

TECH 3821

Lab #2

Relay Driver with Computer Control

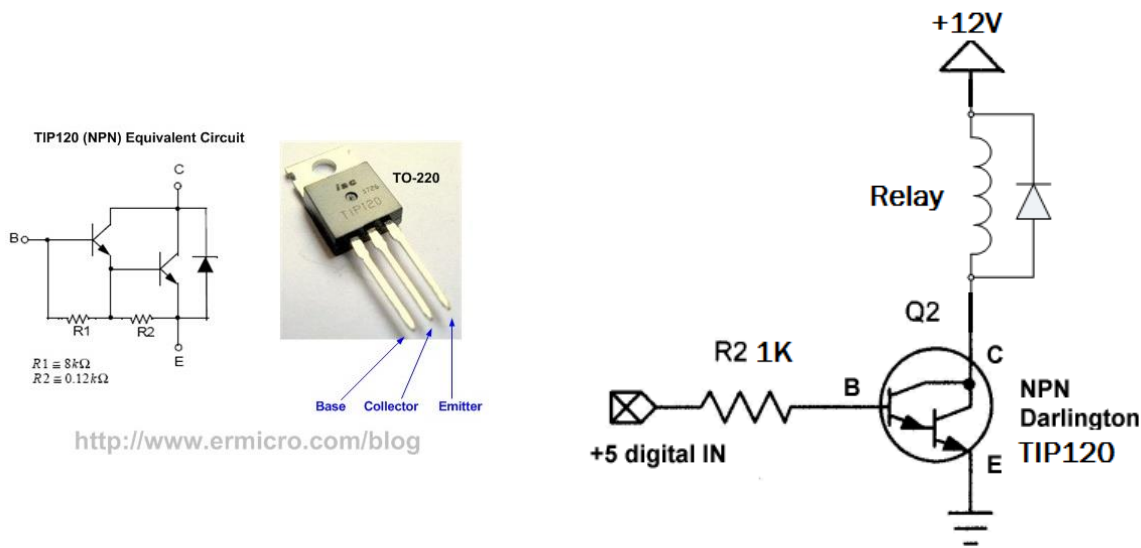
NI USB-6008 Ver 1.5

Name: _____

Background: One of the most basic controls in industry is the ability to turn things on and off. As we saw in Lab #1, a relay is often used to turn on / off devices. In today's lab we will use a Darlington pair transistor to turn on a relay. We will then use a National Instruments Data Acquisition Device to control the relay via a LabVIEW VI.

Equipment: Relay (KRPA-11DG-12), Diode, 1K Resistor, TIP120 Darlington Pair Transistor, Breadboard, NI USB-6008 Data Acquisition Device

Diagrams:



Procedure: Build the circuit as shown on a Breadboard, connect the Heathkit power supply (using A for the +12V and the 5V for the digital in). Make sure you have a common ground (ie the emitter and both the +5V ground and +12V ground are all connected to a common ground point). Touch the 5V supply to the base resistor and verify the relay is energized.

Now connect the Breadboard, to the NI USB-6008 Data Acq device by replacing the +5V digital in, with a wire from the P0.0 Terminal. Replace the Ground with a connection from the GND Terminal (the ground and +12V from the Heathkit power supply remain connected)

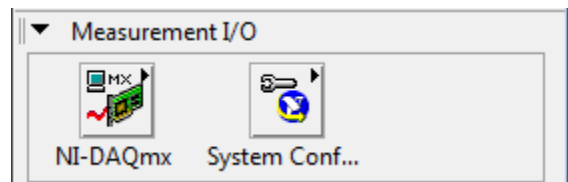
Now we will use LabVIEW to create a program to control our relay driver. LabVIEW is a GRAPHICAL Programming Language. A Program in LabVIEW is called a VI (or Virtual Instrument).

Open LabVIEW and do a FILE | NEW VI.

