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LED in LabVIEW



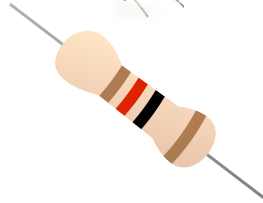
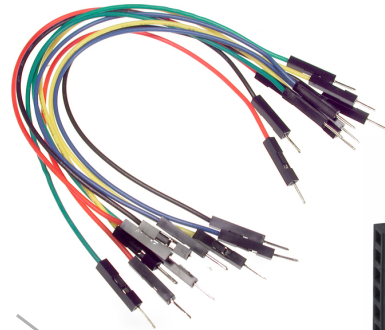
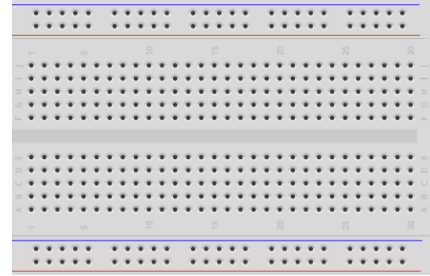
Hans-Petter Halvorsen

Contents

- We will show how to turn on/off a LED using an I/O Module/DAQ Device in LabVIEW
- We will use a USB-6008 module from National Instruments
- We will use the DAQmx driver, so any I/O module that is supported by this driver can be used

Hardware

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

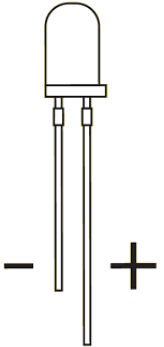
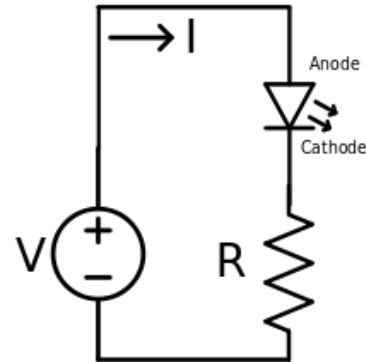
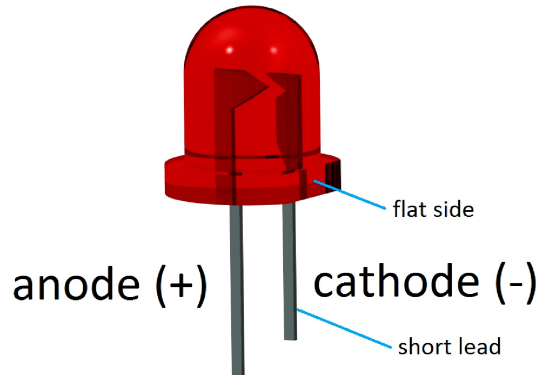
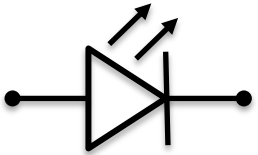
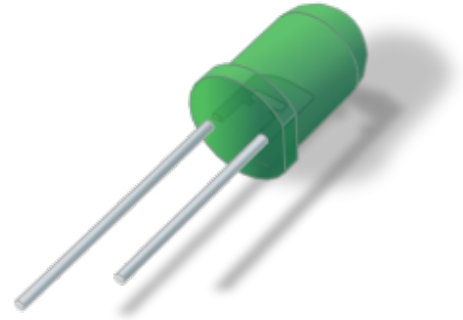
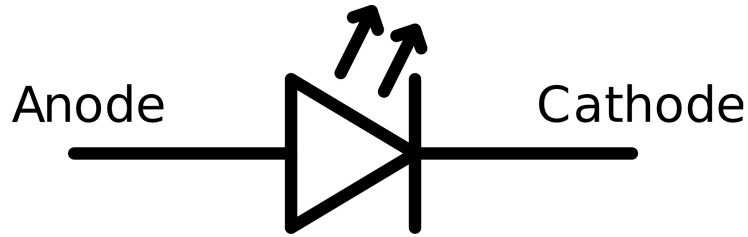


Software

- LabVIEW
 - Graphical Programming Environment
- DAQmx Driver
 - Driver used for Communication with external Hardware such as USB-6008

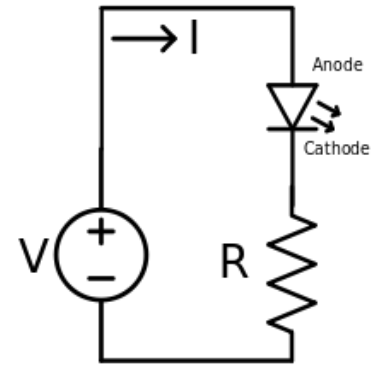
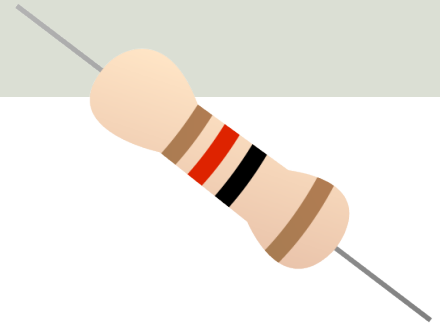
Light-emitting diode - LED

A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it



Resistors

- We need to use a Resistor in order to limit the current flowing through the LED, else the LED will be destroyed.
- Resistance is measured in Ohm (Ω).
- Resistors comes in many sizes, e.g., 220Ω , 270Ω , 330Ω , $1k\Omega$ $10k\Omega$, ...
- The resistance can be found using Ohms Law $U = RI$



Electrical symbol:



