Vernier

2022 UNIVERSITY CATALOG

INTERNATIONAL EDITION

Engage the Scientists and Engineers of Tomorrow

Welcome!

Dear educator,

Last year, we celebrated our 40th anniversary. A lot has changed over those 40 years. What started as two people developing science education software and hardware in their home has grown into a company that sells products in 150 countries—and has been consistently named one of the best places to work in Oregon. However, throughout the years, one thing has remained the same: our gratitude and commitment to science educators. You have been a tremendous source of inspiration and optimism for us, and we want to thank you for your continued support and dedication to hands-on science education for your students.

The last two years have been very challenging for all of us. COVID-19 turned the world—and education—upside down. To support remote learning, we quickly created activities and other resources for science educators. We also updated our Graphical Analysis software so that educators could create experiments and share data with students in real time. But the challenges did not stop there; in early 2021, we began to experience a component shortage due to supply-chain issues and high demand in a recovering economy. In response, we worked tirelessly to secure components from around the world so that we could continue offering high-quality products for a reasonable price. We did not raise prices in 2021 due to our concerns about school budgets during the pandemic. Because of the situation with the supply chain as well as the scarcity of components, it is necessary for us to raise prices in 2022. Rest assured that this was not an easy decision for us and that we continue with our mission to offer the highest-quality products.

We hope that the worst of the pandemic is behind us and that we can all ease back into normalcy quickly. As we do, we encourage you to take advantage of our generous trial period and give our products a try. You can also call our tech support team to brainstorm ways to use our products to conduct experiments in your class. In the meantime, stay tuned for some big announcements this year.

Thank you again for being a source of inspiration and optimism for us—and your students.

John Wheeler
CEO
jwheeler@vernier.com

Dave and Christine Vernier
Co-Presidents
dvernier@vernier.com and cvernier@vernier.com

Why Vernier?
Endless Possibilities.

Our durable hardware and quality software are designed and priced for hands-on student use whether learning remotely or in the laboratory. We have ready-to-go experiments and resources in a wide variety of subjects.

BIOLOGY · CHEMISTRY · PHYSICS · ENGINEERING
AGRICULTURAL SCIENCE · ENVIRONMENTAL SCIENCE · PHYSIOLOGY

Our sensors and data-collection technology are so versatile that you can use them in nearly any science or engineering course.

Contents

What's New?

Go Direct Spectrometers

Our new Go Direct® spectrometers connect to your device via Bluetooth® wireless technology or USB. Our free Vernier Spectral Analysis® app makes it easy to incorporate spectroscopy into your course experiments. The user-friendly software includes analysis features such as curve fitting and data interpolation.

Learn more on pp. 14–17, 25.

Go Direct Fluorescence/UV-VIS Spectrophotometer

See page 14.

Go Direct UV-VIS Spectrophotometer

See page 16.

Go Direct Visible Spectrophotometer

See page 17.

Go Direct Emissions Spectrometer

See page 25.

Vernier Video Analysis: Conservation Laws and Forces

Vernier Video Analysis®: Conservation Laws and Forces explores mechanics topics beyond basic motion. Students explore conservation of energy, momentum, conservative forces, and more.

Learn more on page 21.

Go Direct Wide-Range Pressure

Using robust metal fittings and a leakproof seal, Go Direct Wide-Range Pressure measures absolute pressures up to 690 kPa with excellent accuracy.

Learn more on page 16.

Students don't learn effectively by just sitting and listening—they need to be consistently engaged in what they are learning about. As educators, we are always looking for ways to optimize the learning experience for our students, especially in today's increasingly remote environment.

David Craig
Oregon State University

Join these institutions, and hundreds of others, already using Vernier technology:

Arizona State University
Baltimore City Community College
Benedictine University
California State University—Fullerton
Cameron University
Canisius College
Charles University
Colorado School of Mines
Cornell University
Cuyahoga Community College
Delft University of Technology
Dickinson College
ETH Zurich
Georgia Tech
Harvard University
Haskell Indian Nations University
Immaculata University
Lehigh University
Lund University
Massachusetts Institute of Technology
McGill University
Miami University
Michigan Technological University
Mississippi State University
National University of Colombia
National University of Singapore
Oregon State University
Princeton University
Queensborough Community College
Quinnipiac University
Saint Mary's University
Stanford University
Stephen F. Austin State University
Sungkyunkwan University
TEC Monterrey
Texas A&M
The Ohio State University
University of Arizona
University of British Columbia
University of California—Berkeley
University of Cambridge
University of Chicago
University of Hong Kong
University of Kansas
University of Minnesota—Minneapolis
University of Nebraska—Lincoln
University of Pennsylvania
University of Puerto Rico
University of Sydney
University of Tennessee—Chattanooga
University of Toronto
University of Washington
University of Wisconsin—Madison
Vincennes University
Virginia Commonwealth University
Wake Technical Community College
West Virginia Wesleyan College
Yale University

Biology

vernier.com/biology

Why Vernier?

Vernier biology solutions help students form a deep understanding of key scientific concepts. Whether you are introducing your students to enzymes or exploring primary productivity, our probeware and ready-to-go experiments are the right fit for your laboratory.

Quality

Durable hardware for lab and field use

Affordable

Designed for education and educational budgets

Versatile

Supports a variety of devices and experiments

> **Your great products and superb support of them have been a major part of my labs and are very much appreciated.**
>
> *David Willey*
> *University of Pittsburgh*

A Guide to Vernier Data Collection

We're here to support you as an educator as you incorporate data-collection technology into your instruction. See how our products provide you with affordable laboratory solutions designed for student success.

Our Guarantee: Most of our products are protected by a 5-year limited warranty. And after five years? We'll make every attempt to repair your equipment.

What You Need to Get Started with Go Direct Sensors

Go Direct Sensor

These versatile sensors connect to your device via Bluetooth® wireless technology or USB.

Device

Go Direct® sensors connect to a wide variety of commonly used devices, including Chromebooks, computers, tablets, smartphones, and LabQuest 3.

Software

Vernier Graphical Analysis™ Pro
Vernier Spectral Analysis®

Lab Book

Our popular, award-winning lab books provide hundreds of well-tested, customizable experiments. Our lab books come with a generous site license—purchase once and share files across your department.

What You Need to Get Started with LabQuest 3

Sensor

Go Direct Sensor
These versatile sensors connect to LabQuest® 3 via Bluetooth wireless technology or USB.

LabQuest Sensor
LabQuest sensors connect directly to LabQuest 3 sensor ports (BTA/BTD).

LabQuest 3

LabQuest 3 serves as a standalone data-collection platform that works with all Vernier sensors.

Software

LabQuest App

Lab Book

Our popular, award-winning lab books provide hundreds of well-tested, customizable experiments. Our lab books come with a generous site license—purchase once and share files across your department.

Software

Vernier Spectral Analysis

Spectral Analysis supports our family of spectrometers on computers, Chromebooks, and compatible mobile devices. Use it to generate full spectra, create standard curves, and conduct kinetics experiments.

LabQuest App

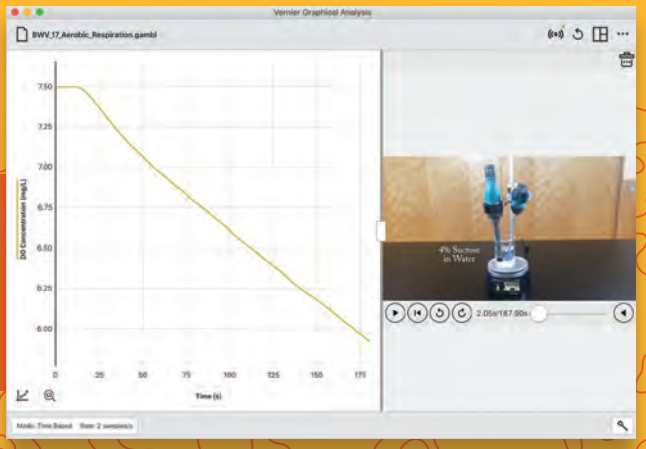
LabQuest 3 has built-in software that gives your students real-time graphing capabilities in a handheld device. It's powerful, yet beautifully simple.

Vernier Graphical Analysis Pro

We have enhanced our award winning Graphical Analysis Pro app with additional features that support remote learning and further analysis of experiment data.

Free Trial for Educators

Try out Graphical Analysis Pro for free for 30 days. Access the sample experiments and enhanced analysis tools to use it with your students.
Get a free trial and learn about site license options at vernier.com/graphical-analysis-pro



Partnerships

LabArchives

We have partnered with LabArchives™ to bring high-quality biology content to instructors through the Lab Builder library. Because all content is structured and standardized, instructors can arrange, customize, and add content to their courses with ease. **Learn more at vernier.com/lab-archives**

ADInstruments

We have partnered with ADInstruments to provide state-of-the-art, customizable biology content using ADInstruments' platform, Lt. This platform supports real-time data collection and analysis with many Vernier sensors and includes instructional videos, quizzes, and classroom management tools. **Learn more at vernier.com/adinstruments**

Why Vernier?

Our durable hardware and quality software are designed for hands-on student use. Give your students the opportunity to gain practical, relevant data-collection and analysis experience that they can use wherever they go next.

General Biology

Go Direct CO_2 Gas

This sensor measures gaseous carbon dioxide concentration levels, air temperature, and relative humidity. With built-in temperature compensation and humidity protection, this sensor is ideal for measuring fermentation, respiration, and photosynthesis.

GDX-CO2

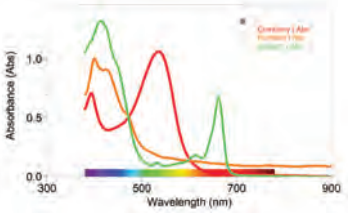
vernier.com/gdx-co2

Go Direct SpectroVis® Plus

Use this spectrophotometer to collect a full-wavelength spectrum (absorbance, percent transmittance, fluorescence, or intensity), study absorbance *vs.* concentration (create standard curves), or monitor enzyme activity (enzyme kinetics).

GDX-SVISPL

vernier.com/gdx-svispl



Vernier Spectral Analysis
FREE DOWNLOAD
Learn more on page 7.

Go Direct Tris-Compatible Flat pH

Use this sensor to measure the pH of solutions. It features a sealed, gel-filled, double-junction electrode, making it compatible with Tris buffers and solutions containing proteins or sulfides.