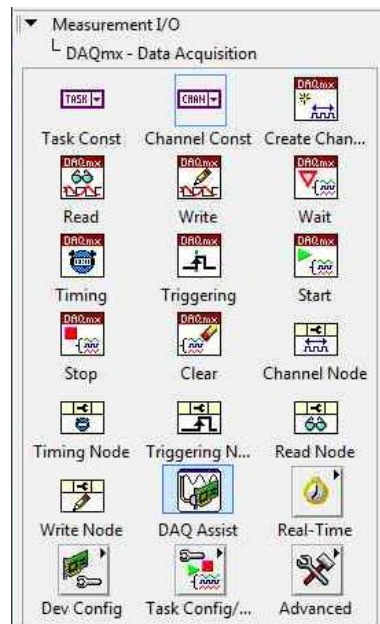
TWO windows should open, a “Front Panel” and a “Block Diagram”. The block diagram is the program and the front panel is the user interface.

We will start in the Block Diagram Window.

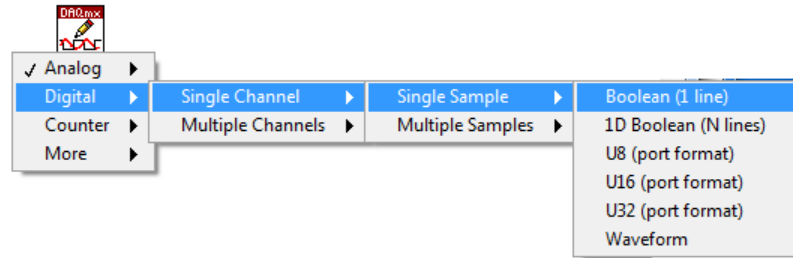
First we need to turn on the Functions Pallet by doing a VIEW | Functions Pallet. Now find the Measurement I/O menu and select it, then select NI-DAQmx.



This will open up all the functions associated with the Data Acq Card. It should look like this:



Find the Write Icon. Click the left mouse button AND hold it down and drag over to your Block Diagram Window and Release. This places that FUNCTION into your program. Under the icon is a pull down menu. Click on the ▾ and do the following selections:



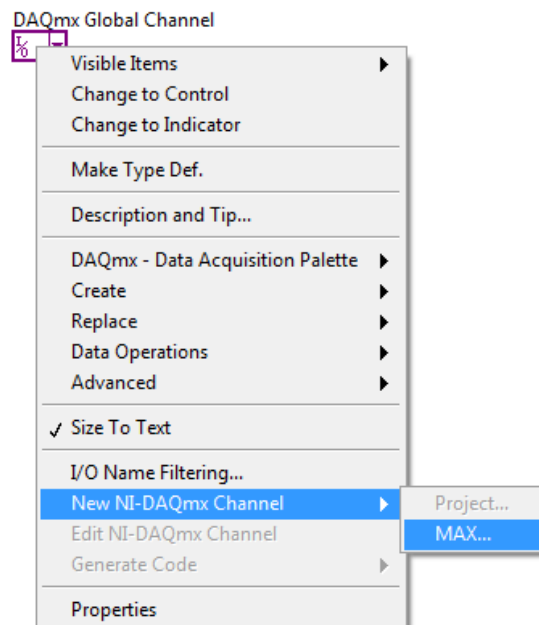
[Digital | Single Channel | Single Sample | Boolean (1 line)]

This sets up one Digital Output Pin. Now we need to define which of the 8 pins we will use. To do that go back to the NI-DAQmx functions and select “Channel Const”



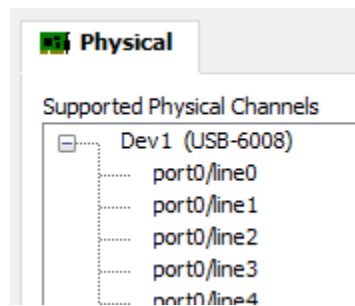
And drag and drop this onto your block diagram to the left of the write block.

Right click on this new block and select the following



This will take you through a series screens. Since we want one digital output pin we will select: GENERATE SIGNALS | DIGITAL OUTPUT | LINE OUTPUT

Then we will select the port/line we will connect the circuit to. On our board we only have one port (called PORT 0) and Lines 0 – 7. We will select line 0.



It will ask you to “Enter a Name”. Please use a name that reflects the purpose of the I/O point and hit finish.

