High Voltage Electrostatics Kit

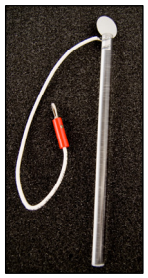
(Order Code HVEK-CRG)

The High Voltage Electrostatics Kits is an accessory for the Vernier Charge Sensor. Use it with a Faraday Pail, which is part of the Electrostatics Kit (order code ESK-CRG) and the Charge Sensor (order code CRG-BTA) to investigate the charge on a sphere. The kit includes an electrostatics voltage source and two conducting spheres. The current output of the High Voltage Source is extremely low, making it safe for electrostatic studies. Experiments include

- Investigate the distribution of charge on a sphere
- Transfer of charge on contact between two spheres
- Charging by Induction

What is Included with the High Voltage Electrostatics Kit?

- Electrostatic High Voltage Source (output 750, 1500, 3000, 6000 VDC)
- Ground Wire
- Voltage Terminal
- Proof Plane
- Conducting Spheres (2)
- DC Power Supply



Voltage Terminal

Ground Wire

Using the Voltage Source

To use the High Voltage Source, ground the ground port of the High Voltage Source by connecting the banana plug on the Ground Wire to the source and connect the other end to a ground of your experiment such as the Ground Plane that is a part of the Electrostatics Kit. Plug the Voltage Terminal into the desired port on the High Voltage Source, such as the one marked 3000 V.

Connect the DC power supply to the High Voltage Source, and plug the power supply into an outlet. Turn on the High Voltage Source.

To transfer a charge to an object, touch the paddle end of the Voltage Terminal to the object. The High Voltage Source is only capable of delivering very small currents, and is therefore safe for classroom use.

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.

Performing Experiments with this kit, a Faraday Pail and the Vernier Charge Sensor

To use this kit, you need to be able to measure the charge on the Conducting Spheres. The best way to accomplish this is by using a Vernier Charge Sensor and a Faraday Pail. When the Charge Sensor is attached to the Pail, the Pail can be used to qualitatively and quantitatively measure charge on objects. Follow these instructions to set up the Faraday Pail and Charge Sensor.

1. Place the plastic disk that holds the Faraday Pail and cage on the Ground Plane.
2. Place the Faraday Pail and the Cage on the disk.
3. Connect the black lead from the Charge Sensor to the Ground Plane.
4. Connect the red lead from the Charge Sensor to the Faraday Pail.
5. Connect the Charge Sensor to an interface, such as LabQuest® 2, original LabQuest, LabPro®, etc.
6. Connect a Grounding Wire between the Cage and the Ground Plane.
7. Attach the grounding strap to your wrist.
8. Ground out the system and zero the sensor by pressing and holding the Reset button on the sensor. You are now ready to collect data.
9. Now insert an object into the center of the Faraday Pail. While the object is in the Pail, the Charge Sensor will display the charge.

Quantitative measurement of electrostatic charge can be challenging. Many factors enter into the buildup of electrostatic charge and your ability to measure the charge. The Charge Sensor is a very sensitive device and it can detect charge on objects where you may not expect to see it, such as your body. Your success is also a function of atmospheric humidity. Electrostatic studies are difficult in humid environments because objects discharge quickly through multiple paths.

The Charge Sensor contains a range switch. You need to select a range that is appropriate for the experiment and environmental conditions. For example if you are

measuring a small electrostatic charge, the smallest range setting on the sensor may be appropriate; however, if the sensor is reading its maximum value, you may want to switch to a higher range.

Note: As you collect data for different situations, you will need to zero the Charge Sensor since it is extremely easy to pick up stray charges. If the sensor reading drifts, press the Reset button on the sensor between data-collection runs.

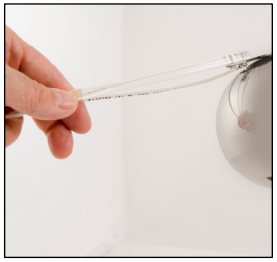
Sample Experiments

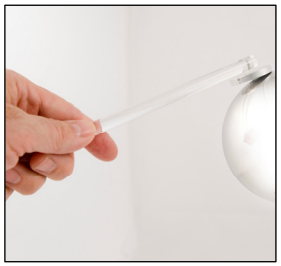
A variety of experiments can be performed with this kit and a Charge Sensor. Below you will find three detailed examples. Try them out to learn more about the equipment.

Amount of charge

Use the sensor to see the difference in the amount of charge transferred using differing voltage sources. You will need a Faraday Pail, Cage, Ground Plane, and Vernier Charge Sensor.

1. Attach the Charge Sensor black lead to the Ground Plane.
2. Attach the Charge Sensor red lead to the Faraday Pail.
3. Connect a Grounding Wire between the Cage and the Ground Plane.
4. Attach the grounding strap to your wrist.
5. Ground the system and discharge the sensor by pressing and holding the Reset button on the sensor.
6. Set up the High Voltage Source by connecting the Voltage Terminal to the 750 V terminal. Ground the other terminal to the Ground Plane.
7. Use the Ground Wire from the Ground Plane to touch a sphere and ground the sphere. Touch the Voltage Terminal to the sphere.
8. Touch the Proof Plane to the sphere and insert it into the Pail without touching the Pail. What does the Charge Sensor read? [Should be positive.]
9. To remove any charge from the Proof Plane, dab all parts of Proof Plane with a damp cotton cloth.
10. Ground the sphere.
11. Connect the Voltage Terminal to the 1500 V terminal and touch the sphere.
12. Touch the Proof Plane to the sphere and insert it into the Pail without touching the Pail. What does the Charge Sensor read? [Should be positive.] How does the reading compare to the first measurement? [Should be about twice that seen in Step 7.]
13. Repeat with the 3000 V source.
14. Explain your results. [Higher voltage sources produced a proportional increase in the charge on the sphere.]





