

# Vernier

## 2018

CATALOGUE



Data-Collection Technology

Chemistry • Physics • Biology • STEM • Biotechnology • Engineering • Math • Primary Science  
Middle School Science • Physical Science • Physiology • Environmental Science • Water Quality • Earth Science

# Vernier Software & Technology

Vernier Software & Technology was co-founded in 1981 by Dave and Christine Vernier. Dave's background as a physics teacher and Christine's knack for business combined to form a company with a deep commitment to education.

Thirty-seven years later, the company is still owned by Christine and Dave, along with 10 employee owners who have backgrounds in science and math education, as well as business.

Vernier is proud to be recognized for its philanthropic commitment, environmental policies, steady growth, and as one of the Best 100 Companies to Work For in Oregon for 17 years.



2017 Best Companies to Work For in Oregon



2017 Healthiest Employers of Oregon



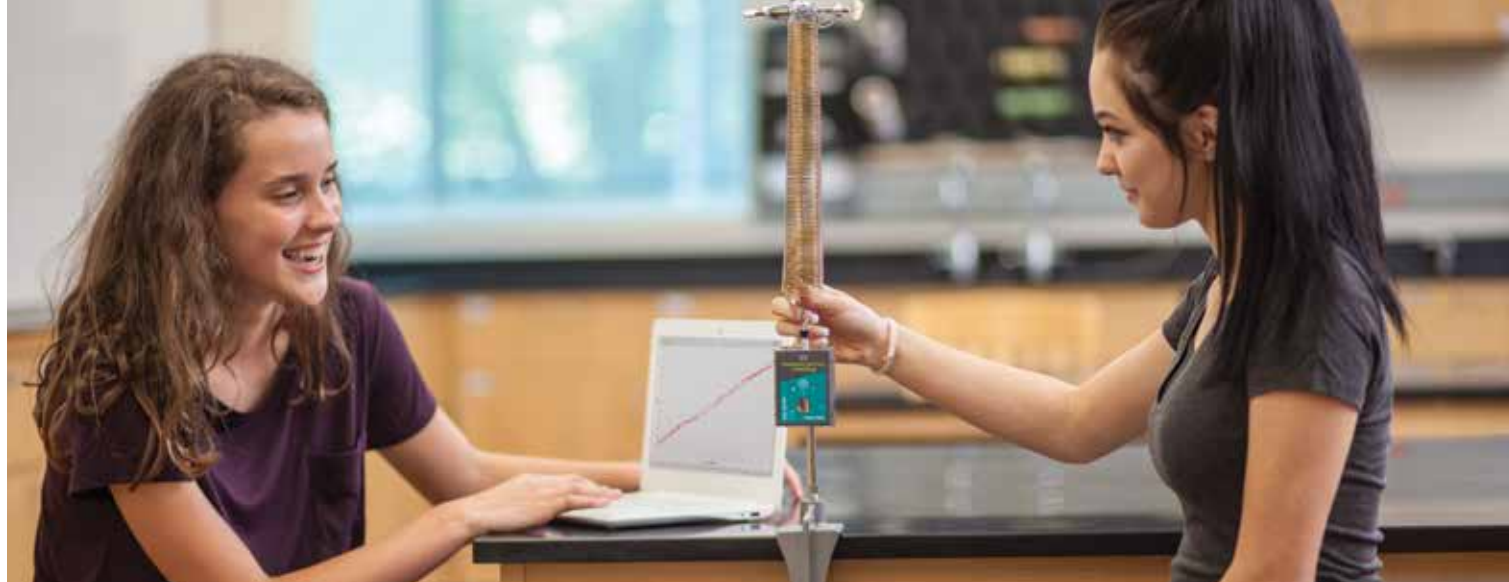
2017 Best Green Companies in Oregon



2017 Top Work Places in Oregon



2017 Corporate Philanthropy Award



## Expanding Possibilities

This year we are expanding our line of Go Direct sensors. There are now 31 of them, with more coming soon. Go Direct sensors give you the flexibility to connect via Bluetooth or USB and can be used with our free Graphical Analysis 4 app (available for macOS, Windows, Chrome, iOS, and Android).

In addition to a complete line of Go Direct chemistry sensors, we have a new spectrometer app, Spectral Analysis (available for macOS, Windows, Chrome, iOS, and soon, Android). This free app was designed specifically for educational spectroscopy. The user-friendly interface walks students through the data-collection process and includes analysis features such as curve fitting and data interpolation.

We are excited to introduce five new Go Direct biology sensors: Go Direct CO<sub>2</sub> Gas, Go Direct O<sub>2</sub> Gas, Go Direct Optical Dissolved Oxygen, Go Direct EKG, and Go Direct Respiration Belt. These additions have allowed us to completely revise and update our lab book *Biology with Vernier* for use with Go Direct sensors and Graphical Analysis 4.

In the physics area, we are excited about two new innovative products. Go Direct Sensor Carts provide an inexpensive way to wirelessly gather position, velocity, acceleration, and force data for physical science and physics experiments. We also partnered with Pivot Interactives to offer a powerful, online tool to supplement hands-on experimentation. Pivot Interactives provides arrays of high-quality videos, allowing students to vary experimental parameters one at a

time to view results from a set of many recordings of the same experiment. Students make measurements and analyze their data directly within the online environment. These are not simulations; the students see high-quality videos of difficult-to-perform or dangerous experiments, and they make the measurements.

Should you be in the Portland, Oregon area, we invite you to stop by for a tour of our building or to attend one of our Summer Institutes.

We also encourage you to give our products a try on a 30-day (or longer) preview basis. Feel free to contact any of us personally at any time.

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*Supporting local community through  
National Women Build Week*

# What's New

## Go Direct™ Sensors

We've added 15 new sensors to our popular Go Direct sensor family. These affordable sensors connect directly to your Chromebook™, mobile device, or computer via Bluetooth® or USB—there is no need for additional equipment. Data are collected and analyzed using our free Graphical Analysis™ 4 app.

Go Direct sensors are backed by Stellar Service from Vernier, which means that you will have award-winning technical support, hands-on workshops, webinar training, and a community that provides best practices.

See page 22.

[www.vernier.com/go-direct](http://www.vernier.com/go-direct)



Go Direct  
Acceleration



Go Direct  
CO<sub>2</sub> Gas



Go Direct  
Current



Go Direct  
EKG



Go Direct  
Energy



Go Direct  
Glass-Body pH



Go Direct  
Motion



Go Direct  
O<sub>2</sub> Gas



Go Direct  
Optical Dissolved  
Oxygen



Go Direct  
Respiration Belt  
Oxygen



Go Direct Rotary  
Motion



Go Direct Sensor  
Carts



Go Direct Surface  
Temperature



Go Direct  
Tris-Compatible  
Flat pH



Go Direct  
Wide-Range  
Temperature



## Complete Go Direct Biology Solution

We now offer Go Direct sensors for biology, including Go Direct CO<sub>2</sub> Gas, Go Direct O<sub>2</sub> Gas, and Go Direct Optical Dissolved Oxygen. Each sensor is supported by ready-to-use experiments and free Graphical Analysis 4 app.

See pp. 30–43.

[www.vernier.com/biology](http://www.vernier.com/biology)

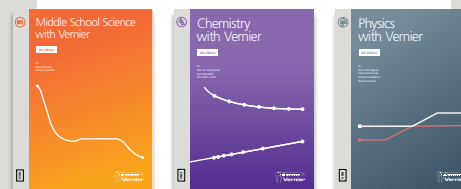


## 4th Edition Lab Books

Many of our lab books have been revised to include updated experiments that support Graphical Analysis 4.

See pp. 26–29.

[www.vernier.com/books](http://www.vernier.com/books)



## Pivot Interactives

Students discover mathematical relationships that underlie physical phenomena when combining online Pivot Interactives activities with hands-on experiments from Vernier. Pivot Interactives allows students to reinforce their knowledge of physics in class or at home.

See page 118.

[www.vernier.com/pivot](http://www.vernier.com/pivot)



## Go Direct Sensor Cart

The built-in sensors of the Go Direct Sensor Cart let your students do all of the standard one-dimensional dynamics and kinematics experiments, all with no additional sensors or interface. With position, force, and acceleration sensors, Go Direct Sensor Cart is both powerful and simple to use.

See page 103.

[www.vernier.com/gdx-cart](http://www.vernier.com/gdx-cart)



## Go Direct Charge Station

GDX-CRG

Go Direct Charge Station is the perfect solution for charging your Go Direct sensors. Each Charge Station has 16 charging ports—eight USB and eight wand-style sensor ports.

[www.vernier.com/gdx-crg](http://www.vernier.com/gdx-crg)

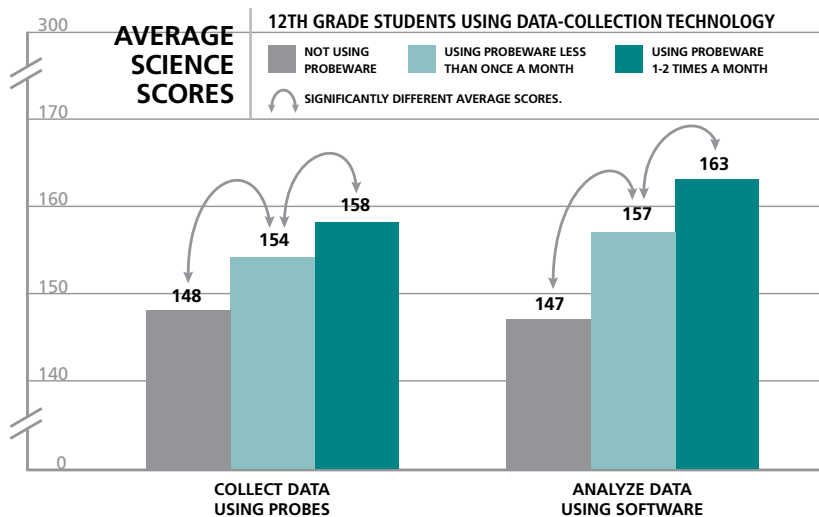


# Why Teachers Choose Vernier

1

## Improves test scores

Use of technology tools for data collection, analysis, and visualization—capabilities supported by Vernier probeware and software—can provide a learning advantage for students, as evidenced in student test scores in science (National Center for Education Statistics, 2002, 2012; Schneider et al., 2002).



This study of 49,000 US students shows that students who used probeware to collect and analyze data scored significantly higher on tests than those who did not. Source: 2000 NAEP Science Assessment

Get details at [www.vernier.com/whitepaper](http://www.vernier.com/whitepaper)

2

## Creates a deeper understanding of science concepts

Use of technology tools for data collection, analysis, and visualization to teach scientific practices and support scientific investigations can help to deepen student understanding of science concepts.

*"Students using data-logging probes along with the LabQuest software allows teachers to plan lessons that make abstract ideas concrete and enables students to access complex and interesting science in ways that we were previously unable to. Our students are very confident in using the technology. It is clear to me that of all the things we have done to improve the quality of science education, the implementation of the Vernier technology has been the most significant."*

—Stephen Daly,  
Riyadh Schools,  
Riyadh, Saudi Arabia

3

## Supports Next Generation Science Standards (NGSS) and state standards

Student hands-on use of technology tools for data collection, analysis, and visualization is recommended in guidelines and requirements from influential national organizations and state standards.

*"When you teach students how to use a probe, they can quickly jump ahead with doing real science. Once they understand what the motion detector does, for example, they can develop questions about velocity and acceleration and then use the detectors to find the answers, analyze a lot of data efficiently, and use their data and graphs to communicate their results. They apply several of the NGSS practices in each lab, and they think it's really cool, too, so I'm sneaking in a lot of learning while they're having fun."*

—Ann Hammersly,  
Retired, Chaparral High School,  
Scottsdale, Arizona



Download our white paper on probeware and student performance  
[www.vernier.com/whitepaper](http://www.vernier.com/whitepaper)

## 4

### Allows more time for teaching and learning

Real-time data collection provides students an opportunity to identify relationships quickly and frees class time for student engagement in higher order thinking skills, such as analysis, synthesis, and evaluation.

*"The range of compatible sensors from Vernier was extensive. ... We have found the equipment extremely useful in demonstrating to pupils how our simplistic experiments relate to, and might be conducted, in industry. In some of our experiments, the equipment provided more teaching time without taking the practical element of the sciences away. The LabQuest 2 has also allowed us to carry out meaningful experiments that we have not been able to do before."*

—Chris Jessop,  
 AKS School,  
 Lytham, United Kingdom

## 5

### Easy to use

At Vernier, we know that classroom technology has to be easy—easy for teachers and easy for students. Creating technology that is intuitive and built for the rigors of science education is our top priority.

*"The Scottish Advanced Higher Chemistry course requires pupils to carry out a 20 hour project independently. Many of them carry out investigations on colour chemistry, and it was for this reason that I decided to purchase two LabQuest 2 devices. ... They are robust and extremely user friendly. Students found them easy to use and gave them results that could be inserted into their writeup."*

—J Anderson,  
 St Aloysius' College,  
 Glasgow, United Kingdom

## 6

### Builds student interest in science

Using probeware engages students, lets them visualize real-world data, and teaches them to predict, analyze, and draw conclusions based on evidence.

*"The LabQuest 2 can build interest in science, make experiments come alive, and deepen understanding of complex concepts. The affordable handheld tool supports student-centered, inquiry-based learning, high-end data collection, and critical analysis as budding scientists use real tools to conduct real-time investigations of natural phenomena."*

—Carol Holzberg,  
 Greenfield Public Schools,  
 Greenfield, Massachusetts

## 7

### Backed by unmatched training and technical support

Quickly find answers to your technical questions using a variety of Vernier-provided resources. If you're looking for the personal touch, call and speak with a former teacher, a lab book author, or a technical expert—people committed to extraordinary customer service.

*"Thanks for all of your hard work and innovation. Your company truly understands science education from the teacher's perspective, and my colleagues and I agree that Vernier is the most teacher-friendly company we have ever worked with."*

—Dana Munn,  
 Martha's Vineyard Regional  
 High School,  
 Oak Bluffs, Massachusetts



# Go Direct Data Logging

[www.vernier.com/go-direct](http://www.vernier.com/go-direct)



A complete sensing solution in each sensor—  
collect and directly stream data to  
your device.

These low-cost sensors connect directly with computers, Chromebook, and iOS and Android devices via Bluetooth or USB.

Go Direct sensors are perfect for educators who

- Are new to probeware
- Plan to equip a new science laboratory
- Need an affordable solution that includes free software and all-in-one sensors
- Are using computers, Chromebooks, and mobile devices for data collection

## Teacher Friendly, Student Centered

- Free Graphical Analysis 4 app
- Over 30 Go Direct sensors available, with more to be released throughout this year
- Backed by Stellar Service from Vernier



## Go Direct™ Sensors

### Connection



Connects directly via USB or Bluetooth®  
to your device

### Compatible platforms



Chromebook™



Computer



iOS device



Android™ device



LabQuest 2

### Software



FREE Graphical Analysis™4,  
LabQuest App (LabQuest 2 only)

# Go Direct Sensors

Sensor	Biology	Chemistry	Earth Science	Primary Science	Environmental Science	Middle School Science	Physical Science	Physics
Go Direct 3-Axis Magnetic Field			●	●		●	●	●
<b>NEW</b> Go Direct Acceleration	●						●	●
<b>NEW</b> Go Direct CO <sub>2</sub> Gas	●		●		●			
Go Direct Colorimeter	●	●			●			
Go Direct Conductivity	●	●	●		●	●	●	
Go Direct Constant Current System		●						
<b>NEW</b> Go Direct Current		●	●		●	●	●	●
Go Direct Drop Counter		●			●			
<b>NEW</b> Go Direct EKG	●							
Go Direct Electrode Amplifier		●						
<b>NEW</b> Go Direct Energy			●	●	●	●	●	
Go Direct Force and Acceleration				●		●	●	●
Go Direct Gas Pressure	●	●		●		●	●	●
Heart Rate Monitors								
Go Wireless Heart Rate	●					●		
Go Wireless Exercise Heart Rate	●					●		
Go Direct Light and Color			●	●	●	●	●	●
Go Direct Melt Station		●						
<b>NEW</b> Go Direct Motion			●	●		●	●	●

Sensor	Biology	Chemistry	Earth Science	Primary Science	Environmental Science	Middle School Science	Physical Science	Physics
<b>NEW</b> Go Direct Optical Dissolved Oxygen	●		●		●	●		
<b>NEW</b> Go Direct O <sub>2</sub> Gas	●		●		●			
Go Direct ORP		●						
pH Sensors								
Go Direct pH	●	●	●		●	●	●	
<b>NEW</b> Go Direct Glass-Body pH		●						
<b>NEW</b> Go Direct Tris-Compatible Flat pH	●	●	●		●	●		
Go Direct Radiation Monitor		●						●
<b>NEW</b> Go Direct Respiration Belt	●							
<b>NEW</b> Go Direct Rotary Motion								●
<b>NEW</b> Go Direct Sensor Cart						●	●	●
Go Direct SpectroVis® Plus	●	●			●			
Temperature Probes								
Go Direct Temperature	●	●	●	●	●	●	●	●
<b>NEW</b> Go Direct Surface Temperature	●	●	●	●	●	●	●	●
<b>NEW</b> Go Direct Wide-Range Temperature		●						
Go Direct Voltage		●	●	●	●	●	●	●

For more information on our Go Direct sensors, visit [www.vernier.com/go-direct](http://www.vernier.com/go-direct)

# Interface Data Logging

[www.vernier.com/interfaces](http://www.vernier.com/interfaces)

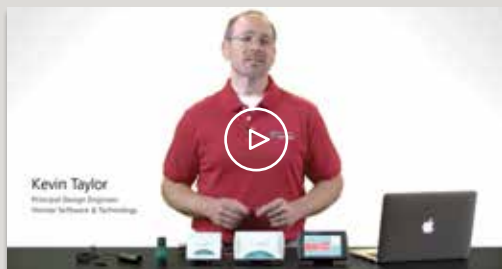


Connect a LabQuest sensor to a Vernier interface to collect and analyze data on your device.










LabQuest sensors require an interface from the LabQuest family to send data to computers, Chromebooks, and iOS and Android devices. Our interfaces are supported by our award-winning data-collection software, including Graphical Analysis 4, Logger Pro 3, and Logger Lite.

Need help deciding which Vernier interface is right for you?

Watch our video overview for a comparison at [www.vernier.com/interfaces](http://www.vernier.com/interfaces)







## LABQUEST Sensors

Connection		Requires an interface from the LabQuest family	
LabQuest family		LabQuest 2	pp. 10–13
		LabQuest Stream	page 14
		LabQuest Mini	page 15
Compatible platforms		Chromebook™	
		Computer	
		iOS device	
Software		Android™ device	
		LabQuest App, Logger Pro, Graphical Analysis™ 4	



# Interface Comparison

Interface	Supported Platforms		Maximum Sampling Rate	Rechargeable Battery	Supports Multiple Sensors	Supports Digital Sensors (motion detectors, photogates, etc.)	Key Features
	Recommended for	Also works with					
<b>LabQuest 2</b> <b>LABQ2</b> 	<ul style="list-style-type: none"> <li>Standalone data logging</li> <li>BYOD classrooms</li> <li>1-to-1 classrooms</li> </ul>	<ul style="list-style-type: none"> <li>Computers</li> <li>Chromebooks</li> <li>Mobile devices                             <ul style="list-style-type: none"> <li>iOS devices</li> <li>Android devices</li> </ul> </li> </ul>	100,000 per second	Yes	Yes	Yes	<ul style="list-style-type: none"> <li>Functions as a standalone data logger</li> <li>Supports all platforms</li> <li>Streams data wirelessly to <b>multiple devices</b> using Wi-Fi</li> <li>Supports the use of multiple sensors simultaneously</li> <li>Includes five built-in sensors, including GPS</li> <li>Works with LabQuest Viewer, see page 19</li> </ul> <p>For more information, see pp. 10–13 or visit <a href="http://www.vernier.com/labq2">www.vernier.com/labq2</a></p>
<b>LabQuest Stream</b> <b>LQ-STREAM</b> 	<ul style="list-style-type: none"> <li>Mobile devices                             <ul style="list-style-type: none"> <li>iOS devices</li> <li>Android devices</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Computers</li> <li>Chromebooks</li> </ul>	<ul style="list-style-type: none"> <li>100,000 per second via USB</li> <li>10,000 per second via Bluetooth®</li> </ul>	Yes	Yes	Yes	<ul style="list-style-type: none"> <li>Connects via Bluetooth to computers and iOS and Android devices</li> <li>Connects via USB to computers and Chromebooks</li> <li>Supports the use of multiple sensors simultaneously</li> </ul> <p>For more information, see page 14 or visit <a href="http://www.vernier.com/lq-stream">www.vernier.com/lq-stream</a></p>
<b>LabQuest Mini</b> <b>LQ-MINI</b> 	<ul style="list-style-type: none"> <li>Computers</li> <li>Chromebooks</li> </ul>	—	100,000 per second	—	Yes	Yes	<ul style="list-style-type: none"> <li>Connects via USB to computers and Chromebooks</li> <li>Supports the use of multiple sensors simultaneously</li> </ul> <p>For more information, see page 15 or visit <a href="http://www.vernier.com/lq-mini">www.vernier.com/lq-mini</a></p>
<b>Go! Link</b> <b>GO-LINK</b> 	<ul style="list-style-type: none"> <li>Computers</li> <li>Chromebooks</li> </ul>	<ul style="list-style-type: none"> <li>LabQuest 2</li> </ul>	200 per second	—	No	No	<ul style="list-style-type: none"> <li>Offers a low-cost option for collecting data with computers and Chromebooks</li> <li>Communicates via USB with computers and Chromebooks</li> <li>Supports the use of a single sensor at a time</li> </ul> <p>For more information, visit <a href="http://www.vernier.com/go-link">www.vernier.com/go-link</a></p>

## Data Collection with LabQuest 2

The most engaging and effective approach to science is hands on, with students collecting and analyzing data to understand and apply core concepts. Graphing and analyzing data is an essential component of the inquiry and learning process, and LabQuest 2 is a powerful, connected, and remarkably versatile data-logging solution.

Why? LabQuest 2 can serve as a standalone data logger, connect to a computer or Chromebook™, or wirelessly transfer data to mobile devices. This makes it the preferred choice for instructors and students in the laboratory, in the classroom, and in the field.

### Award-Winning



//CODiE//  
2013 SRA CODIE FINALIST



bett  
AWARDS 2015  
FINALIST

## LabQuest 2

LABQ2

The freedom to inquire. The technology to excel.

- Use as a standalone device with all Vernier sensors.
- Connect to a Windows® or macOS® computer for use with Logger Pro 3, Logger Lite, or Graphical Analysis™4.
- Transfer data wirelessly to iOS and Android™ devices, Chromebooks, and computers running Graphical Analysis 4.

### Technical Specifications

Screen size	11.2 cm × 6.7 cm
Screen resolution	800 × 480 color display
Weight	350 g
CPU	800 MHz application processor
Battery	Lithium-ion rechargeable battery; carries a one-year warranty

### Included with LabQuest 2

LabQuest 2 unit, rechargeable battery, USB cable, power adapter, stylus, stylus tether

### Features

#### Full sensor support

Compatible with all Vernier sensors

#### High-resolution touch screen

- 12.8 cm, 800 × 480 pixel resolution
- Designed for both stylus and touch
- Wide viewing angle for lab groups

#### Built-in sensors

- GPS
- 3-axis accelerometer
- Ambient temperature
- Light
- Microphone

#### Fast data collection

100,000 samples per second

#### Powerful analysis tools

Statistics, curve fits, integral function, and modeling

#### High-capacity, lithium-ion rechargeable battery

#### Wireless connectivity

- Wi-Fi
- Bluetooth®



### Ports & Connectivity

USB port for use with USB sensors, flash drive, or other USB peripherals

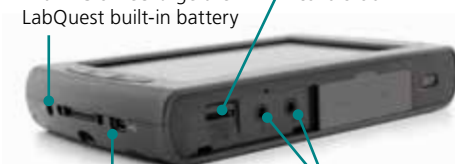


Two digital sensor ports for use with motion detectors, photogates, drop counters, and more

Three analog ports for use with most sensors, such as temperature, pH, and CO<sub>2</sub> sensors

Power port for use with AC or recharge the LabQuest built-in battery

Micro SD/MMC card slot



USB connectivity  
Connect your LabQuest 2 to a Windows or macOS computer or a Chromebook to collect data.

Audio in (left)  
Audio out (right)  
Connect speakers, microphone, power amplifier, or headphones.

## Built-in Software

### Analysis Features

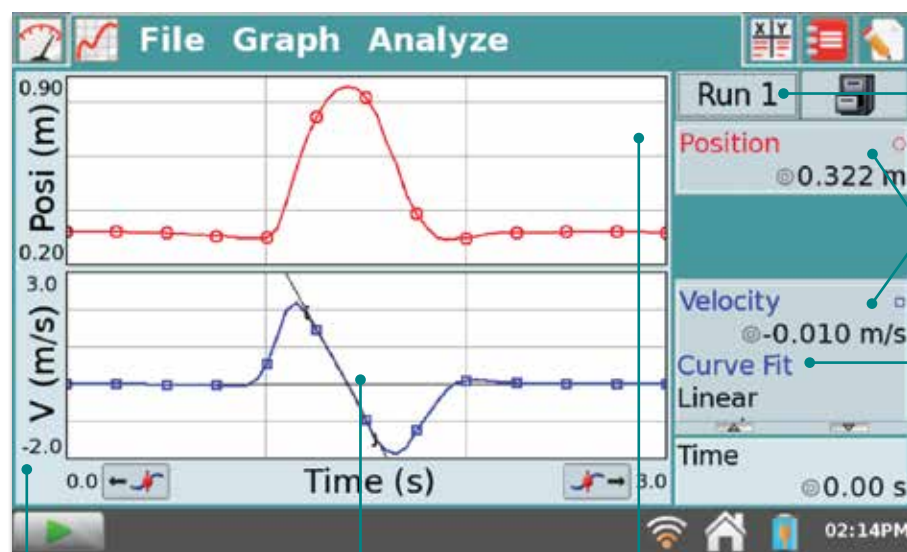
- Perform curve fits.
- View graphs in landscape and portrait orientations.
- Use built-in sensors—GPS, microphone, accelerometers, relative light sensor, and temperature.
- Draw a prediction before collecting data.
- Display two graphs at once.
- Display a tangent line on the graph.
- Use the Integral function tool.
- Calculate statistics for your data.

### Built-in Applications

- Camera App (requires USB camera)
- Stopwatch
- Periodic table
- Scientific calculator
- Audio function generator
- Power amplifier (requires Vernier Power Amplifier)

### Other Great Features

- Transfer data wirelessly (using Wi-Fi) to iPad®, Chromebooks, computers, Android, and other mobile devices.
- Export data to Graphical Analysis 4 and Logger Pro.
- Use with our LabQuest Viewer software for instructions, demonstrations, and class discussions.
- More than 100 preloaded lab instructions from our popular lab books are available.
- Add notes in the Notes field.
- Record voice annotations with internal microphone.
- Find slopes, fit a line to a portion of your data, and display position data and its derivatives.



One or two high-resolution plots of data are displayed in real time.

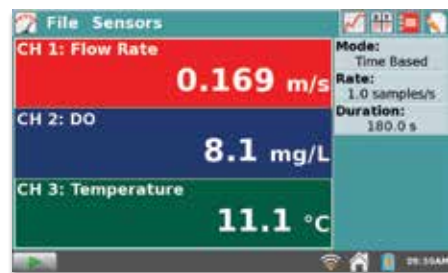
Curve fits and other analysis tools are available.

Quickly access graphs, tables, and meters.

Easily store and recall multiple runs.

View a live display of sensor data.

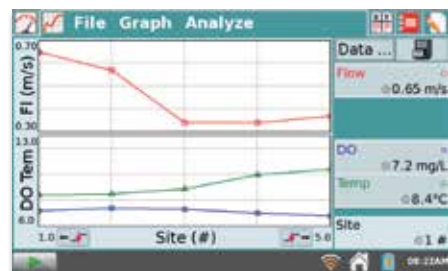
Display curve fit statistics.



Meter

Site (#)	Flow (m/s)	DO (mg/L)	Temp (°C)
1	0.65	7.2	8.8
2	0.57	7.4	8.5
3	0.34	7.3	8.9
4	0.34	7.0	10.0
5	0.37	6.8	10.4
6	0.32	6.6	10.9
7	0.30	6.5	11.5

Data Table



Graph

## One-Touch Simplicity

LabQuest App gives your students real-time graphing capabilities in a handheld device. It's powerful—yet beautifully simple.

Your students can collect data and view them in a Data Table, or Graph.

## Compatible Sensors



Wondering which sensors are supported?

LabQuest 2 works with all of our sensors. Check our website for the latest sensor compatibility.

[www.vernier.com/labquest2](http://www.vernier.com/labquest2)

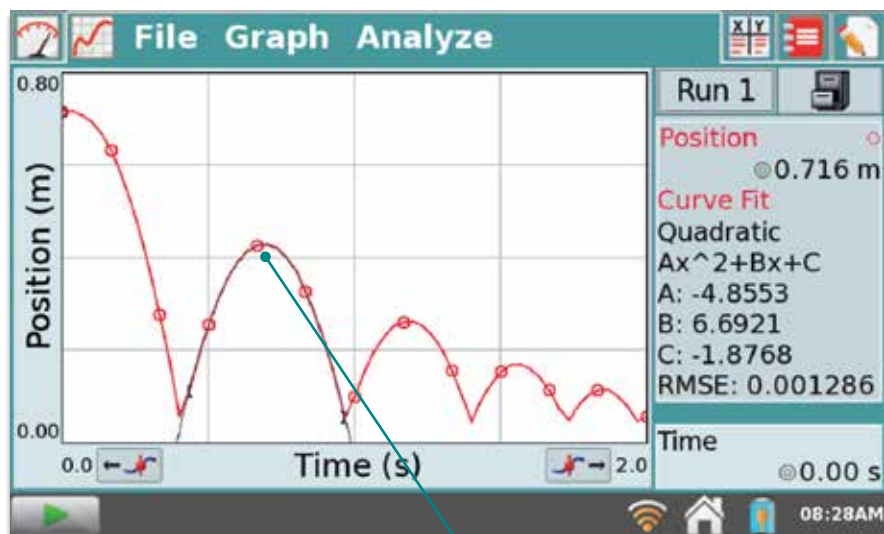


# LabQuest 2

## Data Analysis at Your Fingertips

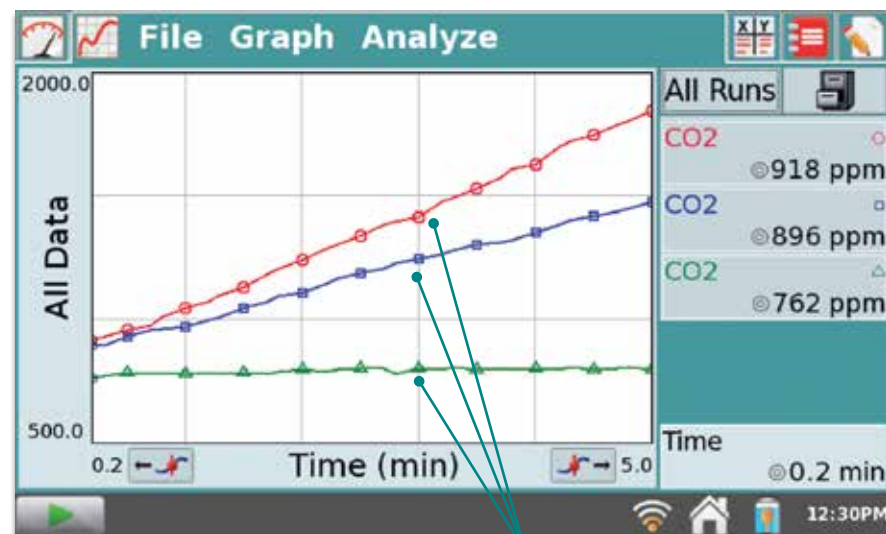
DATA LOGGING

LABQUEST 2



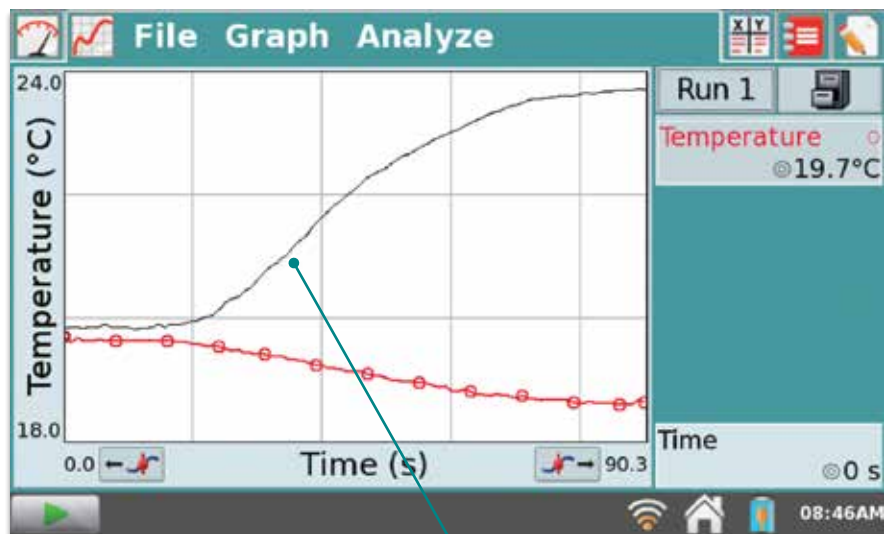
Position vs. time graph of a bouncing ball

Easily analyze any portion of your data by first selecting a region.



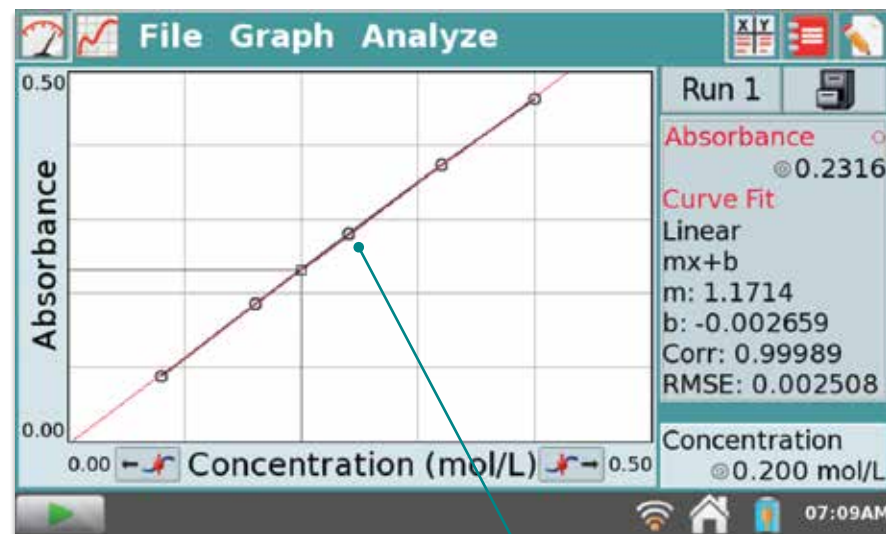
Investigating the rate of cellular respiration at different temperatures

Display data from several sensors or runs on one graph.



Temperature vs. time graph as an Alka-Seltzer® tablet dissolves in water

Use the draw prediction tool to reinforce the scientific process and to help address preconceptions.



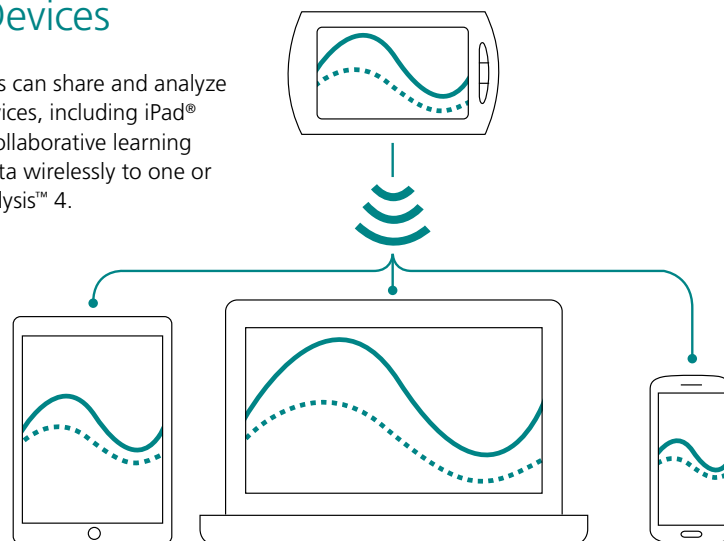
Beer's law analysis of nickel (II) sulfate solution

Use the analyze tools to determine the concentration of an unknown.

## Wirelessly Transfer Data to Chromebooks™, Computers, and iOS and Android™ Devices

With Data Sharing and LabQuest 2, students can share and analyze real-time data on any number of mobile devices, including iPad® and Android tablets, for a truly hands-on, collaborative learning environment. Use LabQuest 2 to transfer data wirelessly to one or more mobile devices running Graphical Analysis™ 4.

See how Data Sharing works at [www.vernier.com/data-sharing](http://www.vernier.com/data-sharing)



## LabQuest Charge Station

**LQ2-CRG**

Want a way to charge and store your LabQuest 2 or LabQuest Stream units? The LabQuest Charge Station has four charging slots with LEDs to indicate the charging status.

[www.vernier.com/lq2-crg](http://www.vernier.com/lq2-crg)

**Note:** If you need to charge an original LabQuest, contact us for inserts.



## LabQuest 2 Accessories and Replacement Parts

Part Name	Order Code
LabQuest Charge Station	LQ2-CRG
LabQuest 2 Lab Armor	LQ2-ARMOR
LabQuest 2 Stand	LQ2-STN
LabQuest Power Supply	LQ-PS
LabQuest Stylus Tether (pkg. of 5)	LQ-TETH-5
LabQuest Lanyard	LQ-LAN
LabQuest 2 Battery	LQ2-BAT
LabQuest Battery Boost 2	LQ-BOOST2
LabQuest SD Card	LQ-SD
LabQuest 2 Stylus (pkg. of 5)	LQ2-STYL-5
Vernier Mini USB Cable	CB-USB-MINI
Vernier USB Type C to Mini USB Cable	CB-USB-C-MINI

Can't find the accessory you need? Check our complete list of accessories (including pictures) at [www.vernier.com/accessories](http://www.vernier.com/accessories)

## LabQuest Stream

### LQ-STREAM

### Mobile-friendly technology that expands possibilities

With LabQuest Stream, our wireless and USB sensor interface, students have the freedom and flexibility to simultaneously collect data from multiple Vernier sensors using a mobile device, a Chromebook,™ or a computer. Just like the name suggests, students can stream data directly to a mobile device using Bluetooth® wireless technology rather than Wi-Fi. This is especially important for schools where network access may be limited or restricted. In addition, LabQuest Stream includes USB connectivity, which allows it to connect directly to a Chromebook or a computer when needed.

