

SNAP CIRCUITS

ELENCO

DISCOVER CODING



Making Coding a Snap®



Hands-On Electronics Learning
Easy App-Driven Projects
Developing STEM Skills in Coding

Requires four (4) "AA" batteries. Not included.
Ages 8 to 108



Project 17

FEATURING
THE SNAP CIRCUITS® CODING MODULE
SC CONTROLLER

USE THE BLUETOOTH® POWERED MODULE
AND DOWNLOADABLE **SNAP CIRCUITS® APP**
FOR ENDLESS CODING FUN!



ELENCO
Learn by doing.™

753060

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WARNING: FOR ALL PROJECTS WITH A ⚠ SYMBOL

Moving parts do not touch the motor or fan during operation. Do not lean over the motor. Do not launch the fan at people, animals, or objects. Eye protection is recommended.



WARNING: SHOCK HAZARD - Never connect Snap Circuits® to the electrical outlets in your home in any way!



WARNING: CHOKING HAZARD - Small parts. Not for children under 3 years.

Conforms to all applicable U.S. government requirements and CAN ICES-3 (B)/NMB-3 (B).

Basic Troubleshooting

1. Most circuit problems are due to incorrect assembly, always double-check that your circuit exactly matches the drawing for it.
2. Be sure that parts with positive/negative markings are positioned as per the drawing.
3. Be sure that all connections are securely snapped.
4. Try replacing the batteries.

Elenco® is not responsible for parts damaged due to incorrect wiring.

Note: If you suspect you have damaged parts, you can follow the Advanced Troubleshooting procedure on page 5 to determine which ones need replacing.

WARNING: Always check your wiring before turning on a circuit. Never leave a circuit unattended while the batteries are installed. Never connect additional batteries or any other power sources to your circuits. Discard any cracked or broken parts.

Adult Supervision:

Because children's abilities vary so much, even with age groups, adults should exercise discretion as to which experiments are suitable and safe (the instructions should enable supervising adults to establish the experiment's suitability for the

child). Make sure your child reads and follows all of the relevant instructions and safety procedures, and keeps them at hand for reference.

This product is intended for use by adults and children who have attained sufficient maturity to read and follow directions and warnings.

Never modify your parts, as doing so may disable important safety features in them, and could put your child at risk of injury.

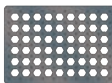


Batteries:

- Use only 1.5V AA type, alkaline batteries (not included).
- Insert batteries with correct polarity.
- Non-rechargeable batteries should not be recharged. Rechargeable batteries should only be charged under adult supervision, and should not be recharged while in the product.
- Do not mix old and new batteries.
- Do not connect batteries or battery holders in parallel.
- Do not mix alkaline, standard (carbon-zinc), or rechargeable (nickel-cadmium) batteries.
- Remove batteries when they are used up.
- Do not short circuit the battery terminals.
- Never throw batteries in a fire or attempt to open its outer casing.
- Batteries are harmful if swallowed, so keep away from small children.
- When installing a battery, be sure the spring is compressed straight back, and not bent up, down, or to one side.
- Battery installation should be supervised by an adult.

Parts List (Colors and styles may vary) Symbols and Numbers

Important: If any parts are missing or damaged, **DO NOT RETURN TO RETAILER.** Call toll-free (800) 533-2441 or e-mail us at: help@elenco.com.
Customer Service: 150 Carpenter Ave., Wheeling, IL 60090 U.S.A. • You may order additional / replacement parts at www.elenco.com/replacement-parts

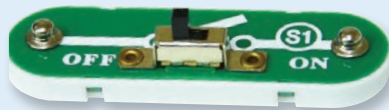
Qty.	ID	Name	Symbol	Part #	Qty.	ID	Name	Symbol	Part #
□ 3	(1)	1- Snap Wire		6SC01	□ 1		Jumper Wire, Red		6SCJ2
□ 6	(2)	2- Snap Wire		6SC02	□ 1		Jumper Wire, Blue		6SCJ4
□ 3	(3)	3- Snap Wire		6SC03	□ 1	(M1)	Motor		6SCM1
□ 1	(4)	4- Snap Wire		6SC04	□ 1		Fan		6SCM1F
□ 1	(5)	5- Snap Wire		6SC05	□ 1	(Q2)	NPN Transistor		6SCQ2
□ 1	(6)	6- Snap Wire		6SC06	□ 1	(R1)	100Ω Resistor		6SCR1
□ 2	(B1)	Battery Holder - uses two (2) 1.5V type "AA" (not Included)		6SCB1	□ 1	(R2)	1kΩ Resistor		6SCR2
□ 1		Base Grid (11.0" x 7.7") Black Tint		6SCBGBK	□ 1	(R4)	10kΩ Resistor		6SCR4
□ 2	(D2)	Green LED		6SCD2	□ 1	(S1)	Slide Switch		6SCS1
□ 1	(D3)	Diode		6SCD3	□ 1	(SP2)	Speaker		6SCSP2
□ 1	(D9)	Blue LED		6SCD9	□ 1	(U2)	Alarm IC		6SCU2
□ 2	(D10)	Red/Yellow LED		6SCD10	□ 1	(U3)	Space War IC		6SCU3
□ 1		Jumper Wire, Black		6SCJ1	□ 1	(U33)	SC Controller		6SCU33

How to Use Snap Circuits®

Snap Circuits® uses building blocks with snaps to build the different electrical and electronic circuits in the projects. Each block has a function: there are switch blocks, light blocks, battery blocks, different length wire blocks, etc. These blocks are different colors and have numbers and letters on them so that you can easily identify them. The blocks you will be using are shown as color symbols, allowing you to easily snap them together to form a circuit.

For Example:

This is the slide switch, it is green and has the marking (S1) on it. The part symbols in this booklet may not exactly match the appearance of the actual parts, but will clearly identify them.



This is a wire block which is blue and comes in different wire lengths.

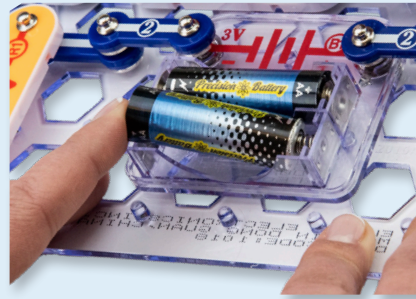
This one has the number (2), (3), (4), (5), or (6) on it depending on the length of the wire connection required.



There is also a 1-snap wire that is used as a spacer or for interconnection between different layers.



You need a power source to build each circuit. This is labeled (B1) and requires two (2) 1.5V "AA" batteries (not included).



When installing a battery, be sure the spring is compressed straight back, and not bent up, down, or to one side. Battery installation should be supervised by an adult.



A large black tinted plastic base grid is included with this kit to help keep the circuit blocks properly spaced. You will see evenly spaced posts that the different blocks snap into. The base has rows labeled A-G and columns labeled 1-10.

Next to each part in every circuit drawing is a small number in black. This tells you which

level the component is placed at. Place all parts on level 1 first, then all of the parts on level 2, then all of the parts on level 3, etc.

Some circuits use the jumper wires to make unusual connections. Just clip them to the metal snaps or as indicated.



Usually when the motor (M1) is used, the fan will usually be placed on it. On top of the motor shaft is a black plastic piece (the motor top) with three little tabs. Lay the fan on the black piece so the slots in its bottom "fall into place" around the three tabs in the motor top. If not placed properly, the fan will fall off when the motor starts to spin.



Note: While building the projects, be careful not to accidentally make a direct connection across the battery holder (a "short circuit"), as this may damage and/or quickly drain the batteries.