USB-6008

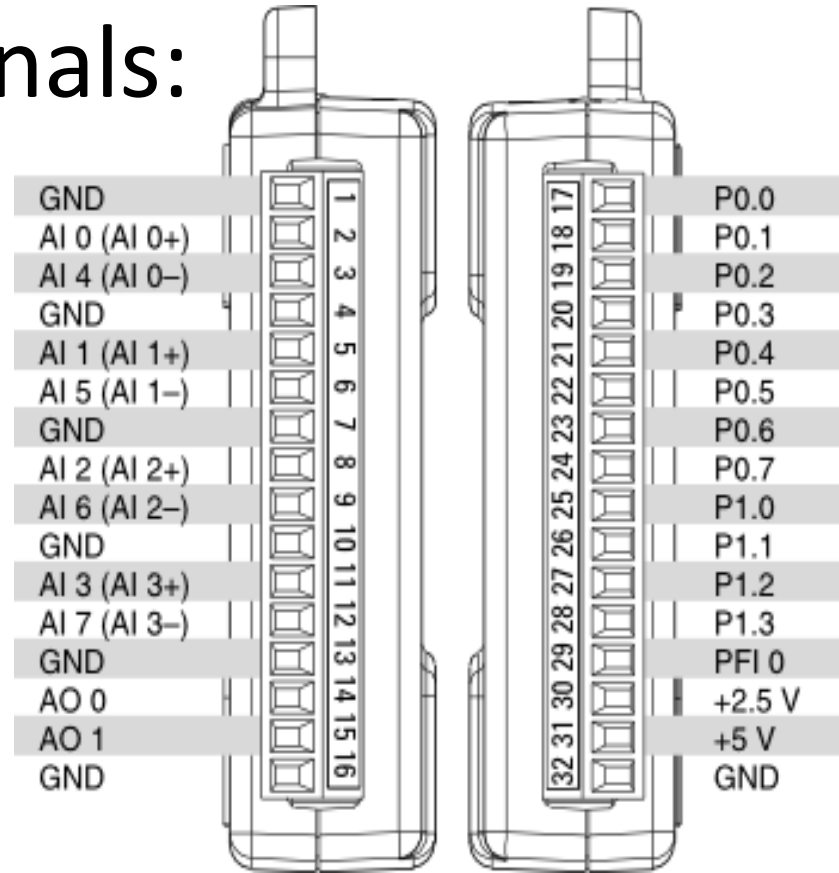
- USB-6008 is a DAQ Device from NI
- Can be used within LabVIEW
- NI-DAQmx Driver
- It has Analog and Digital Inputs and Outputs



USB-6008

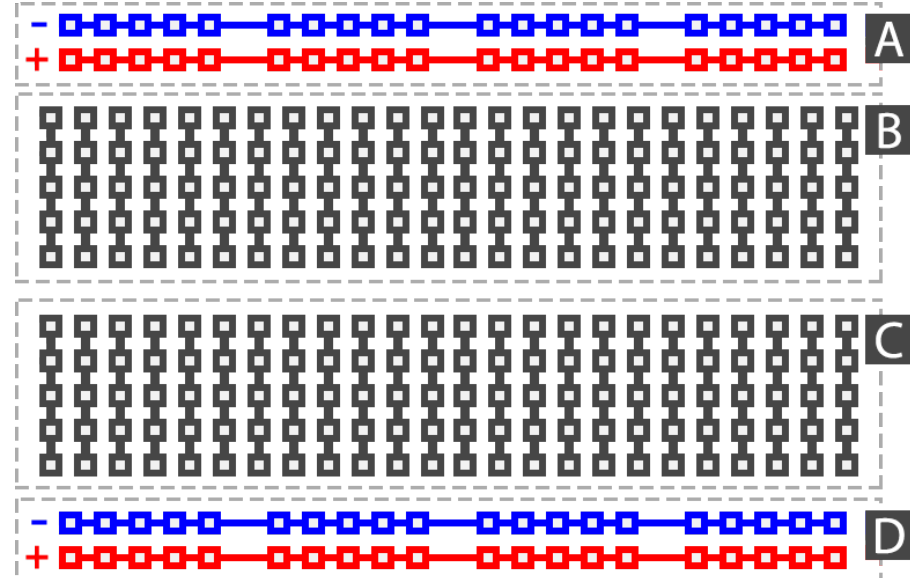
4 different types of Signals:

- AO – Analog Output
- AI – Analog Input
- DO – Digital Output
- DI – Digital Input



Breadboard

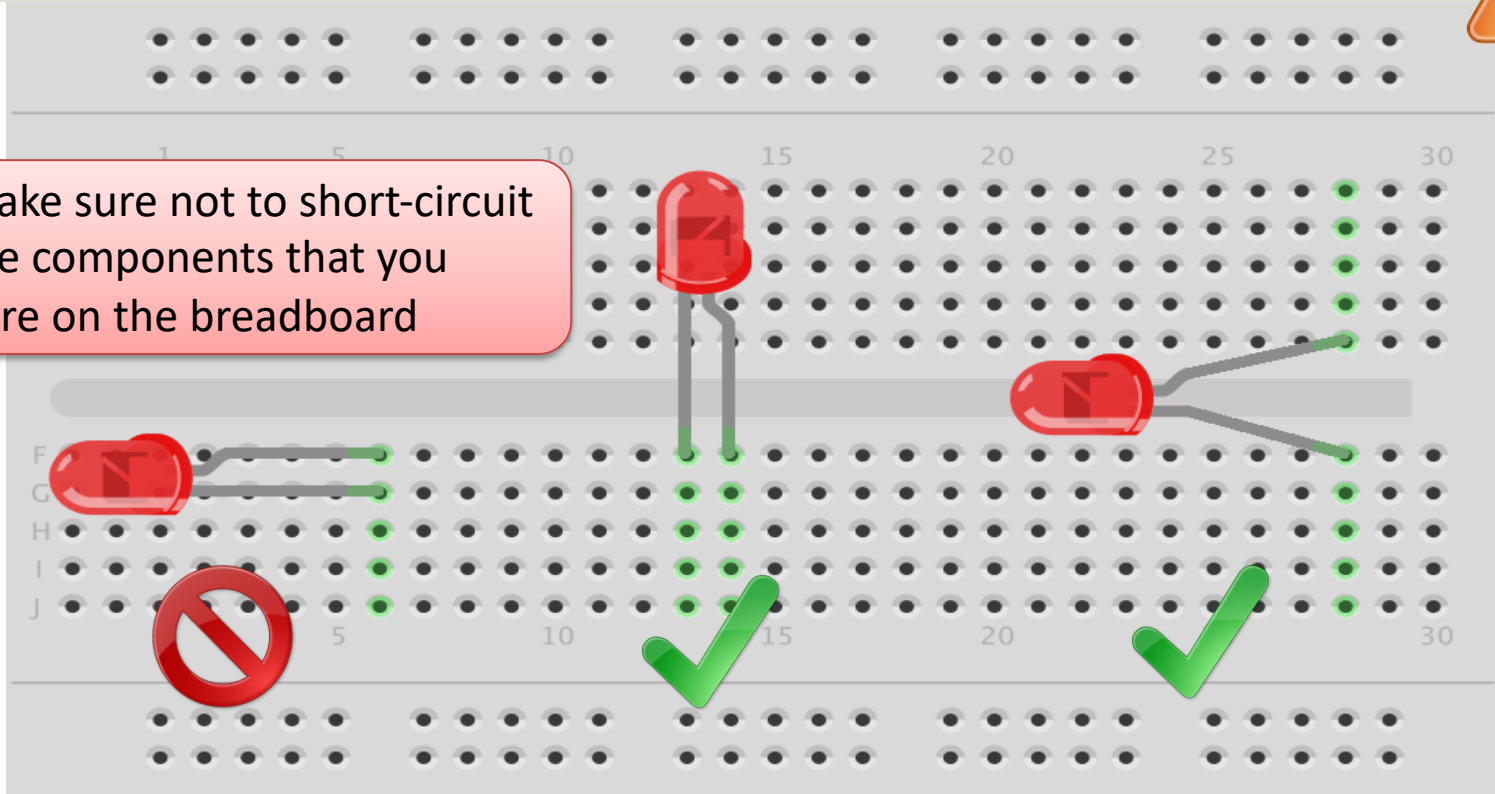
A breadboard is used to wire electric components together