### Technical Specifications

Software requirements	• Graphical Analysis™ 4
	• Logger Pro 3
	• Logger Lite
Analog inputs	3
Digital inputs	2
Bluetooth sampling rate	10,000 samples per second
Wired sampling rate	100,000 samples per second

### Features

- Multi-channel sensor interface supports both wireless data collection for mobile devices and USB data collection for computers and Chromebooks so it works in the lab, the classroom, and in the field
- Five sensor ports give you the flexibility to choose from over 60 Vernier sensors to support multi-variable experiments and data-logging activities
- Real-time wireless data collection—up to 10,000 samples per second
- Rapid, real-time data collection—up to 100,000 samples per second when connected via USB
- High-capacity, rechargeable battery accommodates multiple lab experiments in several classes each day

Bluetooth wireless technology delivers real-time data collection with mobile devices and supported computers.



Power port for AC power or to recharge the built-in battery



#### USB connectivity

Connect your LabQuest Stream to a Windows® or macOS® computer or a Chromebook to collect data.



Two digital sensor ports for use with motion detectors, photogates, drop counters, and more

Three analog ports for use with most sensors, such as temperature, pH, and CO<sub>2</sub> sensors

## LabQuest Mini

LQ-MINI

Affordable. Powerful. Easy to Use.

LabQuest Mini brings the power of our award-winning LabQuest technology to teachers who don't need the versatility of a standalone device. The perfect solution for educators collecting data with a computer or Chromebook, LabQuest Mini interfaces with Graphical Analysis 4, Logger Lite, and Logger *Pro* software.

### Technical Specifications

**Dimensions** 10.5 cm × 8.5 cm × 2.6 cm

**Computer connection** USB 2.0 Full Speed

**Software requirements**

- Graphical Analysis 4
- Logger *Pro* 3
- Logger Lite

**Analog inputs** 3

**Digital inputs** 2

**Maximum sampling rate** 100,000 samples per second

### Features

- A maximum sampling rate of 100,000 per second gives you the unrivaled power of LabQuest.
- Five sensor ports give you the flexibility to choose from over 65 compatible sensors.

### Award-Winning



"Excellent product that will serve many classroom environments well."

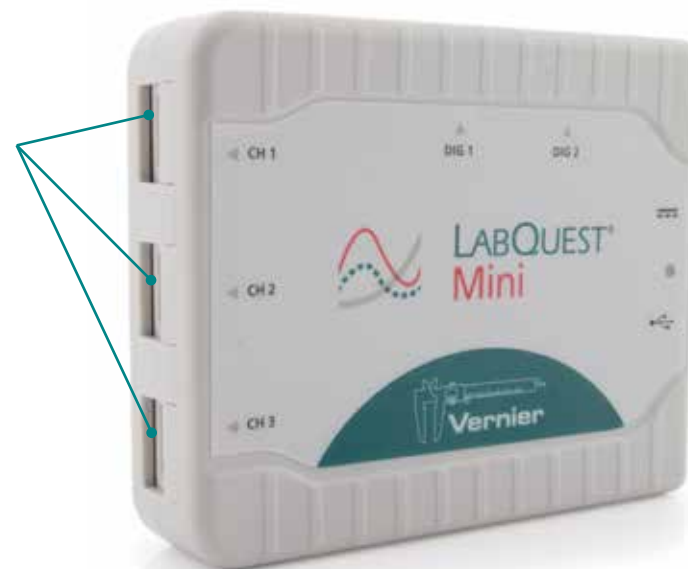
— Tech & Learning

Three analog sensor ports for use with most sensors, such as temperature, pH, and force

**USB connectivity**  
Connect LabQuest Mini to a Windows or macOS computer or a Chromebook to collect data.

Auxiliary power port

Two digital sensor ports for use with digital sensors, such as motion detectors, photogates, chemical polarimeters, diffraction apparatus, and drop counters





# Software

[www.vernier.com/software](http://www.vernier.com/software)



FREE

Collect, share, and analyze sensor data with our free software for Chrome™, iOS, Android™, Windows®, and macOS®.

Using Graphical Analysis 4, you can collect data from nearly all Vernier devices including

- Go Direct sensors
- LabQuest sensors connected to a compatible interface
- LabQuest 2 or Logger Pro Data Sharing source

## Graphical Analysis™ 4

### Go Direct™ Sensors

Use Graphical Analysis 4 with our growing collection of Go Direct sensors connected by Bluetooth® or USB as needed by your platform.

See page 22 for Go Direct sensors.

### LabQuest Sensors

Use Graphical Analysis 4 with more than 60 Vernier LabQuest sensors. Connect LabQuest sensors to an interface from the LabQuest family, including LabQuest Mini, LabQuest Stream, or LabQuest 2.

See pp. 22–23 for LabQuest sensors.

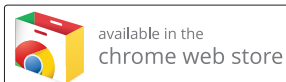
See page 9 for interface options.

### Data Sharing

Students can work together in a lab group to collect data on either LabQuest 2 or a computer running Logger Pro software and share the data over a network. Each lab group member will then receive the same data to analyze separately on any platform with Graphical Analysis 4.

See how Data Sharing works at [www.vernier.com/data-sharing](http://www.vernier.com/data-sharing)

Download  
Graphical Analysis 4



Download for Windows and macOS at  
[www.vernier.com/graphical-analysis](http://www.vernier.com/graphical-analysis)



### Award Winning

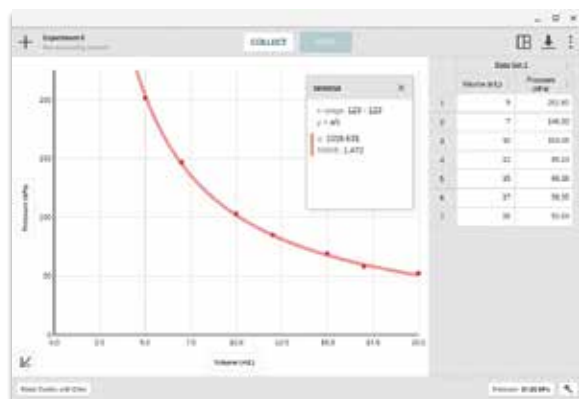
**//CODiE//**  
2014 SIIA CODiE WINNER  
SIIA CODiE 2014 Winner for  
best educational app for a  
mobile device

**BESSIE AWARDS**  
BEST EDUCATIONAL SOFTWARE AWARD  
Winner of 15TH ANNUAL  
BESSIE AWARDS  
Computer Software, Cambridge, CA  
BESSIE Award for best  
educational software for  
multi-level/data analysis

## Key Features

### Data Collection

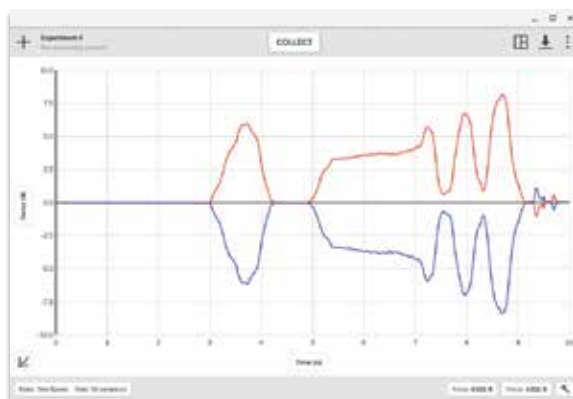
- Collect data from multiple sensors simultaneously, either with a multiple-channel interface such as LabQuest Stream or by using multiple Go Direct sensors. Use Data Sharing to retrieve data from just about every Vernier sensor.
- Select time-based or event-based data collection, including events with entry.
- Adjust data-collection rate and duration as needed.
- Trigger time-based data collection on sensor values.
- Calibrate sensors, although most of the time this is not needed.
- Enter data manually or using the clipboard.
- Change display units on many sensors.
- Draw predictions before data collection.
- Perform graph matching exercises with a Motion Detector.



Choose from standard curve fit equations to analyze experimental data. Boyle's law data requires an inverse fit.

### Data Analysis

- Display one, two, or three graphs as needed.
- Set the graph scale.
- Select what is graphed on each axis, and select line- or point-style graphs.
- Calculate descriptive statistics on all or some of your data.
- Fit lines and curves to some or all of your data.
- Define calculated columns based on sensor columns. Use this to linearize a graph, for example.
- View data in a table.
- Highlight and read values from a graph.
- Interpolate and extrapolate using graphed data.



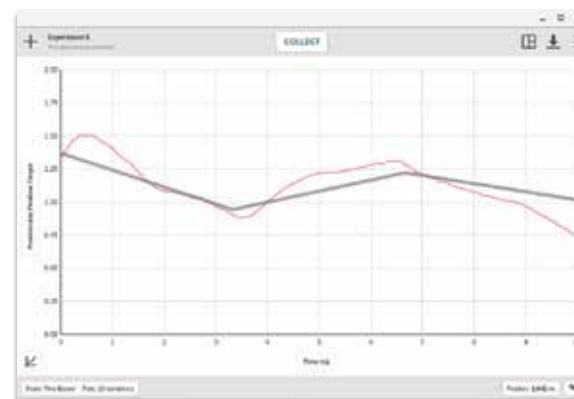
Collect data from multiple sensors simultaneously. Use two force sensors to demonstrate Newton's third law.

### Data Sharing

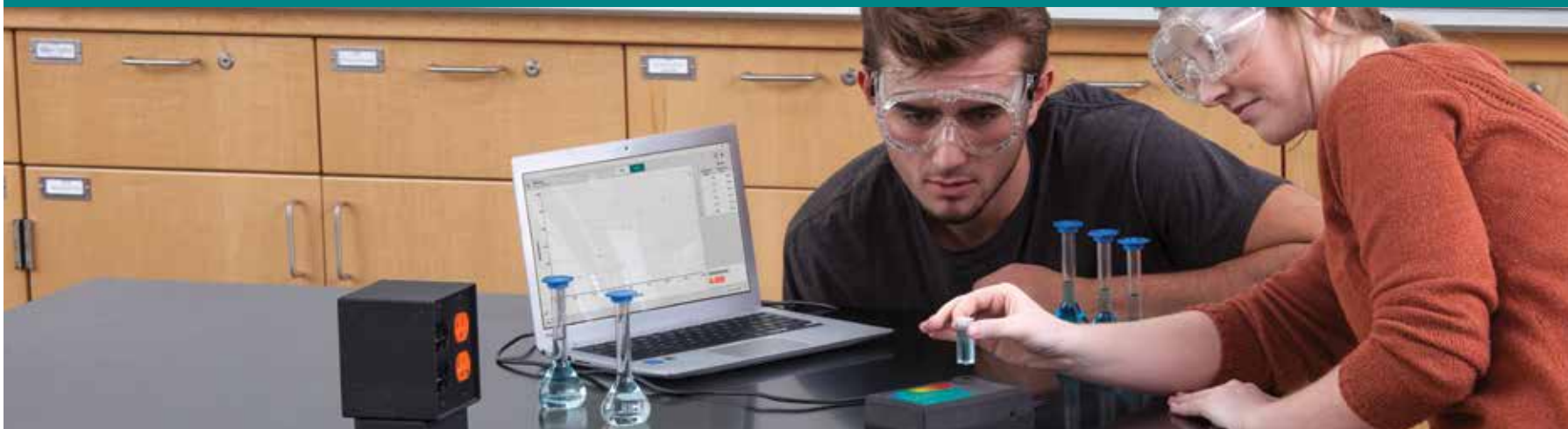
- Receive data shared from LabQuest 2 or a computer running Logger Pro to support 1:1 lab groups.

### Data Storage

- Store and retrieve previously shared data-collection and analysis sessions.
- Save Graphical Analysis 4 software data files with analysis for use in Logger Pro 3.



Perform graph match exercises with a Motion Detector.



## NEW Vernier Spectral Analysis App

Collect, share, and analyze spectrometer data with our free software for Chrome™, iOS, Windows®, and macOS®, and soon, Android™.

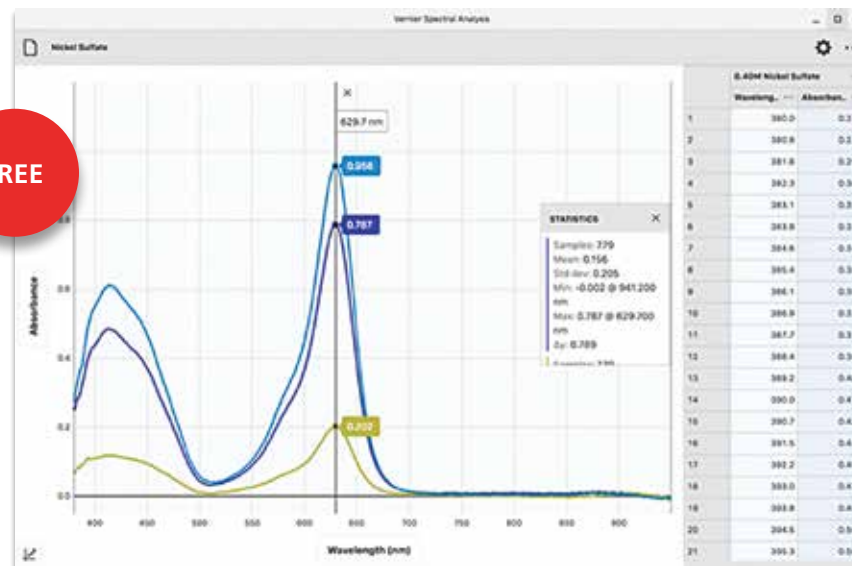
Our free Spectral Analysis app makes it easy to incorporate spectroscopy into your biology and chemistry experiments. Using the app, students can collect a full spectrum and explore topics such as Beer's law, enzyme kinetics, and plant pigments.

The user-friendly interface includes analysis features such as curve fitting and data interpolation.

### Features

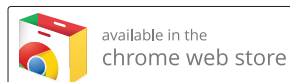
- Follow on-screen instructions for simplified Beer's law or kinetics data collection.
- Collect full spectrum absorbance or % transmittance data in less than one second.
- Analyze data with built-in analysis tools, including data interpolation and curve fittings.
- Determine the order of kinetics reaction with the calculated columns function.
- Understand color transmission using the color strip shown on full spectrum graphs.
- View a full spectrum of your sample while collecting data for Beer's law or kinetic experiments.

FREE



Download  
Spectral Analysis\*

\* Android version available mid-2018.



Download for Windows and macOS at  
[www.vernier.com/spectral-analysis](http://www.vernier.com/spectral-analysis)





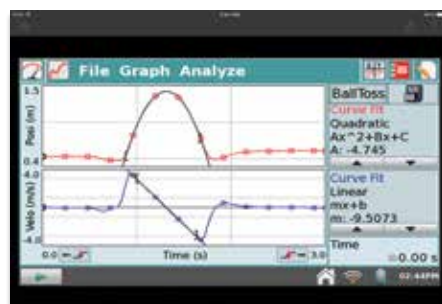
## LabQuest Viewer Software

### LQ-VIEW

Teach students how to use LabQuest by projecting your LabQuest screen. Display live images of all LabQuest units in your lab to monitor student progress. Compatible with both macOS and Windows computers.

Computer software includes a site license for every teacher's computer in your school or university department.

For more information, visit [www.vernier.com/lq-view](http://www.vernier.com/lq-view)



## LabQuest Viewer App for iPad

LabQuest Viewer App for iPad allows you to use your classroom iPad to wirelessly view and control LabQuest. When your iPad is used with a projector, you can easily display any LabQuest screen for the entire class to see.

For more information, visit [www.vernier.com/lq-view-ipad](http://www.vernier.com/lq-view-ipad)



Video analysis of an accelerating Segway®

## Video Physics

Perform Automated Object Tracking on iPad®, iPhone®, and iPod touch®.

Video Physics is perfect for physics students and instructors to perform on-the-go analysis of motion. Measure the velocity of a swing, a roller-coaster, or a basketball free-throw shot.

Ways to use Video Physics in the classroom

- Capture a new video using the built-in camera, choose a video from your Photos collection, or use one of our sample videos.
- Track an object automatically or manually add points to the video frame.
- Set the scale of the video using an object of known size.
- Optionally set coordinate system location and rotation.
- View graphs of trajectory, position, and velocity.
- Export video with points.
- Email the video and data for further analysis in Vernier Logger Pro software for macOS and Windows.
- Open data files directly in our Graphical Analysis 4 software.

For more information, visit [www.vernier.com/video-physics](http://www.vernier.com/video-physics)





## Real-Time Graphing and Powerful Analytical Tools

Logger Pro 3 is our flagship data-collection and analysis software for Windows® and macOS® computers. With a complete suite of data-collection and analysis tools, Logger Pro is suitable for all students, from beginning to advanced.

- One program does it all—for only —for all of your computers AND your students' personal computers.
- Think of Logger Pro as the digital data hub of your classroom and lab. It can gather data from a variety of sources, LabQuest 2, LabQuest Mini, LabQuest Stream, Go! Link, OHAUS® balances, compatible TI graphing calculators, and spectrometers.

### Logger Lite®

Don't need all this power or working with younger students?

Logger Lite, a streamlined subset of Logger Pro, is available at no charge for use with LabQuest 2, LabQuest Mini, Go! Link, Go!Temp, and Go! Motion.

[www.vernier.com/logger-lite](http://www.vernier.com/logger-lite)

## Logger Pro 3

with manual and CD

LP

electronic download\*

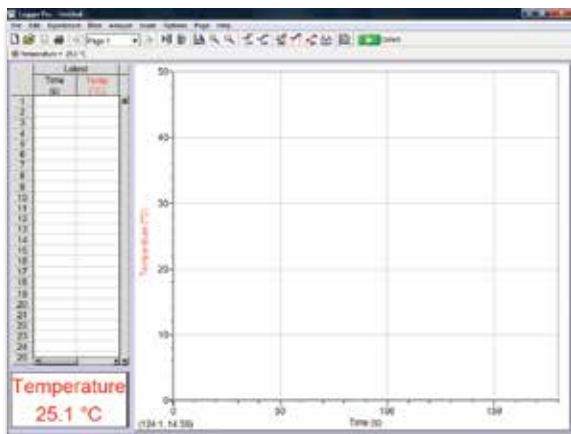
LP-E

- Logger Pro 3 includes a site license for your entire school or university department.
- Site license includes home computers of faculty.
- Site license includes home computers of students—let them take it home!
- Satisfy licensing without counting computers.
- Logger Pro 3 updates are free.
- Logger Pro 3 Data Sharing
  - Supports Graphical Analysis™ 4 for iOS, Android™, Chrome™, and computers
  - Streams data to multiple devices, allowing for 1:1 learning in lab groups and classrooms

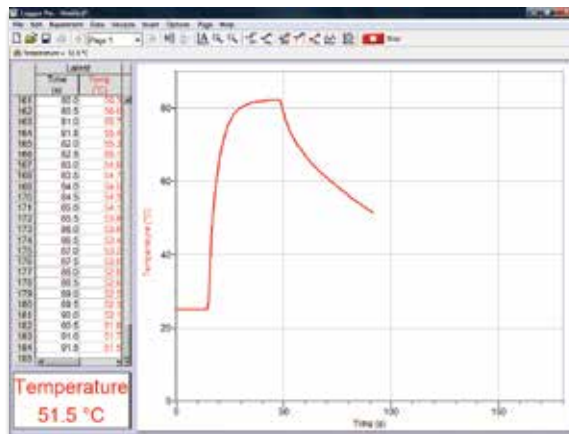
### Award-Winning



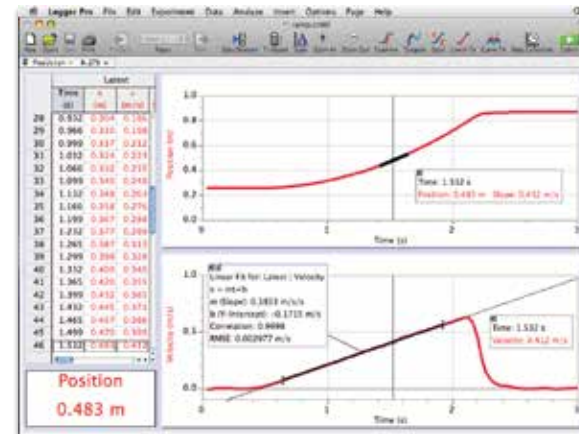
\* Provide an email address to which we will send download information.



Start Logger Pro with a temperature sensor connected. A graph, data table, and meter are all ready to go. Click Collect, and you're taking data.



After you click Collect, Logger Pro draws the graph in real time, and the data table and digital meter update continuously.

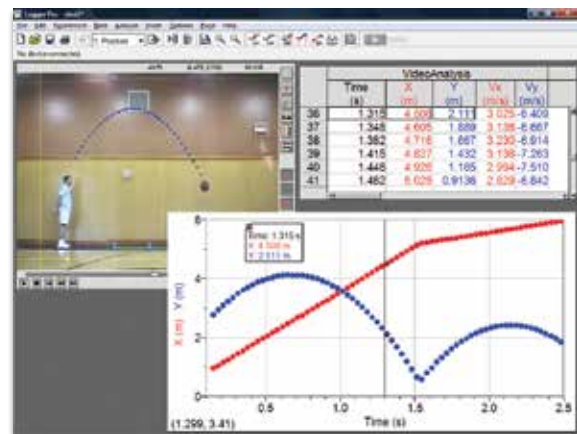
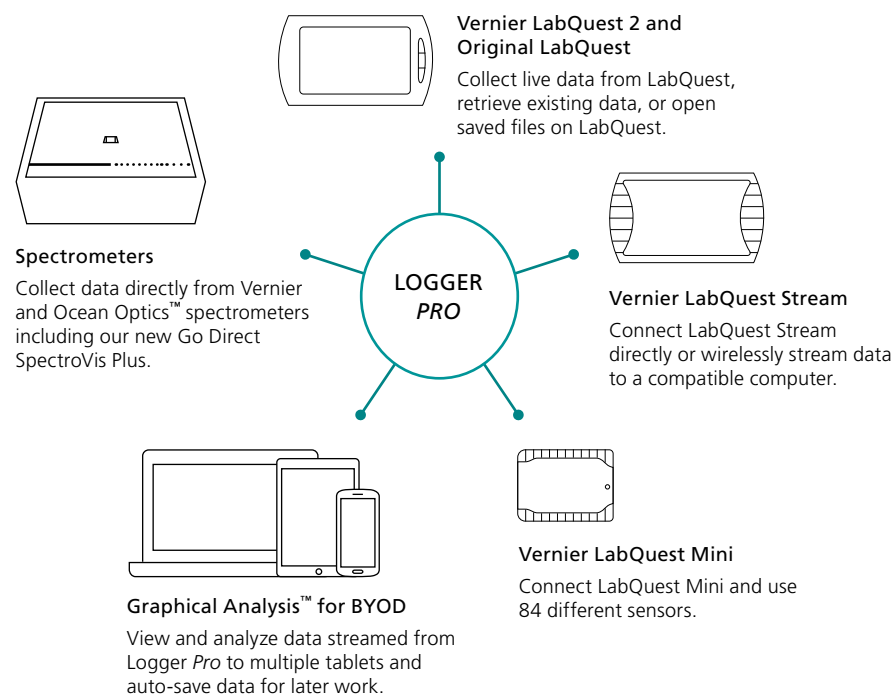


Draw tangent lines to find local slopes and fit lines to selected regions—the analysis tools you need are at your fingertips in Logger Pro.

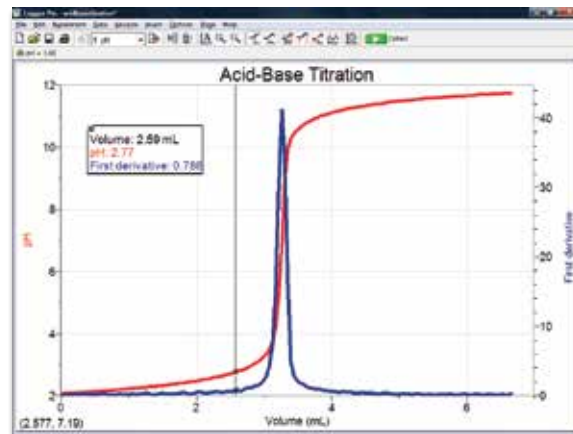
## Logger Pro Features

- Auto-ID sensors make setup effortless—simply connect a sensor, open *Logger Pro*, and click Collect.
  - Collect live data from more than 80 different sensors and devices.
  - Draw predictions on a graph before collecting data.
  - Use a variety of data-collection modes for your experiment: time-based data, selected events, events with typed-in entries, photogate, radiation counting, and more.
  - Manually enter data for graphing and analysis.
  - Import data from LabQuest, mobile devices, and calculators.
  - Lay out graphs, tables, and text across multiple pages to describe your experiment.
  - Read values and slope from graphs using examine and tangent line tools.
  - Print graphs and data tables.
  - Graph data in a variety of ways, including XY graphs, log graphs, double-Y graphs, strip charts, and FFT graphs.
  - Model data with user-adjustable functions.
  - Extract data from movies using frame-by-frame video analysis.
  - Capture video from video cameras or import compatible movie files.
  - Calculated columns allow you to graph new quantities, such as kinetic energy.
  - Perform GC (gas chromatograph) peak analysis.
- Note: *Logger Pro* cannot be used to collect data with our Go Direct™ sensors (other than Go Direct SpectroVis® Plus).

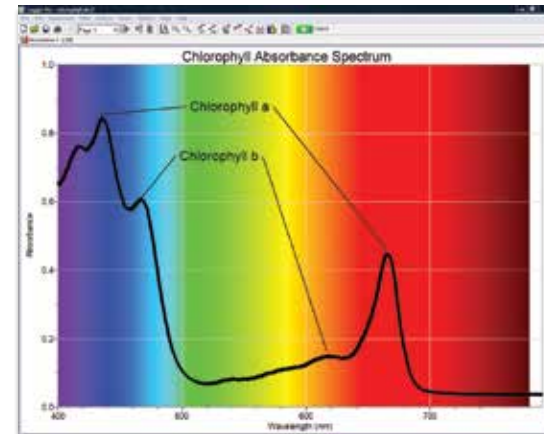
## Why Do I Need Logger Pro?



Analyze videos to study the motion of individual or multiple objects. This feature alone is worth the price of *Logger Pro*!



Create double-Y graphs to tell complex stories with simplicity.



Collect absorbance data from Go Direct SpectroVis Plus, Vernier UV-VIS Spectrophotometers, or Ocean Optics spectrometers.

# Sensors & Accessories [www.vernier.com/sensors](http://www.vernier.com/sensors)

## The Vernier Sensor Advantage

### Outstanding Performance

With 37 years of experience developing technology for education, we design our sensors for active, hands-on experiments. Vernier sensors are rugged, classroom-proven technology that are well supported and easy to use. The sensors provide consistent, high-quality results for the demands of the classroom.

### Connect & Collect

Simply connect, and you're ready to collect. All Vernier sensors on the following pages are automatically detected and set up for data collection when used with Vernier software. It's student-friendly technology designed for ease of use.

### Go Direct™ Sensors

Our Go Direct sensors connect directly to a computer, Chromebook™, or a mobile device via Bluetooth® or USB connection. Most sensors include a rechargeable battery to power the sensor when used as a wireless sensor.

### LabQuest Sensors

Our LabQuest sensors require an interface from the LabQuest family, such as LabQuest 2, LabQuest Stream, or LabQuest Mini. The interface sends information from the sensor to the data-collection and analysis software on a device such as a computer, Chromebook, or mobile device.

For more information on sensor compatibility, visit [www.vernier.com/sensors](http://www.vernier.com/sensors)

### Generous Warranty

Buy with confidence. Most Vernier sensors are covered by a 5-year warranty. We have rarely charged a customer for a repair, no matter how old the equipment.

## Go Direct Sensors

Sensor	Order Code	Page
Go Direct 3-Axis Magnetic Field	GDX-3MG	105
<b>NEW</b> Go Direct Acceleration	GDX-ACC	104
Carts and Tracks		
<b>NEW</b> Dynamics Cart and Track System with Go Direct Sensor Carts	DTS-GDX	103
<b>NEW</b> Go Direct Sensor Cart (Green)	GDX-CART-G	103
<b>NEW</b> Go Direct Sensor Cart (Yellow)	GDX-CART-Y	103
<b>NEW</b> Go Direct CO <sub>2</sub> Gas	GDX-CO2	35
Go Direct Colorimeter	GDX-COL	50
Go Direct Conductivity	GDX-CON	50
Go Direct Constant Current System	GDX-CCS	51
<b>NEW</b> Go Direct Current	GDX-CUR	105
Go Direct Drop Counter	GDX-DC	51
<b>NEW</b> Go Direct EKG	GDX-EKG	36
Go Direct Electrode Amplifier	GDX-EA	51
<b>NEW</b> Go Direct Energy	GDX-NRG	83
Go Direct Force and Acceleration	GDX-FOR	104
Go Direct Gas Pressure	GDX-GP	51
Heart Rate Monitors		
Go Wireless Exercise Heart Rate	GW-EHR	<a href="#">web</a>
Go Wireless Heart Rate	GW-HR	36
Go Direct Light and Color	GDX-LC	105
Go Direct Melt Station	GDX-MLT	51
<b>NEW</b> Go Direct Motion	GDX-MD	104
<b>NEW</b> Go Direct O <sub>2</sub> Gas	GDX-O2	35
<b>NEW</b> Go Direct Optical Dissolved Oxygen	GDX-ODO	35
Go Direct ORP	GDX-ORP	52

## pH Sensors

<b>NEW</b> Go Direct Glass-Body pH	GDX-GPH	52
Go Direct pH	GDX-PH	52
<b>NEW</b> Go Direct Tris-Compatible Flat pH	GDX-FPH	52
Go Direct Radiation Monitor	GDX-RAD	52
<b>NEW</b> Go Direct Respiration Belt	GDX-RB	36
<b>NEW</b> Go Direct Rotary Motion	GDX-RMS	104
Go Direct SpectroVis® Plus	GDX-SVISPL	53
Temperature Probes		
<b>NEW</b> Go Direct Surface Temperature	GDX-ST	53
Go Direct Temperature	GDX-TMP	53
<b>NEW</b> Go Direct Wide-Range Temperature	GDX-WRT	53
Go Direct Voltage	GDX-VOLT	105

## LabQuest Sensors

Sensor	Order Code	Page
Accelerometers		
3-Axis Accelerometer	3D-BTA	108
25-g Accelerometer	ACC-BTA	108
Low-g Accelerometer	LGA-BTA	108
Anemometer	ANM-BTA	<a href="#">web</a>
Barometer	BAR-BTA	<a href="#">web</a>
Blood Pressure Sensor	BPS-BTA	<a href="#">web</a>
Charge Sensor	CRG-BTA	113
CO <sub>2</sub> Gas Sensor	CO2-BTA	37
Colorimeter	COL-BTA	54
Conductivity Probes		
Conductivity Probe	CON-BTA	54
Platinum-Cell Conductivity Probe	CONPT-BTA	54
Constant Current System	CCS-BTA	55
Current Probes		
Current Probe	DCP-BTA	112
High Current Sensor	HCS-BTA	<a href="#">web</a>
Diffraction Apparatus	DAK	115
Digital Control Unit	DCU-BTD	75

Dissolved Oxygen Probes		
Dissolved Oxygen Probe	DO-BTA	<a href="#">web</a>
Optical DO Probe	ODO-BTA	37
Drop Counter	VDC-BTD	55
EKG Sensor	EKG-BTA	<a href="#">web</a>
Electrode Amplifier	EA-BTA	55
Energy Sensor	VES-BTA	86
Ethanol Sensor	ETH-BTA	38
Flow Rate Sensor	FLO-BTA	<a href="#">web</a>
Force Sensors		
Dual-Range Force Sensor	DFS-BTA	109
Force Plate	FP-BTA	109
Gas Pressure Sensors		
Gas Pressure Sensor	GPS-BTA	55
Pressure Sensor 400	PS400-BTA	55
Goniometer	GNM-BTA	<a href="#">web</a>
Hand Dynamometer	HD-BTA	38
Heart Rate Monitors		
Exercise Heart Rate Monitor	EHR-BTA	<a href="#">web</a>
Hand-Grip Heart Rate Monitor	HGH-BTA	38
Instrumentation Amplifier	INA-BTA	55
Ion-Selective Electrodes*		
Ammonium Ion-Selective Electrode	NH4-BTA	<a href="#">web</a>
Calcium Ion-Selective Electrode	CA-BTA	<a href="#">web</a>
Chloride Ion-Selective Electrode	CL-BTA	<a href="#">web</a>
Nitrate Ion-Selective Electrode	NO3-BTA	<a href="#">web</a>
Potassium Ion-Selective Electrode	K-BTA	<a href="#">web</a>
Light Sensor	LS-BTA	115
Magnetic Field Sensor	MG-BTA	113
Melt Station	MLT-BTA	56
Microphone	MCA-BTA	111
Motion Detectors		
Motion Detector	MD-BTD	108
Motion Encoder System	DTS-EC	106
O <sub>2</sub> Gas Sensor	O2-BTA	37
ORP Sensor	ORP-BTA	56
PAR Sensor	PAR-BTA	38

pH Sensors			
Glass-Body pH Electrode BNC (requires Electrode Amplifier)	GPH-BNC		56
pH Sensor	PH-BTA		56
Tris-Compatible Flat pH Sensor	FPH-BTA		38
Photogate	VPG-BTD		108
Polarimeter (Chemical)	CHEM-POL		56
Power Amplifier	PAMP		112
Projectile Launcher	VPL		109
Pyranometer	PYR-BTA	<a href="#">web</a>	
Qubit Sensors	varies	<a href="#">web</a>	
Radiation Monitor	VRM-BTD		57
Relative Humidity Sensor	RH-BTA	<a href="#">web</a>	
Respiration Monitor Belt (requires Gas Pressure Sensor)	RMB	<a href="#">web</a>	
Rotary Motion Sensor	RMV-BTD		110
Salinity Sensor	SAL-BTA	<a href="#">web</a>	
Soil Moisture Sensor	SMS-BTA		85
Sound Level Sensors			
Sound Level Meter	SLM-BTA		111
Sound Level Sensor	SLS-BTA		111
Spirometer	SPR-BTA		38
Structures & Materials Tester	VSMT		74
Temperature Probes			
Extra-Long Temperature Probe	TPL-BTA	<a href="#">web</a>	
Infrared Thermometer	IRT-BTA	<a href="#">web</a>	
Stainless Steel Temperature Probe	TMP-BTA		57
Surface Temperature Sensor	STS-BTA		57
Thermocouple	TCA-BTA		57
Wide-Range Temperature Probe	WRT-BTA		57
Turbidity Sensor	TRB-BTA	<a href="#">web</a>	
UV Sensors			
UVA Sensor	UVA-BTA	<a href="#">web</a>	
UVB Sensor	UVB-BTA		66
Voltage Probes			
30-Volt Voltage Probe	30V-BTA	<a href="#">web</a>	
Differential Voltage Probe	DVP-BTA		112
Voltage Probe	VP-BTA		57

## Balances

OHAUS Balances page 58

## Gas Chromatograph

Gas Chromatograph	Order Code	Page
Mini GC Plus Gas Chromatograph	GC2-MINI	58

## Go! and Easy Sensors (USB Only)

Sensor	Order Code	Page
CBR 2 (for calculators)	CBR2	122
EasyTemp (for calculators)	EZ-TMP	122
Go! Motion	GO-MOT	<a href="#">web</a>
Go!Temp	GO-TEMP	<a href="#">web</a>

## Spectrometers

Spectrometer	Order Code	Page
Go Direct SpectroVis Plus	GDX-SVISPL	59
Vernier Emissions Spectrometer	VSP-EM	116
Vernier Flash Photolysis Spectrometer	VSP-FP	59
Vernier Fluorescence/UV-VIS Spectrophotometer	VSP-FUV	59
Vernier Spectrometer (Ocean Optics)	V-SPEC	<a href="#">web</a>
Vernier UV-VIS Spectrophotometer	VSP-UV	59

## Weather Stations

Davis Weather Stations	page 66
Kestrel Drop Wireless Data Loggers	page 66

\* Ion-Selective Electrodes require excellent chemical technique and careful calibration to obtain accurate results; they are not recommended for primary or middle school students.