GDX-FPH
vernier.com/gdx-fph

Go Direct Optical Dissolved Oxygen

Use this sensor to measure dissolved oxygen, water temperature, and atmospheric pressure. It's ideal for experiments in biology, ecology, and environmental science.

GDX-ODO
vernier.com/gdx-odo

Biology with Vernier

This book includes 31 experiments for fundamental concepts in biology. The instructor information section included for each experiment contains reagent preparation information, sample data, and tips for successful completion.

Topics

- Cell respiration
- Membrane diffusion
- Osmosis
- Photosynthesis and transpiration
- Human physiology

vernier.com/bwv

Download only
BWV-E

Printed book + download
BWV

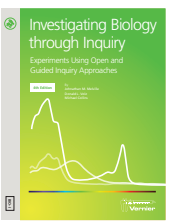
Investigating Biology through Inquiry

This book includes 22 investigations for many fundamental concepts in biology. Each investigation includes a preliminary activity, instructor information, sample researchable questions, and sample data.

Topics

- Cell and molecular biology
- Organismal biology
- Ecology
- Evolution

vernier.com/bio-i



Download only
BIO-I-E

Printed book + download
BIO-I

Biology Go Direct Starter Package

Learn more at vernier.com/gdp-bio-st

This package includes four sensors that work with Vernier Graphical Analysis Pro and LabQuest 3.

- Go Direct Temperature
- Go Wireless® Heart Rate
- Go Direct Gas Pressure
- Go Direct CO_2 Gas

GDP-BIO-ST

Human Physiology

Go Direct EKG

Use Go Direct® EKG to record electrical activity of the heart or skeletal muscles.

GDX-EKG **vernier.com/gdx-ekg**

Go Direct Hand Dynamometer

Measure grip and pinch strength, and perform muscle fatigue studies.

GDX-HD **vernier.com/gdx-hd**

Go Direct Respiration Belt

Use this sensor to measure human respiration rate and study breathing patterns.

GDX-RB

vernier.com/gdx-rb

Go Direct Spirometer

This multi-channel sensor can be used to measure tidal volume, vital capacity, flow rate, air pressure, and respiration rate.

GDX-SPR

vernier.com/gdx-spr

Go Direct O_2 Gas

Use this sensor to measure gaseous oxygen concentration levels and air temperature.

GDX-O2

vernier.com/gdx-o2

Go Direct Blood Pressure

This affordable, non-invasive sensor is designed to easily measure human blood pressure.

GDX-BP **vernier.com/gdx-bp**

Human Physiology Experiments: Volume 1

This book contains 14 experiments that encourage students to investigate the physiology of the cardiac, muscular, respiratory, vascular, and nervous systems using Go Direct sensors.

vernier.com/hsb-hp

This lab book provides instructions for data collection with Vernier Graphical Analysis™ and Go Direct sensors only.

Download only
HSB-HP-E

Printed book + download
HSB-HP

Human Physiology Experiments: Volume 2

An expansion of our *Human Physiology Experiments: Volume 1* lab book, the setup for these experiments is minimal—students are collecting data within minutes.

vernier.com/alb-hp2

This lab book provides instructions for data collection with Vernier Graphical Analysis and Go Direct sensors only.

Download only
ALB-HP2-E

Printed book + download
ALB-HP2

Human Physiology Go Direct Standard Package

This package includes 11 sensors that work with Vernier Graphical Analysis Pro and LabQuest® 3.

- Go Direct EKG
- Go Direct Force and Acceleration
- Go Direct Surface Temperature
- Go Direct Hand Dynamometer
- Go Direct Respiration Belt
- Go Direct O_2 Gas
- Go Direct Blood Pressure
- Go Direct Spirometer
- Go Wireless® Heart Rate
- Reflex Hammer Accessory Kit
- BioChamber 250

GDP-HP-DX

Learn more at vernier.com/gdp-hp-dx

Starter package also available

Biotechnology

Spectrometers

Go Direct SpectroVis® Plus

Use this spectrophotometer to collect a full-wavelength spectrum (absorbance, percent transmittance, fluorescence, or intensity), study absorbance *vs.* concentration (create standard curves), or monitor enzymatic activity (enzyme kinetics).

GDX-SVISPL

vernier.com/gdx-svispl

NEW Go Direct UV-VIS Spectrophotometer

The Go Direct UV-VIS Spectrophotometer connects to your device via Bluetooth® wireless technology or USB to generate full spectra, Beer's law data, and kinetic traces of ultraviolet and visible-absorbing samples such as aspirin, DNA, proteins, and NADH.

GDX-SPEC-UV

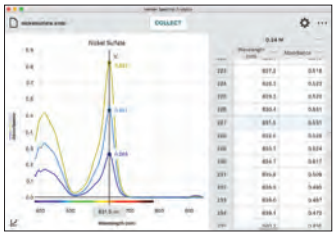
vernier.com/gdx-spec-uv

NEW Go Direct Fluorescence/UV-VIS Spectrophotometer

This spectrophotometer measures the fluorescence and absorbance spectra of samples such as quinine sulfate, fluorescein, chlorophyll, and fluorescent proteins, all while connecting to your device via Bluetooth wireless technology or USB.

GDX-SPEC-FUV

vernier.com/gdx-spec-fuv



Vernier Spectral Analysis

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

FREE DOWNLOAD **vernier.com/spectral-analysis**

Go Direct Tris-Compatible Flat pH

This pH sensor features a sealed, gel-filled, double-junction electrode, making it compatible with Tris buffers and solutions containing proteins or sulfides.

GDX-FPH

vernier.com/gdx-fph

BlueView™ Transilluminator

This transilluminator uses super bright blue LEDs to illuminate electrophoresis gels stained with fluorescent dyes (e.g., SYBR® Safe). This combination is a safer alternative to ethidium bromide and a UV transilluminator.

BLUE-VIEW **vernier.com/blue-view**

Stir Station

This combination stir plate/ring stand can be used with AC power (included) or four C batteries (not included).

STIR **vernier.com/stir**

OHAUS Scout Balances

Collect mass data from OHAUS Scout® balances using Logger *Pro*® 3 software or LabQuest 3. (OHAUS Scout USB Cable is required and not included.)

vernier.com/ohaus

Vernier and 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.

Download free sample experiments at vernier.com/bio-rad-kits

Environmental Science

Go Direct Optical Dissolved Oxygen

Use this sensor to measure dissolved oxygen, water temperature, and atmospheric pressure. It is ideal for experiments in environmental science.

GDX-ODO

vernier.com/gdx-odo

Go Direct Conductivity

Use this sensor to measure total dissolved solids (TDS) in aquatic samples or the salinity of soil samples.

GDX-CON

vernier.com/gdx-con

Go Direct Temperature

This rugged probe measures the temperature of a variety of substances including air, soil, and water.

Range: –40 to 125°C

GDX-TMP

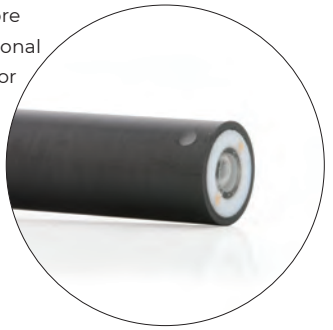
vernier.com/gdx-tmp

Go Direct Tris-Compatible Flat pH

The flat glass shape of this pH sensor is more durable and easier to clean than the traditional pH bulb shape, making it the best choice for environmental science.

GDX-FPH

vernier.com/gdx-fph



Go Direct Nitrate Ion-Selective Electrode

Use this sensor to measure nitrate concentration in water samples from water sources throughout your watershed.

GDX-NO3

vernier.com/gdx-no3

Go Direct Energy

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

GDX-NRG

vernier.com/gdx-nrg

LabQuest 3

LabQuest 3 is a powerful, advanced, easy-to-navigate, and versatile data-logging solution for STEM students.

The all-new LabQuest® 3 is a standalone data-collection platform that students can use to collect, analyze, and interact with data efficiently. With its new touch-screen abilities, students can navigate the platform with ease, and because of its wireless capabilities, students can collect data anywhere.

LABQ3

vernier.com/labq3

LabQuest App

LabQuest 3 has built-in software that gives your students real-time graphing capabilities in a handheld device. It's powerful, yet beautifully simple.

Go Direct Weather System

Easily monitor a wide variety of environmental factors with just one sensor.
Go Direct Weather System includes an affordable, wireless handheld sensor that measures ambient temperature, humidity, wind speed, wind chill, dew point, barometric pressure, and more. The included Go Direct Weather Vane accessory is required to report wind direction. Mounting Go Direct Weather System on a tripod is recommended (tripod not included).

GDX-WTVA

vernier.com/gdx-wtva

Go Direct Sensor Clamp

Prevent accidental drops during field investigations with the Go Direct Sensor Clamp.

GDX-CLAMP

vernier.com/gdx-clamp

Renewable Energy with Vernier

The *Renewable Energy with Vernier* lab book features 26 experiments in wind and solar energy. The book contains a combination of explorations, classic experiments, inquiry investigations, engineering projects, and more.

vernier.com/rev

Download only
REV-E

Printed book + download
REV

Investigating Environmental Science through Inquiry

This book contains 34 inquiry-based environmental science investigations.* Topics include Earth systems and resources, the living world, global change and population, energy resources and consumption, and pollution.

vernier.com/esi

Download only
ESI-E

Printed book + download
ESI

Water Quality with Vernier

With the 18 tests in *Water Quality with Vernier*,* students investigate the water quality of a body of water by testing pH, total dissolved solids, dissolved oxygen, BOD, and more.

vernier.com/wqv

Download only
WQV-E

Printed book + download
WQV

** Instructions for Vernier Graphical Analysis app and Go Direct sensors are not yet available.*

Biology Products

Go Direct Sensors

Product	Order Code
Go Direct® Blood Pressure	GDX-BP
Go Direct CO_2 Gas	GDX-CO2
Go Direct Colorimeter	GDX-COL
Go Direct Conductivity	GDX-CON
Go Direct EKG	GDX-EKG
Go Direct Ethanol Vapor	GDX-ETOH
Go Direct Energy	GDX-NRG
Go Direct Force and Acceleration	GDX-FOR
Go Direct Gas Pressure	GDX-GP
Go Direct Hand Dynamometer	GDX-HD
Heart Rate Monitors	
Go Wireless Exercise Heart Rate	GW-EHR
Go Wireless® Heart Rate	GW-HR
Ion-Selective Electrodes	
Go Direct Ammonium Ion-Selective Electrode	GDX-NH4
Go Direct Nitrate Ion-Selective Electrode	GDX-NO3
Go Direct Light and Color	GDX-LC
Go Direct O_2 Gas	GDX-O2
Go Direct Optical Dissolved Oxygen	GDX-ODO
pH Sensors	
Go Direct pH	GDX-PH
Go Direct Tris-Compatible Flat pH	GDX-FPH
Go Direct Respiration Belt	GDX-RB
Spectrophotometers	
Go Direct SpectroVis® Plus	GDX-SVISPL
NEW Go Direct Fluorescence/ UV-VIS Spectrophotometer	GDX-SPEC-FUV
NEW Go Direct UV-VIS Spectrophotometer	GDX-SPEC-UV
Go Direct Spirometer	GDX-SPR
Temperature Probes	
Go Direct Surface Temperature	GDX-ST
Go Direct Temperature	GDX-TMP
Go Direct Wide-Range Temperature	GDX-WRT
Go Direct Weather	GDX-WTHR
Go Direct Weather System	GDX-WTVA

