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LED

Light Emitting Diode

Hans-Petter Halvorsen

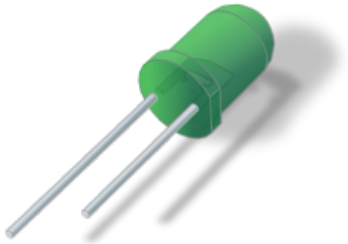
https://www.halvorsen.blog

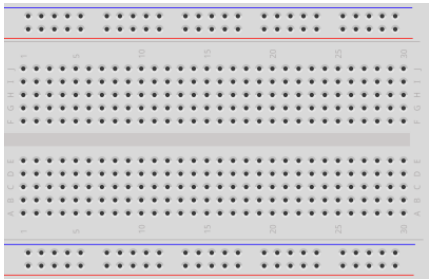
USB-6008

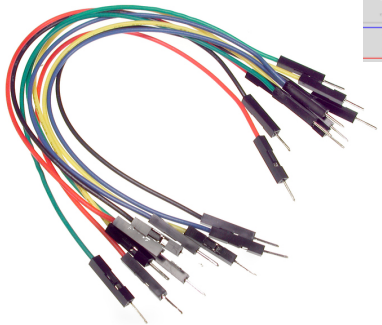
Hans-Petter Halvorsen

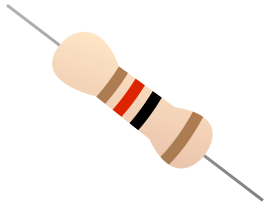
Hardware

- DAQ Device (e.g., USB-6008)
- Breadboard
- LED
- Resistor, $R = 270\Omega$
- Wires (Jumper Wires)



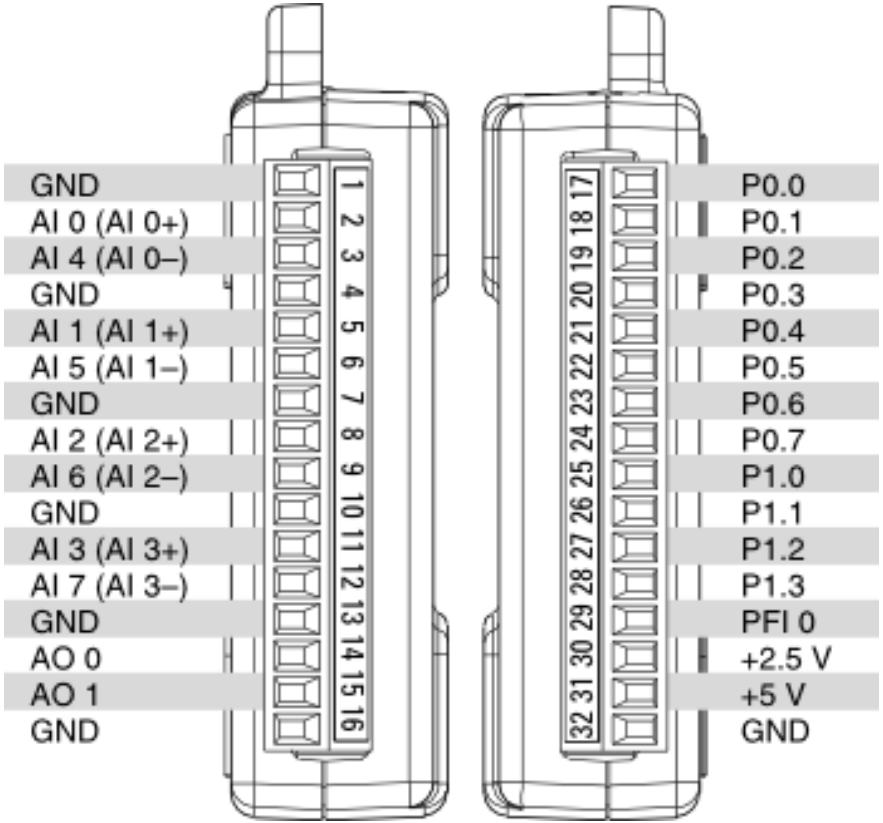




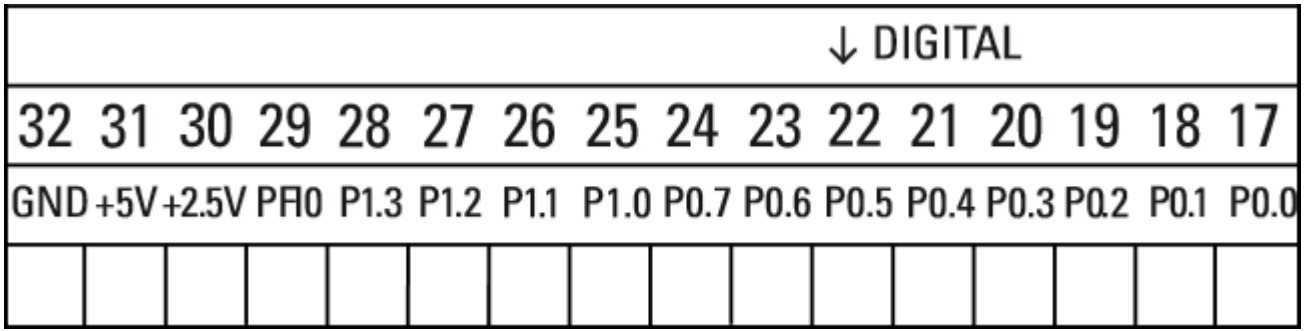


USB-6008


NATIONAL INSTRUMENTS
NI USB-6008
8 Inputs, 12-bit, 10 kS/s Multifunction I/O
Analog
Digital
1
16
17
32


GND
AI 0 (AI 0+)
AI 4 (AI 0–)
GND
AI 1 (AI 1+)
AI 5 (AI 1–)
GND
AI 2 (AI 2+)
AI 6 (AI 2–)
GND
AI 3 (AI 3+)
AI 7 (AI 3–)
GND
AO 0
AO 1
GND
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
P0.0
P0.1
P0.2
P0.3
P0.4
P0.5
P0.6
P0.7
P1.0
P1.1
P1.2
P1.3
PFI 0
+2.5 V
+5 V
GND

Digital Channels



Dev1/Port0/line0:7

P0.<0..7> Port 0 Digital I/O Channels 0 to 7 — You can individually configure each signal as an input or output.

Dev1/Port1/line0:3

P1.<0..3> Port 1 Digital I/O Channels 0 to 3 — You can individually configure each signal as an input or output

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Basic LED Example

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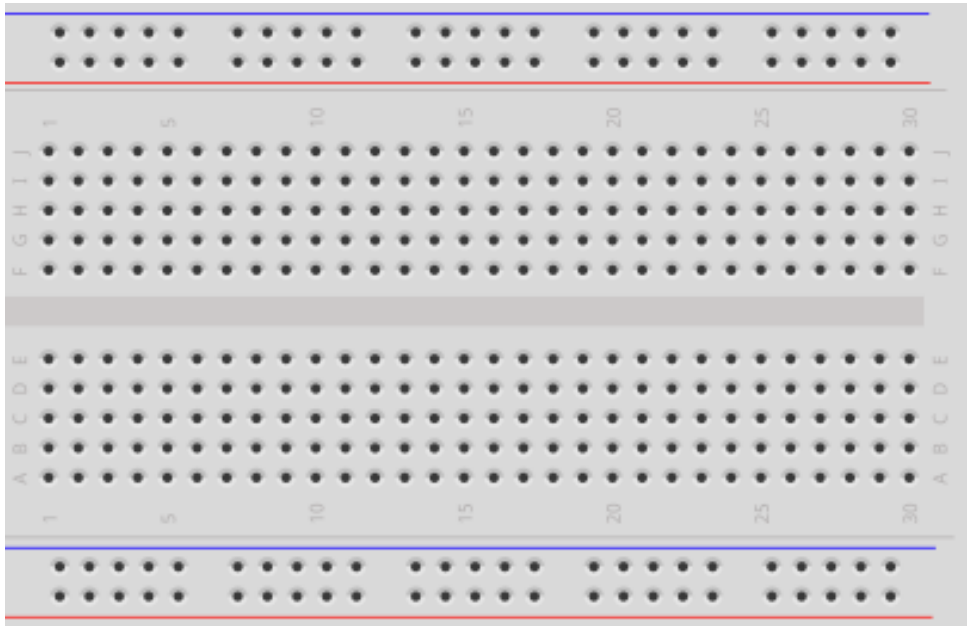
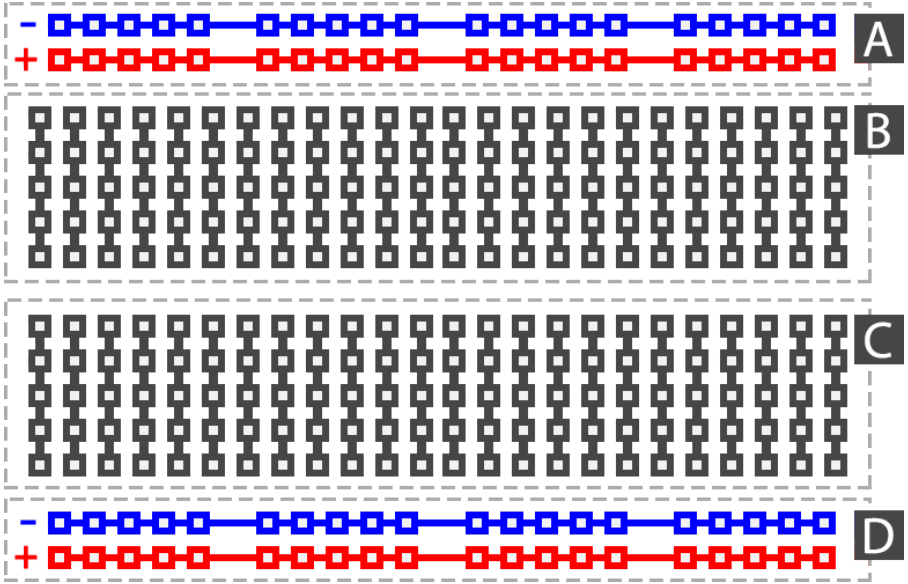
Basic LED Example