# Accessories and Replacement Parts

## Sensors

Part Name	Order Code
<b>Blood Pressure Sensors</b>	
Small Blood Pressure Cuff	CUFF-SM
Large Blood Pressure Cuff	CUFF-LG
<b>Bottles</b>	
Nalgene Bottle (250 mL)	CO2-BTL
Primary Productivity Kit	PPK
Turbidity Bottles (pkg. of 6)	TRB-BOT
Water Quality Bottles (pkg. of 8)	WQ-BOT
<b>CO<sub>2</sub> and/or O<sub>2</sub> Gas Sensors</b>	
BioChamber 250 (250 mL) (2 openings)	BC-250
BioChamber 2000 (2000 mL) (2 openings)	BC-2000
Grommets for CO <sub>2</sub> and O <sub>2</sub> (pkg. of 10)	CO2-GROM
Respiration Chamber (250 mL) (1 opening)	CO2-BTL
<b>Colorimeters</b>	
Cuvette Rack	CUV-RACK
Plastic Cuvettes (pkg. of 100)	CUV
<b>Conductivity Probes</b>	
Conductivity Low Standard (500 mL)	CON-LST
Conductivity Middle Standard (500 mL)	CON-MST
Conductivity High Standard (500 mL)	CON-HST
<b>Dissolved Oxygen Probe (Optical—ODO-BTA)</b>	
Optical DO Probe Metal Guard	ODO-GRD
Optical DO Probe Replacement Cap	ODO-CAP
<b>Dissolved Oxygen Probe (Original—DO-BTA)</b>	
DO Calibration Solution (60 mL)	DO-CAL
DO Filling Solution (130 mL)	FS
DO Polishing Strips	PS
DO Probe Membrane Cap	MEM
<b>Drop Counters</b>	
Microstirrer	MSTIR
Reagent Reservoir, 2 Valves, and Tip	VDC-RR
Stopper Stem	PS-STEM
Plastic 2-Way Valve	PS-2WAY
<b>EKG Sensors</b>	
EKG Electrodes	ELEC
<b>Electrode Amplifier (Go Direct Sensors)</b>	
Go Direct pH BNC Electrode	GDX-PH-BNC
Go Direct Glass-Body pH BNC Electrode	GDX-GPH-BNC
Go Direct Flat pH BNC Electrode	GDX-FPH-BNC
Go Direct ORP BNC Electrode	GDX-ORP-BNC
<b>Electrode Amplifier (LabQuest Sensors)</b>	
pH Electrode BNC	PH-BNC
Glass-Body pH Electrode BNC	GPH-BNC
Flat pH Electrode BNC	FPH-BNC
ORP Electrode BNC	ORP-BNC

<b>Ethanol Sensors</b>	
Ethanol Cap Assemblies (pkg. of 3)	ETH-CAPS
Ethanol Stopper	ETH-STOP
Ethanol Tape	ETH-TAPE
<b>Force Sensors</b>	
Replacement Accessory Rod	ACC-ROD
Force Plate Handles	FP-HAN
Springs Set	SPRINGS
Dual-Range Force Sensor Replacement Parts Kit	DFS-RPK
Bumper Launcher Kit	BLK
Hoop Bumpers for Bumper and Launcher Kit	HOOPS-BLK
<b>Gas Chromatographs</b>	
GC Septa (pkg. of 4)	GC-SEP
GC Syringe, 1 µL Hamilton	GC-SYR-MIC
<b>Gas Pressure Sensors</b>	
Gas Pressure Sensor Bulb (set of 4)	GPS-BULB4
Pressure Sensor Accessories Kit	PS-ACC
#1 1-Hole Rubber Stopper	PS-STOP1
#5 2-Hole Rubber Stopper	PS-STOP5
Luer-Lock Connector	PS-LUER
Plastic 2-Way Valve	PS-2WAY
Plastic Tubing	PS-TUBING
Plastic Tubing Clamps (pkg. of 100)	PTC
Stopper Stem	PS-STEM
Syringe (20 mL, plastic)	PS-SYR
Syringe (20 mL, plastic) (pkg. of 10)	PS-SYR10
<b>Heart Rate Sensors</b>	
Heart Rate Hand Grips	HR-GRIP
Exercise Heart Rate Strap	HR-STRAP
<b>Ion-Selective Electrodes</b>	
ISE Ammonium Replacement Module*	NH4-MOD
ISE Calcium Replacement Module*	CA-MOD
ISE Nitrate Replacement Module*	NO3-MOD
ISE Potassium Replacement Module*	K-MOD
ISE Ammonium Low Standard (500 mL)	NH4-LST
ISE Ammonium High Standard (500 mL)	NH4-HST
ISE Calcium Low Standard (500 mL)	CA-LST
ISE Calcium High Standard (500 mL)	CA-HST
ISE Chloride Low Standard (500 mL)	CL-LST
ISE Chloride High Standard (500 mL)	CL-HST
ISE Nitrate Low Standard (500 mL)	NO3-LST
ISE Nitrate High Standard (500 mL)	NO3-HST
ISE Potassium Low Standard (500 mL)	K-LST
ISE Potassium High Standard (500 mL)	K-HST

\* ISE modules have a life expectancy of 1 to 2 years. We recommend that you do not purchase ISE replacement modules too far in advance of their expected time of use; degradation occurs while replacement modules are stored on the shelf.

<b>Melt Stations</b>	
Melt Station Capillary Tubes (pkg. of 100)	MLT-TUBE
<b>Motion Detectors</b>	
Motion Detector Clamp	MD-CLAMP
<b>pH and ORP Sensors</b>	
Electrode Tip Guard (pkg. of 2)	ETG
Microstirrer	MSTIR
pH Buffer Capsules (3 × 10)	PH-BUFCAP
pH Storage Bottles (pkg. of 5)	BTL
pH Storage Solution (500 mL)	PH-SS
<b>Photogates</b>	
Cart Picket Fence	PF-CART
Laser Pointer	LASER
Laser Pointer Stand	STAND
Photogate Bar Tape Kit	TAPE-VPG
Picket Fence	PF
Pulley Bracket	B-SPA
Ultra Pulley Attachment	SPA
<b>Polarimeters (Chemical)</b>	
Polarimeter Sample Cells (pkg. of 4)	CELLS-POL
<b>Power Amplifiers</b>	
Accessory Speaker	PAAS-PAMP
<b>Projectile Launchers</b>	
Goggles (set of 2)	GGL-VPL
Time of Flight Pad	TOF-VPL
Steel Balls (set of 6)	STB-VPL
Projectile Stop	PS-VPL
Independence of Motion Accessory	IOM-VPL
Replacement Balls for Independence of Motion Accessory	IOM-BLS
Wax Tape (300 ft.)	WXT-VPL
<b>Rotational Motion</b>	
Rotational Motion Accessory Kit	AK-RMV
Rotary Motion Motor Kit	MK-RMV
Swivel Assembly Replacement	SA-CFA
Sliding Carriage Replacement	SC-CFA
Replacement Masses for Centripetal Force Apparatus	M-CFA
Rotary Motion Sensor Replacement Mass	RMV-MASS
Rotary Motion Sensor Replacement Pulley	RMV-PULLEY
Rotary Motion Sensor Replacement Parts Kit	RMV-RPK
Rotary Motion Sensor Replacement Swivel Mount	RMV-SWIVEL
Rotary Motion Sensor Replacement Washer	RMV-WASH
<b>Salinity Sensors</b>	
Salinity Standard (500 mL)	SAL-ST

# Accessories and Replacement Parts

## Spectrophotometers

Cuvette Rack	CUV-RACK
Plastic Cuvettes (pkg. of 100)	CUV
Quartz Cuvettes (pkg. of 2)	CUV-QUARTZ
Fluorescence/UV Quartz Cuvette	CUV-QUARTZ-FUV
Replacement Spectrum Tube Fiber Optic Holder (for Carousel)	ST-FHC
Replacement Spectrum Tube Fiber Optic Holder	ST-FHS
Spectrophotometer Optical Fiber (for GDX-SVISPL, VSP-UV, VSP-FUV)	VSP-FIBER
Spectrophotometer Emissions Fiber (for VSP-EM)	VSP-EM-FIBER

## Spirometers

Disposable Bacterial Filter (pkg. of 10)	SPR-FIL10
Disposable Bacterial Filter (pkg. of 30)	SPR-FIL30
Disposable Mouthpiece (pkg. of 30)	SPR-MP30
Disposable Mouthpiece (pkg. of 100)	SPR-MP100
Noseclip (pkg. of 10)	SPR-NOSE10
Noseclip (pkg. of 30)	SPR-NOSE30
O <sub>2</sub> Gas Sensor to Spirometer Adapter	O2-SPR
Spirometer Flow Head	SPR-FLOW

## Turbidity Sensors

Turbidity Bottles (pkg. of 6)	TRB-BOT
Turbidity Cuvette and Standard	TRB-ACC

## Vernier Structures & Materials Tester

Truss Tester Accessory	VSMT-TRUSS
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## Voltage and Current

Replacement Lamps for Vernier Circuit Board	VCB-BULB
Miniature Alligator Clips for Vernier Circuit Board	VCB-GATOR
Optional Breadboard Kit for the Vernier Circuit Board 2	VCB2-OBK
30-Volt BTA Test Leads	TL-30V
Resistivity Rods	RRS
Inductor	IND

## KidWind

Part Name	Order Code
KidWind Basic Turbine Building Parts	KW-BTPART
Basic Turbine Building Parts (10 Pack)	KW-BTPART10
Blade Design Consumables Classroom Pack	KW-BDC
Blade Pitch Protractor	KW-BPP
Dowels (25 Pack)	KW-D25
Dowels (100 Pack)	KW-D100
Wind Turbine Generator (10 Pack)	KW-GEN10
Wind Turbine Hub (3 Pack)	KW-WTH3
Wind Turbine Hub (10 Pack)	KW-WTH10

## Dynamics Cart and Track System

Part Name	Order Code
DFS/Accelerometer Fasteners	DTS-ACC
Plunger Cart	DTS-CART-P
Standard Cart	DTS-CART-S
Motion Detector Reflector Flag	DTS-FLAG
Mass DTS	DTS-MASS
Motion Detector Bracket	DTS-MDB
Motion Encoder Cart	
Motion Encoder Cart	DTS-CART-MEC
Motion Encoder Cart and Receiver	DTS-MEC
Motion Encoder Cart Upgrade Kit	DTS-MEU
Friction Pad DTS (for plastic carts)	DTS-PAD
Anti-Roll Pegs	VDS-ARP10
Axles and Wheels for Cart (for plastic or metal carts)	WHEELS-VDS
Track-to-Track Coupler	T2T-VDS
Photogate Bracket	PGB-VDS
Cart Picket Fence	PF-CART
Cart Friction Pad (for metal carts)	PAD-VDS
Mass for Dynamics Carts (500 g)	MASS
Adjustable Two Foot Leveler	AL-VDS
Adjustable End Stop	AS-VDS
Pulley Bracket	B-SPA
Vernier Dynamics System Replacement Parts Kit	VDS-RPK

## Optics

Part Name	Order Code
Adjustable Analyzer Replacement	AA-OEK
Adjustable Analyzer for Rotary Motion Sensor Replacement	AAR-OEK
Adjustable Mirror Replacement	AM-OEK
Aperture Assembly	APT-OEK
Convex Mirror Replacement	CNM-OEK
Half Screen Replacement	HS-OEK
Replacement 10 cm Converging Lens	L10B-OEK
Replacement 15 cm Diverging Lens	L15B-OEK
Replacement 20 cm Converging Lens	L20B-OEK
Replacement Light Source for Optics Expansion	LSB-OEK
Replacement Light Sensor Holder for OEK	LSHB-OEK
Replacement Screen for Optics Expansion Kit	SCRN-OEK
Diffraction Slit System	DSS-DAK
Green Diffraction Laser	GDL-DAK
Combination Linear Position and High Sensitivity Light Sensor	LPL-DAK
Red Diffraction Laser	RDL-DAK

## Go Direct and Go Wireless

Part Name	Order Code
Go Direct Charge Station	GDX-CRG
Go Direct Optical Dissolved Oxygen Replacement Cap (for GDX-ODO)	GDX-ODO-CAP
Go Direct pH Replacement Electrode	GDX-PH-BNC
Go Direct ORP Replacement Electrode	GDX-ORP-BNC
Go Wireless USB Radio	GW-RADIO
Vernier Micro USB Cable	CB-USB-MICRO
Vernier USB Type C to Micro USB Cable	CB-USB-C-MICRO

## LabQuest 2 and Original LabQuest

Part Name	Order Code
For LabQuest 2 and Original LabQuest	
LabQuest Charge Station	LQ2-CRG
LabQuest Power Supply	LQ-PS
LabQuest Tether (pkg. of 5)	LQ-TETH-5
LabQuest Lanyard	LQ-LAN
LabQuest Battery Boost 2	LQ-BOOST2
LabQuest SD Card	LQ-SD
Vernier Mini USB Cable	CB-USB-MINI
Vernier USB Type C to Mini USB Cable	CB-USB-C-MINI
For LabQuest 2 Only	
LabQuest 2 Lab Armor	LQ2-ARMOR
LabQuest 2 Stand	LQ2-STN
LabQuest 2 Battery	LQ2-BAT
LabQuest 2 Stylus (pkg. of 5)	LQ2-STYL-5
For Original LabQuest Only	
Original LabQuest Battery	LQ-BAT
Original LabQuest Stylus (pkg. of 5)	LQ-STYL-5

## Misc. Cables / Adapters / Power Supplies

Part Name	Order Code
AC Adapter (for LabPro, CBL 2, or CBL)	IPS
Analog Sensor Extension Cable (2 m)	EXT-BTA
Digital Sensor Extension Cable (2 m)	EXT-BTD
Analog ProtoBoard Connector	BTA-ELV
Digital ProtoBoard Connector	BTD-ELV
Go! Motion to Computer Cable	GMC-USB
LabPro USB Cable	CB-USB
Analog Bare Wire Cable	CB-BTA
Digital Bare Wire Cable	CB-BTD
Easy to Go! USB Adapter	MINI-USB
Go! to Easy USB Adapter	USB-MINI
Motion Detector Cable	MDC-BTD



# Lab Books

[www.vernier.com/books](http://www.vernier.com/books)



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- PDF files of all experiments for easy viewing on tablets and mobile devices
- Teacher information PDF files including sample data and graphs, a complete materials and supplies list, and other supplemental resources
- A searchable PDF of the entire book
- A generous site license—purchase once and share files with other instructors in your school or university department
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## How do I edit Vernier experiments in Google Docs™?

Have you ever wanted to edit Vernier experiments in Google Docs? You can easily edit Microsoft® Word® files in Google Docs:

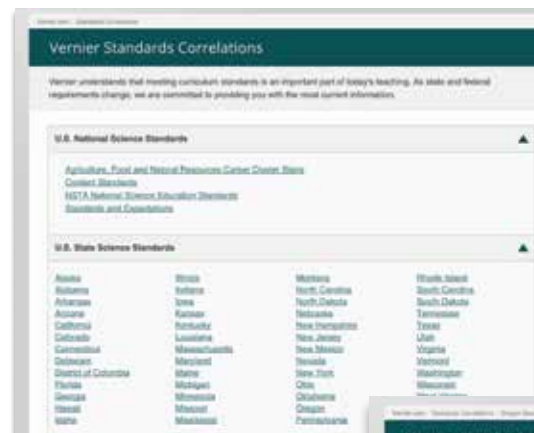
1. In Google Drive™, click the gear icon (Settings).
2. Choose Settings from the menu, and then select "Convert uploaded files to Google Docs editor format." Click Done.
3. Drag and drop Word files into Google Drive. Files will automatically start to upload and convert to Google Doc format.

## Helping You Meet Content Standards

Vernier understands that meeting curriculum standards is an important part of teaching. As state and federal requirements change, we are committed to providing you with the most current information. You will find alignments to the following standards for all lab books published by Vernier at [www.vernier.com/standards](http://www.vernier.com/standards)

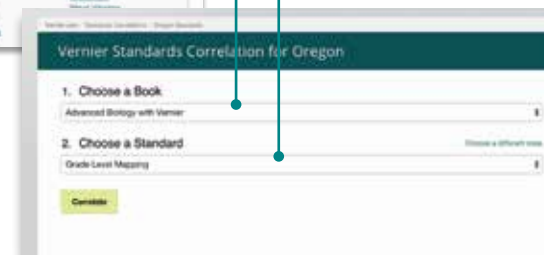
- Science standards for all 50 U.S. states
- Provincial standards for Canada
- NCTM (National Council for Teachers of Mathematics)
- AP and IB
- NSES (National Science Education Standards)
- ISTE (International Society for Technology Educators)

## Vernier Standards Correlation for Your State



Choose the book you'd like to correlate.

Choose the standard to which you'd like to correlate.



For more information, visit [www.vernier.com/standards](http://www.vernier.com/standards)



## Lab Books by Subject

Lab Books by Subject

	Appropriate for				Order Code		Page
	Primary	Middle School	Secondary	University	Electronic	Printed	
Biology							
<b>UPDATED</b> <i>Biology with Vernier</i> 4th Ed.	—	—	●	●	BWV-E	BWV	41
<i>Investigating Biology through Inquiry*</i>	—	—	●	●	BIO-I-E	BIO-I	42
<i>Advanced Biology with Vernier</i>	—	—	●	●	BIO-A-E	BIO-A	42
<i>Human Physiology with Vernier</i>	—	—	●	●	HP-A-E	HP-A	43
<i>Agricultural Science with Vernier</i>	—	—	●	—	AWV-E	AWV	43
Chemistry							
<i>Chemistry with Vernier</i> 4th Ed.	—	—	●	●	CWV-E	CWV	61
<i>Vernier Chemistry Investigations for Use with AP Chemistry</i> 4th Ed.*	—	—	●	—	APCHEM-E	APCHEM	62
<i>Investigating Chemistry through Inquiry</i> 4th Ed.	—	—	●	●	CHEM-I-E	CHEM-I	63
<i>Advanced Chemistry with Vernier</i> 4th Ed.	—	—	●	●	CHEM-A-E	CHEM-A	62
<i>Organic Chemistry with Vernier</i>	—	—	—	●	CHEM-O-E	CHEM-O	63
<i>Forensics with Vernier</i>	—	—	●	—	FWV-E	FWV	<a href="#">web</a>
Earth Science							
<i>Earth Science with Vernier</i>	—	●	●	—	ESV-E	ESV	67
Primary Science							
<b>UPDATED</b> <i>Elementary Science with Vernier</i> 4th Ed.	●	—	—	—	EWV-E	EWV	71
<i>Let's Go! Investigating Temperature</i>	●	—	—	—	ELB-TEMP-E	ELB-TEMP	<a href="#">web</a>
Engineering							
<i>Vernier Engineering Projects with LEGO® MINDSTORMS® Education EV3</i>	—	●	●	—	EP-EV3-E		79
<i>Engineering Projects with NI LabVIEW™ and Vernier</i>	—	—	●	●	EPV-E		79

Note: For supported software titles, see the appropriate page for that book.

## Lab Books by Subject

Lab Books by Subject	Appropriate for				Order Code		Page
	Primary	Middle School	Secondary	University	Electronic	Printed	
Environmental Science							
<i>Investigating Environmental Science through Inquiry*</i>	—	—	●	●	ESI-E	ESI	88
<i>Investigating Solar Energy</i>	●	●	—	—	ELB-SOLAR-E	ELB-SOLAR	71
<i>Investigating Wind Energy</i>	●	●	—	—	ELB-WIND-E	ELB-WIND	71
<i>Water Quality with Vernier</i>	—	●	●	●	WQV-E	WQV	89
<i>Renewable Energy with Vernier</i>	—	●	●	●	REV-E	REV	89
Middle School Science							
<i>Middle School Science with Vernier</i> 4th Ed.	—	●	—	—	MSV-E	MSV	95
Physical Science							
<i>Physical Science with Vernier</i> 4th Ed.	—	●	●	—	PSV-E	PSV	99
Physics							
<b>UPDATED</b> <i>Physics with Vernier</i> 4th Ed.	—	—	●	●	PWV-E	PWV	119
<b>NEW</b> <i>Physics Explorations and Projects</i>	—	—	●	●	PEP-E	PEP	120
<i>Advanced Physics with Vernier—Mechanics*</i>	—	—	●	●	PHYS-AM-E	PHYS-AM	120
<i>Advanced Physics with Vernier—Beyond Mechanics*</i>	—	—	●	●	PHYS-ABM-E	PHYS-ABM	121
<i>Physics with Video Analysis</i>	—	—	●	●	PVA-E	PVA	121
Mathematics							
<i>Real-World Math with Vernier</i>	—	—	●	—	RWV-E	RWV	<a href="#">web</a>
Spanish Lab Books							
<b>ESPAÑOL</b> <i>Química con Vernier</i>	<a href="http://www.vernier.com/cwv-es">www.vernier.com/cwv-es</a>	—	●	●	CWV-ES-E	CWV-ES	61
<b>ESPAÑOL</b> <b>NEW</b> <i>Física con Vernier</i>	<a href="http://www.vernier.com/pwv-es">www.vernier.com/pwv-es</a>	—	●	●	PWV-ES-E	PWV-ES	119
<b>ESPAÑOL</b> <i>Ciencias con lo Mejor de Vernier</i>	<a href="http://www.vernier.com/cmv-lp">www.vernier.com/cmv-lp</a>	—	●	—	CMV-LP-E	CMV-LP	<a href="#">web</a>
<b>ESPAÑOL</b> <i>Energía Renovable con Vernier</i>	<a href="http://www.vernier.com/rev-es">www.vernier.com/rev-es</a>	—	●	●	REV-ES-E	REV-ES	89
<b>ESPAÑOL</b> <i>Ciencia en la Primaria con Vernier</i>	<a href="http://www.vernier.com/cpv">www.vernier.com/cpv</a>	●	—	—	CPV-E	CPV	71

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Investigating plant pigments



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# Biology

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## Packages

Go Direct and LabQuest Packages pp. 32–34

## Go Direct Sensors

Sensor	Order Code	Page
<b>NEW</b> Go Direct Acceleration	GDX-ACC	104
<b>NEW</b> Go Direct CO <sub>2</sub> Gas	GDX-CO2	35
Go Direct Colorimeter	GDX-COL	50
Go Direct Conductivity	GDX-CON	50
<b>NEW</b> Go Direct EKG	GDX-EKG	36
Go Direct Gas Pressure	GDX-GP	36
Heart Rate Monitors		
Go Wireless Exercise Heart Rate	GW-EHR	<a href="#">web</a>
Go Wireless Heart Rate	GW-HR	36
<b>NEW</b> Go Direct O <sub>2</sub> Gas	GDX-O2	35
<b>NEW</b> Go Direct Optical Dissolved Oxygen	GDX-ODO	35
pH Sensors		
Go Direct pH	GDX-PH	36
<b>NEW</b> Go Direct Tris-Compatible Flat pH	GDX-FPH	52
<b>NEW</b> Go Direct Respiration Belt	GDX-RB	36
Go Direct SpectroVis Plus	GDX-SVISPL	39
Temperature Probes		
<b>NEW</b> Go Direct Surface Temperature	GDX-ST	36
Go Direct Temperature	GDX-TMP	53

## Related Content

Environmental Science pp. 80–89  
*Water Quality with Vernier* page 89

## LabQuest Sensors

Sensor	Order Code	Page
25-g Accelerometer	ACC-BTA	108
Blood Pressure Sensor	BPS-BTA	<a href="#">web</a>
CO <sub>2</sub> Gas Sensor	CO2-BTA	37
Colorimeter	COL-BTA	54
Conductivity Probe	CON-BTA	54
EKG Sensor	EKG-BTA	<a href="#">web</a>
Ethanol Sensor	ETH-BTA	38
Gas Pressure Sensor	GPS-BTA	55
Goniometer	GNM-BTA	<a href="#">web</a>
Hand Dynamometer	HD-BTA	38
Heart Rate Monitors		
Exercise Heart Rate Monitor	EHR-BTA	<a href="#">web</a>
Hand-Grip Heart Rate Monitor	HGH-BTA	38
O <sub>2</sub> Gas Sensor	O2-BTA	37
Optical DO Probe	ODO-BTA	37
PAR Sensor	PAR-BTA	38
pH Sensors		
pH Sensor	PH-BTA	56
Tris-Compatible Flat pH Sensor	FPH-BTA	38
Qubit Sensors		
Qubit EKG/EMG Sensor	Q-S207	<a href="#">web</a>
Qubit GSR Sensor	Q-S222	<a href="#">web</a>
Respiration Monitor Belt (requires Gas Pressure Sensor)	RMB	<a href="#">web</a>
Soil Moisture Sensor	SMS-BTA	85
Spirometer	SPR-BTA	38
Temperature Probes		
Stainless Steel Temperature Probe	TMP-BTA	38
Surface Temperature Sensor	STS-BTA	57

## Spectrophotometers

Equipment	Order Code	Page
Go Direct SpectroVis Plus	GDX-SVISPL	39
Vernier Fluorescence/UV-VIS Spectrophotometer	VSP-FUV	59
Vernier UV-VIS Spectrophotometer	VSP-UV	39

## Digital Microscopes

Equipment	Order Code	Page
Celestron Digital Microscope Imager	CS-DMI	40
ProScope 5MP Microscope Camera	BD-PS-MC5UW	40
USB Digital Microscope	BD-EDU-100	40
ProScope Micro Mobile	varies	40
ProScope Digital Microscope and Kits	varies	<a href="#">web</a>

## Accessories

Accessories and replacement parts page 40

## Lab Books

Title	Page
<b>UPDATED</b> <i>Biology with Vernier</i> 4th Edition	41
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<i>Advanced Biology with Vernier</i>	42
<i>Human Physiology with Vernier</i>	43
<i>Agricultural Science with Vernier</i>	43



# Go Direct™ Biology Packages



## Sensor Connection

Go Direct sensors connect directly via USB or Bluetooth®.



## 2–4 Students

Packages support one lab station of 2–4 students.



## Works with Your Existing Devices

Connect to your Chromebook™, mobile device, computer, or LabQuest 2.



## Collect Data with the FREE Graphical Analysis™ 4 App

No additional equipment or software purchase is necessary.



## Go Direct sensors are perfect for instructors who

- Are new to probeware
- Plan to equip a new school
- Are already using Chromebooks and mobile devices

## Deluxe Package

GDP-BIO-ODX

### Starter Package

GDP-BIO-ST



Go Direct Temperature



Go Wireless Heart Rate



Go Direct Gas Pressure



Go Direct CO<sub>2</sub> Gas



Go Direct O<sub>2</sub> Gas



Go Direct Conductivity



Go Direct pH



Go Direct Colorimeter



Go Direct Optical Dissolved Oxygen



Go Direct EKG



BioChamber 250



BioChamber 2000



Go Direct Respiration Belt

## You May Also Want

<b>NEW</b> Go Direct Charge Station	GDX-CRG	page 3
Go Direct SpectroVis® Plus	GDX-SVISPL	page 39
<b>NEW</b> Go Direct Surface Temperature	GDX-ST	page 36
Lab books for biology		pp. 41–43

Additional recommendations available at  
[www.vernier.com/packages](http://www.vernier.com/packages)

# LABQUEST Biology Packages



## Sensor Connection

LabQuest sensors connect to an interface from the LabQuest family.



## 2–4 Students

Packages support one lab station of 2–4 students.



## Standalone Device

Use LabQuest 2 as a standalone device with all Vernier sensors and built-in LabQuest App.

OR



## Wireless—One-to-Many

Transfer LabQuest 2 data wirelessly via Wi-Fi to one or more devices running Graphical Analysis 4 app.

OR



## Wired—One-to-One

LabQuest 2 works with Chromebooks and Windows® and macOS® computers.

## Deluxe Package

LQ2-BIO-ODX

### Starter Package



LabQuest 2



Stainless Steel Temperature Probe



Go Wireless Heart Rate



Gas Pressure Sensor



CO<sub>2</sub> Gas Sensor



O<sub>2</sub> Gas Sensor



Conductivity Probe



pH Sensor



Colorimeter



Vernier Optical DO Probe



EKG Sensor



BioChamber 250



BioChamber 2000



Go Direct Respiration Belt

LQ2-BIO-ST

## You May Also Want

LabQuest Charge Station	LQ2-CRG	page 13
LabQuest Viewer Software	LQ-VIEW	page 19
Go Direct SpectroVis Plus	GDX-SVISPL	page 39
Ethanol Sensor	ETH-BTA	page 38
Lab books for biology		pp. 41–43

Additional recommendations available at  
[www.vernier.com/packages](http://www.vernier.com/packages)

# LABQUEST Human Physiology Package



## Sensor Connection

LabQuest sensors connect to an interface from the LabQuest family.



## 2–4 Students

Packages support one lab station of 2–4 students.



## Standalone Device

Use LabQuest 2 as a standalone device with all Vernier sensors and built-in LabQuest App.

OR



## Wireless—One-to-Many

Transfer LabQuest 2 data wirelessly via Wi-Fi to one or more devices running Graphical Analysis™ 4 app.

OR



## Wired—One-to-One

LabQuest 2 works with Chromebooks™ and Windows® and macOS® computers.

## Deluxe Package

LQ2-HP-DLX



LabQuest 2



EKG Sensor



Go Wireless Heart Rate



Surface Temperature Sensor



Blood Pressure Sensor



Hand Dynamometer



Spirometer



O<sub>2</sub> Gas Sensor



O<sub>2</sub> Gas Sensor to Spirometer Adapter



25-g Accelerometer

## You May Also Want

LabQuest Charge Station	LQ2-CRG	page 13
LabQuest Viewer Software	LQ-VIEW	page 19
<b>NEW</b> Go Direct Respiration Belt	GDX-RB	page 36
Goniometer	GNM-BTA	<a href="http://www.vernier.com/gnm-bta">www.vernier.com/gnm-bta</a>
<i>Human Physiology with Vernier</i>	HP-A	page 43

Additional recommendations available at  
[www.vernier.com/packages](http://www.vernier.com/packages)



Measuring the rate of transpiration

#### Connection



Connects directly via USB or Bluetooth® to your device

#### Compatible platforms



Chromebook



Computer



iOS device



Android™ device



LabQuest 2

#### Software



FREE Graphical Analysis 4, LabQuest App (LabQuest 2 only)



For LabQuest sensors, see pp. 37–39.

## NEW Go Direct CO<sub>2</sub> Gas

GDX-CO2

Monitor changes in carbon dioxide, temperature, and relative humidity easily with Go Direct CO<sub>2</sub> Gas. This sensor includes built-in temperature compensation and humidity protection. A 250 mL respiration chamber is included for running controlled experiments with small plants and animals.

[www.vernier.com/gdx-co2](http://www.vernier.com/gdx-co2)



## NEW Go Direct O<sub>2</sub> Gas

GDX-O2

Go Direct O<sub>2</sub> Gas measures gaseous oxygen concentration and air temperature. This sensor has a wide measurement range, which is ideal for studying human and cellular respiration. A 250 mL respiration chamber is included for running controlled experiments with small plants and animals.

[www.vernier.com/gdx-o2](http://www.vernier.com/gdx-o2)



## NEW Go Direct Optical Dissolved Oxygen

GDX-ODO

Go Direct Optical Dissolved Oxygen combines the power of multiple sensors to measure dissolved oxygen, water temperature, and atmospheric pressure. Ideal for experiments in biology, ecology, and environmental science courses, this probe uses luminescent technology to provide fast, easy, and accurate results.

[www.vernier.com/gdx-odo](http://www.vernier.com/gdx-odo)



## Go Direct Optical Dissolved Oxygen Replacement Cap

[www.vernier.com/gdx-odo-cap](http://www.vernier.com/gdx-odo-cap)

GDX-ODO-CAP



## Go Wireless® Heart Rate

GW-HR

### Compatible with Chrome™

The Vernier Go Wireless Heart Rate is ideal for continuously monitoring heart rate before, during, and after exercise or while a person is stationary. Data are wirelessly transmitted to LabQuest 2, iOS devices, or Android™ devices.

[www.vernier.com/gw-hr](http://www.vernier.com/gw-hr)



## Exercise Heart Rate Strap

HR-STRAP

[www.vernier.com/hr-strap](http://www.vernier.com/hr-strap)

## NEW Go Direct Surface Temperature

GDX-ST

Designed for use in situations in which low thermal mass or flexibility is required, Go Direct Surface Temperature has an exposed thermistor that results in an extremely rapid response time. This design allows for use in air and water.

[www.vernier.com/gdx-st](http://www.vernier.com/gdx-st)



## Go Direct Gas Pressure

GDX-GP

Monitor the pressure of a gas (up to 400 kPa) throughout various experiments. Determine reaction rates, investigate transpiration, study cell respiration, and more. Includes a syringe, tubing, and stoppers to simplify setup for experiments.

[www.vernier.com/gdx-gp](http://www.vernier.com/gdx-gp)



## Go Direct pH

GDX-PH

Conduct acid-base titrations, monitor pH change during chemical reactions, test the pH and alkalinity of bodies of water, investigate household acids and bases, or examine the cause and effect of acid rain.

### Go Direct pH Teacher Pack

GDX-PH-TP

Includes eight Go Direct pH Sensors and a Go Direct Charge Station.

[www.vernier.com/gdx-ph](http://www.vernier.com/gdx-ph)



## NEW Go Direct EKG

GDX-EKG

Go Direct EKG measures electrical activity in the heart and electrical signals produced during muscle contractions. This sensor provides two separate outputs: one optimized for standard 3-lead EKG tracings and one optimized for surface EMG recordings.

[www.vernier.com/gdx-ekg](http://www.vernier.com/gdx-ekg)



## NEW Go Direct Respiration Belt

GDX-RB

Go Direct Respiration Belt uses a force sensor and an adjustable nylon strap around the chest to measure respiration effort and respiration rate. Respiration rate is reported in the data-collection software, which makes it easy to do comparison studies between subjects or experiments.

[www.vernier.com/gdx-rb](http://www.vernier.com/gdx-rb)



# LABQUEST Sensors

Investigating primary productivity using the Vernier Optical DO Probe



## Connection



Requires an interface from the LabQuest family

## LabQuest family



LabQuest 2 pp. 10–13



LabQuest Stream page 14



LabQuest Mini page 15

## Compatible platforms



Chromebook™



Computer



iOS device



Android device

## Software



LabQuest App, Logger Pro, Graphical Analysis™ 4



For Go Direct sensors, see pp. 35–36.

## Vernier Optical DO Probe

### ODO-BTA

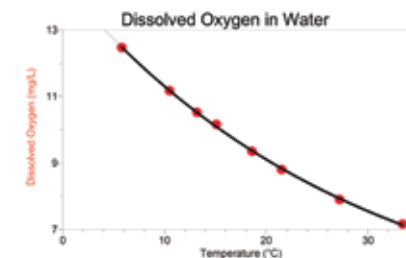
The Vernier Optical DO Probe uses luminescent technology to provide fast, easy, and accurate measurements of dissolved oxygen concentrations, making it a terrific choice for biology, ecology, or environmental science courses.

- Plug-and-play technology—no filling solution, warm-up time, calibration, or stirring necessary
- Built-in temperature and pressure compensation
- Easy maintenance

[www.vernier.com/odo-bta](http://www.vernier.com/odo-bta)



Range	0 to 20 mg/L, 0 to 300% saturation
Response time	90% of final reading in 40 seconds
Temperature compensation	automatic from 0 to 50°C
Pressure compensation	automatic from 228 mmHg to 1519 mmHg



Saturated dissolved oxygen at various temperatures

## CO<sub>2</sub> Gas Sensor

### CO2-BTA

The CO<sub>2</sub> Gas Sensor measures gaseous carbon dioxide and supports cellular respiration and photosynthetic metabolism studies as well as investigations into human respiratory changes in CO<sub>2</sub> based on exercise. Includes a 250 mL respiration chamber.

Low range 0 to 10,000 ppm

High range 0 to 100,000 ppm

[www.vernier.com/co2-bta](http://www.vernier.com/co2-bta)



## O<sub>2</sub> Gas Sensor

### O2-BTA

The O<sub>2</sub> Gas Sensor measures oxygen concentration in air and can be used to study human and cellular respiration. Includes a 250 mL respiration chamber.

Range 0 to 27%  
(0 to 270 ppt)

Normal operating temperature range 25°C (±5°C)

[www.vernier.com/o2-bta](http://www.vernier.com/o2-bta)



## Hand-Grip Heart Rate Monitor

HGH-BTA

The Hand-Grip Heart Rate Monitor makes it easy to monitor heart rate before, during, and after exercise. Data from the hand-grips are wirelessly transmitted to the data-collection device via Bluetooth® or by using the included receiver.

[www.vernier.com/hgh-bta](http://www.vernier.com/hgh-bta)



## Exercise Heart Rate Strap

HR-STRAP

[www.vernier.com/hr-strap](http://www.vernier.com/hr-strap)

## Spirometer

SPR-BTA

The Spirometer is designed to make human respiratory measurements at rest and during moderate activity. Use it to perform a variety of experiments related to air flow and lung volume. The removable flow head makes it easy to clean and sterilize.

Flow range  $\pm 600$  L/min

Dead space 93 mL

[www.vernier.com/spr-bta](http://www.vernier.com/spr-bta)



## Tris-Compatible Flat pH Sensor

FPH-BTA

Compatible with Tris buffers and solutions containing proteins. The flat glass shape makes it ideal for measuring the pH of semisolids, such as food or soil.

[www.vernier.com/fph-bta](http://www.vernier.com/fph-bta)



## Stainless Steel Temperature Probe

TMP-BTA

This rugged and durable temperature probe has a sealed stainless steel shaft that can be used in organic liquids, salt solutions, acids, and bases.

Range  $-40$  to  $135^{\circ}\text{C}$

[www.vernier.com/tmp-bta](http://www.vernier.com/tmp-bta)



## PAR Sensor

PAR-BTA

The PAR (Photosynthetically Active Radiation) Sensor reports the power of electromagnetic radiation in the spectral range that is used by plants for photosynthesis. The waterproof sensor head makes it ideal for agricultural and environmental science investigations related to photosynthesis and primary productivity.

Range 0 to  $2000 \mu\text{mol m}^{-2} \text{s}^{-1}$  in full sun

Wavelength range 410 to 655 nm

[www.vernier.com/par-bta](http://www.vernier.com/par-bta)



*Using a PAR Sensor to monitor the amount of photosynthetically active radiation available for photosynthesis outside*

## Ethanol Sensor

ETH-BTA

Use the Ethanol Sensor to measure the concentration of ethanol in air above an aqueous sample.

Range 0 to 3%

[www.vernier.com/eth-bta](http://www.vernier.com/eth-bta)



## Hand Dynamometer

HD-BTA

Our Hand Dynamometer can be used to measure grip strength or finger-pinch strength alone or in combination with EMG recordings for detailed studies of muscular activity.

Force range 0 to 600 N

Typical accuracy  $\pm 0.6$  N

[www.vernier.com/hd-bta](http://www.vernier.com/hd-bta)



## BlueView Transilluminator

### BLUE-VIEW

The BlueView Transilluminator, utilizing super-bright blue LEDs to illuminate fluorescent-stained electrophoresis gels, is a safer alternative to a UV transilluminator. Stain and gels are not included.

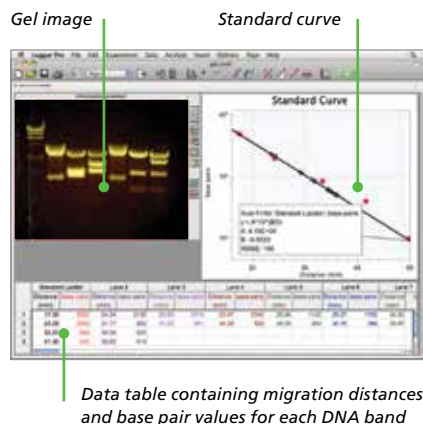
- Accommodates gels up to 15 × 12 cm with a viewing area of 11 × 11 cm
- Can be used with a variety of fluorescent stains such as SYBR® Safe

For a complete imaging system that includes a digital camera, see the Blue Digital Bioimaging System at [www.vernier.com/bl-dbs](http://www.vernier.com/bl-dbs)

## Four Easy Steps for Gel Analysis

Vernier provides tools for digital photodocumentation and analysis of gel electrophoresis.

- 1 Run your gel.
- 2 Use our BlueView Transilluminator to image your gel.
- 3 Use a digital camera to capture a digital photo of the gel in Logger Pro, or take a picture with your cell phone and simply import into Logger Pro.
- 4 Use the Gel Analysis feature in Logger Pro to create a standard curve and determine the number of base pairs in each experimental band.