LabQuest Sensors

Product	Order Code
PAR Sensor	PAR-BTA
Relative Humidity Sensor	RH-BTA
Salinity Sensor	SAL-BTA
Soil Moisture Sensor	SMS-BTA
Turbidity Sensor	TRB-BTA

Accessories and Lab Equipment

Product	Order Code
BioChamber 250	BC-250
BioChamber 2000	BC-2000
BlueView Transilluminator	BLUE-VIEW
Disposable Bacteria Filters (pkg. of 10)	SPR-FIL10
Disposable Mouth Pieces (pkg. of 30)	SPR-MP30
EKG Electrodes (pkg. of 100)	ELEC
Go Direct Charge Station	GDX-CRG
Go Direct Sensor Clamp	GDX-CLAMP
Nose Clip (pkg. of 10)	SPR-NOSE10
OHAUS® Balances	vernier.com/ohaus
Primary Productivity Kit	PPK
Reflex Hammer Accessory Kit	RFX-ACC
Stir Station	STIR
Water Depth Sampler	WDS
Water Quality Bottles	WQ-BOT

Lab Books*

Product	Order Code
Biology with Vernier	BWV
Investigating Biology through Inquiry	BIO-I
Advanced Biology with Vernier (LabQuest sensors only)	BIO-A
Human Physiology Experiments: Volume 1 (Go Direct sensors only)	HSB-HP
Human Physiology Experiments: Volume 2 (Go Direct sensors only)	ALB-HP2
Investigating Environmental Science through Inquiry (LabQuest sensors only)	ESI
Renewable Energy with Vernier	REV
Water Quality with Vernier (LabQuest sensors only)	WQV

** Includes printed book and download; also available as a download only*

See all our products for biology at vernier.com/biology

Chemistry

vernier.com/chemistry

Why Vernier?

When you teach with Vernier, you're teaching with a complete chemistry solution. From titrations to spectroscopy, our sensors and instrumentation are backed by powerful analytical software, university-level experiments, and unparalleled support.

Quality

Durable hardware for lab and field use

Affordable

Designed for education and educational budgets

Versatile

Supports a variety of devices and experiments

> **The use of these technologies helps to build students' proficiency using instrumentation while providing them with hands-on experience that will better prepare them for careers in the chemistry field.**

Seth Barrett, PhD
Muskingham University

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Vernier Spectral Analysis®
Vernier Instrumental Analysis®

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LQ What You Need to Get Started with LabQuest 3

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LabQuest App

Lab Book

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Software

Vernier Spectral Analysis GDX LQ

Vernier Spectral Analysis supports our family of spectrometers. Use it to generate full spectra, conduct Beer's law investigations, and investigate kinetics.

Vernier Instrumental Analysis GDX LQ

Vernier Instrumental Analysis is used for more advanced instrumentation such as Go Direct Mini GC,™ Go Direct Polarimeter, and Go Direct Cyclic Voltammetry System.

Logger *Pro* 3 LQ

Logger *Pro*® 3 is our data-collection and analysis software for LabQuest sensors and spectrometers on Windows® and macOS® computers.

Vernier Graphical Analysis Pro GDX LQ

We have enhanced our award winning Graphical Analysis Pro app with additional features that support remote learning and further analysis of experiment data.

Free Trial for Educators

Try out Graphical Analysis Pro for free for 30 days. Access the sample experiments and enhanced analysis tools to use it with your students.
Get a free trial and learn about site license options at vernier.com/graphical-analysis-pro

Partnerships

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General Chemistry

Go Direct Temperature

Use this rugged temperature probe for investigating endothermic and exothermic reactions, determining the physical properties of water, and investigating intermolecular forces.

Range: –40 to 125°C

GDX-TMP

vernier.com/gdx-tmp

Go Direct pH

Go Direct pH is an important and versatile sensor for your laboratory. Conduct acid-base titrations, monitor pH changes during chemical reactions, and investigate buffers. The wireless connection makes it easier to do field-based studies such as testing the pH of surface water.

GDX-PH

vernier.com/gdx-ph

Go Direct Gas Pressure

Explore gas laws and the Clausius-Clapeyron equation with this sensor that measures the absolute pressure of a gas.

Range: 0 to 400 kPa

GDX-GP

vernier.com/gdx-gp

Go Direct SpectroVis® Plus

With a range of 380 to 950 nm, students can use this spectrophotometer to easily collect a full-wavelength spectrum, study absorbance *vs.* concentration, or monitor rates of reaction. Collect and analyze data using Vernier Spectral Analysis, LabQuest App, or Logger *Pro* 3.

GDX-SVISPL

vernier.com/gdx-svispl

Go Direct Drop Counter

As an alternative to using a buret, the drop counter precisely records the number of drops of titrant added during a titration and then automatically converts it to volume.

GDX-DC

vernier.com/gdx-dc

Stir Station

This combination stir plate/ring stand can be used with AC power (included) or four C batteries (not included).

STIR

vernier.com/stir

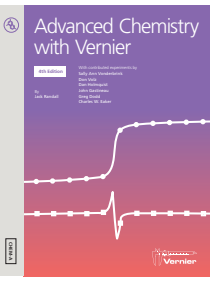
Advanced Chemistry with Vernier

This book contains 35 ready-to-use student experiments that support general chemistry. Instructor notes with sample data are also included.

Topics

- Gas laws
- Titrations
- Spectroscopy
- Electrochemistry

vernier.com/chem-a



Download only
CHEM-A-E

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CHEM-A

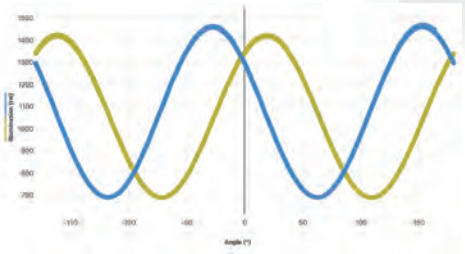
Biochemistry

Go Direct Polarimeter

The concept of chirality can be difficult for students to visualize. Go Direct® Polarimeter provides a visual representation of this concept by measuring the optical rotation of optical isomers such as sugars, amino acids, and proteins.

GDX-POL

vernier.com/gdx-pol



Comparing the optical rotations of fructose and sucrose

Free Software

Vernier Instrumental Analysis

See page 15.

NEW Go Direct Fluorescence/ UV-VIS Spectrophotometer

This spectrophotometer measures the fluorescence and absorbance spectra of samples such as quinine sulfate, fluorescein, chlorophyll, and fluorescent proteins, all while connecting to your device via Bluetooth® wireless technology or USB.

GDX-SPEC-FUV

vernier.com/gdx-spec-fuv

Wavelength Range

- 220 to 850 nm

Light Sources

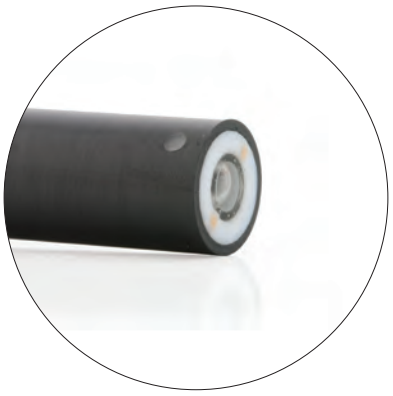
- Visible: LED-boosted tungsten
- UV: Deuterium
- Fluorescence: Exchangeable LEDs for excitation at 375 nm, 450 nm, and 525 nm (additional wavelengths sold separately)

Go Direct Tris-Compatible Flat pH

Go Direct Tris-Compatible Flat pH is a double-junction electrode for measuring pH in Tris buffers and solutions containing proteins or sulfides. The flat glass shape makes it easy to clean and useful for measuring the pH of semisolids such as soil slurries and certain foods.

GDX-FPH

vernier.com/gdx-fph

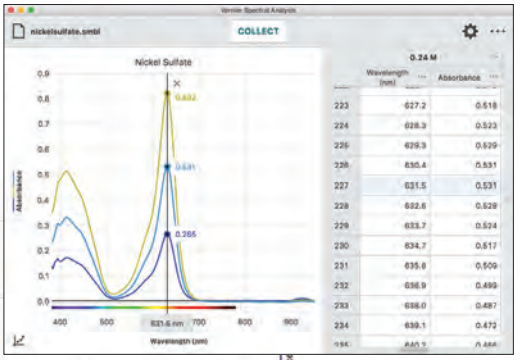


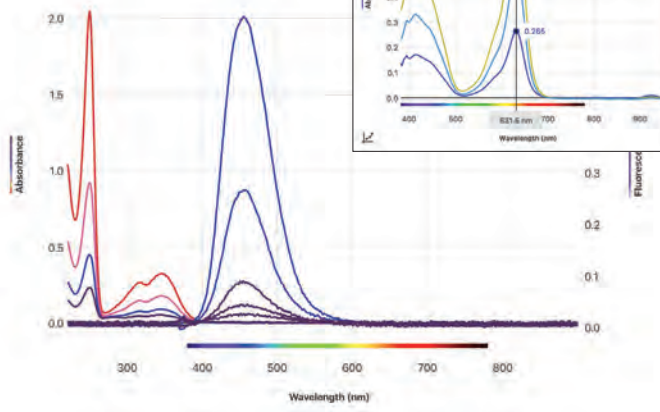
Vernier Spectral Analysis

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

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

vernier.com/spectral-analysis





Organic Chemistry

Go Direct Melt Station

Go Direct Melt Station accurately measures melting temperatures of a solid (up to 260°C), and real-time graphing provides a unique perspective of the melting process.