DOs and DON'Ts of Building Circuits

After building the circuits given in this booklet, you may wish to experiment on your own. Use the projects in this booklet as a guide, as many important design concepts are introduced throughout them. Every circuit will include a power source (the batteries), a resistance (which might be a resistor, LED, motor, integrated circuit, etc.), and wiring paths between them and back. **You must be careful not to create "short circuits"** (very low-resistance paths across the batteries, see examples below) as this will damage components and/or quickly drain your batteries. Only connect the ICs using configurations given in the projects, incorrectly doing so may damage them. **Elenco® is not responsible for parts damaged due to incorrect wiring.**

Here are some important guidelines:

ALWAYS USE EYE PROTECTION WHEN EXPERIMENTING ON YOUR OWN.

ALWAYS include at least one component that will limit the current through a circuit, such as a lamp, motor, IC, or an LED (which has an internal protection resistor).

ALWAYS use switches in conjunction with other components that will limit the current through them. Failure to do so will create a short circuit and/or damage those parts.

ALWAYS disconnect your batteries immediately and check your wiring if something appears to be getting hot.

ALWAYS check your wiring before turning on a circuit.

NEVER connect to an electrical outlet in your home in any way.

NEVER leave a circuit unattended when it is turned on.

For all of the projects given in this book, the parts may be arranged in different ways without changing the circuit. For example, the order of parts connected in series or in parallel does not matter — what matters is how combinations of these sub-circuits are arranged together.



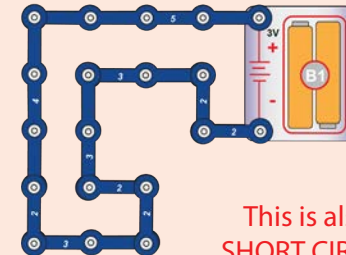
Warning to Snap Circuits® Owners: Do not connect additional voltage sources from other sets, or you may damage your parts. Contact ELENCO® if you have questions or need guidance.

Examples of SHORT CIRCUITS - NEVER DO THESE!!!

Placing a 3-snap wire directly across the batteries is a SHORT CIRCUIT.



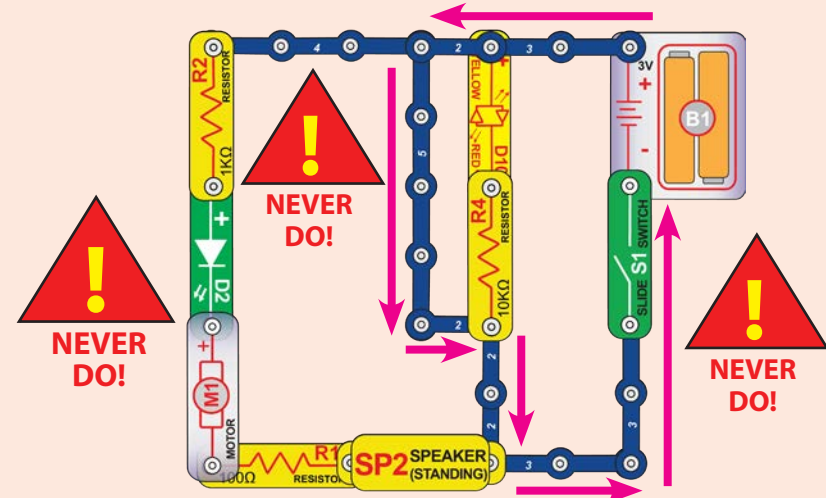
NEVER DO!



NEVER DO!

This is also a SHORT CIRCUIT.

When the slide switch (S1) is turned on, this large circuit has a SHORT CIRCUIT path (as shown by the arrows). The short circuit prevents any other portions of the circuit from ever working.



You are encouraged to tell us about new circuits and structures you create. If they are unique, we will post them with your name and state on our website at: elenco.com/showcase

Send your suggestions (with photos) to ELENCO®: info@elenco.com

ELENCO® provides a circuit designer so that you can make your own Snap Circuits® drawings. This Microsoft® Word document can be downloaded from: www.elenco.com/for-makers.



WARNING: SHOCK HAZARD - Never connect Snap Circuits® to the electrical outlets in your home in any way!

Advanced Troubleshooting (Adult supervision recommended)

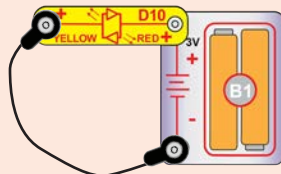
Elenco® is not responsible for parts damaged due to incorrect wiring.

If you suspect you have damaged parts, you can follow this procedure to systematically determine which ones need replacing:

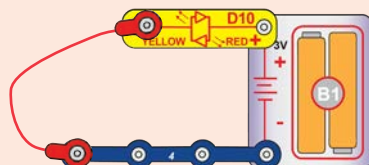
1. Battery holder (B1), motor (M1), and LEDs (D2, D9, & D10):

Place batteries in holder. Place each LED directly across the battery holder (LED "+" to battery "+"), it should light. The red/yellow LED (D10) should be red in one direction and yellow in the other direction. Touch the motor across the battery snaps (motor + to battery +), it should spin to the right at high speed. If none work, then replace your batteries and repeat, if still bad then the battery holder is damaged. If the motor spins but does not balance the fan in the projects, check that there is a black plastic piece with 3 prongs at the top of the motor shaft.

2. Jumper wires: Use this mini-circuit to test each jumper wire, the LED should light.

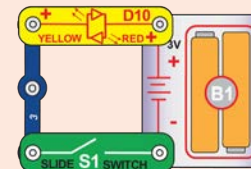


3. Snap wires: Use this mini-circuit to test each of the snap wires, one at a time. The LED should light.

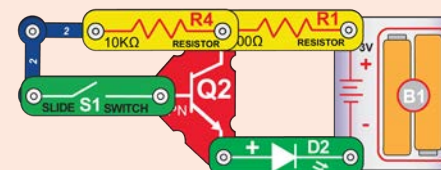


4. Slide switch (S1), speaker (SP2), diode (D3), and resistors (R1, R2, & R4): Use this mini circuit, the LED should be on when the switch is on and off when the switch is off, or the switch is broken. Replace the switch with the speaker, the LED should light or the speaker is broken. Replace the speaker with the diode ("+" on left), the LED should light or the diode is broken. Replace the diode with the R1 resistor; the LED should light. Replace R1 with R2, LED should be dimmer. Replace R2 with R4, the LED should be much dimmer but still light.

the LED should light or the diode is broken. Replace the diode with the R1 resistor; the LED should light. Replace R1 with R2, LED should be dimmer. Replace R2 with R4, the LED should be much dimmer but still light.



5. NPN transistor (Q2): Use this mini circuit, the green LED (D2) should only be on when the switch (S1) is on, or the transistor is broken.



6. Alarm IC (U2): Build project 11, you should hear a siren. Then make the variants in parts B-D to get different sounds.

7. Space war IC (U3): Build project 14, turning switch S1 on and off should change the sound. Then move the switch to points labeled A & B, turning S1 on and off, this should also change the sound.

8. SC Controller (U33): Build project 1, the blue (Bluetooth) light on the SC Controller should be blinking when the switch (S1) is turned on. Connect the SC Controller to the App and use the Circuit screen of Control mode to light the LEDs connected to the 5 outputs (D1-D4 and A) on the SC Controller. Note: if this test works but turning on the motor (M1)/fan in other projects resets the SC Controller (making the blue Bluetooth light on it flashing instead of staying on) then replace your batteries.

