

Go Direct[®] Ethanol Vapor (Order Code GDX-ETOH)



Go Direct Ethanol Vapor measures the concentration of ethanol in the air above an aqueous sample. This sensor can be used in a wide variety of experiments in biological, agricultural, food, and environmental studies.

- Determine the rate of ethanol production during fermentation.
- Measure the discrete amount of ethanol in a given sample.
- Investigate which sugars yeast can ferment.
- Identify specific organisms that can utilize ethanol fermentation as a metabolic pathway.

Note: 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.

What's Included

- Go Direct Ethanol Vapor
- Micro USB Cable
- 250 mL Nalgene Bottle
- Ethanol Cap Assemblies
- Plumber's Tape
- #6 Stopper

Compatible Software

See www.vernier.com/manuals/gdx-etoh for a list of software compatible with Go Direct Ethanol Vapor.

Quick Start: Vernier Graphical Analysis[®] and Bluetooth[®]

1. Charge your sensor for at least 2 hours before first use.
2. Turn on your sensor. The LED will blink red.
3. Launch Graphical Analysis, then click **Sensor Data Collection**.
4. Select your sensor from the list. The sensor ID is located on the sensor label near the bar code. **Note:** If you don't see a list of available sensors, click **WIRELESS**. After selecting your sensor, click **Pair**.
5. Click **DONE**. You are now ready to collect data.

Using other Vernier data-collection apps or want to connect via USB?

Visit www.vernier.com/start-go-direct

Note: This sensor also works with LabQuest 2 and LabQuest 3; it does not work with the original LabQuest.

Charging the Sensor

Connect Go Direct Ethanol Vapor to the included Micro USB Cable and any USB device for two hours.

You can also charge up to eight Go Direct Ethanol Vapor Sensors using our Go Direct Charge Station, sold separately (order code: GDX-CRG). An LED on each Go Direct Ethanol Vapor indicates charging status.

Charging	Blue LED on steady while sensor is connected to the Micro USB Cable or Charging Station.
Fully charged	Blue LED is off when charging is complete.

Powering the Sensor

Turning on the sensor	Press button once. Red LED indicator flashes when unit is on.
Putting the sensor in sleep mode	Press and hold button for more than three seconds to put into sleep mode. Red LED indicator stops flashing when sleeping.

Connecting the Sensor

See the following link for up-to-date connection information:

www.vernier.com/start/gdx-etoh

Connected and charging	Blue and Green LED solid when sensor is connected to Graphical Analysis via USB and unit is charging. (Green LED is obscured by the blue one.)
Connected	Green LED solid when sensor is connected to Graphical Analysis via USB and the unit is fully charged. Green LED flashing when sensor is connected to Graphical Analysis via Bluetooth wireless technology.
Charging via USB, connected via Bluetooth wireless technology	Blue LED is solid and green LED is flashing, but the green flashing LED looks white because it is overwhelmed by the blue.

Identifying the Sensor

When two or more sensors are connected, the sensors can be identified by tapping or clicking Identify in Sensor Information.

Calibrating the Sensor

It may not be necessary to perform a calibration when using Go Direct Ethanol Vapor. If your experiment or application is evaluating the rate of ethanol production, such as determining fermentation rates with yeast, or the relative change in ethanol concentration, then the stored calibration works well.

For quantitative analysis of ethanol samples, it is best to use a two-point calibration to improve accuracy. The two points you choose for your calibration will depend on the expected amount of ethanol in your sample. For best results at low concentrations (0.1–1%), calibrate using 1% and 0.1% ethanol. For best results at high concentrations (1.0–3.0%), calibrate using 3.0% and 1% ethanol. If you are measuring an intermediate range you can also calibrate using 0.2% and 2.0% ethanol.

To calibrate the sensor in Graphical Analysis, complete the following steps.

1. Click or tap the sensor meter to view sensor options.
2. Select Calibrate and follow the applicable prompts on the Calibrate Sensor screen.

Once you have calibrated your Go Direct Ethanol Vapor, the calibration is automatically stored to the sensor and will be used each time you connect to your device. You can always choose to restore factory defaults if you feel the custom calibration is invalid.

To restore factory defaults in Graphical Analysis, complete the following steps.

1. Click or tap the live readouts meter and choose Calibrate.
2. Click or tap Reset Calibration.

A window will appear warning you that you are about to reset the calibration. Choose Reset Calibration.