## Did you know?

BIO-RAD

Bio-Rad® combines high-quality supplies, equipment, and curricula with outstanding customer service and technical support—things we believe are important to teachers. Vernier and Bio-Rad enhance classroom experiences with joint experiments and curricula for biotechnology. Find additional information on biotechnology at [www.vernier.com/biotech](http://www.vernier.com/biotech)

## Spectrometers

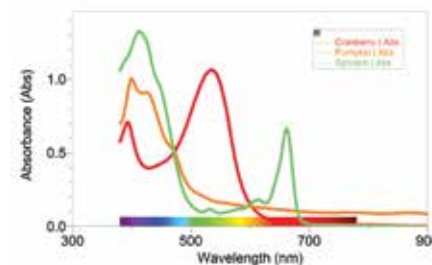
## Go Direct™ SpectroVis® Plus

### GDX-SVISPL

Introduce your students to spectroscopy with the affordable Go Direct SpectroVis Plus. Students can easily collect a full wavelength spectrum (absorbance, percent transmission, fluorescence, or intensity), study absorbance vs. concentration (Beer's law), or monitor rates of reaction (kinetics). Collect and analyze data using Vernier Spectral Analysis™ App, LabQuest App, or Logger Pro 3.

**Wavelength range** 380 to 950 nm

[www.vernier.com/gdx-svispl](http://www.vernier.com/gdx-svispl)



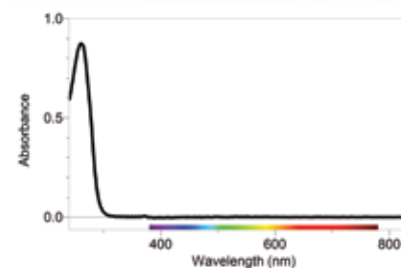
## Vernier UV-VIS Spectrophotometer

### VSP-UV

The Vernier UV-VIS Spectrophotometer is a portable ultraviolet and visible light spectrophotometer. It is ideal for measuring the absorbance spectra of various biochemical compounds, including DNA and proteins. Use it for kinetics studies such as enzyme assays as well.

**Wavelength range** 220 to 850 nm

[www.vernier.com/vsp-uv](http://www.vernier.com/vsp-uv)





## Digital Microscopes

### Recommended platforms



Chromebook™



Computer  
(macOS® and Windows®)

## USB Digital Microscope

**BD-EDU-100**

This 5 megapixel USB Digital Microscope connects to a computer, Chromebook, or LabQuest 2. It features 10–300× magnification with manual focus and an adjustable LED light source. In addition to capturing still images, you can also record short videos and time-lapse sequences.\*

[www.vernier.com/bd-edu-100](http://www.vernier.com/bd-edu-100)



BOTH  
WORK WITH  
LABQUEST 2  
See pp. 10–11.

## Celestron® Digital Microscope Imager

**CS-DMI**

**CS-5MP**

The Celestron Digital Microscope Imager turns your traditional compound or stereo microscope into a high-resolution digital imager using a computer, Chromebook, or LabQuest 2. The imager replaces the eyepiece of the microscope and connects via USB directly to your device.

[www.vernier.com/cs-dmi](http://www.vernier.com/cs-dmi)



\*Movies and time lapse only supported on computers

### Recommended platforms



iOS Device



Android™ Device

## ProScope™ Micro Mobile

The ProScope Micro Mobile is a professional-level microscope made for use with iPhone®, iPod touch®, iPad®, iPad Air®, iPad mini™, and Galaxy S®4.

For additional ProScope options and more information, visit [www.vernier.com/bd-pmm](http://www.vernier.com/bd-pmm)



## ProScope 5MP Microscope Camera

**BD-PS-MC5UW**

The ProScope 5MP Microscope Camera is a Wi-Fi and USB camera that simply replaces the eyepiece of a traditional compound or stereo microscope. This turns your personal computer, Chromebook, iPad, or Android device into a high-resolution camera for capturing high-quality digital images. With the Wi-Fi option, you can wirelessly send images to multiple iOS or Android devices.

[www.vernier.com/bd-ps-mc5uw](http://www.vernier.com/bd-ps-mc5uw)



## Accessories and Replacement Parts

Part Name	Order Code
<b>CO<sub>2</sub> and/or O<sub>2</sub> Gas</b>	
BioChamber 250 (250 mL) (2 openings)	BC-250
BioChamber 2000 (2000 mL) (2 openings)	BC-2000
<b>EKG</b>	
EKG Electrodes	ELEC
<b>Gas Pressure</b>	
Gas Pressure Sensor Bulb (set of 4)	GPS-BULB4
Gas Pressure Sensor Replacement Parts	PS-ACC
<b>Optical Dissolved Oxygen Probes</b>	
Go Direct Optical Dissolved Oxygen Replacement Cap (for GDX-ODO)	GDX-ODO-CAP
Optical DO Probe Metal Guard	ODO-GRD
Optical DO Probe Replacement Cap (for ODO-BTA)	ODO-CAP
<b>pH</b>	
pH Buffer Capsules Kit	PH-BUFCAP
pH Storage Solution (500 mL)	PH-SS
<b>Spirometer</b>	
Disposable Bacterial Filter (pkg. of 30)	SPR-FIL30
Disposable Mouthpiece (pkg. of 100)	SPR-MP100
Noseclip (pkg. of 30)	SPR-NOSE30
O <sub>2</sub> Gas Sensor to Spirometer Adapter	O2-SPR
Spirometer Flow Head	SPR-FLOW

## Lab Books

### Enhance Your Curriculum with Vernier Lab Books

Enhance your curriculum with our award-winning lab books, which are available as eco-friendly electronic downloads in addition to the traditional print format. Now you'll always have access to the most up-to-date versions of the experiments through your Vernier account.

- Download word-processing files to customize the experiments to fit your curricular needs.
- Electronic versions include a generous site license—purchase once and share files with other instructors in your school or university department.

#### Biology Lab Books

Subjects	<i>Biology with Vernier</i> 4th Edition	<i>Investigating Biology</i> through Inquiry	<i>Advanced Biology</i> with Vernier	<i>Human Physiology</i> with Vernier	<i>Agricultural Science</i> with Vernier
Life Science	●				
Secondary Biology	●	●			
AP* Biology	●	●	●		
IB† Biology	●	●	●		
Agricultural Science					●
Anatomy and Physiology				●	
University Biology	●	●	●	●	

\* AP and Advanced Placement Program are registered trademarks of the College Entrance Examination Board, which was not involved in the production of and does not endorse this product.

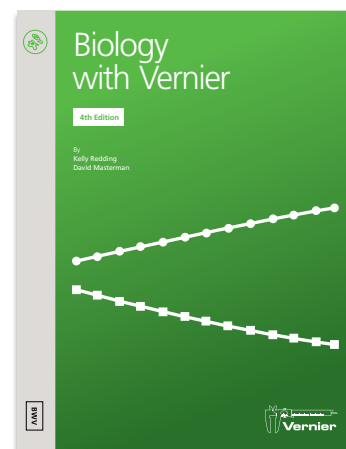
† The IB Diploma Program is an official program of the International Baccalaureate Organization (IBO) which authorizes schools to offer it. The material available here has been developed independently of the IBO and is not endorsed by it.

**UPDATED**

### *Biology with Vernier* 4th Edition

SECONDARY

UNIVERSITY



Electronic Lab Book Only

BWV-E

Printed + Electronic Lab Book

BWV

Topics include

- Cellular respiration
- Photosynthesis
- Enzymes
- Environmental science
- Human physiology

For a complete list of all 31 experiments, visit [www.vernier.com/bwv](http://www.vernier.com/bwv)

#### Sensors Used

Sensor	Page
Temperature	38, 53
Heart Rate	36, 38
Gas Pressure	36, 55
CO <sub>2</sub> Gas	35, 37
O <sub>2</sub> Gas	35, 37
Conductivity	50, 54
pH	36, 56
Colorimeter	50, 54
Dissolved Oxygen	35, 37
EKG	36, <a href="http://www.vernier.com/ekg-bta">www.vernier.com/ekg-bta</a>
Respiration Belt	36, <a href="http://www.vernier.com/rmb">www.vernier.com/rmb</a>

#### Additional Products

Equipment	Page
BioChamber 250	40
BioChamber 2000	40
Stir Station	58
Primary Productivity Kit	24
Water Quality Bottles	88

#### Supported Software

Software	Page
Logger Pro	20–21
LabQuest App	11–12
Graphical Analysis™ 4	16–17
Spectral Analysis	18
EasyData	<a href="http://www.vernier.com/easydata">www.vernier.com/easydata</a>

# Investigating Biology through Inquiry

SECONDARY

UNIVERSITY



Electronic Lab  
Book Only

BIO-I-E

Printed +  
Electronic  
Lab Book

BIO-I

Topics include

- Cellular respiration
- Photosynthesis
- Enzyme action
- Evolution
- Ecology
- Human physiology

For a complete list of all 22 investigations, visit [www.vernier.com/bio-i](http://www.vernier.com/bio-i)

## Sensors Used

Sensor	Page
Temperature	38, 53
Gas Pressure	36, 55
Spectrometer	39
CO <sub>2</sub> Gas	35, 37
Conductivity	50, 54
Dissolved Oxygen	35, 37
O <sub>2</sub> Gas	35, 37
Heart Rate	36, 38
pH	36, 56

## Additional Products

Equipment	Page
Primary Productivity Kit	24
Stir Station	58

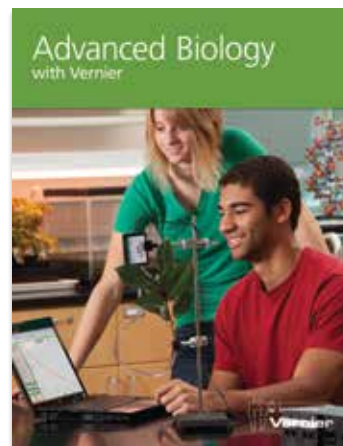
## Supported Software

Software	Page
Logger Pro	20–21
LabQuest App	11–12

# Advanced Biology with Vernier

SECONDARY

UNIVERSITY



Electronic Lab  
Book Only

BIO-A-E

Printed +  
Electronic  
Lab Book

BIO-A

Topics include

- Cellular respiration
- Photosynthesis
- Enzymes
- Biotechnology
- Environmental science
- Human physiology

For a complete list of all 17 experiments, visit [www.vernier.com/bio-a](http://www.vernier.com/bio-a)

## Sensors Used

Sensor	Page
Temperature	38, 53
Gas Pressure	36, 55
Conductivity	50, 54
CO <sub>2</sub> Gas	35, 37
O <sub>2</sub> Gas	35, 37
Dissolved Oxygen	35, 37
Heart Rate	36, 38
Blood Pressure	<a href="http://www.vernier.com/bps-bta">www.vernier.com/bps-bta</a>
Spectrometer	39

## Additional Products

Equipment	Page
BioChamber 250	40
BlueView Transilluminator	39
Primary Productivity Kit	24

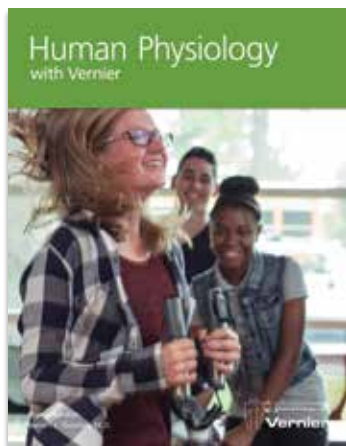
## Supported Software

Software	Page
Logger Pro	20–21
LabQuest App	11–12
EasyData	<a href="http://www.vernier.com/easydata">www.vernier.com/easydata</a>

## Human Physiology with Vernier

SECONDARY

UNIVERSITY



Electronic Lab  
Book Only

HP-A-E

Printed +  
Electronic  
Lab Book

HP-A

Topics include

- Heart rate and EKG
- Blood pressure
- Lung function and analysis
- Muscle action
- Reflex activity
- Aerobic metabolism

For a complete list of all 24 experiments,  
visit [www.vernier.com/hp-a](http://www.vernier.com/hp-a)

### Sensors Used

Sensor	Page
EKG	36, <a href="http://www.vernier.com/ekg-bta">www.vernier.com/ekg-bta</a>
Heart Rate	36, 38
Surface Temperature	36, 57
Blood Pressure	<a href="http://www.vernier.com/bps-bta">www.vernier.com/bps-bta</a>
Hand Dynamometer	38
Spirometer	38
O <sub>2</sub> Gas	35, 37
Accelerometer	104, 108

### Additional Products

Equipment	Page
O <sub>2</sub> Gas Sensor to Spirometer Adapter	40

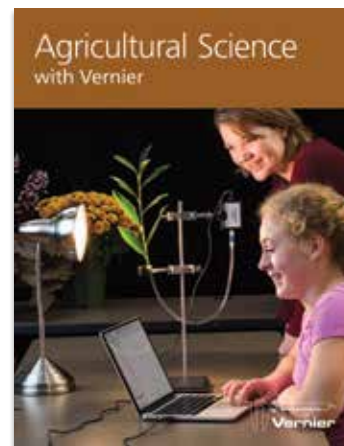
### Supported Software

Software	Page
Logger Pro	20–21
LabQuest App	11–12

## Agricultural Science with Vernier

SECONDARY

UNIVERSITY



Electronic Lab  
Book Only

AWV-E

Printed +  
Electronic  
Lab Book

AWV

Topics include

- Fundamentals of agriculture
- Plant and soil science
- Animal science
- Energy and electricity

For a complete list of all 29 experiments,  
visit [www.vernier.com/awv](http://www.vernier.com/awv)

### Sensors Used

Sensor	Page
Temperature	38, 53
Tris-Compatible pH	38, 52
Conductivity	50, 54
CO <sub>2</sub> Gas	35, 37
Ethanol	38
Dissolved Oxygen	35, 37
Current	105, 112
Gas Pressure	36, 55
O <sub>2</sub> Gas	35, 37
Light	84, 115
Soil Moisture	85

### Additional Products

Equipment	Page
BioChamber 250	40
BioChamber 2000	40

### Supported Software

Software	Page
Logger Pro	20–21
LabQuest App	11–12
EasyData	<a href="http://www.vernier.com/easydata">www.vernier.com/easydata</a>



Performing an acid-base titration



View our Tech Tips instructional video at  
[www.vernier.com/videos](http://www.vernier.com/videos)



# Chemistry

[www.vernier.com/chemistry](http://www.vernier.com/chemistry)

## Packages

Go Direct and LabQuest packages pp. 46–49

## Go Direct Sensors

Sensor	Order Code	Page
Go Direct Colorimeter	GDX-COL	50
Go Direct Conductivity	GDX-CON	50
Go Direct Constant Current System	GDX-CCS	51
<b>NEW</b> Go Direct Current	GDX-CUR	105
Go Direct Drop Counter	GDX-DC	51
Go Direct Electrode Amplifier	GDX-EA	51
Go Direct Gas Pressure	GDX-GP	51
Go Direct Melt Station	GDX-MLT	51
Go Direct ORP	GDX-ORP	52
pH Sensors		
<b>NEW</b> Go Direct Glass-Body pH	GDX-GPH	52
Go Direct pH	GDX-PH	52
<b>NEW</b> Go Direct Tris-Compatible Flat pH	GDX-FPH	52
Go Direct Radiation Monitor	GDX-RAD	52
Go Direct SpectroVis® Plus	GDX-SVISPL	53
Temperature Probes		
<b>NEW</b> Go Direct Surface Temperature	GDX-ST	53
Go Direct Temperature	GDX-TMP	53
<b>NEW</b> Go Direct Wide-Range Temperature	GDX-WRT	53
Go Direct Voltage	GDX-VOLT	53

## LabQuest Sensors

Sensor	Order Code	Page
Colorimeter	COL-BTA	54
Conductivity Probes		
Conductivity Probe	CON-BTA	54
Platinum-Cell Conductivity Probe	CONPT-BTA	54

## Current Probes

Constant Current System	CCS-BTA	55
Current Probe	DCP-BTA	55
Drop Counter	VDC-BTD	55
Electrode Amplifier	EA-BTA	55

## Gas Pressure Sensors

Gas Pressure Sensor	GPS-BTA	55
Pressure Sensor 400	PS400-BTA	55
Instrumentation Amplifier	INA-BTA	55
Melt Station	MLT-BTA	56
ORP Sensor	ORP-BTA	56

## pH Sensors

Glass-Body pH Electrode BNC (requires Electrode Amplifier)	GPH-BNC	56
pH Sensor	PH-BTA	56
Tris-Compatible Flat pH Sensor	FPH-BTA	38
Polarimeter (Chemical)	CHEM-POL	56
Vernier Radiation Monitor	VRM-BTD	57

## Temperature Probes

Stainless Steel Temperature Probe	TMP-BTA	57
Surface Temperature Sensor	STS-BTA	57
Thermocouple	TCA-BTA	57
Wide-Range Temperature Probe	WRT-BTA	57

## Voltage Probes

Differential Voltage Probe	DVP-BTA	57
Voltage Probe	VP-BTA	57

## Balances

Balances	Order Code	Page
OHAUS Scout (120 g)	OHS-123	58
OHAUS Scout (220 g)	OHS-222	58
OHAUS Scout (420 g)	OHS-422	58

## Gas Chromatograph

Gas Chromatograph	Order Code	Page
Mini GC Plus Gas Chromatograph	GC2-MINI	58

## Lab Equipment

Equipment	Order Code	Page
Electrode Support	ESUP	58
Stir Station	STIR	58

## Spectrometers

Spectrometers	Order Code	Page
Go Direct SpectroVis Plus	GDX-SVISPL	59
Vernier Emissions Spectrometer	VSP-EM	59
Vernier Flash Photolysis Spectrometer	VSP-FP	59
Vernier Fluorescence/UV-VIS Spectrophotometer	VSP-FUV	59
Vernier Spectrometer (Ocean Optics™)	V-SPEC	<a href="#">web</a>
Vernier UV-VIS Spectrophotometer	VSP-UV	59

## Accessories

Accessories and replacement parts page 60

## Lab Books

Title	Page
<i>Chemistry with Vernier</i> 4th Edition	61
<i>Advanced Chemistry with Vernier</i> 4th Edition	62
<i>Vernier Chemistry Investigations for Use with AP Chemistry</i> 4th Edition	62
<i>Investigating Chemistry through Inquiry</i> 4th Edition	63
<i>Organic Chemistry with Vernier</i>	63
<i>Química con Vernier</i>	61

# Go Direct™ Chemistry Packages



## Sensor Connection

Go Direct sensors connect directly via USB or Bluetooth.®



## 2–4 Students

Packages support one lab station of 2–4 students.



## Works with Your Existing Devices

Connect to your Chromebook,™ mobile device, computer, or LabQuest 2.



## Collect Data with the FREE Graphical Analysis™ 4 App

No additional equipment or software purchase is necessary.



## Go Direct sensors are perfect for instructors who

- Are new to probeware
- Plan to equip a new school
- Are already using Chromebooks and mobile devices

## Deluxe Package

GDP-CH-DX

### Starter Package

GDP-CH-ST



Go Direct Temperature (x2)



Go Direct pH



Go Direct Voltage



Go Direct Gas Pressure



Go Direct Conductivity



Go Direct Colorimeter



Go Direct Drop Counter

## You May Also Want

<b>NEW</b> Go Direct Charge Station	GDX-CRG	page 3
Go Direct SpectroVis® Plus	GDX-SVISPL	page 53
Electrode Support	ESUP	page 58
Stir Station	STIR	page 58
Chemistry with Vernier	CWV	page 61
Investigating Chemistry through Inquiry	CHEM-I	page 63

Additional recommendations available at  
[www.vernier.com/packages](http://www.vernier.com/packages)

# LABQUEST Chemistry Packages



## Sensor Connection

LabQuest sensors connect to an interface from the LabQuest family.



## 2–4 Students

Packages support one lab station of 2–4 students.



## Standalone Device

Use LabQuest 2 as a standalone device with all Vernier sensors and built-in LabQuest App.

OR



## Wireless—One-to-Many

Transfer LabQuest 2 data wirelessly via Wi-Fi to one or more devices running Graphical Analysis 4 app.

OR



## Wired—One-to-One

LabQuest 2 works with Chromebooks and Windows® and macOS® computers.

## Deluxe Package

LQ2-CH-DX

### Starter Package

LQ2-CH-ST



LabQuest 2



Stainless Steel Temperature Probe (x2)



pH Sensor



Voltage Probe



Gas Pressure Sensor



Conductivity Probe



Colorimeter



Drop Counter

## You May Also Want

LabQuest Charge Station	LQ2-CRG	page 13
LabQuest Viewer Software	LQ-VIEW	page 19
Go Direct SpectroVis Plus	GDX-SVISPL	page 59
Electrode Support	ESUP	page 58
Stir Station	STIR	page 58
Chemistry with Vernier	CWV	page 61
Investigating Chemistry through Inquiry	CHEM-I	page 63

Additional recommendations available at  
[www.vernier.com/packages](http://www.vernier.com/packages)



# Go Direct™ Advanced Chemistry Package



## Sensor Connection

Go Direct sensors connect directly via USB or Bluetooth.®



## 2–4 Students

Packages support one lab station of 2–4 students.



## Works with Your Existing Devices

Connect to your Chromebook,™ mobile device, computer, or LabQuest 2.



## Collect Data with the FREE Graphical Analysis™ 4 App

No additional equipment or software purchase is necessary.



## Go Direct sensors are perfect for instructors who

- Are new to probeware
- Plan to equip a new school
- Are already using Chromebooks and mobile devices

## Deluxe Package

GDP-CHMA-SV



Go Direct Temperature



Go Direct pH



Go Direct Gas Pressure



Go Direct Voltage



Go Direct Conductivity



Go Direct Drop Counter



Go Direct Constant Current System



Go Direct ORP Sensor



Go Direct SpectroVis Plus

## You May Also Want

<b>NEW</b> Go Direct Charge Station	GDX-CRG	page 3
Go Direct Melt Station	GDX-MLT	page 51
Go Direct Radiation Monitor	GDX-RAD	page 52
Electrode Support	ESUP	page 58
Stir Station	STIR	page 58
<i>Advanced Chemistry with Vernier</i>	CHEM-A	page 62

Additional recommendations available at  
[www.vernier.com/packages](http://www.vernier.com/packages)

# LABQUEST Advanced Chemistry Package



## Sensor Connection

LabQuest sensors connect to an interface from the LabQuest family.



## 2–4 Students

Packages support one lab station of 2–4 students.



## Standalone Device

Use LabQuest 2 as a standalone device with all Vernier sensors and built-in LabQuest App.

OR



## Wireless—One-to-Many

Transfer LabQuest 2 data wirelessly via Wi-Fi to one or more devices running Graphical Analysis 4 app.

OR



## Wired—One-to-One

LabQuest 2 works with Chromebooks and Windows® and macOS® computers.

## Deluxe Package

LQ2-CHMA-SV



LabQuest 2



Stainless Steel Temperature Probe



pH Sensor



Gas Pressure Sensor



Voltage Probe



Conductivity Probe



Drop Counter



Constant Current System



ORP Sensor



Go Direct SpectroVis Plus

## You May Also Want

LabQuest Charge Station	LQ2-CRG	page 13
LabQuest Viewer Software	LQ-VIEW	page 19
Melt Station	MLT-BTA	page 56
Vernier Radiation Monitor	VRM-BTD	page 57
Electrode Support	ESUP	page 58
Stir Station	STIR	page 58
Advanced Chemistry with Vernier	CHEM-A	page 62

Additional recommendations available at  
[www.vernier.com/packages](http://www.vernier.com/packages)



Conducting an acid-base titration using Go Direct pH, Go Direct Drop Counter, and Stir Station

#### Connection



Connects directly via USB or Bluetooth® to your device

#### Compatible platforms



Chromebook™



Computer



iOS device



Android™ device



LabQuest 2

#### Software



FREE Graphical Analysis™ 4, LabQuest App (LabQuest 2 only)



For LabQuest sensors, see pp. 54–57.

## Go Direct Colorimeter

### GDX-COL

Use this sensor to explore absorbance and percent transmittance in a variety of experiments including Beer's law (absorbance vs. concentration) and kinetic studies (concentration vs. time). Students select between four wavelengths (430 nm, 470 nm, 565 nm, and 635 nm) to set up their experiment.

[www.vernier.com/gdx-col](http://www.vernier.com/gdx-col)



## Go Direct Conductivity

### GDX-CON

Investigate the difference between ionic and molecular compounds or measure Total Dissolved Solids (TDS). Our Go Direct Conductivity determines the ionic content of an aqueous solution by measuring its electrical conductivity (up to 20,000  $\mu\text{S}/\text{cm}$ ). The sensor includes automatic temperature compensation for general use that can be turned off to perform conductivity studies as a function of temperature.

[www.vernier.com/gdx-con](http://www.vernier.com/gdx-con)



## Go Direct Constant Current System

### GDX-CCS

Determine Avogadro's number and perform various electroplating and electrolysis experiments. This system combines a DC power source with a built-in current sensor to eliminate the need for a separate power supply. It can deliver up to 0.6 A at 5 V DC.

[www.vernier.com/gdx-ccs](http://www.vernier.com/gdx-ccs)



## Go Direct Drop Counter

### GDX-DC

Our Go Direct Drop Counter precisely records the number of drops of titrant added during a titration and then automatically converts it to volume. Use in conjunction with our Go Direct pH, Go Direct Conductivity, or Go Direct ORP to perform acid-base, conductometric, or potentiometric titrations.

[www.vernier.com/gdx-dc](http://www.vernier.com/gdx-dc)



## Go Direct Electrode Amplifier

### GDX-EA

The versatility of the Electrode Amplifier makes it possible to collect data from electrodes that have a BNC connector.

[www.vernier.com/gdx-ea](http://www.vernier.com/gdx-ea)



## Go Direct Gas Pressure

### GDX-GP

Monitor the pressure of a gas (up to 400 kPa) throughout various chemistry experiments. Explore the properties of gas, determine reaction rates, investigate pressure-volume or temperature-pressure relationships, and more. Includes a syringe, tubing, and stoppers to simplify setup for experiments, such as Boyle's law.

[www.vernier.com/gdx-gp](http://www.vernier.com/gdx-gp)



## Go Direct Melt Station

### GDX-MLT

Teach students the visual detection capillary method of melting point determination with Go Direct Melt Station. It accurately measures melting temperatures of a solid (up to 260°C), and the real-time graphing provides a unique perspective of the melting process.

[www.vernier.com/gdx-mlt](http://www.vernier.com/gdx-mlt)



## Go Direct ORP

### GDX-ORP

Use Go Direct ORP (Oxidation-Reduction Potential) to measure the ability of a solution to act as an oxidizing or reducing agent. Determine the equivalence point of an oxidation-reduction titration, measure the oxidizing ability of chlorine in swimming pools, or investigate the amount of hydrogen peroxide in a commercial product.

[www.vernier.com/gdx-orp](http://www.vernier.com/gdx-orp)



## Go Direct Radiation Monitor

### GDX-RAD

Explore radiation statistics, measure the rate of nuclear decay, and monitor radon progeny. Go Direct Radiation Monitor detects alpha, beta, gamma, and X-ray radiation, and features LED and audible indicators for each detection.

[www.vernier.com/gdx-rad](http://www.vernier.com/gdx-rad)



## pH Sensors

[www.vernier.com/ph-sensors](http://www.vernier.com/ph-sensors)

### Sensor

## Go Direct pH

### GDX-PH



### Features

#### Recommended for general use

Go Direct pH is an important and versatile sensor for lab and field activities alike. Conduct acid-base titrations, monitor pH changes during chemical reactions, and investigate household acids and bases. The wireless connection makes it easier to do field-based studies such as testing the acidity and alkalinity of bodies of water.

#### Go Direct pH Teacher Pack

### GDX-PH-TP

Includes eight Go Direct pH Sensors and a Go Direct Charge Station.

## NEW Go Direct Tris-Compatible Flat pH

### GDX-FPH



Go Direct Tris-Compatible Flat pH is a double-junction electrode for measuring pH in Tris buffers and solutions containing proteins or sulfides.

## NEW Go Direct Glass-Body pH

### GDX-GPH






Go Direct Glass-Body pH can be used with non-aqueous solutions and solutions containing solvents, strong acids, and strong bases.



## Temperature Probes

[www.vernier.com/temperature-sensors](http://www.vernier.com/temperature-sensors)

Sensor	Range	Features and applications
<b>Go Direct Temperature</b> <b>GDX-TMP</b> 	-40°C to 125°C	<b>Recommended for general use</b> <ul style="list-style-type: none"> <li>Conduct endothermic and exothermic reactions.</li> <li>Determine the physical properties of water.</li> <li>Measure the energy content of foods.</li> <li>Investigate intermolecular forces.</li> </ul>
<b>NEW Go Direct Surface Temperature</b> <b>GDX-ST</b> 	-25°C to 125°C	<ul style="list-style-type: none"> <li>Use in situations in which low thermal mass or flexibility is required.</li> <li>The exposed thermistor provides an extremely rapid response to temperature changes.</li> </ul>
<b>NEW Go Direct Wide-Range Temperature</b> <b>GDX-WRT</b> 	-20°C to 330°C	<ul style="list-style-type: none"> <li>Determine the melting point of caffeine or the boiling point of different vegetable oils.</li> <li>RTD (Resistance Temperature Detector) technology establishes a <math>\pm 0.5^\circ\text{C}</math> accuracy.</li> </ul>



*Collecting temperature data during the freezing and melting of water*

### Go Direct Temperature Teacher Pack

**GDX-TMP-TP**

Includes eight Go Direct Temperature Probes and a Go Direct Charge Station.

## Go Direct SpectroVis® Plus

**GDX-SVISPL**

Introduce your students to spectroscopy with the affordable Go Direct SpectroVis Plus. With a range of 380 to 950 nm, students can easily collect a full wavelength spectrum (absorbance, percent transmission, fluorescence, or intensity), study absorbance vs. concentration (Beer's law), or monitor rates of reaction (kinetics). Collect and analyze data using Spectral Analysis, LabQuest App, or Logger Pro 3.

[www.vernier.com/gdx-svispl](http://www.vernier.com/gdx-svispl)

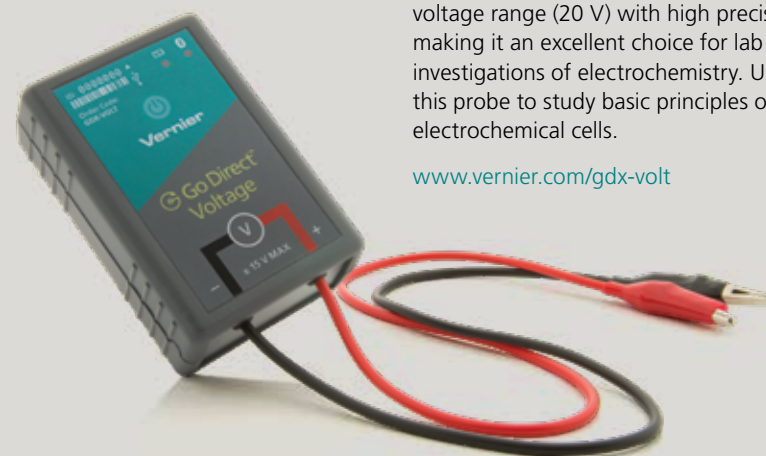


## Go Direct Voltage

**GDX-VOLT**

Go Direct Voltage combines a wide input voltage range (20 V) with high precision, making it an excellent choice for lab investigations of electrochemistry. Use this probe to study basic principles of electrochemical cells.

[www.vernier.com/gdx-volt](http://www.vernier.com/gdx-volt)



# LABQUEST Sensors



Determining the quantity of iron in a vitamin tablet

Connection		Requires an interface from the LabQuest family
LabQuest family		LabQuest 2 pp. 10–13
		LabQuest Stream page 14
		LabQuest Mini page 15
Compatible platforms		Chromebook™
		Computer
		iOS device
		Android™ device
Software		LabQuest App, Logger Pro, Graphical Analysis™ 4



For Go Direct sensors, see pp. 50–53.

## Colorimeter

COL-BTA



Use this sensor to explore absorbance and percent transmittance in a variety of experiments including Beer's law (absorbance vs. concentration) and kinetic studies (concentration vs. time). Students select between four wavelengths (430 nm, 470 nm, 565 nm, and 635 nm) to set up their experiments. Includes 15 cuvettes. Additional cuvettes may be purchased in a package of 100 (CUV).

[www.vernier.com/col-bta](http://www.vernier.com/col-bta)

## Conductivity Probes

[www.vernier.com/conductivity-probes](http://www.vernier.com/conductivity-probes)

Sensor

Features

### Conductivity Probe

#### Recommended for general use

CON-BTA

The Conductivity Probe determines the ionic content of an aqueous solution by measuring its electrical conductivity. Students can quickly investigate the difference between ionic and molecular compounds, strong and weak acids, or ionic compounds that yield different ratios of ions.



#### Additional Features

- Fast response time—reaches 98% of full value in less than 5 seconds
- Built-in temperature compensation
- Alternating current at the electrodes prevents polarization and electrolysis, reducing contamination of solutions
- Three ranges provide optimal precision in any given range

### Platinum-Cell Conductivity Probe

CONPT-BTA



#### Developed for University Educators

The 2-cell platinum sensing element and epoxy body of this electrode ensure greater chemical compatibility and accuracy when measuring the conductivity of non-aqueous solutions and strong acids and bases. The Platinum-Cell Conductivity Probe features automatic temperature compensation (2%) for aqueous solutions; turn off temperature compensation to allow students to explore the dependence of conductivity on temperature.

## Current Probes

[www.vernier.com/current-sensors](http://www.vernier.com/current-sensors)

### Sensor

### Current range

### Features

#### Current Probe

$\pm 0.6$  A

Measures currents in low-voltage AC and DC circuits or for electrochemistry experiments

DCP-BTA



#### Constant Current System

0–0.6 A

DC power source with a built-in current probe designed for use in electrochemistry experiments

CCS-BTA



## Drop Counter

VDC-BTD

By precisely recording the number of drops of titrant during a titration, the Drop Counter makes it possible for students to successfully conduct multiple titrations. The drop number is automatically converted to volume by the data-collection software, saving valuable time. Use the Drop Counter in conjunction with other sensors, such as a pH Sensor, Conductivity Probe, or ORP Sensor to perform acid-base, conductometric, or potentiometric titrations.

[www.vernier.com/vdc-btd](http://www.vernier.com/vdc-btd)



## Electrode Amplifier

EA-BTA

The versatility of the Electrode Amplifier makes it possible to collect data from electrodes that have a BNC connector, including several Vernier electrodes and a variety of third-party electrodes. To get started, connect an electrode, such as our Glass-Body pH Electrode BNC, to the Electrode Amplifier, and then connect the Electrode Amplifier to a Vernier interface.

[www.vernier.com/ea-bta](http://www.vernier.com/ea-bta)



## Gas Pressure Sensors

[www.vernier.com/pressure-sensors](http://www.vernier.com/pressure-sensors)

### Gas Pressure Sensor

GPS-BTA

The Gas Pressure Sensor measures the absolute pressure of a gas. It has sufficient resolution and range to work for many chemistry experiments.

- Wide enough range for Boyle's law experiments
- Sufficient resolution for vapor-pressure or pressure-temperature experiments

Includes the Pressure Sensor Accessories Kit. For replacement parts, see page 60.

**Range** 0 to 210 kPa (0 to 2.1 atm or 0 to 1600 mmHg)



### Pressure Sensor 400

PS400-BTA

**Developed for University Educators**

The Pressure Sensor 400 is the optimal sensor for conducting physical and analytical chemistry experiments, such as approximating the adiabatic expansion of a gas, Charles' law experiments, and ideal gas law investigations. The robust metal fittings and included accessories allow for a tight, leakproof seal to your reaction apparatus.

**Range** 0 to 400 kPa (0 to 3.95 atm or 0 to 3000 mmHg)



## Instrumentation Amplifier

INA-BTA

The Instrumentation Amplifier monitors voltages from 20 mV to 1 V (DC or AC). It is typically used to amplify the chart recorder or analog output of any instrument, such as a third-party gas chromatograph.

[www.vernier.com/ina-bta](http://www.vernier.com/ina-bta)



## Melt Station

MLT-BTA

### Developed for University Educators

Teach students the visual detection capillary method of melting point determination with the Melt Station. The Melt Station accurately measures melting temperatures of a solid up to 260°C.

[www.vernier.com/mlt-bta](http://www.vernier.com/mlt-bta)



## ORP Sensor

ORP-BTA

The Oxidation-Reduction Potential (ORP) Sensor lets you measure the ability of a solution to act as an oxidizing or reducing agent.

[www.vernier.com/orp-bta](http://www.vernier.com/orp-bta)



## Chemical Polarimeter

CHEM-POL

### Developed for University Educators

Help students master stereochemistry with the Chemical Polarimeter. The Chemical Polarimeter teaches students about the handedness of molecules by determining the optical rotation of a compound (R or S, + or –, right-handed or left-handed).

[www.vernier.com/chem-pol](http://www.vernier.com/chem-pol)



## pH Sensor

PH-BTA

### Recommended for general use

Use the pH Sensor just as you would a traditional pH meter with the additional advantages of automated data collection, graphing, and data analysis. The amplifier and single-junction pH electrode are constructed as a single unit.

[www.vernier.com/ph-bta](http://www.vernier.com/ph-bta)



## pH Electrodes

(Electrode Amplifier\* required; see page 55)

[www.vernier.com/ph-sensors](http://www.vernier.com/ph-sensors)

### Sensor

### Features

#### pH Electrode BNC

PH-BNC



- Single-junction electrode for general purpose aqueous solutions
- Comparable applications as the Vernier pH Sensor

#### Tris-Compatible Flat pH Electrode BNC

FPH-BNC



- Double-junction electrode allows measurement of the pH of solutions containing proteins, sulfides, or Tris buffers
- Flat shape of the sensor tip makes it easy to clean and allows for smaller sample sizes and measurement of pH of semisolids (e.g., food or soil slurries)

#### Glass-Body pH Electrode BNC

GPH-BNC







- Measures the pH of aqueous and non-aqueous solutions
- Can be used in solutions containing organic solvents and in highly concentrated acids or bases

\* Information on the Electrode Amplifier is available at [www.vernier.com/ea-bta](http://www.vernier.com/ea-bta)



## Temperature Sensors

[www.vernier.com/temperature-sensors](http://www.vernier.com/temperature-sensors)

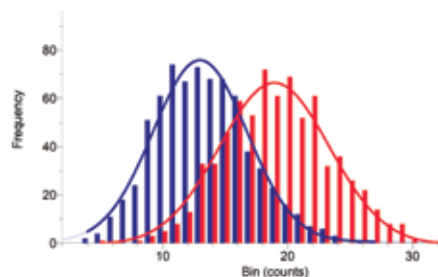
Sensor	Range	Features
<b>Stainless Steel Temperature Probe</b> TMP-BTA 	-40 to 135°C	<b>Recommended for general use</b> <ul style="list-style-type: none"> <li>For use in organic liquids, salt solutions, dilute acids, and dilute bases</li> <li>Durable and versatile so you can use it as you would use a thermometer for a wide range of experiments and subject areas</li> </ul>
<b>Surface Temperature Probe</b> STS-BTA 	-25 to 125°C	<ul style="list-style-type: none"> <li>For use in air or water only</li> <li>Exposed thermistor and flexibility allows for a rapid response time</li> </ul>
<b>Thermocouple</b> TCA-BTA 	-200 to 1400°C	<ul style="list-style-type: none"> <li>Can measure flame temperatures as high as 1400°C or liquid nitrogen temperatures as low as -196°C</li> <li>Internal ice-point compensation means you do not need to place a reference wire in an ice-water bath during use</li> </ul>
<b>Wide-Range Temperature Probe</b> WRT-BTA 	-20 to 330°C	<ul style="list-style-type: none"> <li>Offers a wider temperature range than the Stainless Steel Temperature Probe</li> <li>Diameter of the body of the probe is designed to match a thermometer, making it easy to use with existing glassware and equipment</li> </ul>

## Vernier Radiation Monitor

VRM-BTD

The Vernier Radiation Monitor detects alpha, beta, gamma, and X-ray radiation and can be used for experiments in nuclear counting statistics, shielding, and decay rate measurements.