You may order additional / replacement parts at:
www.elenco.com/replacement-parts



ELENCO®

150 Carpenter Avenue Wheeling, IL 60090 | Phone: (847) 541-3800 | E-mail: help@elenco.com | www.elenco.com

Guidelines For Classrooms or Home Schooling

This product is a tool for opening the exciting worlds of coding & electronics. Following the Learn by Doing® concept, coding & electronics will be easy for students to understand by using Snap Circuits® to learn about circuits and the Snap Circuits® Coding App to learn about coding. This kit emphasizes the practical applications of coding & electronics, without bogging down in mathematics. This course is as much about thinking processes & science as about coding & electronics.

Why should students learn about coding or electronics? Coding & electronics play important and increasing roles in their everyday lives, and so some basic knowledge of them is a must for everyone in today's society. Learning about them teaches how to do scientific investigation, logical thinking, and helps develop basic skills needed in today's world.

This product is intended for ages 8 and up, for adults and children who have attained sufficient maturity to read and follow directions and warnings.

It should take about 6 hours to do this entire book, or about 4 hours to do just the coding projects (projects 1, 10, 12, 13, 15-18). The focus of this set is to learn about coding and then to code on your own, so teachers should determine what is best for their students.

INSTRUCTOR PREPARATION/ORGANIZATION

- Determine what the learning environment will be. Will the students be learning independently or in small groups? How much teacher instruction will there be for each section? Will the students be reading the lesson as homework and then have limited teacher instruction before performing the experiments? Decide if quizzes will be given and how they will be organized.
- Allocate time within the session as needed for:
 - Teacher instruction about the topics being covered during the session.
 - Getting the Snap Circuits® components into the workspace.
 - Teacher instruction about the specific projects to be performed during that session.
 - Building and testing the circuits.
 - Loading the SC Coding App and connecting to a SC Controller circuit.
 - Performing experiments (and teacher verification if desired).
 - Dismantling the circuits and returning Snap Circuits® components to storage area.
 - Reassembling the class for review.
- Make sure the students know their objectives for the day, how much time they will need for cleanup, and where the materials are being stored.
- Students must understand that there are usually many ways of making the same circuit or program, and that the instructor may not know all the answers. They are doing scientific investigation, and many circuit projects & programs suggest variations to experiment with.
- Have students review the DO's and DON'Ts of Building Circuits on page 4 at the beginning of each session.

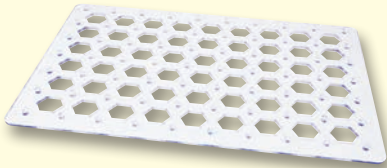
Project Listings

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About Your Snap Circuits® Parts

BASE GRID

The **base grid** is a platform for mounting parts and wires. It functions like the printed circuit boards used in most electronic products, or like how the walls are used for mounting the electrical wiring in your home.



SNAP WIRES & JUMPER WIRES

The blue **snap wires** are wires used to connect components. They are used to transport electricity and do not affect circuit performance. They come in different lengths to allow orderly arrangement of connections on the base grid.



The red, black, and blue **jumper wires** make flexible connections for times when using the snap wires would be difficult. They also are used to make connections off the base grid.



Wires transport electricity just like pipes are used to transport water. The colorful plastic coating protects them and prevents electricity from getting in or out.

(Part designs are subject to change without notice).

BATTERY HOLDER

The **batteries (B1)** produce an electrical voltage using a chemical reaction. This “voltage” can be thought of as electrical pressure, pushing electricity through a circuit just like a pump pushes water through pipes. This voltage is much lower and much safer than that used in your house wiring. Using more batteries increases the “pressure”, therefore, more electricity flows.



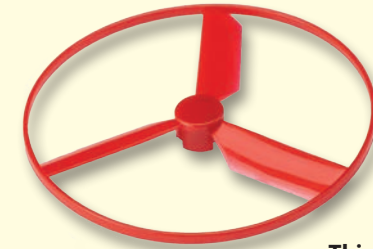
Battery Holder (B1)

MOTOR

The **motor (M1)** converts electricity into mechanical motion. An electric current in the motor will turn the shaft and the motor blades, and the fan blade if it is on the motor.

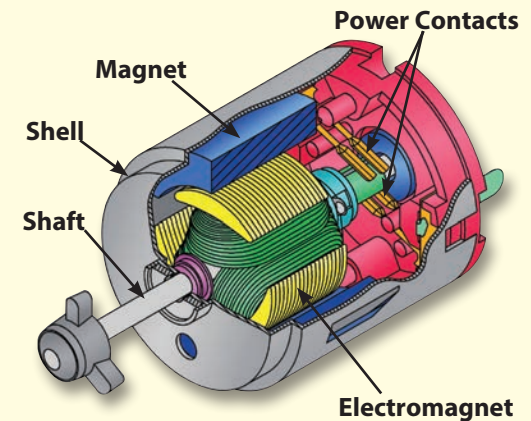


Motor (M1)



This set may have a red fan.

How does electricity turn the shaft in the motor? The answer is magnetism. Electricity is closely related to magnetism, and an electric current flowing in a wire has a magnetic field similar to that of a very tiny magnet. Inside the motor is a coil of wire with many loops wrapped around metal plates. This is called an electromagnet. If a large electric current flows through the loops, it will turn ordinary metal into a magnet. The motor shell also has a magnet on it. When electricity flows through the electromagnet, it repels from the magnet on the motor shell and the shaft spins. If the fan is on the motor shaft, then its blades will create airflow.



About Your Snap Circuits® Parts

DIODES & LEDs

The **diode (D3)** is like a one-way valve that only lets current flow in the direction of the arrow in its symbol. The diode has a turn-on threshold of about 0.7V that voltage must exceed before any current will flow.

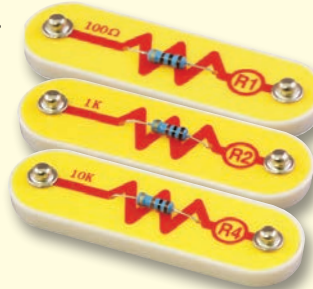
The **green, blue, and red/yellow LEDs (D2, D9, & D10)** are light emitting diodes, and may be thought of as special one-way light bulbs. The color emitted depends on the material used in their construction. Their turn-on threshold is higher than for a normal diode, about 1.5V for red, about 2.0V for green, and about 3.0V for blue; brightness then increases. The red/yellow LED contains red and yellow LEDs connected in opposite directions in the same package. A high current will burn out an LED, so the current must be limited by other components in the circuit, however your Snap Circuits® LEDs have internal resistors to protect against incorrect wiring). Like normal diodes, LEDs block electricity in the “reverse” direction.



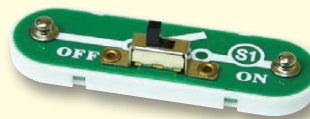
(Part designs are subject to change without notice).

RESISTORS & SWITCH

Resistors “resist” the flow of electricity and are used to control or limit the current in a circuit. This set includes **100Ω (R1), 1kΩ (R2), and 10kΩ (R4) resistors** (“k” symbolizes 1,000, so R4 is really 10,000Ω). Materials like metal have very low resistance (<1Ω), while materials like paper, plastic, and air have near-infinite resistance. Increasing circuit resistance reduces the flow of electricity.



The **slide switch (S1)** connects (“ON”) or disconnects (“OFF”) the wires in a circuit. When ON it has no effect on circuit performance. Switches turn on electricity just like a faucet turns on water from a pipe.