- We will turn on/off the LED by clicking on a Boolean button on the Front Panel

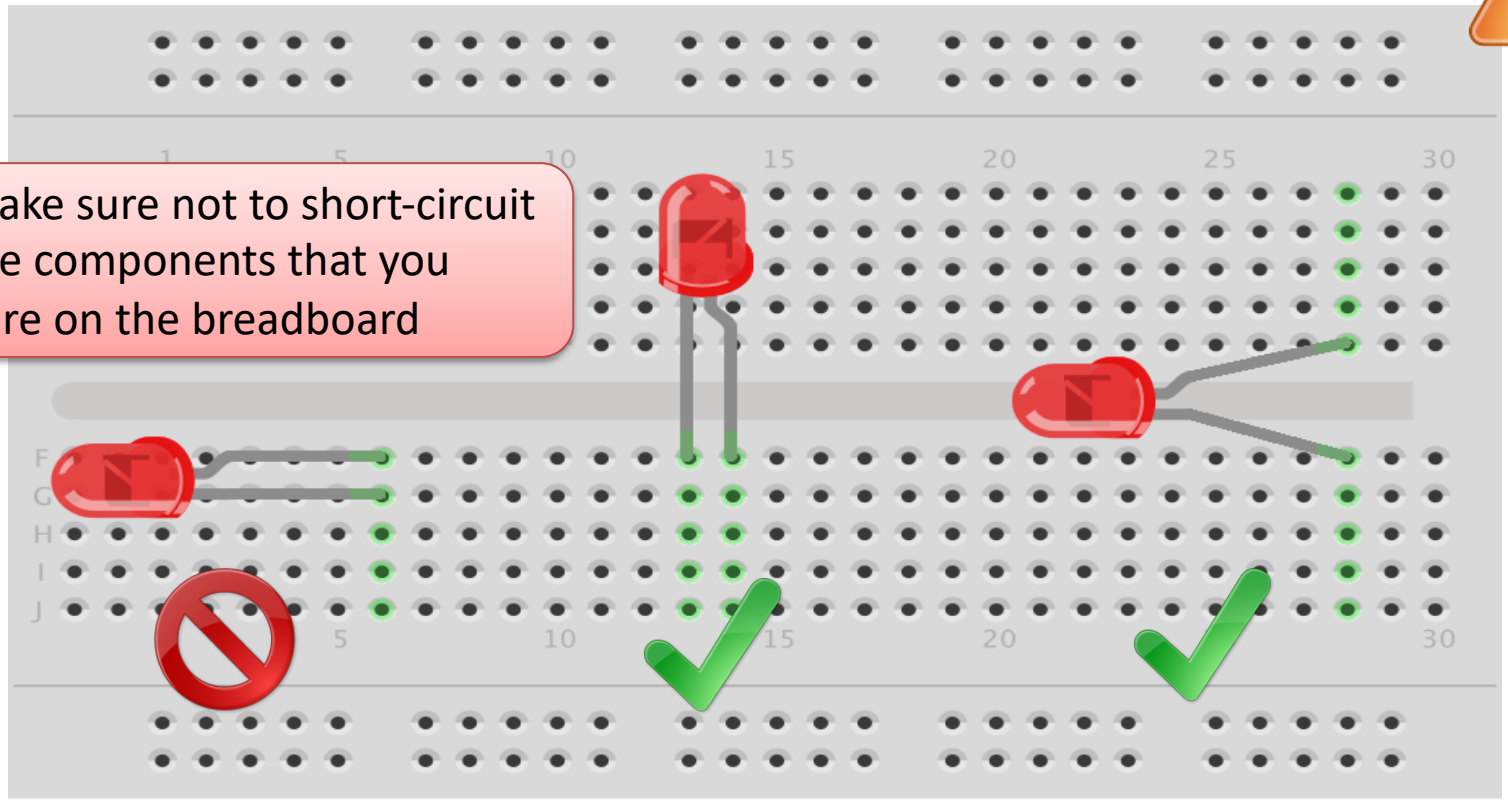
Breadboard



A breadboard is used to wire electric components together



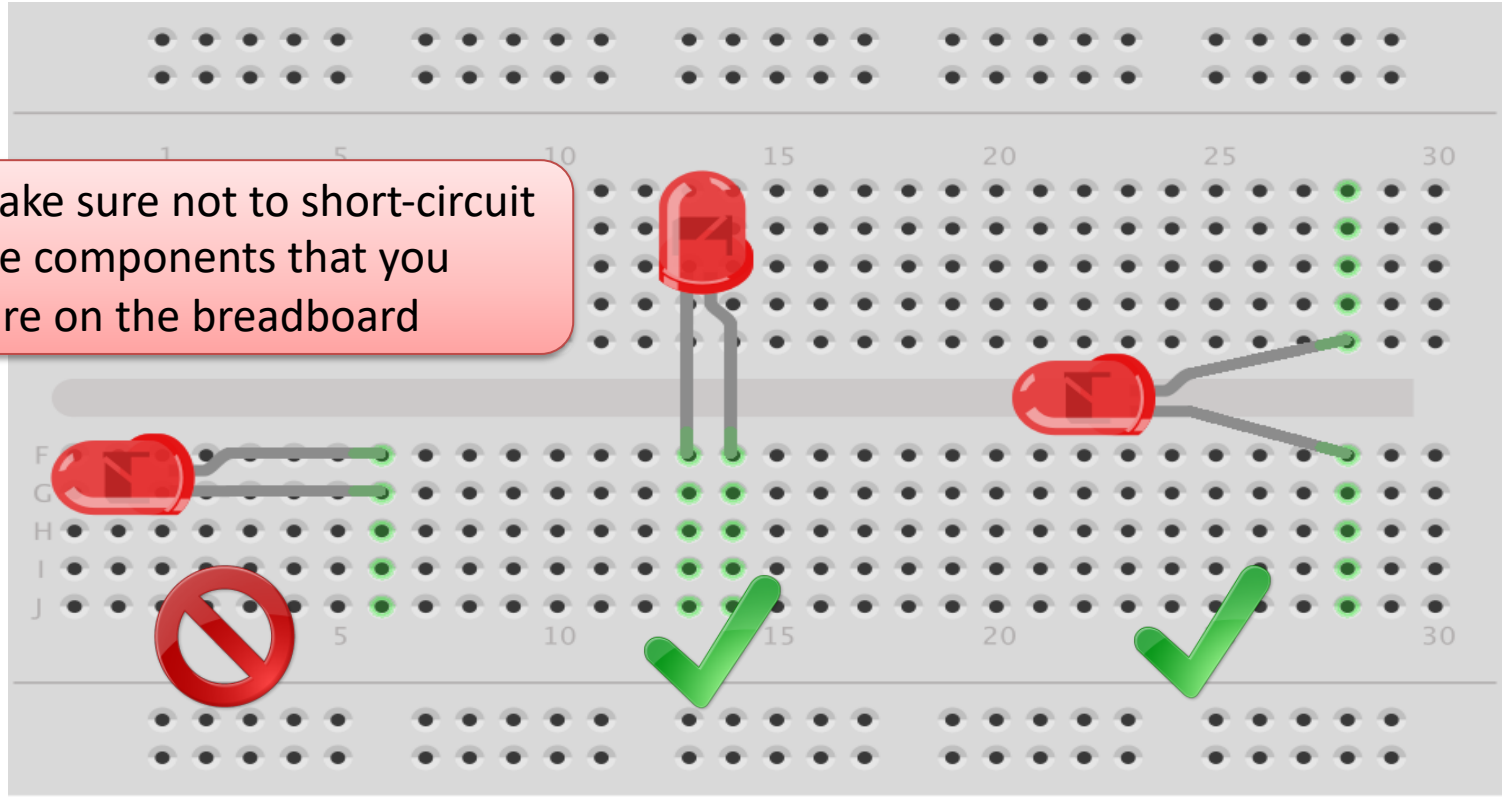
Breadboard Wiring



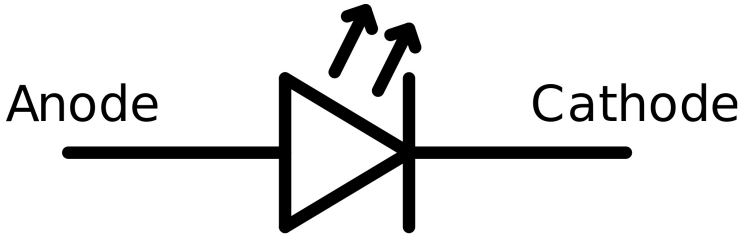
The Breadboard is used to connect components and electrical circuits

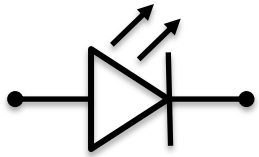
fritzing

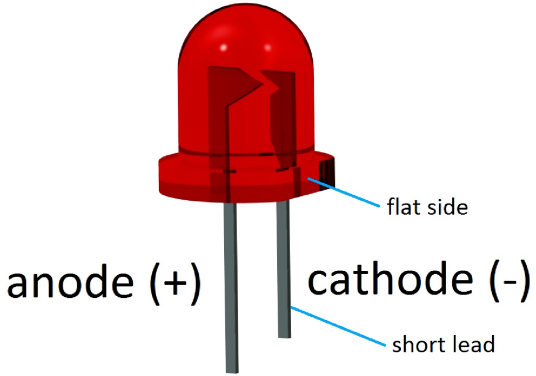
Make sure not to short-circuit the components that you wire on the breadboard

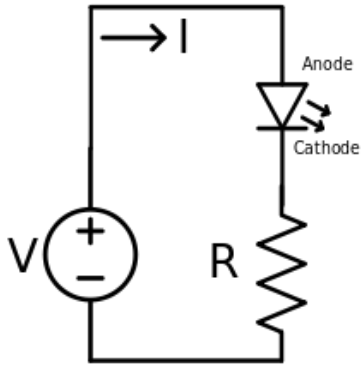


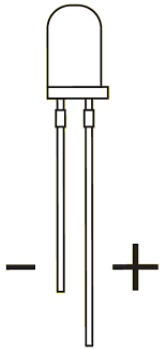
Light-emitting diode - LED





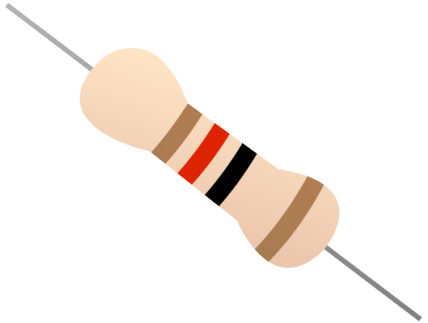






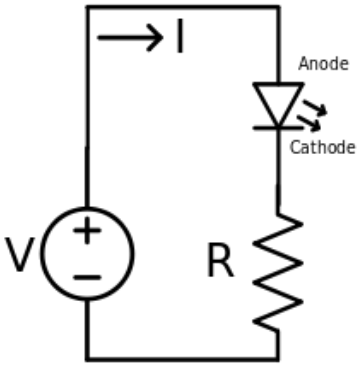
[Wikipedia]

Resistors



Resistance is measured in Ohm (Ω)

Resistors comes in many sizes, e.g., 220Ω , 270Ω, 330Ω, 1kΩm 10kΩ, ...