[www.vernier.com/vrm-btd](http://www.vernier.com/vrm-btd)



Count histograms for wood (blue) and granite (red) countertops show the slight natural radioactivity of granite.

## Voltage Probes

[www.vernier.com/voltage-probes](http://www.vernier.com/voltage-probes)

### Differential Voltage Probe

DVP-BTA

The Differential Voltage Probe reports the potential difference between its two leads. Multiple probes can be used at one time on a single circuit.

Voltage range  $\pm 6\text{ V}$



### Voltage Probe

VP-BTA

Measure voltages developed in a variety of electrochemical (voltaic) cells with the Voltage Probe. This probe can be used to measure the potential in AC and DC circuits.

Voltage range  $\pm 10\text{ V}$





## Balances

### OHAUS Scout® Balances

[www.vernier.com/ohaus](http://www.vernier.com/ohaus)

OHAUS Scout 120 g  
0.001 g precision

OHS-123

OHAUS Scout 220 g  
0.01 g precision

OHS-222

OHAUS Scout 420 g  
0.01 g precision

OHS-422

It is easy to collect mass data from an OHAUS balance using our popular Logger Pro software or LabQuest App. Simply connect a supported balance to the USB port using the OHAUS Scout USB Cable, start the software, and collect real-time data as if the OHAUS balance were just another Vernier sensor!



All three balances require an OHAUS Scout USB Cable for data collection.

OHAUS Scout USB Cable

OHS-USB

## Lab Equipment

### Electrode Support

ESUP

Our Electrode Support is a great complement to the Vernier Stir Station, as well as a perfect holder for many sensors. It is built to connect to all standard ring-stand posts; its large-handled locking nut keeps your sensors firmly in place.

[www.vernier.com/esup](http://www.vernier.com/esup)

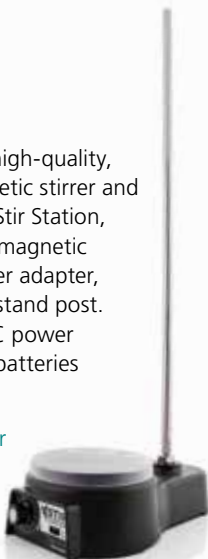


### Stir Station

STIR

The Stir Station is a high-quality, multi-function magnetic stirrer and ring stand. Includes Stir Station, Vernier Microstirrer, magnetic stirring bar, AC power adapter, and removable ring-stand post. Can be used with AC power (included) or four C batteries (not included).

[www.vernier.com/stir](http://www.vernier.com/stir)



## Gas Chromatograph

### Vernier Mini GC® Plus

GC2-MINI

Developed for  
University Educators

The Mini GC Plus allows students to separate, analyze, and identify organic substances in a liquid sample. This desktop gas chromatograph utilizes a MEMS chip sensor that permits room air to be used as a carrier gas and provides valid and reliable results with microliter volumes of samples.

The Mini GC Plus can detect a variety of compounds. The features that make this possible include

- A maximum column temperature of 160°C, offering flexibility in designing temperature profiles
- A MEMS chip sensor that can be set at either of two levels of sensitivity
  - Standard sensitivity mode works well for polar compounds, such as ketones, alcohols, and esters.
  - High sensitivity mode works well for compounds such as halogenated alkanes and substituted aromatics, as well as mixtures with one or more compound of low concentration.

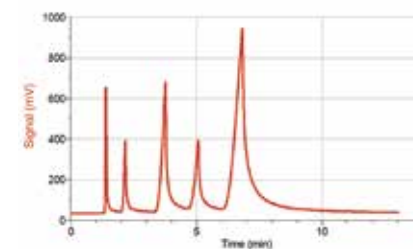
**Includes free lab ebook**—Features five experiments suitable for university organic chemistry or advanced secondary chemistry.

The Mini GC Plus is covered by a two-year warranty (syringe, column, detector, and septa excluded).

[www.vernier.com/gc2-mini](http://www.vernier.com/gc2-mini)



Analyzing ketones using the Vernier Mini GC Plus and LabQuest 2



Mini GC Plus chromatogram of a ketone mixture

# Spectrometers

Spectrometer	Go Direct™ SpectroVis® Plus Spectrophotometer	Vernier UV-VIS Spectrophotometer	Vernier Fluorescence/UV-VIS Spectrophotometer	Vernier Emissions Spectrometer	Vernier Flash Photolysis Spectrometer
Order Code & Price	GDX-SVISPL	VSP-UV	VSP-FUV	VSP-EM	VSP-FP
					
Description	The Go Direct SpectroVis Plus Spectrophotometer quickly measures a full wavelength spectrum. It directly connects wirelessly via Bluetooth® or wired via USB to your platform.	The Vernier UV-VIS Spectrophotometer generates a full spectrum, Beer's law graph, and kinetics traces of ultraviolet and visible-absorbing samples such as aspirin, DNA, proteins, and NADH.	The Fluorescence/UV-VIS Spectrophotometer measures the fluorescence and absorbance spectra of ultraviolet and visible samples such as quinine sulfate, fluorescein, rhodamine, and DAPI.	The perfect tool to conduct emissions analysis, the Vernier Emissions Spectrometer allows you to instantly collect emissions spectra from light bulbs, gas discharge tubes, or the sun.	The Vernier Flash Photolysis Spectrometer allows students to explore the fundamental principles of photochemical reactions. It measures the absorption and emission changes of a photoexcited sample with microsecond resolution.
Wavelength Range	380 to 950 nm	220 to 850 nm	220 to 850 nm	350 to 900 nm	450 to 750 nm
Light source	Visible: LED-boosted tungsten  Fluorescence: built-in LEDs for excitation at 405 nm and 500 nm	Visible: LED-boosted tungsten  UV: Deuterium	Visible: LED-boosted tungsten  UV: Deuterium  Fluorescence: exchangeable LEDs for excitation at 375 nm, 450 nm, and 525 nm (additional wavelengths sold separately)	N/A	Xenon flashlamp (pump) white LED (probe)
Warranty	5 years (tungsten light source: 3 years)	5 years (tungsten light source: 3 years; deuterium light source: 1 year)	5 years (tungsten light source: 3 years; deuterium light source: 1 year; included fluorescence LEDs: 1 year)	5 years	5 years
More Information	Innovative use ideas available at <a href="http://www.vernier.com/gdx-svispl">www.vernier.com/gdx-svispl</a>	Download free experiments at <a href="http://www.vernier.com/vsp-uv">www.vernier.com/vsp-uv</a>	Download free experiments at <a href="http://www.vernier.com/vsp-fuv">www.vernier.com/vsp-fuv</a>	Innovative use ideas available at <a href="http://www.vernier.com/vsp-em">www.vernier.com/vsp-em</a>	Download free experiments at <a href="http://www.vernier.com/vsp-fp">www.vernier.com/vsp-fp</a>

## What Vernier Technology is Available for Biochemistry?

Common experiments performed in introductory biochemistry labs include acid/base chemistry and buffer preparation, protein and enzyme purification, enzyme activity assays, analysis of carbohydrates and lipids, and gel electrophoresis. Experiments that cover many topics, such as the examples in the following table, are found in the these lab books: *Advanced Biology with Vernier* (BIO-A), *Advanced Chemistry with Vernier* (CHEM-A), and *Organic Chemistry with Vernier* (CHEM-O).



Topic	Acid/base chemistry and buffer preparation
Equipment	pH Sensor
Lab Book	CHEM-A



Topic	Gel electrophoresis
Equipment	Vernier Blue Digital Bioimaging System
Lab Book	BIO-A



Topic	Enzyme activity assays
Equipment	Vernier UV-VIS Spectrophotometer
Download	<a href="http://www.vernier.com/vsp-uv">vernier.com/vsp-uv</a>



Topic	DNA investigations
Equipment	Fluorescence/UV-VIS Spectrophotometer
Download	<a href="http://www.vernier.com/vsp-fuv">vernier.com/vsp-fuv</a>

[www.vernier.com/biochemistry](http://www.vernier.com/biochemistry)

Part Name	Order Code
<b>BNC Electrodes</b>	
Go Direct Sensors	
Go Direct Flat pH BNC Electrode	GDX-FPH-BNC
Go Direct Glass-Body pH BNC Electrode	GDX-GPH-BNC
Go Direct ORP BNC Electrode	GDX-ORP-BNC
Go Direct pH BNC Electrode	GDX-PH-BNC
LabQuest Sensors	
Flat pH Electrode BNC	FPH-BNC
Glass-Body pH Electrode BNC	GPH-BNC
ORP Electrode BNC	ORP-BNC
pH Electrode BNC	PH-BNC
<b>Colorimeters</b>	
Cuvette Rack	CUV-RACK
Plastic Cuvettes (pkg. of 100)	CUV
<b>Conductivity</b>	
Conductivity Low Standard (500 mL)	CON-LST
Conductivity Middle Standard (500 mL)	CON-MST
Conductivity High Standard (500 mL)	CON-HST
<b>Drop Counters</b>	
Microstirrer	MSTIR
Plastic 2-Way Valve	PS-2WAY
Reagent Reservoir, 2 Valves, and Tip	VDC-RR
Stopper Stem	PS-STEM
<b>Gas Chromatograph</b>	
GC Septa (pkg. of 4)	GC-SEP
GC Syringe, 1 µL Hamilton	GC-SYR-MIC
<b>Gas Pressure</b>	
#1 1-Hole Rubber Stopper	PS-STOP1
#5 2-Hole Rubber Stopper	PS-STOP5
Luer-Lock Connector	PS-LUER
Plastic 2-Way Valve	PS-2WAY
Plastic Tubing	PS-TUBING
Pressure Sensor Accessories Kit	PS-ACC

Part Name	Order Code
Stopper Stem	PS-STEM
Plastic Syringe	PS-SYR
Plastic Syringe (10-pack)	PS-SYR10
Plastic Tubing Clamps	PTC
Additional replacement parts	<a href="http://www.vernier.com/ps-acc">www.vernier.com/ps-acc</a>
<b>Melt Stations</b>	
Melt Station Capillary Tubes (pkg. of 100)	MLT-TUBE
<b>OHAUS Balances</b>	
OHAUS Scout® USB Cable	OHS-USB
<b>ORP</b>	
pH Storage Solution	PH-SS
pH Storage Solution Bottles (5)	BTL
<b>pH</b>	
Electrode Tip Guard (pkg. of 2)	ETG
Microstirrer	MSTIR
pH Buffer Capsules (3 × 10)	PH-BUFCAP
pH Storage Bottles (pkg. of 5)	BTL
pH Storage Solution (500 mL)	PH-SS
<b>Polarimeter (Chemical)</b>	
Polarimeter Sample Cells (pkg. of 4)	CELLS-POL
<b>Spectrophotometers</b>	
Cuvette Rack	CUV-RACK
Fluorescence/UV Quartz Cuvette	CUV-QUARTZ-FUV
Plastic Cuvettes (pkg. of 100)	CUV-UV
Plastic Cuvettes (pkg. of 100)	CUV
Quartz Cuvettes (pkg. of 2)	CUV-QUARTZ
Spectrophotometer Optical Fiber (for GDX-SVISPL, VSP-UV, VSP-FUV)	VSP-FIBER
Vernier Emissions Fiber (for VSP-EM)	VSP-EM-FIBER

For all of our accessories, visit  
[www.vernier.com/accessories](http://www.vernier.com/accessories)

## Enhance Your Curriculum with Vernier Lab Books

Enhance your curriculum with our award-winning lab books, which are available as eco-friendly electronic downloads in addition to the traditional print format. Now you'll always have access to the most up-to-date versions of the experiments through your Vernier account.

- Download word-processing files to customize the experiments to fit your curricular needs.
- Electronic versions include a generous site license—purchase once and share files with other instructors in your school or university department.

### Chemistry Lab Books

Subjects	<i>Chemistry with Vernier</i> 4th Edition	<i>Advanced Chemistry with Vernier</i> 4th Edition	<i>Vernier Chemistry Investigations for Use with AP* Chemistry</i> 4th Edition	<i>Investigating Chemistry through Inquiry</i> 4th Edition	<i>Organic Chemistry with Vernier</i>
Secondary Chemistry	●	●		●	
AP* Chemistry	●	●	●		
IB† Chemistry	●	●		●	
General Chemistry	●	●		●	
Organic Chemistry					●

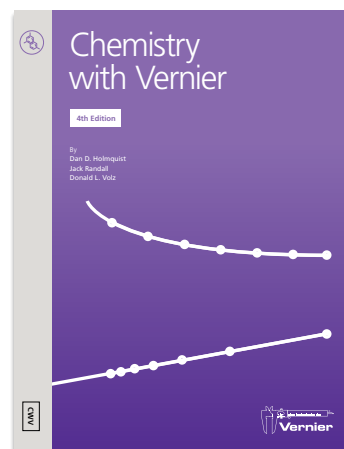
\* AP and Advanced Placement Program are registered trademarks of the College Entrance Examination Board, which was not involved in the production of and does not endorse this product.

† The IB Diploma Program is an official program of the International Baccalaureate Organization (IBO) which authorizes schools to offer it. The material available here has been developed independently of the IBO and is not endorsed by it.

## Chemistry with Vernier 4th Edition

SECONDARY

UNIVERSITY



Electronic Lab Book Only

CWV-E

Printed + Electronic Lab Book

CWV

Topics include

- Stoichiometry
- Gas laws
- Acid-base titrations
- Calorimetry

For a complete list of all 36 experiments, visit [www.vernier.com/cwv](http://www.vernier.com/cwv)

### Sensors Used

Sensor	Page
Temperature	53, 57
pH	52, 56
Gas Pressure	51, 55
Conductivity	50, 54
Drop Counter	51, 55
Voltage	53, 57
Choose one:	
Colorimeter	50, 54
SpectroVis® Plus	59

### Supported Software

Software	Page
Logger Pro	20–21
LabQuest App	11–12
Graphical Analysis™ 4	16–17
Spectral Analysis	18
EasyData	<a href="http://www.vernier.com/easydata">www.vernier.com/easydata</a>

### Additional Products

Equipment	Page
Stir Station	58
Electrode Support	58

### Química Con Vernier



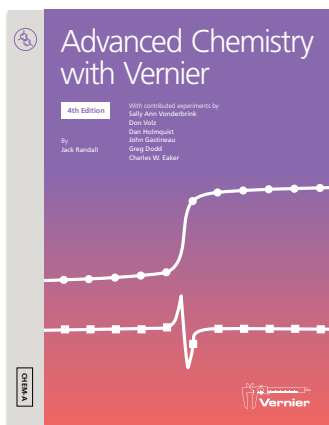
*Química con Vernier* is the Spanish-language version of *Chemistry with Vernier*.

[www.vernier.com/cwv-es](http://www.vernier.com/cwv-es)

# Advanced Chemistry with Vernier 4th Edition

SECONDARY

UNIVERSITY



Electronic Lab  
Book Only

CHEM-A-E

Printed +  
Electronic  
Lab Book

CHEM-A

Topics include

- Stoichiometry and the mole
- Redox reactions
- Electrochemistry
- Chemical kinetics
- Spectroscopy

For a complete list of all 35 experiments,  
visit [www.vernier.com/chem-a](http://www.vernier.com/chem-a)

## Sensors Used

Sensor	Page
Temperature	53, 57
pH	52, 56
Gas Pressure	51, 55
Conductivity	50, 54
Drop Counter	51, 55
Voltage	53, 57
Choose one:	
Colorimeter	50, 54
SpectroVis® Plus	59
ORP	52, 56
Choose one:	
Constant Current	51, 55
Current Probe	55, 105
Platinum-Cell Conductivity	54
Radiation Monitor	52, 57
Melt Station	51, 56

## Additional Products

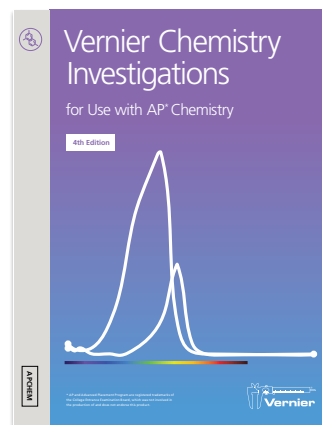
Equipment	Page
Stir Station	58
Electrode Support	58

## Supported Software

Software	Page
Logger Pro	20–21
LabQuest App	11–12
Graphical Analysis™ 4	16–17
Spectral Analysis	18

# Vernier Chemistry Investigations for Use with AP\* Chemistry 4th Edition

SECONDARY



Electronic Lab  
Book Only

APCHEM-E

Printed +  
Electronic  
Lab Book

APCHEM

Includes inquiry-based laboratory  
experiments aligned with the  
16 investigations published by  
The College Board

Topics include

- Spectroscopy
- Titrations
- Chemical kinetics
- Equilibrium
- Calorimetry

For a complete list of all 16 investigations,  
visit [www.vernier.com/apchem](http://www.vernier.com/apchem)

## Sensors Used

Sensor	Page
Temperature	53, 57
pH	52, 56
Gas Pressure	51, 55
Conductivity	50, 54
Drop Counter	51, 55
SpectroVis Plus	59
ORP	52, 56
Melt Station	51, 56

## Additional Products

Equipment	Page
Stir Station	58
Electrode Support	58

## Supported Software

Software	Page
Logger Pro	20–21
LabQuest App	11–12
Graphical Analysis 4	16–17
Spectral Analysis	18

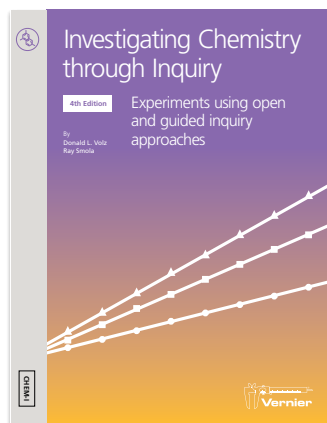
\* AP and Advanced Placement Program are registered trademarks of the College Entrance Examination Board, which was not involved in the production of and does not endorse this product.



# Investigating Chemistry through Inquiry 4th Edition

SECONDARY

UNIVERSITY



Electronic Lab  
Book Only

CHEM-I-E

Printed +  
Electronic  
Lab Book

CHEM-I

Topics include

- Chemical bonding and structure
- Energetics/thermochemistry
- Atomic structure
- Chemical kinetics

For a complete list of all 25 investigations,  
visit [www.vernier.com/chem-i](http://www.vernier.com/chem-i)

## Sensors Used

Sensor	Page
Temperature	53, 57
pH	52, 56
Gas Pressure	51, 55
Conductivity	50, 54
Voltage	53, 57
Choose one:	
Colorimeter	50, 54
SpectroVis Plus	59
ORP	52, 56
Radiation Monitor	52, 57

## Additional Products

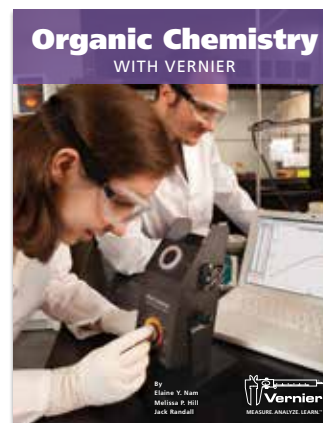
Equipment	Page
Stir Station	58
Electrode Support	58

## Supported Software

Software	Page
Logger Pro	20–21
LabQuest App	11–12
Graphical Analysis 4	16–17
Spectral Analysis	18
EasyData	<a href="http://www.vernier.com/easydata">www.vernier.com/easydata</a>

# Organic Chemistry with Vernier

UNIVERSITY



Electronic Lab  
Book Only

CHEM-O-E

Printed +  
Electronic  
Lab Book

CHEM-O

Topics include

- Synthesis
- Isolation and purification
- Distillation
- Chromatography
- Spectroscopy

For a complete list of all 26 experiments,  
visit [www.vernier.com/chem-o](http://www.vernier.com/chem-o)

## Sensors Used

Sensor	Page
Wide-Range Temperature	57
Polarimeter	56
Melt Station	56
Mini GC Plus	58
SpectroVis Plus	59

## Additional Products

Equipment	Page
Stir Station	58
Electrode Support	58

## Supported Software

Software	Page
Logger Pro	20–21
LabQuest App	11–12

Studying the relationship between  
the angle of insolation and  
temperature change



# Earth Science

[www.vernier.com/earth-science](http://www.vernier.com/earth-science)



## Go Direct Sensors

Sensor	Order Code	Page
Go Direct 3-Axis Magnetic Field	GDX-3MG	105
<b>NEW</b> Go Direct CO <sub>2</sub> Gas	GDX-CO2	35
Go Direct Conductivity	GDX-CON	50
<b>NEW</b> Go Direct Current	GDX-CUR	105
<b>NEW</b> Go Direct Energy	GDX-NRG	83
Go Direct Light and Color	GDX-LC	105
<b>NEW</b> Go Direct Motion	GDX-MD	104
<b>NEW</b> Go Direct O <sub>2</sub> Gas	GDX-O2	35
<b>NEW</b> Go Direct Optical Dissolved Oxygen	GDX-ODO	35
pH Sensors		
Go Direct pH	GDX-PH	52
<b>NEW</b> Go Direct Tris-Compatible Flat pH	GDX-FPH	52
Temperature Probes		
<b>NEW</b> Go Direct Surface Temperature	GDX-ST	53
Go Direct Temperature	GDX-TMP	53
Go Direct Voltage	GDX-VOLT	105

## Go! Sensors (USB only)

Equipment	Order Code	Page
Go! Motion	GO-MOT	<a href="#">web</a>
Go!Temp	GO-TEMP	<a href="#">web</a>

## Related Content

<i>Renewable Energy with Vernier</i>	page 89
<i>Water Quality with Vernier</i>	page 89

## LabQuest Sensors

Sensor	Order Code	Page
Anemometer	ANM-BTA	<a href="#">web</a>
Barometer	BAR-BTA	<a href="#">web</a>
CO <sub>2</sub> Gas Sensor	CO2-BTA	37
Conductivity Probe	CON-BTA	54
Current Probe	DCP-BTA	112
Energy Sensor	VES-BTA	86
Flow Rate Sensor	FLO-BTA	<a href="#">web</a>
Gas Pressure Sensor	GPS-BTA	55
Light Sensor	LS-BTA	115
Magnetic Field Sensor	MG-BTA	66
Motion Detector	MD-BTD	108
O <sub>2</sub> Gas Sensor	O2-BTA	37
Optical DO Probe	ODO-BTA	37
pH Sensors		
pH Sensor	PH-BTA	56
Tris-Compatible Flat pH Sensor	FPH-BTA	66
Pyranometer	PYR-BTA	<a href="#">web</a>
Relative Humidity Sensor	RH-BTA	<a href="#">web</a>
Salinity Sensor	SAL-BTA	<a href="#">web</a>
Soil Moisture Sensor	SMS-BTA	85
Temperature Probes		
Extra-Long Temperature Probe	TPL-BTA	<a href="#">web</a>
Infrared Thermometer	IRT-BTA	<a href="#">web</a>
Stainless Steel Temperature Probe	TMP-BTA	66
Surface Temperature Sensor	STS-BTA	57
Turbidity Sensor	TRB-BTA	<a href="#">web</a>
UV Sensors		
UVA Sensor	UVA-BTA	<a href="#">web</a>
UVB Sensor	UVB-BTA	66
Voltage Probe	VP-BTA	57

## Balances

Balances	Order Code	Page
OHAUS Scout (120 g)	OHS-123	58
OHAUS Scout (220 g)	OHS-222	58
OHAUS Scout (420 g)	OHS-422	58

## Weather Stations

Equipment	Order Code	Page
Davis WeatherLinkIP™	DWLINK-IP	<a href="#">web</a>
Vantage Pro2™	DWVP	<a href="#">web</a>
Vantage Pro2™ Plus	DWPLUS	<a href="#">web</a>
Vantage Vue®	DWVUE	66
Kestrel DROP D1	KES-D1	66
Kestrel DROP D2	KES-D2	66
Kestrel DROP D3	KES-D3	66

## Additional Products

Product	Order Code	Page
Electrode Support	ESUP	58
KidWind 2V/400mA Solar Panel	KW-SP2V	86
KidWind Basic Wind Experiment Kit	KW-BWX	87
KidWind MINI Wind Turbine with Blade Design	KW-MWTBD	87
Solar Energy Exploration Kit	KW-SEEK	86
Vernier Resistor Board	VES-RB	86

## Lab Books

Title	Page
<i>Earth Science with Vernier</i>	67

## Magnetic Field Sensor

MG-BTA

The Magnetic Field Sensor can be used to study the field around permanent magnets, coils, and electrical devices.

[www.vernier.com/mg-bta](http://www.vernier.com/mg-bta)



## Stainless Steel Temperature Probe

TMP-BTA

This rugged and durable temperature probe has a sealed stainless steel shaft that can be used in organic liquids, salt solutions, acids, and bases.

Range      $-40$  to  $135^{\circ}\text{C}$

[www.vernier.com/tmp-bta](http://www.vernier.com/tmp-bta)



## Tris-Compatible Flat pH Sensor

FPH-BTA

- Double-junction electrode allows measurement of the pH of solutions containing proteins, sulfides, or Tris buffers, all of which can be harmful to a standard pH electrode
- Flat shape of the sensor tip makes it easy to clean and allows for smaller sample sizes and measurement of pH of semisolids (e.g., food or soil slurries)

[www.vernier.com/fph-bta](http://www.vernier.com/fph-bta)



## UVB Sensor

UVB-BTA

The UVB Sensor is an ultraviolet light sensor that responds primarily to UVB radiation (approximately 290 to 320 nm). It is ideal for experiments using sunlight as your UV source.

[www.vernier.com/uvb-bta](http://www.vernier.com/uvb-bta)



## Davis Vantage Vue® Weather Station

DWVUE

The Vantage Vue weather station includes a console with an AC power adapter and a self-contained, easy-to-install sensor system. The console displays current data along with the ability to view graphs—all without a computer!

For additional Davis weather stations and supporting products, including computer software and hardware mounting options, see [www.vernier.com/weather](http://www.vernier.com/weather)



## Kestrel® DROP Wireless Data Loggers

Kestrel DROP Wireless Data Loggers are small, rugged, and accurate environmental data loggers. Depending on the model, collect temperature, relative humidity, or pressure data on the Kestrel LiNK app for iOS and Android™ devices.

**Kestrel DROP D1**     KES-D1

**Kestrel DROP D2**     KES-D2

**Kestrel DROP D3**     KES-D3

[www.vernier.com/kestrel](http://www.vernier.com/kestrel)



For available Go Direct™ versions of Earth Science sensors, visit [www.vernier.com/earth-science](http://www.vernier.com/earth-science)



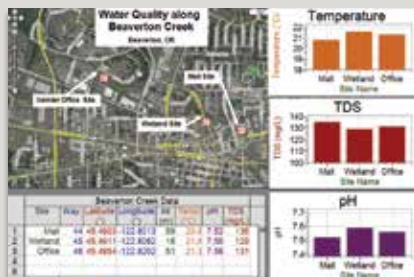


Geotag data collected on LabQuest 2

## Did you know?

The built-in GPS in LabQuest 2 makes it easy to add location information to your field data. When finished, simply transfer the data to Logger *Pro* and then export to Google Maps™ or in a GIS-compatible format.

Using Geographic Information System (GIS) software to map data can be a very effective tool for analysis. The steep learning curve with some GIS software can be intimidating. Fortunately, the free online version of ArcGIS™ from Esri™ is easy to use with data collected on LabQuest 2.



Water quality data, including an imported Google Maps image, in Logger *Pro*



ArcGIS Online provides a variety of tools for data analysis.

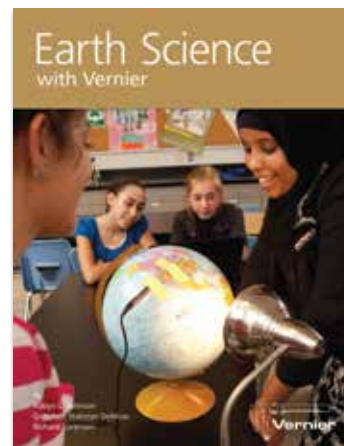
Visit [www.vernier.com/til/2802](http://www.vernier.com/til/2802)

## Lab Books

### Earth Science with Vernier

MIDDLE SCHOOL

SECONDARY



Electronic Lab Book Only

ESV-E

Printed + Electronic Lab Book

ESV

Topics include

- Geology/soil analysis
- Water quality
- Hydrology/oceanography
- Meteorology
- Renewable energy

For a complete list of all 33 experiments, visit [www.vernier.com/esv](http://www.vernier.com/esv)

### Sensors Used

Sensor	Page
Temperature	66
Light	115
pH	56
Motion Detector	108
UVB	66
Magnetic Field	66
Conductivity	54
Turbidity	<a href="http://www.vernier.com/trb-bta">www.vernier.com/trb-bta</a>
Current	112
Voltage	57

### Additional Products

Equipment	Page
Electrode Support	58
Davis Weather Station	66
KidWind 2V/400mA Solar Panel	86
KidWind MINI Wind Turbine	87
Stir Station	58
Water Depth Sampler	<a href="http://www.vernier.com/wds">www.vernier.com/wds</a>
Water Quality Bottles	88

### Supported Software

Software	Page
Logger <i>Pro</i>	20–21
LabQuest App	11–12



Exploring solar panel output



# Primary Science

[www.vernier.com/elementary-science](http://www.vernier.com/elementary-science)



## Packages

**NEW** Go Direct Packages page 70

## Go Direct Sensors

Sensor	Order Code	Page
Go Direct 3-Axis Magnetic Field	GDX-3MG	105
<b>NEW</b> Go Direct Energy	GDX-NRG	94
Go Direct Force and Acceleration	GDX-FOR	104
Go Direct Gas Pressure	GDX-GP	51
Go Direct Light and Color	GDX-LC	105
<b>NEW</b> Go Direct Motion	GDX-MD	94
Temperature Probes		
<b>NEW</b> Go Direct Surface Temperature	GDX-ST	53
Go Direct Temperature	GDX-TMP	94
Go Direct Voltage	GDX-VOLT	105

## LabQuest Sensors

Sensor	Order Code	Page
Anemometer	ANM-BTA	<a href="#">web</a>
Barometer	BAR-BTA	<a href="#">web</a>
Dual-Range Force Sensor	DFS-BTA	109
Energy Sensor	VES-BTA	86
Force Plate	FP-BTA	109
Gas Pressure Sensor	GPS-BTA	55
Magnetic Field Sensor	MG-BTA	113
Motion Detector	MD-BTD	108
Relative Humidity Sensor	RH-BTA	<a href="#">web</a>
Sound Level Sensor	SLS-BTA	111
Temperature Probes		
Infrared Thermometer	IRT-BTA	<a href="#">web</a>
Stainless Steel Temperature Probe	TMP-BTA	57
Surface Temperature Sensor	STS-BTA	57
TI Light Probe	TILT-BTA	<a href="#">web</a>
Voltage Probe	VP-BTA	57

## Go! Sensors (USB only)

Equipment	Order Code	Page
Go! Motion	GO-MOT	<a href="#">web</a>
Go!Temp	GO-TEMP	<a href="#">web</a>

## Additional Products

Product	Order Code	Page
Davis Weather Station	varies	66
Digital Microscopes	varies	40
KidWind MINI Wind Turbine with Blade Design	KW-MWTBD	87
KidWind Solar Energy Exploration Kit	KW-SEEK	86
Vernier Resistor Board	VES-RB	86

## Lab Books

Title	Page
<b>UPDATED</b> <i>Elementary Science with Vernier</i> 4th Edition	71
<i>Investigating Solar Energy</i>	71
<i>Investigating Wind Energy</i>	71
<i>Let's Go! Investigating Temperature</i>	<a href="#">web</a>
<i>Ciencia en la Primaria con Vernier</i>	71

# Go Direct™ Primary Packages



## Sensor Connection

Go Direct sensors connect directly via USB or Bluetooth®.



## 2–4 Students

Packages support one lab station of 2–4 students.



## Works with Your Existing Devices

Connect to your Chromebook™, mobile device, computer, or LabQuest 2.



## Collect Data with the FREE Graphical Analysis™ 4 App

No additional equipment or software purchase is necessary.



## Go Direct sensors are perfect for instructors who

- Are new to probeware
- Plan to equip a new school
- Are already using Chromebooks and mobile devices

## Deluxe Package

GDP-EL-DX

### Starter Package

GDP-EL-ST



Go Direct  
Temperature



Go Direct  
Light and Color



Go Direct  
Motion



Go Direct  
3-Axis Magnetic Field



Go Direct  
Gas Pressure



Go Direct  
Voltage



Go Direct  
Force and Acceleration

## You May Also Want

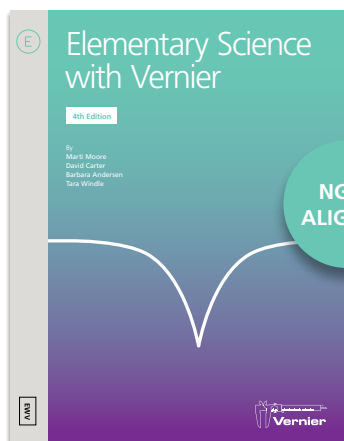
<b>NEW</b> Go Direct Charge Station	GDX-CRG	page 3
<b>NEW</b> Go Direct Energy	GDX-NRG	page 94
<i>Elementary Science with Vernier</i>	EWV	page 71

Additional recommendations available at  
[www.vernier.com/packages](http://www.vernier.com/packages)

**UPDATED**

## Elementary Science with Vernier 4th Edition

PRIMARY



NGSS  
ALIGNED

Electronic  
Lab Book Only

EWV-E

Printed +  
Electronic  
Lab Book

EWV

Topics include

- Properties of matter
- Forces and interactions
- Electricity

For a complete list of all 43 experiments, see [www.vernier.com/ewv](http://www.vernier.com/ewv)

### Sensors Used

Sensor	Page
Temperature	57, 94
Light	105, <a href="http://www.vernier.com/tilt-bta">www.vernier.com/tilt-bta</a>
Motion Detector	94, 108
Gas Pressure	51, 55
Magnetic Field	105, 113
Voltage	57, 105
Force	104, 109

### Supported Software

Software	Page
Logger Lite <a href="http://www.vernier.com/logger-lite">www.vernier.com/logger-lite</a>	
LabQuest App	11–12
Graphical Analysis 4	16–17

### Ciencia en la Primaria con Vernier



*Ciencia en la Primaria con Vernier* is the Spanish-language version of *Elementary Science with Vernier*.