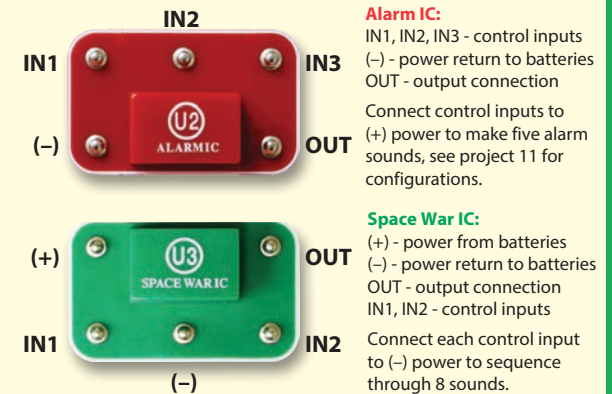
SPEAKER

The **speaker (SP2)** converts electricity into sound by making mechanical vibrations. These vibrations create variations in air pressure, which travel across the room. You “hear” sound when your ears feel these air pressure variations.



ELECTRONIC MODULES

The **alarm and space war ICs (U2 and U3)** contain specialized sound-generation ICs and other supporting components (resistors, capacitors, and transistors) that are always needed with them. This was done to simplify the connections you need to make to use them. Schematics for them are available at www.elenco.com/faqs.



The **SC Controller (U33)** lets you control Snap Circuits® parts using Bluetooth. Its functions and use are described on page 33.

TRANSISTORS

The **NPN (Q2) transistor** is a component that uses a small electric current to control a large current, and is used in switching, amplifier, and buffering applications. Transistors are easy to miniaturize, and are the main building blocks of integrated circuits including the microprocessor and memory circuits in computers.



Introduction to Electricity

What is electricity? Nobody really knows. We only know how to produce it, understand its properties, and how to control it. Electricity is the movement of sub-atomic charged particles (called **electrons**) through a material due to electrical pressure across the material, such as from a battery.

Power sources, such as batteries, push electricity through a circuit, like a pump pushes water through pipes. Wires carry electricity, like pipes carry water. Devices like LEDs, motors, and speakers use the energy in electricity to do things. Switches and transistors control the flow of electricity like valves and faucets control water. Resistors limit the flow of electricity.

The electrical pressure exerted by a battery or other power source is called **voltage** and is measured in **volts** (V). Notice the “+” and “-” signs on the battery; these indicate which direction the battery will “pump” the electricity.

The **electric current** is a measure of how fast electricity is flowing in a wire, just as the water current describes how fast water is flowing in a pipe. It is expressed in **amperes** (A) or **milliamps** (mA, 1/1000 of an ampere).

The “**power**” of electricity is a measure of how fast energy is moving through a wire. It is a combination of the voltage and current (Power = Voltage x Current). It is expressed in **watts** (W).

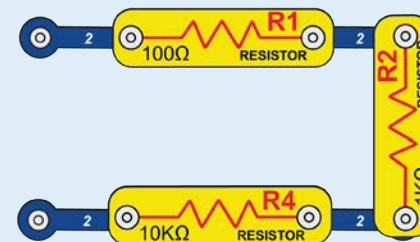
The **resistance** of a component or circuit represents how much it resists the electrical pressure (voltage) and limits the flow of electric current. The relationship is Voltage = Current x Resistance. When the resistance increases, less current flows. Resistance is measured in **ohms** (Ω), or **kilo ohms** (k Ω , 1000 ohms).

Nearly all of the electricity used in our world is produced at enormous generators driven by steam or water pressure. Wires are used to efficiently transport this energy to homes and businesses where it is used. Motors convert the electricity back into mechanical form to drive machinery

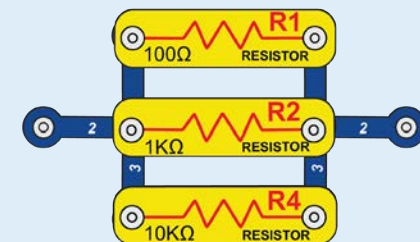
and appliances. The most important aspect of electricity in our society is that it allows energy to be easily transported over distances.

Note that “distances” includes not just large distances but also tiny distances. Try to imagine a plumbing structure of the same complexity as the circuitry inside a portable radio - it would have to be large because we can’t make water pipes so small. Electricity allows complex designs to be made very small.

There are two ways of arranging parts in a circuit, in series or in parallel. Here are examples:



Series Circuit



Parallel Circuit

Placing components in series increases the resistance; highest value dominates. Placing components in parallel decreases the resistance; lowest value dominates.

The parts within these series and parallel sub-circuits may be arranged in different ways without changing what the circuit does. Large circuits are made of combinations of smaller series and parallel circuits.

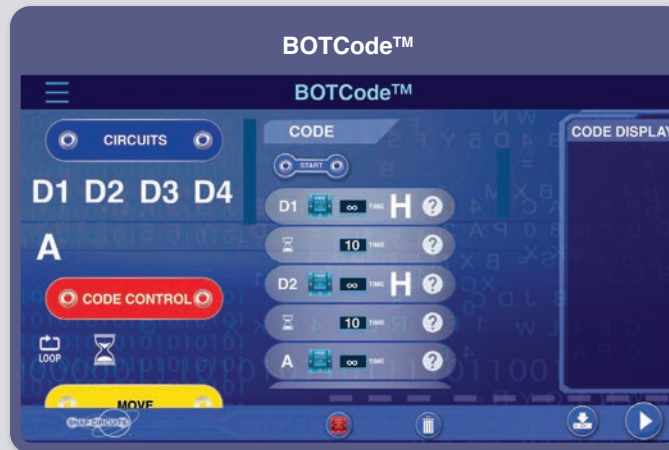
WELCOME TO CODING!

All computers, micro-controllers, apps, and websites are controlled using lines of code, which tell the device what to do, in what order, and when. You probably do not realize how many devices in your home or vehicle have microprocessors or simpler micro-controllers that use code to tell them what to do. Code controls thermostats for heating and air conditioning, digital clocks, vehicle fuel injection systems, oven timers, timers for outdoor lighting systems, stoplights, sprinkler control systems, computers, music players, and many others. Code also controls what you see on websites and apps.

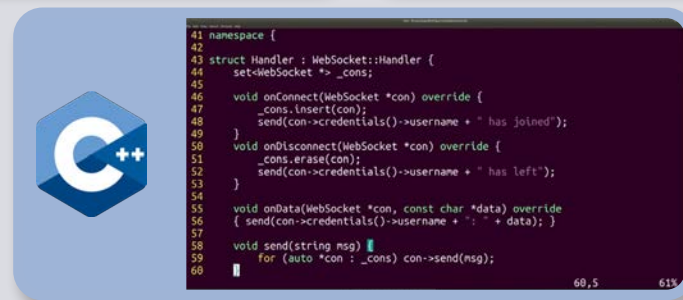
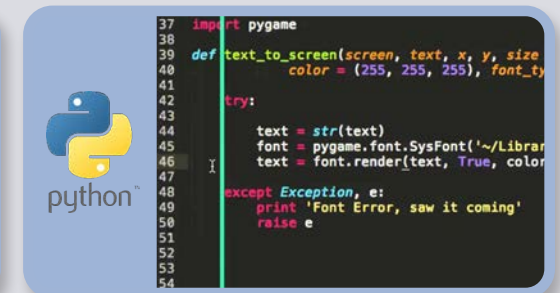
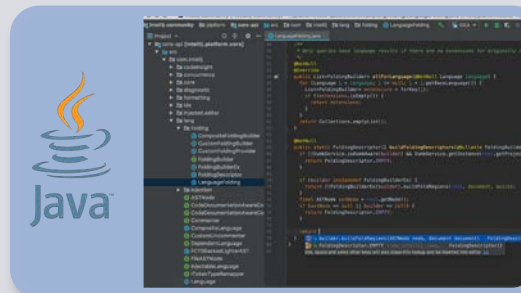
Understanding coding helps you understand logical thinking and problem solving. When you code you create a series of steps to make your device do what you want. It is important that your coding instructions be clear and orderly because a coding controller (or any computer) does what you tell it to do - which may not be what you want it to do.

