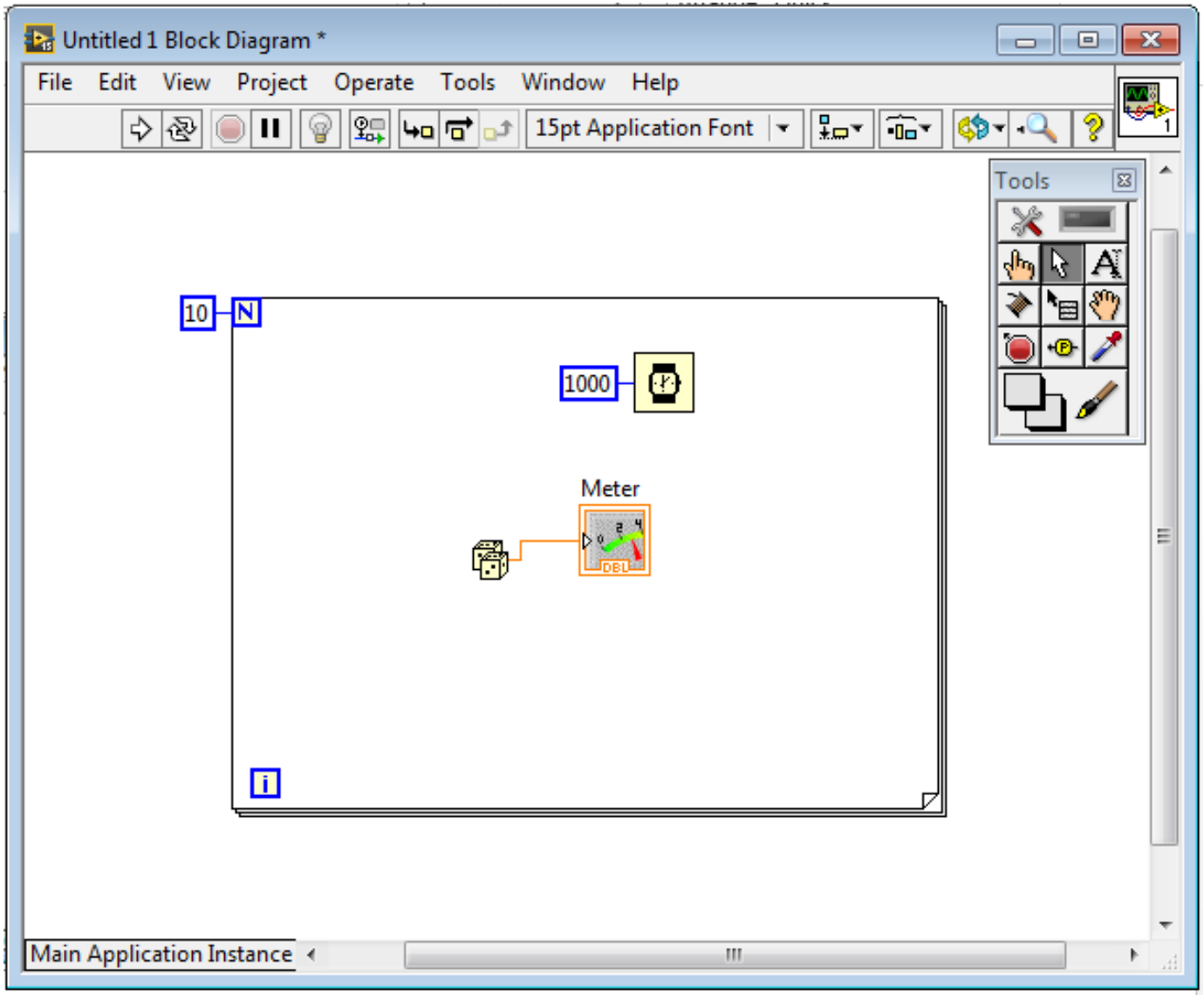
Hover over this with the bobbin tool selected



Right click and make a constant.



Set the value to 1000 because it’s ms and run it again.



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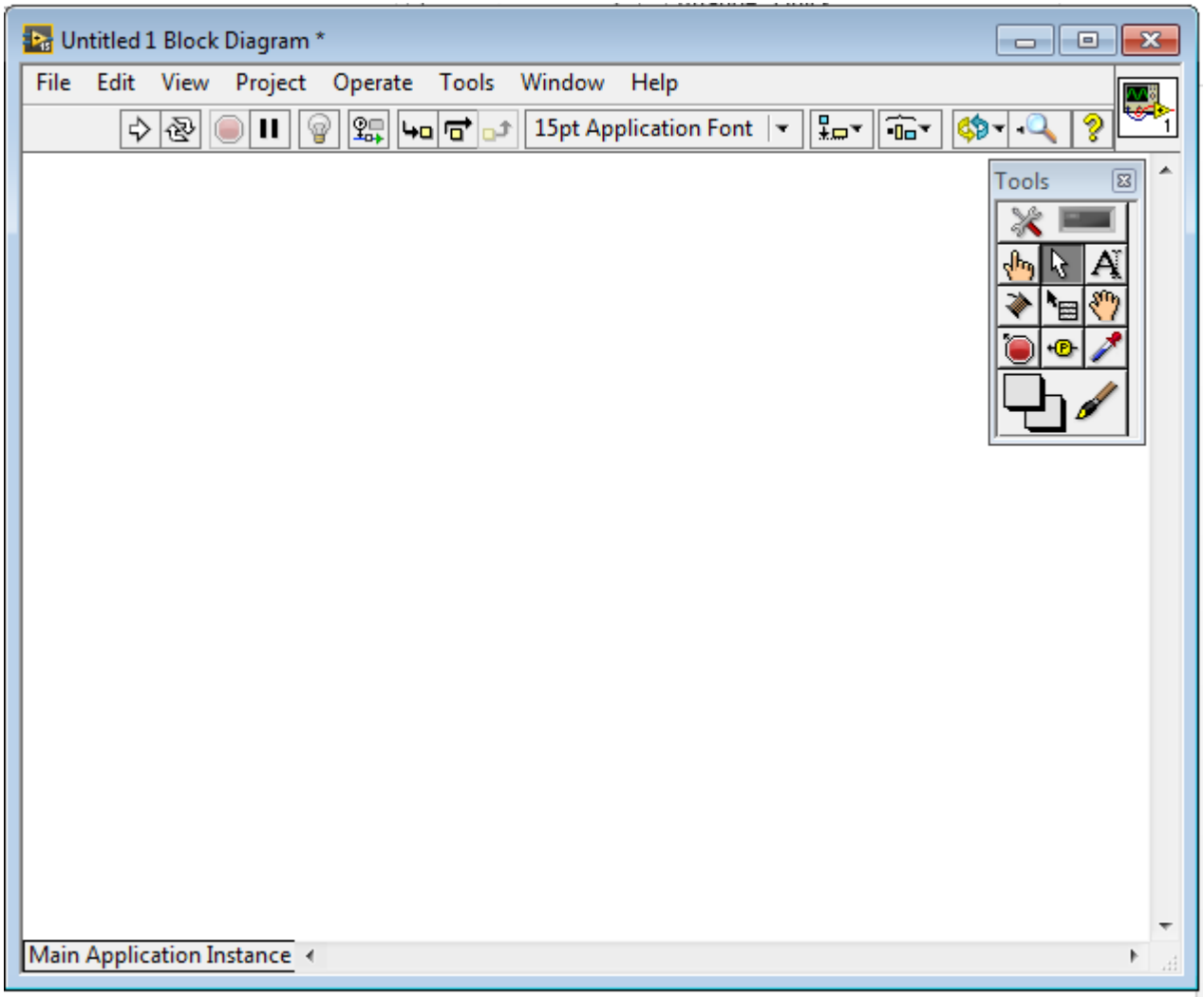
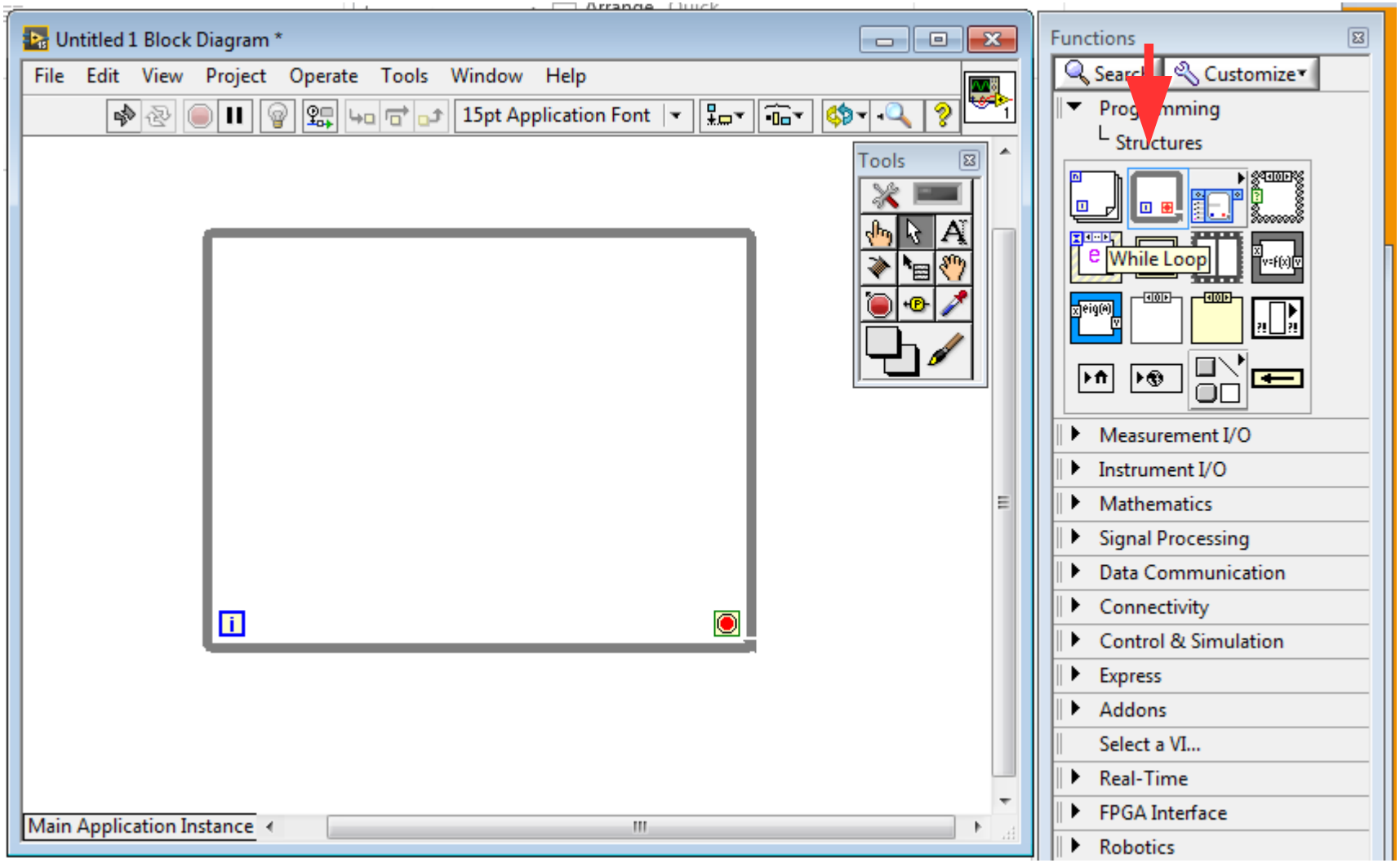
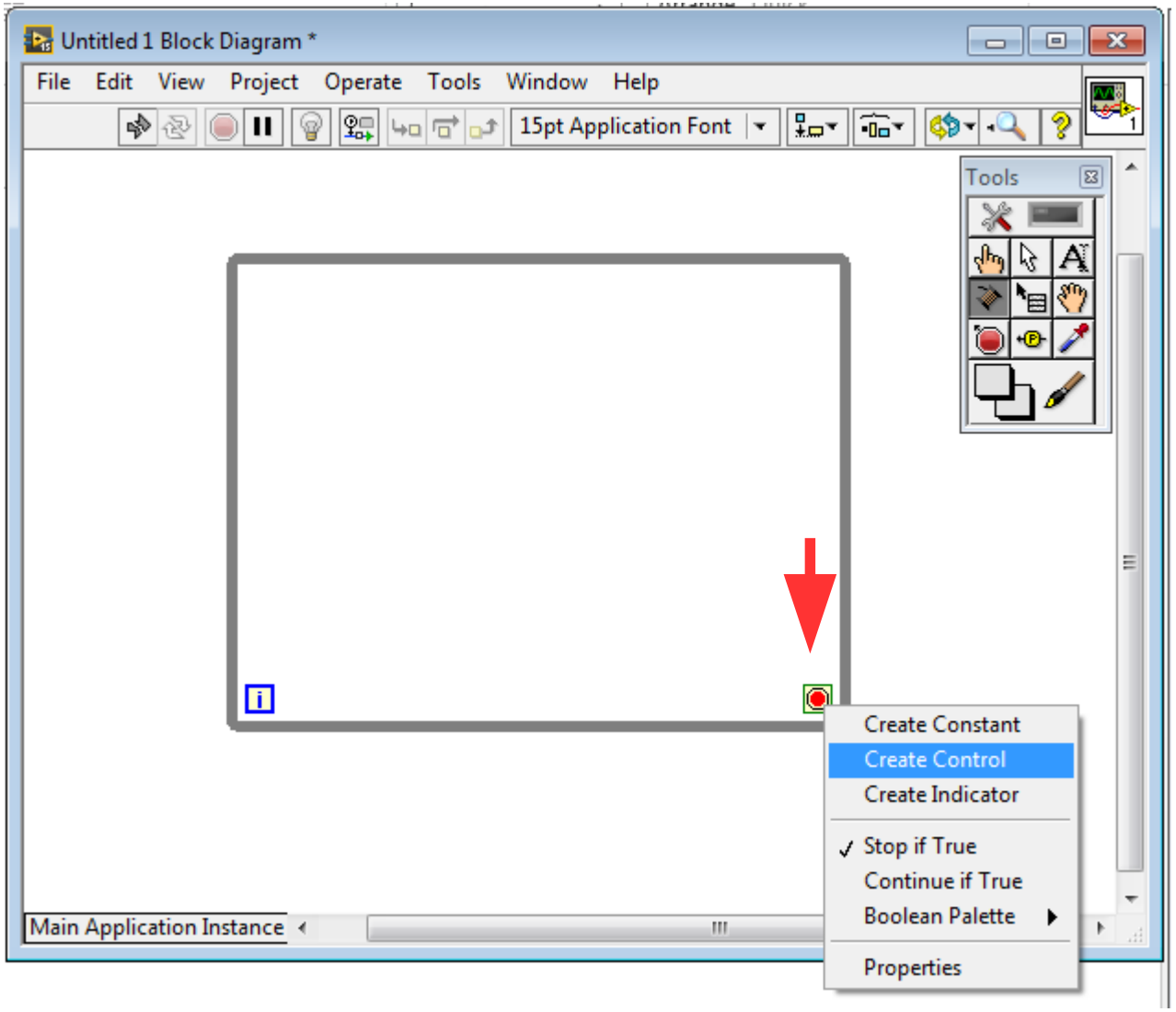
So, let's start over, and delete every thing.



This time instead of using a for loop, let's use a while loop.



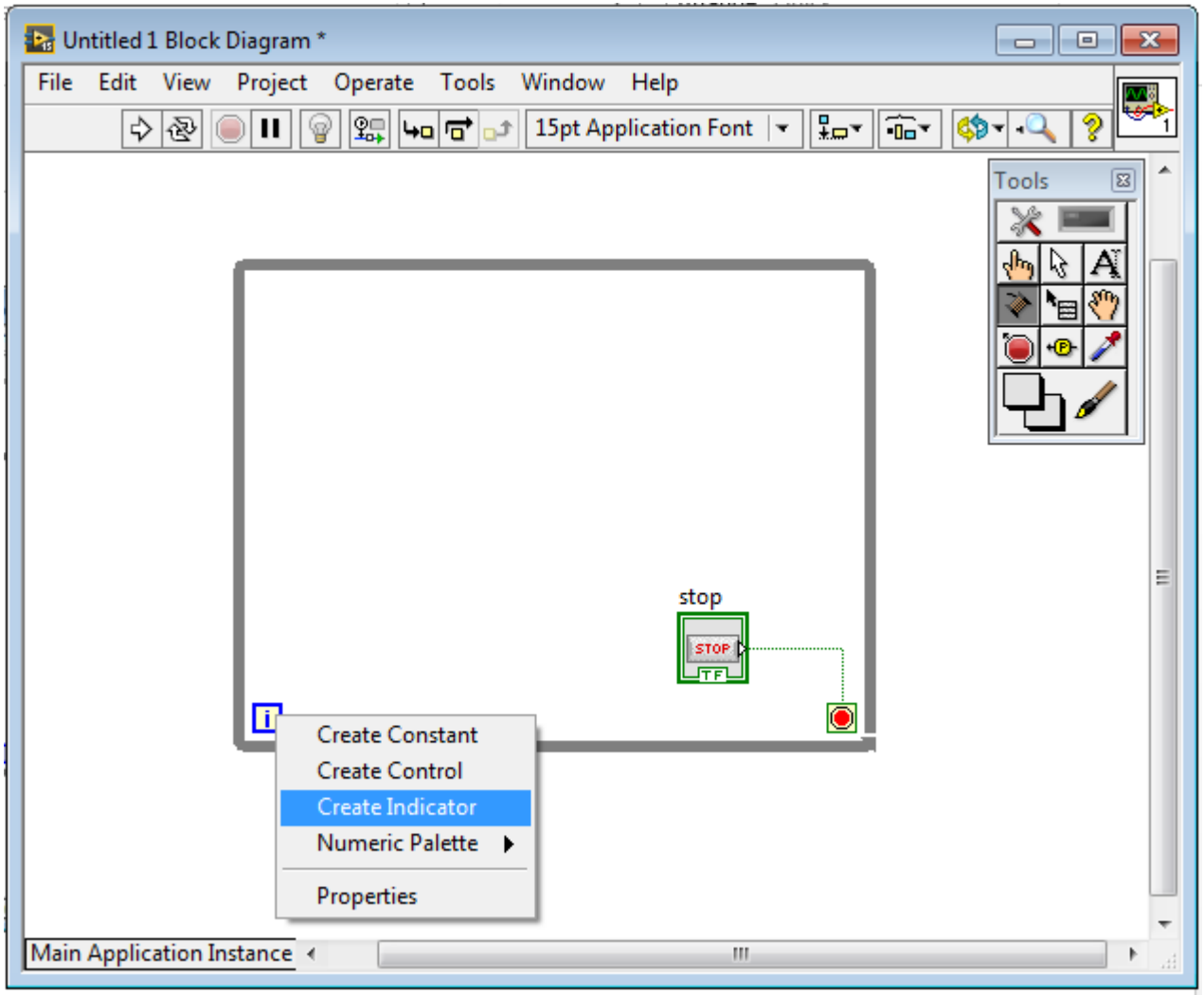
While loops run forever until they are told to stop.