GDX-MLT

vernier.com/gdx-mlt

Go Direct Wide-Range Temperature

Go Direct Wide-Range Temperature is designed to be used as you would use a thermometer for experiments such as the recrystallization of benzoic acid, simple and fractional distillations, determination of boiling points, the synthesis and analysis of aspirin and other organic compounds, and more.

Range: –20 to 330°C

GDX-WRT

vernier.com/gdx-wrt

Go Direct Mini GC

With the easy-to-use Go Direct Mini GC™ and the free Vernier Instrumental Analysis app, students can separate, analyze, and identify substances contained in a volatile liquid or gaseous sample. This portable gas chromatograph detects polar and nonpolar compounds allowing for a wide range of experiments. Sample experiments include fractional distillation and Fischer esterification.

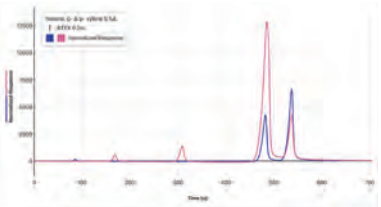
GDX-GC

vernier.com/gdx-gc

Vernier Instrumental Analysis

With our free Vernier Instrumental Analysis® app, students can collect and analyze data from our Go Direct Mini GC, Go Direct Polarimeter, and Go Direct Cyclic Voltammetry System (page 16) using computers, Chromebooks, or compatible mobile devices.

vernier.com/instrumental-analysis



NEW Go Direct UV-VIS Spectrophotometer

The Go Direct UV-VIS Spectrophotometer connects to your device via Bluetooth wireless technology or USB to generate full spectra, Beer's law data, and kinetic traces of ultraviolet and visible-absorbing samples such as aspirin, DNA, proteins, and NADH.

GDX-SPEC-UV

vernier.com/gdx-spec-uv

Wavelength Range

- 220 to 850 nm

Light Sources

- Visible: LED-boosted tungsten
- UV: Deuterium

Free Software

Vernier Spectral Analysis

See page 14.

Organic Chemistry with Vernier

Organic Chemistry with Vernier contains 26 experiments that represent a broad range of topics and techniques taught in most university organic chemistry lab courses. The experiments in this book build upon prior knowledge, laboratory techniques, and skills that students learn in general chemistry courses.

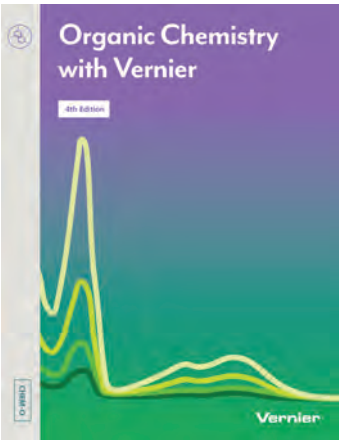
Topics

- Distillation
- Chromatography
- Synthesis
- Polarimetry

vernier.com/chem-o

Download only
CHEM-O-E

Printed book + download
CHEM-O



Analytical and Physical Chemistry

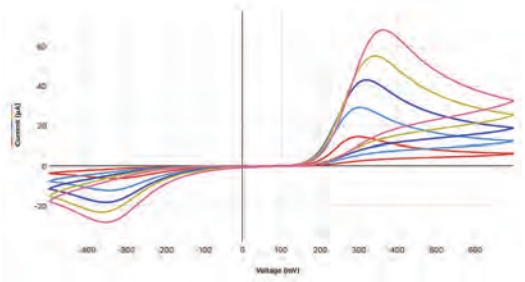
Go Direct Cyclic Voltammetry System

Give your students hands-on experience with electrochemically active reactions using this affordable potentiostat and disposable screen-printed electrodes.

Easily incorporate electrochemistry into your curriculum using our e-book, *Electrochemistry Experiments with the Go Direct Cyclic Voltammetry System*, available for free with your purchase.

GDX-CVS

vernier.com/gdx-cvs



Free Software

Vernier Instrumental Analysis®

See page 15.

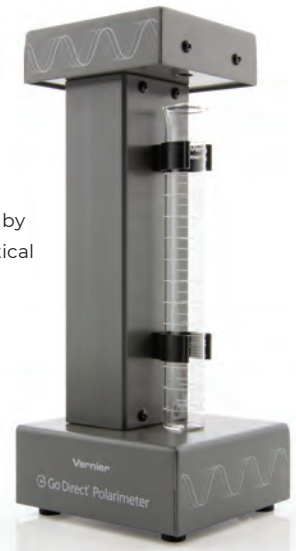
Determining acetaminophen concentration in children's liquid Tylenol® with the Go Direct Cyclic Voltammetry System

Go Direct Polarimeter

The concept of chirality can be difficult for students to visualize. Go Direct® Polarimeter provides a visual representation of this concept by measuring the optical rotation of optical isomers such as sugars, amino acids, and proteins.

GDX-POL

vernier.com/gdx-pol



NEW Go Direct UV-VIS Spectrophotometer

An easy-to-use and accurate instrument ideal for measuring the absorbance spectra of various chemical and biochemical compounds, the Go Direct UV-VIS Spectrophotometer connects to your device via Bluetooth® wireless technology or USB.

GDX-SPEC-UV

Wavelength Range
- 220 to 850 nm

Light Sources
- Visible: LED-boosted tungsten
- UV: Deuterium

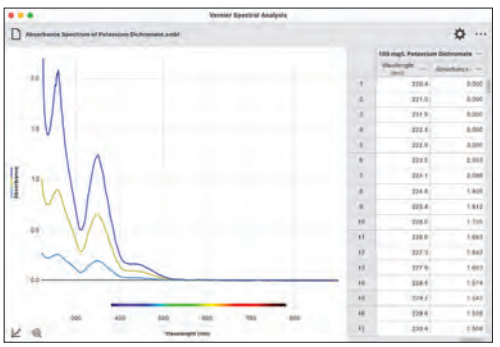
vernier.com/gdx-spec-uv

Recommended Accessory

Vernier Spectrophotometer Optical Fiber

Analyze emissions spectra of gas discharge tubes or flame tests with this optical fiber.

VSP-FIBER
vernier.com/vsp-fiber



Examining the absorbance spectrum of potassium dichromate using the Go Direct UV-VIS Spectrophotometer and Spectral Analysis

Free Software

Vernier Spectral Analysis®

See page 14.

Go Direct pH

Use this general-purpose pH sensor to monitor the pH of aqueous solutions.

GDX-PH

vernier.com/gdx-ph

NEW Go Direct Wide-Range Pressure

Using robust metal fittings and a leakproof seal, Go Direct Wide-Range Pressure measures absolute pressures up to 690 kPa (100 psi) with excellent accuracy.

GDX-WRP

vernier.com/gdx-wrp

Analytical and Physical Chemistry

NEW Go Direct Fluorescence/ UV-VIS Spectrophotometer

The Go Direct Fluorescence/UV-VIS Spectrophotometer measures the fluorescence and absorbance spectra of various samples. It easily connects to your device via Bluetooth wireless technology or USB to conduct Beer's law experiments, measure a Stokes shift, or measure quantum yields.

GDX-SPEC-FUV

Wavelength Range

- 220 to 850 nm

Light Sources

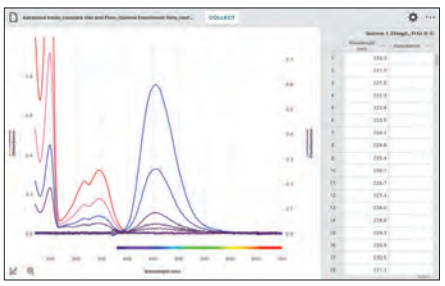
- Visible: LED-boosted tungsten
- UV: Deuterium
- Fluorescence: Exchangeable LEDs for excitation at 375 nm, 450 nm, and 525 nm (additional wavelengths sold separately)

Free experiment downloads available at vernier.com/gdx-spec-fuv

Free Software

Vernier Spectral Analysis

See page 14.



Absorbance and fluorescence spectra of quinine sulfate at varying concentrations

Vernier Flash Photolysis Spectrometer

The Vernier Flash Photolysis Spectrometer is perfect for students to explore the fundamental principles of photochemical reactions. This spectrometer now includes 13 detection filters for measuring the absorption and emission changes of a photoexcited sample with microsecond resolution. Excitation filters (2) are also included.

VSP-FP

Wavelength Range

- 450 to 750 nm

Light Sources

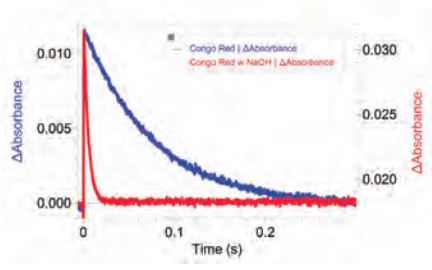
- Xenon flashlamp (pump) white LED (probe)
- 13 exchangeable filters for detection wavelength
- 2 exchangeable colored glass filters for excitation wavelength

Free experiment downloads available at vernier.com/vsp-fp

Free Software

Collect data with the free all-inclusive Flash Photolysis Spectrometer Software.*

**Available for Windows® only*



Fast photocatalysis of Congo Red

NEW Go Direct Visible Spectrophotometer

The Go Direct Visible Spectrophotometer is a robust and accurate portable visible light spectrophotometer that connects easily to your device via Bluetooth wireless technology or USB to conduct Beer's law experiments, kinetic or equilibrium studies of absorbance, or emission spectrum analysis.

GDX-SPEC-VIS

Wavelength Range

- 380 to 950 nm

Light Sources

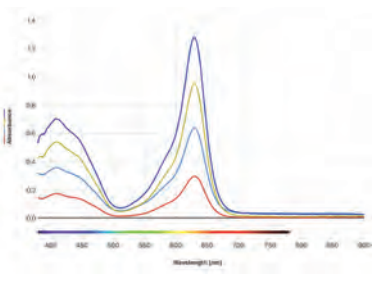
- Visible: LED-boosted tungsten

vernier.com/gdx-spec-vis

Free Software

Vernier Spectral Analysis

See page 14.