A computer does not understand any of the programming languages we use, or even graphical programming like BOTCode™. A computer is made up of millions of transistors that can only be turned on or off. These transistors can be grouped together in large numbers to form digital memories and do calculations. The computer or app code we write gets translated into a much longer but very simple form that is used to turn transistors on and off. Many different programming languages have been developed to work with the many different designs for computer hardware (microprocessors, micro-controllers, memories, video controllers), to focus on different applications, or to be easier to use. The BOTCode™ that you will be using is simple and easy to use, making it a great introduction to the world of coding.

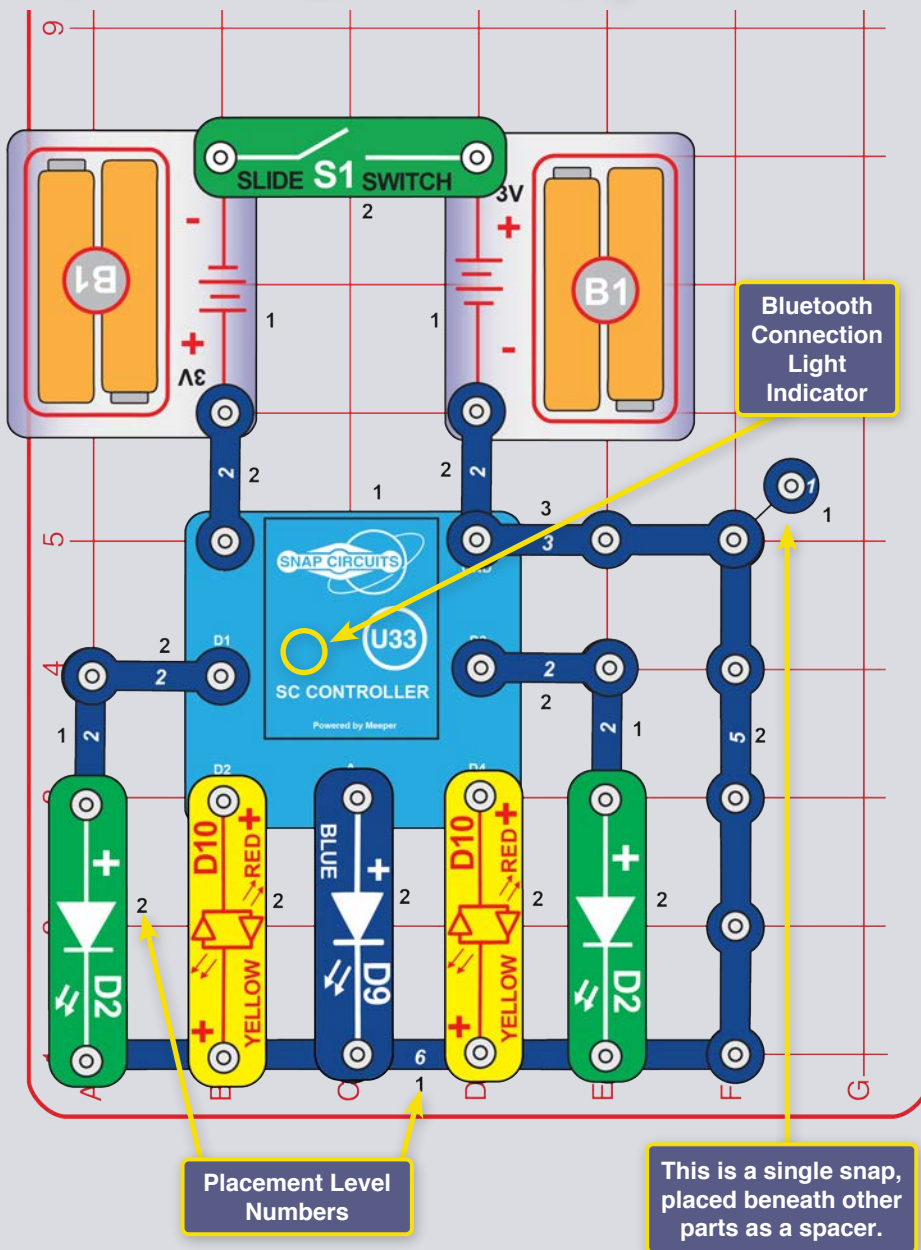
FORMS OF CODE YOU WILL USE



OTHER FORMS OF CODE



PROJECT 1



CODING 5 LIGHTS

(QUICK START - DIVE INTO CODING)

This is a summarized version of the Snap Circuits® Coding app instructions for those already familiar with Snap Circuits® and apps and want to just start coding. To first learn more about Snap Circuits® start with projects 2-9, 11, and 14. For more detailed app instructions, see page 33.

Snap Circuits® uses electronic blocks that snap onto a plastic grid to build different circuits. These blocks have different colors and numbers on them so that you can easily identify them.

Build the circuit shown on the left by placing all the parts with a black 1 next to them on the board first. Then, assemble parts marked with a 2. Then, assemble the part marked with a 3. Install two (2) "AA" batteries (not included) into the battery holders (B1) if you have not done so already. **When installing a battery, be sure the spring is compressed straight back, and not bent up, down, or to one side. Battery installation should be supervised by an adult.**

1. Build the circuit shown here, and turn on the slide switch (S1). A blue light on the SC Controller (U33) should be flashing, indicating that the module is waiting for a Bluetooth connection to a device.
2. Go to the app store on your device and find the Snap Circuits® Coding app; install and open it.



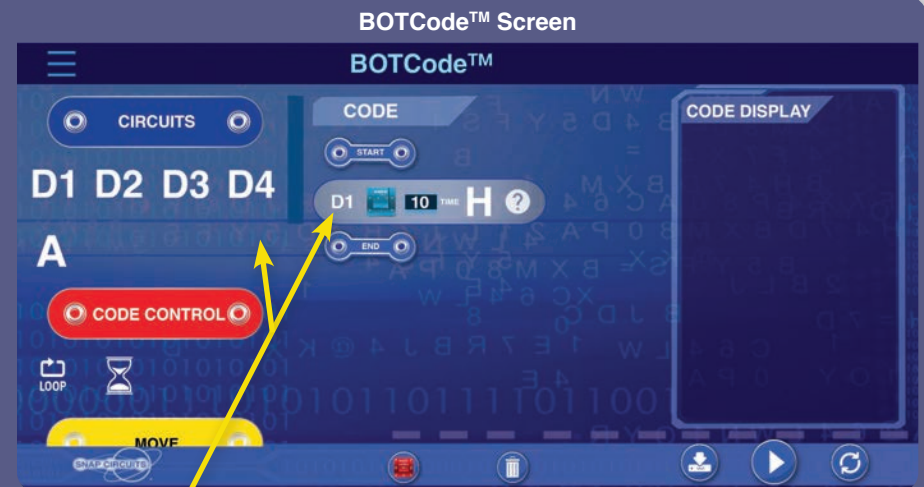
3. The Connect screen should appear, and show device SCC (your SC controller module (U33)). Tap on the red "Not Connected" dot to connect the app to your SC Controller. The red dot on the app should turn green, indicating your SC Controller module is now connected to the app. The Bluetooth indicator light on your SC Controller will now be a solid blue, indicating it is connected. You are now ready to Control or Code.