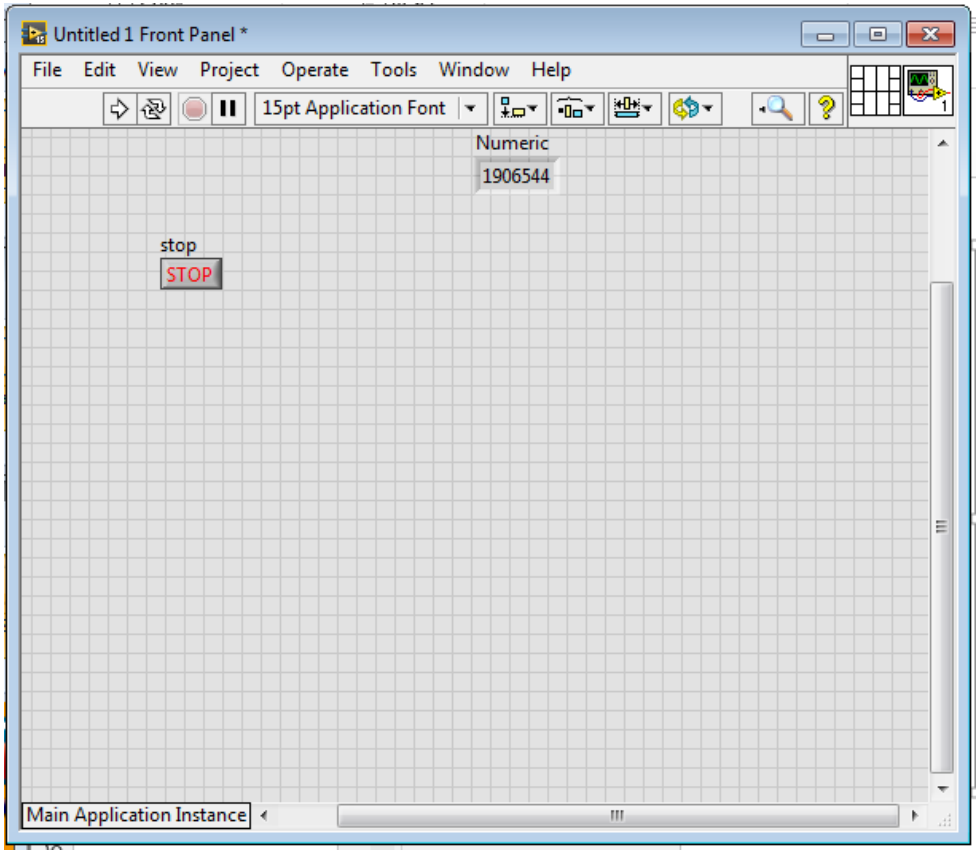
- This is the button that tells the while loop to stop.

- Click create control.

This tells us how many times the while loop has run, to view the value click create indicator.

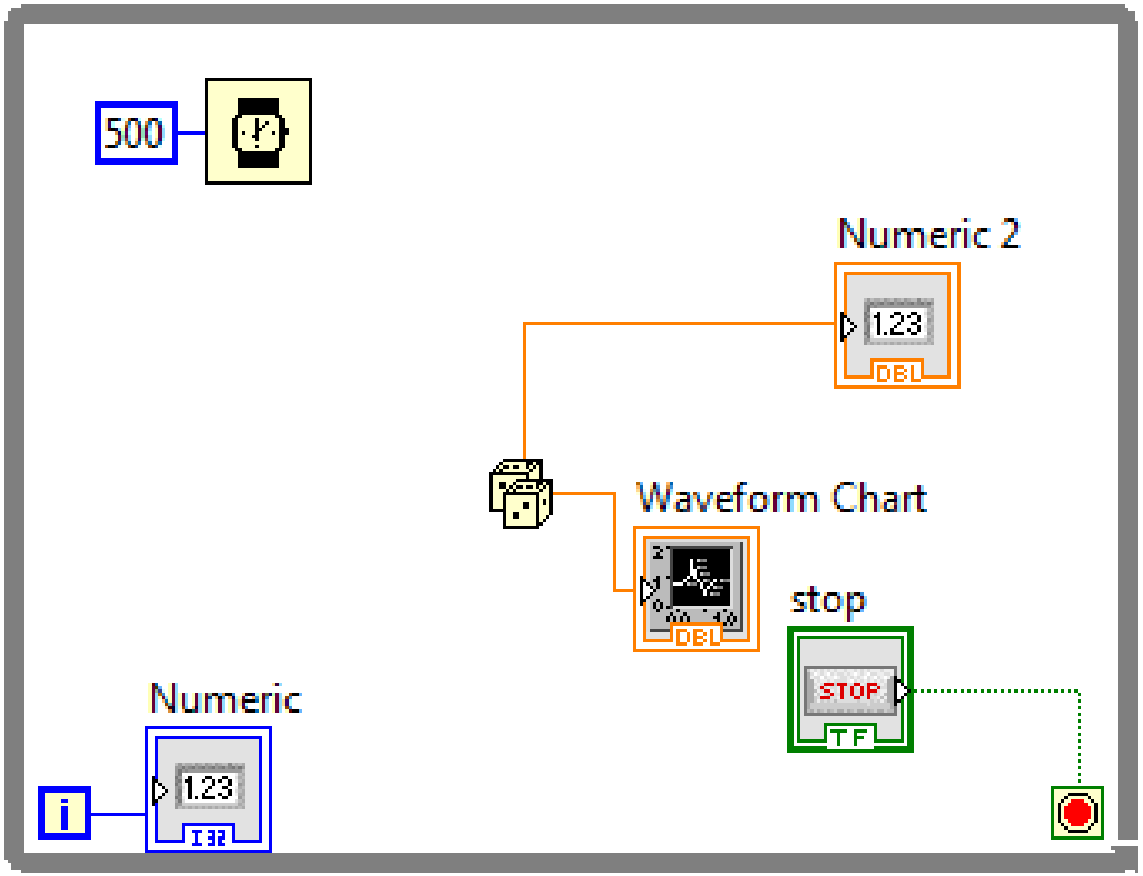


Click the run once button. And then hit the stop button when you want it to stop.

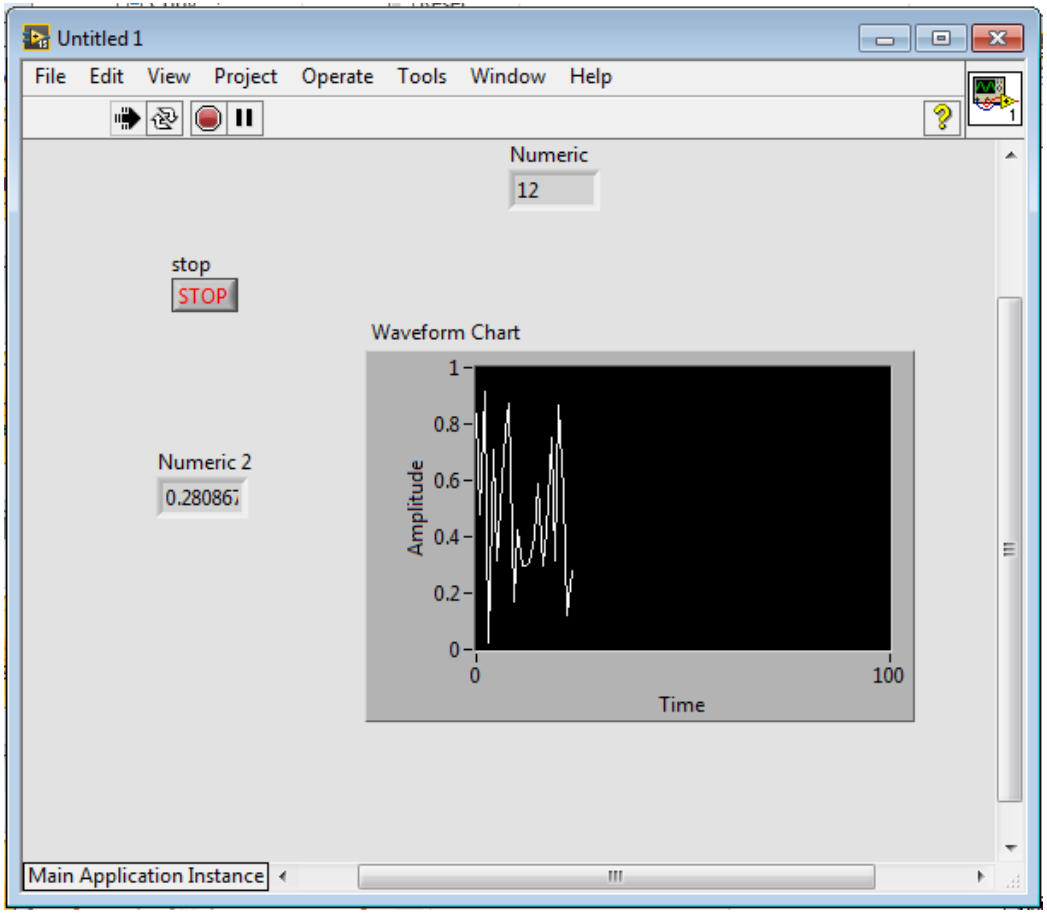


- How quickly can you stop it
- What's the lowest number you can get it to count to?

In class exercise: Try to make this little program.



This is what it should look like.



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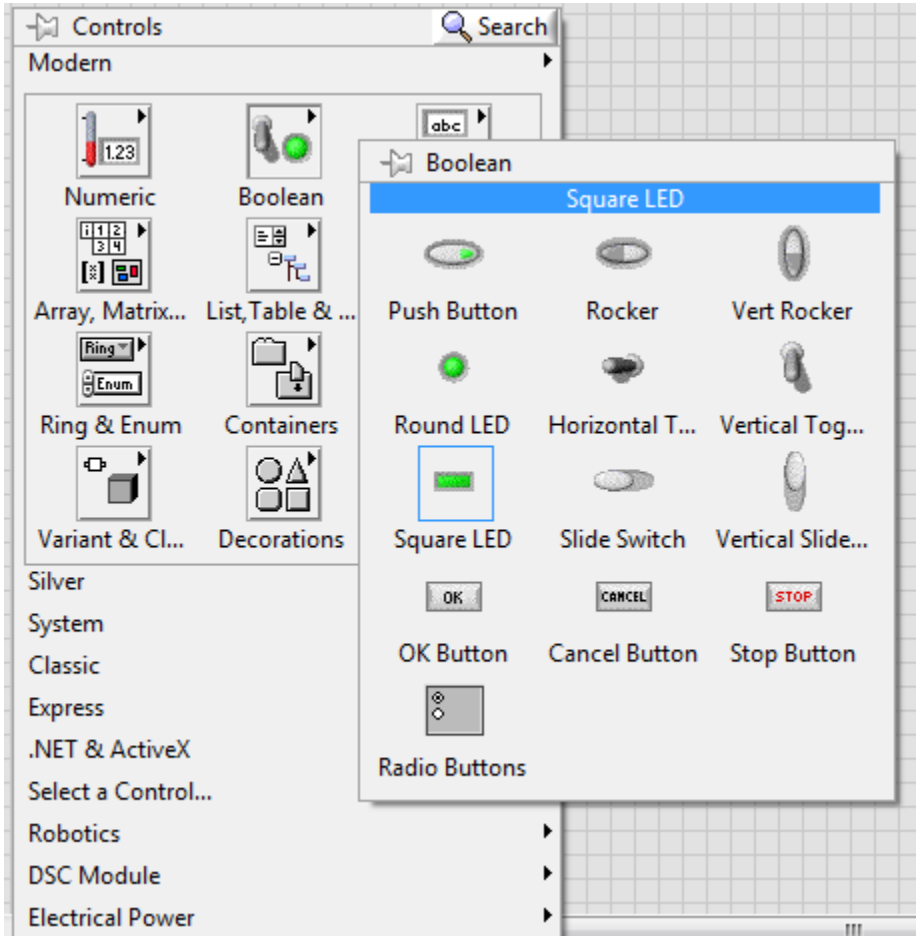
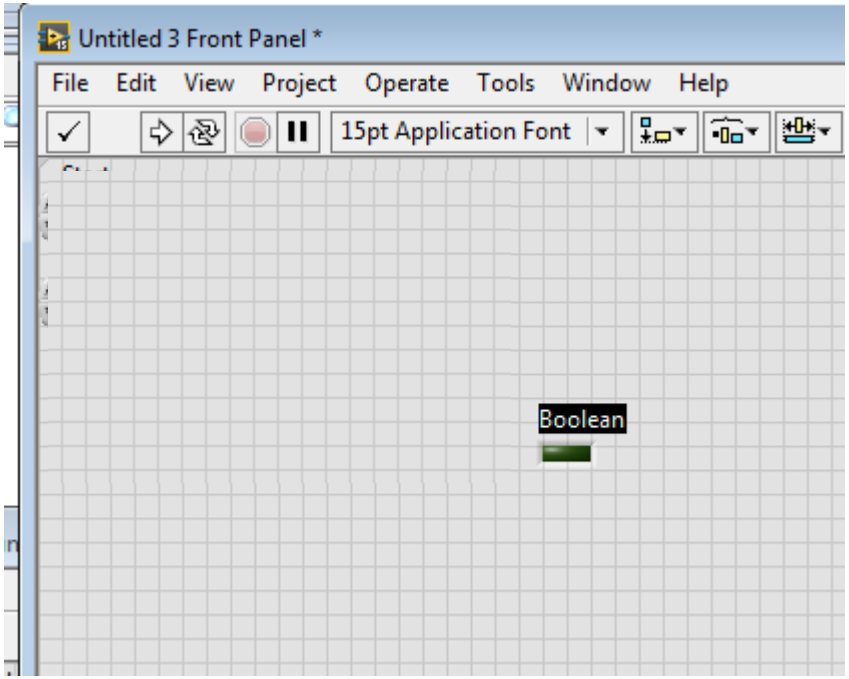
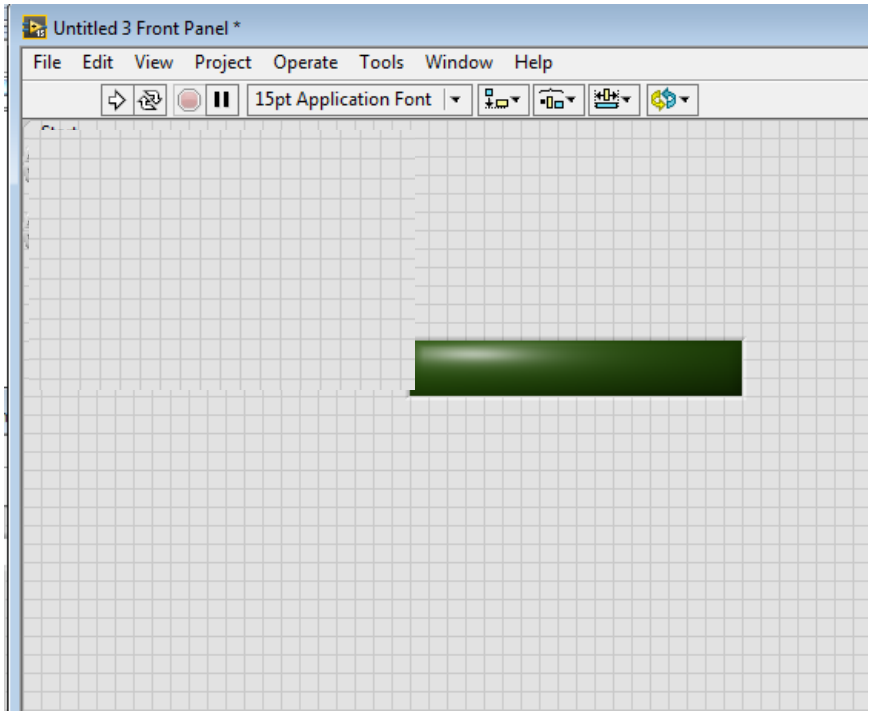
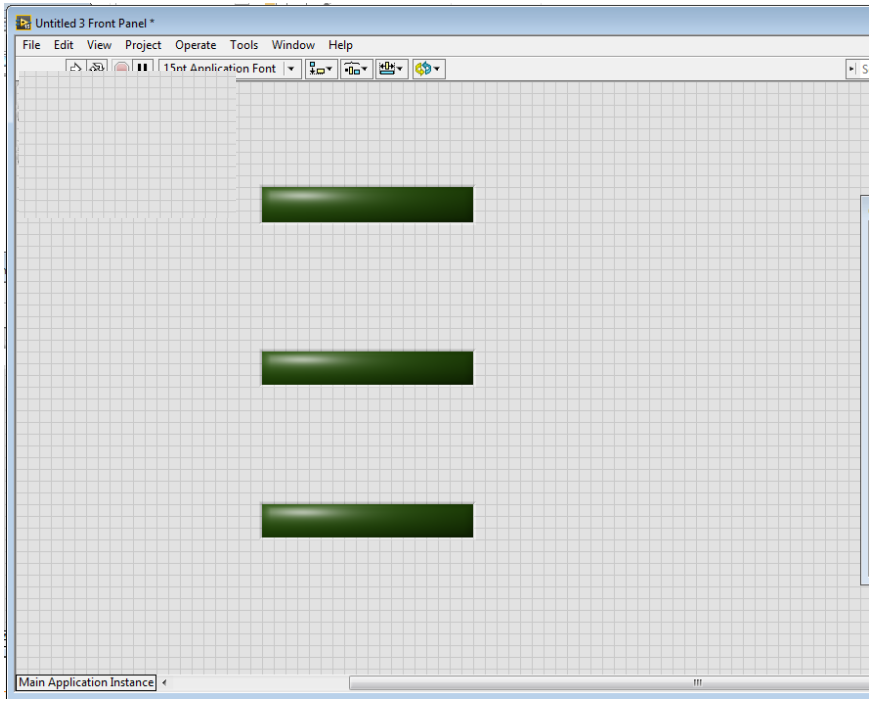
Find the square LED from the ‘Modern’ menu