Breadboard Wiring



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



The Breadboard is used to connect components and electrical circuits

fritzing

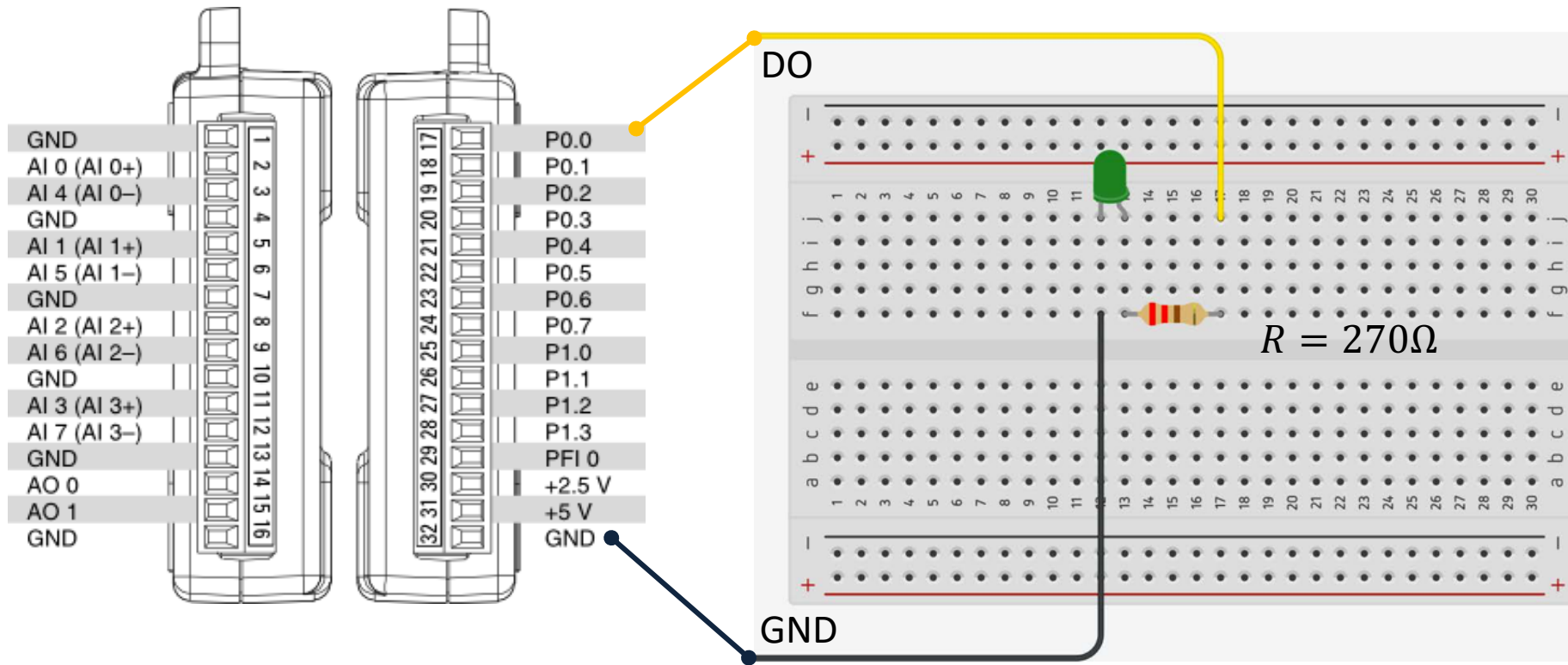


Digital Out (DO)