[www.vernier.com/cpv](http://www.vernier.com/cpv)



NGSS  
ALIGNED

## Investigating Wind Energy

PRIMARY

Electronic  
Lab Book Only

ELB-WIND-E

Printed +  
Electronic  
Lab Book

ELB-WIND

Topics include

- Energy
- Renewable energy
- Engineering design

For a complete list of all 11 experiments, see [www.vernier.com/elb-wind](http://www.vernier.com/elb-wind)

### Products Used

Product	Page
KidWind MINI Wind Turbine with Blade Design	87
Energy Sensor	86
Vernier Resistor Board	86

### Supported Software

Logger Lite [www.vernier.com/logger-lite](http://www.vernier.com/logger-lite)

LabQuest App pp. 11–12



NGSS  
ALIGNED

## Investigating Solar Energy

2016 AWARDS  
EXCELLENCE  
TECH LEARNING

PRIMARY

Electronic  
Lab Book Only

ELB-SOLAR-E

Printed +  
Electronic  
Lab Book

ELB-SOLAR

Topics include

- Energy
- Renewable energy
- Engineering design

For a complete list of all 11 experiments, see [www.vernier.com/elb-solar](http://www.vernier.com/elb-solar)

### Products Used

Product	Page
KidWind Solar Energy Exploration Kit	86
Energy Sensor	86
Surface Temperature Sensor	57
Vernier Resistor Board	86

### Supported Software

Logger Lite [www.vernier.com/logger-lite](http://www.vernier.com/logger-lite)

LabQuest App pp. 11–12



Applying engineering design  
processes to evaluate structure  
failure and improve design



View a Tech Tip video of engineering  
experiments at [www.vernier.com/videos](http://www.vernier.com/videos)



# Engineering

[www.vernier.com/engineering](http://www.vernier.com/engineering)





## Engineering Products

Product	Order Code	Page
Engineering for Science Classrooms		
Structures & Materials Tester	VSMT	74
Truss Tester Accessory	VSMT-TRUSS	74
Digital Control Unit	DCU-BTD	75
Analog Breadboard Cable	BB-BTA	75
Digital Breadboard Cable	BB-BTD	75
Programming and Robotics		
Scratch Programming		
Go! Link	GO-LINK	75
Go! Motion	GO-MOT	75
Go!Temp	GO-TEMP	75
LEGO® MINDSTORMS® Robotics		
NXT Sensor Adapter for EV3 and NXT	BTA-NXT	75
Arduino™		
SparkFun® RedBoard	ARD-RED	76
Arduino Interface Shield	BT-ARD	76
LabVIEW		
SensorDAQ®	SDAQ	77
myDAQ Adapter	BT-MDAQ	77
Analog Protoboard Adapter	BTA-ELV	77
Digital Protoboard Adapter	BTD-ELV	77
Project Lead The Way		
K–12 Engineering Curriculum		78

## Engineering Lab Books

Title	Page
<i>Vernier Engineering Projects with LEGO® MINDSTORMS® Education EV3</i>	79
<i>Engineering Projects with NI LabVIEW™ and Vernier</i>	79

## Related Products

KidWind Renewable Energy Kits	pp. 86–87
<i>Renewable Energy with Vernier</i>	page 89



## Structures & Materials Tester

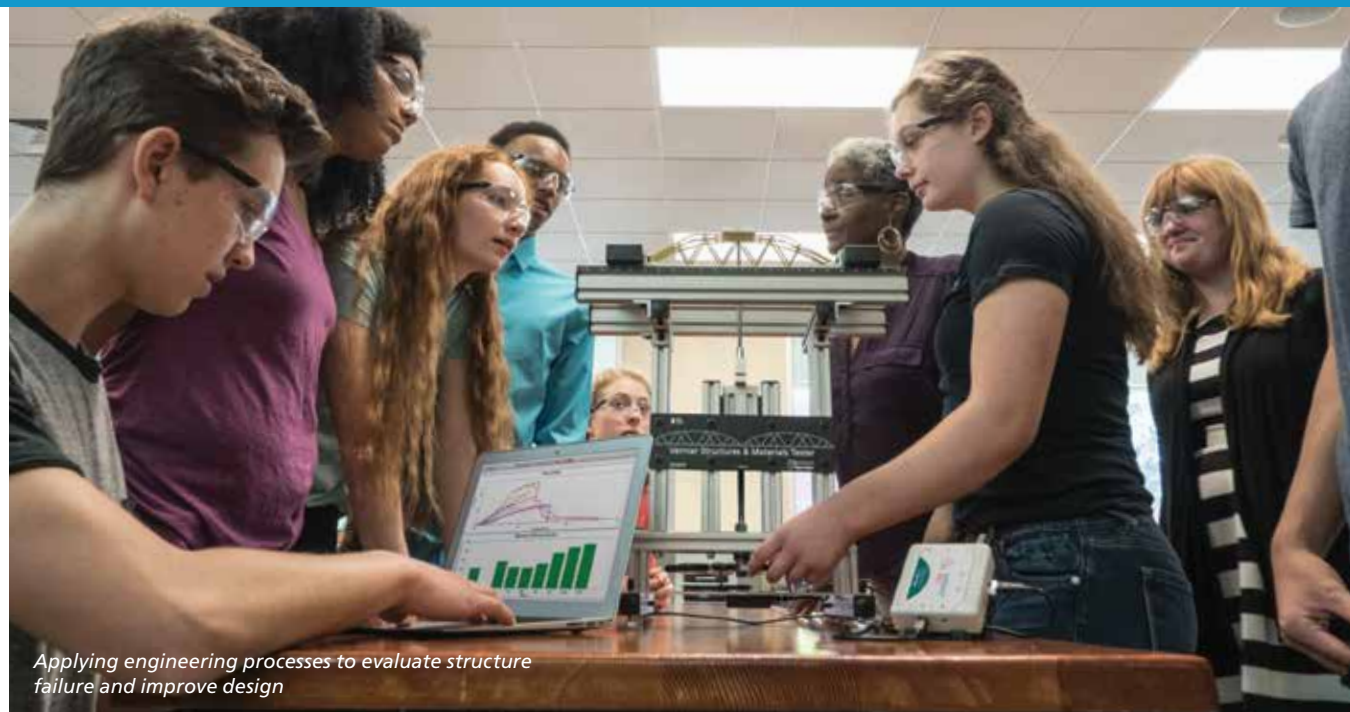
### VSMT\*

Use the Vernier Structures & Materials Tester (VSMT), along with the engineering design method, to design, build, and test structures. You can also conduct bridge competitions, as well as investigate and analyze beam designs and material properties.

The VSMT is equipped with a load cell and a displacement sensor, which enables students to evaluate stress and strain. Use Logger Pro video analysis in conjunction with sensor measurements to see how and when things bend and break.

[www.vernier.com/vsmt](http://www.vernier.com/vsmt)

\* Additional shipping charges may apply due to weight.



Applying engineering processes to evaluate structure failure and improve design

## Includes VSMT Tackle Kit

- Two aluminum load plates
  - 50 × 50 × 6 mm
  - 50 × 80 × 6 mm
- Chain
- Rods
- U-bolts



## Product Specifications

Load cell	0 to 1000 N
Displacement sensor	0.1 mm resolution
Maximum travel	7.5 cm

## Truss Tester Accessory

### VSMT-TRUSS

The Truss Tester Accessory attaches to the Vernier Structures & Materials Tester (VSMT) to measure the force and deflection of trusses. The Truss Tester Accessory holds a single truss upright and allows the load to be applied in a variety of locations.

It is designed for trusses built with 1/4" square balsa wood sticks with a 20 cm base and a maximum height of 18 cm.

[www.vernier.com/vsmt-truss](http://www.vernier.com/vsmt-truss)



## Digital Control Unit

### DCU-BTD

The Digital Control Unit (DCU) connects to a Vernier interface and allows you to control output devices such as motors, buzzers, pumps, and LEDs using Logger Pro software or LabQuest App†.

An external power supply, such as the LabQuest or LabPro power supply (not included, LQ-PS, or IPS), is required to power the device.

The DCU can also connect to an Arduino™ Interface Shield, myDAQ Adapter, and SensorDAQ® See page 76.

[www.vernier.com/dcu-btd](http://www.vernier.com/dcu-btd)

### Easy Steps for Controlling DCU Output in Logger Pro or LabQuest App†

- 1 Connect a DCU and sensor to a Vernier interface.
- 2 Connect an output device (e.g., a pump) to the DCU.
- 3 Select the DCU line or lines you want to activate.
- 4 Build a logic statement to activate the line when the statement is true. Choose AND, UNTIL, or OR to create a compound statement.



† Works with LabQuest 2 only



## Breadboard Cables

These cables make it easy for students to build their own sensor circuitry and input the signal into a Vernier interface for data acquisition.

### Analog

#### BB-BTA

[www.vernier.com/bb-bta](http://www.vernier.com/bb-bta)

### Digital

#### BB-BTD

[www.vernier.com/bb-btd](http://www.vernier.com/bb-btd)



## Scratch Programming



Our Go! Extensions bring real-world data—collected from a Go!Temp, Go! Motion, or Go!Link and a compatible sensor—into your Scratch project. Have the Scratch Cat move in response to the position data from a Go! Motion or change costumes when the temperature measured by the Go!Temp increases. Our extensions add a new way for students to interact with code.

For more information, visit [www.vernier.com/scratch](http://www.vernier.com/scratch)

### Go! Motion

#### GO-MOT

[www.vernier.com/go-motion](http://www.vernier.com/go-motion)

### Go!Temp

#### GO-TEMP

[www.vernier.com/go-temp](http://www.vernier.com/go-temp)

### Go!Link

#### GO-LINK

[www.vernier.com/go-link](http://www.vernier.com/go-link)



## LEGO® MINDSTORMS® Robotics

### NXT Sensor Adapter for EV3 and NXT

#### BTA-NXT

The Vernier NXT Sensor Adapter allows certain Vernier sensors to work on the LEGO® MINDSTORMS® EV3 and LEGO® MINDSTORMS® NXT robotics systems. Enhance your robots and sensor-based control systems with sensors for measuring everything from temperature to force, light level, UV level, pH, and more.

[www.vernier.com/bta-nxt](http://www.vernier.com/bta-nxt)



## Arduino™

Vernier Software & Technology has always supported hands-on, do-it-yourself projects for students (and teachers). The availability of very inexpensive, easy-to-program microcomputers, like the Arduino, make projects easy and affordable.

We have created an online guide for using Vernier sensors with Arduino. This guide helps you connect, program, and calibrate our sensors. It includes many Arduino sketches (programs) that can be used as a starting point for your projects. These sketches were intentionally kept simple, so that you can follow along without getting overwhelmed with complex details.

In addition, you will find some entertaining and educational project ideas, such as

- Produce a Tone Out that Depends on Sensor Reading
- Control an RGB LED with a 3-Axis Accelerometer
- Control a Mousetrap with a Photogate
- Control a Laser Pointer with a Motion Detector
- Add a Display For Temperature Readings
- Drive a Pendulum
- Explore PID Control

For more information, visit [www.vernier.com/arduino](http://www.vernier.com/arduino)

## SparkFun® RedBoard with Cable

### ARD-RED

The SparkFun RedBoard is a surface-mount board that is pin-for-pin compatible with the Arduino UNO R3 layout. The RedBoard uses a mini-B USB connector instead of a full-size, type-B USB connector. The RedBoard can supply 5 V, which is the operating voltage of most Vernier sensors.

[www.vernier.com/ard-red](http://www.vernier.com/ard-red)

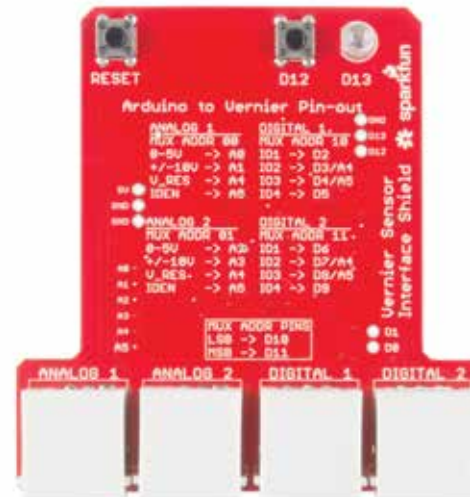


## Arduino Interface Shield

### BT-ARD

The Arduino Interface Shield plugs directly on top of the Arduino and adds two BTA (analog) and two BTD (digital) sockets. This shield was developed to be used with the SparkFun Arduino RedBoard but will work with the Arduino UNO and other UNO equivalents.

[www.vernier.com/bt-ard](http://www.vernier.com/bt-ard)



*The Arduino Interface Shield attaches directly to the SparkFun RedBoard.*





## National Instruments LabVIEW™ Software and Vernier

Introduce your students to a programming language used throughout the engineering disciplines. We have sample LabVIEW programs (VIs) for LabQuest, SensorDAQ, and other Vernier hardware.

For more information on LabVIEW software and to download our sample LabVIEW VIs, visit [www.vernier.com/ni-labview](http://www.vernier.com/ni-labview)

### Engineering for Science Classrooms

Science experiments traditionally focus on a particular principle and specify which tools to use in the investigation. Engineering activities, on the other hand, typically present a problem and challenge students to solve it by applying creativity, scientific principles, and whatever tools are at their disposal. Including engineering activities in your science curriculum increases student engagement, provides context for science learning, offers an alternative form of assessment, and teaches problem-solving skills.

Whether you teach physics, chemistry, or biology, we have a number of ways that you can include engineering activities in your curriculum.

For a complete list of activities, visit [www.vernier.com/engineering/science](http://www.vernier.com/engineering/science)



## SensorDAQ®

SDAQ

Designed by National Instruments and Vernier for Engineering Education

SensorDAQ is perfect for teaching NI LabVIEW or for building sensor-controlled student projects using NI LabVIEW software.

Compatible with over 80 Vernier sensors.

- Use with NI LabVIEW software. Not compatible with Logger Pro or Logger Lite software.
- Works with Windows® only.

### What's Included

- SensorDAQ
- Voltage Probe
- USB cable

[www.vernier.com/sdaq](http://www.vernier.com/sdaq)

SensorDAQ carries a one-year warranty.



## Protoboard Adapters

Use these adapters to connect Vernier sensors to a non-Vernier interface. The connector fits into a standard prototyping board or National Instruments' ELVIS prototyping board.

[www.vernier.com/protoboard-adapters](http://www.vernier.com/protoboard-adapters)

### Analog

BTA-ELV

### Digital

BTD-ELV



## myDAQ Adapter

BT-MDAQ

The myDAQ Adapter can be used to perform data acquisition with more than 60 Vernier sensors and the NI myDAQ interface (sold separately). Designed for use with NI LabVIEW software.

[www.vernier.com/bt-mdaq](http://www.vernier.com/bt-mdaq)







## Project Lead The Way and Vernier

Over the years, Vernier has developed a strong partnership with Project Lead The Way (PLTW). We value their mission to empower students to thrive in an evolving world.

By providing a comprehensive curriculum package based on national standards, focusing on teacher training, and integrating Vernier technology, PLTW programs are extremely valuable for schools integrating hands-on, project-based learning.

### About Project Lead The Way

Project Lead The Way is a nonprofit organization that provides a transformative learning experience for K–12 students and teachers across the United States. PLTW empowers students to develop in-demand, transportable knowledge and skills through pathways in computer science, engineering, and biomedical science. PLTW's teacher training and resources support teachers as they engage their students in real-world learning. More than 10,500 schools in all 50 states and the District of Columbia offer PLTW programs. For more information on Project Lead The Way, visit [www.pltw.org](http://www.pltw.org)



*Determining the effect of heart rate and exercise in the PLTW Biomedical Sciences Program*

## PLTW Programs

### PLTW Gateway

MIDDLE SCHOOL

PLTW Gateway sparks a joy of discovery and illuminates the range of paths and possibilities students can look forward to in high school and beyond. By tackling challenges like designing tires for a moon rover, cleaning up an oil spill, or solving a medical mystery, students in grades 6–8 learn to test their limits and question what's possible.

### PLTW Biomedical Science

SECONDARY

PLTW Biomedical Science students in grades 9–12 step into the roles of medical investigators, surgeons, and biomedical engineers. The program's collaborative, hands-on explorations inspire students to make an impact on the lives of those around them while preparing them with the knowledge and skills they need to thrive.

### PLTW Engineering

SECONDARY

PLTW Engineering engages students in grades 9–12 in collaborative, real-world activities like designing a home, programming electronic devices or robotic arms, or exploring algae as a biofuel source. By pushing themselves to rework and refine their projects, students learn that both failed attempts and perseverance are key to learning and innovation.

## Vernier Engineering Projects with LEGO® MINDSTORMS® Education EV3

MIDDLE SCHOOL

SECONDARY



Electronic Lab Book Only

EP-EV3-E

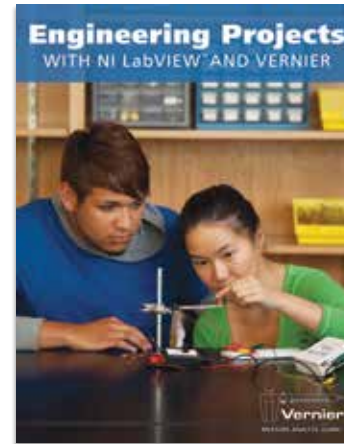
This book contains 13 engineering challenges to build and program robots using the LEGO® MINDSTORMS® Education EV3 Core Set, MINDSTORMS® EV3 Software, and Vernier sensors.

For a complete list of projects, see [www.vernier.com/ep-ev3](http://www.vernier.com/ep-ev3)

## Engineering Projects with NI LabVIEW™ and Vernier

SECONDARY

UNIVERSITY



Electronic Lab Book Only

EPV-E

This lab book contains engaging, hands-on projects for SensorDAQ® or LabQuest interfaces. It introduces engineering concepts and programming with NI LabVIEW software. An introductory knowledge of NI LabVIEW programming is assumed.

For a complete list of projects, see [www.vernier.com/epv](http://www.vernier.com/epv)

## Additional Engineering Books and Activities

### Engineering for Science Classrooms

- Beam and Bridge Inquiry Activities  
[www.vernier.com/products/sensors/vsmt](http://www.vernier.com/products/sensors/vsmt)
- Engineering Extension Activities  
[www.vernier.com/engineering/science-classrooms/extensions](http://www.vernier.com/engineering/science-classrooms/extensions)
- Build Your Own Sensors (BYOS) Activities  
[www.vernier.com/engineering/science-classrooms/sensors](http://www.vernier.com/engineering/science-classrooms/sensors)
- Engineering Projects  
[www.vernier.com/engineering/science-classrooms/projects](http://www.vernier.com/engineering/science-classrooms/projects)

### Scratch

- Scratch Coding Projects  
[www.vernier.com/engineering/scratch](http://www.vernier.com/engineering/scratch)

### LEGO® MINDSTORMS® Robotics

- Vernier Mars Challenge with LEGO® MINDSTORMS® Education EV3  
[www.vernier.com/mars-ev3](http://www.vernier.com/mars-ev3)
- Vernier Engineering Projects with LEGO® MINDSTORMS® Education NXT  
[www.vernier.com/ep-nxt](http://www.vernier.com/ep-nxt)

### Arduino™

- Arduino with Vernier Guide  
[www.vernier.com/engineering/arduino](http://www.vernier.com/engineering/arduino)

### LabVIEW

- Hands-On Introduction to NI LabVIEW™ with Vernier  
[www.vernier.com/lwv](http://www.vernier.com/lwv)

Measuring temperature and dissolved oxygen  
concentration of river water



# Environmental Science

[www.vernier.com/environmental-science](http://www.vernier.com/environmental-science)



## Packages

LabQuest 2 Packages page 82

## Go Direct Sensors

Sensor	Order Code	Page
<b>NEW</b> Go Direct CO <sub>2</sub> Gas	GDX-CO2	35
Go Direct Colorimeter	GDX-COL	50
Go Direct Conductivity	GDX-CON	84
<b>NEW</b> Go Direct Current	GDX-CUR	105
<b>NEW</b> Go Direct Energy	GDX-NRG	83
Go Direct Light and Color	GDX-LC	84
<b>NEW</b> Go Direct O <sub>2</sub> Gas	GDX-O2	35
<b>NEW</b> Go Direct Optical Dissolved Oxygen	GDX-ODO	83
pH Sensors		
Go Direct pH	GDX-PH	84
<b>NEW</b> Go Direct Tris-Compatible Flat pH	GDX-FPH	52
Go Direct SpectroVis Plus	GDX-SVISPL	53
Temperature Probes		
<b>NEW</b> Go Direct Surface Temperature	GDX-ST	84
Go Direct Temperature	GDX-TMP	84
Go Direct Voltage	GDX-VOLT	105

## LabQuest Sensors

Sensor	Order Code	Page
Anemometer	ANM-BTA	<a href="#">web</a>
Barometer	BAR-BTA	<a href="#">web</a>
CO <sub>2</sub> Gas Sensor	CO2-BTA	37
Colorimeter	COL-BTA	54
Conductivity Probe	CON-BTA	54
Current Probes		
Current Probe	DCP-BTA	112
High Current Sensor	HCS-BTA	<a href="#">web</a>

Energy Sensor	VES-BTA	86
Flow Rate Sensor	FLO-BTA	<a href="#">web</a>
Ion-Selective Electrodes*		
Ammonium Ion-Selective Electrode	NH4-BTA	<a href="#">web</a>
Calcium Ion-Selective Electrode	CA-BTA	<a href="#">web</a>
Chloride Ion-Selective Electrode	CL-BTA	<a href="#">web</a>
Nitrate Ion-Selective Electrode	NO3-BTA	<a href="#">web</a>
Potassium Ion-Selective Electrode	K-BTA	<a href="#">web</a>
Light Sensor	LS-BTA	115
O <sub>2</sub> Gas Sensor	O2-BTA	37
Optical DO Probe	ODO-BTA	85
PAR Sensor	PAR-BTA	38
pH Sensors		
pH Sensor	PH-BTA	56
Tris-Compatible Flat pH Sensor	FPH-BTA	38
Pyranometer	PYR-BTA	<a href="#">web</a>
Relative Humidity Sensor	RH-BTA	<a href="#">web</a>
Salinity Sensor	SAL-BTA	<a href="#">web</a>
Soil Moisture Sensor	SMS-BTA	85
Temperature Probes		
Extra-Long Temperature Probe	TPL-BTA	<a href="#">web</a>
Stainless Steel Temperature Probe	TMP-BTA	57
Surface Temperature Sensor	STS-BTA	57
Turbidity Sensor	TRB-BTA	<a href="#">web</a>
UV Sensors		
UVA Sensor	UVA-BTA	<a href="#">web</a>
UVB Sensor	UVB-BTA	66
Voltage Probes		
30-Volt Voltage Probe	30V-BTA	<a href="#">web</a>
Differential Voltage Probe	DVP-BTA	112
Voltage Probe	VP-BTA	57

## Digital Microscopes

Equipment	Order Code	Page
Celestron® Digital Microscope Imager	CS-DMI	40
ProScope™ Micro Mobile	Varies	40
USB Digital Microscope	BD-EDU-100	40

## Lab Equipment

Equipment	Order Code	Page
Primary Productivity Kit	PPK	<a href="#">web</a>
KidWind Wind Energy Kits	varies	87
Solar Exploration Kits	varies	86
Water Depth Sampler	WDS	<a href="#">web</a>

## Accessories

Accessories and replacement parts page 88

## Lab Books

Title	Page
<i>Investigating Environmental Science through Inquiry</i>	88
<i>Water Quality with Vernier</i>	89
<i>Renewable Energy with Vernier</i>	89
<i>Investigating Wind Energy</i>	71
<i>Investigating Solar Energy</i>	71
<i>Energía Renovable con Vernier</i>	89

\* Ion-Selective Electrodes require excellent chemical technique and careful calibration to obtain accurate results; they are not recommended for middle school or primary students.



# LABQUEST Environmental Science Packages



## Sensor Connection

LabQuest sensors connect to an interface from the LabQuest family.



## 2–4 Students

Packages support one lab station of 2–4 students.



## Standalone Device

Use LabQuest 2 as a standalone device with all Vernier sensors and built-in LabQuest App.

OR



## Wireless—One-to-Many

Transfer LabQuest 2 data wirelessly via Wi-Fi to one or more devices running Graphical Analysis™ 4 app.

OR



## Wired—One-to-One

LabQuest 2 works with Chromebooks™ and Windows® and macOS® computers.

## Deluxe Package

LQ2-EV-ODX

### Starter Package

LQ2-EV-OST



LabQuest 2



Stainless Steel Temperature Probe



pH Sensor



Conductivity Probe



Relative Humidity Sensor



UVB Sensor



CO<sub>2</sub> Gas Sensor



Vernier Optical DO Probe



Soil Moisture Sensor



Turbidity Sensor



Voltage Probe



Current Probe



Light Sensor

## You May Also Want

LabQuest Charge Station	LQ2-CRG	page 13
LabQuest Viewer software	LQ-VIEW	page 19
Vernier Energy Sensor	VES-BTA	page 86
<i>Investigating Environmental Science through Inquiry</i>	ESI	page 88

Additional recommendations available at  
[www.vernier.com/packages](http://www.vernier.com/packages)



Monitoring the level of dissolved oxygen during photosynthesis



## Connection



Connects directly via USB or Bluetooth® to your device

## Compatible platforms



Chromebook™



Computer



iOS device



Android™ device



LabQuest 2

## Software



FREE Graphical Analysis 4, LabQuest App (LabQuest 2 only)



For LabQuest sensors, see pp. 85–86.

## NEW Go Direct Optical Dissolved Oxygen

### GDX-ODO

Measure biological/biochemical oxygen demand or monitor watersheds over time with Go Direct Optical Dissolved Oxygen.

- Combines the power of multiple sensors to measure dissolved oxygen, water temperature, and atmospheric pressure
- Ready to sample dissolved oxygen immediately without additional setup or the need to warm it up—so more class time can be spent on the investigation

Range 0 to 20 mg/L  
0 to 300% saturation

[www.vernier.com/gdx-odo](http://www.vernier.com/gdx-odo)



## Go Direct Optical Dissolved Oxygen Replacement Cap

### GDX-ODO-CAP

[www.vernier.com/gdx-odo-cap](http://www.vernier.com/gdx-odo-cap)

## NEW Go Direct Energy

### GDX-NRG

Simpler to use than a multimeter, Go Direct Energy measures the voltage and current of a renewable energy system. Connect a source, such as a small wind turbine or solar panel, and our free Graphical Analysis 4 app calculates the power and energy output.

[www.vernier.com/gdx-nrg](http://www.vernier.com/gdx-nrg)



## Go Direct Light and Color



### GDX-LC

Go Direct Light and Color combines the power of visible light, UV, and RGB sensors to measure source emission, transmittance, and reflection of light in the visible light to ultraviolet electromagnetic spectrum. Explore light intensity as a function of distance, conduct polarized filter studies, observe the flicker of fluorescent lamps, perform reflectivity studies, and analyze RGB color contribution.

[www.vernier.com/gdx-lc](http://www.vernier.com/gdx-lc)

## Go Direct Conductivity

### GDX-CON

Investigate the difference between ionic and molecular compounds or measure Total Dissolved Solids (TDS). Our Go Direct Conductivity determines the ionic content of an aqueous solution by measuring its electrical conductivity (up to 20,000  $\mu\text{S}/\text{cm}$ ). The sensor includes automatic temperature compensation for general use that can be turned off to perform conductivity studies as a function of temperature.

[www.vernier.com/gdx-con](http://www.vernier.com/gdx-con)



## Go Direct pH

### GDX-PH

Use Go Direct pH to conduct acid-base titrations, monitor pH change during chemical reactions, test the pH and alkalinity of bodies of water, investigate household acids and bases, or examine the cause and effect of acid rain.

### Go Direct pH Teacher Pack

#### GDX-PH-TP

Includes eight Go Direct pH Sensors and a Go Direct Charge Station.

[www.vernier.com/gdx-ph](http://www.vernier.com/gdx-ph)



## Temperature Probes

[www.vernier.com/temperature-sensors](http://www.vernier.com/temperature-sensors)

Sensor	Temperature range	Features
Go Direct Temperature	-40°C to 125°C	Conduct endothermic and exothermic reactions, determine the physical properties of water, measure the energy content of foods, or investigate intermolecular forces.

### GDX-TMP



## NEW Go Direct Surface Temperature

### GDX-ST



-25°C to 125°C

Designed for use in situations in which low thermal mass or flexibility is required, this sensor has an exposed thermistor that results in an extremely rapid response time, and this design allows for use in air and water.

### Go Direct Temperature Teacher Pack

#### GDX-TMP-TP










Includes eight Go Direct Temperature Probes and a Go Direct Charge Station.



# LABQUEST Sensors

Measuring water quality parameters of a lake



Connection		Requires an interface from the LabQuest family	
LabQuest family		LabQuest 2	pp. 10–13
		LabQuest Stream	page 14
		LabQuest Mini	page 15
Compatible platforms		Chromebook™	
		Computer	
		iOS device	
		Android™ device	
Software		LabQuest App, Logger Pro, Graphical Analysis™ 4	



For Go Direct™ sensors, see pp. 83–84.

## Vernier Optical DO Probe

ODO-BTA



Students can measure the concentration of dissolved oxygen in water quickly and easily with the Vernier Optical DO Probe.

- Plug-and-play technology—no filling solution, warm-up time, calibration, or stirring necessary
- Built-in temperature and pressure compensation

Range 0 to 20 mg/L  
0 to 300% saturation

[www.vernier.com/odo-bta](http://www.vernier.com/odo-bta)

## Soil Moisture Sensor

SMS-BTA

The Soil Moisture Sensor uses capacitance to measure the water content of soil. Simply insert this rugged sensor into the soil to be tested and the volumetric water content of soil is reported in percent. Use it to conduct experiments in ecology, environmental science, agricultural science, horticulture, biology, and more.

Range 0 to 45% volumetric water content

[www.vernier.com/sms-bta](http://www.vernier.com/sms-bta)



## GLOBE® & Vernier

The GLOBE Program is an international science and education program that provides students and the public worldwide with the opportunity to participate in data collection and the scientific process as well as contribute meaningfully to our understanding of the Earth system and global environment. Use Vernier sensors to collect GLOBE data.

To learn more about Vernier and GLOBE, see [www.vernier.com/globe](http://www.vernier.com/globe)

## Vernier Energy Sensor

VES-BTA

The Vernier Energy Sensor offers an easy way to quantify voltage, current, power, and energy output of small wind turbines and solar panels.

Source input potential range	$\pm 30$ V
Source input current range	$\pm 1000$ mA

[www.vernier.com/ves-bta](http://www.vernier.com/ves-bta)



## Vernier Variable Load

VES-VL

The Vernier Variable Load is used in conjunction with the Vernier Energy Sensor to provide a range of resistive loads for projects with wind turbines or solar panels. This load is used in our *Renewable Energy with Vernier* lab book.

[www.vernier.com/ves-vl](http://www.vernier.com/ves-vl)



## Vernier Resistor Board

VES-RB

The Vernier Resistor Board provides a set of seven different load resistors for KidWind wind turbines and solar panels. This board is used in our *Investigating Wind Energy* and *Investigating Solar Energy* lab books.

[www.vernier.com/ves-rb](http://www.vernier.com/ves-rb)



## Lab Equipment

## KidWind simpleGEN

KW-SGEN

The simpleGEN is an easy-to-build AC generator that students can use to demonstrate Faraday's law, light LEDs, and perform experiments that explore how coils, magnets, and rotation affect power generation. Convert your generator to a simple motor and explore additional variables. Take your experiments to the next level by converting your simpleGEN into a wind turbine nacelle.

### KidWind simpleGEN Classroom Pack

KW-SGENC

The simpleGEN Classroom Pack has enough materials to build 10 generators.

[www.vernier.com/kw-sgen](http://www.vernier.com/kw-sgen)



## Solar Energy Exploration Kit

KW-SEEK



Explore solar energy with this innovative science kit designed to help students investigate energy transformations. Discover how the angle of photovoltaic panels relative to the sun affects power output. Experiment with basic circuits and learn about important factors in photovoltaic systems.

[www.vernier.com/kw-seek](http://www.vernier.com/kw-seek)



## 2V/400mA Solar Panel

KW-SP2V

This high-quality solar panel is great for demonstrations and experiments. External screw terminals and attached clip cords make the panels easy to use.

[www.vernier.com/kw-sp2v](http://www.vernier.com/kw-sp2v)



## Solar Thermal Exploration Kit

KW-STXK

The Solar Thermal Exploration Kit is modeled after a domestic solar water-heating system. Explore variables such as box color, light intensity, tube design, and rate of water pumping.

[www.vernier.com/kw-stxk](http://www.vernier.com/kw-stxk)



## Recommended Classroom Setup



3 Setups



6–10 Groups  
of 2–4 Students

We recommend three setups for a classroom with 6 to 10 groups of 2 to 4 students.

Each setup should have

- Box fan
- Wind turbine tower and base
- Vernier interface
- Vernier Energy Sensor (VES-BTA)
- Either a Vernier Variable Load (VES-VL) or a Vernier Resistor Board (VES-RB)

Each group needs

- Blade Pitch Protractor
- Wind Turbine Hub
- Blade consumables

## Which KidWind Kit Should I Buy?

I Teach	I Should Buy
K–3	MINI Wind Turbine
4–5	MINI Wind Turbine with Blade Design
6–8	Basic Wind Experiment Kit
Secondary	Advanced Wind Experiment Kit
University	Advanced Wind Experiment Kit with GENPack or simpleGEN

## KidWind Advanced Wind Experiment Kit

KW-AWX

Discover advanced concepts of wind turbine technology, including gearboxes and generator construction (with the simpleGEN add-on). Students use the blades they design to generate electricity, lift weights, and pump water. This kit is recommended for use with our lab book *Renewable Energy with Vernier*.

KidWind Advanced Wind Experiment Kit Classroom Pack

KW-AWXC

[www.vernier.com/kw-awx](http://www.vernier.com/kw-awx)



Make measuring power output easy with Go Direct Energy.

See page 86.

## KidWind Basic Wind Experiment Kit

KW-BWX

This kit allows young scientists to test a variety of blade designs, generate electricity (0.5–3 V range), and lift weights. Great for classrooms as well as individual science fair projects.

KidWind Basic Wind Experiment Kit Classroom Pack

KW-BWXC

[www.vernier.com/kw-bwx](http://www.vernier.com/kw-bwx)



## KidWind MINI Wind Turbine with Blade Design

KW-MWTBD

The MINI Wind Turbine with Blade Design allows students to perform basic blade experiments on a desk using a small house fan (not included). This kit is recommended for use with our lab book *Investigating Wind Energy*.

[www.vernier.com/kw-mwtbd](http://www.vernier.com/kw-mwtbd)



## KidWind MINI Wind Turbine

KW-MWT

This easy-to-build turbine can light an LED or play a tune on the Sound and Light Board (included).

[www.vernier.com/kw-mwt](http://www.vernier.com/kw-mwt)



For information on complete kit contents and additional KidWind parts and accessories, visit [www.vernier.com/kidwind](http://www.vernier.com/kidwind)



## Accessories and Replacement Parts

Part Name	Order Code
<b>Bottles</b>	
Water Quality Bottles (pkg. of 8)	WQ-BOT
<b>CO<sub>2</sub> and/or O<sub>2</sub> Gas Sensor</b>	
BioChamber 250 (250 mL) (2 openings)	BC-250
BioChamber 2000 (2000 mL) (2 openings)	BC-2000
<b>KidWind</b>	
Basic Turbine Building Parts	KW-BTPART
Basic Turbine Building Parts (10 Pack)	KW-BTPART10
Blade Design Consumables Classroom Pack	KW-BDC
Blade Pitch Protractor	KW-BPP
Dowels (25 Pack)	KW-D25
Dowels (100 Pack)	KW-D100
Wind Turbine Generator (10 Pack)	KW-GEN10
Wind Turbine Hub (3 Pack)	KW-WTH3
Wind Turbine Hub (10 Pack)	KW-WTH10
<b>Optical Dissolved Oxygen Probes</b>	
Go Direct Dissolved Oxygen Replacement Cap (for GDX-ODO)	GDX-ODO-CAP
Optical DO Probe Metal Guard	ODO-GRD
Optical DO Probe Replacement Cap (for ODO-BTA)	ODO-CAP

## Lab Books

### Lab Books

#### Subjects

	<i>Investigating Environmental Science through Inquiry</i>	<i>Water Quality with Vernier</i>	<i>Renewable Energy with Vernier</i>
General Science	●	●	●
AP* Environmental Science	●	●	●
IB† Environmental Systems and Societies	●	●	●
Earth Science		●	●
Environmental Engineering			●
STEM			●

#### Did you know?

AP\* Environmental Studies program and the IB† Environmental Systems and Societies programs both recommend a strong laboratory and field investigation component. The *Investigating Environmental Science through Inquiry* lab book includes experiments correlated to both AP and IB standards. For correlations of Vernier labs to AP/IB objectives, visit [www.vernier.com/environmental](http://www.vernier.com/environmental)

\* AP and Advanced Placement Program are registered trademarks of the College Entrance Examination Board, which was not involved in the production of and does not endorse this product.

† The IB Diploma Program is an official program of the International Baccalaureate Organization (IBO) which authorizes schools to offer it. The material available here has been developed independently of the IBO and is not endorsed by it.

## Investigating Environmental Science through Inquiry

SECONDARY

UNIVERSITY



Electronic Lab Book Only

ESI-E

Printed + Electronic Lab Book

ESI

Topics include

- Acid deposition
- Water quality
- Climate change
- Weather
- Renewable energy

For a complete list of all 38 investigations, visit [www.vernier.com/esi](http://www.vernier.com/esi)

### Sensors Used

Sensor	Page
Temperature	57
pH	56
Conductivity	54
Dissolved Oxygen	85
Soil Moisture	85
Turbidity	<a href="http://www.vernier.com/trb-bta">www.vernier.com/trb-bta</a>
Relative Humidity	<a href="http://www.vernier.com/rh-bta">www.vernier.com/rh-bta</a>
UVB	66
CO <sub>2</sub> Gas	37
Voltage	57
Current	112
Light	115

### Additional Products

Equipment	Page
Water Depth Sampler	<a href="http://www.vernier.com/wds">www.vernier.com/wds</a>
Primary Productivity Kit	<a href="http://www.vernier.com/ppk">www.vernier.com/ppk</a>
Stir Station	58

### Supported Software

Software	Page
Logger Pro	20–21
LabQuest App	11–12
Graphical Analysis™ 4	16–17
EasyData	<a href="http://www.vernier.com/easydata">www.vernier.com/easydata</a>

## Water Quality with Vernier

MIDDLE SCHOOL

SECONDARY

UNIVERSITY



Electronic Lab  
Book Only

WQV-E

Printed +  
Electronic  
Lab Book

WQV

Topics include

- Water quality testing

For a complete list of all 18 tests, visit [www.vernier.com/wqv](http://www.vernier.com/wqv)

### Sensors Used

Sensor	Page
Temperature	57
pH	56
Turbidity	<a href="http://www.vernier.com/trb-bta">www.vernier.com/trb-bta</a>
Dissolved Oxygen	85
Colorimeter	54
Conductivity	54
Nitrate ISE <sup>†</sup>	<a href="http://www.vernier.com/no3-bta">www.vernier.com/no3-bta</a>
Ammonium ISE <sup>†</sup>	<a href="http://www.vernier.com/nh4-bta">www.vernier.com/nh4-bta</a>
Calcium ISE <sup>†</sup>	<a href="http://www.vernier.com/ca-bta">www.vernier.com/ca-bta</a>
Chloride ISE <sup>†</sup>	<a href="http://www.vernier.com/cl-bta">www.vernier.com/cl-bta</a>
Flow Rate	<a href="http://www.vernier.com/flo-bta">www.vernier.com/flo-bta</a>
PAR Sensor	38

### Additional Products

Equipment	Page
Water Depth Sampler	<a href="http://www.vernier.com/wds">www.vernier.com/wds</a>
Water Quality Bottles	88

### Supported Software

Software	Page
Logger Pro	20–21
LabQuest App	11–12
EasyData	<a href="http://www.vernier.com/easydata">www.vernier.com/easydata</a>

<sup>†</sup> Ion-Selective Electrodes require excellent chemical technique and careful calibration to obtain accurate results; they are not recommended for middle school or primary students.