It will then bring up a test screen where you can check your I/O. To do this click on the RUN ICON:

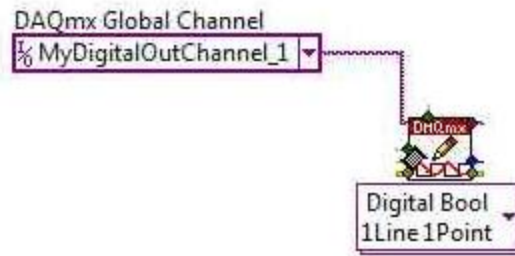


Then click on the radio button on the screen to turn the I/O point on and off. If it is working correctly, and the relay is connected to P0.0 on the NI USB-6008 device, the relay should activate and deactivate with the radio button



Once you are done testing, press the stop button and then click on OK at the bottom of the window to continue.

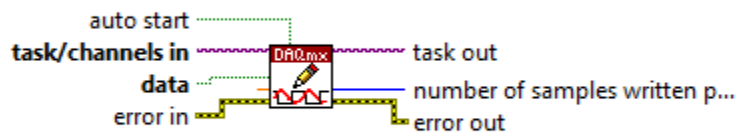
Now you should be back on the Block Diagram. Draw a line between the DAQmx name and the DAQmx Write block as follows:



Note: each colored dot is a connection point for information. If you turn on HELP | Show Context Help, you will see what each point does (when you click on the block). In this case we are connecting to the task/channels in (as shown below)

Context Help

DAQmx Write (Digital Bool 1Line 1Point).vi

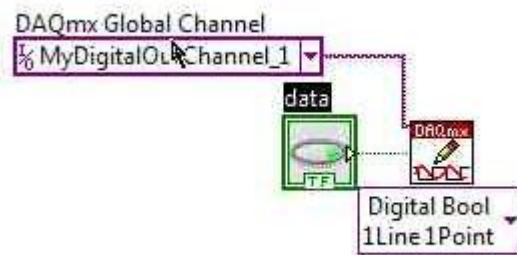


Writes a single Boolean sample to a task that contains a digital output channel composed of a single line.

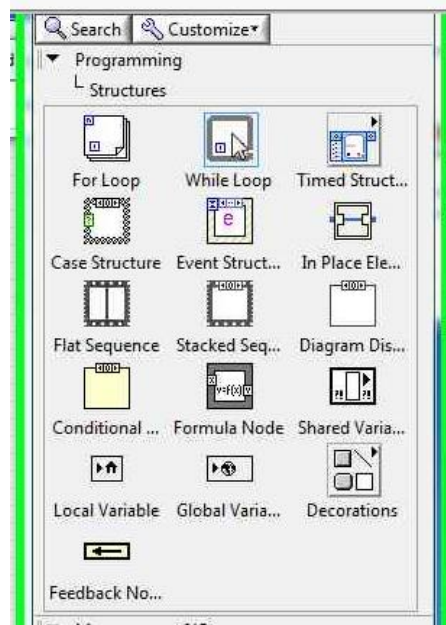
[Detailed help](#)

Now you need to add a control (to tell the I/O point to turn on and off). To do this put the wiring spool over the dot on the DAQmx Write block that says "DATA" and then do a right click | Create | Control

