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Preface

This book provides a hands-on introduction to National Instrument's LabVIEW Education Edition¹ software. It uses the Vernier SensorDAQ or LabQuest interfaces and Vernier sensors for data collection and analysis as you learn the basics of LabVIEW. We are convinced that learning LabVIEW while working with sensors is a great way to introduce students to the field of engineering. It is also a lot more fun than working with simulated data.

In 2003, we started conducting workshops with National Instruments in which we used LabVIEW with Vernier sensors. In these training courses, we introduced the basics of LabVIEW programming, followed by exercises that showed how to use Vernier interfaces and sensors for measurement and automation. The training culminated with a hands-on project. We take the same approach in our two books introducing engineering students to LabVIEW.

This book is designed to introduce students to LabVIEW programming. It begins with opening and running a fairly complete data-collection program written in LabVIEW. This is followed by seven chapters describing the basics of LabVIEW programming. Topics include the front panel and block diagram, dataflow programming, working with controls and functions, LabVIEW structures, and creating subVIs. Each of these chapters has two parts. First we explain the new material and at the end of the chapter there is a hands-on exercise with step-by-step instructions. In the exercise, students build a program that performs simple data acquisition with a Vernier sensor.

The LabVIEW material in this book is based on National Instrument's *Introduction to LabVIEW 8 in 6 Hours* document, as well as their online student training entitled *Getting Started with NI LabVIEW Student Training* (a compilation of tutorial, video, and exercises).

The only sensors required for the exercises and projects in this book are a temperature sensor and a microphone. One chapter, written exclusively for SensorDAQ, also requires a voltage probe. These sensors were chosen because they are inexpensive and can be used in many different ways. See *Appendix C* for additional details about the Vernier equipment used in this book.

The last chapter of this book presents the student with two open-ended projects. Creating a project allows students to consider design requirements, manage time constraints, work through troubleshooting challenges, and manage all of the other factors involved in real-world situations. The exercises provide the foundation, and the projects show the possibilities for the next level of use of these tools. Also, the projects are fun and motivational for students.

The first printing of this book was written for a Vernier SensorDAQ interface. Vernier worked with National Instruments to design the SensorDAQ interface. It was designed specifically for engineering education and automatically detects and configures Vernier sensors when used with LabVIEW. The result is that students can get started very quickly developing data collection VIs. The SensorDAQ also has screw terminals for connections to other inputs and outputs.

In this edition of the book, we have added support for the use of Vernier LabQuest interfaces. We have developed LabVIEW drivers and examples to allow most of the activities in this book

¹ Although we recommend LabVIEW Education Edition, other versions of LabVIEW that can communicate with Vernier interfaces and sensors may be used with this book. Note that the screenshots may look slightly different if you use a different version of LabVIEW.

to be done just as they are performed with the SensorDAQ. The only chapter that cannot be done using a LabQuest interface is Chapter 8, because it requires the use of the screw terminals on the SensorDAQ.

We feel it is important for teachers to read the information presented in the appendices. The appendices include valuable information that can help you become more comfortable with your initial use of Vernier sensors and LabVIEW software. Here is a short summary of the information available in each appendix:

- *Appendix A* provides instructions on how to use the files found on the CD.
- *Appendix B* provides a list of the equipment and supplies used in these activities.
- *Appendix C* provides information on Vernier products for Engineering Education.
- *Appendix D* provides information on the required software.
- *Appendix E* provides a brief discussion of the screenshots and how they may differ from what you see when you open LabVIEW.
- *Appendix F* describes common errors that occur when working with the SensorDAQ Express VI and the DAQ Assistant Express VI.
- *Appendix G* provides a summary of an actual classroom experience using this book to teach LabVIEW.

We recently completed a second book, *Engineering Projects with NI LabVIEW and Vernier*, which is intended for teaching engineering education in college or advanced high school classes. *Engineering Projects with NI LabVIEW and Vernier* was designed to follow this book, as it assumes some experience with LabVIEW programming. It offers a number of open-ended projects that introduce engineering concepts, common electrical circuits, designing simple fixtures, and more advanced LabVIEW programming to students. We feel these projects are a great way to get students excited about engineering.

The material for this book was compiled and created by Sam Swartley. He has been working with LabVIEW since version 5.1 and was the Vernier team leader for the development of the SensorDAQ interface. This edition was modified by Dave Vernier, who has been using LabVIEW since version 4. Edits, feedback, and material for the book also came from Steve Decker, a high school engineering teacher in Portland, and member of the Vernier Engineering Education department. Michele Perrin, a former engineering, math, and science teacher in Saint Louis, Stephanie Brierty, K-12 Product Marketing Engineer at National Instruments, and Peter Tampas, Professor Emeritus of Electrical Engineering Technology, Michigan Technological University also provided valuable feedback and edits. We are thankful to Gretchen Stahmer DeMoss, John Wheeler, and Christine Vernier for the help they provided in proofreading this book. Special thanks to Ray Almgren and Ravi Marawar of National Instruments, and David Vernier, CEO and founder of Vernier Software & Technology, for supporting this project and for their continued support of STEM education.