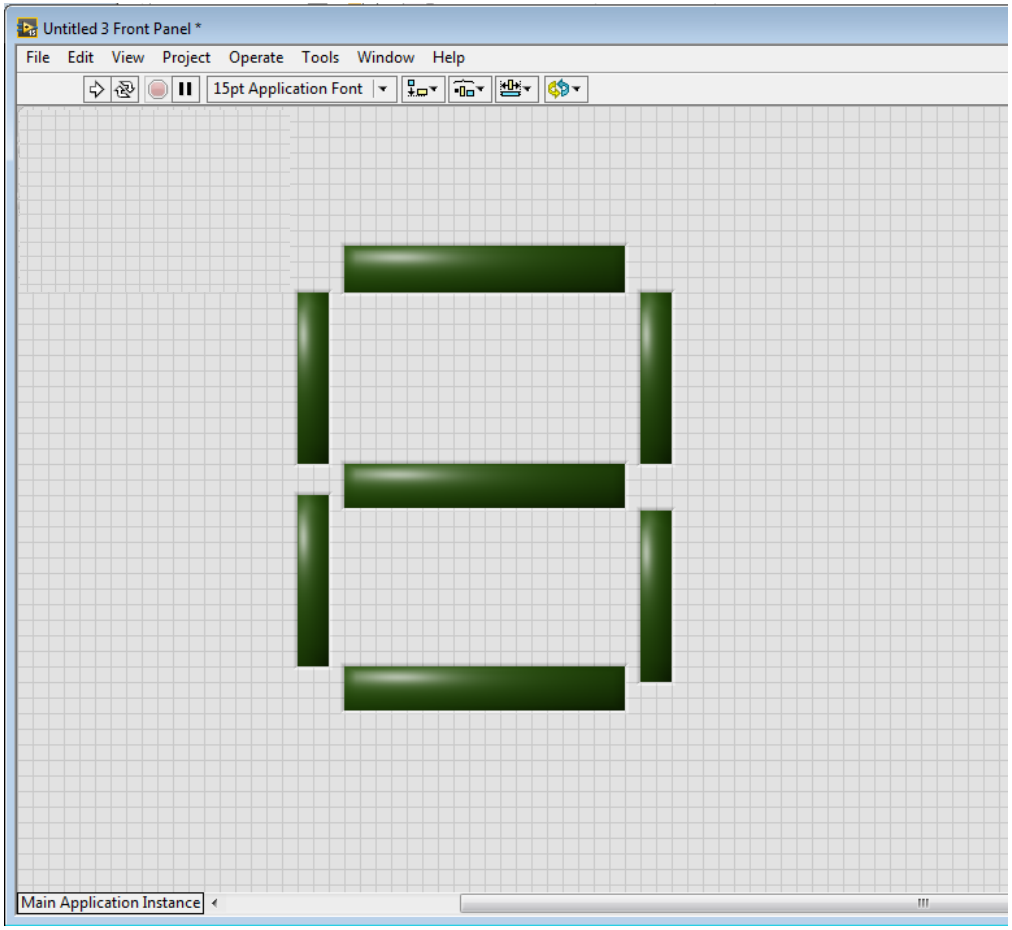


Now make it bigger and arrange it like this

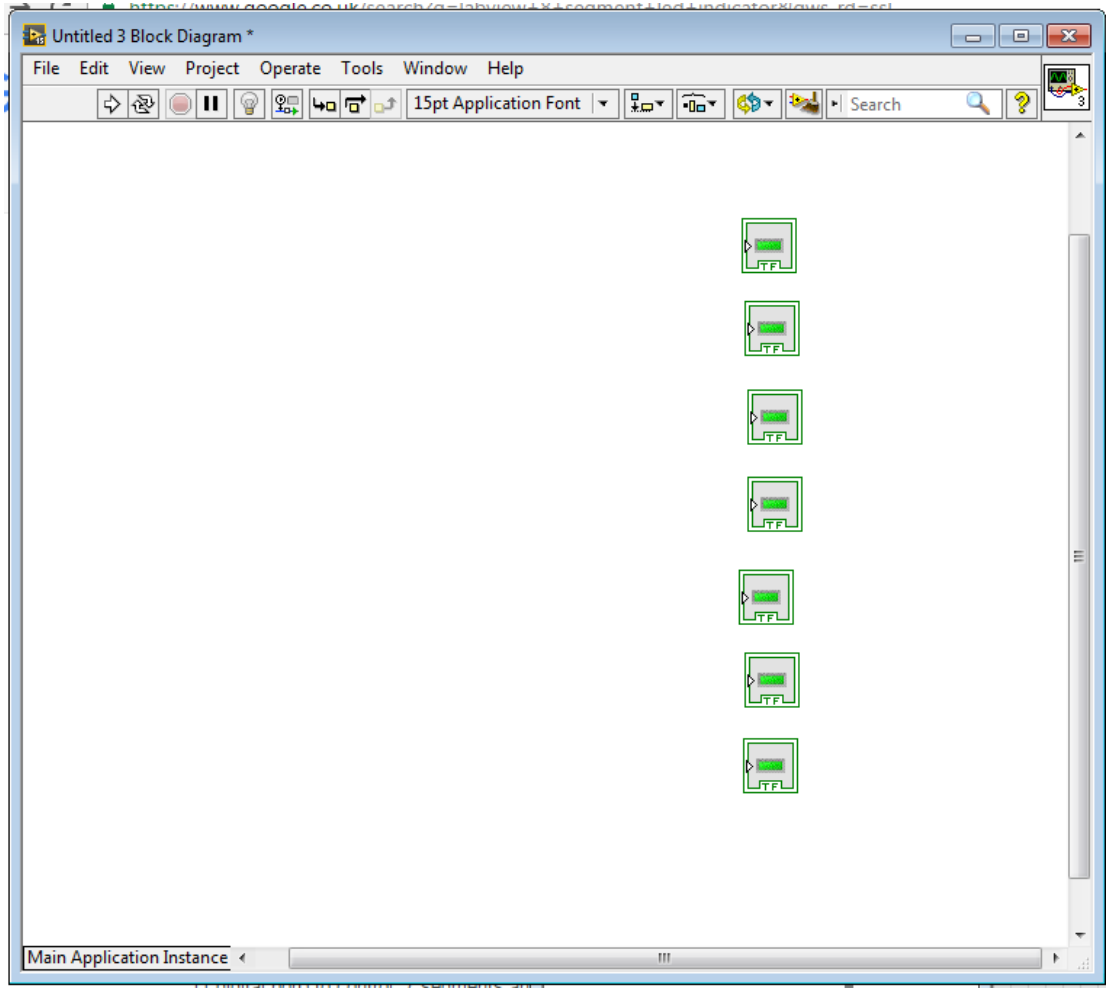




You should end up with something like this

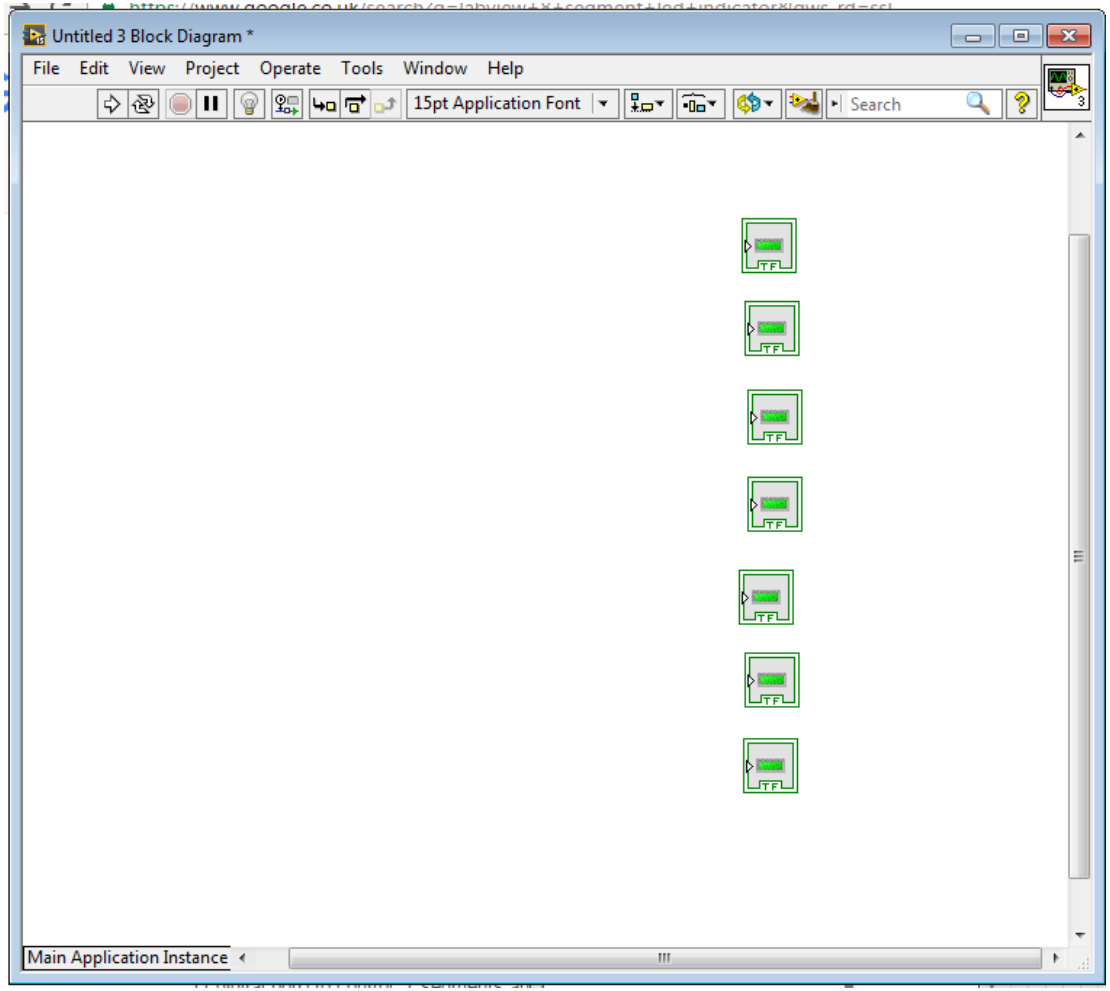


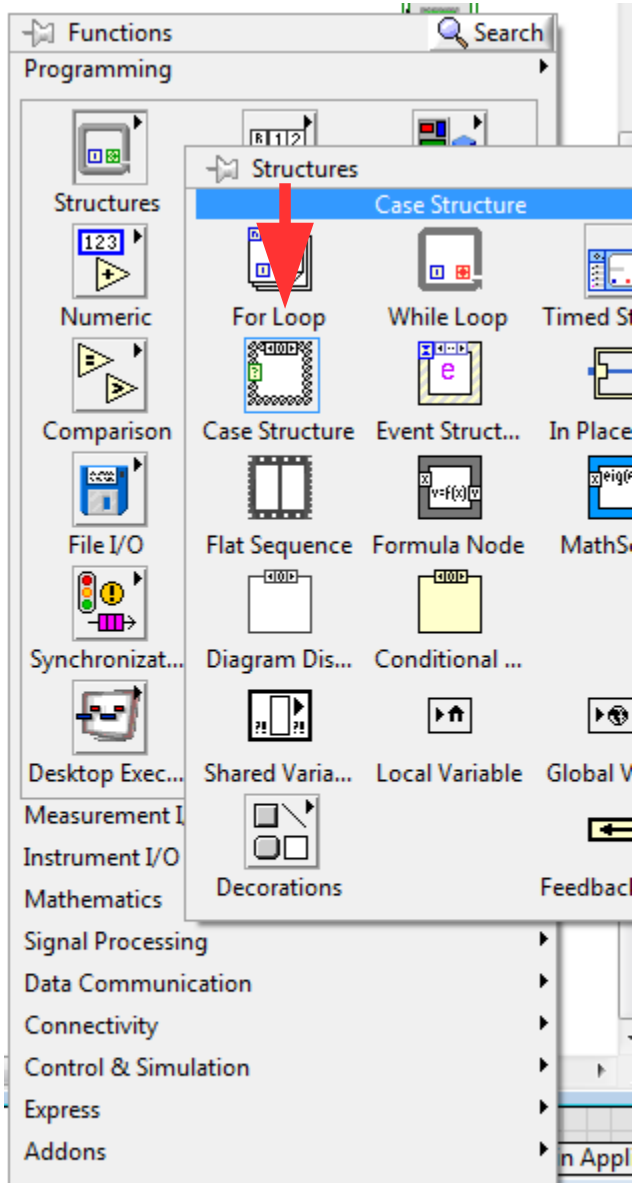
In your block diagram you should have 7 LED indicators



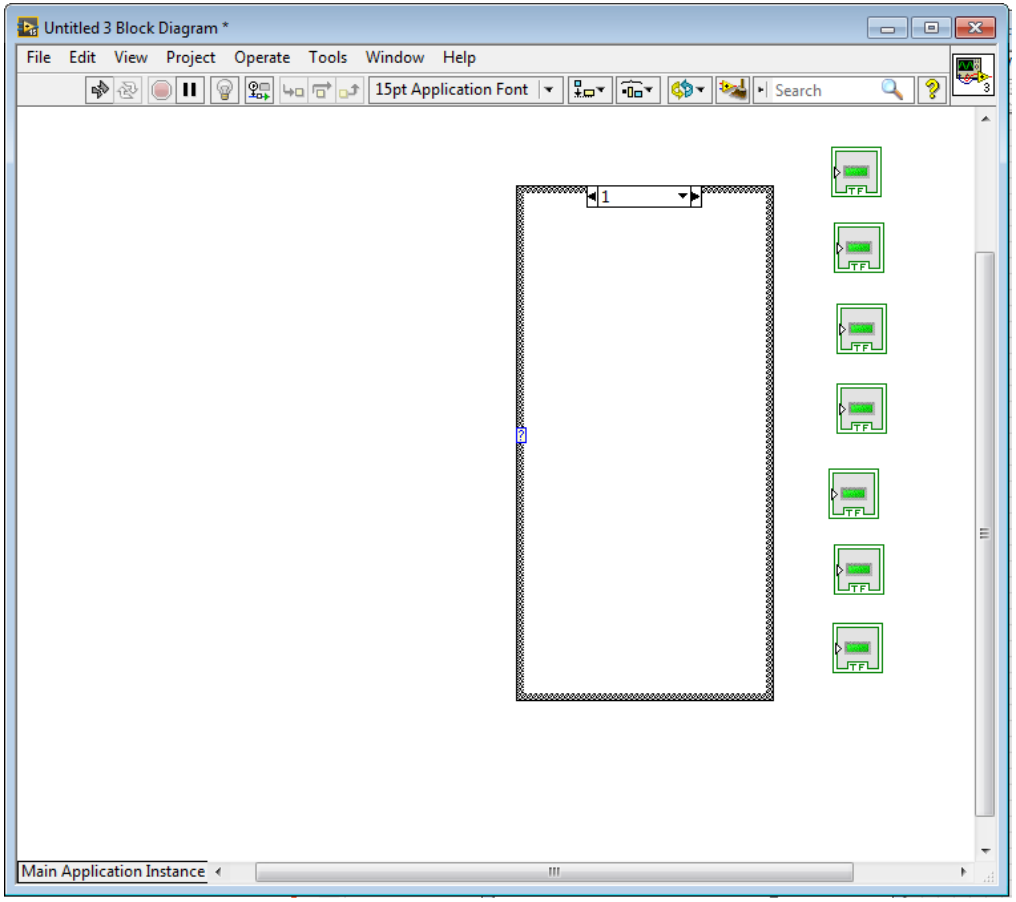
Line them up.