Absorbance spectra for nickel sulfate at various concentrations

Chemistry Products

Go Direct Sensors

Sensor	Order Code
Go Direct® Colorimeter	GDX-COL
Conductivity Probes	
Go Direct Conductivity	GDX-CON
Go Direct Platinum-Cell Conductivity	GDX-CONPT
Current Probes	
Go Direct Constant Current System	GDX-CCS
Go Direct Current	GDX-CUR
Go Direct Drop Counter	GDX-DC
Go Direct Electrode Amplifier	GDX-EA
Gas Pressure Sensors	
Go Direct Gas Pressure	GDX-GP
NEW Go Direct Wide-Range Pressure	GDX-WRP
Go Direct Melt Station	GDX-MLT
Go Direct ORP	GDX-ORP
pH Sensors	
Go Direct Glass-Body pH	GDX-GPH
Go Direct pH	GDX-PH
Go Direct Tris-Compatible Flat pH	GDX-FPH
Go Direct Radiation Monitor	GDX-RAD
Temperature Probes	
Go Direct Surface Temperature	GDX-ST
Go Direct Temperature	GDX-TMP
Go Direct Thermocouple	GDX-TC
Go Direct Wide-Range Temperature	GDX-WRT
Go Direct Voltage	GDX-VOLT

LabQuest Sensors

Sensor	Order Code
Colorimeter	COL-BTA
Conductivity Probes	
Conductivity Probe	CON-BTA
Platinum-Cell Conductivity Probe	CONPT-BTA
Current Probes	
Constant Current System	CCS-BTA
Current Probe	DCP-BTA
Drop Counter	VDC-BTD
Electrode Amplifier	EA-BTA
Gas Pressure Sensors	
Gas Pressure Sensor	GPS-BTA
Pressure Sensor 400	PS400-BTA
Instrumentation Amplifier	INA-BTA
Melt Station	MLT-BTA
ORP Sensor	ORP-BTA
pH Sensors	
Glass-Body pH Electrode BNC (requires Electrode Amplifier)	GPH-BNC
pH Sensor	PH-BTA
Tris-Compatible Flat pH Sensor	FPH-BTA
Polarimeter (Chemical)	CHEM-POL
Radiation Monitor	VRM-BTD
Temperature Probes	
Stainless Steel Temperature Probe	TMP-BTA
Surface Temperature Sensor	STS-BTA
Thermocouple	TCA-BTA
Wide-Range Temperature Probe	WRT-BTA
Voltage Probes	
Differential Voltage Probe	DVP-BTA
Voltage Probe	VP-BTA

Instrumentation

Instrument	Order Code
Go Direct Cyclic Voltammetry System	GDX-CVS
Go Direct Mini GC™	GDX-GC
Go Direct Polarimeter	GDX-POL

Spectrometers

Spectrometer	Order Code
NEW Go Direct Emissions Spectrometer	GDX-SPEC-EM
Vernier Flash Photolysis Spectrometer	VSP-FP
NEW Go Direct Fluorescence/UV-VIS Spectrophotometer	GDX-SPEC-FUV
Go Direct SpectroVis® Plus	GDX-SVISPL
NEW Go Direct Visible Spectrophotometer	GDX-SPEC-VIS
NEW Go Direct UV-VIS Spectrophotometer	GDX-SPEC-UV

Lab Equipment

Equipment	Order Code
Electrode Support	ESUP
OHAUS® Balances	vernier.com/ohaus
Stir Station	STIR
Cuvette Rack	CUV-RACK
Go Direct Charge Station	GDX-CRG

Lab Books*

Equipment	Order Code
Advanced Chemistry with Vernier	CHEM-A
Chemistry with Vernier	CWV
Food Chemistry Experiments (Go Direct sensors only)	HSB-FOOD
Investigating Chemistry through Inquiry	CHEM-I
Organic Chemistry with Vernier	CHEM-O

** Includes printed book and download; also available as a download only*

See all our products for university chemistry online at vernier.com/chemistry

Physics

vernier.com/physics

Why Vernier?

Vernier started when one educator, Dave Vernier, decided to build solutions to bring physics to life for his students. Today, our complete physics solution is still powered by the desire to inspire students and foster learning and is backed by powerful software and unparalleled support.

Quality

Durable hardware lasts for years of use

Affordable

Designed for education and educational budgets

Versatile

Supports a variety of devices and experiments

> **I really find your hardware, and especially Logger *Pro*, extremely helpful in my teaching. Couldn't do it without your stuff.**
>
> *Barbara Hughey*
> *Massachusetts Institute of Technology*
> *Cambridge, MA*

A Guide to Vernier Data Collection

We're here to support you as an educator as you incorporate data-collection technology into your instruction. See how our products provide you with affordable laboratory solutions designed for student success.

Our Guarantee: Most of our products are protected by a 5-year limited warranty. And after five years? We'll make every attempt to repair your equipment.

GDX What You Need to Get Started with Go Direct Sensors

Go Direct Sensor

These versatile sensors connect to your device via Bluetooth® wireless technology or USB.

Device

Go Direct® sensors connect to a wide variety of commonly used devices, including Chromebooks, computers, smartphones, tablets, and LabQuest 3.

Software

Vernier Graphical Analysis™ Pro
Vernier Spectral Analysis®
Vernier Video Analysis®

Lab Book

Our popular, award-winning lab books provide hundreds of well-tested, customizable experiments. Our lab books come with a generous site license—purchase once and share files across your department.

LQ What You Need to Get Started with LabQuest Sensors

LabQuest Sensor

LabQuest® sensors share data with your device via a wired connection (BTA/BTD) to an interface from the LabQuest family.

Interface

An interface sends information from the sensor to the data-collection and analysis software. The LabQuest family includes LabQuest 3, LabQuest Stream,® and LabQuest Mini.

Device

LabQuest sensors connect to computers, Chromebooks, and compatible mobile devices through a LabQuest interface.

Software

Vernier Graphical Analysis Pro
Logger *Pro*® 3

Lab Book

Our popular, award-winning lab books provide hundreds of well-tested, customizable experiments. Our lab books come with a generous site license—purchase once and share files across your department.

Software

Vernier Spectral Analysis GDX LQ

Spectral Analysis supports our family of spectrometers. The user-friendly interface walks students through the data-collection process and includes analysis features such as curve fitting and data interpolation.

Vernier Video Analysis GDX LQ

Students can use their smartphone or tablet in the laboratory or out in the field to record motion. They can then import the video into Video Analysis on any device to mark the object in motion, set the scale, and create graphs of the motion.

Logger *Pro* 3 LQ

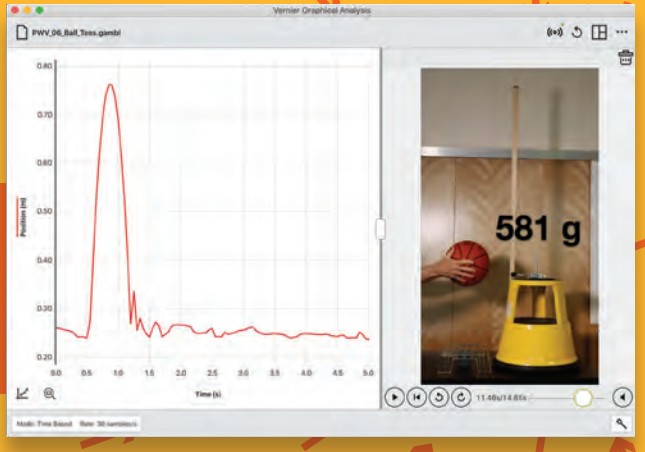
Logger *Pro* 3 is our data-collection and analysis software for LabQuest sensors and spectrometers on Windows and macOS computers.

Vernier Graphical Analysis Pro GDX LQ

We have enhanced our award winning Graphical Analysis Pro app with additional features that support remote learning and further analysis of experiment data.

Free Trial for Educators

Try out Graphical Analysis Pro for free for 30 days. Access the sample experiments and enhanced analysis tools to use it with your students.
Get a free trial and learn about site license options at www.vernier.com/graphical-analysis-pro



Why Vernier?

Our durable hardware and quality software are designed for hands-on student use. Give your students the opportunity to gain practical, relevant data-collection and analysis experience that they can use wherever they go next.

Mechanics

Dynamics Cart and Track System with Go Direct Sensor Cart

GDX

The Dynamics Cart and Track System with Go Direct Sensor Cart includes essential laboratory equipment for teaching dynamics and kinematics. With our Go Direct Sensor Cart, students can explore force, position, velocity, and acceleration directly on their device using Bluetooth wireless technology. There are no wires to create drag, and no additional equipment is required! Each cart features built-in sensors that simplify experiment setup and make this system the best choice for studying dynamics and kinematics.

with 1.2 m Track DTS-GDX
with 2.2 m Track DTS-GDX-LONG

vernier.com/dts-gdx

Additional Cart and Track options are available at vernier.com/dynamics

Go Direct Photogate

GDX

This double-gate sensor includes two photogates built into the arms of the sensor. It accurately measures velocity and acceleration.

GDX-VPG

vernier.com/gdx-vpg

Go Direct Force and Acceleration

GDX

Measure forces as small as ±0.1 N and up to ±50 N with this sensor that couples a 3-axis accelerometer with a stable and accurate force sensor. It also includes a 3-axis gyroscope for experiments involving rotation.

GDX-FOR

vernier.com/gdx-for

Go Direct Centripetal Force Apparatus

GDX

When combined with Go Direct Force and Acceleration (not included), the Centripetal Force Apparatus makes an ideal tool to explore rotational dynamics.

GDX-CFA

vernier.com/gdx-cfa

Moment of Inertia Accessory Kit

GDX LQ

With the Moment of Inertia Accessory Kit, students can explore inertia in a broader context. The kit expands the capabilities of the Vernier Centripetal Force Apparatus when investigating moments of inertia of different geometries.

CFA-MIK

vernier.com/cfa-mik

Go Direct Motion

GDX

Use ultrasound to measure the position, velocity, and acceleration of moving objects.

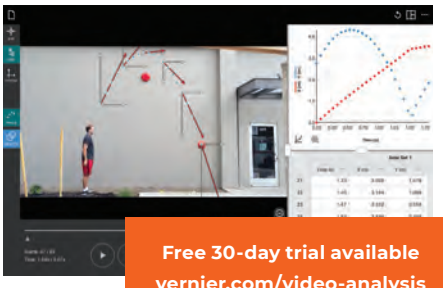
GDX-MD

vernier.com/gdx-md

Vernier Video Analysis App

Students can use their smartphones and tablets in the laboratory or out in the field to capture motion. Once the video is inserted into the app, students set the scale and mark points within the video to track the object in motion. Vernier Video Analysis generates accurate and visually rich graphs and a data table reflecting the recorded motion.