Making Ethanol Standards for Calibration

To make solutions for the ethanol calibration, you will need to dilute fresh, stock ethanol to the appropriate concentration. Denatured ethanol or non-denatured, grain ethanol may be used. Ethanol that is 70% is more stable than 95%. For the most accurate results, use a volumetric flask to make the standards. Use the following equation to guide you:

$$C_1V_1 = C_2V_2$$

- C_1 is the concentration of the stock solution (typically 70% or 95%).
- V_1 is the amount of stock solution to be added (you will solve for this).
- C_2 is the desired concentration in %.
- V_2 the total final volume.
- $V_2 - V_1 =$ amount of distilled water to add to the stock solution.

It may be necessary to do a serial dilution in order to get the precision you need for your standards. The following table shows an example of a serial dilution to make 0.1% ethanol starting with 70% ethanol.

Original concentration of ethanol	Amount of ethanol to add (mL)	Final volume (ethanol and water) (mL)	Final concentration
70%	14.3	100.0	10%
10%	10.0	100.0	1%
1%	10.0	100.0	0.1%

Specifications

Range (%)	0 to 3%
Accuracy (factory calibration)	±1.5% at 3%
Accuracy (custom calibration) 1–3%	±0.5% at 3%
Accuracy (custom calibration) 0.1–1%	±0.3% at 1%
Response time	90% of full scale in 60 seconds
Type	Metal Oxide
Wireless specification	Bluetooth 4.2
Maximum wireless range	30 m
Battery	650 mA Li-Poly
Battery life (single full charge)	~24 hours
Battery life (long term)	~500 full charge cycles (several years depending on usage)

Care and Maintenance

Battery Information

Go Direct Ethanol Vapor contains a small lithium-ion battery. The system is designed to consume very little power and not put heavy demands on the battery. Although the battery is warranted for one year, the expected battery life should be several years. Replacement batteries are available from Vernier (order code: GDX-BAT-650).

Storage and Maintenance

To store Go Direct Ethanol Vapor for extended periods of time, put the device in sleep mode by holding the button down for at least three seconds. The red LED

will stop flashing to show that the unit is in sleep mode. Over several months, the battery will discharge but will not be damaged. After such storage, charge the device for a few hours, and the unit will be ready to go.

Exposing the battery to temperatures over 35°C (95°F) will reduce its lifespan. If possible, store the device in an area that is not exposed to temperature extremes.

Note: It is recommended that you wash the Nalgene bottle by hand. Most dishwashers will melt plastic bottles.

Water Resistance

Important: Go Direct Ethanol Vapor is neither waterproof, nor is it water resistant and should never be immersed in any liquid.

If any liquid gets into the device, immediately power the unit down (press and hold the power button for more than three seconds). Disconnect the sensor and charging cable, and remove the battery. Allow the device to dry thoroughly before attempting to use the device again. Do not attempt to dry using an external heat source.

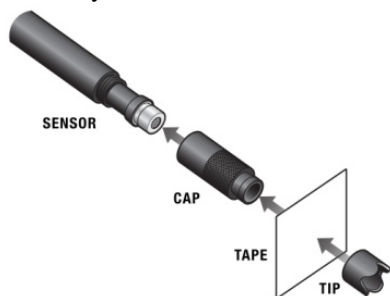
Note: Damage due to exposure to liquids is not covered under warranty.

Making a Cap Assembly

Go Direct Ethanol Vapor comes with caps that have a membrane installed. You do not need to make a cap assembly using teflon tape, but if you choose to do so, follow the steps below.

1. Remove the tip of the cap from the sensor. Discard the tissue paper covering the cap (first use only).
2. Cut a 1.5 centimeter piece of plumber's tape (included).
3. Cover the cap entirely with the tape and inspect the tape for wrinkles or gaps.
4. Place the tip over the tape and verify that it is secure before proceeding.
5. Connect the probe following the steps in the Getting Started section of this user manual.

Note: Remove the tape from the cap at the end of the experiment. For best results, use a new piece of tape each day the sensor is used.



Assembly of sensor, cap, tape, and tip

How the Sensor Works

Go Direct Ethanol Vapor uses a metal oxide semiconductor to detect ethanol concentrations in the air. Ethanol vapor reacts with the metal oxide and is

consumed in a reaction that reduces the resistance of the sensing element. A circuit converts the change in resistance into an appropriate ethanol concentration. The sensing element is very sensitive to ethanol vapor and also responds to a wide range of volatile organic compounds. It also responds to water vapor and carbon dioxide gas but to a lesser degree.