## Renewable Energy with Vernier

winner!  
2015 AWARDS  
of EXCELLENCE  
in TECH & LEARNING

MIDDLE SCHOOL

SECONDARY

UNIVERSITY



Electronic Lab  
Book Only

REV-E

Printed +  
Electronic  
Lab Book

REV

Topics include

- Renewable energy
- Wind power
- Solar power

For a complete list of all 26 experiments, visit [www.vernier.com/rev](http://www.vernier.com/rev)

NGSS  
ALIGNED

### Sensors Used

Sensor	Page
Energy	86
Surface Temperature	57
Light	115
Anemometer	<a href="http://www.vernier.com/anm-bta">www.vernier.com/anm-bta</a>

### Additional Products

Equipment	Page
Vernier Variable Load	86
KidWind Advanced Wind Experiment Kit	87
KidWind Solar Panel	86
KidWind SimpleGen Kit	86
KidWind Solar Thermal Exploration Kit	86

### Energía Renovable con Vernier



*Energía Renovable con Vernier is the Spanish-language version of Renewable Energy with Vernier.*

[www.vernier.com/rev-es](http://www.vernier.com/rev-es)

### Supported Software

Software	Page
Logger Pro	20–21
LabQuest App	11–12

Measuring the potential developed by a lemon battery



# Middle School Science

[www.vernier.com/ms-science](http://www.vernier.com/ms-science)



## Packages

Go Direct and LabQuest Packages pp. 92–93

## Go Direct Sensors

Sensor	Order Code	Page
Go Direct 3-Axis Magnetic Field	GDX-3MG	105
Carts and Tracks		
<b>NEW</b> Dynamics Cart and Track System with Go Direct Sensor Carts	DTS-GDX	103
<b>NEW</b> Go Direct Sensor Cart (Green)	GDX-CART-G	94
<b>NEW</b> Go Direct Sensor Cart (Yellow)	GDX-CART-Y	94
Go Direct Conductivity	GDX-CON	50
<b>NEW</b> Go Direct Current	GDX-CUR	105
<b>NEW</b> Go Direct Energy	GDX-NRG	94
Go Direct Force and Acceleration	GDX-FOR	104
Go Direct Gas Pressure	GDX-GP	51
Heart Rate Monitors		
Go Wireless Exercise Heart Rate	GW-EHR	<a href="#">web</a>
Go Wireless Heart Rate	GW-HR	36
Go Direct Light and Color	GDX-LC	105
<b>NEW</b> Go Direct Motion	GDX-MD	94
<b>NEW</b> Go Direct Optical Dissolved Oxygen	GDX-ODO	35
pH Sensors		
Go Direct pH	GDX-PH	52
<b>NEW</b> Go Direct Tris-Compatible Flat pH	GDX-FPH	52
Temperature Probes		
<b>NEW</b> Go Direct Surface Temperature	GDX-ST	53
Go Direct Temperature	GDX-TMP	94
Go Direct Voltage	GDX-VOLT	105

## LabQuest Sensors

Sensor	Order Code	Page
Anemometer	ANM-BTA	<a href="#">web</a>
Barometer	BAR-BTA	<a href="#">web</a>
Conductivity Probe	CON-BTA	54
Current Probe	DCP-BTA	112
Energy Sensor	VES-BTA	86
Force Sensors		
Dual-Range Force Sensor	DFS-BTA	109
Force Plate	FP-BTA	109
Gas Pressure Sensor	GPS-BTA	55
Hand Dynamometer	HD-BTA	38
Hand-Grip Heart Rate Monitor	HGH-BTA	38
Light Sensor	LS-BTA	115
Magnetic Field Sensor	MG-BTA	113
Motion Detectors		
Dynamics Cart and Track System with Motion Encoder	DTS-EC	106
Motion Detector	MD-BTD	108
Optical DO Probe	ODO-BTA	37
pH Sensors		
pH Sensor	PH-BTA	56
Tris-Compatible Flat pH Sensor	FPH-BTA	38
Pyranometer	PYR-BTA	<a href="#">web</a>
Relative Humidity Sensor	RH-BTA	<a href="#">web</a>
Salinity Sensor	SAL-BTA	<a href="#">web</a>
Soil Moisture Sensor	SMS-BTA	85
Sound Level Sensor	SLS-BTA	111
Structures & Materials Tester	VSMT	74
Temperature Probes		
Extra-Long Temperature Probe	TPL-BTA	<a href="#">web</a>
Infrared Thermometer	IRT-BTA	<a href="#">web</a>
Stainless Steel Temperature Probe	TMP-BTA	57
Surface Temperature Sensor	STS-BTA	57
Thermocouple	TCA-BTA	57

## UV Sensors

UVA Sensor	UVA-BTA	<a href="#">web</a>
UVB Sensor	UVB-BTA	66

## Voltage Probes

Differential Voltage Probe	DVP-BTA	112
Voltage Probe	VP-BTA	57

## Go! Sensors (USB Only)

Product	Order Code	Page
Go! Motion	GO-MOT	<a href="#">web</a>
Go!Temp	GO-TEMP	<a href="#">web</a>

## Additional Products

Product	Order Code	Page
Dynamics Cart and Track System	DTS	106
OHAUS® Balances	Varies	58
KidWind MINI Wind Turbine with Blade Design	KW-MWTBD	87
KidWind Basic Wind Experiment Kit	KW-BWX	87
Solar Energy Exploration Kit	KW-SEEK	86
Vernier Resistor Board	VES-RB	86

## Lab Books

Title	Page
<i>Middle School Science with Vernier</i> 4th Edition	95
<i>Earth Science with Vernier</i>	67
<i>Investigating Solar Energy</i>	71
<i>Investigating Wind Energy</i>	71
<i>Physical Science with Vernier</i> 4th Edition	99

# Go Direct™ Middle School Packages



## Sensor Connection

Go Direct sensors connect directly via USB or Bluetooth®.



## 2–4 Students

Packages support one lab station of 2–4 students.



## Works with Your Existing Devices

Connect to your Chromebook™, mobile device, computer, or LabQuest 2.



## Collect data with the FREE Graphical Analysis™ 4 app

No additional equipment or software purchase is necessary.



## Go Direct sensors are perfect for instructors who

- Are new to probeware
- Plan to equip a new school
- Are already using Chromebooks and mobile devices

## Deluxe Package

GDP-MS-DX

### Starter Package

GDP-MS-ST



Go Direct Motion



Go Direct pH



Go Direct Voltage



Go Direct Temperature (x2)



Go Direct Light and Color



Go Direct Force and Acceleration



Go Direct Gas Pressure



Go Direct Conductivity



Go Direct 3-Axis Magnetic Field



Go Wireless Heart Rate

## You May Also Want

<b>NEW</b> Go Direct Charge Station	GDX-CRG	page 3
<b>NEW</b> Go Direct Energy Sensor	GDX-NRG	page 94
<b>NEW</b> Go Direct Sensor Carts	GDX-CART-G, GDX-CART-Y	page 94
<i>Middle School Science with Vernier</i>	MSV	page 95

Additional recommendations available at  
[www.vernier.com/packages](http://www.vernier.com/packages)



# LABQUEST Middle School Packages



## Sensor Connection

LabQuest sensors connect to an interface from the LabQuest family.



## 2–4 Students

Packages support one lab station of 2–4 students.



## Standalone Device

Use LabQuest 2 as a standalone device with all Vernier sensors and built-in LabQuest App.

OR



## Wireless—One-to-Many

Transfer LabQuest 2 data wirelessly via Wi-Fi to one or more devices running Graphical Analysis 4 app.

OR



## Wired—One-to-One

LabQuest 2 works with Chromebooks and Windows® and macOS® computers.

## Deluxe Package

LQ2-MS-DX

### Starter Package

LQ2-MS-ST



LabQuest 2



pH Sensor



Motion Detector



Stainless Steel Temperature Probes (x2)



Voltage Probe



Light Sensor



Dual-Range Force Sensor



Gas Pressure Sensor



Conductivity Probe



Magnetic Field Sensor



Go Wireless Heart Rate

## You May Also Want

LabQuest Charge Station	LQ2-CRG	page 13
LabQuest Viewer Software	LQ-VIEW	page 19
Vernier Energy Sensor	VES-BTA	page 86
Middle School Science with Vernier	MSV	page 95

Additional recommendations available at  
[www.vernier.com/packages](http://www.vernier.com/packages)

Measuring mechanical advantage  
in a pulley system



## Connection



Connects directly via USB or  
Bluetooth® to your device

## Compatible platforms



Chromebook™



Computer



iOS device



Android™ device



LabQuest 2

## Software



FREE Graphical Analysis™ 4,  
LabQuest App (LabQuest 2 only)



For more Go Direct sensors, see  
[www.vernier.com/middle-school-science](http://www.vernier.com/middle-school-science)



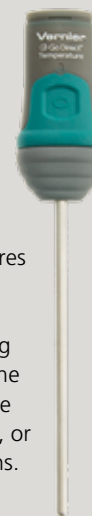
For LabQuest sensors, see  
[www.vernier.com/middle-school-science](http://www.vernier.com/middle-school-science)

## Go Direct Temperature

### GDX-TMP

With Go Direct Temperature, students can monitor temperatures from  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ , conduct endothermic and exothermic reactions, investigate the freezing and melting of water, measure the energy content of foods, examine the absorption of radiant energy, or monitor environmental conditions.

[www.vernier.com/gdx-tmp](http://www.vernier.com/gdx-tmp)



## Go Direct Temperature Teacher Pack

### GDX-TMP-TP

Includes eight Go Direct Temperature Probes and a Go Direct Charge Station.

## NEW Go Direct Energy

### GDX-NRG

Go Direct Energy quantifies the voltage, current, power, and energy output of small wind turbines and solar panels, such as those used in our KidWind Experiment Kits (see pp. 86–87).

[www.vernier.com/gdx-nrg](http://www.vernier.com/gdx-nrg)



## NEW Go Direct Motion

### GDX-MD

Go Direct Motion accurately tracks objects as close as 15 cm and as far away as 2.5 m. The compact design and wireless capabilities of this motion detector eliminate the concern of a dangling cable getting in the way.

The built-in temperature compensation of Go Direct Motion automatically adjusts for the difference in the speed of sound in cold and warm locations.

[www.vernier.com/gdx-md](http://www.vernier.com/gdx-md)



## NEW Go Direct Sensor Carts

### Go Direct Sensor Cart (Green)

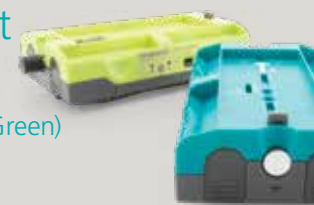
#### GDX-CART-G

### Go Direct Sensor Cart (Yellow)

#### GDX-CART-Y

We've added wireless sensors to our popular dynamics cart. Built-in sensors report motion, force, and acceleration data. Conduct basic investigations with or without a track.

[www.vernier.com/gdx-cart](http://www.vernier.com/gdx-cart)



## Enhance Your Curriculum with Vernier Lab Books

Enhance your curriculum with our award-winning lab books, which are available as eco-friendly electronic downloads in addition to the traditional print format. Now you'll always have access to the most up-to-date versions of the experiments through your Vernier account.

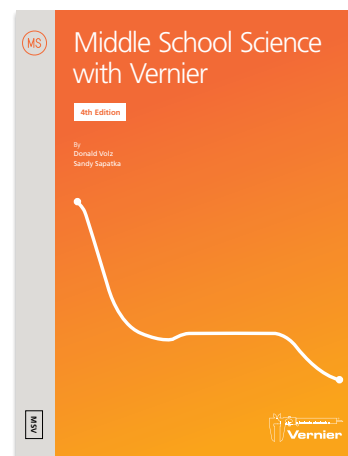
- Download word-processing files to customize the experiments to fit your curricular needs.
- Electronic versions include a generous site license—purchase once and share files with other instructors in your school or university department.

### Middle School Lab Books

Subjects	<i>Middle School Science with Vernier</i>	<i>Physical Science with Vernier</i> (see page 99)	<i>Earth Science with Vernier</i> (see page 67)	<i>Investigating Wind Energy</i> (see page 71)	<i>Investigating Solar Energy</i> (see page 71)	<i>Vernier Engineering Projects with LEGO® MINDSTORMS® Education EV3</i> (see page 79)
Life Science	•					•
Earth and Space Science	•		•	•	•	•
Physical Science	•	•				•
Environmental Science	•			•	•	•
Engineering Education				•	•	•

## Middle School Science with Vernier 4th Edition

MIDDLE SCHOOL



Electronic Lab Book Only

MSV-E

Printed + Electronic Lab Book

MSV

Topics include

- Physical science
- Life science
- Earth science
- Renewable energy

For a complete list of all 38 experiments, visit [www.vernier.com/msv](http://www.vernier.com/msv)

### Sensors Used

Sensor	Page
Temperature	57, 94
pH	52, 56
Voltage	57, 105
Motion Detector	94, 108
Light	105, 115
Force	104, 109
Conductivity	50, 54
Gas Pressure	51, 55
Heart Rate Monitor	36, 38
Magnetic Field	105, 113

### Additional Products

Equipment	Page
Electrode Support	58
Stir Station	58

### Supported Software

Software	Page
Logger Pro	20–21
LabQuest App	11–12
Graphical Analysis 4	16–17
EasyData	<a href="http://www.vernier.com/easydata">www.vernier.com/easydata</a>

Measuring mechanical advantage in a pulley system



# Physical Science

[www.vernier.com/physical-science](http://www.vernier.com/physical-science)



## Go Direct Sensors

Sensor	Order Code	Page
Go Direct 3-Axis Magnetic Field	GDX-3MG	98
<b>NEW</b> Go Direct Acceleration	GDX-ACC	104
Carts and Tracks		
<b>NEW</b> Dynamics Cart and Track System with Go Direct Sensor Carts	DTS-GDX	103
<b>NEW</b> Go Direct Sensor Cart (Green)	GDX-CART-G	103
<b>NEW</b> Go Direct Sensor Cart (Yellow)	GDX-CART-Y	103
Go Direct Conductivity	GDX-CON	99
<b>NEW</b> Go Direct Current	GDX-CUR	105
<b>NEW</b> Go Direct Energy	GDX-NRG	83
Go Direct Force and Acceleration	GDX-FOR	98
Go Direct Gas Pressure	GDX-GP	99
Go Direct Light and Color	GDX-LC	99
<b>NEW</b> Go Direct Motion	GDX-MD	98
Go Direct pH	GDX-PH	52
Temperature Probes		
<b>NEW</b> Go Direct Surface Temperature	GDX-ST	53
Go Direct Temperature	GDX-TMP	99
Go Direct Voltage	GDX-VOLT	105

## LabQuest Sensors

Sensor	Order Code	Page
Accelerometers		
3-Axis Accelerometer	3D-BTA	108
25-g Accelerometer	ACC-BTA	108
Low-g Accelerometer	LGA-BTA	108
Conductivity Probe	CON-BTA	54
Current Probes		
Current Probe	DCP-BTA	112
High Current Sensor	HCS-BTA	<a href="#">web</a>
Energy Sensor	VES-BTA	86
Force Sensors		
Dual-Range Force Sensor	DFS-BTA	109
Force Plate	FP-BTA	109
Gas Pressure Sensor	GPS-BTA	55
Light Sensor	LS-BTA	115
Magnetic Field Sensor	MG-BTA	113
Microphone	MCA-BTA	111
Motion Detectors		
Motion Detector	MD-BTD	108
Dynamics Cart and Track System with Motion Encoder	DTS-EC	106
pH Sensor	PH-BTA	56
Photogate	VPG-BTD	108
Sound Level Sensor	SLS-BTA	111
Structures & Materials Tester	VSMT	74
Temperature Probes		
Infrared Thermometer	IRT-BTA	<a href="#">web</a>
Stainless Steel Temperature Probe	TMP-BTA	57
Surface Temperature Sensor	STS-BTA	57
Thermocouple	TCA-BTA	57
Voltage Probes		
30-Volt Voltage Probe	30V-BTA	<a href="#">web</a>
Differential Voltage Probe	DVP-BTA	112
Voltage Probe	VP-BTA	57

## Balances

Balances	Order Code	Page
OHAUS Scout (120 g)	OHS-123	58
OHAUS Scout (220 g)	OHS-222	58
OHAUS Scout (420 g)	OHS-422	58

## Go! Sensors (USB Only)

Sensor	Order Code	Page
Go! Motion	GO-MOT	<a href="#">web</a>
Go!Temp	GO-TEMP	<a href="#">web</a>

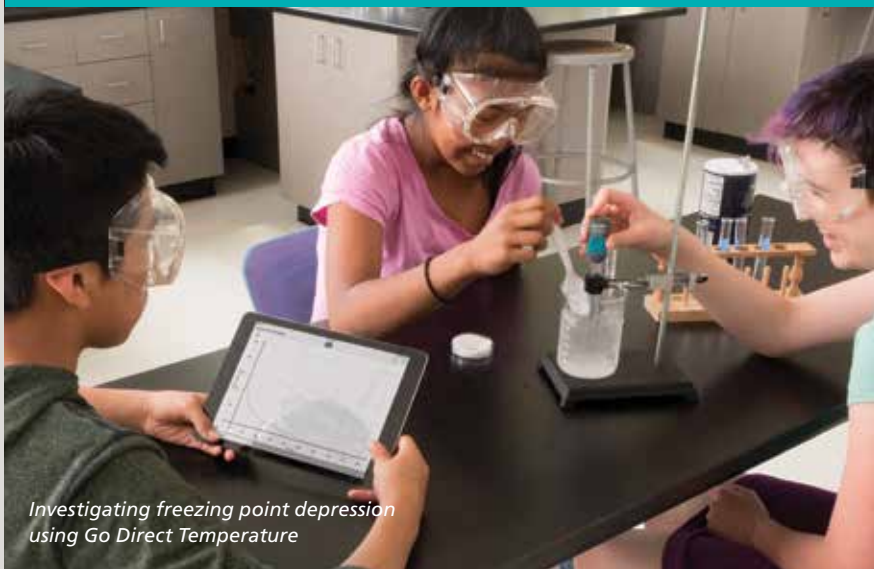
## Additional Products

Product	Order Code	Page
Dynamics Cart and Track System	DTS	106
Electrode Support	ESUP	58
Motion Detector Clamp	MD-CLAMP	<a href="#">web</a>
Stir Station	STIR	58

## Lab Books

Title	Page
<i>Physical Science with Vernier</i> 4th Edition	99





Investigating freezing point depression using Go Direct Temperature

## Connection



USB or Bluetooth® connects directly to your device

## Compatible platforms



Chromebook™



Computer



iOS Device



Android™ Device



LabQuest 2

## Software



FREE Graphical Analysis™ 4, LabQuest App (LabQuest 2 only)



For LabQuest sensors, see [www.vernier.com/physical-science](http://www.vernier.com/physical-science)

## NEW Go Direct Motion

### GDX-MD

Go Direct Motion accurately tracks objects as close as 15 cm and as far away as 2.5 m. The compact design and wireless capability of this motion detector eliminate the concern of a dangling cable getting in the way.

The built-in temperature compensation of Go Direct Motion automatically adjusts for the difference in the speed of sound in cold and warm locations.

[www.vernier.com/gdx-md](http://www.vernier.com/gdx-md)



## Go Direct Force and Acceleration

### GDX-FOR

Go Direct Force and Acceleration includes a  $\pm 50$  N force sensor, a 3-axis accelerometer, and a 3-axis gyroscope. Take it on an amusement park ride, mount it on a dynamics cart, or attach a string and whirl it in a horizontal or vertical circle.

[www.vernier.com/gdx-for](http://www.vernier.com/gdx-for)



## Go Direct 3-Axis Magnetic Field

### GDX-3MG

This sensor measures the components of the magnetic field along three orthogonal axes. Use it to study the Earth's magnetic field or investigate magnetic fields of permanent magnets, electromagnets, and solenoids.

[www.vernier.com/gdx-3mg](http://www.vernier.com/gdx-3mg)



## Go Direct Conductivity

### GDX-CON

Use Go Direct Conductivity to determine the ionic content of an aqueous solution by measuring its electrical conductivity (up to 20,000  $\mu\text{S}/\text{cm}$ ).

[www.vernier.com/gdx-con](http://www.vernier.com/gdx-con)



## Go Direct Gas Pressure

### GDX-GP

Monitor the pressure of a gas (up to 400 kPa). Explore pressure-volume or temperature-pressure relationships, investigate grip strength and muscle fatigue, and more.

[www.vernier.com/gdx-gp](http://www.vernier.com/gdx-gp)



## Go Direct Light and Color

### GDX-LC

Go Direct Light and Color combines the power of visible light, UVA/UVB, and RGB sensors to measure source emission, transmittance, and reflection of light in the visible light to ultraviolet electromagnetic spectrum. Explore light intensity as a function of distance, observe the flicker of fluorescent lamps, and perform reflectivity studies.

[www.vernier.com/gdx-lc](http://www.vernier.com/gdx-lc)

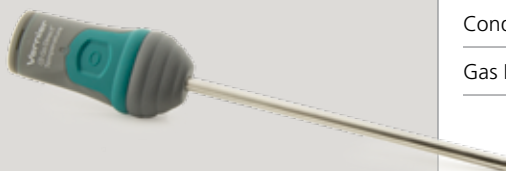


## Go Direct Temperature

### GDX-TMP

With Go Direct Temperature, students can monitor temperatures from  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . Conduct endothermic and exothermic reactions, investigate the freezing and melting of water, and more.

[www.vernier.com/gdx-tmp](http://www.vernier.com/gdx-tmp)

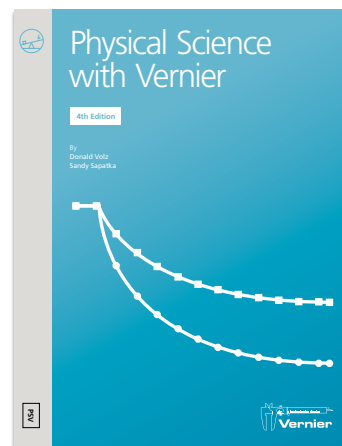


## Lab Books

### Physical Science with Vernier 4th Edition

MIDDLE SCHOOL

SECONDARY



Electronic Lab  
Book Only

PSV-E

Printed +  
Electronic  
Lab Book

PSV

Topics include

- Properties of matter
- Forces and interactions
- Electricity

For a complete list of all 40 experiments, visit [www.vernier.com/psv](http://www.vernier.com/psv)

### Sensors Used

Sensor	Page
Temperature	57, 99
Motion Detector	98, 108
pH	52, 56
Voltage	105, 112
Force	98, 109
Light	99, 115
Magnetic Field	98, 113
Conductivity	54, 99
Gas Pressure	99, 55

### Additional Products

Equipment	Page
Electrode Support	58
Vernier Circuit Board 2	113
Dynamics Cart and Track System	106
Motion Detector Clamp	24

### Supported Software

Software	Page
Logger Pro	20–21
LabQuest App	11–12
Graphical Analysis 4	16–17
EasyData	<a href="http://www.vernier.com/easydata">www.vernier.com/easydata</a>

For more information, visit [www.vernier.com/physical-science](http://www.vernier.com/physical-science)

Exploring impulse and change in momentum



# Physics

[www.vernier.com/physics](http://www.vernier.com/physics)

## Packages

LabQuest Packages page 102

## Go Direct Sensors

Sensor	Order Code	Page
Go Direct 3-Axis Magnetic Field	GDX-3MG	105
<b>NEW</b> Go Direct Acceleration	GDX-ACC	104
Carts and Tracks		
<b>NEW</b> Dynamics Cart and Track System with Go Direct Sensor Carts	DTS-GDX	103
<b>NEW</b> Go Direct Sensor Cart (Green)	GDX-CART-G	103
<b>NEW</b> Go Direct Sensor Cart (Yellow)	GDX-CART-Y	103
<b>NEW</b> Go Direct Current	GDX-CUR	105
Go Direct Force and Acceleration	GDX-FOR	104
Go Direct Gas Pressure	GDX-GP	105
Go Direct Light and Color	GDX-LC	105
<b>NEW</b> Go Direct Motion	GDX-MD	104
Go Direct Radiation Monitor	GDX-RAD	105
<b>NEW</b> Go Direct Rotary Motion	GDX-RMS	104
Temperature Probes		
<b>NEW</b> Go Direct Surface Temperature	GDX-ST	104
Go Direct Temperature	GDX-TMP	104
Go Direct Voltage	GDX-VOLT	105

## LabQuest Sensors

Sensor	Order Code	Page
Accelerometers		
3-Axis Accelerometer	3D-BTA	108
25-g Accelerometer	ACC-BTA	108
Low-g Accelerometer	LGA-BTA	108

### Carts and Tracks

Dynamics Cart and Track System with Motion Encoder	DTS-EC	106
Encoder Fan Cart	CART-FEC	107

### Current Sensors

Current Probe	DCP-BTA	112
High Current Sensor	HCS-BTA	<a href="#">web</a>
Vernier Energy Sensor	VES-BTA	86

### Electricity and Magnetism Sensors

Charge Sensor	CRG-BTA	113
Magnetic Field Sensor	MG-BTA	113

### Force Sensors

Dual-Range Force Sensor	DFS-BTA	109
Force Plate	FP-BTA	109

Gas Pressure Sensor	GPS-BTA	111
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### Light Sensors

Diffraction Apparatus	DAK	115
Light Sensor	LS-BTA	115

### Motion Detectors

Go! Motion (USB sensor)	GO-MOT	108
Motion Detector	MD-BTD	108
Photogate	VPG-BTD	108

Power Amplifier	PAMP	112
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### Projectiles

Projectile Launcher	VPL	109
Time of Flight Pad	TOF-VPL	109

Radiation Monitor	VRM-BTD	116
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Rotary Motion Sensor	RMV-BTD	110
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### Sound Sensors

Microphone	MCA-BTA	111
Sound Level Meter	SLM-BTA	111
Sound Level Sensor	SLS-BTA	111

### Temperature Probes

Infrared Thermometer	IRT-BTA	<a href="#">web</a>
Stainless Steel Temperature Probe	TMP-BTA	111
Surface Temperature Sensor	STS-BTA	111

### Voltage Probes

30-Volt Voltage Probe	30V-BTA	<a href="#">web</a>
Differential Voltage Probe	DVP-BTA	112
Instrumentation Amplifier	INA-BTA	55
Vernier Energy Sensor	VES-BTA	86
Voltage Probe	VP-BTA	57

## Emission Spectrometer

Emission Spectrometer	Order Code	Page
Vernier Emissions Spectrometer	VSP-EM	116

## Infrared Cameras

FLIR ONE thermal cameras page 111

## Accessories

Accessories and replacement parts page 117

## Lab Books

Title	Page
<b>UPDATED</b> <i>Physics with Vernier</i> 4th Edition	119
<b>NEW</b> <i>Physics Explorations and Projects</i>	120
<i>Advanced Physics with Vernier—Mechanics</i>	120
<i>Advanced Physics with Vernier—Beyond Mechanics</i>	121
<i>Physics with Video Analysis</i>	121
<b>NEW</b> <i>Fisica Con Vernier</i>	119
Additional physics lab books	121



page 118



# LABQUEST Physics Packages



## Sensor Connection

LabQuest sensors connect to an interface from the LabQuest family.



## 2–4 Students

Packages support one lab station of 2–4 students.



## Standalone Device

Use LabQuest 2 as a standalone device with all Vernier sensors and built-in LabQuest App.

OR



## Wireless—One-to-Many

Transfer LabQuest 2 data wirelessly via Wi-Fi to one or more devices running Graphical Analysis™ 4 app.

OR



## Wired—One-to-One

LabQuest 2 works with Chromebooks and Windows® and macOS® computers.

## Deluxe Package

LQ2-PHY-DX

### Starter Package

LQ2-PHY-ST



LabQuest 2



Motion Detector



Dual-Range Force Sensor



Microphone



Differential Voltage Probe



Differential Voltage Probe



Low-g Accelerometer



Light Sensor



Vernier Photogates (x2)



Ultra Pulley Attachment



Picket Fence



Stainless Steel Temperature Probe



Magnetic Field Sensor



Current Probes (x2)

## You May Also Want

LabQuest Charge Station	LQ2-CRG	page 13
LabQuest Viewer Software	LQ-VIEW	page 19
Dynamics Cart and Track System with Motion Encoder	DTS-EC	page 106
Additional sensors for physics		pp. 106–116
Lab books for physics		pp. 119–121

Looking for physics packages that include the low-cost and powerful LabQuest Mini interface?  
See [www.vernier.com/lm-phy-dx](http://www.vernier.com/lm-phy-dx)

Additional recommendations available at  
[www.vernier.com/packages](http://www.vernier.com/packages)



Investigating impulse and change in momentum with  
Go Direct Sensor Cart and Graphical Analysis 4



## Connection



Connects directly via USB or  
Bluetooth® to your device



Chromebook™



Computer

## Compatible platforms



iOS device



Android™ device



LabQuest 2

## Software



FREE Graphical Analysis 4,  
LabQuest App (LabQuest 2 only)



For LabQuest sensors, see pp. 106–116.

## NEW Go Direct Sensor Carts

Go Direct Sensor Cart (Green)

GDX-CART-G

Go Direct Sensor Cart (Yellow)

GDX-CART-Y

We've added wireless sensors to our popular dynamics cart. Each cart includes an encoder wheel to report position, velocity, and acceleration; a 3-axis accelerometer to measure independent accelerations; and a  $\pm 50$  N force sensor to measure pushes and pulls. Conduct basic physics investigations with or without a track.

[www.vernier.com/gdx-cart](http://www.vernier.com/gdx-cart)



We have dynamics systems that include  
Go Direct Sensor Carts

**NEW** Dynamics Cart and Track  
System with Go Direct Sensor  
Carts

DTS-GDX\*

**NEW** Dynamics Cart and Track  
System with Go Direct Sensor  
Carts and Long Track

DTS-GDX-LONG\*

You can use our Go Direct Sensor Carts with most dynamics tracks.

[www.vernier.com/dts-gdx](http://www.vernier.com/dts-gdx)

\* Additional shipping charges may apply due to weight.

## Motion

### NEW Go Direct Motion

#### GDX-MD

Go Direct Motion accurately tracks objects as close as 15 cm and as far away as 2.5 m. The compact design and wireless capability of this motion detector eliminate the concern of a dangling cable getting in the way.

The built-in temperature compensation of Go Direct Motion automatically adjusts for the difference in the speed of sound in cold and warm locations.

[www.vernier.com/gdx-md](http://www.vernier.com/gdx-md)



### NEW Go Direct Acceleration

#### GDX-ACC

Collect acceleration, rotation, and altitude data in the classroom or in the field. This 3-axis acceleration sensor has two acceleration ranges plus an altimeter and a 3-axis gyroscope.

[www.vernier.com/gdx-acc](http://www.vernier.com/gdx-acc)



## Thermodynamics

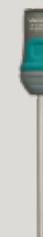
### Temperature Probes

[www.vernier.com/temperature-sensors](http://www.vernier.com/temperature-sensors)

#### Go Direct Temperature

##### GDX-TMP

Temperature range  
-40°C to 125°C



#### NEW Go Direct Surface Temperature

##### GDX-ST

Temperature range  
-40°C to 125°C



## Force

### Go Direct Force and Acceleration

#### GDX-FOR

Go Direct Force and Acceleration includes a  $\pm 50$  N force sensor, a 3-axis accelerometer, and a 3-axis gyroscope. Take it on an amusement park ride, mount it on a dynamics cart, or attach a string and whirl it in a horizontal or vertical circle—in wireless mode, your imagination is the only limiting factor!

[www.vernier.com/gdx-for](http://www.vernier.com/gdx-for)



#### Force Accessories

Bumper Launcher Kit page 108

## Rotation

### NEW Go Direct Rotary Motion

#### GDX-RMS

Monitor angular motion easily and precisely with Go Direct Rotary Motion, which connects wirelessly via Bluetooth® or wired via USB to your device. The wireless connection eliminates the cables that can get caught and tangled during rotational investigations.

[www.vernier.com/gdx-rms](http://www.vernier.com/gdx-rms)

#### Rotation Accessories

Rotational Motion  
Accessory Kit page 110

Rotary Motion Motor Kit page 110



## Thermodynamics

### Go Direct Gas Pressure

GDX-GP

Monitor the pressure of a gas (up to 400 kPa) while investigating heat engines or the kinetic theory of gases with Go Direct Gas Pressure. Includes a syringe, tubing, and stoppers to ease setup for experiments such as Boyle's law or the relationship between fluid pressure and depth. (The sensor cannot measure water pressure directly—only air pressure.)

[www.vernier.com/gdx-gp](http://www.vernier.com/gdx-gp)



## Light and Optics

### Go Direct Light and Color

GDX-LC

Go Direct Light and Color combines the power of visible light, UV, and RGB sensors to measure source emission, transmittance, and reflection of light in the visible light to ultraviolet electromagnetic spectrum. Explore light intensity as a function of distance, conduct polarized filter studies, observe the flicker of fluorescent lamps, perform reflectivity studies, and analyze RGB color contribution.

[www.vernier.com/gdx-lc](http://www.vernier.com/gdx-lc)

#### Light and Optics Accessories

Optics Accessories pp. 114–115



## Magnetism

### Go Direct 3-Axis Magnetic Field

GDX-3MG

This sensor measures the components of a magnetic field along three orthogonal axes with a range that allows students to study the Earth's magnetic field or investigate magnetic fields of permanent magnets, electromagnets, and solenoids.

[www.vernier.com/gdx-3mg](http://www.vernier.com/gdx-3mg)



## Electricity

### Go Direct Voltage

GDX-VOLT

Go Direct Voltage combines a wide input voltage range and high precision, making it an excellent choice for lab investigations of both AC/DC circuits and electromagnetism. Use this differential probe to measure the voltage in simple circuits, to study basic principles of electrochemical cells, or to investigate the resistivity of different metals.

[www.vernier.com/gdx-volt](http://www.vernier.com/gdx-volt)



### NEW Go Direct Current

GDX-CUR

Simplify your experiment setup with Go Direct Current. Capture small currents like those produced by a magnet falling through a coil. Use this sensor in combination with Go Direct Voltage to investigate Ohm's law or series and parallel circuits.

[www.vernier.com/gdx-cur](http://www.vernier.com/gdx-cur)



#### Electricity Accessories

Vernier Circuit Board 2 page 113

Optional Breadboard Kit page 113

Extech® Digital DC Power Supply page 112

## Modern Physics

### Go Direct Radiation Monitor

GDX-RAD

Explore radiation statistics, measure the rate of nuclear decay, and monitor radon progeny. Go Direct Radiation Monitor detects alpha, beta, gamma, and X-ray radiation, and includes LED and audible indicators for each detection.

[www.vernier.com/gdx-rad](http://www.vernier.com/gdx-rad)





Collecting position, velocity, and acceleration data using a Dynamics Cart and Track with Motion Encoder

Connection		Requires an interface from the LabQuest family
LabQuest family		LabQuest 2 pp. 10–13
		LabQuest Stream page 14
		LabQuest Mini page 15
Compatible platforms		Chromebook™
		Computer
		iOS device
		Android™ device
Software		LabQuest App, Logger Pro, Graphical Analysis™ 4



For Go Direct™ sensors, see pp. 103–105.

## Dynamics Cart and Track System

DTS\*

This cart and track system features the Combination 1.2 m Track/Optics Bench, two low-friction plastic carts (one standard and one with an adjustable plunger), and attachment accessories.

[www.vernier.com/dts](http://www.vernier.com/dts)



## Dynamics Cart and Track System with Motion Encoder

DTS-EC\*

The Dynamics Cart and Track System with Motion Encoder adds an optical position sensing system to record cart motion.

[www.vernier.com/dts-ec](http://www.vernier.com/dts-ec)

## Did you know?

The Dynamics Cart and Track System can be used year round. Simply add the Vernier Optics Expansion Kit to your Dynamics Cart and Track System to conduct optics experiments, such as image formation with lenses and light intensity vs. distance. For more information, see page 114.

\* Additional shipping charges may apply due to weight.



## Motion Encoder Cart and Receiver

### DTS-MEC

This kit includes a fully assembled Motion Encoder Cart, as well as the Motion Encoder Receiver and Motion Encoder Long Track Strip.

[www.vernier.com/dts-mec](http://www.vernier.com/dts-mec)



## Friction Pad DTS

### DTS-PAD

Add a Friction Pad to any of our plastic dynamics carts to study the effect of consistent friction on the motion of the cart.

[www.vernier.com/dts-pad](http://www.vernier.com/dts-pad)



## Dynamics Cart and Track System with Long Track

Both our Dynamics Cart and Track System and Dynamics Cart and Track System with Motion Encoder can be reconfigured to include a long track (2.2 m).

### Dynamics Cart and Track System with Long Track

#### DTS-LONG\*

[www.vernier.com/dts-long](http://www.vernier.com/dts-long)

### Dynamics Cart and Track System with Motion Encoder and Long Track

#### DTS-EC-LONG\*

[www.vernier.com/dts-ec-long](http://www.vernier.com/dts-ec-long)

\* Additional shipping charges may apply due to weight.



Data collection with the Encoder Fan Cart

## Fan Carts

### Fan Cart

#### CART-F

Use with a Motion Detector and the Vernier Dynamics System. The Fan Cart requires four AA batteries (not included).

[www.vernier.com/cart-f](http://www.vernier.com/cart-f)



### Encoder Fan Cart

#### CART-FEC

Use with the Motion Encoder System. The Encoder Fan Cart requires four AA batteries (not included) and the Motion Encoder Transmitter requires two AAA batteries (not included).

[www.vernier.com/cart-fec](http://www.vernier.com/cart-fec)





## Motion

## Photogate

VPG-BTD

Study free fall, rolling objects, collisions, and pendulums with the Vernier Photogate. Use the built-in laser detector to create a photogate through which you could drive a truck. Includes an accessory rod for attaching to a ring stand or for adding the Ultra Pulley Attachment (sold separately).

[www.vernier.com/vpg-btd](http://www.vernier.com/vpg-btd)



## Accelerometers

[www.vernier.com/accelerometers](http://www.vernier.com/accelerometers)

## Low-g Accelerometer

LGA-BTA

This is the best choice for most experiments. Use it for studying the one-dimensional motion of a car (real and toy), elevator, pendulum bob, or amusement park ride.

Range  $\pm 50 \text{ m/s}^2$



## 3-Axis Accelerometer

3D-BTA

Use this to study the complex motion of an amusement park ride, a bungee jump, or simply a toss in the air.

Range  $\pm 50 \text{ m/s}^2$



## 25-g Accelerometer

ACC-BTA

Choose this for studying one-dimensional collisions or any motion with larger accelerations.

Range  $\pm 250 \text{ m/s}^2$



## Motion Detector

MD-BTD

The Motion Detector uses ultrasound to measure the position of carts, balls, people, and other objects.

Can be used with interfaces from the LabQuest family, LabPro, and CBL 2. Not supported with Go! Link or EasyLink.

Range 0.15 to 6 m

Resolution 1 mm

[www.vernier.com/md-btd](http://www.vernier.com/md-btd)



## Go! Motion

GO-MOT

Go! Motion has the same features as our Motion Detector but connects via USB directly to your Windows® or macOS® computer, Chromebook™, or LabQuest.

Range 0.15 to 6 m

Resolution 1 mm

[www.vernier.com/go-mot](http://www.vernier.com/go-mot)



## Impulse/Momentum

## Bumper and Launcher Kit

BLK

The Bumper and Launcher Kit allows students to use the Dynamics Cart and Track System to perform Hooke's law experiments or to study momentum and impulse. The kit includes

- Track bracket
- Dual-magnet bumper
- Force sensor mounting screw
- 2 magnetic bumpers
- 2 rubber bumpers
- 2 hoop bumpers
- 2 clay holders and about 20 grams of clay

[www.vernier.com/blk](http://www.vernier.com/blk)



Track and Force Sensor not included

## Dual-Range Force Sensor

DFS-BTA

Using our Dual-Range Force Sensor, students can test Newton's third law of motion, explore Hooke's law, or graph the transition from static friction to kinetic friction.