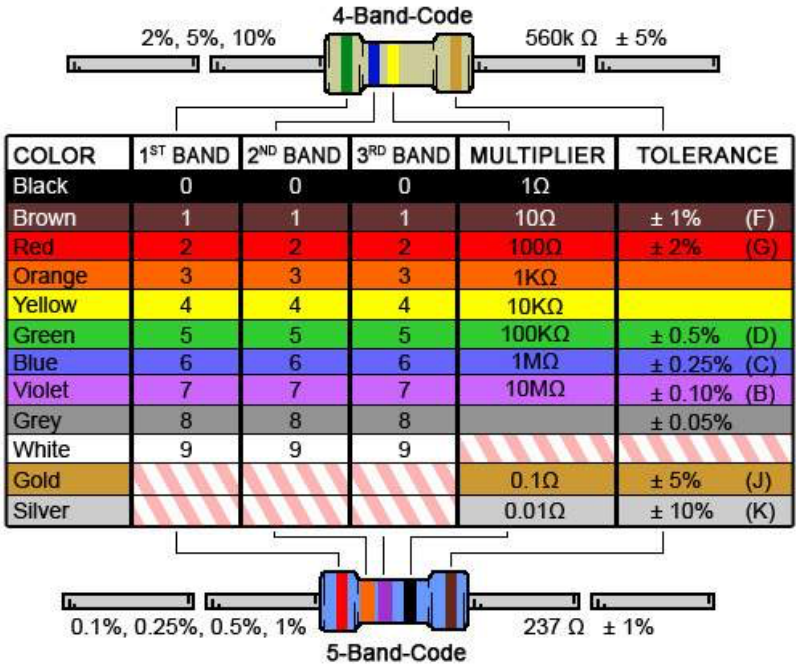
The resistance can be found using Ohms Law

$U = RI$

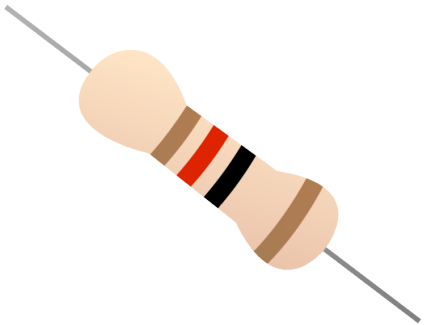
https://en.wikipedia.org/wiki/Resistor

Electrical symbol:

Resistor Color Codes

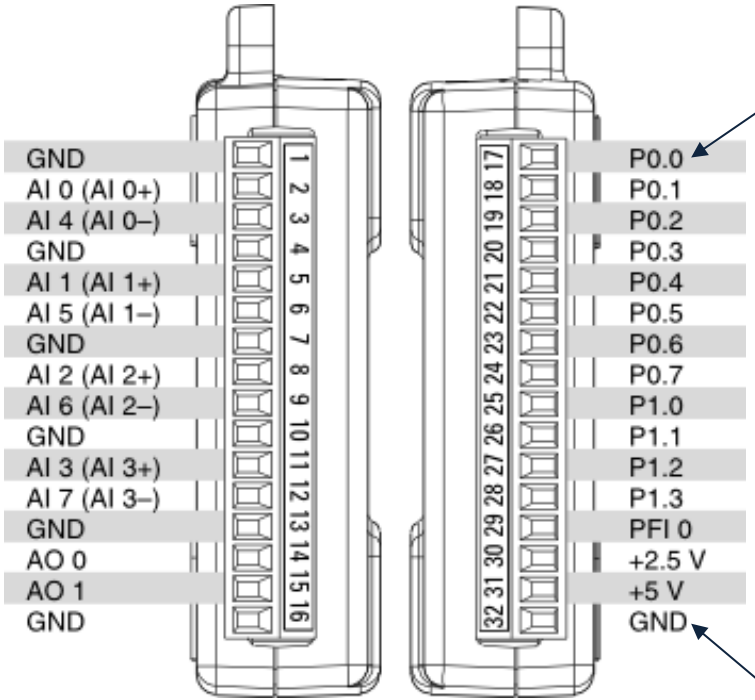


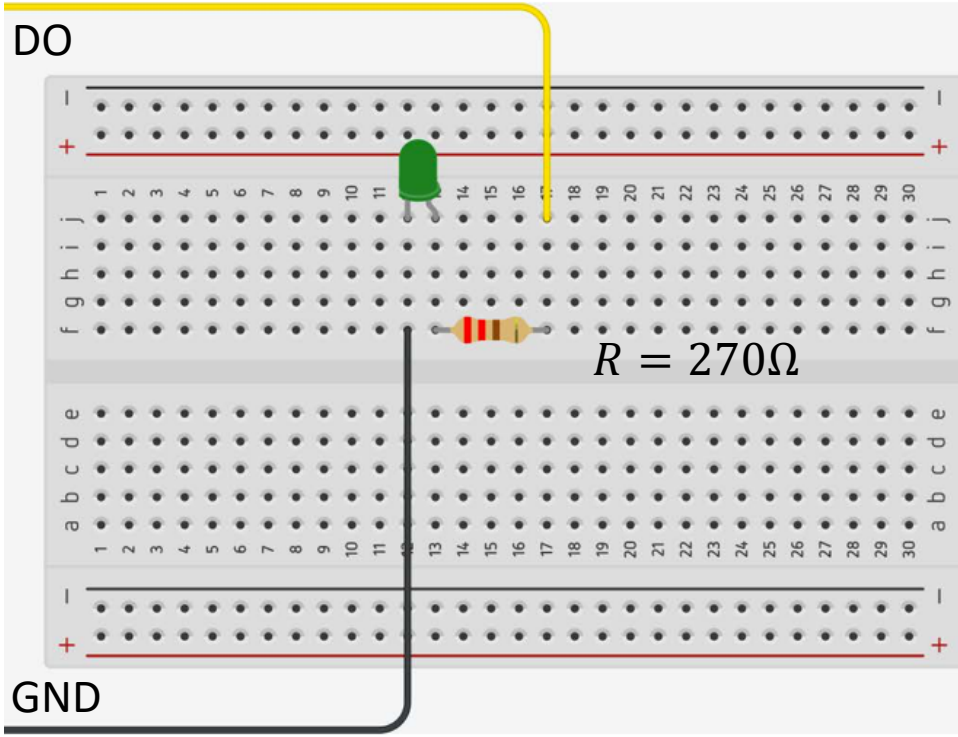
COLOR	1ST BAND	2ND BAND	3RD BAND	MULTIPLIER	TOLERANCE
Black	0	0	0	1Ω	
Brown	1	1	1	10Ω	± 1% (F)
Red	2	2	2	100Ω	± 2% (G)
Orange	3	3	3	1KΩ	
Yellow	4	4	4	10KΩ	
Green	5	5	5	100KΩ	± 0.5% (D)
Blue	6	6	6	1MΩ	± 0.25% (C)
Violet	7	7	7	10MΩ	± 0.10% (B)
Grey	8	8	8		± 0.05%
White	9	9	9		
Gold				0.1Ω	± 5% (J)
Silver				0.01Ω	± 10% (K)



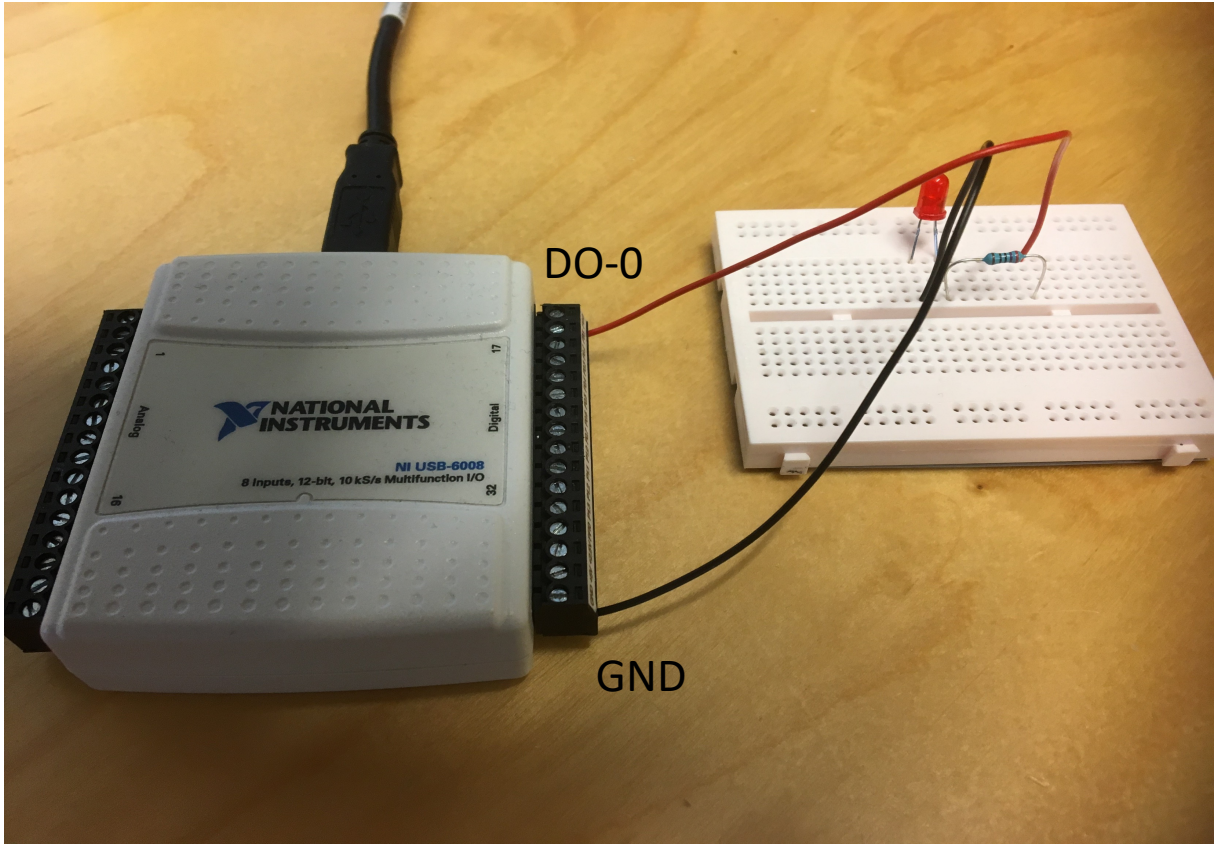
Resistor Calculator: http://www.allaboutcircuits.com/tools/resistor-color-code-calculator/

Wiring


GND
AI 0 (AI 0+)
AI 4 (AI 0–)
GND
AI 1 (AI 1+)
AI 5 (AI 1–)
GND
AI 2 (AI 2+)
AI 6 (AI 2–)
GND
AI 3 (AI 3+)
AI 7 (AI 3–)
GND
AO 0
AO 1
GND
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
P0.0
P0.1
P0.2
P0.3
P0.4
P0.5
P0.6
P0.7
P1.0
P1.1
P1.2
P1.3
PFI 0
+2.5 V
+5 V
GND