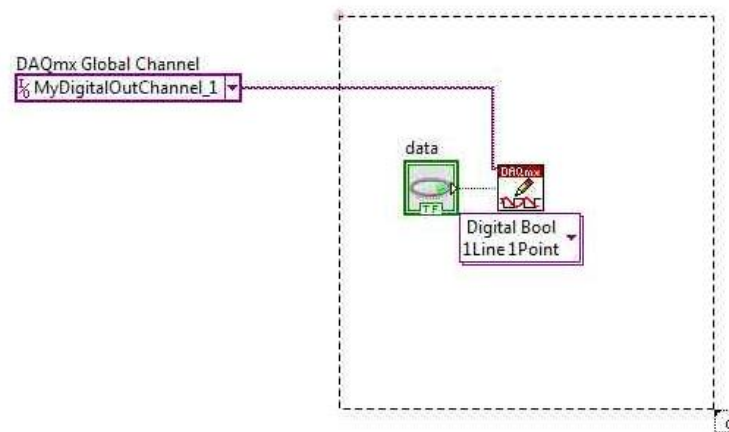
You should now have

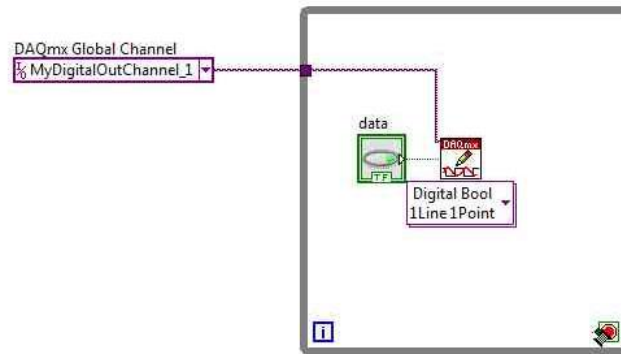


Lastly we want to do this over and over, so we will create a loop. From the Functions Pallet, select Programming | Structures | While Loop



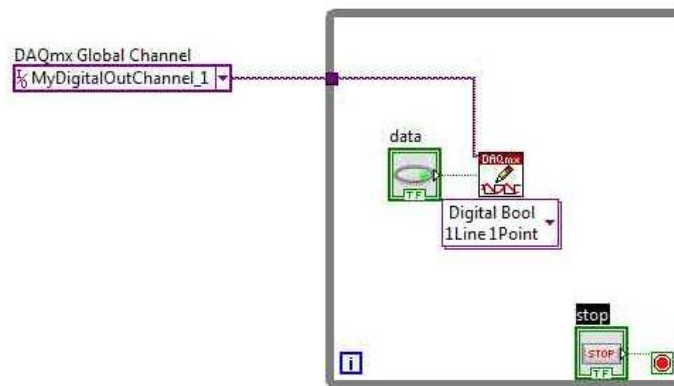
Then draw the while loop box around everything by the Global Channel:



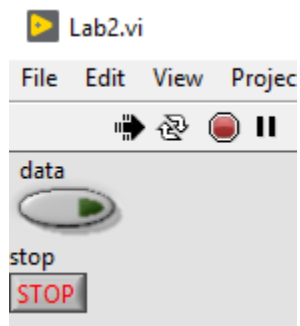


Lastly do a right click on the dot next to the red stop sign in the corner and do Create | Control

You should end up with



Go to the front panel, and you should have

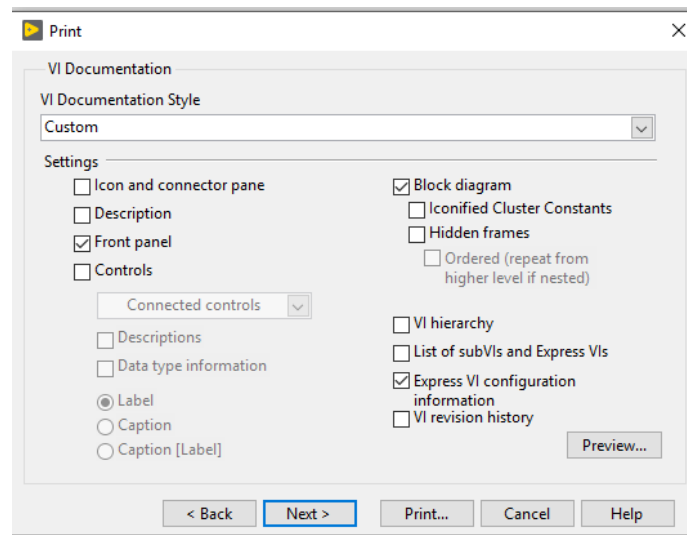


Except where the black arrow is, your arrow will be white, indicating the program is not running. Click on the Arrow to run the program. Click on the Data button to turn it on (indicated by the green light) and the relay should click, going to the NO position. Hit the Data button again (green light should go off) and the relay should click again, returning to the NC position. Hit stop to end the program.

Demo the code / circuit to the instructor. Submit the finish .vi file via the on line submission system.

Please submit 2 files, the VI program (.vi) and a document (.docx).