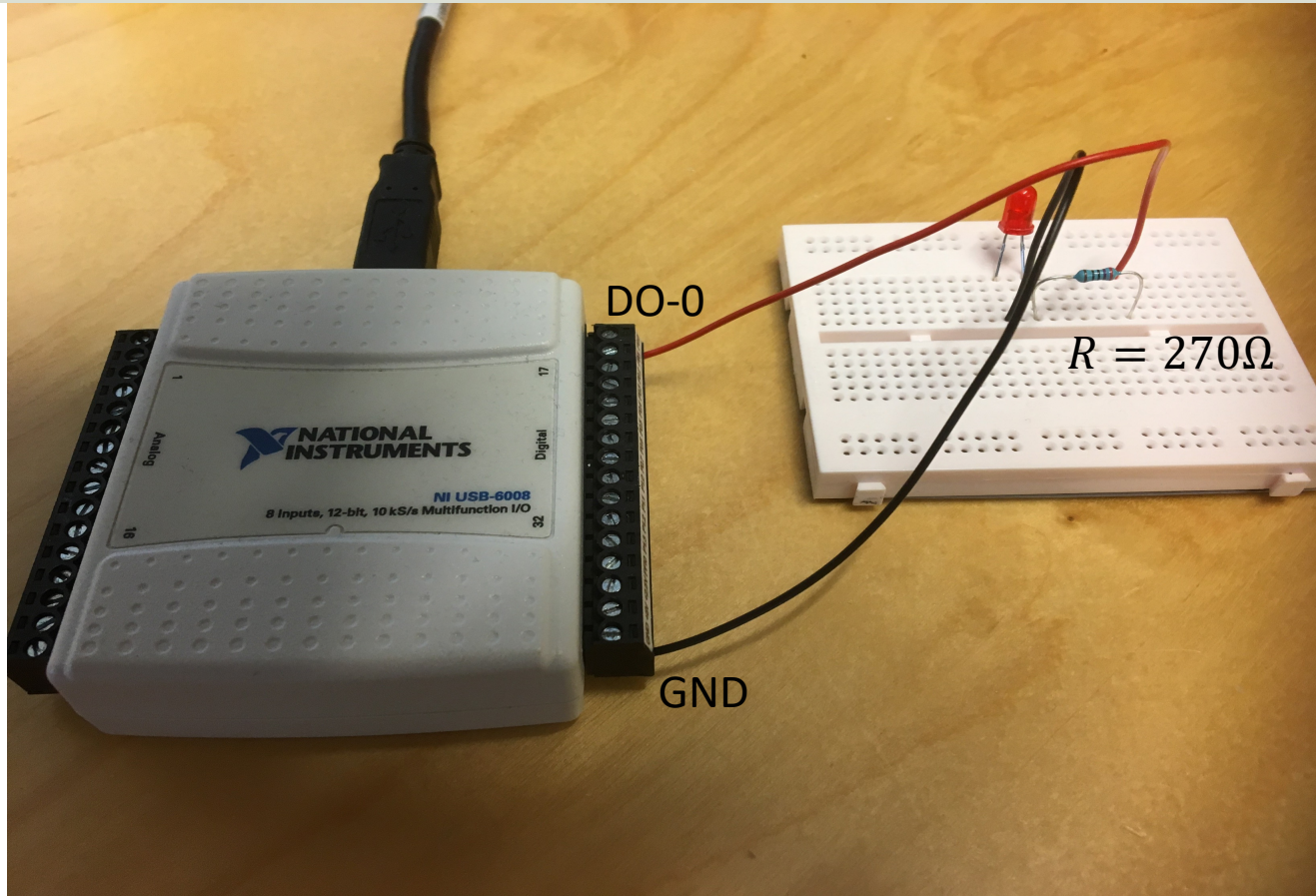


Turn the LED ON/OFF

Wiring



Hardware Setup



Measurement and Automation Explorer (MAX)

The screenshot displays the Measurement and Automation Explorer (MAX) interface. The title bar reads "NI USB-6008 'Dev1' - Measurement & Automation Explorer". The menu bar includes "File", "Edit", "View", "Tools", and "Help".

The left sidebar shows a tree view of the system hierarchy:

- My System
 - Data Neighborhood
 - Devices and Interfaces
 - Integrated Webcam "cam0"
 - Logitech Webcam C930e "cam3"
 - NI USB-6008 "Dev1"
 - NI USB-TC01 "TC01"
 - Network Devices
 - Historical Data
 - Scales
 - Software
 - Remote Systems

The main area features a toolbar with icons for "Save", "Refresh", "Reset", "Self-Test", "Test Panels...", "Create Task...", "Device Pinouts", and "Hide Help". A notification banner at the top of the main area states: "The self test completed successfully." Below this, the "Settings" section is displayed:

Settings	
Name	Dev1
Vendor	National Instruments
Model	NI USB-6008
Serial Number	0300E351
Status	Present

Below the settings is the "External Calibration" section:

External Calibration	
Calibration Date	2013-04-03 00:00
Recommended Next Calibration	2014-04-03 00:00

The right sidebar contains a "Back" button and a section titled "NI-DAQmx Device Basics". Below the title, it asks "What do you want to do?" and lists three options:

- ▶Run the NI-DAQmx Test Panels
- ▶Remove the device
- ▶View or change device configuration

At the bottom of the interface, a "Settings" tab is visible.

Measurement and Automation Explorer (MAX)

Test Panels : NI USB-6008: "Dev1"

Analog Input Analog Output Digital I/O Counter I/O

1. Select Port

Port Name
port0

2. Select Direction

Port/Line Direction
port0/line0:7

Input (1) port0/line0:7
Output (0) 7

All Input
All Output

port0 Direction
00000000
7 0

3. Select State

Port/Line State
port0/line0:7

High (1) port0/line0:7
Low (0) 7

All High
All Low

port0 State
00000001
7 0

Start Stop

Close Help

DAQmx and DAQ Assistant

The image shows the LabVIEW software interface. At the top, the title bar reads "Untitled 1 Block Diagram". Below it is the menu bar with "File", "Edit", "View", "Project", "Operate", "Tools", "Window", and "Help". The toolbar contains various icons for navigation and execution. The main workspace is divided into two primary palettes:

- Functions Palette (Left):** Organized into categories such as "Programming", "Measurement I/O", "Instrument I/O", "Mathematics", "Signal Processing", "Data Communication", "Connectivity", "Control & Simulation", and "Express". The "Measurement I/O" category is currently selected and expanded, showing sub-categories like "NI DAQmx", "System Configuration", and "NI Scan Engine". The "NI DAQmx" icon is highlighted with a red box.
- DAQmx - Data Acquisition Palette (Right):** A specialized palette for data acquisition tasks. It includes a search bar and a "Customize" button. The icons are arranged in a grid and include:
 - Task Const
 - Channel Const
 - Create Channel
 - Read
 - Write
 - Wait
 - Timing
 - Triggering
 - Start
 - Stop
 - Clear
 - Channel Node
 - Timing Node
 - Triggering Node
 - Read Node
 - Write Node
 - Real-Time
 - Dev Config
 - Task Config/Ctrl
 - AdvancedThe "DAQ Assist" icon, located in the "Channel Node" row, is highlighted with a red box. A red arrow points from this icon to the "NI DAQmx" icon in the "Measurement I/O" palette.

DAQ Settings

Create New ...

NATIONAL INSTRUMENTS

Select the measurement type for the task.

A [task](#) is a collection of one or more virtual channels with timing, triggering, and other properties.