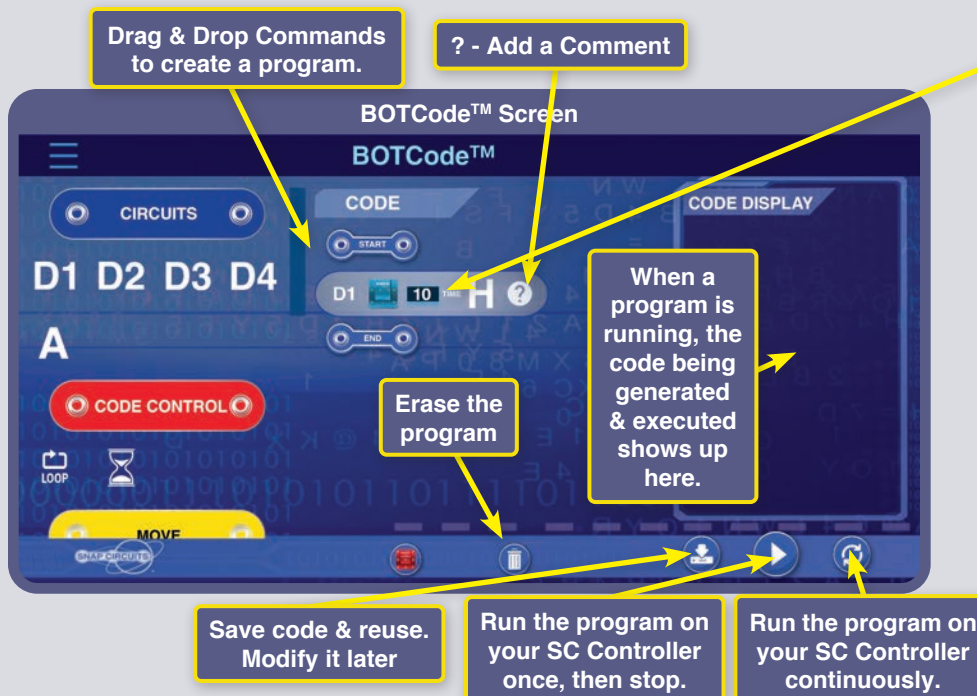
4. Go to the Control Screen by tapping the Control button or using the app menu. The Control screen begins in Circuit mode. The SC Controller has 5 outputs (D1, D2, D3, D4, and A) that are controlled through the app. Outputs D1-D2 and D3-D4 are paired so they can each control a motor in both directions and can be set to either of two output voltage levels, called H (Higher) and L (Lower). Output A has low power and cannot control most motors. Use the app controls to turn the LEDs in your circuit on and off.



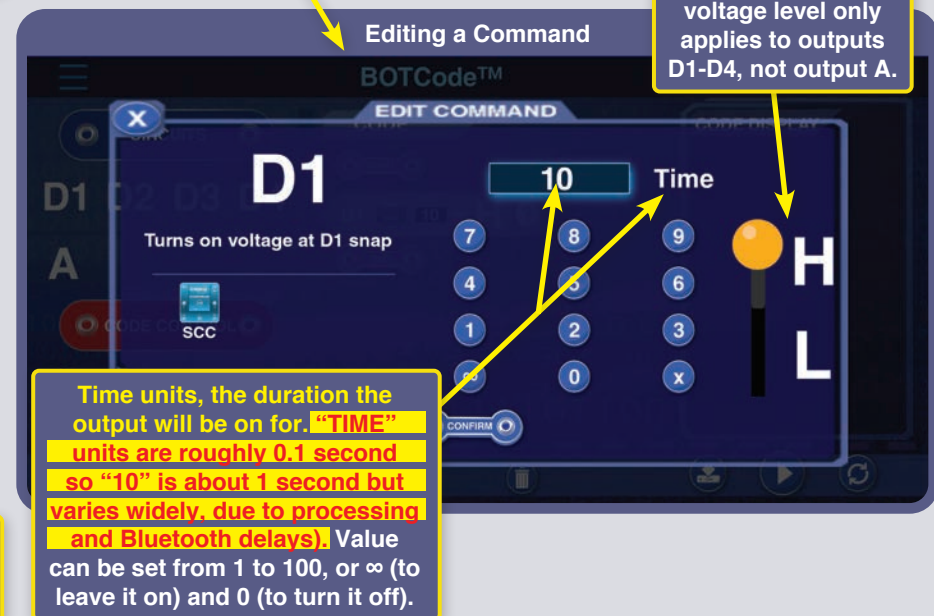
5. Go to the BOTCode™ screen using the app menu. Drag commands from the list on left to the program area in the center.



Drag & Drop Commands from the choices on the left to the CODE area in the center to create a program routine.



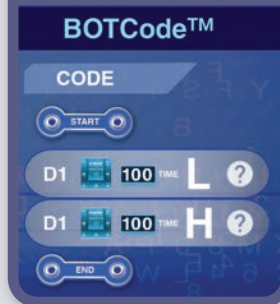
Select the command and change the SC Controller voltage level (H=5V and L=3V) and time on each command. **NOTE: "TIME" units are roughly 0.1 seconds but varies so "10" is about 1 second.**



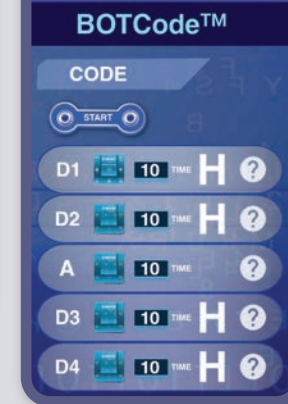
Now that you know the basics of BOTCode™, program the SC Controller to do different things with the lights in this circuit. Here are some programming examples: drag-n-drop the commands into the program area, edit the time and voltage levels, and then run the program once or continuously.

Experiment with changing parameters for commands, such as the time duration.

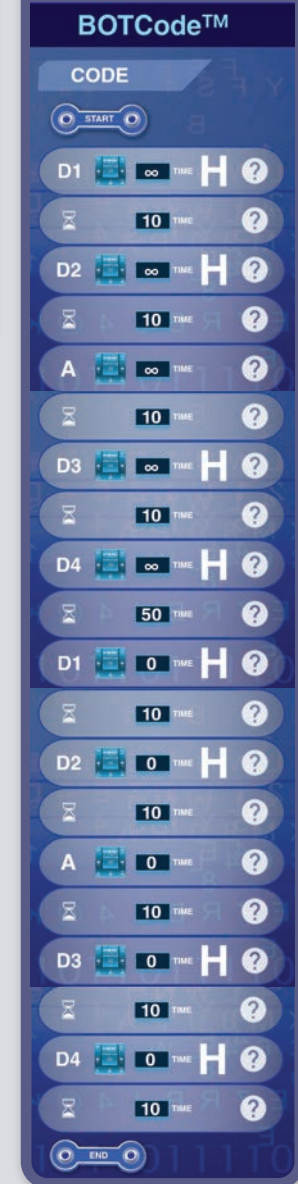
Turn on D1, low brightness, then high brightness.



Turn on the 5 LEDs one at a time.

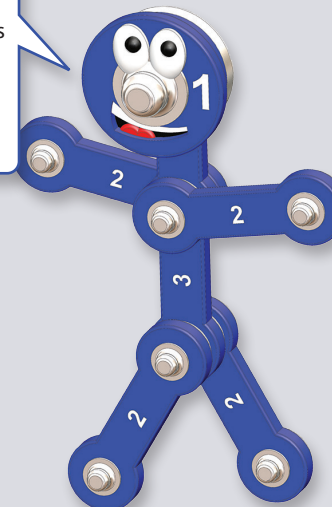


Turn on LEDs one at a time until all are on, then turn them off one at a time.



Limitations of the SC Controller and BOTCode™:
The SC Controller has only circuit outputs (no inputs), so cannot make measurements or decisions based on anything happening in your circuit.

