Potassium Ion-Selective Electrode

(Order Code K-BTA)

The Vernier Potassium Ion-Selective Electrode is used to measure the concentration of potassium (K^+) ions in aqueous samples.

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

- Potassium Ion-Selective Electrode, packed in a storage bottle
- 30 mL bottle of High Standard solution with SDS (1000 mg/L K^+)
- 30 mL bottle of Low Standard solution with SDS (10 mg/L K^+)
- Short-Term ISE Soaking Bottle

Compatible Software

See **www.vernier.com/manuals/k-bta** for a list of software compatible with the Potassium Ion-Selective Electrode.

Quick Start

1. Prepare the electrode by soaking it in the High Standard solution for 30 minutes. Refer to the next section for more information.
2. Plug the sensor into the interface (LabQuest 3, LabQuest Mini, etc.).
3. Connect the interface to your device.
   - If using USB, connect to the USB port on your computer.
   - If using Bluetooth® wireless technology, click your interface type and then select your device.
4. Prepare for data collection:
   - Vernier Graphical Analysis®: Launch the app, if necessary, and click Sensor Data Collection.
   - LabQuest® App: Choose New from the File menu.
5. The software will identify the sensor and load a default data-collection setup. You are now ready to collect data.
6. Perform a two-point calibration using the High and Low Standard solutions. Refer to the next section for more information.

Need Additional Information?

Visit the following link:

www.vernier.com/start-lq-sensor

Preparing the Potassium ISE for Use

Note: Follow this two-part process before taking measurements with your ISE.

Part I: Soak the Electrode

Soak the electrode in the High Standard solution (included with the ISE) for approximately 30 minutes. The ISE should not rest on the bottom of the container, and the small white reference contacts near the tip of the electrode should be immersed. Make sure no air bubbles are trapped below the ISE. **Important**: Do not leave the ISE soaking for more than 24 hours. **Important**: If you plan to use the electrode outside the range of the standards provided, you will need to prepare your own standards and use those for soaking.

Note: If the ISE needs to be transported to the field during the soaking process, use the Short-Term ISE Soaking Bottle. Remove the cap from the bottle and fill it 3/4 full with High Standard. Slide the bottle's cap onto the ISE, insert it into the bottle, and tighten.

For long-term storage, greater than 24 hours, make sure the sensor is stored in its storage bottle with the sponge slightly damp.

Part II: Calibrate the ISE

Calibrating the Potassium ISE in Graphical Analysis

1. Connect the sensor according to the Quick Start section.
2. Click or tap the live readouts meter and choose Calibrate.
3. **High Standard Calibration Point**: The Potassium ISE should still be soaking in the High Standard. The ISE should not rest on the bottom of the container, and the 2 small white reference contacts near the tip of the electrode should be immersed. Make sure no air bubbles are trapped below the ISE.
4. Enter the concentration value of the High Standard (e.g., **100** for 100 mg/L) in the edit box and click or tap Keep.
5. **Low Standard Calibration Point**: Remove the ISE from the High Standard, rinse well with distilled water, and gently blot the ISE dry with a paper towel. Place the ISE into the Low Standard. Make sure the ISE is not resting on the bottom of the container, the white reference contacts near the tip of the electrode are immersed, and no air bubbles are trapped below the ISE.
6. Enter the concentration value for the Low Standard (e.g., **1** for 1 mg/L) and click or tap Keep .
7. Click or tap Apply to complete the calibration process.

Calibrating the Potassium ISE with LabQuest App

1. Connect the Potassium ISE to LabQuest. Choose Calibrate from the Sensors menu and select Calibrate Now.
2. **High Standard Calibration Point**: The Potassium ISE should still be soaking in the High Standard. The ISE should not rest on the bottom of the container, and the small white reference contacts near the tip of the electrode should be immersed. Make sure no air bubbles are trapped below the ISE.
3. Enter the concentration of the High Standard (e.g., **100** for 100 mg/L) for Reading 1.
4. After the voltage reading stabilizes (~2 minutes), tap Keep.

