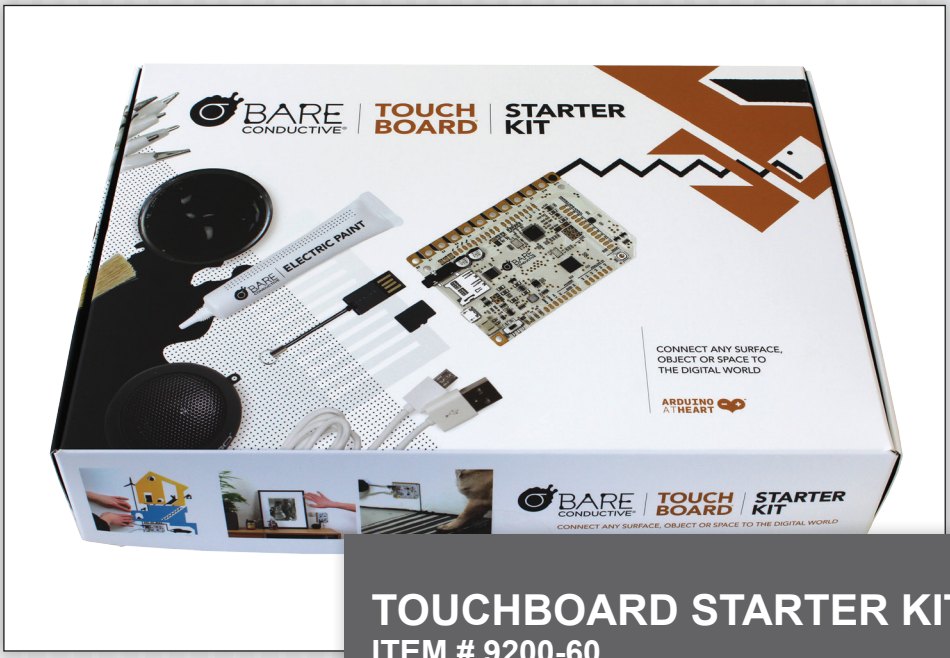
TEACHERS GUIDE



TOUCHBOARD STARTER KIT

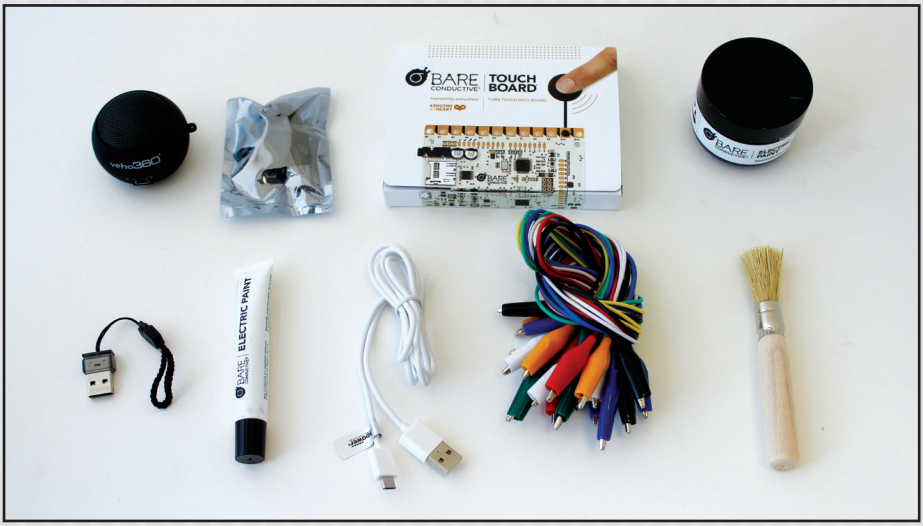
ITEM # 9200-60

ENERGY - INTERACTIVE TOUCH CIRCUITS, SENSORS, AND MICROCONTROLLERS

Bare Conductive has developed an innovative electric paint and touch microcontroller system that can be used by children and adults of all ages. They support their products with numerous FREE video and visual tutorials to help beginners get started. More advanced users can integrate the touch board system with many other electronic systems, including arduinos, to upload their own written code.