To have [multiple measurement types](#) within a single task, you must first create the task with one measurement type. After you create the task, click the **Add Channels** button to add a new measurement type to the task.

- Acquire Signals
- Generate Signals
 - Analog Output
 - Counter Output
 - Digital Output
 - Line Output**
 - Port Output

< Back Next > Finish **Cancel**

Create New ...

NATIONAL INSTRUMENTS

Select the physical channel(s) to add to the task.

If you have previously configured [global virtual channels](#) of the same measurement type as the task, click the **Virtual** tab to add or copy global virtual channels to the task. When you copy the global virtual channel to the task, it becomes a local virtual channel. When you add a global virtual channel to the task, the task uses the actual global virtual channel, and any changes to that global virtual channel are reflected in the task.

If you have TEDS configured, click the **TEDS** tab to add TEDS channels to the task.

For hardware that supports [multiple channels](#) in a task, you can select multiple channels to

Physical

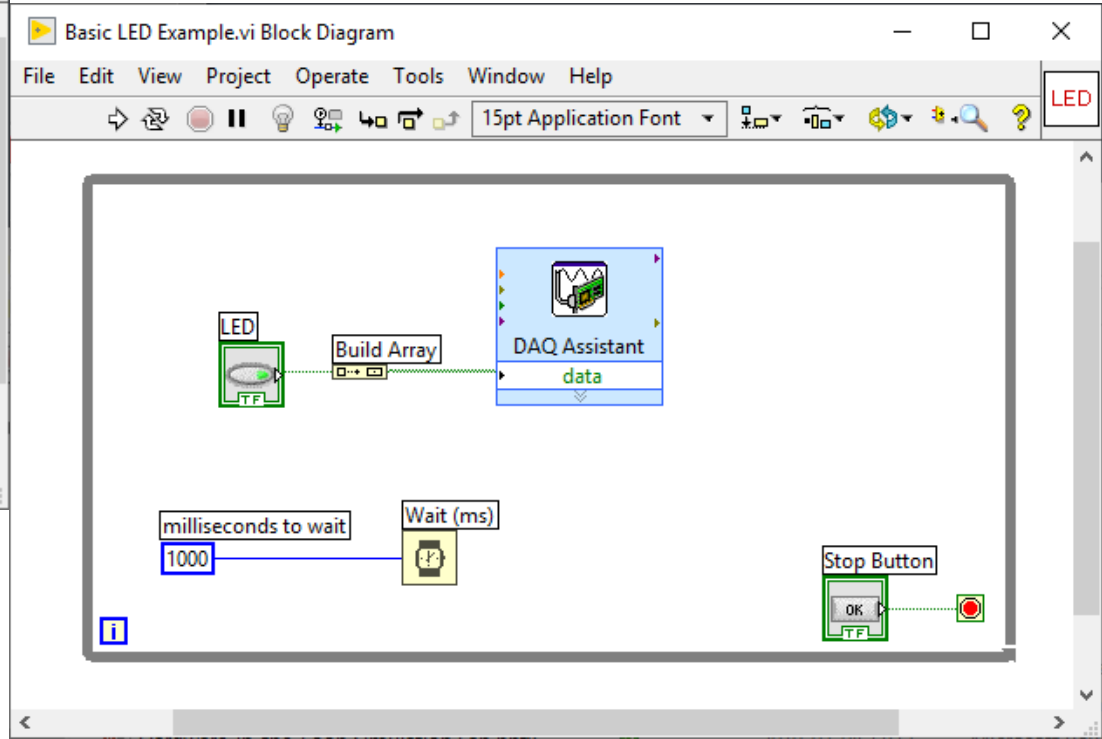
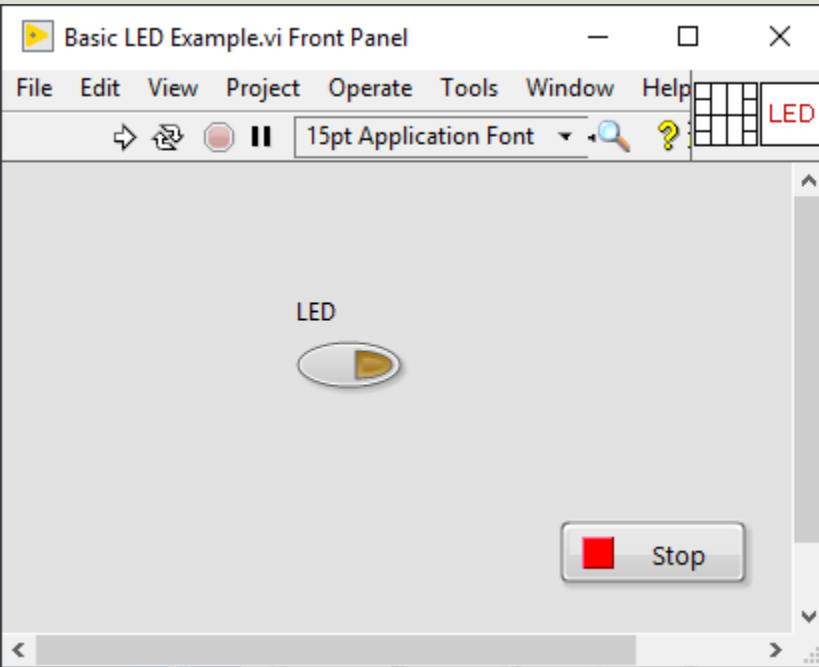
Supported Physical Channels

- Dev1 (USB-6008)
 - port0/line0**
 - port0/line1
 - port0/line2
 - port0/line3
 - port0/line4
 - port0/line5
 - port0/line6
 - port0/line7
 - port1/line0
 - port1/line1
 - port1/line2
 - port1/line3

<Ctrl> or <Shift> click to select multiple channels.