Now find the case structure again.

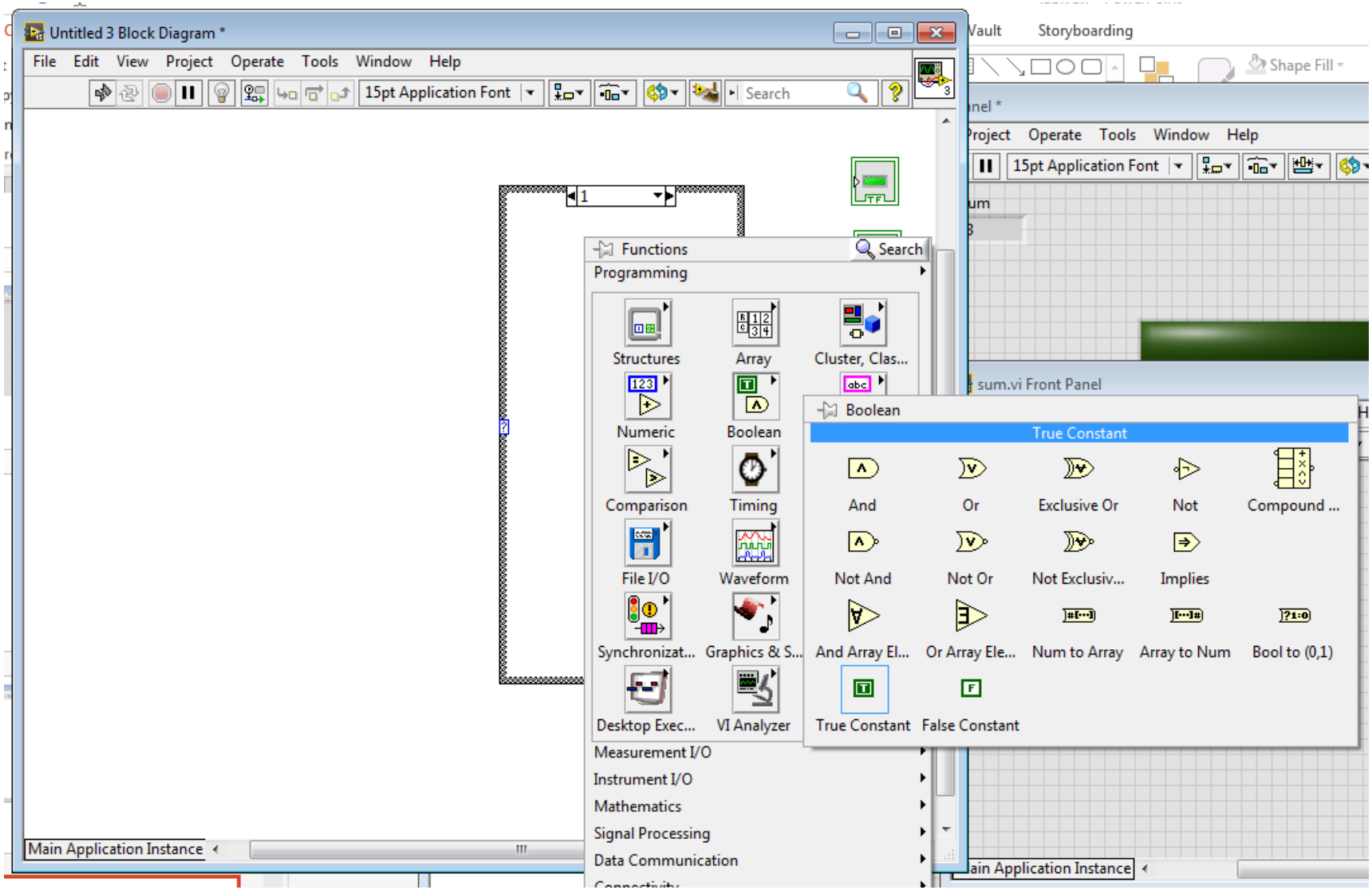




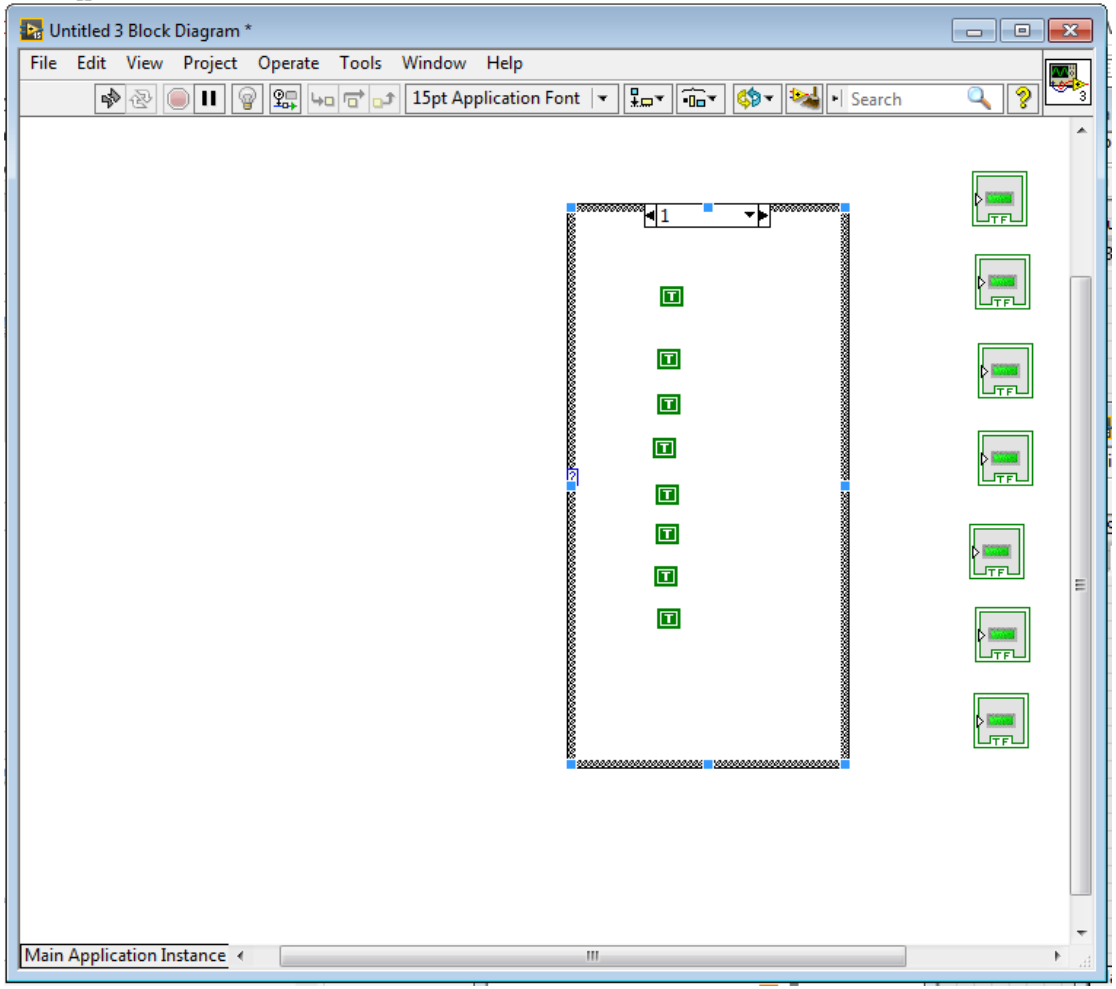
And make your window look like this.



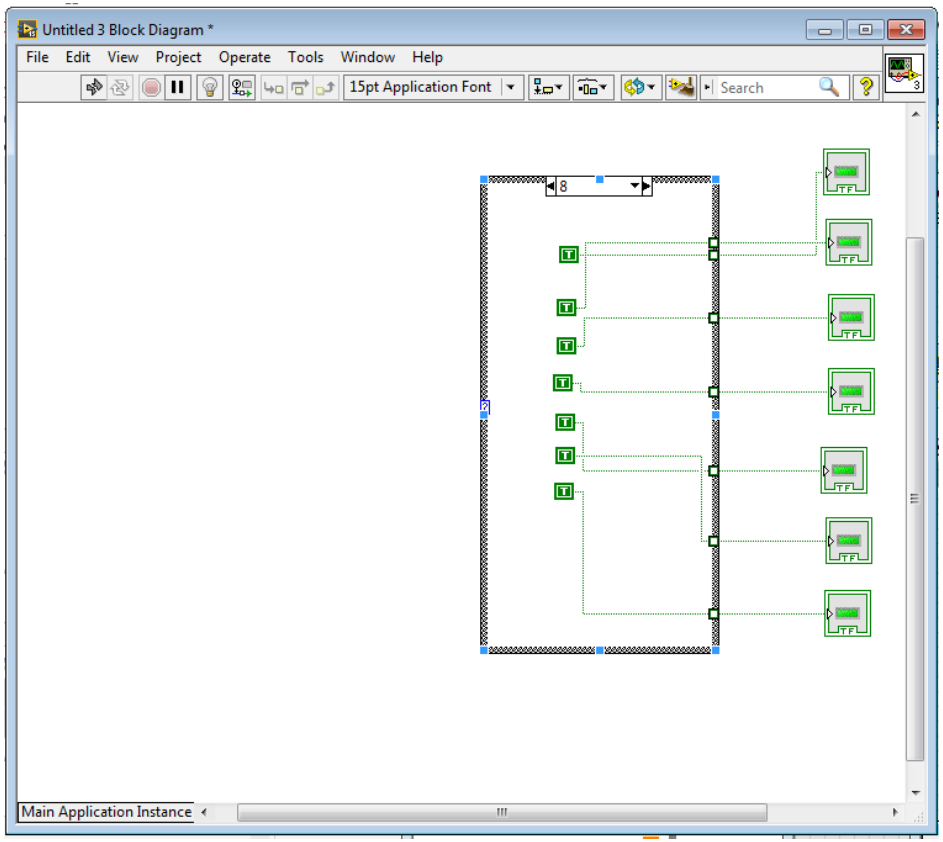
Find the ‘true constant’ in the menu.



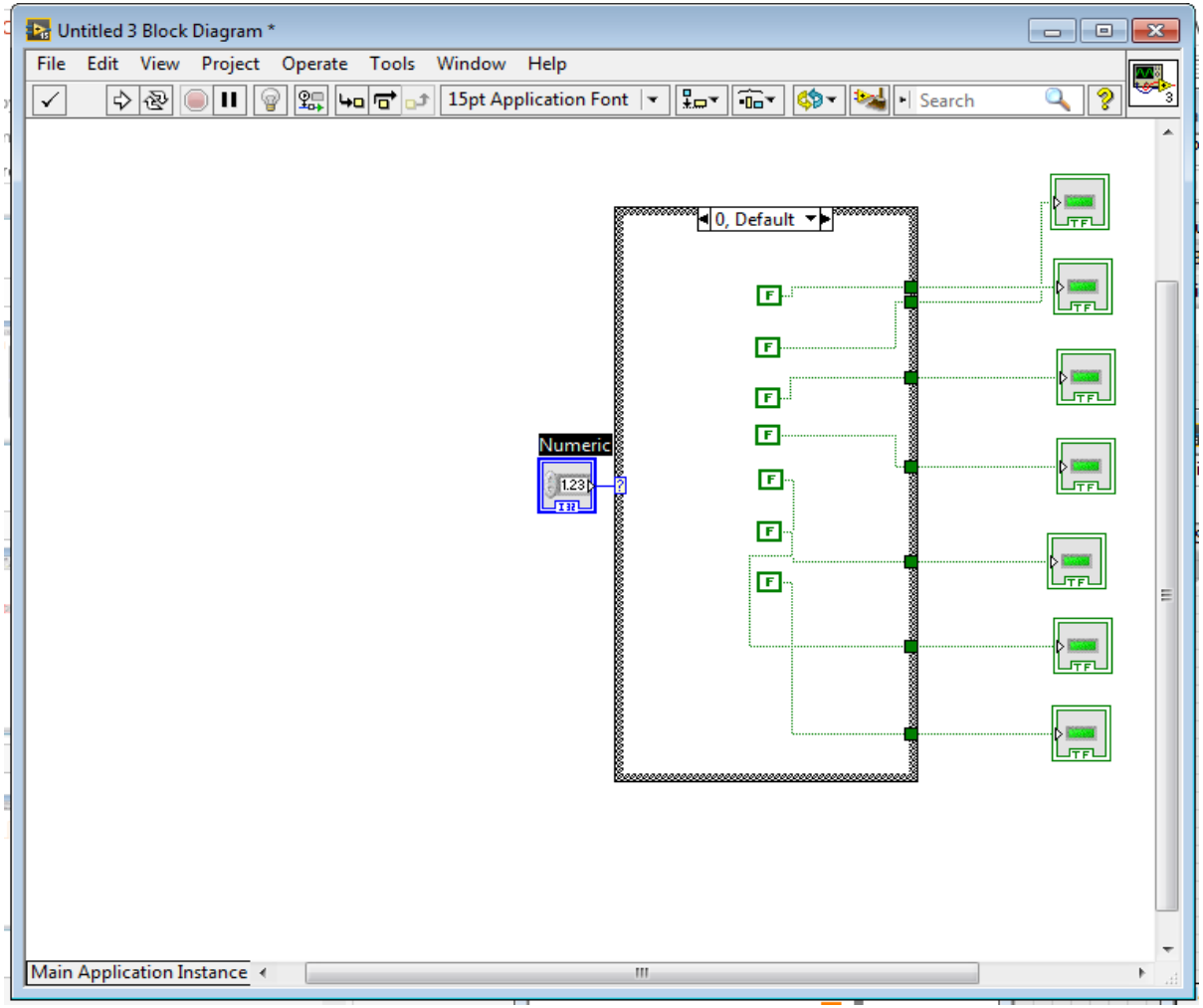
And make 7 copies of the true constant.



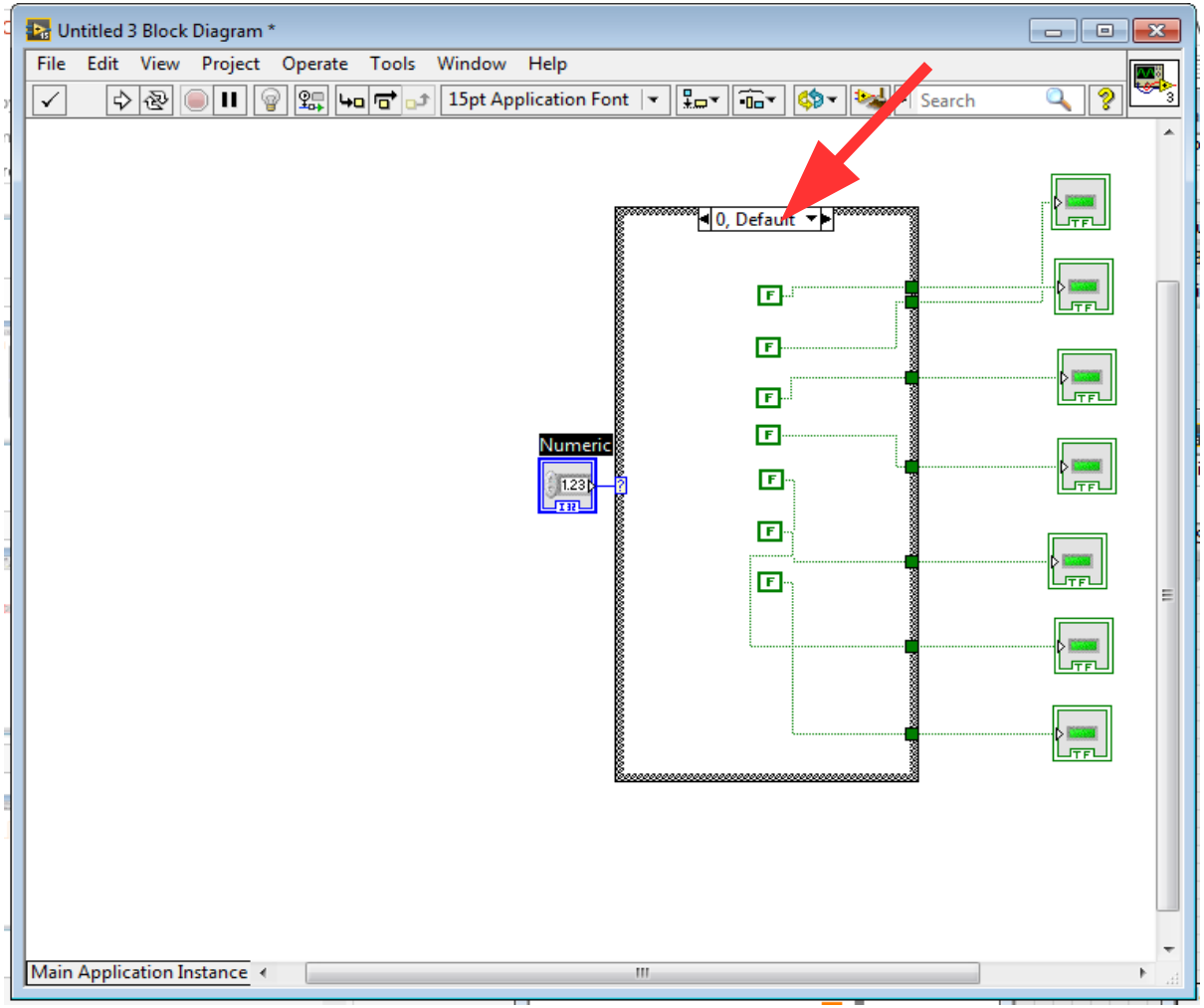
Now wire each true constant to a display element



