



Programming the LabQuest mini with LabVIEW

Loyola University Maryland, June 19–21, 2017

(3-6 setups for 6 participants)

Host and Mentor



Steve Wonnell has been the head teaching labs manager in the Department of Physics and Astronomy at Johns Hopkins University since 1997. His duties include assisting with intermediate and advanced laboratories and lecture demonstrations. He has taught a one-credit, Introduction to LabVIEW course six times during the past ten years, and used the Vernier LabQuest mini as the main data acquisition device for the past three. He earned a Bachelor of General Studies Degree from the University of Michigan at Ann Arbor and a Ph.D. in experimental condensed matter physics from the University of North Carolina at Chapel Hill, and worked at UNC-Chapel Hill, the Centre d'Etudes de Saclay, and the Max Planck Institute for Solid State Physics before coming to Hopkins.

Steven Wonnell, Physics Instructional Resource Manager, Johns Hopkins University, Department of Physics and Astronomy, 3400 N. Charles Street, Baltimore, MD 21218. Email: wonnell@jhu.edu. Telephone: 410-516-5468.

Vernier's LabQuest™ and LabQuest mini™ are powerful, relatively inexpensive devices that are widely used for data acquisition. Typical these are used in high school and

freshman courses with dedicated software (Vernier's Logger Pro™) and one or more self-configuring sensors. A wide range of sensors are available for the devices. For straightforward data collection, these, as well as similar products from other companies, are excellent.

LabQuest mini

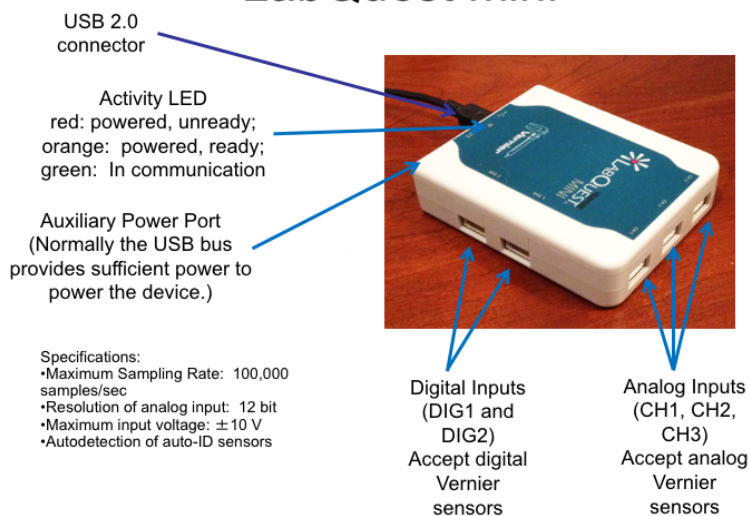
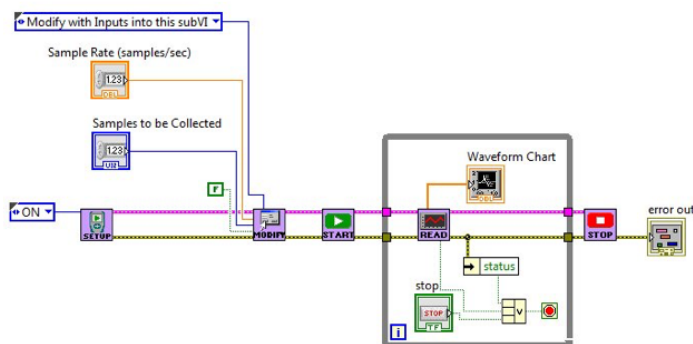


Figure 1: Vernier's LabQuest mini data acquisition unit.

LabVIEW™ is a powerful commercial programming language ideally suited for data acquisition, visualization, and analysis. It is widely used in research and industry, often by high tech companies for quickly building, testing, and deploying instrumentation. Historically LabVIEW has been expensive for academic use but price drops in recent years have made it affordable.

Minimal Program for Analog Sensors



This is the essence of the Vernier Example LQ FastRate.vi found in Analog Low Level Examples

Figure 2: LabVIEW™ code for acquiring data from the LabQuest™ using low-level drivers. LabVIEW is a graphical programming language; shown are the “terminals” on the block diagram which are “wired” together for information flow. Each terminal has a control or an indicator on the front panel (not shown) to set values and view results.

Recently, Vernier introduced Mac LabVIEW drivers for its LabQuest interfaces in addition to its longstanding PC drivers. Both the Mac and the PC can now communicate with LabQuest via LabVIEW. These drivers, the availability of LabVIEW, and the LabQuest interfaces

create a flexible, powerful and inexpensive platform that opens the door for a lot of low-cost but high quality advanced instructional labs and independent projects.

The goal of this Immersion is to become comfortable and confident in using the LabQuest mini (our chosen platform at JHU) as a data acquisition device using LabVIEW. Day one topics will cover data acquisition from analog sensors and digital sensors using both low-level and high level ("Express") drivers and the control of experiments using the Digital Control Unit. Day two will be a topic of your choice, to be selected from Vernier's new book, "Engineering Projects with NI LabVIEW and Vernier," copyright 2014. The latter lists 12 projects, many challenging, that make good starting points for further exploration. Alternatively you may select your own topic for study. The mentor will communicate with you to help you decide, one month in advance of the Immersion, which project(s) you may be interested in, in order to procure the supplies necessary for performing that experiment.

Those who are not familiar with LabVIEW will be send materials and links to online tutorials to get them up to speed at the level necessary to benefit from this Immersion. Plan on devoting ten to twenty hours for this preparation if you are new to LabVIEW.

Windows laptops with LabVIEW installed will be supplied; however participants are encouraged to bring their own laptops (Mac or PC) with a version of LabVIEW installed. A notebook may be useful.

Safety considerations: none.

Costs: The LabQuest mini at \$149 may be the most expensive part; Vernier sensors are typically a bit cheaper. Homemade sensor are on the order of \$10-12. Depending on the project, other miscellaneous parts are needed. Starting from scratch, the cost per setup is likely to be no more than \$300-\$500 or so; if one already has a LabQuest and sensors then the cost is minimal. Fully functional versions of LabVIEW are available free on a trial basis, and a low-cost non-trial solution is normally available in some form. Many institutions have site licenses for LabVIEW available.

Financial support to help purchase apparatus used in Laboratory Immersions is provided on a competitive basis by a program of the Jonathan F. Reichert Foundation. Limitations and exlusions apply, but generally speaking the foundation may support up to 40% of the cost of the required equipment.