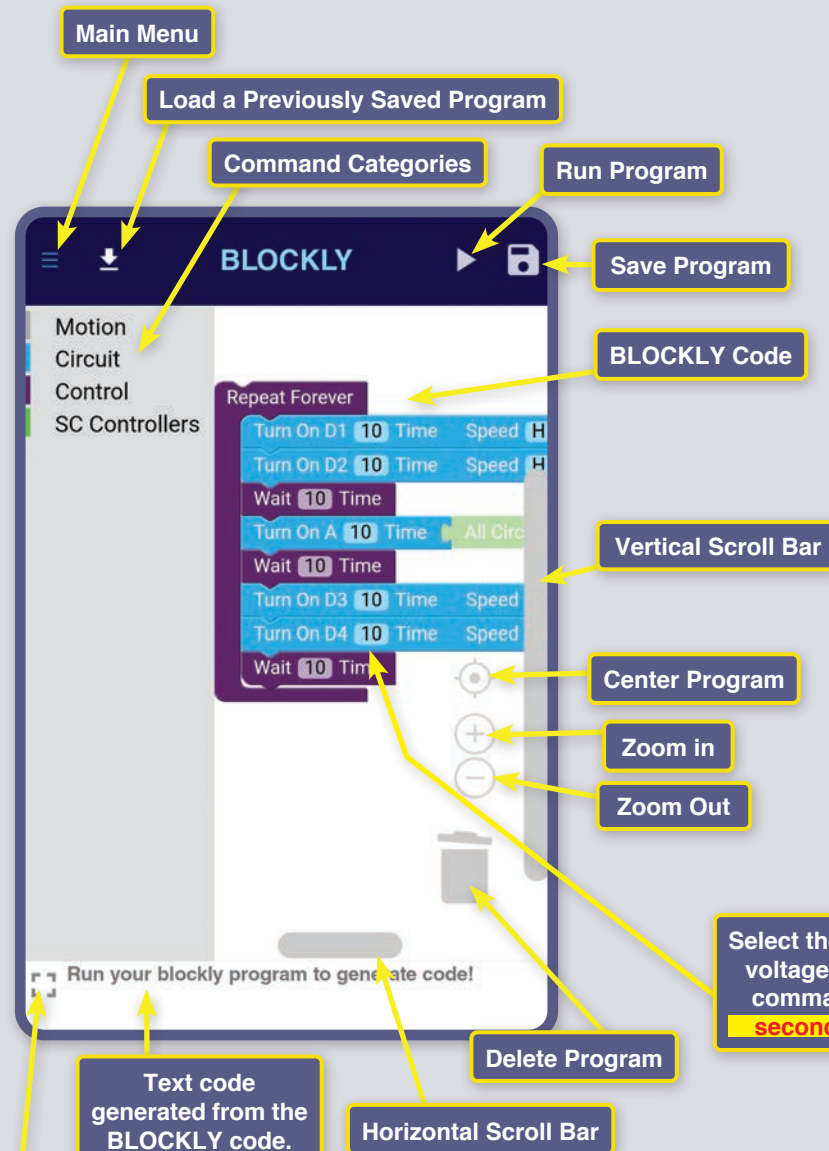
Also, the A output on the SC Controller can only supply low currents, so it cannot be used to control the motor (M1) directly.



CHALLENGES

- Turn on only the green LEDs, then only the red LEDs.
- Make an LED turn on for several seconds, then off for a much shorter time.
- Make an LED flash every 20 seconds.
- Flip one of the red/yellow LEDs (D10) around to its yellow side, then program a stoplight pattern using red, yellow, and green LEDs.
- Try to get the lights blinking in a pattern like a beat to a song.

PART II



Full Text Screen Mode

Text code generated from the BLOCKLY code.

Horizontal Scroll Bar

Delete Program

Select the command and change the SC Controller voltage level (H=5V and L=3V) and time on each command. **NOTE: "TIME" units are roughly 0.1 seconds but varies so "10" is about 1 second.**

BLOCKLY CODING:

BLOCKLY is another form of visual block programming that makes it easy to program the SC Controller (U33) to turn on lights, sounds, or motors, in any order or for different durations. BLOCKLY is similar to how BOTCode™ works.

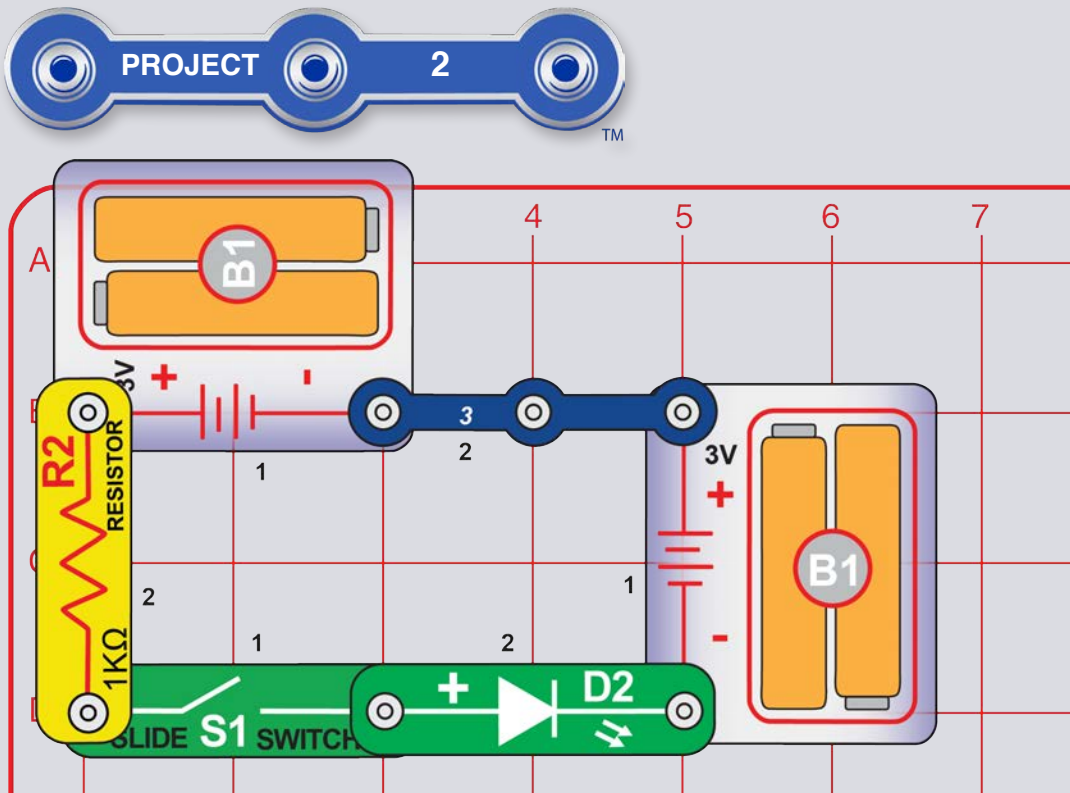
To try BLOCKLY coding, build the project 1 circuit, turn on the circuit, open the SC Coding app on your device, and connect your SC Controller to it as described earlier. Go to the BLOCKLY screen and enter a program like this one.

To enter the program, get the D1-D4 and A commands from the Circuit category, and the Delay and Forever command from the Control category. Select the category, click on the command to bring it into your program area, then drag it to attach to the other commands in your program. Put the Forever command around the others. Click on the command to change the Time and voltage level (H or L) if you like. The Run button is at the top of the BLOCKLY screen.

NOTE: Projects 2-9, 11, and 14 are an introduction to your parts and basic circuits without coding. To jump to the other Coding projects skip to projects 10, 12, 13, and 15-18..

PROJECT

2



ELECTRIC LIGHT

Turn on the slide switch (S1), and the green LED (D2) lights.