Troubleshooting

- **Very important:** Do not place the sensor into any liquid. The sensor is designed to measure ethanol vapor above an aqueous sample.
- For best results, allow the sensor to warm up for 5 minutes before taking measurements.
- Built-in temperature, pressure, and humidity compensation are not provided. For best results, calibrate before use and use at room temperature.
- The recommended sampling rate is 1 sample per second or slower for this sensor. This allows the sensor to average a set of measurements before reporting a value. Gas must diffuse to the sensing element to detect any changes in concentration. Because diffusion of gases is a slow process, there can be a delay in response time.
- When using a fermentation chamber, use a clamp or an electrode support to adjust the position of the sensor tip by moving the shaft up or down as necessary.
- The 250 mL Nalgene Bottle and #6 stopper that are included can be used as a fermentation chamber. Wrap the stopper around the sensor shaft, rather than sliding it on or off. Place the probe with the stopper into the bottle, and then gently twist the stopper. Verify that the sensor tip is not immersed in fluid. For best results, place the chamber on a stir plate and use a magnetic stir bar to keep the sample moving.
- To collect data in a controlled environment and also use our one of our CO₂ gas sensors, we recommend purchasing the BioChamber 2000 (2 L capacity). This BioChamber has a second, grommited opening so that you can insert two probes at once.

For more troubleshooting and FAQs, see www.vernier.com/til/4303

Repair Information

If you have followed the troubleshooting steps and are still having trouble with your Go Direct Ethanol Vapor, contact Vernier Technical Support at support@vernier.com or call 888-837-6437. Support specialists will work with you to determine if the unit needs to be sent in for repair. At that time, a Return Merchandise Authorization (RMA) number will be issued and instructions will be communicated on how to return the unit for repair.

Accessories/Replacements

Item	Order Code
Micro USB Cable	CB-USB-MICRO
USB-C to Micro USB Cable	CB-USB-C-MICRO
Go Direct 650 mAh Replacement Battery	GDX-BAT-650
Ethanol Cap Assemblies (package of 3)	ETH-CAPS
#6 Stopper	ETH-STOP
Plumber's Tape	ETH-TAPE
250 mL Nalgene Bottle w/Lid	CO2-BTL
BioChamber 2000	BC-2000
Electrode Support	ESUP
Stir Station	STIR

Warranty

Warranty information for this product can be found on the Support tab at www.vernier.com/gdx-etoh

General warranty information can be found at www.vernier.com/warranty

Consumable items, such as Plumber's Tape, are excluded from the warranty.

Disposal

When disposing of this electronic product, do not treat it as household waste. Its disposal is subject to regulations that vary by country and region. This item should be given to an applicable collection point for the recycling of electrical and electronic equipment. By ensuring that this product is disposed of correctly, you help prevent potential negative consequences on human health or on the environment. The recycling of materials will help to conserve natural resources. For more detailed information about recycling this product, contact your local city office or your disposal service.

Battery recycling information is available at www.call2recycle.org

Do not puncture or expose the battery to excessive heat or flame.



The symbol, shown here, indicates that this product must not be disposed of in a standard waste container.

Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) this device may not cause harmful interference and
- (2) this device must accept any interference received, including interference that may cause undesired operation

RF Exposure Warning

The equipment complies with RF exposure limits set forth for an uncontrolled environment. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

IC Statement

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

- (1) this device may not cause interference, and
- (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Industry Canada - Class B This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the interference-causing equipment standard entitled "Digital Apparatus," ICES-003 of Industry Canada. Operation is subject to the following two conditions: (1) this device may not cause interference, and

- (2) this device must accept any interference, including interference that may cause undesired operation of the device.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

RF exposure warning: The equipment complies with RF exposure limits set forth for an uncontrolled environment. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

- (1) l'appareil ne doit pas produire de brouillage, et
- (2) l'appareil doit accepter toute interférence radioélectrique, même si cela résulte à un brouillage susceptible d'en compromettre le fonctionnement.

Cet appareil numérique respecte les limites de bruits radioélectriques applicables aux appareils numériques de Classe B prescrites dans la norme sur le matériel interférant-brouilleur: "Appareils Numériques," NMB-003 édictée par industrie Canada. L'utilisation est soumise aux deux conditions suivantes:

- (1) cet appareil ne peut causer d'interférences, et
- (2) cet appareil doit accepter toutes interférences, y comprises celles susceptibles de provoquer un dysfonctionnement du dispositif.

Afin de réduire les interférences radio potentielles pour les autres utilisateurs, le type d'antenne et son gain doivent être choisis de telle façon que l'équivalent de puissance isotrope émise (e.i.r.p.) n'est pas plus grand que celui permis pour une communication établie.

Avertissement d'exposition RF: L'équipement est conforme aux limites d'exposition aux RF établies pour un environnement non supervisé. L'antenne (s) utilisée pour ce transmetteur ne doit pas être jumelée ou fonctionner en conjonction avec toute autre antenne ou transmetteur.

Note: This product is a sensitive measurement device. For best results, use the cables that were provided. Keep the device away from electromagnetic noise sources, such as microwaves, monitors, electric motors, and appliances.



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