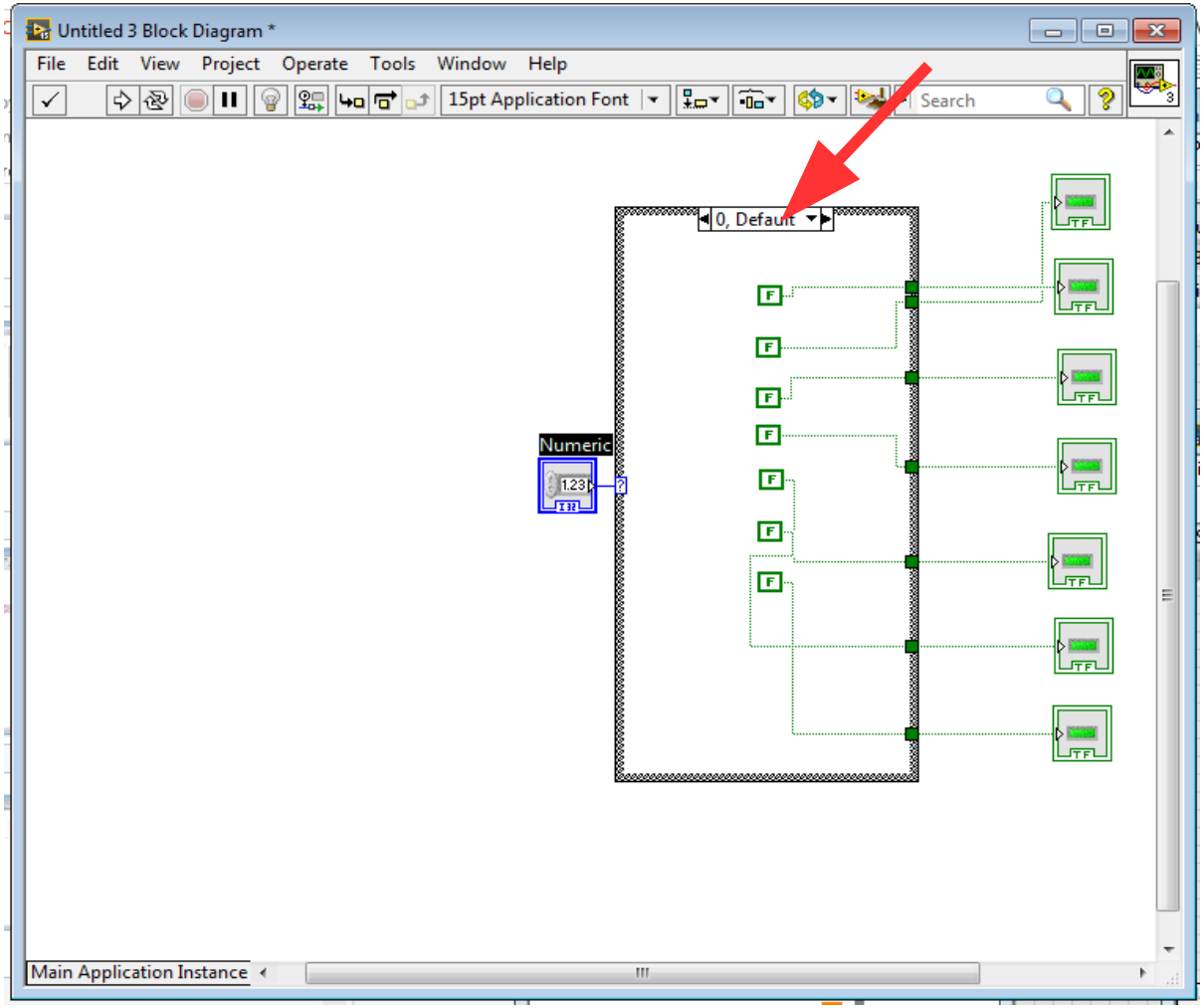
Add a numeric control and wire it up.



Right click on here and click ‘add case after’



Now, it’s your job to make the rest of the segments work.



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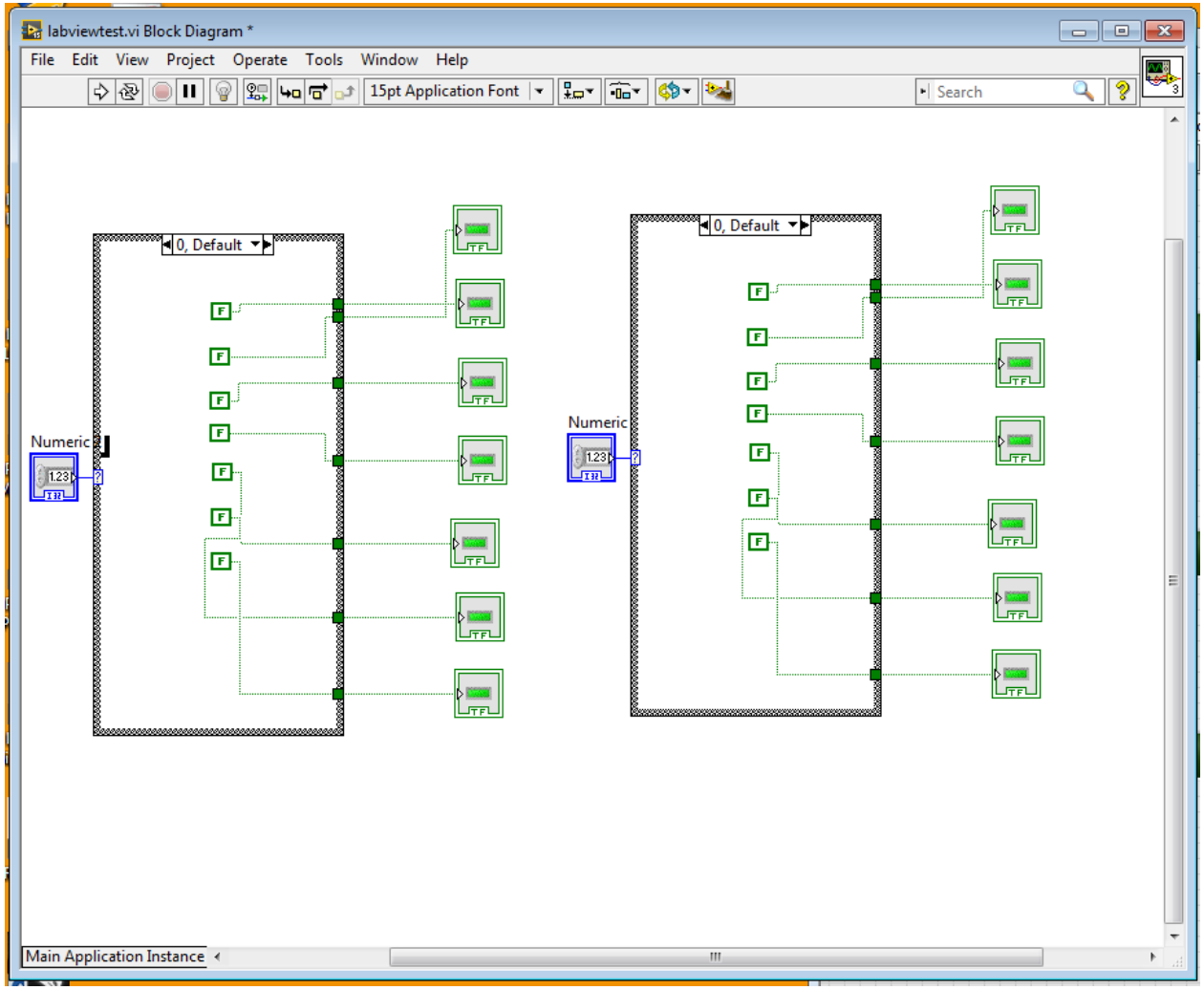
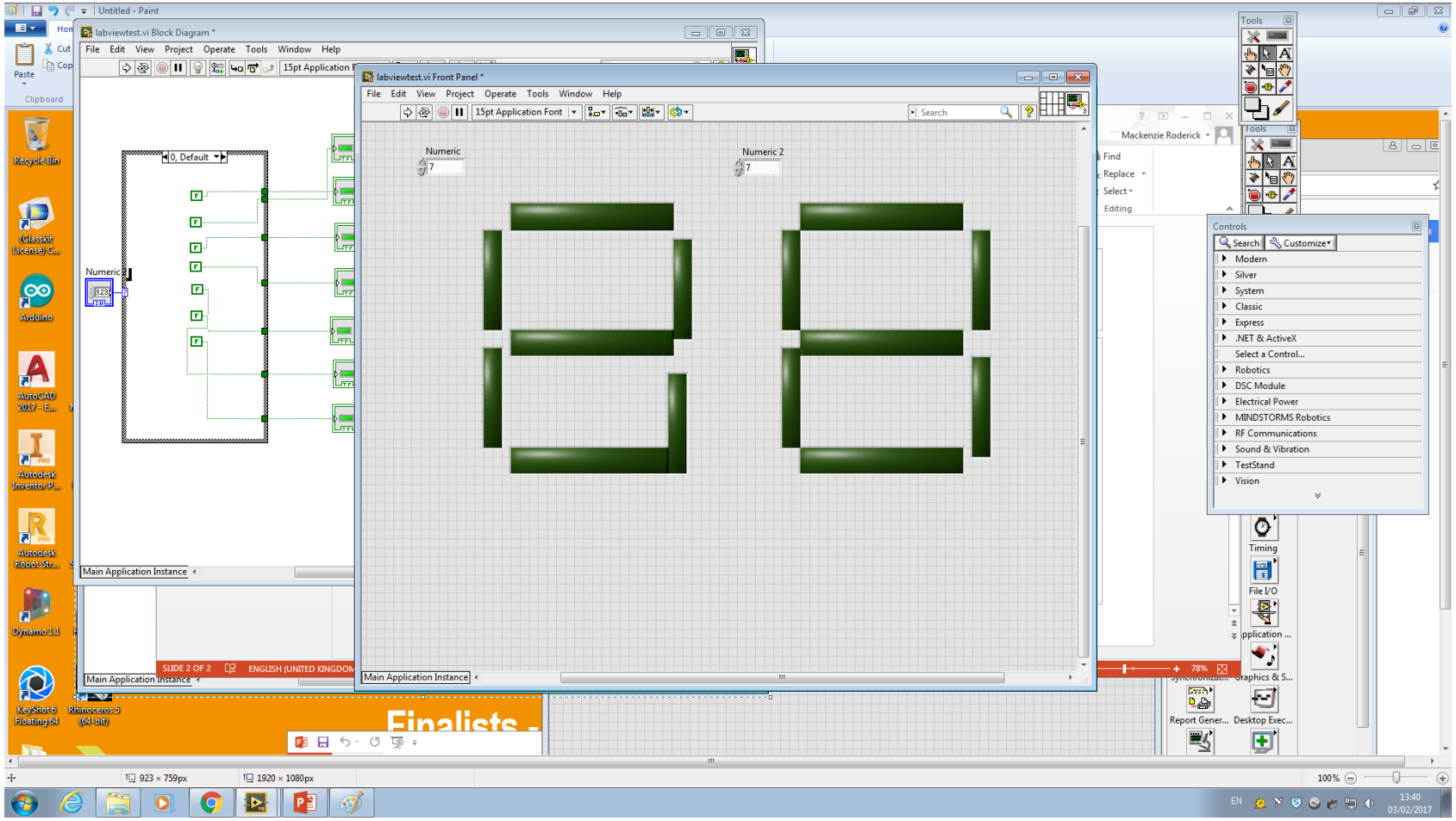
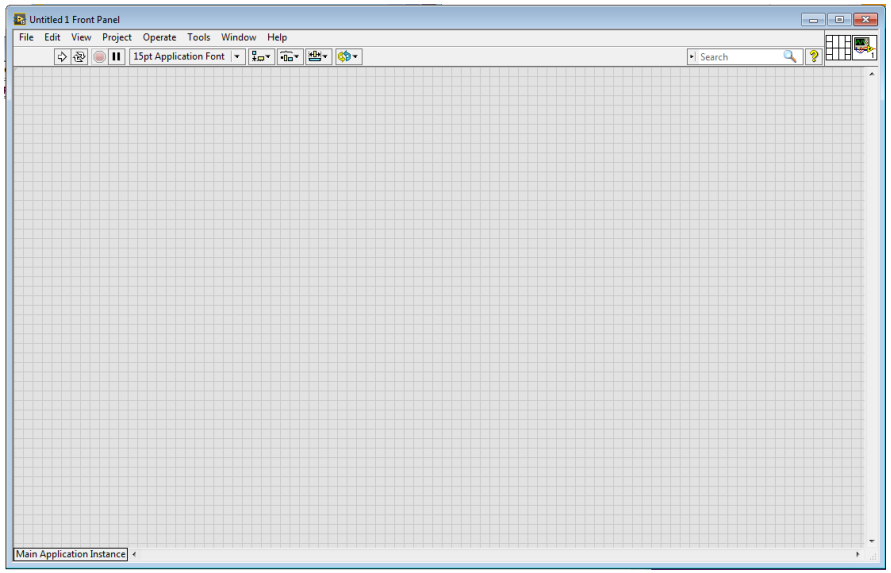
Now using the arrow make a second copy of your program.