Video Analysis is a browser-based app that works on Windows,® macOS,® Android,™ Chrome OS,™ iOS, and iPadOS.®



Free 30-day trial available
vernier.com/video-analysis

Investigations for Vernier Video Analysis

Each e-book includes investigations for use with Vernier Video Analysis, including ready-to-use videos.

Vernier Video Analysis: Motion and Sports
Download only: HSB-VVAMS-E

NEW *Vernier Video Analysis: Conservation Laws and Forces*
Download only: HSB-VVACLF-E

Waves and Sound

Go Direct Sound

GDX

This is really two sensors in one—measure sound level in decibels, or capture and evaluate sound waveforms.

GDX-SND

vernier.com/gdx-snd

Power Amplifier

Drive devices such as speakers, lamps, and small DC motors.

PAMP

vernier.com/pamp

Power Amplifier Accessory Speaker

Study mechanical waves on strings and springs.

PAAS-PAMP

vernier.com/paas-pamp

Thermodynamics

Go Direct Gas Pressure

GDX

This sensor measures the absolute pressure of a gas.

GDX-GP

vernier.com/gdx-gp

Go Direct Temperature

GDX

Go Direct® Temperature is a durable, stainless steel temperature sensor for use in liquids or air.

Range: –40 to 125°C

GDX-TMP

vernier.com/gdx-tmp

Go Direct Surface Temperature

GDX

An exposed temperature sensor makes this an ideal choice for situations where low thermal mass and extremely rapid response are needed. Use in air and water only.

Range: –25 to 125°C

GDX-ST

vernier.com/gdx-st

Electricity and Magnetism

Go Direct Voltage

GDX

This sensor combines a wide input voltage range and high precision, making it an excellent choice for investigations of both AC/DC circuits and electromagnetism.

Ranges: ±20 V and ±1 V

GDX-VOLT

vernier.com/gdx-volt

Go Direct Current

GDX

Measure electric currents in circuits with this versatile sensor.

Ranges: ±1 A and ±0.1 A

GDX-CUR

vernier.com/gdx-cur

Go Direct Static Charge

GDX

With Go Direct Static Charge, students can easily perform quantitative measurements of static charges. Designed with ease of use in mind, this wireless sensor ensures enhanced accuracy and performance.

Range: ±100 nC

GDX-Q

vernier.com/gdx-q

Go Direct 3-Axis Magnetic Field

GDX

Determine the magnitude and direction of a magnetic field at any point in space with this 3-axis sensor.

Ranges: ±5 mT and ±130 mT

GDX-3MG

vernier.com/gdx-3mg

Electrostatics Kit

When using the Electrostatics Kit with Go Direct Static Charge, students can conduct a range of experiments in electrostatics.

ESK-CRG

vernier.com/esk-crg

High-Voltage Electrostatics Kit

Use this kit to investigate the distribution of charge on a sphere, transfer of charge on contact between two spheres, and charging by induction.

HVEK-CRG

vernier.com/hvek-crg

Extech® Digital Power Supply

This power supply provides constant current or constant voltage for physics activities that require DC power.

EXPS

vernier.com/exps

Vernier Circuit Board 2

Use this convenient platform to study basic series and parallel circuits as well as RLC circuits. Many components for experimentation are provided, and additional components can be added to expand the capability of this useful board.

VCB2

vernier.com/vcb2

Electrostatic High-Voltage Genecon

A great addition to the High Voltage Electrostatics Kit, the Electrostatic High-Voltage Genecon generates both positive and negative charges and reliably creates charge differences in high humidity.

HVEK-GEN

vernier.com/hvek-gen

Light and Optics

Light Sensors

Go Direct Light and Color

GDX

This sensor combines visible light, UV, and RGB sensors to measure source emission, transmittance, and reflection of light in the visible light to ultraviolet electromagnetic spectrum.

GDX-LC

vernier.com/gdx-lc

Light Sensor*

LQ

Investigate polarizers, reflectivity, and solar energy with this sensor that approximates the human eye in spectral response. It's great for inverse square law experiments.

LS-BTA vernier.com/ls-bta

Diffraction Apparatus‡

LQ

Use the Diffraction Apparatus* to map light intensity *vs.* position for various slit geometries.

DAK vernier.com/dak

Green Diffraction Laser *(optional)*

Add this laser to your Diffraction Apparatus to study the effect of wavelength on a diffraction pattern.

GDL-DAK vernier.com/gdl-dak

Optics Expansion Kit

Use the Optics Expansion Kit‡ with your dynamics track 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 experiments in our *Physics with Vernier* and *Advanced Physics with Vernier—Beyond Mechanics* lab books.

OEK

vernier.com/oek

See website for replacement parts.

Accessories

Color Mixer Kit‡

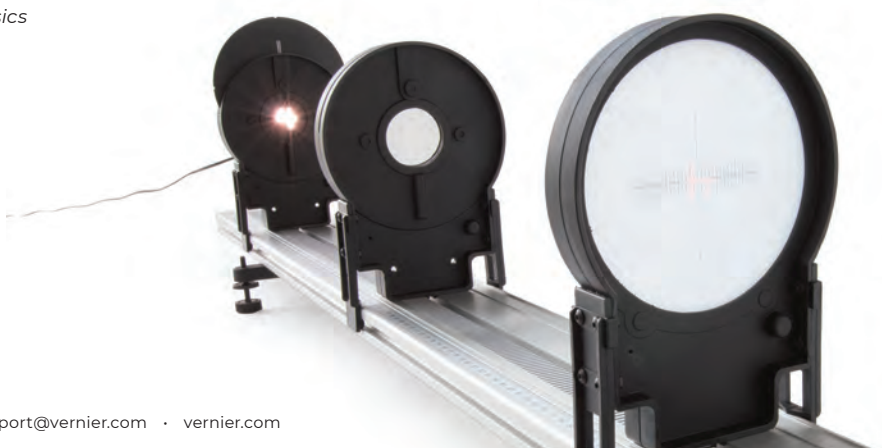
CM-OEK vernier.com/cm-oek

Mirror Set

M-OEK vernier.com/m-oek

Polarizer/Analyzer Set

PAK-OEK vernier.com/pak-oek



** Requires an interface such as LabQuest® 3 or LabQuest Mini*

‡ Requires a Combination 1.2 m Track/Optics Bench (TRACK)

Modern Physics

Radiation Monitors

Our radiation monitors detect alpha, beta, gamma, and X-ray radiation. They can be used to explore radiation statistics, measure the rate of nuclear decay, monitor radon progeny, and investigate the effects of shielding. The sensors include both LED and audible indicators.

Go Direct Radiation Monitor

GDX

GDX-RAD

vernier.com/gdx-rad

Vernier Radiation Monitor*

LQ

VRM-BTD

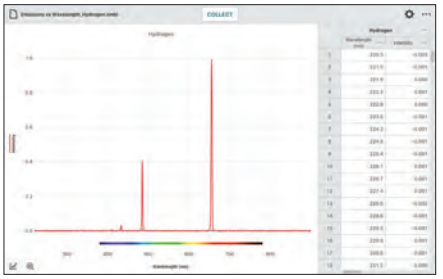
vernier.com/vrm-btd

NEW Go Direct Emissions Spectrometer

The Go Direct® Emissions Spectrometer connects to your device via Bluetooth® wireless technology or USB to give precise measurements over a range of 350–900 nm. Use it with or without the Vernier Emissions Fiber (not included) to examine spectra of light bulbs, spectrum tubes, or the sun.

GDX-SPEC-EM

vernier.com/gdx-spec-em



Vernier Spectral Analysis App

Our free Vernier Spectral Analysis® app with our Emissions Spectrometer makes it easy to analyze spectra. Students can quickly locate peaks or compare spectra from different sources.

vernier.com/spectral-analysis

Vernier Emissions Fiber

VSP-EM-FIBER

vernier.com/vsp-em-fiber

Spectrum Tube Power Supply

This power supply features an ultra-safe design for electrifying spectrum tubes.

ST-SPS

vernier.com/st-sps

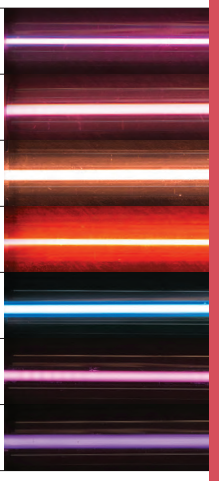
Spectrum Tubes

Spectrum Tubes are permanently enclosed in protective plastic carriers, with no exposed high voltage.

Spectrum Tubes carry a warranty of 2 years or 100 hours, whichever comes first (hydrogen tube: 2 years or 40 hours, whichever comes first).

vernier.com/spectrum-tubes

Spectrum Tube	Order Code
Hydrogen	ST-H
Nitrogen	ST-N
Helium	ST-HE
Neon	ST-NE
Carbon Dioxide	ST-CO2
Air	ST-AIR
Argon	ST-AR



Additional Physics Products

Mechanics

Product	Order Code
Go Direct® Acceleration	GDX-ACC
3-Axis Accelerometer	3D-BTA
25-g Accelerometer	ACC-BTA
Bumper and Launcher Kit	BLK
Centripetal Force Apparatus	CFA
Dual-Range Force Sensor	DFS-BTA
Dynamics Cart and Track System	DTS
Dynamics Cart and Track System with Motion Encoder	DTS-EC
Eddy Current Brake	DTS-ECB
Encoder Fan Cart	CART-FEC
Fan Cart	CART-F
Force Plate	FP-BTA
Friction Pad DTS	DTS-PAD
Independence of Motion	IOM-VPL
Go Direct Sensor Cart Accessory Kit	GDX-CART-AK
Low-g Accelerometer	LGA-BTA
Motion Detector	MD-BTD
Photogate	VPG-BTD
Go Direct Projectile Launcher	GDX-PL
Vernier Projectile Launcher	VPL
Projectile Stop	PS-VPL
Pulley Bracket	B-SPA
Go Direct Rotary Motion	GDX-RMS
Rotary Motion Sensor	RMV-BTD
Rotational Motion Accessory Kit	AK-RMV
Time of Flight Pad	TOF-VPL
Ultra Pulley Attachment	SPA

Waves and Sound

Product	Order Code
Microphone	MCA-BTA
Sound Level Sensor	SLS-BTA

Thermodynamics

Product	Order Code
Gas Pressure Sensor	GPS-BTA
Stainless Steel Temperature Probe	TMP-BTA
Surface Temperature Sensor	STS-BTA

Electricity and Magnetism

Product	Order Code
Magnetic Field Sensor	MG-BTA
Power Amplifier	PAMP
Differential Voltage Probe	DVP-BTA
Current Probe	DCP-BTA
Instrumentation Amplifier	INA-BTA
Optional Breadboard Kit for the Vernier Circuit Board 2	VCB2-OBBK
Extech® Digital DC Power Supply	EXPS
Charge Sensor	CRG-BTA

Light and Optics

Product	Order Code
Polarizer/Analyzer Set for Optics Expansion Kit	PAK-OEK
Combination 1.2 m Track/Optics Bench	TRACK
Combination 2.2 m Track/Optics Bench	TRACK-LONG
Green Diffraction Laser	GDL-DAK

Lab Books

Product	Order Code
Physics with Vernier	PWV*
Advanced Physics with Vernier—Mechanics	PHYS-AM*
Advanced Physics with Vernier—Beyond Mechanics	PHYS-ABM*
Physics Explorations and Projects	PEP*
Vernier Video Analysis: Motion and Sports	HSB-VVAMS-E
NEW *Vernier Video Analysis: Conservation Laws and Forces*	HSB-VVACLF-E

** Includes printed book and download; also available as a download only*

This is just a sample of our physics solutions. To see the full suite of Vernier physics products, please visit vernier.com/physics

Engineering

vernier.com/engineering

Why Vernier?