Ranges  $\pm 10\text{ N}$ ,  $\pm 50\text{ N}$

Resolution  $0.01\text{ N}$ ,  $0.05\text{ N}$

[www.vernier.com/dfs-bta](http://www.vernier.com/dfs-bta)



## Force Plate

FP-BTA\*

The Force Plate—a force sensor about the size of a bathroom scale—is tough enough to jump on. Two handles are included for pushing or pulling. Additional pairs of handles are available (FP-HAN).

Ranges  $-850\text{ to }+3500\text{ N}$   
 $-200\text{ to }+850\text{ N}$

[www.vernier.com/fp-bta](http://www.vernier.com/fp-bta)



\* Additional shipping charges may apply due to weight.

## Projectile Launcher

VPL\*

The Projectile Launcher and accessories are used to investigate concepts in two-dimensional kinematics, such as launch speed and launch angle. Launch steel balls at angles from  $0$  to  $70^\circ$  and up to a distance of  $2.5\text{ m}$ .

Projectile Launcher includes

- Launcher
- Six steel balls
- Hand pump
- Two pairs of goggles
- Level
- Roll of waxed marking paper
- Photogate cable

[www.vernier.com/vpl](http://www.vernier.com/vpl)



## Independence of Motion Accessory

IOM-VPL

The Independence of Motion Accessory enables the Vernier Projectile Launcher to perform the classic experiment where one ball is dropped as another is projected horizontally. The balls strike the floor simultaneously. [www.vernier.com/iom/iom-vpl](http://www.vernier.com/iom/iom-vpl)



## Time of Flight Pad

TOF-VPL

The Time of Flight Pad is used with a projectile launcher or photogate (not included) to precisely measure how long a projectile has been in motion.

[www.vernier.com/tof-vpl](http://www.vernier.com/tof-vpl)



## Projectile Stop

PS-VPL

The Projectile Stop has one job: to keep the projectiles from the Vernier Projectile Launcher from rolling out of sight.

[www.vernier.com/ps-vpl](http://www.vernier.com/ps-vpl)



## 2-D Motion



### Video Physics™

Vernier Video Physics brings video analysis to iPad®, iPhone®, and iPod touch®. Track an object automatically, set the scale, and see graphs of trajectory, position, and velocity.

For more details, see page 19.



### Awards



## Circular Motion

### Centripetal Force Apparatus

CFA\*

The Centripetal Force Apparatus can be used to investigate relationships between mass, radius, tension force, and angular velocity. Required sensors, such as force sensors and photogates, are sold separately.

[www.vernier.com/cfa](http://www.vernier.com/cfa)



\* Additional shipping charges may apply due to weight.

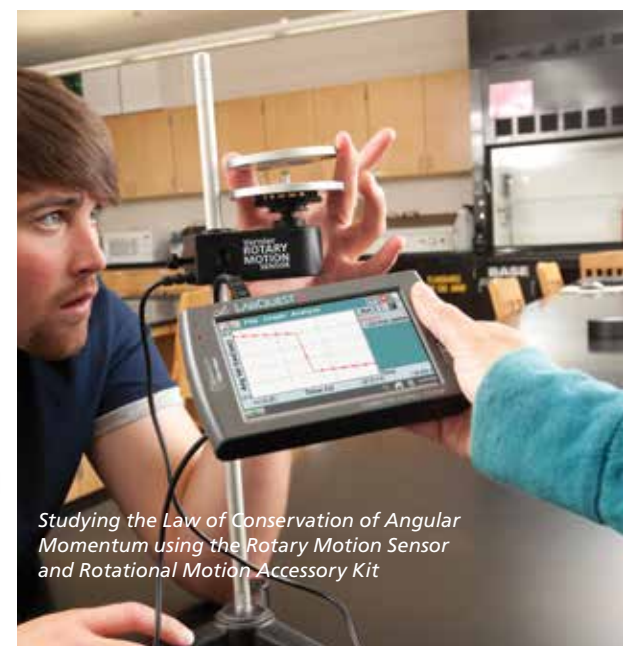
## Rotational Motion

### Rotary Motion Sensor

RMV-BTD

Our Rotary Motion Sensor lets you collect angular displacement, angular velocity, and angular acceleration data precisely and easily.

[www.vernier.com/rmv-btd](http://www.vernier.com/rmv-btd)



*Studying the Law of Conservation of Angular Momentum using the Rotary Motion Sensor and Rotational Motion Accessory Kit*

### Rotational Motion Accessory Kit

AK-RMV

This accessory kit is used to study the motion of a physical pendulum; the rotational inertia of disks, rings, and point masses; and the conservation of angular momentum.

[www.vernier.com/ak-rmv](http://www.vernier.com/ak-rmv)



### Rotary Motion Motor Kit

MK-RMV

The Rotary Motion Motor Kit includes a small electric motor with pulley, rubber band belt, motor clip, and mounting screw. The motor can be attached to the Rotary Motion Sensor and used as an analog tachometer or generator. You can also use it to perform experiments that investigate motor efficiency.

[www.vernier.com/mk-rmv](http://www.vernier.com/mk-rmv)



## FLIR ONE® Thermal Camera

Using a FLIR ONE Thermal Camera, students can observe temperature changes on the skin, illustrate convection, track heating due to friction, compare heat conduction in different materials, analyze the transparency of materials in infrared compared to visible light, and so much more.

[www.vernier.com/flir](http://www.vernier.com/flir)

### FLIR ONE Pro

FLIRPRO-10S



### FLIR ONE Gen 3

FLIRONE3-10S



## Gas Pressure Sensor

GPS-BTA

**Range** 0 to 210 kPa (0 to 2.1 atm or 0 to 1600 mmHg)

[www.vernier.com/gps-bta](http://www.vernier.com/gps-bta)



## Temperature Probes

### Stainless Steel Temperature Probe

TMP-BTA

**Range** -40 to 135°C



### Surface Temperature Sensor

STS-BTA

**Range** -25 to 125°C



[www.vernier.com/temperature-sensors](http://www.vernier.com/temperature-sensors)

## Microphone

MCA-BTA

Use our Microphone to display and study the waveforms of sounds from voices and musical instruments. It is also appropriate for speed of sound experiments. If you are interested in measuring sound level, use one of our sound level sensors.

[www.vernier.com/mca-bta](http://www.vernier.com/mca-bta)



## Sound Level Sensor

SLS-BTA

The Sound Level Sensor allows you to easily measure sound level in decibels (dB) in a variety of experiments.

If you are interested in collecting sound waveforms, use the Vernier Microphone.

<b>Range</b>	55 to 110 dB
<b>Accuracy</b>	±3 dB
<b>Frequency range</b>	30 to 10,000 Hz

[www.vernier.com/sls-bta](http://www.vernier.com/sls-bta)



## Sound Level Meter

SLM-BTA

The Sound Level Meter supports both A- and C-weighting. The LCD panel allows you to also use it as a standalone device.

<b>Ranges</b>	35 to 90 dB, 75 to 130 dB
<b>Accuracy</b>	±1.5 dB at 94 dB
<b>Frequency range</b>	31.5 to 8,000 Hz

[www.vernier.com/slm-bta](http://www.vernier.com/slm-bta)





## Extech Digital DC Power Supply

### EXPS\*

The Extech® Digital DC Power Supply provides constant current or constant voltage for physics activities that require DC power. This quality power supply has three outputs: adjustable 0–30 V at 0–3 A, fixed 5 V, and fixed 12 V.

The Extech Digital DC Power Supply is used in *Physics with Vernier* and *Advanced Physics with Vernier—Beyond Mechanics* experiments.

[www.vernier.com/exp5](http://www.vernier.com/exp5)

\* Additional shipping charges may apply due to weight.



## Power Amplifier

### PAMP

The Vernier Power Amplifier is used to drive loads with  $\pm 10$  V and currents up to 1 A. It works with any waveform, including DC, sine, square, triangle, and sawtooth.

[www.vernier.com/pamp](http://www.vernier.com/pamp)



## Differential Voltage Probe

### DVP-BTA

The Differential Voltage Probe is designed for exploring the basic principles of electricity. Use this probe to measure voltages in low voltage AC and DC circuits.

[www.vernier.com/dvp-bta](http://www.vernier.com/dvp-bta)



## Voltage Probes

Sensor	Voltage Range	URL
30-Volt Voltage	$\pm 30$ V	<a href="http://www.vernier.com/30v-bta">www.vernier.com/30v-bta</a>
Differential Voltage Probe	$\pm 6$ V	<a href="http://www.vernier.com/dvp-bta">www.vernier.com/dvp-bta</a>
Instrumentation Amplifier	$\pm 1$ V	<a href="http://www.vernier.com/ina-bta">www.vernier.com/ina-bta</a>
Vernier Energy Sensor	$\pm 30$ V	<a href="http://www.vernier.com/ves-bta">www.vernier.com/ves-bta</a>
Voltage Probe	$\pm 10$ V	<a href="http://www.vernier.com/vp-bta">www.vernier.com/vp-bta</a>

## Sound and Mechanical Waves

## Power Amplifier Accessory Speaker

### PAAS-PAMP

This kit includes a speaker and accessories that can be used with the Vernier Power Amplifier to study mechanical waves and springs.

[www.vernier.com/paas-pamp](http://www.vernier.com/paas-pamp)



## Current Probe

### DCP-BTA

The Current Probe can be used to measure currents in low-voltage AC and DC circuits or for electrochemistry experiments.

[www.vernier.com/dcp-bta](http://www.vernier.com/dcp-bta)



## Current Probes

Sensor	Current Range	URL
Current Probe	$\pm 0.6$ A	<a href="http://www.vernier.com/dcp-bta">www.vernier.com/dcp-bta</a>
High Current Sensor	$\pm 10$ V	<a href="http://www.vernier.com/hcs-bta">www.vernier.com/hcs-bta</a>
Vernier Energy Sensor	$\pm 1$ A	<a href="http://www.vernier.com/ves-bta">www.vernier.com/ves-bta</a>



## Vernier Circuit Board 2

VCB2

The Vernier Circuit Board 2 is a convenient platform for circuit experiments, from basic series and parallel circuits to RLC circuits. Many components are provided for experimentation, and additional components can be added to expand the capability of this useful board.

The Vernier Circuit Board is used in *Physics with Vernier* and *Advanced Physics with Vernier—Beyond Mechanics* experiments.

[www.vernier.com/vcb2](http://www.vernier.com/vcb2)



## Optional Breadboard Kit

VCB2-OBK

Add this small breadboard to your Vernier Circuit Board 2 to conduct experiments using components not included on the circuit board. Kit includes a 555 timer, photocell, two transistors, and a tri-color LED.

[www.vernier.com/vcb2-obk](http://www.vernier.com/vcb2-obk)



## Magnetic Field Sensor

MG-BTA

Use the Magnetic Field Sensor to study the field around permanent magnets, coils, and electrical devices. The rotating sensor tip measures both transverse and longitudinal magnetic fields.

[www.vernier.com/mg-bta](http://www.vernier.com/mg-bta)



## Static Electricity

### Charge Sensor

CRG-BTA

The Charge Sensor is an extremely high impedance voltage sensor with a 0.01  $\mu\text{F}$  input capacitor that can be used to make quantitative charge measurements in electrostatics experiments.

[www.vernier.com/crg-bta](http://www.vernier.com/crg-bta)



### Electrostatics Kit

ESK-CRG

The Electrostatics Kit, when used with the Vernier Charge Sensor (not included), allows students to perform a range of electrostatics experiments, including quantitative and qualitative measurement of charge as well as charging by friction, contact, and/or induction.

[www.vernier.com/esk-crg](http://www.vernier.com/esk-crg)



### High-Voltage Electrostatics Kit

HVEK-CRG

Use the High-Voltage Electrostatics Kit with the Vernier Charge Sensor and Electrostatics Kit (each sold separately) to investigate the distribution of charge on a sphere, transfer of charge on contact between two spheres, and charging by induction. Extremely low output current makes this device safe for classroom use.

[www.vernier.com/hvek-crg](http://www.vernier.com/hvek-crg)



## Eddy Current Brake

DTS-ECB

Eddy current brakes are used as a braking system for high-speed trains and roller coasters. Recreate this unusual braking system in your classroom or laboratory by installing our Eddy Current Brake into the end cap of a Vernier dynamics cart.

As the cart moves over the track, the magnets in the Eddy Current Brake create an electromagnetic drag on the cart that is proportional to the cart's speed.

[www.vernier.com/dts-ecb](http://www.vernier.com/dts-ecb)



## Optics Expansion Kit

### OEK

Use the Optics Expansion Kit with your dynamics track (not included) to conduct optics experiments, such as image formation with lenses and light intensity vs. distance. You can even use the kit to build a basic telescope.

Kit includes

- 3 lenses (100 mm converging lens, 200 mm converging lens, -150 mm diverging lens)
- Screen
- Combination luminous and point light source
- Light Sensor holder
- Aperture screen
- Power supply



The Optics Expansion Kit is used in *Physics with Vernier* and *Advanced Physics with Vernier—Beyond Mechanics* experiments.

Download free sample experiments online at [www.vernier.com/oek](http://www.vernier.com/oek)

## Mirror Set

### M-OEK

The Mirror Set extends the Optics Expansion Kit to allow students to easily study image formation by concave and convex mirrors. Includes a concave mirror, a convex mirror, and a half screen. Requires components from the Optics Expansion Kit for use.

[www.vernier.com/m-oek](http://www.vernier.com/m-oek)

Light source not included.



## Polarizer/Analyzer Set

### PAK-OEK

The Polarizer/Analyzer Set allows students to study light polarization, doing experiments such as Malus's law. The set consists of three adjustable linear polarizers, one of which includes attachment points for the Vernier Rotary Motion Sensor.

The Polarizer/Analyzer Set is used in *Physics with Vernier* experiments.

[www.vernier.com/pak-oek](http://www.vernier.com/pak-oek)



Do you have a Vernier Combination Dynamics Track/Optics Bench?

Combination 1.2 m Track/Optics Bench

TRACK\*

Combination 2.2 m Track/Optics Bench

TRACK-LONG\*

\* Additional shipping charges may apply due to weight.



## Light Sensor

LS-BTA

The Light Sensor approximates the human eye in spectral response. Use it for inverse square law experiments or for studying polarizers, reflectivity, or solar energy.

[www.vernier.com/ls-bta](http://www.vernier.com/ls-bta)



## Color Mixer

CM-OEK

The Color Mixer accessory can be used to study the mixing of red, blue, and green light by additive and subtractive mixing. Requires a Combination Track/Optics Bench (not included).

Download a free sample experiment at [www.vernier.com/cm-oek](http://www.vernier.com/cm-oek)



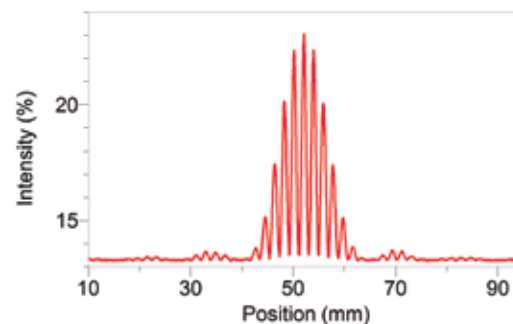
## Diffraction Apparatus

DAK

The Diffraction Apparatus, with its included Red Diffraction Laser, high-precision slits, and High Sensitivity Light Sensor, lets students create, view, and measure diffraction and interference patterns.

The Diffraction Apparatus requires a Combination Track/Optics Bench (not included).

[www.vernier.com/dak](http://www.vernier.com/dak)



Double-slit diffraction pattern intensity data using the included Red Diffraction Laser

## Green Diffraction Laser

GDL-DAK

Add the Green Diffraction Laser to your Diffraction Apparatus (not included) to study the effect of wavelength on a diffraction pattern.

[www.vernier.com/gdl-dak](http://www.vernier.com/gdl-dak)

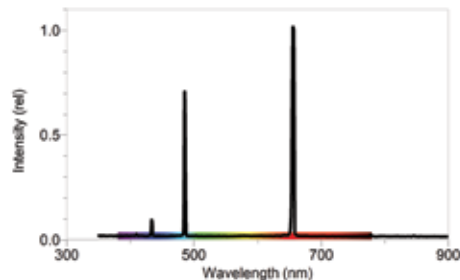


## Vernier Emissions Spectrometer

### VSP-EM

The Vernier Emissions Spectrometer gives precise measurements over a range of 350–900 nm. Use it with or without an optical fiber (not included) to examine spectra of light bulbs, spectrum tubes, or the sun.

[www.vernier.com/vsp-em](http://www.vernier.com/vsp-em)



Hydrogen emission spectrum



Analyzing gas tube emission spectra

## Vernier Emissions Fiber

### VSP-EM-FIBER

[www.vernier.com/vsp-em-fiber](http://www.vernier.com/vsp-em-fiber)



## Spectrum Tube Power Supplies

### Spectrum Tube Single Power Supply

#### ST-SPS

These power supplies feature an ultra-safe design for electrifying spectrum tubes.

[www.vernier.com/st-sps](http://www.vernier.com/st-sps)



### Spectrum Tube Carousel Power Supply

#### ST-CAR

Holds eight gas spectrum tubes.

[www.vernier.com/st-car](http://www.vernier.com/st-car)



### Spectrum Tubes

Spectrum Tubes are permanently enclosed in protective plastic carriers, with no exposed high voltage. All Spectrum Tubes are sold separately:

Hydrogen	ST-H	
Nitrogen	ST-N	
Helium	ST-HE	
Neon	ST-NE	
Carbon Dioxide	ST-CO2	
Air	ST-AIR	
Argon	ST-AR	

Spectrum Tubes carry a two-year warranty.\*

[www.vernier.com/spectrum-tubes](http://www.vernier.com/spectrum-tubes)

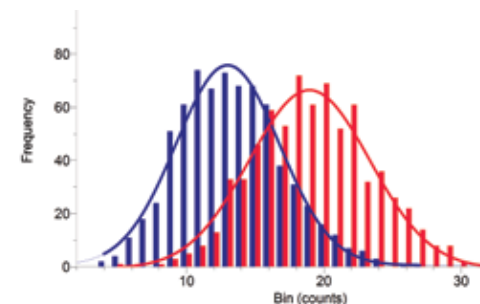
\* Two years or 40 hours, whichever comes first, on the hydrogen tube. Two years or 100 hours, whichever comes first, on all other gas tubes.

## Vernier Radiation Monitor

### VRM-BTD

The Vernier Radiation Monitor detects alpha, beta, gamma, and X-ray radiation and can be used for experiments in nuclear counting statistics, shielding, and decay rate measurements.

[www.vernier.com/vrm-btd](http://www.vernier.com/vrm-btd)



Count histograms for wood (blue) and granite (red) counttops show the slight natural radioactivity of granite.



# Accessories and Replacement Parts

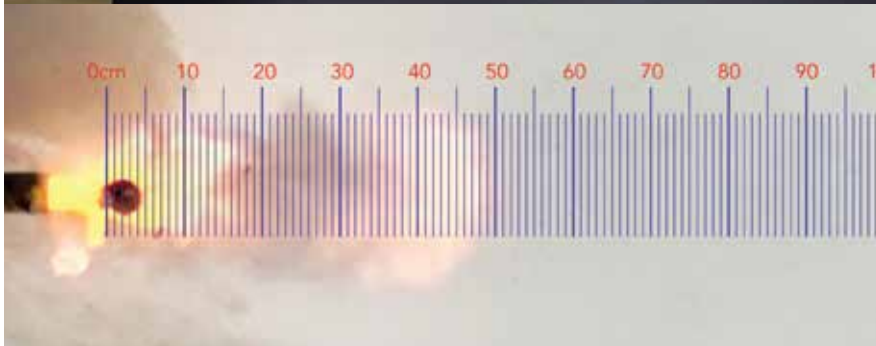
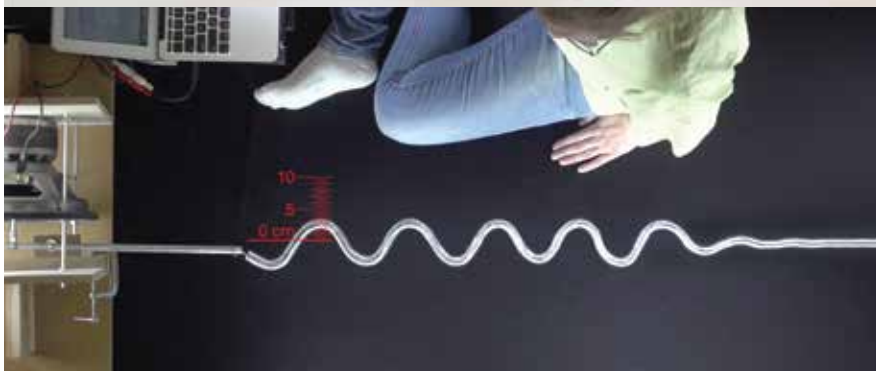
Part Name	Order Code
<b>Dynamics Cart and Track System</b>	
Adjustable Two Foot Leveler	AL-VDS
Adjustable End Stop	AS-VDS
Anti-Roll Pegs	VDS-ARP10
Cart Friction Pad	PAD-VDS
Cart Picket Fence	PF-CART
Dynamics Cart and Track System Fasteners for Force Sensor and Accelerometer	DTS-ACC
DTS Motion Encoder Cart	DTS-CART-MEC
Friction Pad DTS	DTS-PAD
Mass DTS	DTS-MASS
Motion Detector Bracket	DTS-MDB
Motion Detector Reflector Flag	DTS-FLAG
Motion Encoder Cart and Receiver	DTS-MEC
Motion Encoder Cart Upgrade Kit	DTS-MEU
Photogate Bracket	PGB-VDS
Plunger Cart	DTS-CART-P
Pulley Bracket	B-SPA
Standard Cart	DTS-CART-S
Track-to-Track Coupler	T2T-VDS
Vernier Dynamics System Axles and Wheels for Cart	WHEELS-VDS
Vernier Dynamics System Replacement Parts Kit	VDS-RPK
<b>Force Sensor Related Items</b>	
Dual-Range Force Sensor Replacement Parts Kit	DFS-RPK
Extra Force Plate Handles	FP-HAN
Hoop Bumpers for Bumper and Launcher Kit	HOOPS-BLK
Replacement Rod for Dual-Range Force Sensor, Photogate, or WDSS	ACC-ROD
Springs Set	SPRINGS
<b>Projectile Launcher Related Items</b>	
Goggles (set of 2)	GGL-VPL

Independence of Motion	IOM-VPL
Projectile Stop	PS-VPL
Replacement Balls for Independence of Motion Accessory	IOM-BLS
Steel Balls (set of 6)	STB-VPL
Time of Flight Pad	TOF-VPL
Wax Tape (300 feet)	WXT-VPL
<b>Modern Physics: Atomic Spectra</b>	
Replacement Spectrum Tube Fiber Optic Holder Carousel	ST-FHC
Replacement Spectrum Tube Fiber Optic Holder	ST-FHS
Vernier Emissions Fiber	VSP-EM-FIBER
<b>Rotary Motion and Centripetal Force Items</b>	
Replacement Masses for Centripetal Force Apparatus	M-CFA
Rotary Motion Motor Kit	MK-RMV
Rotary Motion Sensor Replacement Mass	RMV-MASS
Rotary Motion Sensor Replacement Pulley	RMV-PULLEY
Rotary Motion Sensor Replacement Parts Kit	RMV-RPK
Rotary Motion Sensor Replacement Swivel Mount	RMV-SWIVEL
Rotary Motion Sensor Replacement Washer	RMV-WASH
Rotational Motion Accessory Kit	AK-RMV
Sliding Carriage Replacement	SC-CFA
Swivel Assembly Replacement	SA-CFA
<b>Other Motion Related Items</b>	
Data Vest	DV
Laser Pointer	LASER
Laser Pointer Stand	STAND
Motion Detector Clamp	MD-CLAMP
Picket Fence	PF
Photogate Bar Tape Kit	TAPE-VPK
Ultra Pulley Attachment	SPA

<b>Electricity Items</b>	
30-Volt BTA Test Leads	TL-30V
Inductor	IND
Miniature Alligator Clips for Vernier Circuit Board	VCB-GATOR
Optional Breadboard Kit for the Vernier Circuit Board 2	VCB2-OBK
Replacement Lamps for Vernier Circuit Board	VCB-BULB
Resistivity Rods	RRS
<b>Light and Optics</b>	
Adjustable Analyzer Replacement	AA-OEK
Adjustable Analyzer for Rotary Motion Sensor Replacement	AAR-OEK
Adjustable Mirror Replacement	AM-OEK
Aperture Assembly	APT-OEK
Combination Linear Position and High Sensitivity Light Sensor	LPL-DAK
Convex Mirror Replacement	CNM-OEK
Diffraction Slit System	DSS-DAK
Green Diffraction Laser	GDL-DAK
Half Screen Replacement	HS-OEK
Red Diffraction Laser	RDL-DAK
Replacement 10 cm Converging Lens for Optics Expansion Kit	L10B-OEK
Replacement 15 cm Diverging Lens for Optics Expansion Kit	L15B-OEK
Replacement 20 cm Converging Lens for Optics Expansion Kit	L20B-OEK
Replacement Light Sensor Holder for Optics Expansion Kit	LSHB-OEK
Replacement Light Source for Optics Expansion Kit	LSB-OEK
Replacement Screen for Optics Expansion Kit	SCRN-OEK

For all of our accessories and replacement parts, visit [www.vernier.com/accessories](http://www.vernier.com/accessories)





Pivot Interactives is a subscription-based, online supplement to hands-on experimentation in introductory physics.

Each activity consists of a set of videos that allows students to vary experimental parameters, one at a time. Students use embedded analysis tools to make measurements and analyze their data directly within the online environment.

## Features

- Classroom-ready experiments with teacher guides and grading/feedback tools
- Libraries (or matrices) of videos for each topic in introductory physics
- High-production-quality videos of hard-to-replicate phenomena—not simulations
- Built-in, interactive measurement and analysis tools for use within each activity
- Teacher-customizable experiments
- Web-based access on computers, Chromebooks™, and mobile devices

## Suggested Uses

- Pre-lab exercises
- Lab skills assessment
- Flipped classroom learning
- Post-lab assessment
- Substitute teacher days
- Credit recovery / homebound students

## Free Trial for Educators

At [vernier.com/pivot](http://vernier.com/pivot), you can see a short video of Pivot Interactives in action. Start a free, 30-day, fully functioning trial of Pivot Interactives with your students. Use the entire library of videos, try new analysis tools, and more.

[www.vernier.com/pivot](http://www.vernier.com/pivot)

## Enhance Your Curriculum with Vernier Lab Books

Enhance your curriculum with our award-winning lab books, which are available as eco-friendly electronic downloads in addition to the traditional print format. Now you'll always have access to the most up-to-date versions of the experiments through your Vernier account.

- Download word-processing files to customize the experiments to fit your curricular needs.
- Electronic versions include a generous site license—purchase once and share files with other instructors in your school or university department.

### Physics Lab Books

#### Subjects

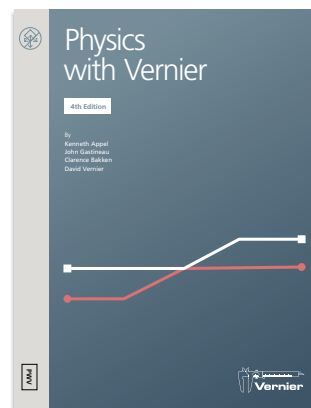
	<i>Physics with Vernier 4th Edition</i>	<i>Physics Explorations and Projects</i>	<i>Advanced Physics with Vernier—Mechanics</i>	<i>Advanced Physics with Vernier—Beyond Mechanics</i>	<i>Physics with Video Analysis</i>
Physics First / Conceptual Physics	●	●			
Regular / Honors Physics	●	●			●
AP Physics 1	●	●	●	●	●
AP Physics 2	●	●		●	●
AP Physics C Mechanics		●	●		●
AP Physics C Electricity and Magnetism		●		●	●
IB Physics			●	●	
University Physics (Algebra-based)	●	●	●	●	●
University Physics (Calculus-based)		●	●	●	●

**UPDATED**

## Physics with Vernier 4th Edition

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UNIVERSITY



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Book Only

PWV-E

Printed +  
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PWV

Topics include

- Kinematics
- Newton's laws
- Momentum and energy
- Circuits
- Light and sound

For a complete list of all 35 activities, visit [www.vernier.com/pwv](http://www.vernier.com/pwv)

### Sensors Used

Sensor	Page
Motion Detector	104, 108
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Accelerometer	104, 108
Light	105, 115
Photogate*	108
Temperature	104, 111
Magnetic Field	105, 113
Current	105, 112

\* Graphical Analysis™ 4 Photogate support coming spring 2018



**NEW**  
*Fisica con  
Vernier*

This is the Spanish-language version of *Physics with Vernier* (3rd Edition).  
[www.vernier.com/pwv-es](http://www.vernier.com/pwv-es)

### Additional Products

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Springs Set	117
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Bumper and Launcher Kit	108
Polarizer/Analyzer Set	114
Extech Digital DC Power Supply	112
Friction Pad	107
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Independence of Motion Accessory	109
Time of Flight Pad	109
Vernier Circuit Board 2	113

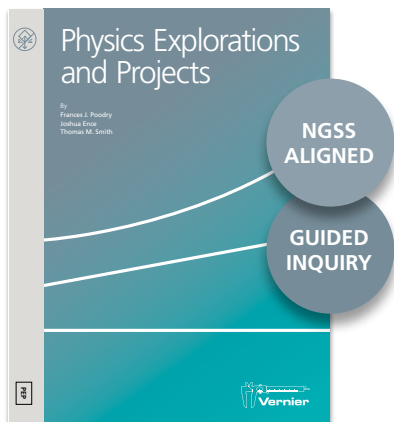
### Supported Software

Software	Page
Logger Pro	20–21
LabQuest App	11–12
Graphical Analysis 4	16–17
EasyData	<a href="http://www.vernier.com/easydata">www.vernier.com/easydata</a>

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PEP

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- Science and engineering practices
- Newton's laws
- Momentum and energy
- Electricity and magnetism
- Waves

For a complete list of all 35 investigations,  
visit [www.vernier.com/pep](http://www.vernier.com/pep)

## Suggested Sensors

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## Additional Products

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## Supported Software

Software	Page
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LabQuest App	11–12
Graphical Analysis™ 4	16–17

*Advanced Physics with Vernier—  
Mechanics*

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Electronic Lab  
Book Only

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Printed +  
Electronic  
Lab Book

PHYS-AM

Topics include

- Newton's laws
- Momentum
- Energy
- Rotation
- Simple harmonic motion

For a complete list of all 16 experiments,  
visit [www.vernier.com/phys-am](http://www.vernier.com/phys-am)

## Sensors Used

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Motion Detector	108
Photogate	108
Rotary Motion	110

## Supported Software

Software	Page
Logger Pro	20–21
LabQuest App	11–12

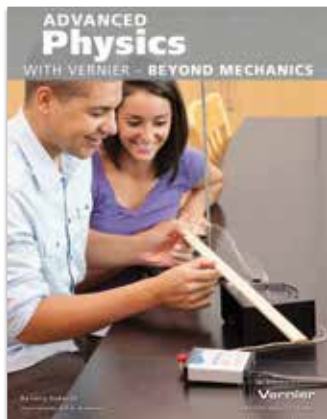
## Additional Products

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Rotational Motion Accessory Kit	110
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Springs Set	117

## Advanced Physics with Vernier— Beyond Mechanics

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Electronic Lab  
Book Only

PHYS-ABM-E

Printed +  
Electronic  
Lab Book

PHYS-ABM

Topics include

- Mechanical waves
- Electricity
- Magnetism
- RC and RLC circuits
- Optics
- Electromagnetic waves

For a complete list of all 22 experiments,  
visit [www.vernier.com/phys-abm](http://www.vernier.com/phys-abm)

### Sensors Used

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Gas Pressure	111
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Mirror Set	114
Emissions Optical Fiber	116
Spectrum Tube Power Supply	116
Hydrogen Spectrum Tube	116

## Physics with Video Analysis

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Electronic Lab  
Book Only

PVA-E

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Electronic  
Lab Book

PVA

Requires Logger Pro 3 software for  
macOS® and Windows computers

Topics include

- Mechanical waves
- Electricity
- Magnetism
- RC and RLC circuits
- Optics
- Electromagnetic waves

For a complete list of all 33 activities,  
visit [www.vernier.com/pva](http://www.vernier.com/pva)

### Supported Software

Software	Page
Logger Pro	20–21

## Additional Physics Books and Activities

For details on the following books, go to [www.vernier.com/books](http://www.vernier.com/books) and expand Physics.

### Tools for Scientific Thinking

David R. Sokoloff  
Ronald K. Thornton

### Interactive Lecture Demonstrations

David R. Sokoloff  
Ronald K. Thornton

### Activity Based Physics

David R. Sokoloff  
Ronald K. Thornton  
Priscilla W. Laws

### RealTime Physics

David R. Sokoloff  
Ronald K. Thornton  
Priscilla W. Laws



# TI

## Data Collection

### TI-84 Plus CE

#### TI-84PCE

The TI-84 Plus CE has a full-color, high-resolution, backlit screen, making it easy to read. The calculator comes with a rechargeable battery, so there is never a need to buy AAA batteries.

- Supported USB sensors: CBR 2 and EasyTemp
- Supported interface: EasyLink

Includes TI-84 Plus CE calculator, rechargeable battery, and AC wall adapter.

[www.vernier.com/ti-84pce](http://www.vernier.com/ti-84pce)

### TI-84 Plus CE Teacher Pack

#### TI-84PCE-TPK

Includes 10 CE EZ Spot calculators, 10 rechargeable batteries, and a 10-unit charging station.



### CBR 2

#### CBR2

The CBR 2 connects directly to a TI calculator. This motion detector collects distance, velocity, and acceleration data.

[www.vernier.com/cbr2](http://www.vernier.com/cbr2)



### TI-84 Plus

#### TI-84PL

The TI-84 Plus is a lower-price alternative to the TI-84 Plus CE calculator. The TI-84 Plus supports data collection with 78 Vernier sensors, including microphones, photogates, and drop counters, when used with a CBL 2 sensor interface.

- Supported USB sensors: CBR 2 and EasyTemp
- Support interfaces: EasyLink and CBL 2
- Collect data from multiple sensors simultaneously with CBL 2.

[www.vernier.com/ti-84pl](http://www.vernier.com/ti-84pl)

### TI-84 EZ Spot Teacher Pack

#### TI-84SPOTTP

Includes 10 EZ Spot calculators and 40 AAA batteries.



### Vernier EasyTemp

#### EZ-TMP

EasyTemp is a temperature probe designed for use with TI-84 Plus calculators and TI-Nspire handhelds.

Range -20 to 115°C

[www.vernier.com/ez-temp](http://www.vernier.com/ez-temp)



### Vernier EasyLink

#### EZ-LINK

EasyLink is a single-channel sensor interface that plugs into the USB port of a TI-84 Plus calculator or TI-Nspire handheld. It supports any one of over 60 Vernier sensors.

[www.vernier.com/ez-link](http://www.vernier.com/ez-link)







## TI-Nspire™ CX Handheld

### TI-NSCX

TI-Nspire CX handheld is the latest in learning technology from Texas Instruments. The handheld includes an easy-glide Touchpad that works more like a computer with a mouse. Recommended for: algebra, geometry, trigonometry, and precalculus

Includes TI-Nspire CX handheld, rechargeable battery, and AC wall adapter.

[www.vernier.com/ti-nsxcx](http://www.vernier.com/ti-nsxcx)

## TI-Nspire CX School Pack

### TI-NSCX-TPK

Includes 10 TI-Nspire CX EZ Spot handhelds with the words "School Property" on the keypad, 10 rechargeable batteries, and a 10-unit docking station.

## TI-Nspire CX CAS Handheld

### TI-NSCXCAS

The TI-Nspire CX CAS handheld has all the features of the TI-Nspire CX handheld plus a built-in Computer Algebra System (CAS) for factoring and expanding expressions, solving for common denominators, and performing symbolic calculations. Recommend for: geometry, trigonometry, precalculus, and calculus

Includes TI-Nspire CX CAS handheld, rechargeable battery, and AC wall adapter.

[www.vernier.com/ti-nsxcxcas](http://www.vernier.com/ti-nsxcxcas)

## TI-Nspire CX CAS School Pack

### TI-NSCXCAS-TPK

Includes 10 TI-Nspire CX CAS handhelds, 10 rechargeable batteries, and a 10-unit docking station.



## Calculator Products

Product	Order Code	
Books	<i>Real-World Math with Vernier</i>	RMV
	<i>Real-World Math with Vernier</i> (electronic version)	RMV-E
Calculators	TI-84 Plus CE	TI-84PCE
	TI-84 Plus CE Teacher Pack (10 calculators & charging station)	TI-84PCE-TPK
	TI-84 Plus Calculator	TI-84PL
	TI-84 Plus EZ Spot Teacher Pack (10 calculators)	TI-84SPOTTP
	TI-Nspire CX Handheld	TI-NSCX
	TI-Nspire CX School Pack (10 handhelds & docking station)	TI-NSCX-TPK
Charging/Docking Stations	TI-Nspire CX CAS Handheld	TI-NSCXCAS
	TI-Nspire CX CAS School Pack (10 handhelds & docking station)	TI-NSCXCAS-TPK
	TI-84 Plus CE Charging Station	TI-84PCE-CS
Data Collection	TI-Nspire CX Docking Station	TI-NSCX-DS
	CBL 2*	CBL2
	TI-Nspire Lab Cradle	TI-NSLABC
Emulator/Computer Software	TI-Nspire Lab Cradle Bundle (includes 5 interfaces)	TI-NSLABC-5
	TI-SmartView Emulator software for TI-84	<a href="http://www.vernier.com/ti-software">www.vernier.com/ti-software</a>
	TI-Nspire Student Software	
	TI-Nspire Teacher Software	
Miscellaneous Accessories	Calculator-to-calculator Link Cable*	TI-CLC
	TI USB Connectivity Kit*	GLC-USB
TI Navigator System	30-User TI-Nspire CX Navigator System	TI-NAV-CX30
	15-User TI-Nspire CX Navigator System	TI-NAV-CX15
	5-User TI-Nspire CX Navigator Add-on†	TI-NAV-CX5
	TI-Nspire Navigator CX Teacher Software Add-on†	TI-NAVX-SP-KT

\* Cannot be used with TI-84 Plus CE or TI-Nspire Handhelds

† Requires purchase of a Navigator system.

TI products purchased in the United States are covered by a one-year warranty based on the date of purchase. Units are warranted against defective materials or workmanship.

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 CO<sub>2</sub> Gas Sensor 37  
 Go Direct CO<sub>2</sub> Gas 35  
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**Matthew Denton**

Sr. Quality Assurance Engineer and Technical Support Specialist



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Engineering Educational Technology Specialist



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**Melissa Hill, Ph.D.**

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**Tom Smith**

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**Dave Vernier**

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