< Back Next > **Finish** Cancel

LabVIEW



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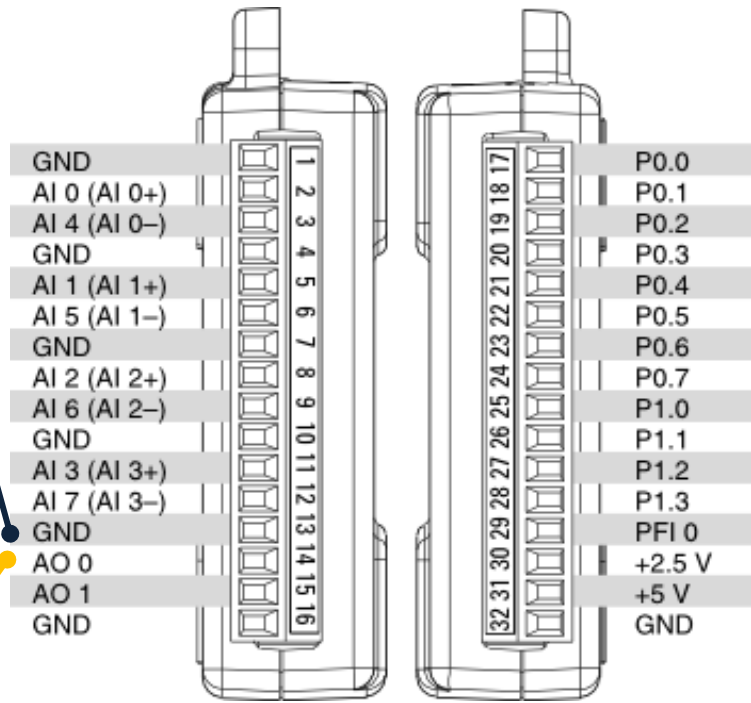
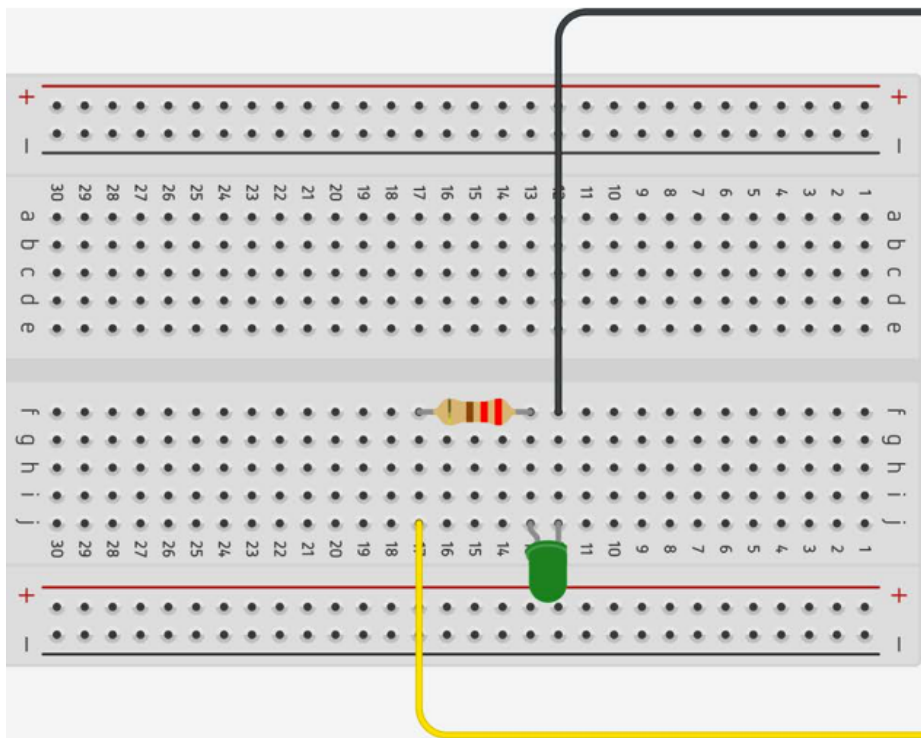
Analog Out (AO)