Vernier engineering solutions harness the power of analytical software and the precision of high-quality sensors to help students sharpen their design skills and prepare to enter the workforce. As with all of our solutions, our engineering technology is backed by unparalleled support.

Quality

Durable hardware for lab and field use

Affordable

Designed for education and educational budgets

Versatile

Supports a variety of devices and experiments

> **Our projects are about more than just supporting the need for engineering education in local classrooms. Vernier products help deepen our students' learning through experiential, hands-on community engagement.**

Maija A. Benitz, PhD
Assistant Professor of Engineering
Roger Williams University

A Guide to Vernier Data Collection

We're here to support you as an educator as you incorporate data-collection technology into your instruction. See how our products provide you with affordable laboratory solutions designed for student success.

Our Guarantee: Most of our products are protected by a 5-year limited warranty. And after five years? We'll make every attempt to repair your equipment.

What You Need to Get Started with Go Direct Sensors

Go Direct® sensors connect directly (no interface required) to your computer, Chromebook,™ or compatible mobile device via USB or Bluetooth® wireless technology. Collect and analyze data with Vernier Graphical Analysis™ Pro app, LabVIEW,™ Python,® or JavaScript.™

A Go Direct sensor

B Computer, Chromebook, tablet, smartphone

C Software

- Vernier Graphical Analysis Pro
- National Instruments LabVIEW
- Python
- JavaScript

What You Need to Get Started with LabQuest Sensors

LabQuest® sensors have a cable with a plug that makes it easy to connect to an interface without any additional wiring. Use LabQuest sensors with a Vernier interface, Arduino,® NI ELVIS, NI myDAQ, or your own DAQ hardware. If using a non-Vernier interface, these sensors require a +5.0 volt supply voltage and output a 0 to 5 volt signal. Most sensors have a simple, linear calibration.

A LabQuest sensor

B Interface (LabQuest, DAQ, or Arduino)

C Computer, Chromebook, tablet, smartphone

D Software

- Vernier Graphical Analysis Pro
- Logger *Pro*® 3
- National Instruments LabVIEW
- Arduino IDE
- Python

Vernier Graphical Analysis Pro

We have enhanced our award winning Graphical Analysis Pro app with additional features that support remote learning and further analysis of experiment data.

Free Trial for Educators

Try out Graphical Analysis Pro for free for 30 days. Access the sample experiments and enhanced analysis tools to use it with your students.

Get a free trial and learn about site license options at vernier.com/graphical-analysis-pro

Our durable hardware and quality software are designed for hands-on student use. Give your students the opportunity to gain practical, relevant data-collection and analysis experience that they can use wherever they go next.

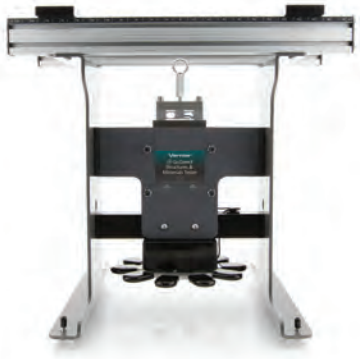
Introduction to Engineering

Go Direct Structures & Materials Tester

Use our Go Direct Structures & Materials Tester to evaluate the strength of model bridges and engineered structures by measuring the applied load. Utilizing both load and displacement sensors, your students can evaluate the properties of materials.

GDX-VSMT

vernier.com/gdx-vsmt



Advanced Wind Experiment Kit

Use this kit as a fast and easy way to introduce the engineering aspects of wind turbine technology. Investigate different blade designs, gear ratios, and generators.

KW-AWX

vernier.com/kw-awx

Vernier Variable Load

Use the Vernier Variable Load in conjunction with Go Direct Energy to provide a range of resistive loads for projects such as engineering wind turbines or investigating solar panels. Students can adjust the potentiometer to provide resistances between 6 and 255 Ω to determine the optimal load on a system.

VES-VL vernier.com/ves-vl

Go Direct Energy

Go Direct Energy measures voltage and current as well as displays power and energy output of scale model wind turbines and solar panels, so students can quantitatively evaluate the effects of their design changes. It connects via Bluetooth wireless technology or USB to your device.

GDX-NRG vernier.com/gdx-nrg

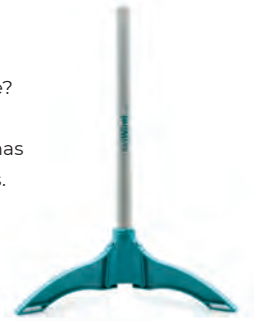
See all our products for engineering at vernier.com/engineering

Wind Turbine Design

Tower and Base Set

Do you need a tower for your turbine nacelle? This is the same tower that comes in the Advanced Wind Experiment Kit. The tower has a diameter that fits inside 1-inch PVC fittings.

KW-TBS vernier.com/kw-tbs



Basic Turbine Building Parts

The Basic Turbine Building Parts kit includes three hubs, a wind turbine generator, and 25 dowels, all in one package.

KW-BTPART
vernier.com/kw-btpart

Wind Turbine Generator with Wires

This is the primary generator for wind turbine experiments because it runs smoothly and provides high power output at a relatively low RPM.

KW-GEN
vernier.com/kw-gen

Hub (3 Pack)

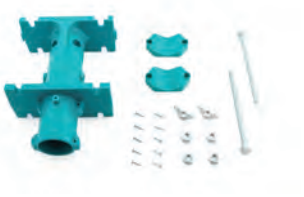
With these 12-hole crimping hubs, made from recycled plastic, students can turn a DC generator into a wind turbine.

KW-WTH3
vernier.com/kw-wth3

Nacelle

Build a complete turbine by making your own tower and base with PVC pipe (from a hardware store) or use the Tower and Base Set. You will also need a generator and a way to affix the turbine blades.

KW-NAC
vernier.com/kw-nac



simpleGEN

Students can use the easy-to-build AC generator of the simpleGEN to explore the basics of electrical generator design.

KW-SGEN
vernier.com/kw-sgen

Gear Set

The small 8-tooth gear fits on 2 mm driveshafts that are found on many DC generators. The gears have a keying feature and can be changed quickly and easily using the included hex locks. The hex locks secure to our 9/64 inch hex driveshaft, which is included in the Drivetrain Set (KW-DS).

Gear sizes: 64 teeth, 32 teeth, 16 teeth, 8 teeth

KW-GEAR
vernier.com/kw-gear

Balsa Blade Sheets

Balsa wood is very lightweight and stiff, making it perfect for wind turbine blade design.

Balsa Blade Sheets (10 Sheets) KW-BBS10
Balsa Blade Sheets (100 Sheets) KW-BBS100
vernier.com/kw-bbs10

See all our products for engineering at vernier.com/engineering

Biomedical Engineering with Go Direct Sensors

With wireless options and multiple on-board sensors, Go Direct sensors are perfect for analyzing and studying physiological functions.

GDX

Go Direct EKG

Go Direct® EKG has five channels:
EKG, heart rate, EMG, EMG rectified, and voltage.

GDX-EKG

vernier.com/gdx-ekg

Go Direct O_2 Gas

This sensor measures gaseous oxygen concentration levels and air temperature.

GDX-O2

vernier.com/gdx-o2

Go Direct Blood Pressure

Go Direct Blood Pressure has seven channels: cuff pressure, mean arterial pressure, systolic pressure, diastolic pressure, pulse rate, oscillations, and envelope.

GDX-BP

vernier.com/gdx-bp

Go Direct Temperature

This rugged, general purpose sensor has a temperature range of –40 to 125°C.

GDX-TMP

vernier.com/gdx-tmp

Go Direct Spirometer

Go Direct Spirometer has six channels:
flow rate, volume, adjusted volume, cycle volume, respiration rate, and differential pressure.

GDX-SPR

vernier.com/gdx-spr

Go Direct Surface Temperature

With a range of –25 to 125°C, this sensor is designed for use in situations in which low thermal mass or flexibility is required, such as on human skin.

GDX-ST

vernier.com/gdx-st

Go Direct Hand Dynamometer

Go Direct Hand Dynamometer has seven channels:
force, x-axis acceleration, y-axis acceleration, z-axis acceleration, x-axis gyro, y-axis gyro, and z-axis gyro.

GDX-HD

vernier.com/gdx-hd

Go Direct Respiration Belt

Go Direct Respiration Belt has four channels:
force, respiration rate, steps, and step rate.

GDX-RB

vernier.com/gdx-rb

Go Direct CO_2 Gas

Go Direct CO_2 Gas has three channels:
CO_2 gas, temperature, and relative humidity.

GDX-CO2

vernier.com/gdx-co2

Go Direct Acceleration

This 3-axis acceleration sensor has two acceleration ranges (±157 m/s² and ±1960 m/s²) plus an altimeter and a 3-axis gyroscope.

GDX-ACC

vernier.com/gdx-acc

See all our products for engineering at vernier.com/engineering

Arduino with LabQuest Sensors

LQ

Help students build coding skills and foster creative critical thinking by combining Vernier sensors with Arduino®

Vernier Coding with Arduino—Analog Sensor Package

The package has everything needed for students to use Vernier sensors with Arduino microcontrollers, including the *Vernier Coding Activities with Arduino: Analog Sensors* e-book at no additional cost.