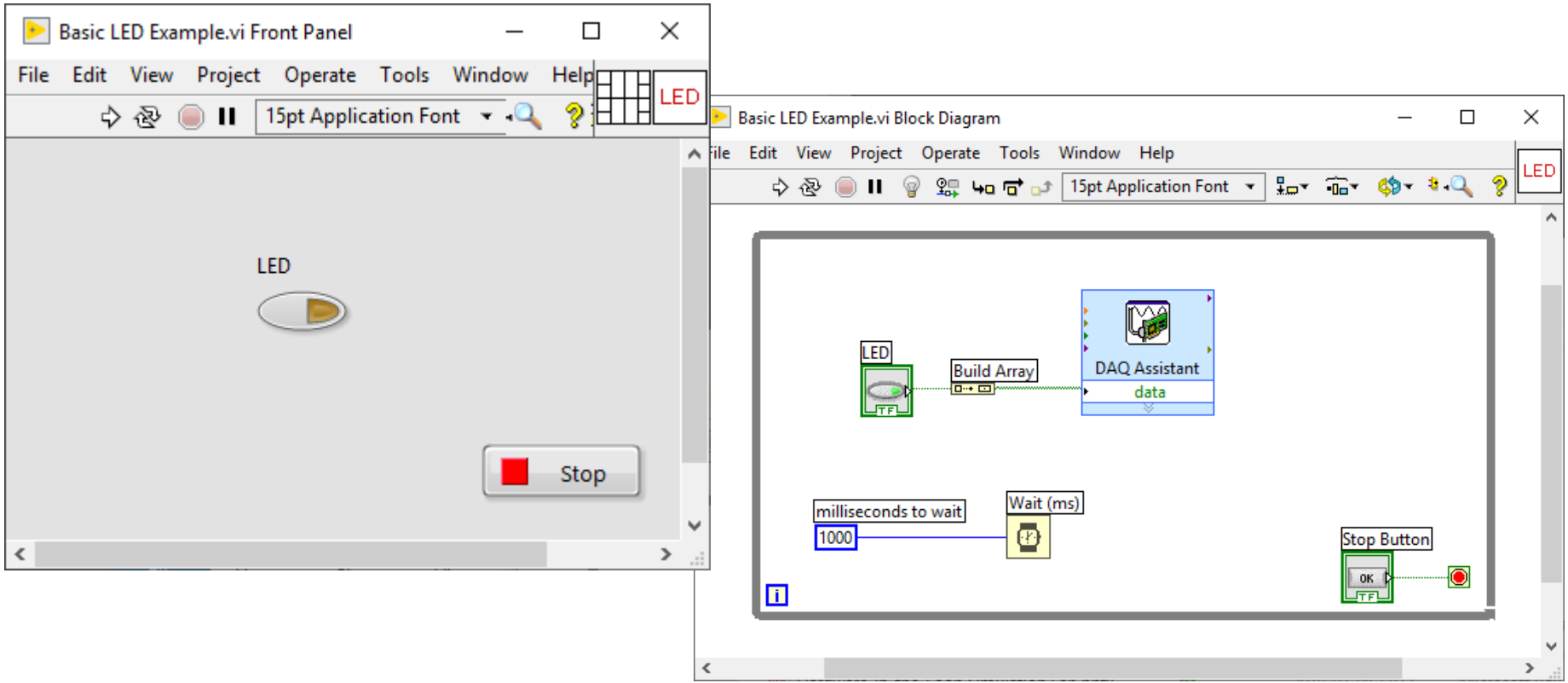

DO
$R = 270\Omega$
GND

Hardware Setup

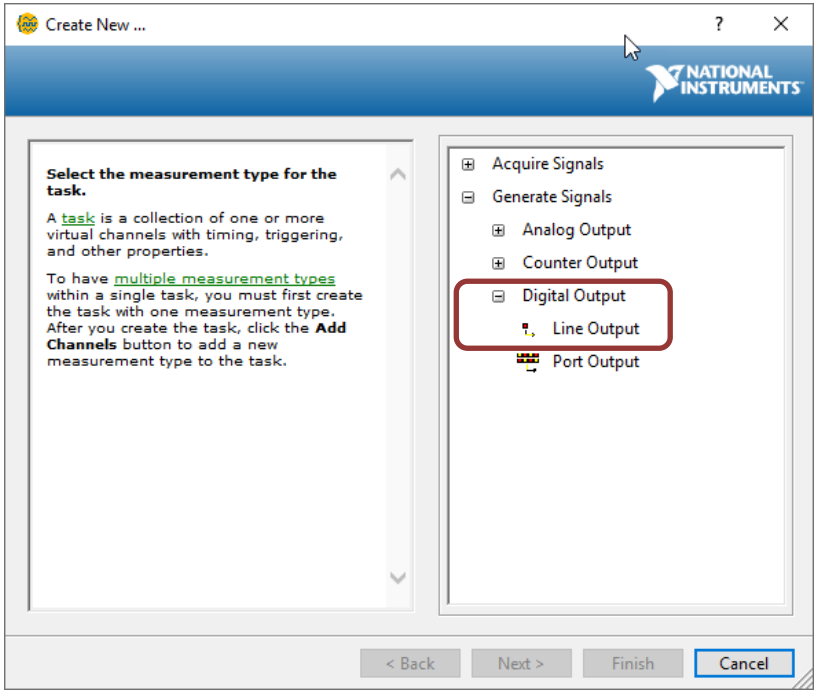


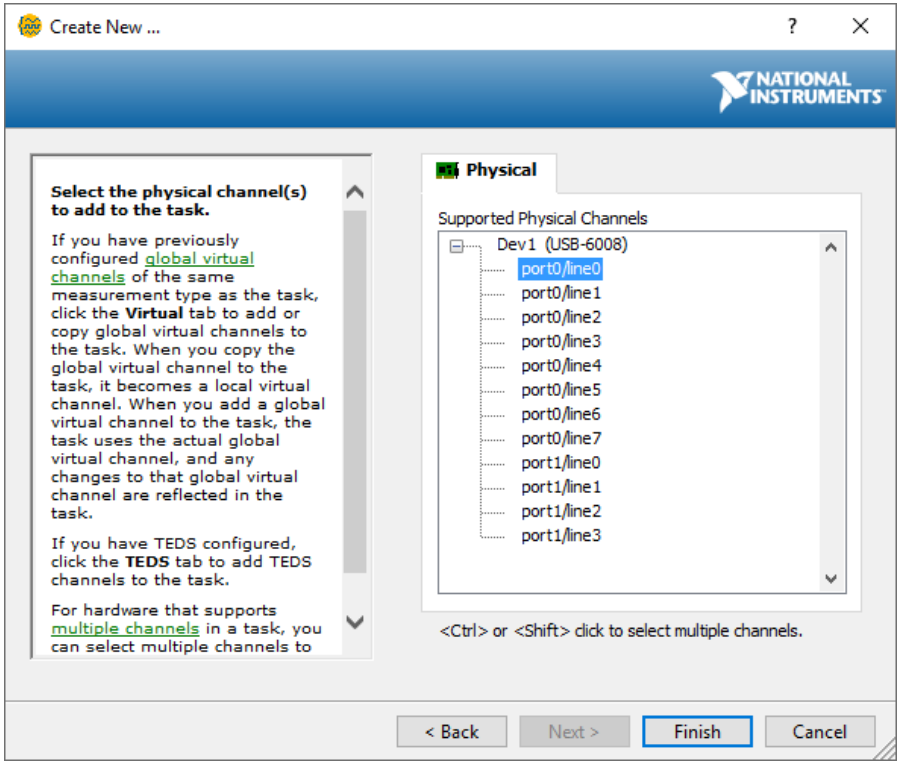
$R = 270\Omega$

LabVIEW Example



DAQ Settings





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Visual Studio

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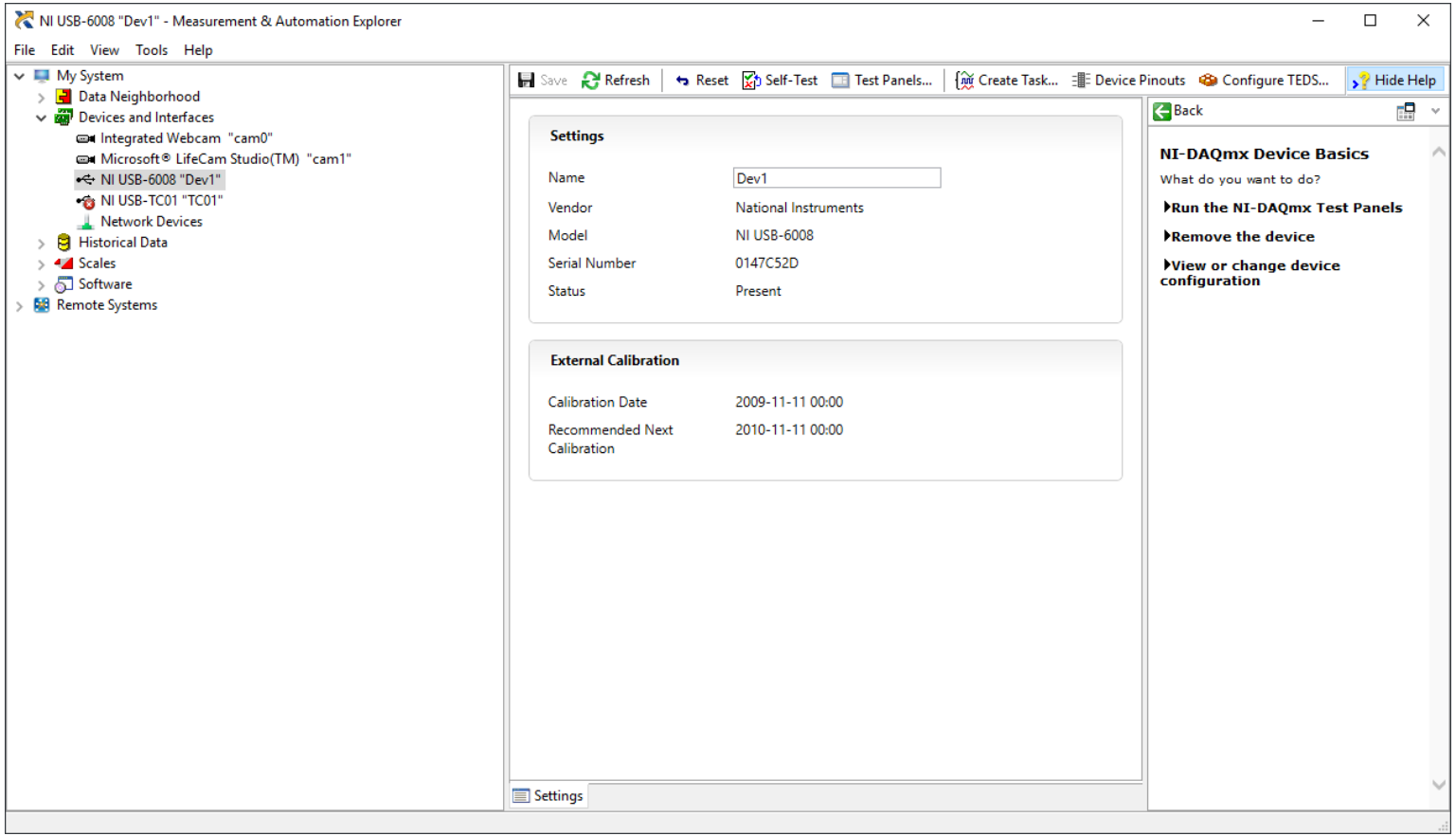
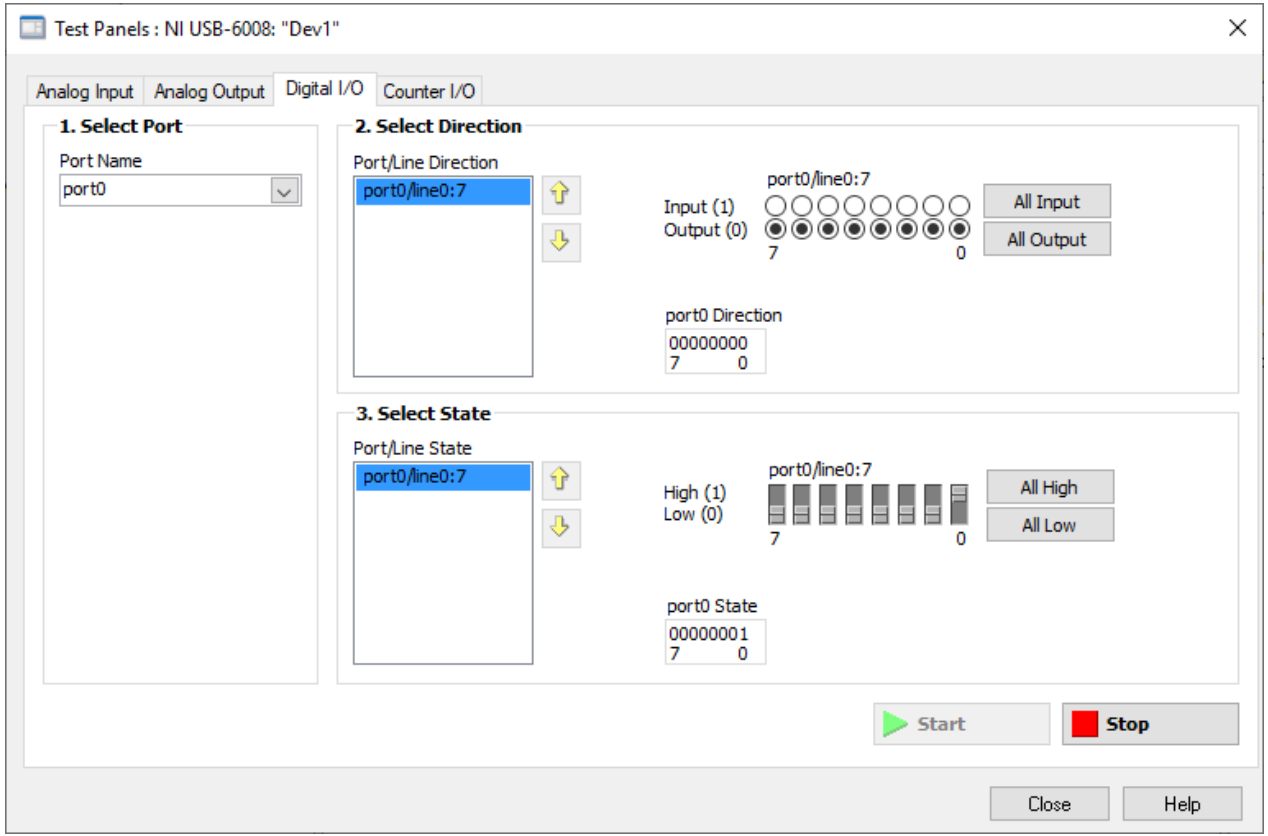
Measurement & Automation Explorer (MAX)