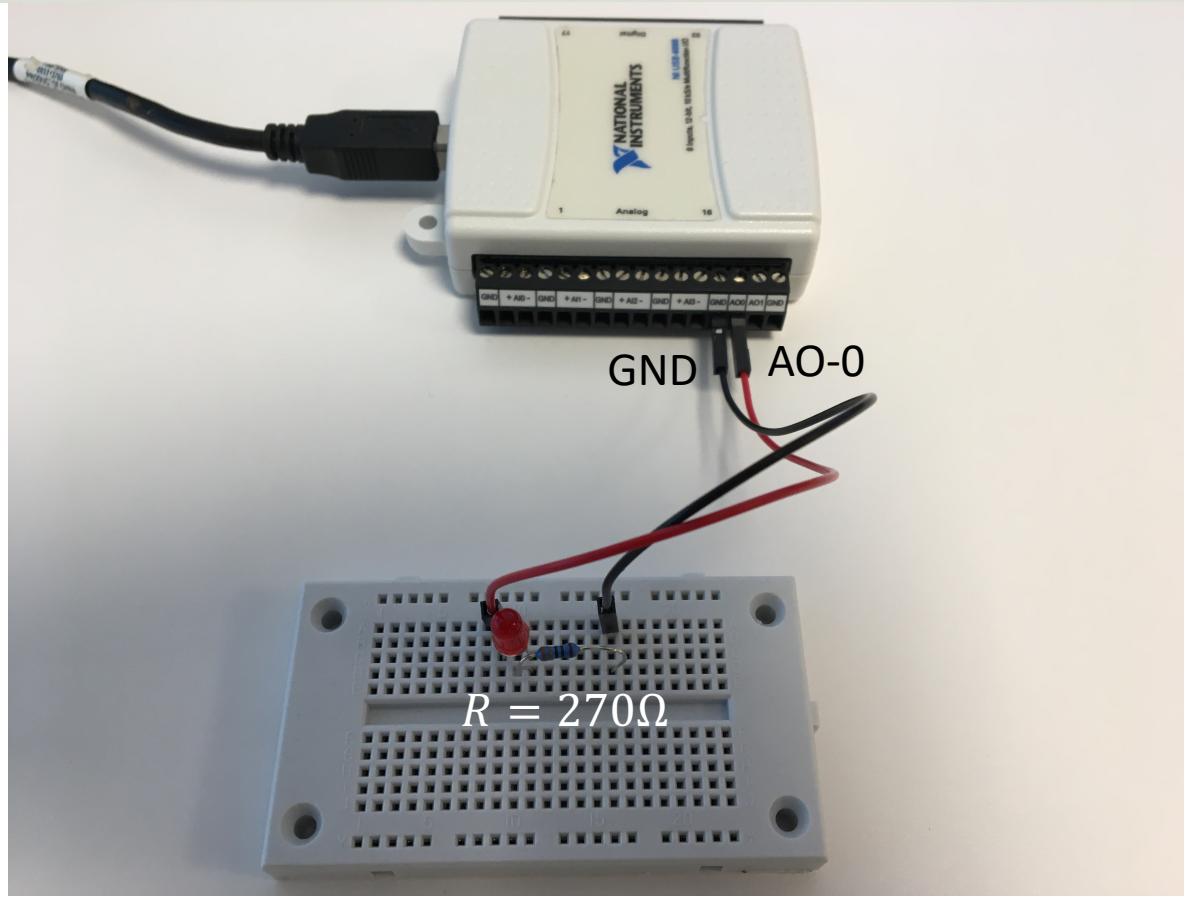
Control the Intensity of the LED

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Wiring



Hardware Setup



DAQ Settings

Select the measurement type for the task.

A **task** is a collection of one or more virtual channels with timing, triggering, and other properties.

To have **multiple measurement types** within a single task, you must first create the task with one measurement type. After you create the task, click the **Add Channels** button to add a new measurement type to the task.

- Acquire Signals
- Generate Signals
 - Analog Output**
 - Current
 - Counter Output
 - Digital Output

Select the physical channel(s) to add to the task.

If you have previously configured **global virtual channels** of the same measurement type as the task, click the **Virtual** tab to add or copy global virtual channels to the task. When you copy the global virtual channel to the task, it becomes a local virtual channel to the task, the task uses the actual global virtual channel, and any changes to that global virtual channel are reflected in the task.

If you have TEDS configured, click the **TEDS** tab to add TEDS channels to the task.

For hardware that supports **multiple channels** in a task, you can select multiple channels to

Supported Physical Channels

- Dev1 (USB-6008)
 - ao0**
 - ao1

DAQ Assistant

Undo Redo Run Add Channels Remove Channels

0 Apply Value to All

VoltageOut	1.1

Configuration Triggering Advanced Timing

Channel Settings

VoltageOut

Voltage Output Setup

Signal Output Range

Max 5 Min 0 Scaled Units Volts

Terminal Configuration RSE

Custom Scaling <No Scale>

Timing Settings

Generation Mode 1 Sample (On Demand)

Samples to Write 100 Rate (Hz) 1k

Generating Current or Voltage

You can generate two main kinds of signals for channels:

- Single samples, including DC signals**—When generating single samples, you can use software or hardware timing (if available) to control when your device generates a signal.
- Multiple samples**—Use multiple samples to generate an AC signal, such as a sine wave. Also called buffered analog output, generating multiple samples involves the following steps:
 - Your application writes multiple samples into a buffer.

Rate (Hz) specifies the sampling rate in Hertz.

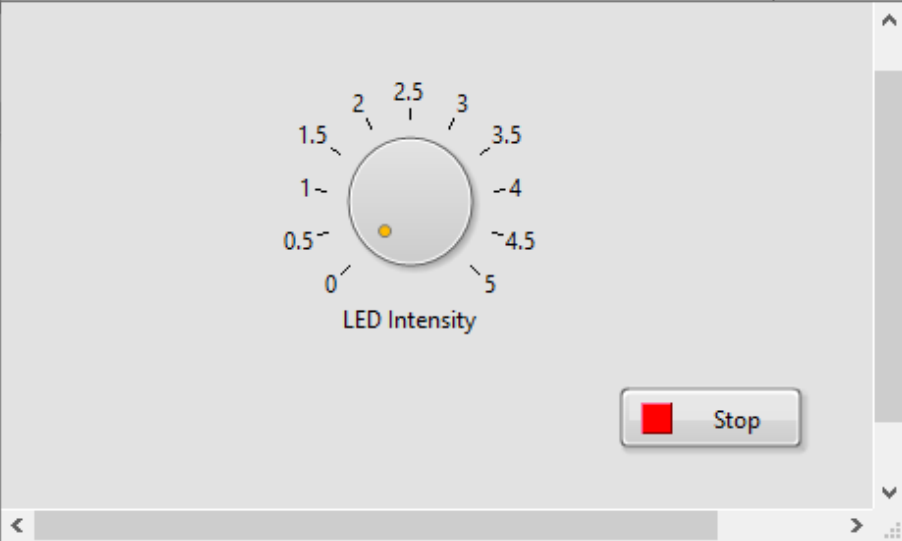
Sample/Update Period (s) specifies the sample period in seconds.