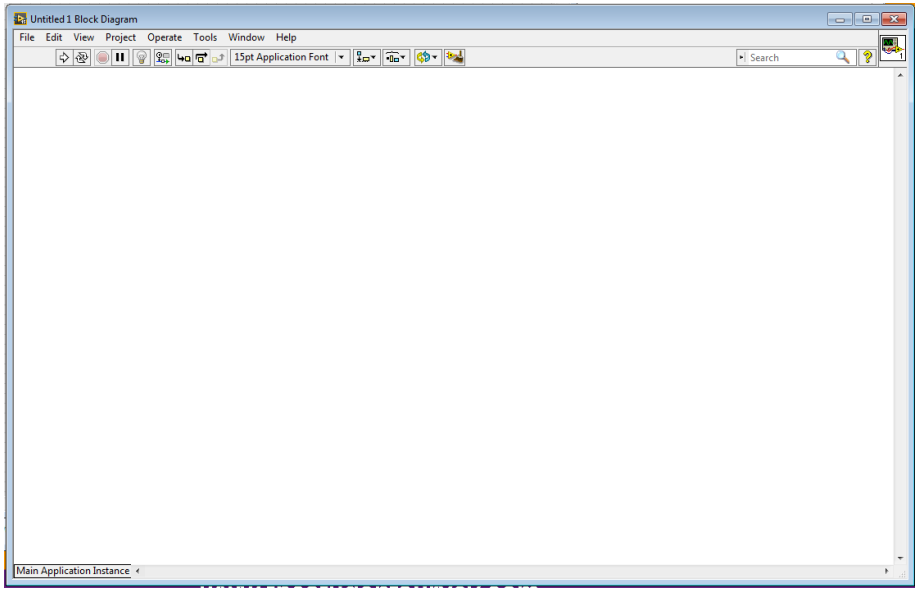


Rearrange the Front Page so it looks like this

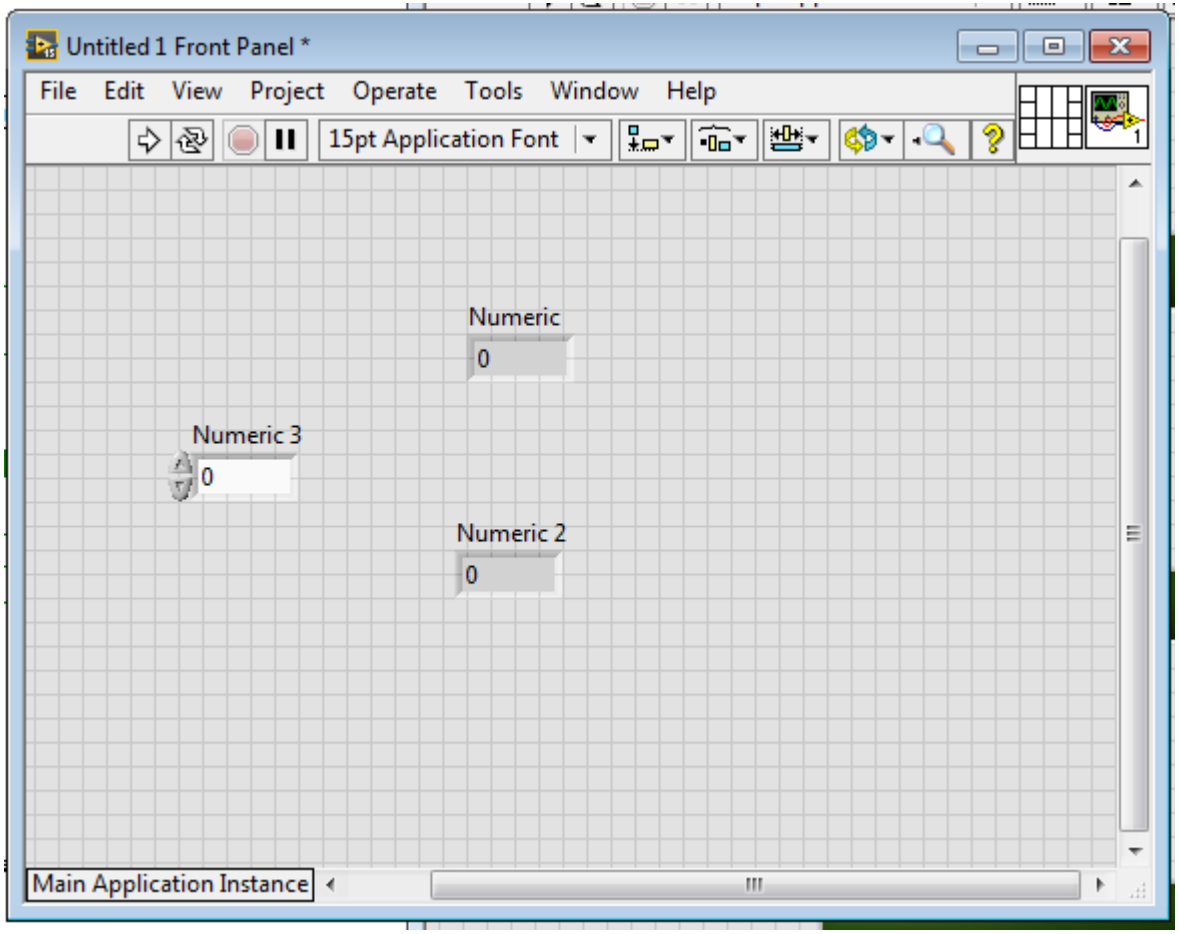


Now make a new VI

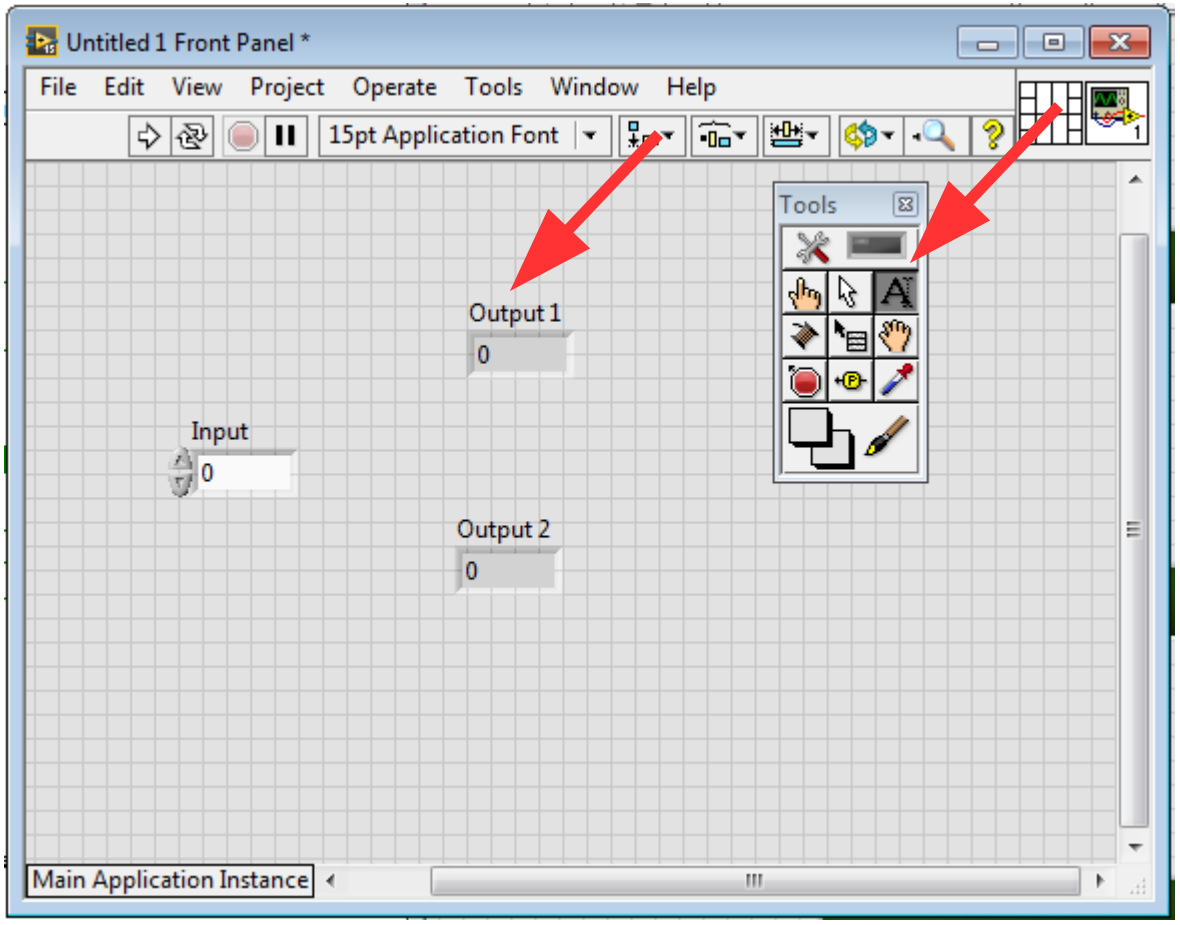




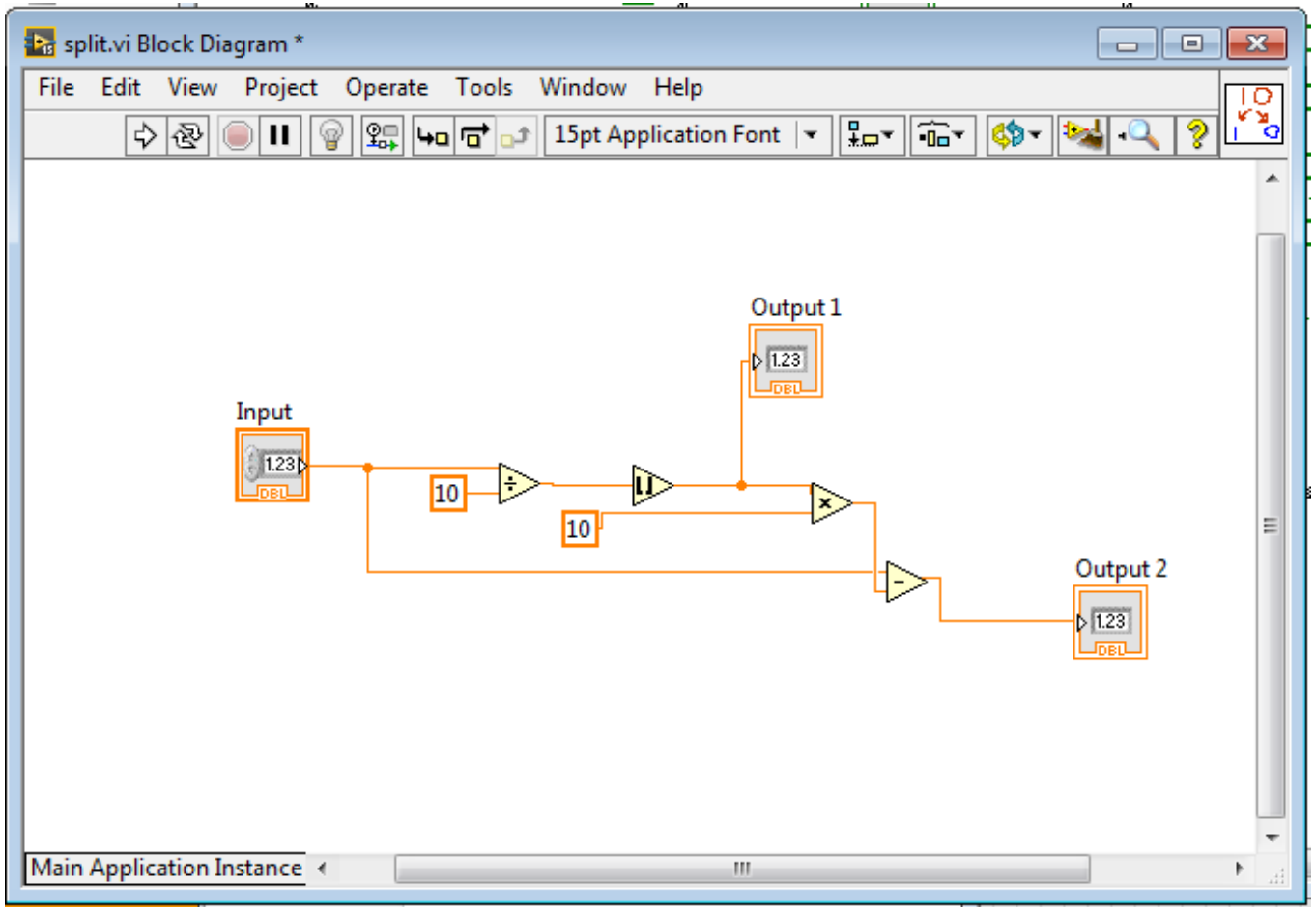
Make one control and two outputs



Using the edit tool, rename them.

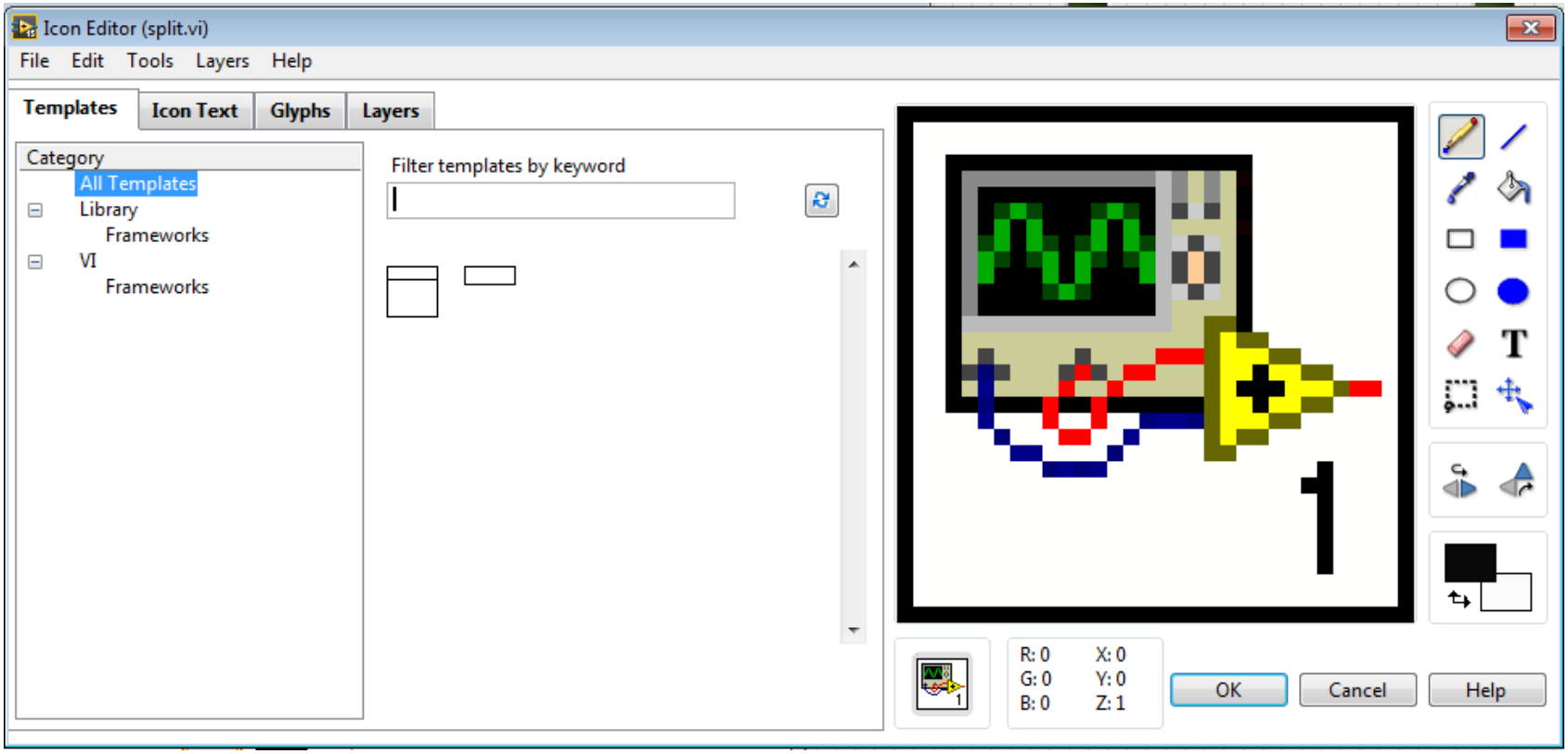


Now using the math pallet, make the block diagram look like this.

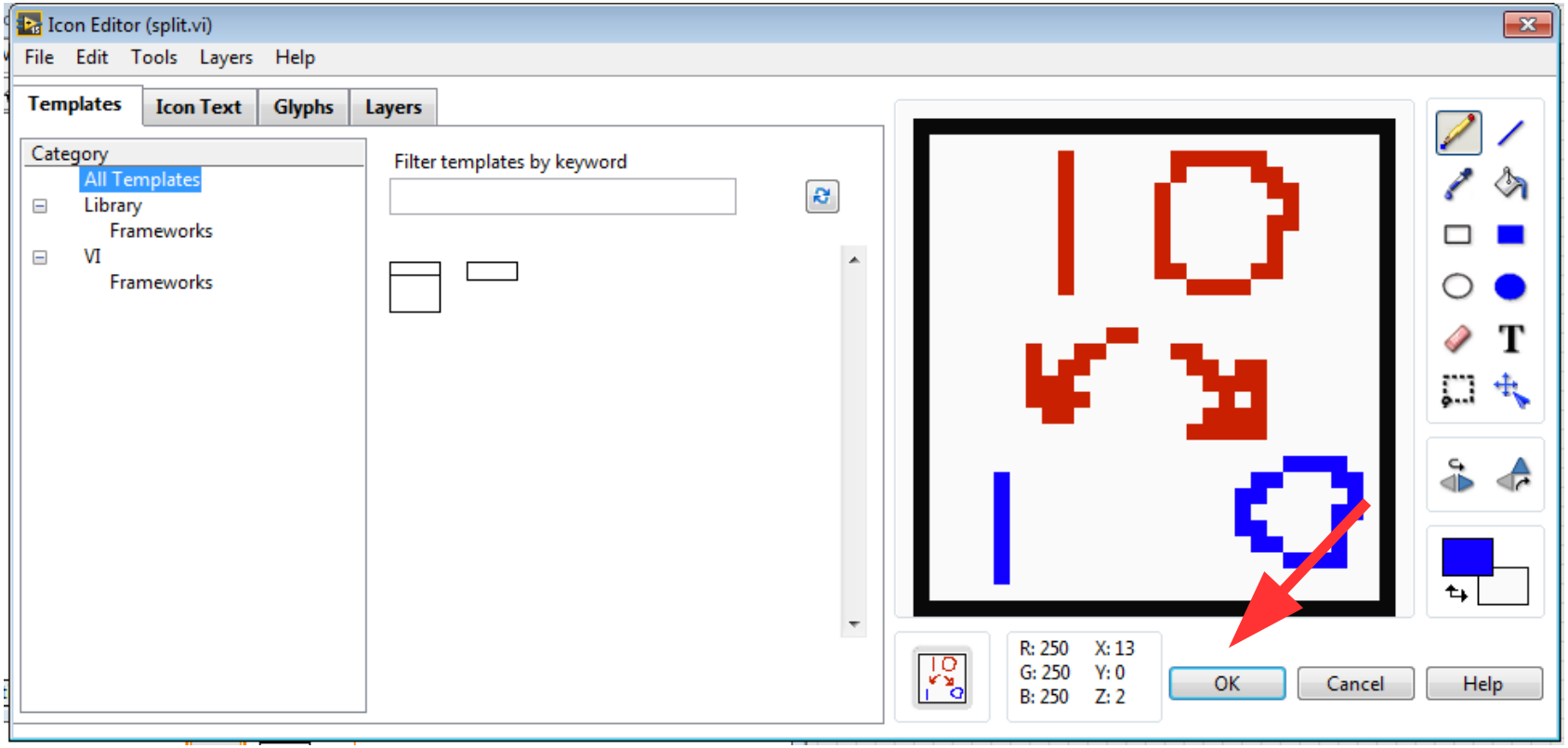


What does the program do?