Test Panel in MAX



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Search for templates (Alt+S)

Clear all

C# | Windows | Desktop

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- ASP.NET Web Application (.NET Framework) — C#
- ASP.NET Web Application (.NET Framework) — Visual Basic
- Windows Forms App (.NET Core) — C#
- Python Application — Python
- Windows Forms App (.NET Framework) — C#

NUnit Test Project (.NET Core)
A project that contains NUnit tests that can run on .NET Core on Windows, Linux and MacOS.
C# Linux macOS Windows Desktop Test Web

Windows Forms App (.NET Framework)
A project for creating an application with a Windows Forms (WinForms) user interface
C# Windows Desktop

WPF App (.NET Framework)
Windows Presentation Foundation client application
C# Windows Desktop

WPF App (.NET Core)
Windows Presentation Foundation client application
C# Windows Desktop

WPF Custom Control Library (.NET Core)
Windows Presentation Foundation custom control library
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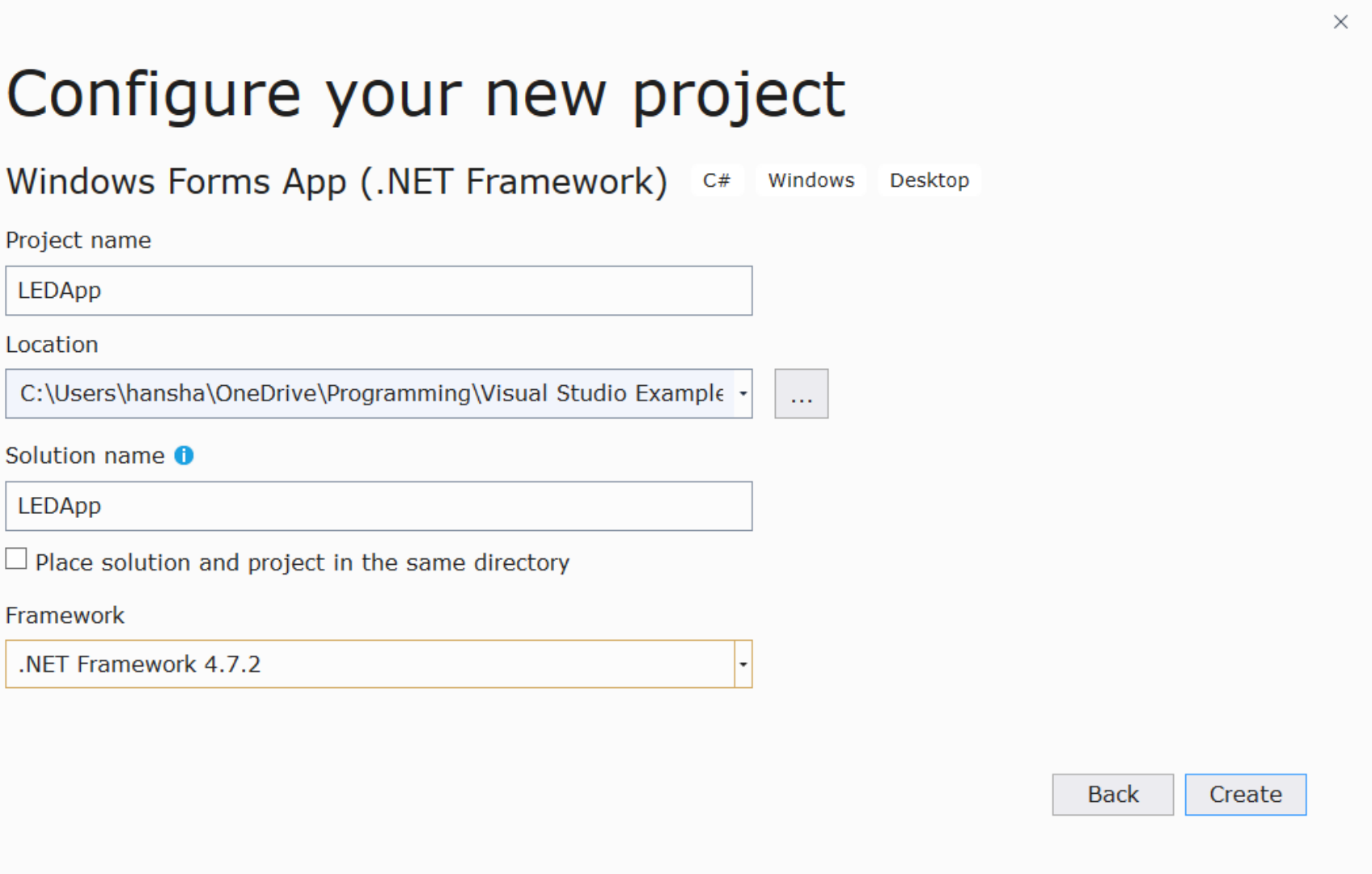
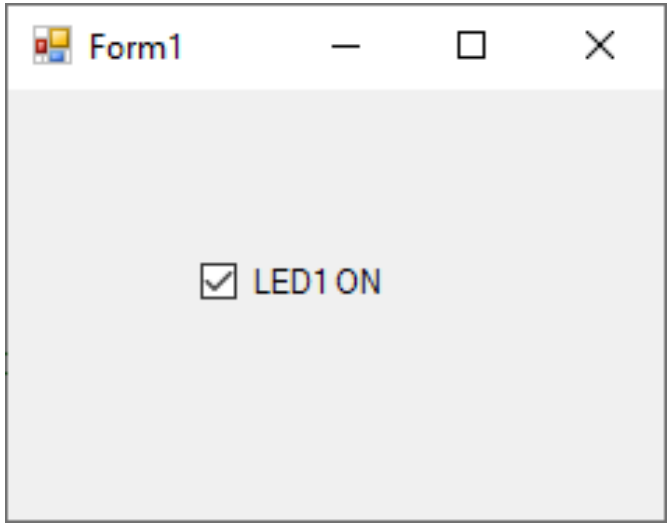
WPF User Control Library (.NET Core)
Windows Presentation Foundation user control library
C# Windows Desktop Library

Blank App (Universal Windows)
A project for a single-page Universal Windows Platform (UWP) app that has no predefined controls or layout.
C# Windows Xbox UWP Desktop

Back Next


Configure your new project
Windows Forms App (.NET Framework)
C#
Windows
Desktop
Project name
LEDApp
Location
C:\Users\hansha\OneDrive\Programming\Visual Studio Example
...
Solution name
LEDApp
Place solution and project in the same directory
Framework
.NET Framework 4.7.2
Back
Create

Example 1




```
using System;
using System.Windows.Forms;
using NationalInstruments.DAQmx;

namespace LEDApp
{
   public partial class Form1 : Form
   {
      public Form1()
      {
         InitializeComponent();
      }

      private void chkLED_CheckedChanged(object sender, EventArgs e)
      {
         Task digitalOutTask = new Task();

         digitalOutTask.DOChannels.CreateChannel("dev1/Port0/line0",
                        "myDAChannel",
                        ChannelLineGrouping.OneChannelForEachLine);

         DigitalSingleChannelWriter writer = new
                           DigitalSingleChannelWriter(digitalOutTask.Stream);

         bool digitalDataOut = chkLed1.Checked;

         writer.WriteSingleSampleSingleLine(true, digitalDataOut);
      }
   }
}
```

Example 2


```
using System;
using System.Windows.Forms;
using NationalInstruments.DAQmx;

namespace LEDApp
{
   public partial class Form2 : Form
   {
      public Form2()
      {
         InitializeComponent();
      }
      private void btnWriteDaq_Click(object sender, EventArgs e)
      {
         Task digitalOutTask = new Task();

         digitalOutTask.DOChannels.CreateChannel("dev1/Port0/line0:7",
                                 "myDAChannel", ChannelLineGrouping.OneChannelForAllLines);

         DigitalSingleChannelWriter writer = new DigitalSingleChannelWriter(digitalOutTask.Stream);

         bool[] dataArray = new bool[8];
         dataArray[0] = chkLed1.Checked;
         dataArray[1] = chkLed2.Checked;
         dataArray[2] = chkLed3.Checked;
         dataArray[3] = chkLed4.Checked;
         dataArray[4] = chkLed5.Checked;
         dataArray[5] = chkLed6.Checked;
         dataArray[6] = chkLed7.Checked;
         dataArray[7] = chkLed8.Checked;

         writer.WriteSingleSampleMultiLine(true, dataArray);
      }
   }
}
```

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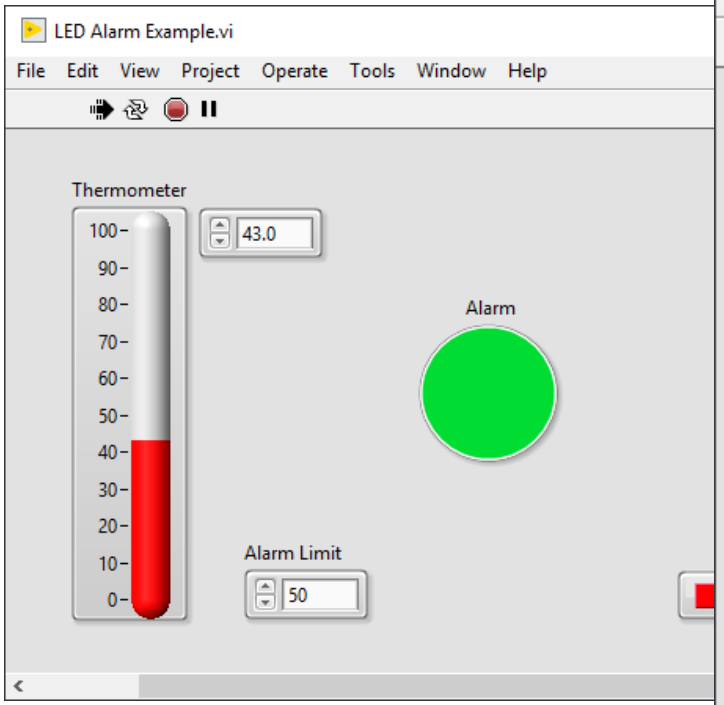
Alarm LED Example