What's in the Box?

- 1x Touch Board
- 1x 10ml tube of Electric Paint
- 1x 50ml jar of Electric Paint
- 1x Guidebook
- 1 x MicroSD Card
- 1 x MicroSD Card Reader
- 1 x Micro USB Cable
- 1 x Mini Speaker
- 1 x House Stencil
- 12 x Alligator Clips (colors vary)
- 12 x Sticky Tabs
- 1 x Stencil Brush
- 2 x Paper Cutouts
- 3 x Velcro Stickers



Additional Matrials

- poster board (or other surface to paint your sensors on)
- computer
- *Kit includes all necessary materials, but can be used with a variety of othes!*

Goals & Objectives

See page 8 for Next Generation Science Standards

INTRODUCTION

The Bare Conductive Touch Board Starter Kit provides the necessary materials to turn any surface, object, or space into a touch sensor!

The electric paint is used to create touch sensors that activate sounds what the sensors are connected to the touch board and speaker. The touch board includes a micro SD card that you can load with any MP3 file that you want to connect to your sensor.

The starter kit includes stencils and many beginning ideas to get you started. You are not limited to graphical sensors, you can use the paint on many surfaces and objects to create interactive projects with sound and/or light.

Students can investigate the properties of circuits by making their painted sensors different thicknesses, shapes, and sizes. They can use the included alligator clips to quickly connect and remove the touch board from their project sensors or use the electric paint pen to draw wires and use to adhere the project to the touch board.

Circuits are not just for science class anymore. The Bare Conductive Touch Board Starter kit has endless uses in visual art classes.

VOCABULARY

- arduinos
- Circuits
- computer coding
- conductive ink
- conductors
- crystal structures
- energy conversions and transfer
- entrepreneurial products
- insulators
- microcontrollers
- scientific method
- SD memory cards
- Sensors
- technological design
- USBs

DISCUSSION

1. Before you begin, brainstorm with your students what factors they think will affect the ability of a circuit to conduct well. Ask them how they know or why they believe the variable they identify will affect the voltage. Encourage them to develop hypotheses, with scientific reasons to support their hypotheses, and predictions to design an experiment. After experimentation, ask students to describe applications for which the conductive paint would be easier to use.

2. Compare the bare conductive electric paint that uses graphite with another conductive ink that uses silver instead. How is the crystal structure if graphite different from silvers? Look up images of the structures and compare them? Silver has delocalized electrons throughout the entire metal that allows it to be a good conductor of electricity and graphite has delocalized electrons in sheets. Research how silver is used in some conductive ink applications. Is it a superior conductive ink? Be specific using examples of applications and properties.

3. How does the shape of your painted sensor affect the time it takes to activate the MP3 sound file or LED? Why does bare conductive not recommend sensors larger than one meter to be created using the paint?

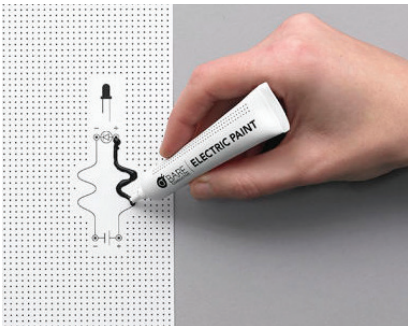
4. How could the sensors be used to help people? Education uses? People with disabilities? Artistic projects? Could you make musical instruments? Toys? Books? Pets?

5. What tutorials are provided by the Bare Conductive online community? Do these inspire you?
   Critics have stated that the Bare Conductive products are frivolous without clear objectives and goals. Do you agree? Why? What modern technologies currently use touch as a method of conducting and controlling circuits? How has technology changed over time? In what ways does it influence society and scientific progress? How have others new materials changed your daily life?