The document will be the documentation of the VI. To create the .docx file, press File | Print, and select your VI then press NEXT. Select VI DOCUMENTATION and press NEXT. Make sure you have selected Block Diagram, Hidden Frames , Front Panel and Express VI Configuration information Selected (as shown below)



And hit NEXT. Select Rich Text Format (RTF) file and hit next. Hit next again, and then hit save.

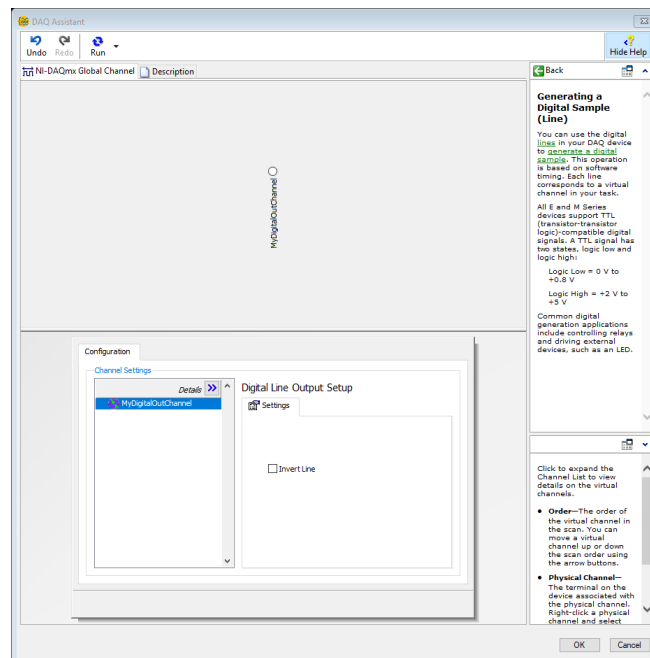
Open the document just created in word. It should have your Front Panel and your Block Diagram for your lab. Add an appropriate heading (Lab ___, Student Names, etc) and modify the formatting to ensure everything is visible, if necessary. Do a SAVE AS and save the file as a .DOCX file.

Submit both the **VI** and the **.DOCX** file via online submission.

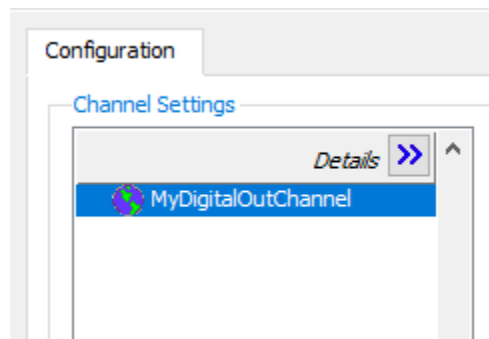
To Reopen the VI

Since the NI USB-6008 device is tied to the “Channel Const” in the VI, if you change to a different computer or different NI USB-6008 the VI will NOT find the Hardware.

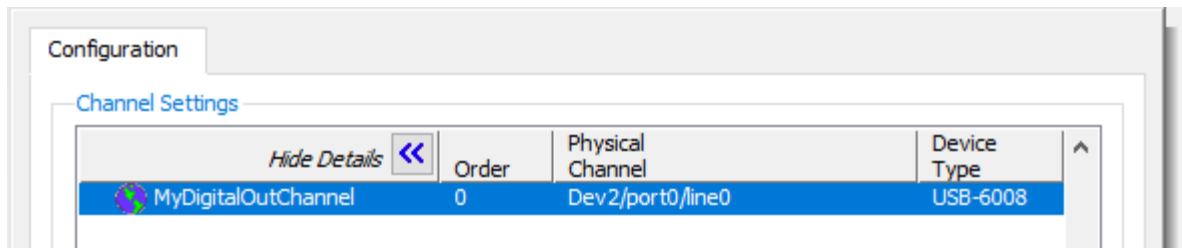
To get it to work again, open the VI and right click on the Channel Const. Select “Edit NI-DAQWmx Channel” when it opens you will see this:



Click on the Details >> button above the defined IO point:



To see:



Then right click on the physical channel (in the above example the “Dev2/Port0/line0”). And select “Change Physical Channel” and select the new point (if it is the same NI USB-6008 the “OK” button will be greyed out, indicating it is ok as is (and you can cancel out. If it is not greyed out, select the IO point and click ok.