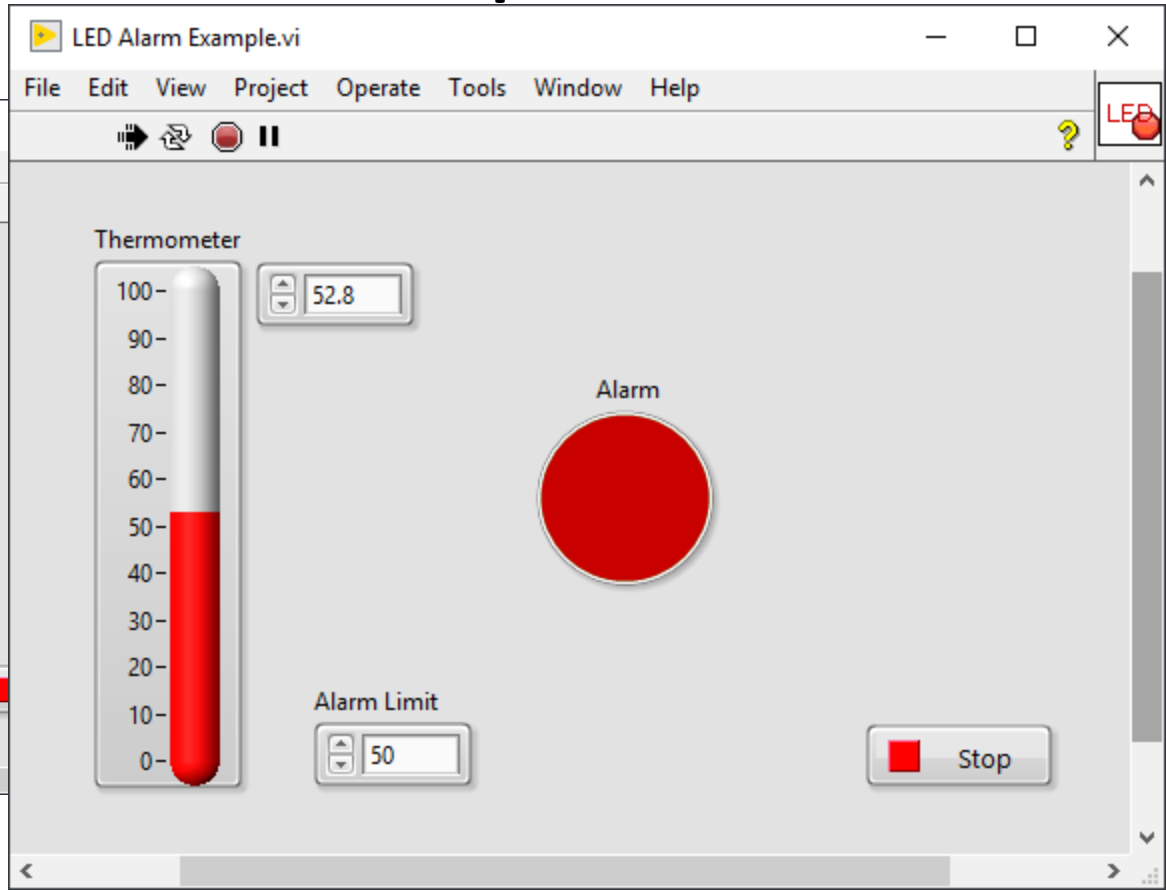
Hans-Petter Halvorsen

Alarm LED Example

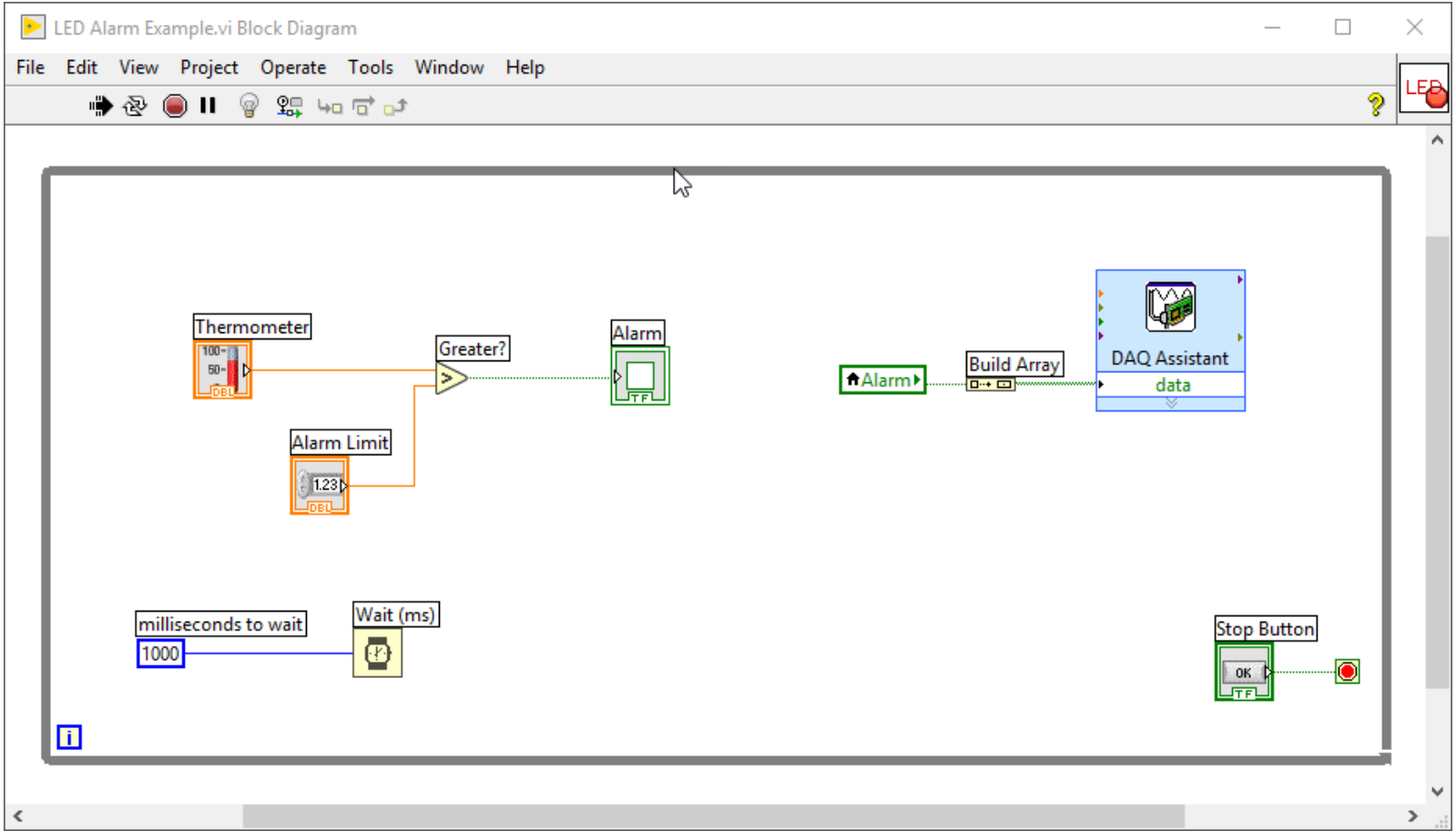
- We will turn on the LED when the temperature reach a specific Alarm Level

LabVIEW Example





LabVIEW Example



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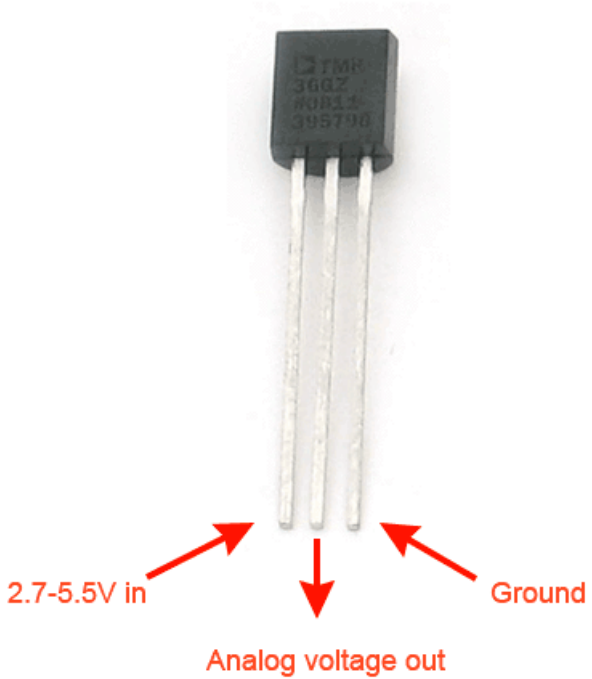
Temperature Sensor Example

Hans-Petter Halvorsen

TMP36 Temperature Sensor



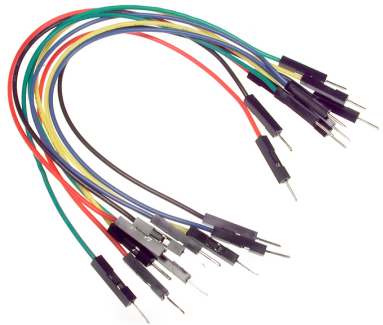
A Temperature sensor like TM36 use a solid-state technique to determine the temperature.

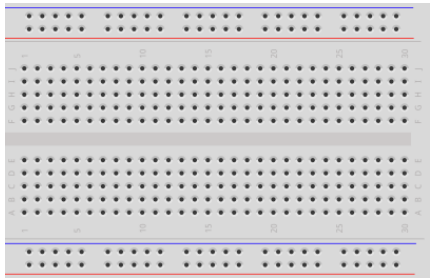
They use the fact as temperature increases, the voltage across a diode increases at a known rate.