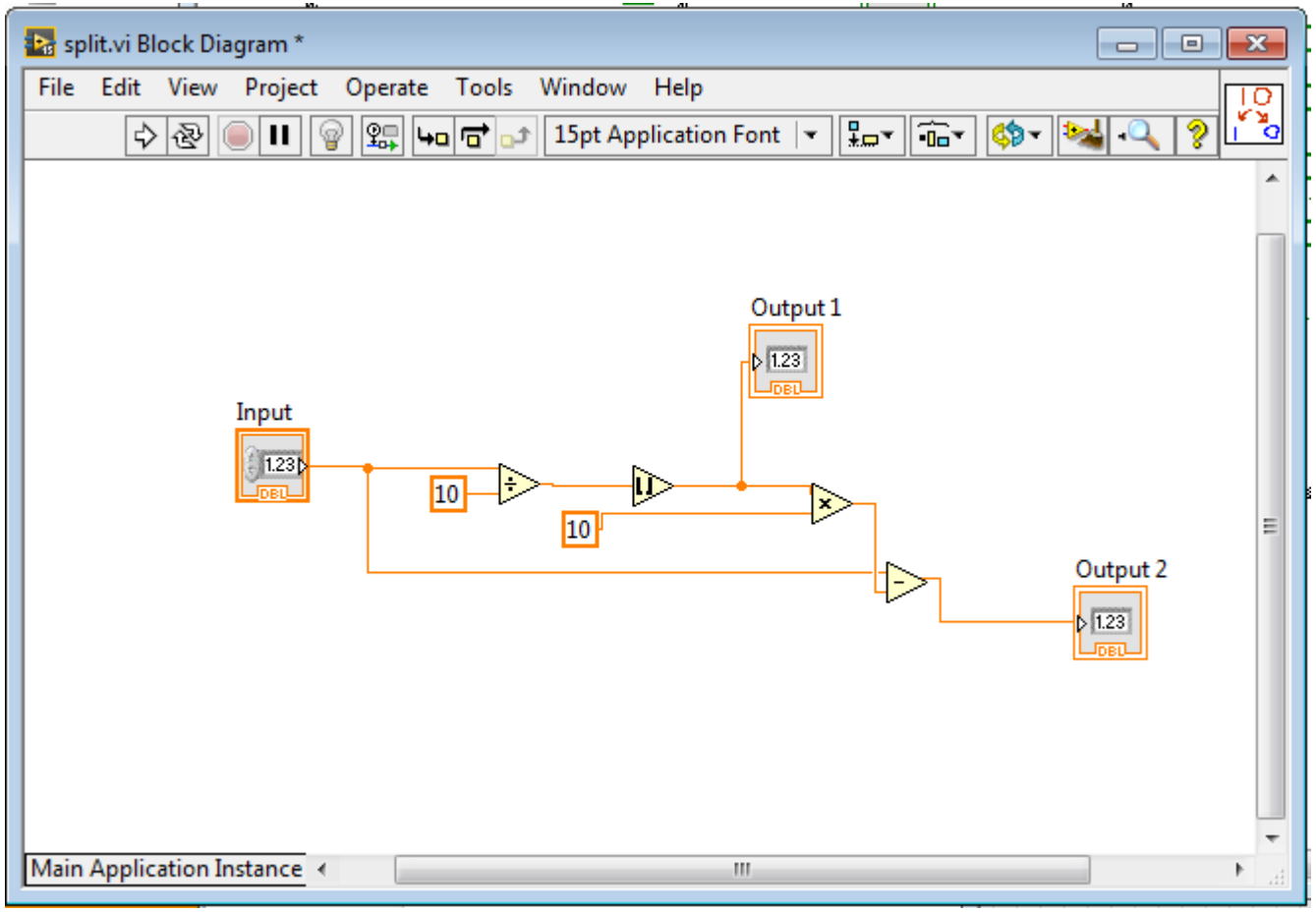
Let’s give the program an icon.



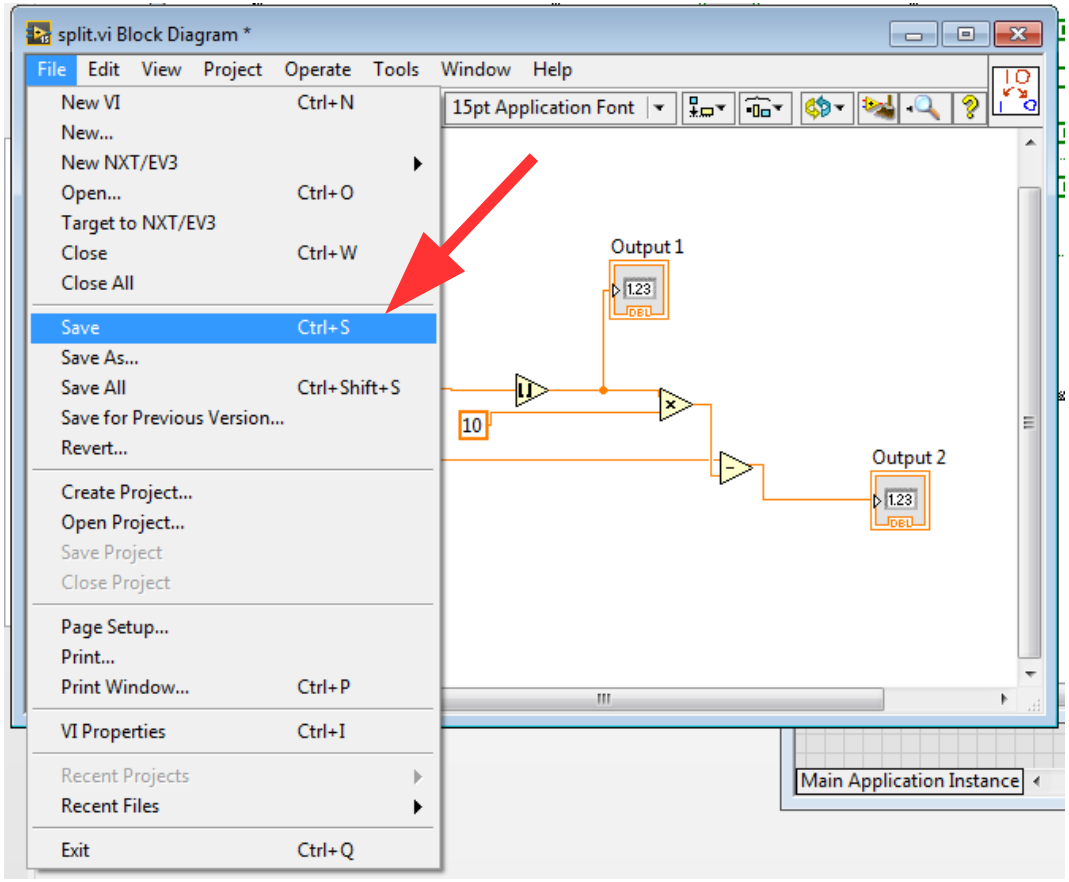
Make it look pretty, I'm sure you can do better than me.



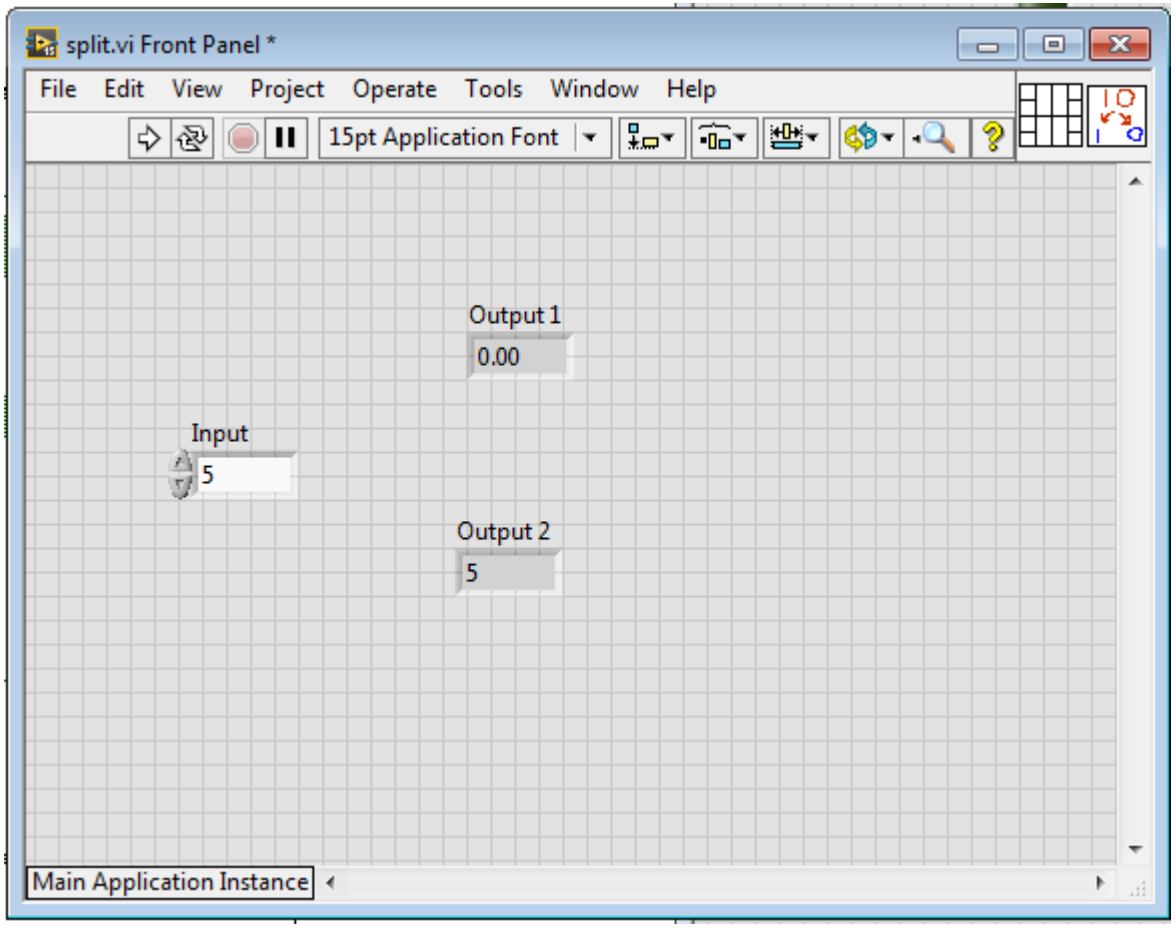
It should now look like this.



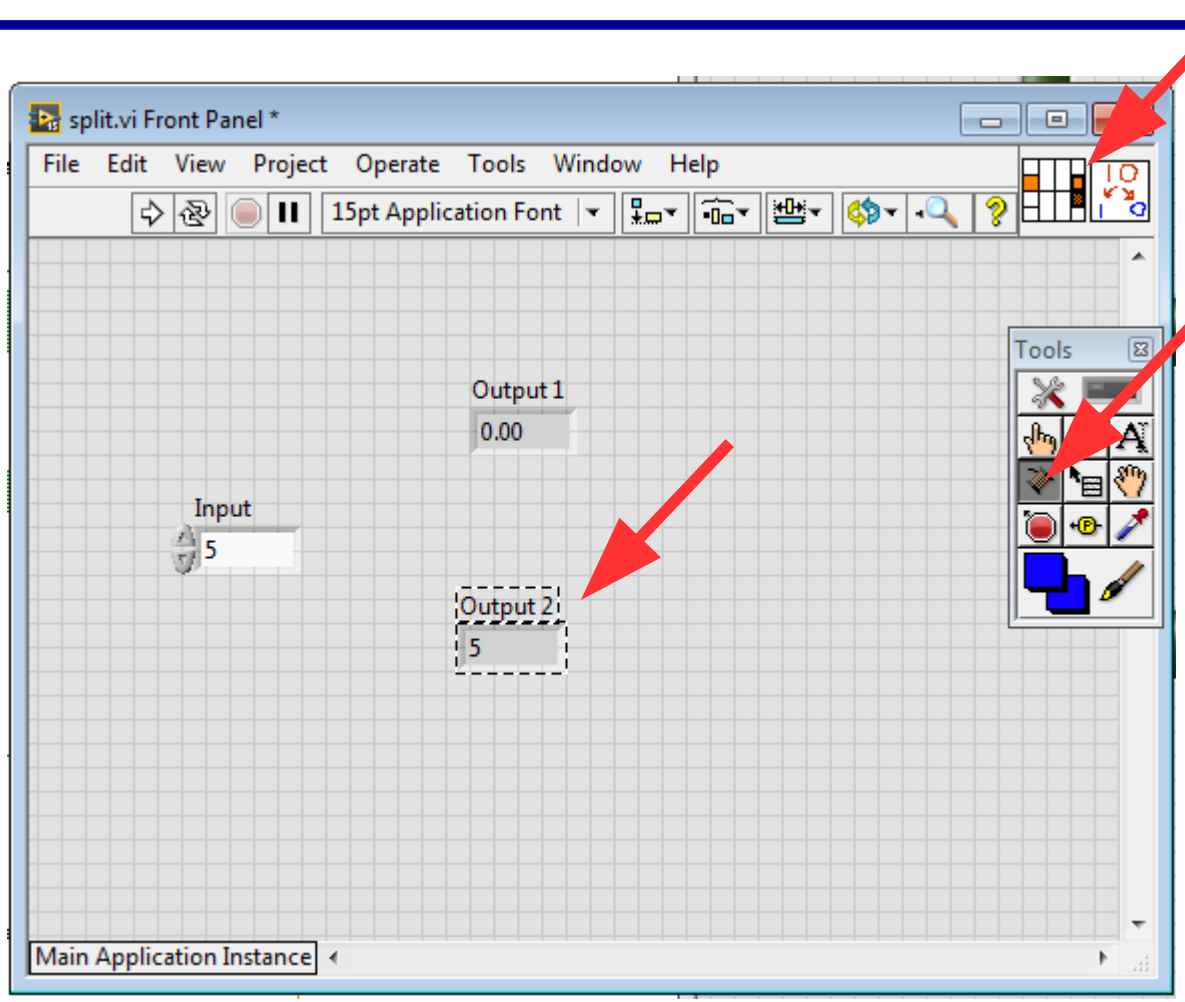
Now save it, I would call it split.vi



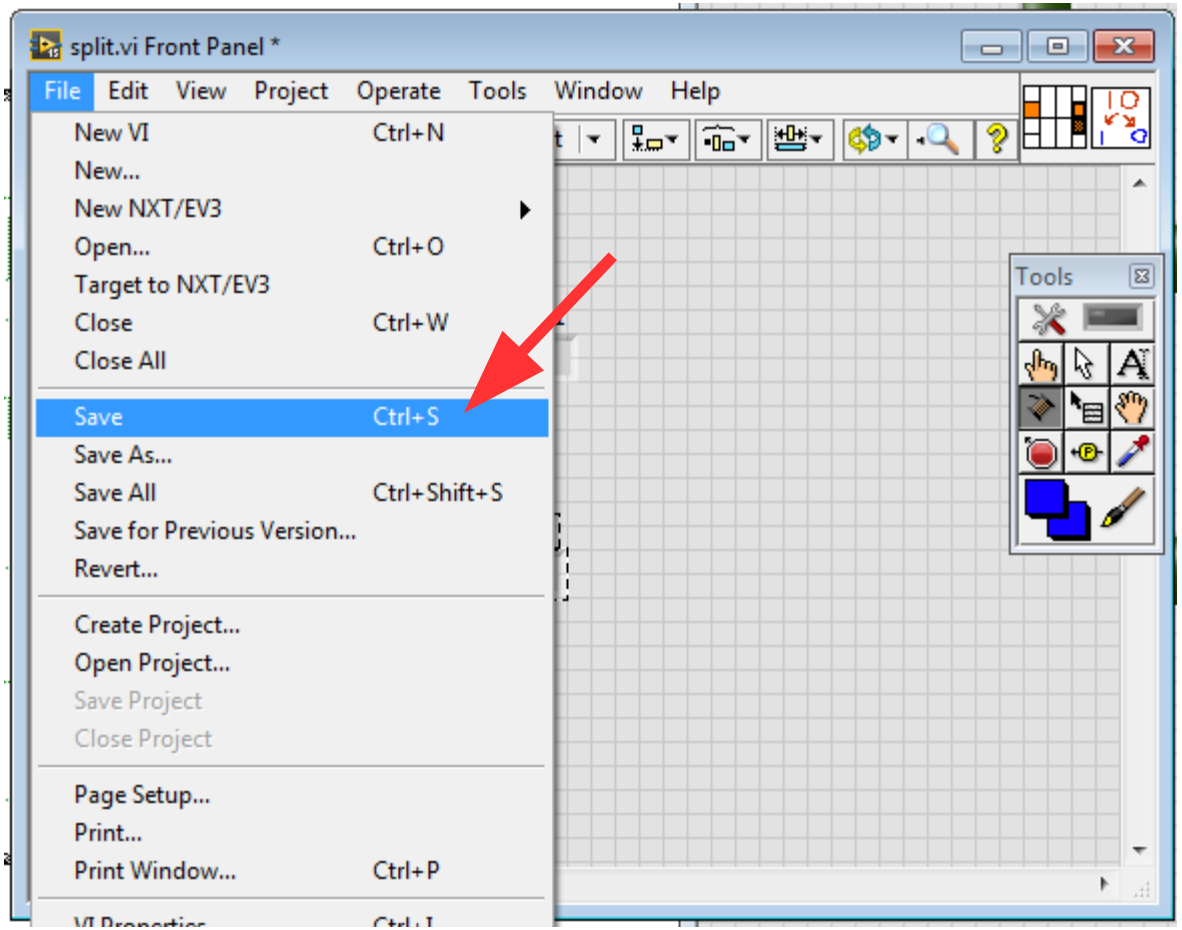
Go back to the from panel



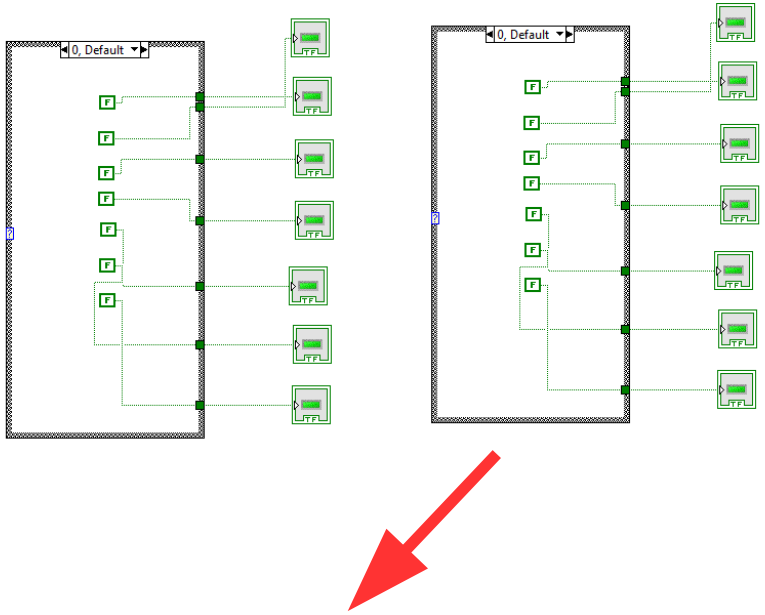
Wire up the connectors.