VCA-AS-PKG **vernier.com/vca-as-pkg**

SparkFun RedBoard with Cable

This Arduino-compatible board makes it easy to take sensor measurements when used with the Vernier Arduino Interface Shield.

ARD-RED **vernier.com/ard-red**

Vernier Ardunio Interface Shield

Conveniently connect the SparkFun® RedBoard or Arduino Uno to Vernier LabQuest sensors with the Vernier Arduino Interface Shield.

BT-ARD **vernier.com/bt-ard**

Gas Pressure Sensor

Use the Gas Pressure Sensor to monitor pressure changes of a gas.

GPS-BTA **vernier.com/gps-bta**

Surface Temperature Sensor

Measure temperature where low thermal mass or flexibility is required.
Range: –25 to 125°C

STS-BTA **vernier.com/sts-bta**

Motion Detector

The Motion Detector uses ultrasound to measure the position of objects.
Range: 0.15 to 6 m
Resolution: 1 mm

MD-BTD **vernier.com/md-btd**

pH Sensor

This is a general-purpose pH sensor.
Range: pH 0 to 14
Accuracy: ±0.2 pH units

PH-BTA **vernier.com/ph-bta**

Digital Control Unit

Use the digital output lines of an interface to control DC electrical devices.

DCU-BTD **vernier.com/dcu-btd**

Anemometer

This is an impeller-type anemometer for measuring wind speed.
Range: 0.5 to 30 m/s (1 to 67 mph)

ANM-BTA **vernier.com/anm-bta**

Read the online guide and see all our products for Arduino at vernier.com/arduino

Sensors and Coding

Students gain a deeper understanding of coding when they see their code interact with sensor data. Our coding solutions give students valuable experience using popular programming languages to affect things beyond the screen.

LabVIEW

Use our free activity book to introduce NI LabVIEW™ programming with Vernier sensors in your classroom.

vernier.com/ni-labview

National Instruments LabVIEW and Vernier

Introduce your students to NI LabVIEW software, a programming language used throughout the engineering disciplines. We have sample LabVIEW programs (VIs) for LabQuest® Mini, myDAQ, Go Direct® sensors, and other Vernier hardware.

With LabQuest Sensors LQ

LabQuest Mini

LabQuest Mini is a powerful, affordable, and easy-to-use sensor interface for data acquisition with more than 75 Vernier LabQuest sensors.

LQ-MINI

vernier.com/lq-mini

myDAQ Adapter

The myDAQ Adapter can be used to perform data acquisition with more than 75 Vernier LabQuest sensors and the NI myDAQ interface (sold separately). It is designed for use with NI LabVIEW software.

BT-MDAQ

vernier.com/bt-mdaq

Analog Protoboard Adapter

Use these adapters to connect Vernier LabQuest sensors to a non-Vernier interface, such as NI ELVIS. The connector fits into a standard prototyping board.

BTA-ELV **vernier.com/bta-elv**

With Go Direct Sensors GDX

Integrate over 50 wireless sensors into your LabVIEW project to acquire data or control your NI DAQ hardware.

Go Direct Acceleration		GDX-ACC	vernier.com/gdx-acc	**Go Direct Motion**	 GDX-MD	vernier.com/gdx-md
Go Direct Force and Acceleration		GDX-FOR	vernier.com/gdx-for	**Go Direct Light and Color**	 GDX-LC	vernier.com/gdx-lc
Go Direct Rotary Motion		GDX-RMS	vernier.com/gdx-rms	**Go Direct Weather**	 GDX-WTHR	vernier.com/gdx-wthr

See all our products for NI LabVIEW at vernier.com/ni-labview

Python

We have created a guide and examples that make it easy to start using Vernier sensors with Python®.

vernier.com/python

Arduino IDE

Use our starter package to teach the basics of coding Arduino with Vernier sensors.

vernier.com/arduino

JavaScript

Students can use JavaScript™ to integrate Go Direct sensor data into their custom web applications.

vernier.com/javascript

Engineering Products

Wind Turbine Design

Product	Order Code
Advanced Wind Experiment Kit	KW-AWX
Balsa Blade Sheets (10 Sheets)	KW-BBS10
Basic Turbine Building Parts	KW-BTPART
Drivetrain Set	KW-DS
Gear Set	KW-GEAR
Go Direct® Energy	GDX-NRG
Hub (3 Pack)	KW-WTH3
Nacelle	KW-NAC
Tower and Base Set	KW-TBS
Vernier Variable Load	VES-VL
Wind Turbine Generator with Wires	KW-GEN

Engineering with Arduino

Product	Order Code
Anemometer	ANM-BTA
Digital Control Unit	DCU-BTD
Gas Pressure Sensor	GPS-BTA
Motion Detector	MD-BTD
pH Sensor	PH-BTA
SparkFun RedBoard with Cable	ARD-RED
Surface Temperature Sensor	STS-BTA
Vernier Arduino Interface Shield	BT-ARD
Vernier Coding Activities with Arduino: Analog Sensors lab book	VCA-AS-E

LabQuest Sensors

Product	Order Code
Barometer	BAR-BTA
Gas Pressure Sensor	GPS-BTA
Light Sensor	LS-BTA
Magnetic Field Sensor	MG-BTA
Microphone	MCA-BTA
Soil Moisture Sensor	SMS-BTA
Stainless Steel Temperature Probe	TMP-BTA

Learn more about over 80 LabQuest sensors at vernier.com/labquest

Biomedical Engineering

Product	Order Code
Go Direct Acceleration	GDX-ACC
Go Direct Blood Pressure	GDX-BP
Go Direct CO_2 Gas	GDX-CO2
Go Direct EKG	GDX-EKG
Go Direct Hand Dynamometer	GDX-HD
Go Direct O_2 Gas	GDX-O2
Go Direct Respiration Belt	GDX-RB
Go Direct Spirometer	GDX-SPR
Go Direct Surface Temperature	GDX-ST
Go Direct Temperature	GDX-TMP

NI LabVIEW and Vernier

Product	Order Code
Analog Protoboard Adapter	BTA-ELV
myDAQ Adapter	BT-MDAQ
LabQuest® Mini	LQ-MINI

Go Direct Sensors

Product	Order Code
Go Direct Acceleration	GDX-ACC
Go Direct Force and Acceleration	GDX-FOR
Go Direct Light and Color	GDX-LC
Go Direct Motion	GDX-MD
Go Direct Rotary Motion	GDX-RMS

Learn more about over 50 Go Direct sensors at vernier.com/go-direct

See all of our engineering products online at vernier.com/engineering

Index

Vernier and the Environment

A strong commitment to the environment is central to our mission.

Here are just a few examples of our practices

- **Solar panels**—We have installed over 37,000 watts of solar panels.
- **Alternative transportation**—All employees are provided with free transit passes and are encouraged to walk, bike, carpool, or take public transport to work.
- **Recycling**—We recycle everything we can: paper, plastic, aluminum, cardboard, electronics, batteries, and more.
- **Worm bin composting**—Vernier employees compost food scraps and yard clippings using a colony of red wiggler worms.
- **Electric car charging stations**—Over 10% of Vernier employees own hybrid, plug-in hybrid, or pure electric vehicles.
- **Packing materials**—Employees reuse boxes and packing materials.
- **Lighting**—We've installed energy-saving LED bulbs in our fixtures.
- **LEED-EB Gold rating**—In 2006, and again in 2016, our building qualified for the second highest rating possible from the U.S. Green Building Council.
- **Green Company Award**—We have been named one of the 100 Best Green Companies to Work For in Oregon for twelve years.

Terms and Conditions

Satisfaction Guarantee

Vernier has been selling science education software and data-collection hardware since 1981. We pride ourselves on the quality and affordability of our products and our service to our customers. If at any time you are unhappy with any of our products or service, please get in touch.

Vernier Software & Technology
13979 SW Millikan Way
Beaverton, OR 97005-2886
vernier.com · info@vernier.com
Toll Free: 888-VERNIER (888-837-6437)
Fax: 503-277-2440

Product Usage

Vernier products are designed for educational use. Our products are not designed nor are they recommended for any industrial, medical, or commercial process, such as life support, patient diagnosis, control of a manufacturing process, or industrial testing of any kind. We design our products with the specifications and features that educators and students need to be successful. In our effort to keep our products affordable and easy to use, we may not meet the specifications or include the features that an industrial scientist or medical professional might want.

Equipment Return

Any product that does not meet your needs may be returned within 30 days for a full refund. Equipment returned after 30 days may be subject to a restocking fee.

A Return Merchandise Authorization, available from Vernier, is required for any product return. Equipment returned for exchange or credit must be in new condition and in its original packaging.

Shipping

Shipping charges may vary, depending on method of shipment. Increased shipping charges for heavier or bulkier items may apply due to weight or dimensions. Applicable sales tax may be charged. For export shipments, local taxes and duties are not included.

Preview Policy

Most Vernier products are available for a 30-day preview (or longer, if requested) to US educational institutions.

International Sales

All Vernier orders for use outside of the US and Canada are handled by us and the worldwide network of Vernier dealers. Contact us for more information.

Warranties

Most Vernier-branded products carry a five-year limited warranty. During the warranty period, Vernier will repair or replace the item if there is a defect in materials or workmanship. Outside the warranty, Vernier will attempt to repair most products. The Vernier warranty covers products when used by educational institutions only. Products manufactured by anyone other than Vernier are subject to the conditions of the warranty supplied by the manufacturer.

Additional exclusions and limitations can be found at vernier.com/warranty

Software Licenses

We have a very generous site license policy for our software. The purchase of one copy of Logger *Pro* 3 or LabQuest Viewer computer software entitles you to install it on every computer in your school or, for post-secondary institutions, department. Installation to local machines over a network is allowed. Purchasers are also permitted to distribute Logger *Pro* 3 to their students and instructors for home use. The license is limited to a single campus if your institution has multiple campuses.

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If you wish to be removed from our mailing list, simply write to us at updates@vernier.com, and we will remove you immediately.

Trademarks

Technical Support

We are readily available to help you with individual questions about our software and hardware—simply email support@vernier.com, chat with us live on vernier.com, or call us at our toll free number: 888-VERNIER (888-837-6437).

Our email newsletter, *The Caliper*, makes it easy to access new ideas, learn about new products, and get inspired by fellow educators. Sign up at vernier.com/newsletter

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Our Guarantee

Most of our products are protected by a 5-year limited warranty. And after five years? We'll make every attempt to repair your equipment.