https://learn.adafruit.com/tmp36-temperature-sensor

Necessary Equipment

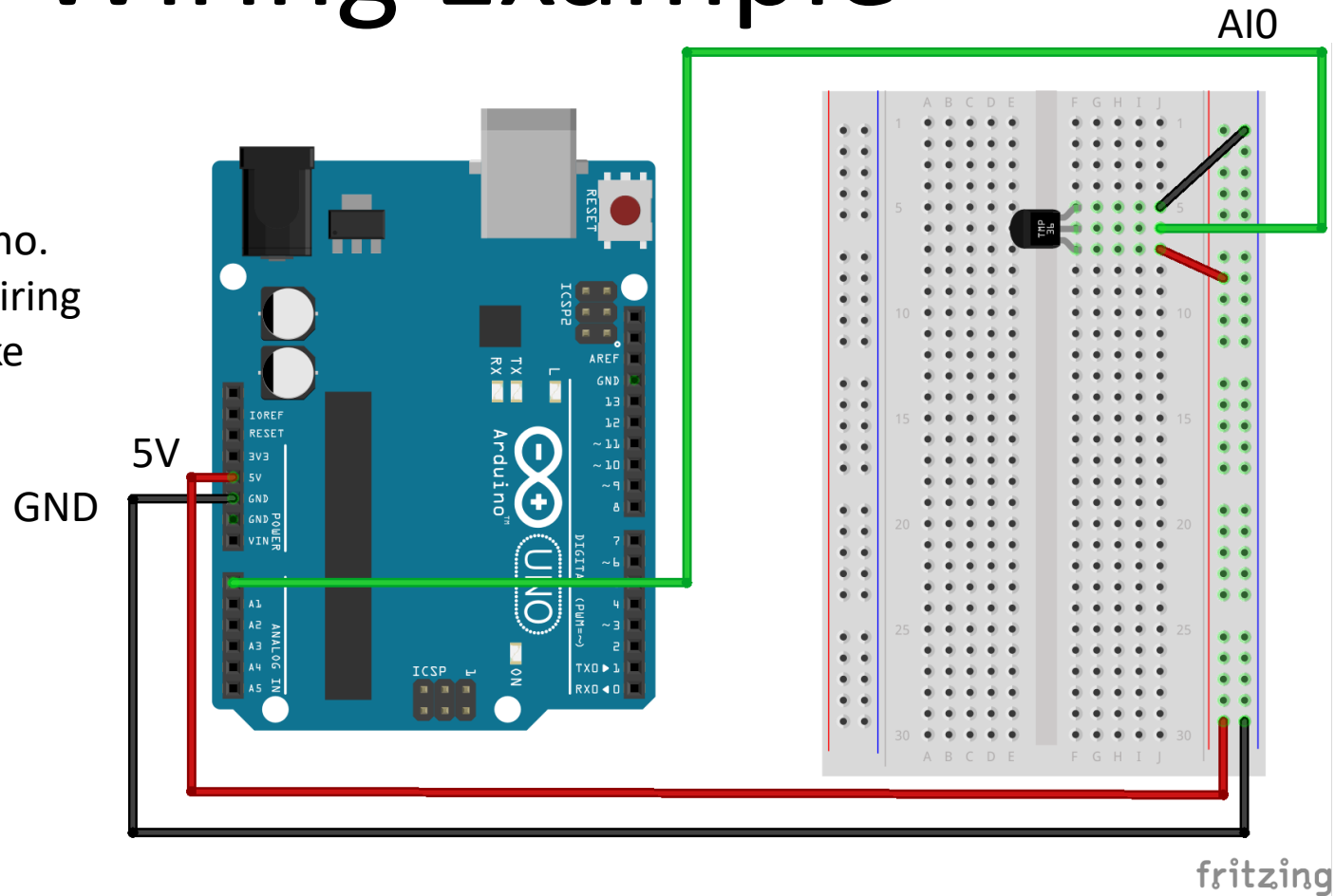
- PC
- DAQ Module, e.g., USB-6008
- Breadboard
- TMP36
- Wires (Jumper Wires)



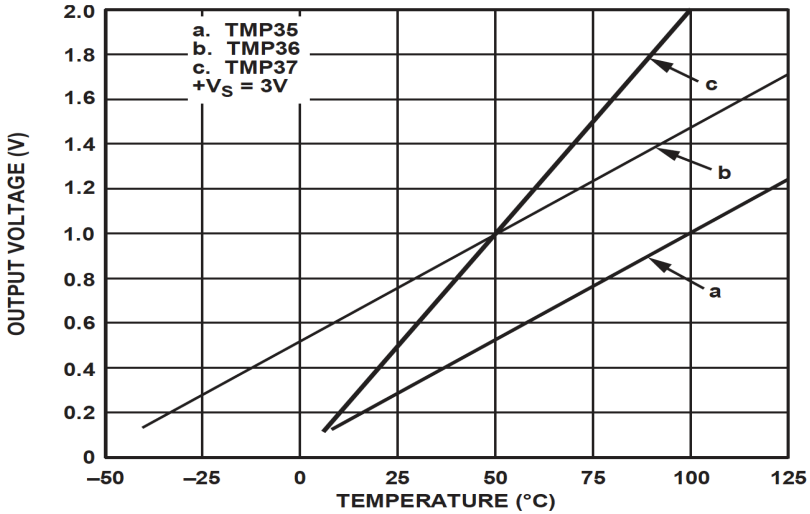


Wiring Example

Here you see a wiring examples using Arduino. You make the same wiring using a DAQ device like USB-6008 or similar.



Linear Scaling



This gives:

$$y - 25 = \frac{50 - 25}{1 - 0.75}(x - 0.75)$$

Then we get the following formula:

$$y = 100x - 50$$

Convert form Voltage (V) to degrees Celsius

From the Datasheet we have:

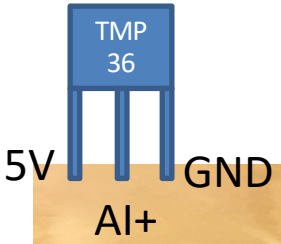
$$(x_1, y_1) = (0.75V, 25°C)$$
$$(x_2, y_2) = (1V, 50°C)$$

There is a linear relationship between Voltage and degrees Celsius:

$$y = ax + b$$

We can find a and b using the following known formula:

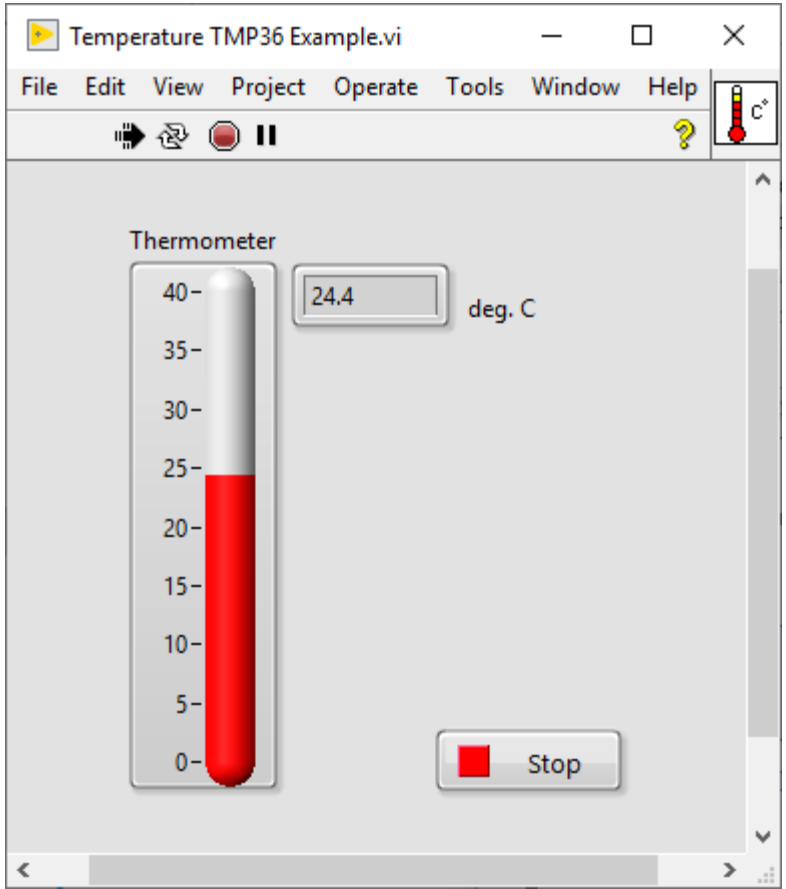
$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$$

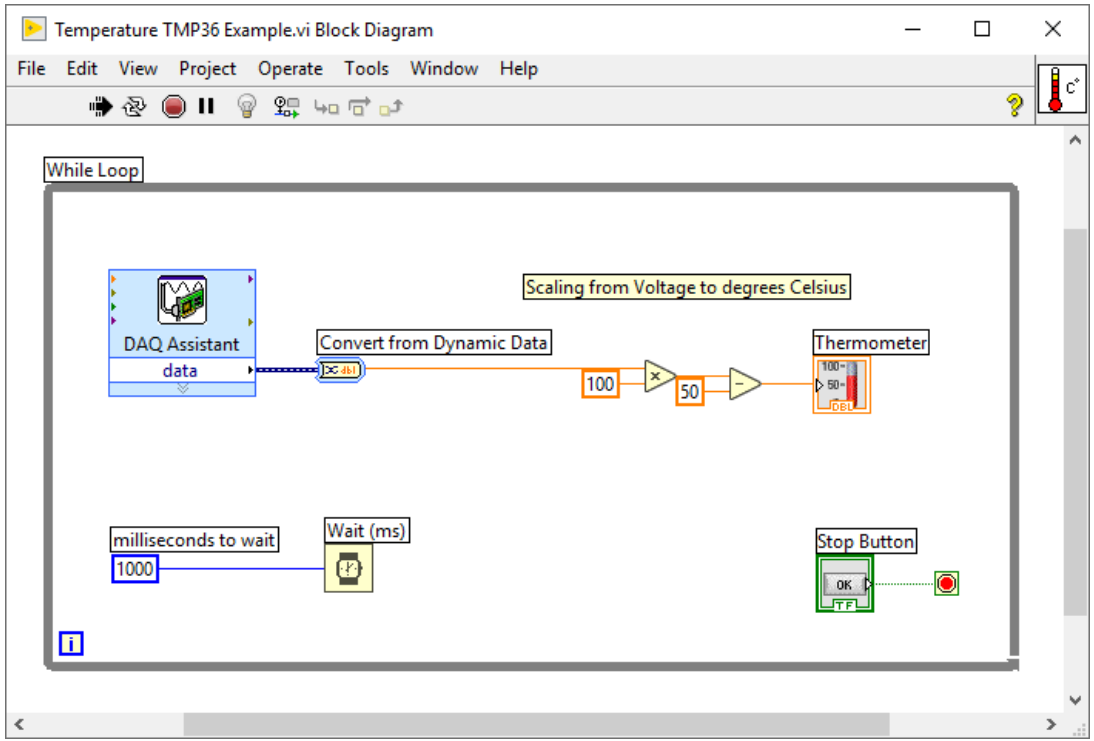


USB-6008 Wiring Example

We connect the TMP36 to LabVIEW using a USB DAQ Device from National Instruments, e.g., USB-6001, USB-6008 or similar. I have used a breadboard for the wiring.

LabVIEW Example





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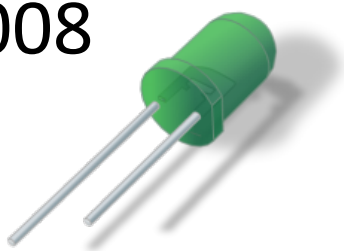
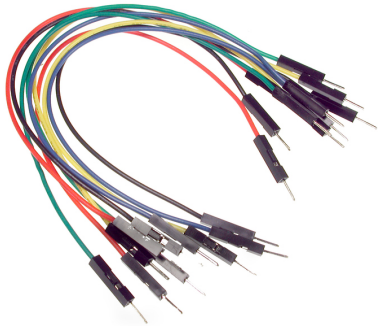
Temperature Sensor with Alarm Example