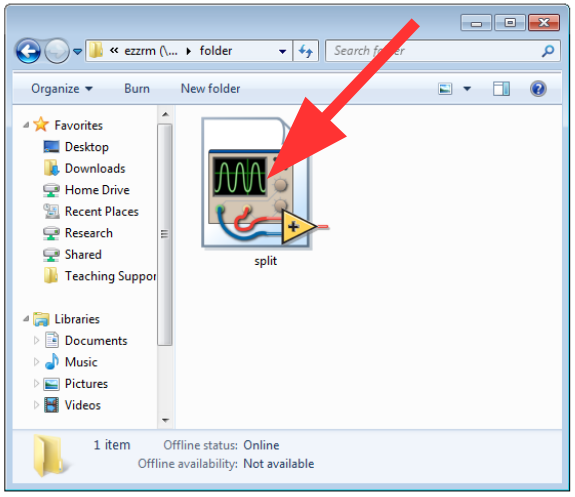


Save it again.

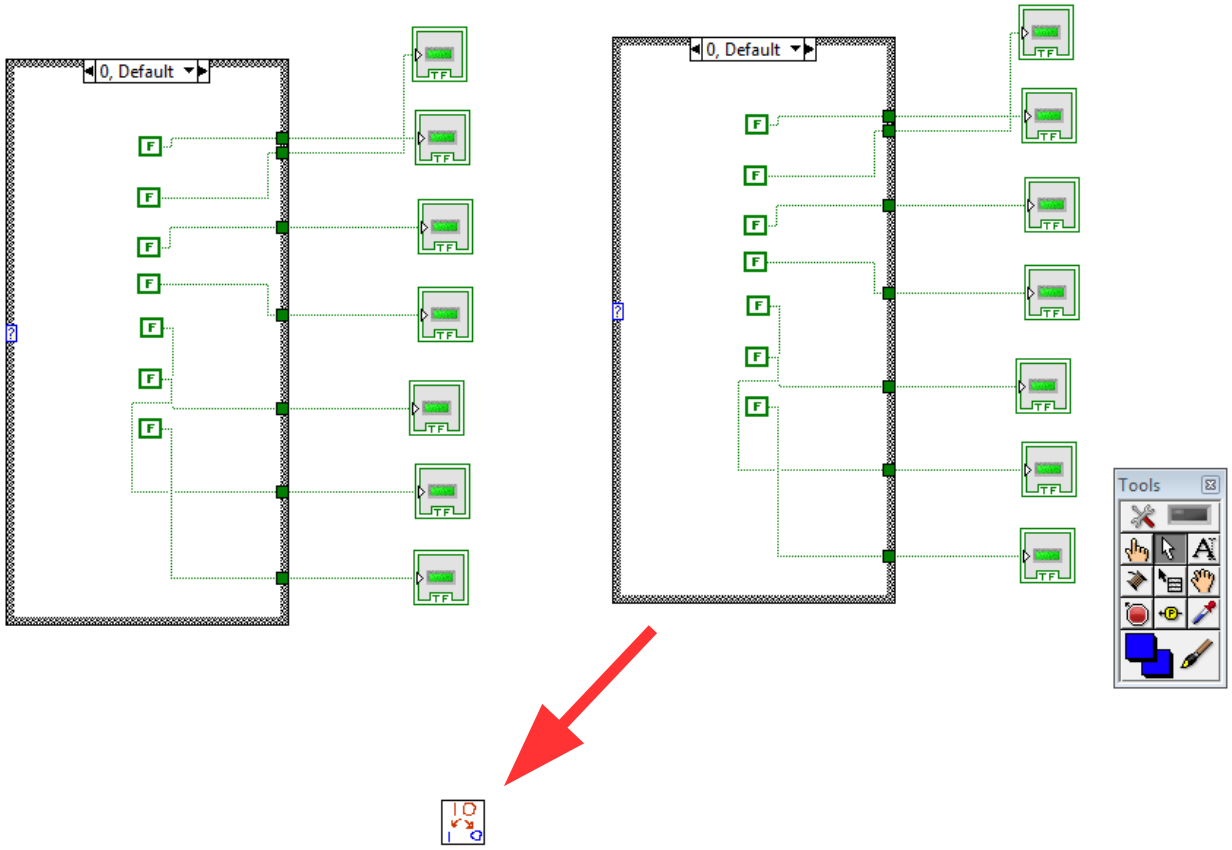


Now find the VI using the file manager and drag and drop it into your main program.

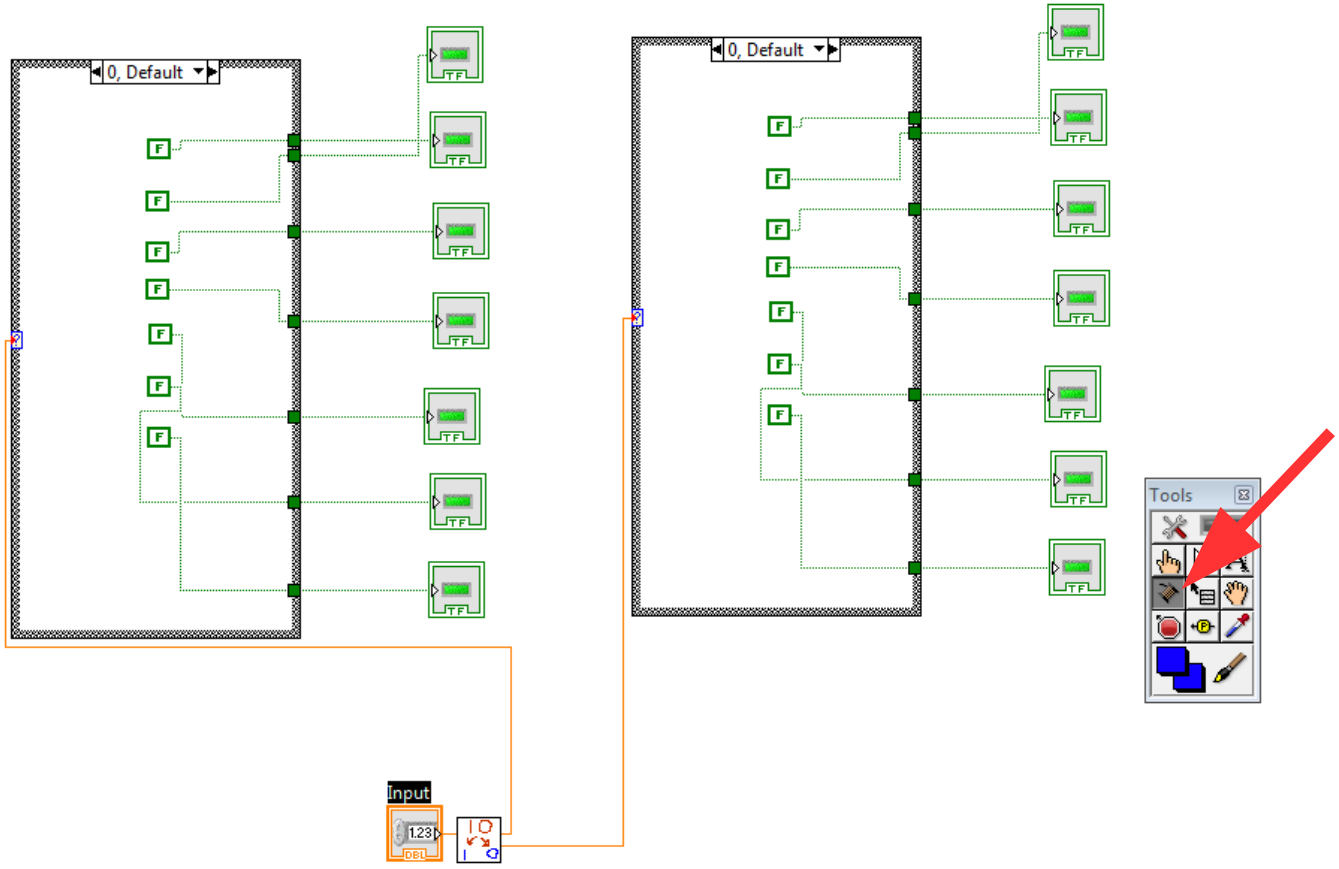




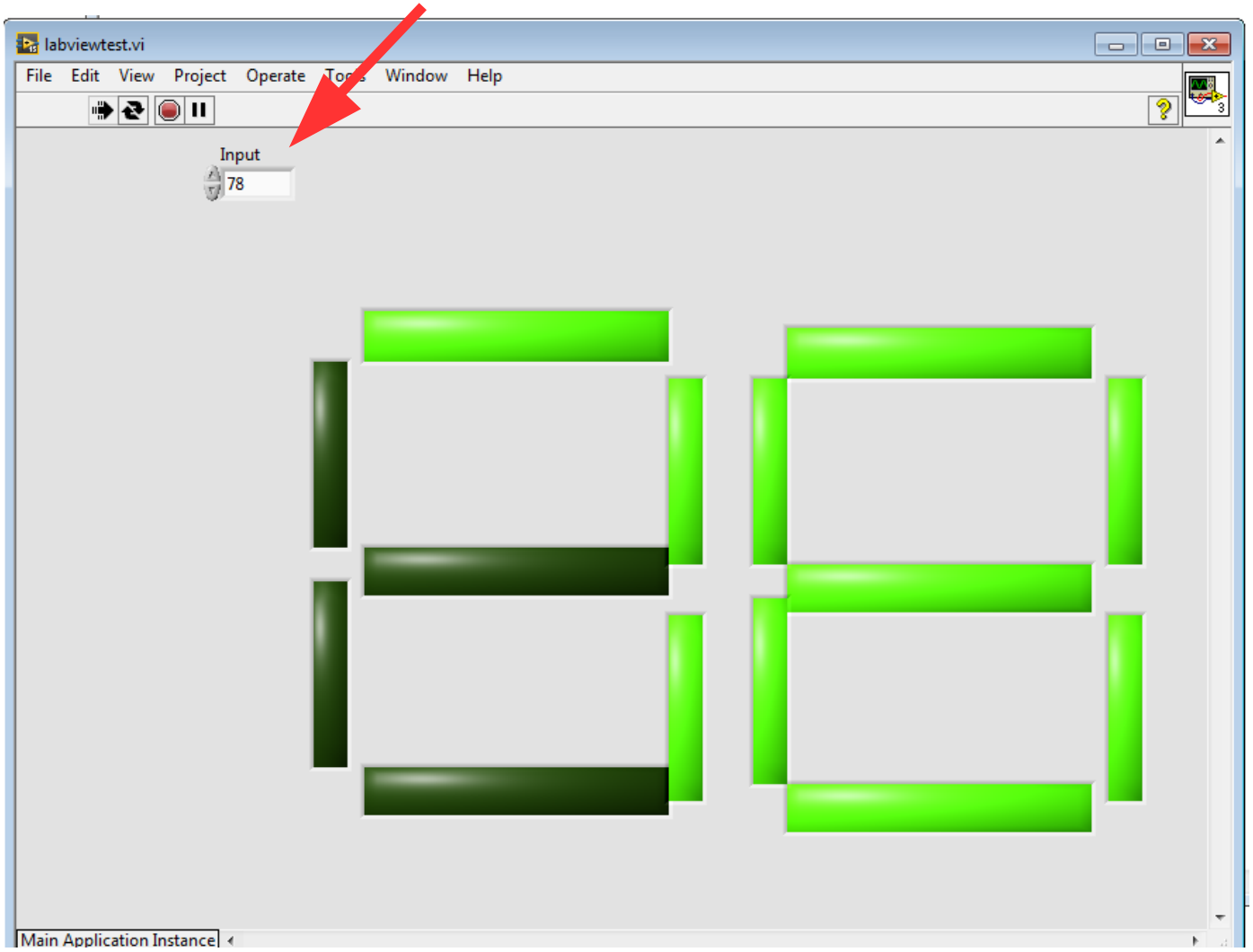
Drag and drop.



Wire it up.



And you should have a working two segment display.

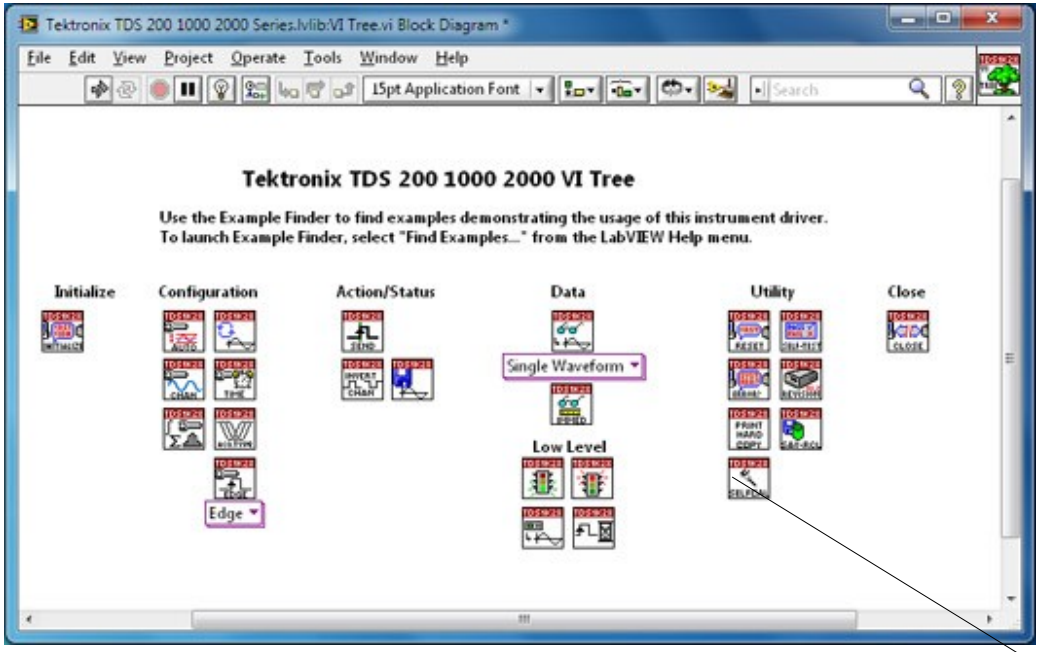


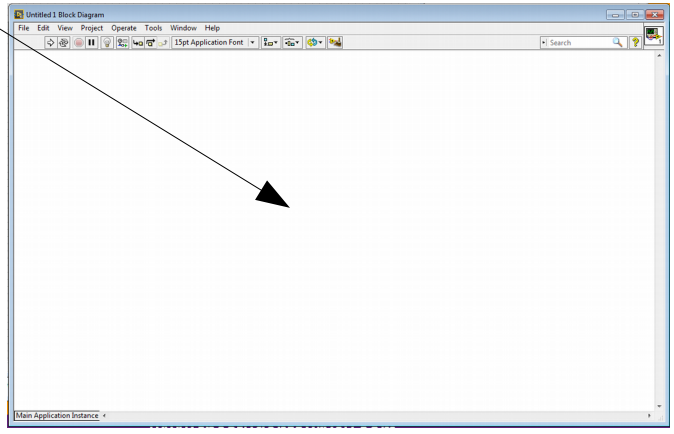
Outline of the lecture

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA

- What is LabView and why should I know about it?
- Starting LabView
- Input and output
- Basic mathematics
- Case statements
- For loops
- While loops
- Making an LED display segment.
- Embedding code in VIs
- **Controlling instruments**

Controlling robots...





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