5. **Low Standard Calibration Point**: Remove the ISE from the High Standard, rinse well with distilled water, and gently blot the ISE dry with a paper towel. Place the ISE into the Low Standard. Make sure the ISE is not resting on the bottom of the container, the white reference contacts near the tip of the electrode are immersed, and no air bubbles are trapped below the ISE.
6. Enter the concentration of the Low Standard (e.g., **1** for 1 mg/L) for Reading 2.
7. After the voltage reading stabilizes, tap Keep.
8. To save the calibration to the sensor, follow the steps below:
   a. Tap Storage.
   b. Tap Save Calibration to Sensor. Tap OK.
   c. Tap OK to complete the process.

Using the Product

How Can I Have My ISE Read mV Output Instead of mg/L?

The mV output of the electrode can be calculated using the following equation:

-23.5*(-7.2 – ln("Potassium(mg/L)")) – 168.23 = Potassium (mV)

This equation provides the mV output of the electrode, before amplification. If you want post-amplification Volts, the equation is

V = 0.00727*mV + 1.223

Collecting Data

1. Make sure the sensor is properly calibrated. If the meter has a reading of 1.0 mg/L and the sensor is not in a 1.0 mg/L solution, you need to calibrate. After calibration, rinse off the tip of the ISE and blot it dry with a paper towel.
2. Insert the tip of the ISE into the aqueous sample to be tested.
   Important: Make sure the ISE is not resting on the bottom of the container, the white reference contacts near the tip of the electrode are immersed, and no air bubbles are trapped below the ISE. **Note**: Do not completely submerge the sensor. The handle is not waterproof.
3. Hold the ISE still until the reading stabilizes and record the displayed reading.
   Note: With some aqueous samples, especially those at high concentrations, it could take several minutes for the reading of the Potassium ISE to stabilize. If you know the approximate concentrations of your samples, it is best to analyze them from lowest concentration to highest.

Using Your Potassium ISE with Other Vernier Sensors

Some combinations of sensors interfere with each other when placed in the same solution. The degree of interference depends on many factors. For more information, see **www.vernier.com/til/638/**

Using Ionic Strength Adjuster (ISA) Solutions to Improve Accuracy

For optimal results at low concentrations of ions, a standard method for making measurements with the Potassium Ion-Selective Electrode (ISE) is to add ionic strength adjuster (ISA) solutions to each of your standard solutions and samples.

Adding an ISA ensures that the total ion activity in each solution being measured is nearly equal, regardless of the specific ion concentration. This is especially important when measuring very low concentrations of specific ions. The ISA contains no ions common to the Potassium Ion-Selective Electrode itself.
Note: The additions of ISA to samples or standards does not need to have a high level of accuracy— combining the ISA solution and sample solution counting drops using a disposable Beral pipet works fine. We recommend using 1M NaCl solution as the ISA solution for the Potassium ISE.

Videos

View videos related to this product at **www.vernier.com/k-bta**

Specifications

Range	1 to 39,000 mg/L
Reproducibility (precision)	±11% of full scale (calibrated 10 to 1000 mg/L)
Interfering ions	Rb^{2+}, Cs^{2+}, NH_4^+, Ca^{2+}, Mg^{2+}, Li^+
pH range	2–12
Temperature range	0 to 40°C (no temperature compensation)
Electrode slope	56 ± 4 mV/decade at 25°C
Calibration voltages, typical	2.7 V (1000 ppm), 1.9 V (10 ppm)
Electrode resistance	1 to 10 MΩ
Minimum sample size	Must be submerged 2.8 cm (1.1 in)
Electrode length	155 mm
Body diameter	12 mm
Cap diameter	16 mm
Cable length	100 cm

Care and Maintenance

Storing an Ion-Selective Electrode

Proper care and storage are important for optimal longevity of your Potassium ISE

- Long-term storage of the ISE (longer than 24 hours): Moisten the sponge in the bottom of the long-term storage bottle with distilled water. When you finish using the ISE, rinse it off with distilled water and blot it dry with a tissue. Loosen the lid of the bottle and insert the ISE. **Note**: The tip of the ISE should NOT be touching the sponge. Check to be sure the reference mark is inside, rather than outside the bottle or under the grommet. Tighten the lid. This keeps the electrode in a humid environment, which prevents the reference junctions from completely drying out.
- Short-term, wet storage (less than 24 hours): Fill the short-term soaking bottle 3/4 full with High Standard. Loosen the cap, insert the electrode into the bottle, and tighten.