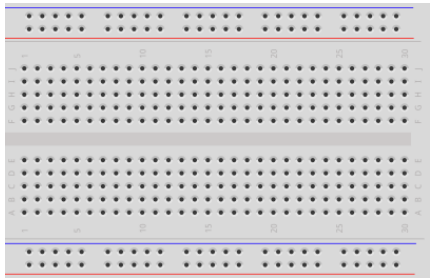
Hans-Petter Halvorsen

Necessary Equipment

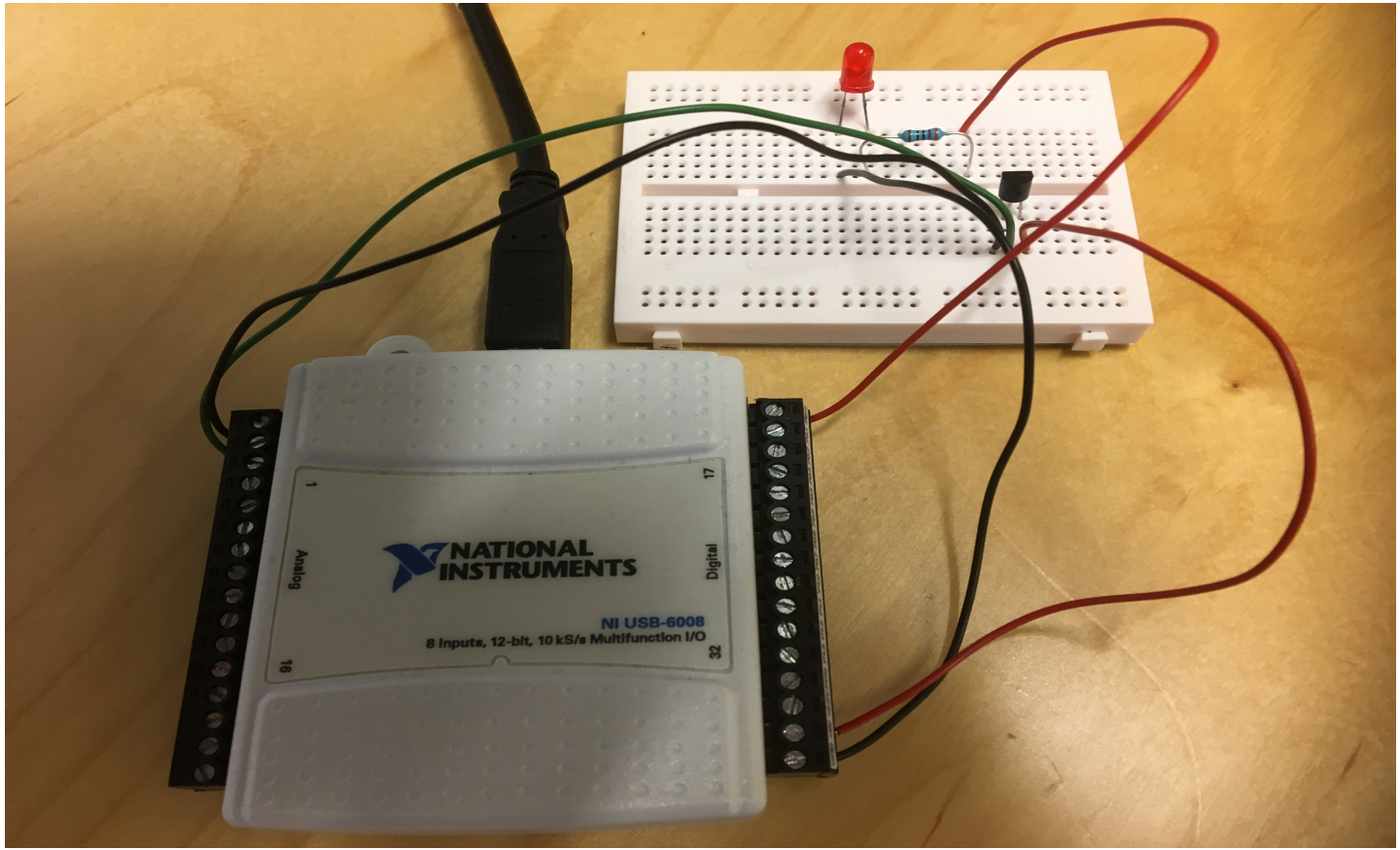
- PC
- DAQ Module, e.g., USB-6008
- Breadboard
- TMP36
- LED
- Resistor, $R = 270\Omega$
- Wires (Jumper Wires)



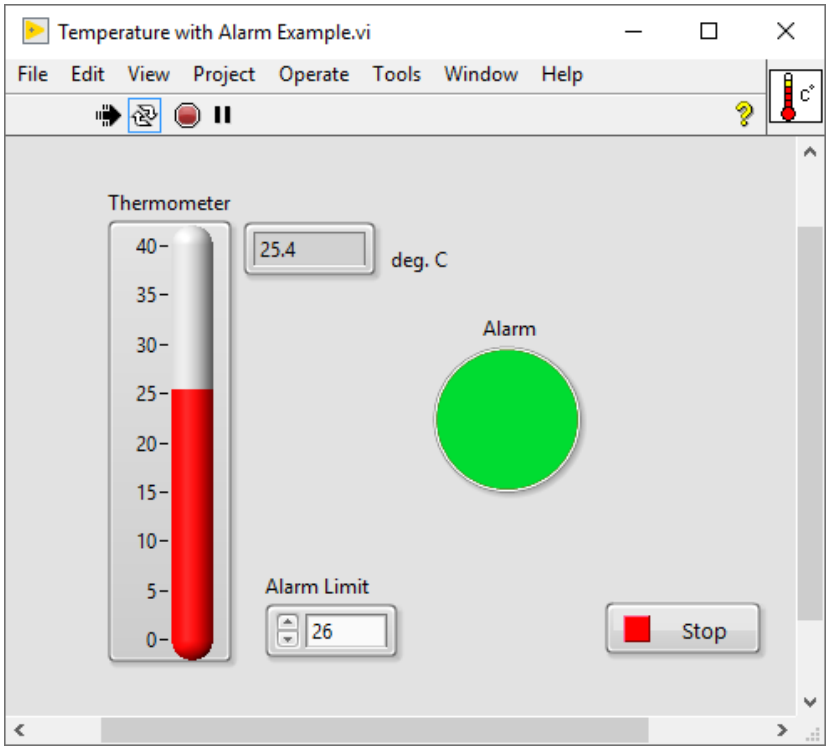


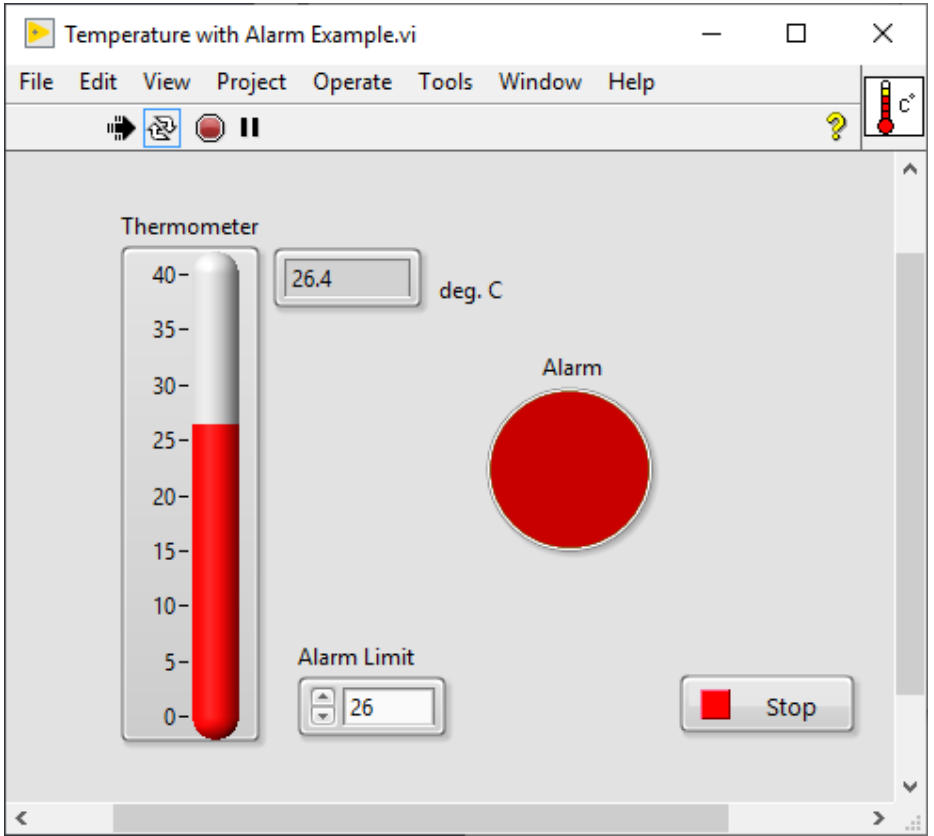


Wiring

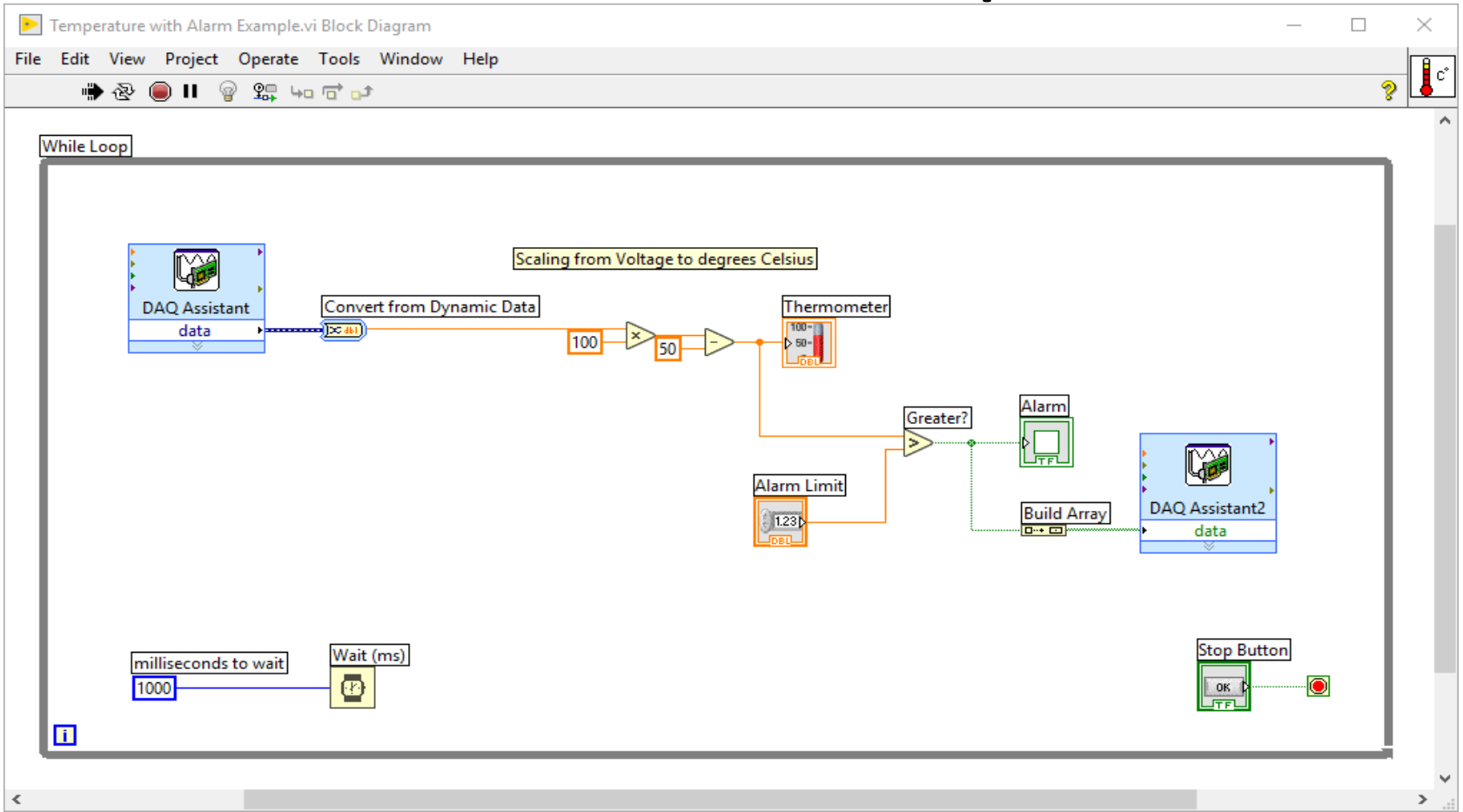

NATIONAL INSTRUMENTS
NI USB-6008
8 Inputs, 12-bit, 10 kS/s Multifunction I/O
Analog
Digital
1
17
18
32

LabVIEW Example





LabVIEW Example



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