6. How are conductive inks changing the world? What are the limitations of the paint? How might these limitations be improved? In what ways might conductive paints advance technological change? Brainstorm specific lines of inquiry, products, and/or applications

ACTIVITIES

1 Paint a circuit with long lines and short lines with identical thickness and attach to an LED and power source. Use the included circuit template to guide your class.



Does the LED light? Students can use the galvanometer or voltage probe to determine the voltage output of their battery before it is attached to the circuit and after it has passed through the circuit they draw by replacing the LED with the sensor.

- How has the voltage changed?

2 Repeat with a circuit that has thick short lines, and thick long lines and attach to an LED.
Check the resistance of the painted “wires” again.

- How has it changed?

3 Compare these experiments with copper wires that are also long/short and thin with copper wires that are thicker.

- Do the copper wires or conductive paint work better?
- Can they make a painted wire that has an equivalent voltage output in the circuit?

4 Connect several LED in series and parallel circuits with copper wire and painted wires.

- How do they compare?

5 How will other variables (for example, temperature) affect the ability of the painted wires to conduct well?
Challenge your students to design an experiment to test their variables. Be sure to approve their design before they test it.

6 The paint has powdered graphite (pure carbon) in it. Their pencils are also made of graphite.

- Does the graphite in their pencil complete a circuit?
- Why is graphite on its own not a good wire? (brittle).

More advanced classes might explore the properties of graphite structure that allows it to conduct electricity although it is not a metal.

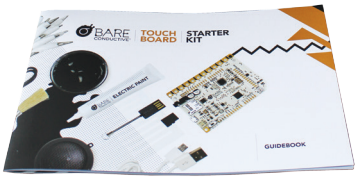
7 Physics students should compare the published resistance of the paint pen, Surface resistivity approx 55 ohms/square at 50 microns layer thickness, to their own results.

- What might cause any discrepancies?
- Can they improve their circuit?

ACTIVITIES

8 The flashing card activity pack (*http://www.bareconductive.com/make/how-to-run-a-workshop-with-the-flashing-card-activity-pack/*) provides instructions for your students to create circuit art that lights up! They can take their card home to share.

9 Use the graphics and instructions provided in the Bare Conductive guidebook to design the interactive house.

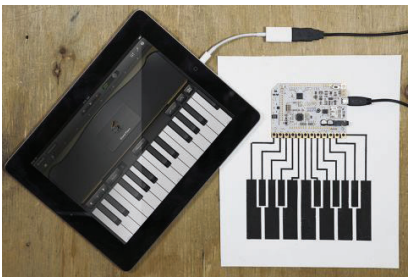


10 Turn any object into a touch sensor using the electic paint and connect it to the touchboard with your original MP3 files.

11 Create touch graphic sensors that are shaped differently and compare how well they work with the conductive paint.

Have some that are filled in with the paint and some that are donut shaped, or a hashtag shape.
Make some that are large and some that are small.
Use a stop watch to measure if there is a time delay between touching the sensor and when it plays the sound file.

12 Make a musical instrument on cardboard with MPS files. Drums, guitars, pianos, drinking glasses with water.



13 Make an interactive storybook or a toy that will teach young children the alphabet or how to spell their name.

14 More advanced users and older students should identify the functions of the touch board pins.

Investigate and design a product which allows you to upload code from wireless shields or motor shields.

Bare Conductive provides extensive support and tutorials on how to extend the capabilities of the touchboard, including how to change touch events into physical movements in your project. You can create a painted light switch, or touch sensors that turn on any electrical appliance.