Distribution of charge

Use the equipment to see the distribution of charge on a sphere. You will need a Faraday Pail, Cage, Ground Plane, and Vernier Charge Sensor.

1. Attach the Charge Sensor black lead to the Ground Plane.
2. Attach the Charge Sensor red lead to the Faraday Pail.
3. Connect a Grounding Wire between the Cage and the Ground Plane.
4. Attach the grounding strap to your wrist.
5. Ground the system and discharge the sensor by pressing and holding the Reset button on the sensor.
6. Set up the High Voltage Source by connecting the Voltage Terminal to the 3000 V terminal. Ground the other terminal to the Ground Plane.
7. Use the Ground Wire from the Ground Plane to touch a sphere, discharging it. Touch the Voltage Terminal to the sphere, charging it.
8. Touch the Proof Plane to the sphere and insert it into the Pail without touching the Pail. What does the Charge Sensor read? [Should be a positive reading.]
9. To remove any charge from the Proof Plane, dab all parts of the Proof Plane with a damp cotton cloth.
10. Touch the Proof Plane to another part of the sphere and insert it into the Pail without touching the Pail. What does the Charge Sensor read? How does the reading compare to the first measurement? [Should be the same as above.]
11. Repeat a third time.
12. Explain your results. [The charge distribution on a sphere is uniform.]

Distribution of charge to two spheres

Use the equipment to see the distribution of charge as charge is shared with a second sphere. You will need a Faraday Pail, Cage, Ground Plane, and Vernier Charge Sensor.

1. Attach the Charge Sensor black lead to the Ground Plane.
2. Attach the Charge Sensor red lead to the Faraday Pail.
3. Connect a Grounding Wire between the Cage and the Ground Plane.
4. Attach the grounding strap to your wrist.
5. Ground the system and discharge the sensor by pressing and holding the Reset button on the sensor.
6. Set up the High Voltage Source by connecting the Voltage Terminal to the 3000 V terminal. Ground the other terminal to the Ground Plane.
7. Use the Ground Wire from the Ground Plane to ground both spheres, discharging them.
8. Touch the Voltage Terminal to a sphere, charging it.
9. Touch the Proof Plane to the sphere and insert it into the Pail without touching the Pail. What does the Charge Sensor read? [Should be positive.]
10. To remove any charge from the Proof Plane, dab all parts of the Proof Plane with a damp cotton cloth.

11. Touch the two spheres together which establishes an electrical connection between the spheres briefly and then move them apart.
12. Use the Proof Plane to measure the charge on each sphere.
13. Explain your results. [Each sphere had about half the charge measured on the one sphere by itself.]

Charging by Induction

Use the equipment to detect charge generated by induction. You will need a Faraday Pail, Cage, Ground Plane, and Vernier Charge Sensor.

1. Attach the Charge Sensor black lead to the Ground Plane.
2. Attach the Charge Sensor red lead to the Faraday Pail.
3. Connect a Grounding Wire between the Cage and the Ground Plane.
4. Attach the grounding strap to your wrist.
5. Ground the system and discharge the sensor by pressing and holding the Reset button on the sensor.
6. Set up the High Voltage Source by connecting the test terminal to the 3000 V terminal. Ground the other terminal to the Ground Plane.
7. Use the Ground Wire from the Ground Plane to ground both spheres, discharging them.
8. Touch the Voltage Terminal to a sphere, charging it.
9. Bring the second sphere near the first.
10. Ground the second sphere by touching it with your finger and then remove your finger.
11. Use the Proof Plane to measure the charge on each sphere.
12. Explain your results. [When the second sphere is grounded, positive charge on that sphere attracts negative charge from ground to the second sphere. When the ground is removed, a net negative charge is left on the second sphere.]

Specifications

Wall mount power supply output: 15 VDC, 1000 mA, UL listed

Other Products for Use with this Kit

Vernier Charge Sensor (order code CRG-BTA)

The Charge Sensor is used as an electronic electroscope. Unlike a traditional electroscope, the Charge Sensor can make quantitative measurements. Numerical measurements improve many electrostatics experiments such as charging by induction, charging by friction, and charging by contact. The sensor can also be used to measure charge polarity.

Electrostatic High-Voltage Genecon (order code HVEK-GEN)

The Electrostatic High-Voltage Genecon provides an alternate way to create safe, consistent, and reliable positive or negative electrostatic charges, even in relatively high humidity. It can be used with an electroscope, charge sensor, or any device meant to measure static electricity.

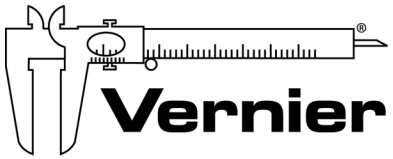
Electrostatics Kit (Order Code ESK-CRG)

The Electrostatics Kit is an accessory for the Vernier Charge Sensor. This kit allows students to perform a range of experiments in electrostatics including the use of Faraday's Ice Pail, quantitative and qualitative measurement of charge, charging by friction, charging by contact and charging by induction. The kit includes

- Faraday Pail and cage
- Grounding plane
- Grounding wire and wrist strap
- Charge producers and proof plane
- Wool, vinyl, nylon rod, PVC rod
- Cotton cloth

Warranty

Vernier warrants this product to be free from defects in materials and workmanship for a period of five years from the date of shipment to the customer. This warranty does not cover damage to the product caused by abuse or improper use.



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