LabVIEW – LED Intensity

LED Analog Out Example.vi Front Panel

File Edit View Project Operate Tools Window Help

15pt Application Font

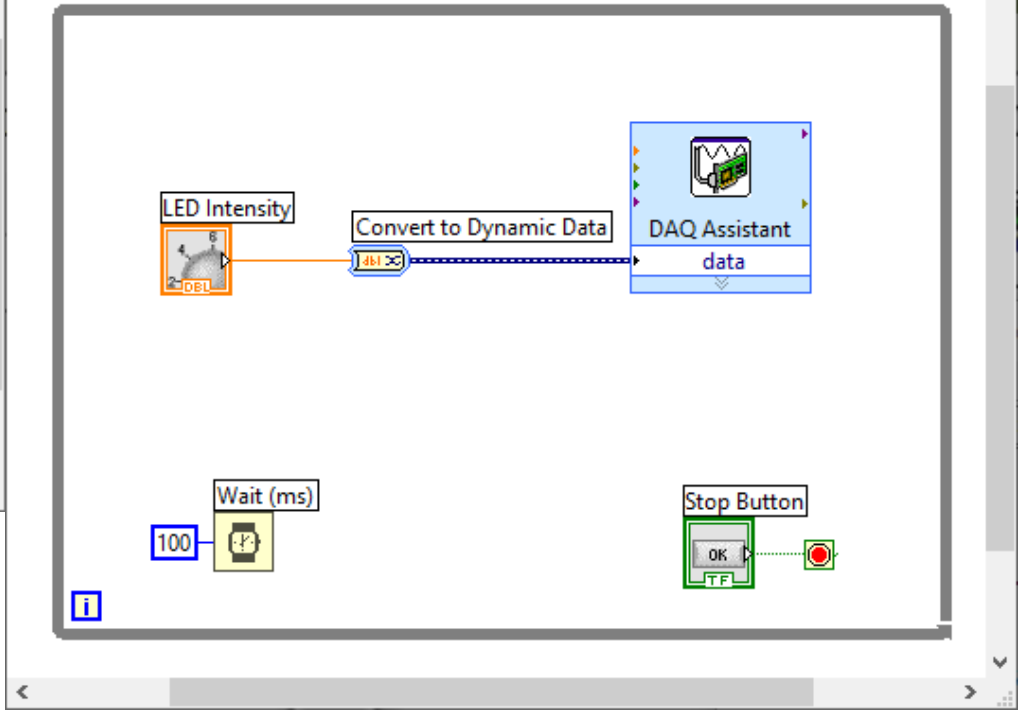


The front panel features a circular LED Intensity control with a yellow indicator dot. The scale is marked from 0 to 5 in increments of 0.5. Below the control is a red square Stop button labeled "Stop".

LED Analog Out Example.vi Block Diagram

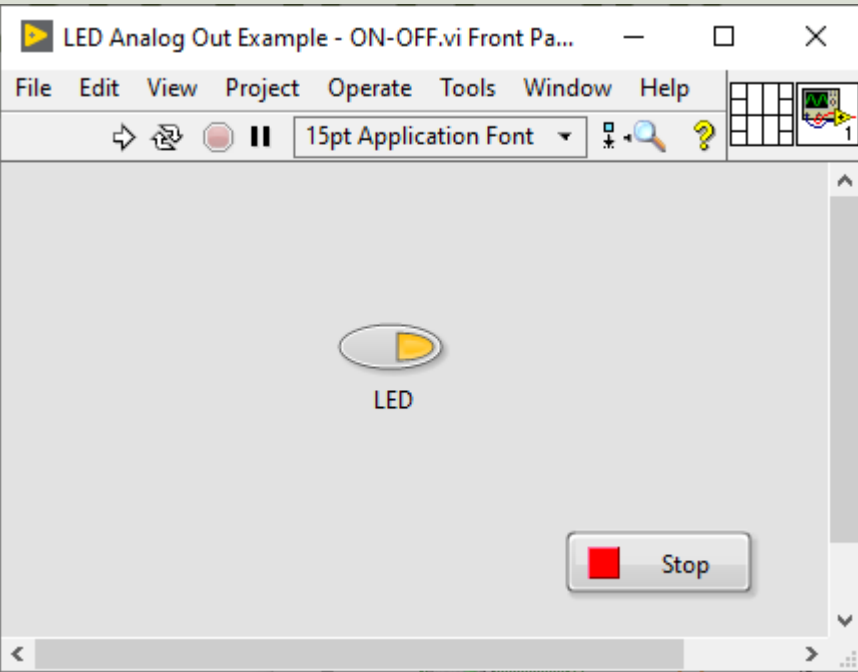
File Edit View Project Operate Tools Window Help

15pt Application Font

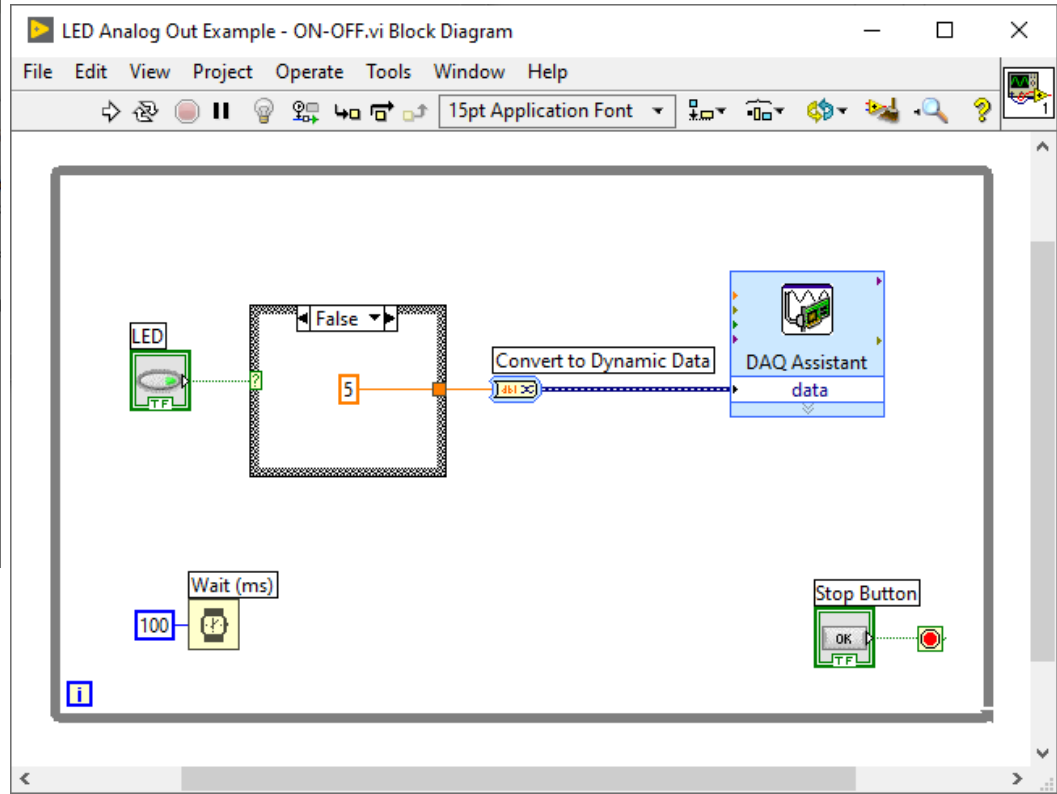


The block diagram shows the logic for the LED intensity control. It starts with a "Wait (ms)" block set to 100 ms. This is followed by a "Convert to Dynamic Data" block. The output of this block is connected to a "DAQ Assistant" block, which is configured to output "data". A "Stop Button" block is also present, which is connected to a "TF" (True/False) block. The "TF" block is connected to the "Wait (ms)" block, indicating that the wait time is updated when the stop button is pressed.

LabVIEW – LED On/Off



0V -> Off
5V -> On (or any voltage above 0V,
depending on the light intensity)



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