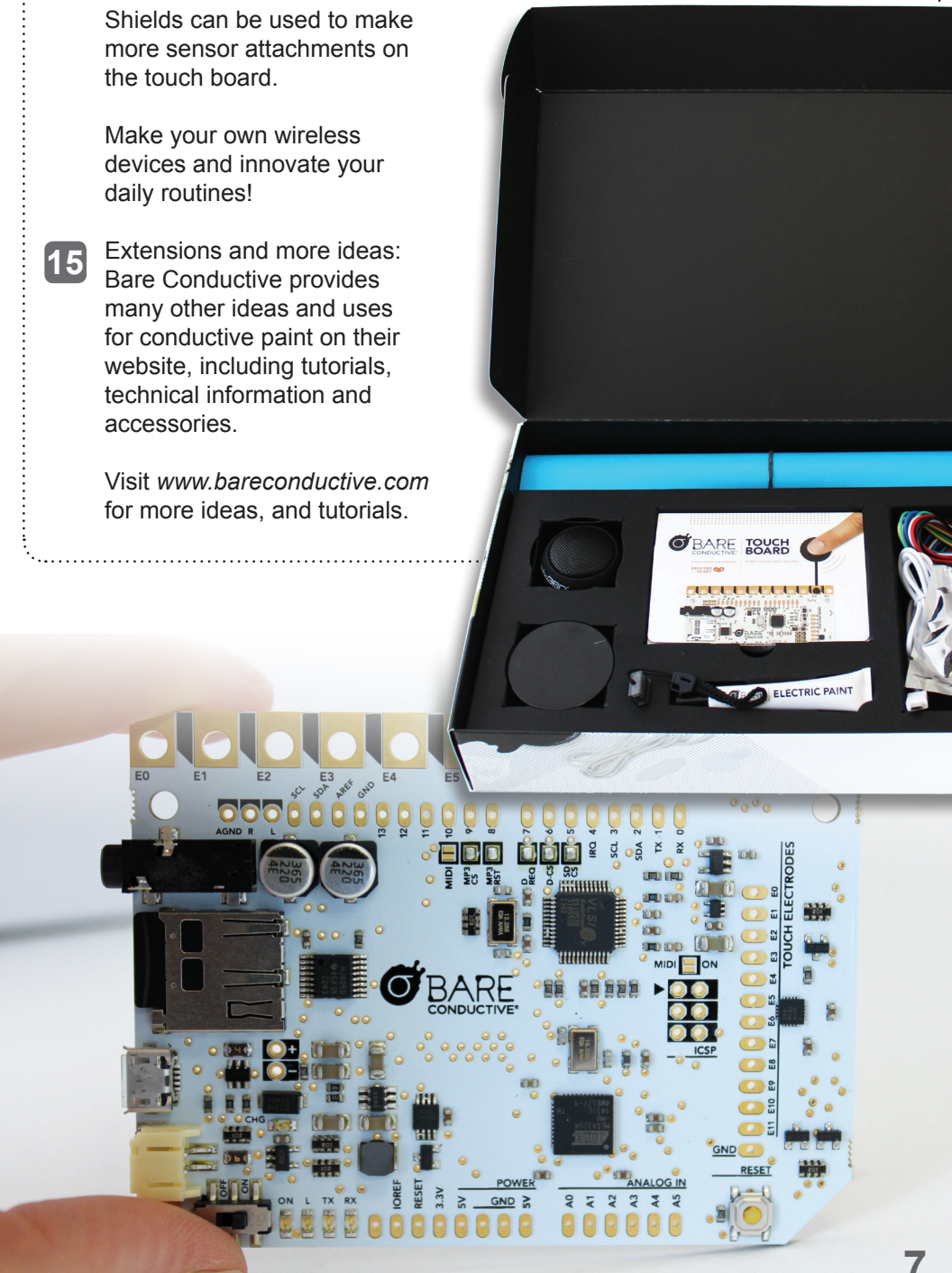
ACTIVITIES

Shields can be used to make more sensor attachments on the touch board.

Make your own wireless devices and innovate your daily routines!

15 Extensions and more ideas: Bare Conductive provides many other ideas and uses for conductive paint on their website, including tutorials, technical information and accessories.

Visit *www.bareconductive.com* for more ideas, and tutorials.



Next Generation Science Standards

Students who demonstrate understanding can:

3-PS2-3.
Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.

4-PS3-2.
Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

4-PS3-4.
Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

HS-PS3-3.
Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

Standards Key

K = Kindergarten
3 = 3rd Grade
(numbered by grade)
MS = Middle School
HS = High School
PS = Physical Science