Maintaining and Replacing the ISE Standard Calibration Solutions

Having accurate standard solutions is essential for performing good calibrations. The two standard solutions that were included with your ISE can last a long time if you take care not to contaminate them. At some point, you will need to replenish your supply of standard solutions.

Vernier sells replacement standards in 500 mL bottles. Order codes are

- K-LST: Potassium Low Standard: 10 mg/L
- K-HST: Potassium High Standard, 1000 mg/L

To prepare your own standard solutions, use the information in the table below. **Note**: Use glassware designed for accurate volume measurements, such as volumetric flasks or graduated cylinders. All glassware must be very clean.

Standard Solution	Concentration (mg/L or ppm)	Preparation Method using High Quality Distilled Water
Potassium (K^+) High Standard	1000 mg/L K^+	1.907 g KCl / 1 L solution
Potassium (K^+) Low Standard	10 mg/L K^+	Dilute the High Standard by a factor of 100 (from 1000 mg/L to 10 mg/L)

Do not wrap the cable tightly around the sensor for storage. Repeatedly doing so can irreparably damage the wires and is not covered under warranty.

How the Sensor Works

The Vernier Potassium Ion-Selective Electrode (ISE) is a membrane-based electrode that measures a specific ion (K^+) in an aqueous solution. When the membrane of the electrode is in contact with a solution containing the specific ion, a voltage, dependent on the level of that ion in solution, develops at the membrane. The ISE is a combination style electrode. The voltage develops in relation to an internal Ag/AgCl reference electrode. The ISE measures for the specific ion concentration directly. Samples need to be aqueous to avoid contaminating or dissolving the membrane. The Vernier Potassium Ion-Selective Electrode has a solid polymer membrane. The membrane is a porous plastic disk, permeable to the ion exchanger, but impermeable to water. It allows the sensing cell to contact the sample solution and separates the internal filling solution from the sample. The membrane module has a shelf life of 12–24 months and is replaceable.

The voltage developed between the sensing and reference electrodes is a measure of the concentration of the reactive ion being measured. As the concentration of the ion reacting at the sensing electrode varies, so does the voltage measured between the two electrodes.

As described in the Nernst equation, ISE response is a linear equation:

$$E = E_o + m(\ln a)$$

where E is the measured voltage, Eo is the standard potential for the combination of the two half cells, m is the slope, ln is natural log, and a is the activity of the measured ion species.

Assuming the ionic strength is fairly constant, the Nernst equation may be rewritten to describe the electrode response to the concentration, C, of the measured ionic species:

$$E = E_o + m(\ln C)$$

Troubleshooting

For troubleshooting and FAQs, see **www.vernier.com/til/3115**

Repair Information

If you have watched the related product video(s), followed the troubleshooting steps, and are still having trouble with your Potassium Ion-Selective Electrode, 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

Potassium ISE Replacement Membrane Modules

The Potassium ISE has a PVC membrane module with a limited life expectancy. The module is warranted to be free from defects for a period of twelve (12) months from the date of purchase. It is possible, however, that you may get somewhat longer use than the warranty period. If you notice a reduced response (e.g., distinctly different voltages or voltage ranges during calibration), it is probably time to replace the membrane module. **Important**: Do not order membrane modules far in advance of the time you will be using them; the process of degradation takes place even when they are stored on the shelf.

Additional Vernier Ion-Selective Electrodes

Vernier sells Ion-Selective Electrodes that measure the concentration of ammonium (NH_4^+), calcium (Ca^{2+}), chloride (Cl^-), and nitrate (NO_3^-) ions in aqueous solutions:

Item	Order Code
Ammonium Ion-Selective Electrode	NH4-BTA
Calcium Ion-Selective Electrode	CA-BTA
Chloride Ion-Selective Electrode	CL-BTA
Nitrate Ion-Selective Electrode	NO3-BTA
Electrode Storage Bottles, pkg of 5	BTL-ES
Standard High Potassium ISE Solution	K-HST
Standard Low Potassium ISE Solution	K-LST
Potassium Replacement Module	K-MOD

Warranty

Warranty information for this product can be found on the Support tab at **www.vernier.com/k-bta**

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

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

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