Engineering Design Projects with Logger *Pro* 3 and the Digital Control Unit (DCU)

NSTA 2018

Atlanta, GA



Measure. Analyze. Learn."



Digital Control Unit (DCU), Order Code DCU-BTD

Explore ways to extend your science experiments with engineering challenges. Using our Digital Control Unit with LabQuest 2 and Logger *Pro*, you will learn how to apply logic statements to control inexpensive electronic devices (fans, buzzers, LEDs) based on sensor inputs..

© Vernier Software & Technology

Activity 1: Getting Started with the DCU and Logger Pro

- Step 1: Equipment Set Up
 - a) Open Logger *Pro* on the laptop. It should be available on the laptop's desktop.
 - b) Connect a Dual-Range Force Sensor and the DCU to the LabQuest 2.
 - c) Connect the power supply to the DCU.
 - d) Connect the LabQuest 2 to the laptop.
 - e) Plug the green plug with an output device (LED, buzzer, etc.) into the DCU
- Step 2: Test Your DCU Hardware
 - a) Click on the LabQuest icon (the colorful icon at the far left of the toolbar)
 - b) Click on Digital Control Unit pull-down menu to select Digital Out.
 - c) Click on the box labeled "Line 1 on". Make sure your device turns on.
- Step 3: Use the Digital Out dialog to configure the system for each of the following scenarios:
 - a) Have the device turn on when a force reading of 5 newtons has been exceeded.
 - b) Have the device turn on when the force reading is between an 5 newtons and 8 newtons.
 - c) Have the device turn on for the first 5 seconds of the data collection.
 - d) Have the device turn on after 5 seconds if (and only if) the Force reading is greater than 5 newtons.
 - e) Optional for the advanced user: Have the device turn on when the force reading has exceeded a threshold, but instead of setting that limit in the DCU setup screen, use Limit-_1 as a User Parameter, and control the trigger level from a Parameter Control on the data collection graph in Logger *Pro*.

NOTE: For this workshop we have placed the DCU User Manual on desktop of your computer. It is always available at http://www.vernier.com/files/manuals/dcu-btd.pdf More information for the DCU can be found at

http://www.vernier.com/products/sensors/dcu-btd/.

Activity 2: Several Activities to Choose From, and Two Ways to Do Them -

We have brought the hardware for a number "feedback and control" projects. Links to many of these and other engineering activities can be found at <u>http://www.vernier.com/engineering/stem/</u>. Work in small groups on some of these projects. You can do them using LabQuest 2 with Logger *Pro* or with a stand-alone LabQuest 2. Try to do at least one project each way.

Activity 3: Create your own DCU engineering activity

We have lots of sensors, buzzers, LEDs, fans, pumps, and motors you can use. Come up with a system that responds to a sensor reading. Be creative and have fun!

Activity 4: Discussion and Questions

We will answer questions and facilitate a discussion at the end of the session to allow you to collaborate on how you might incorporate DCU engineering activities into your science courses.