Part B: Replace the 1kΩ resistor (R2) with the larger 10kΩ resistor (R4) or the smaller 100Ω resistor (R1) and see how the LED brightness changes.

Part C: Reverse the position of the LED (so it is backwards) and see how the LED works in reverse.

Part D: Replace the green LED (D2) with the blue LED (D9) and try the above circuits again.

Part E: Replace the LED with the red/yellow LED (D10); try it in both orientations.

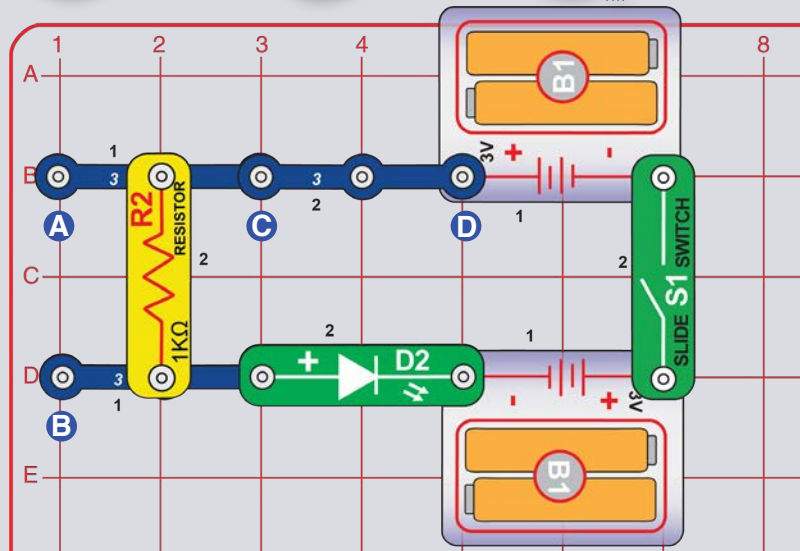
Part F: Reduce the battery voltage by replacing one of the battery holders (B1) with a 3-snap wire and see how the LED brightness changes for any of the above LED-resistor configurations.

When you turn on the slide switch, electricity flows from the batteries through the resistor, then the switch, then the LED, and then back to the batteries. If the switch is off, the flow of electricity is blocked, and the LED won't light.

Resistors "resist" the flow of electricity and are used to control or limit the current in a circuit.

LEDs are like one-way light bulbs that can produce different colors depending on the material used in them.

PROJECT 3



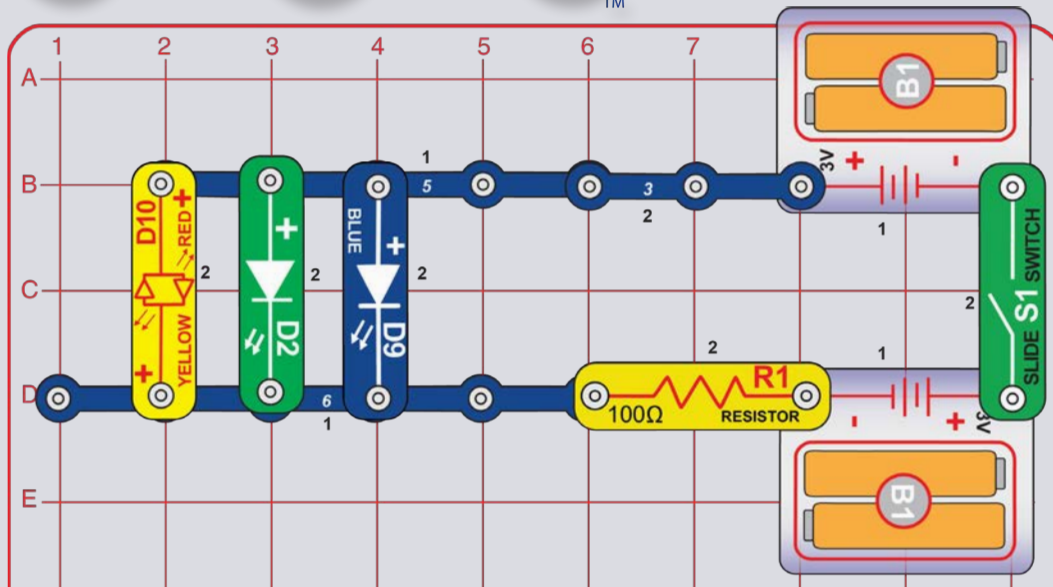
SERIES & PARALLEL CIRCUITS

Build the circuit as shown and turn on the slide switch (S1); the green LED (D2) lights. Now place the larger 10kΩ resistor (R4) or the smaller 100Ω resistor (R1) between the points labeled A & B, so it is next to (and in parallel with) the 1kΩ resistor (R2), and see how the LED brightness changes.

Part B: Use the original circuit but replace the 3-snap wire at points C & D with 10kΩ resistor (R4) or the 100Ω resistor (R1), placing that resistor in series with the 1kΩ resistor (R2). Notice how the resistors combine to affect the LED brightness.

Part C: Use the original circuit but replace the 3-snap wire at points C & D with another LED (D2, D9, or D10, “+” on right, D10 in either orientation). Compare the LED brightness two LEDs are in series. You can also replace the 1kΩ resistor (R2) with the larger 10kΩ resistor (R4) or the smaller 100Ω resistor (R1) and see how the LED brightness changes.

PROJECT 4



LED COMPARISON

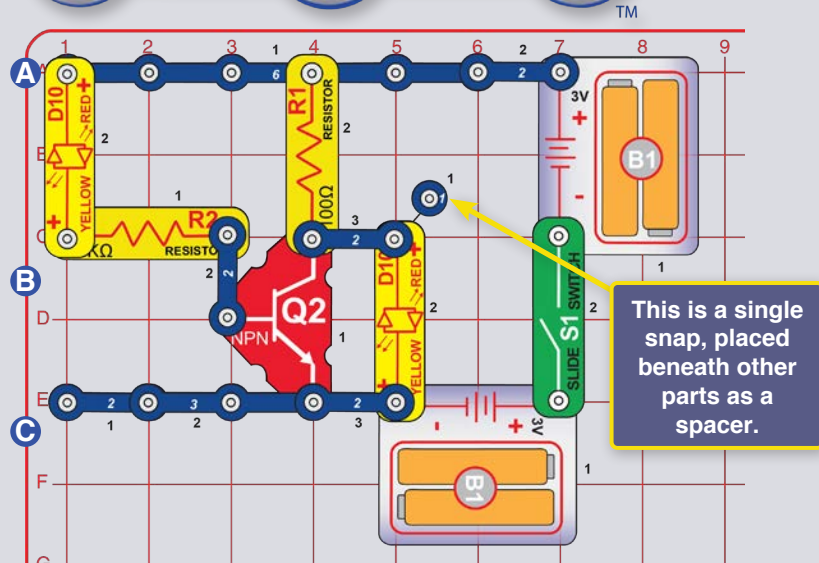
Build the circuit as shown and turn on the slide switch (S1); the three LEDs (D10, D2, & D9) light. Now replace the 100Ω resistor (R1) with the larger 1kΩ resistor (R2) and then the much larger 10kΩ resistor (R4) and see how the brightness changes on each LED.

Try the red/yellow LED (D10) in both red and yellow orientations. Your set includes a second green LED and red/yellow LED, so you can experiment with different LEDs and have up to five at once (add two more to the right of the blue LED).

Electricity flows through an LED if the voltage exceeds a turn-on threshold (about 1.5V for red, about 2.0V for green, and about 3.0V for blue). The resistor limits the voltage/current through all the LEDs, but the blue LED is affected the most because of its higher turn-on level.



PROJECT 5



TRANSISTOR INVERTER

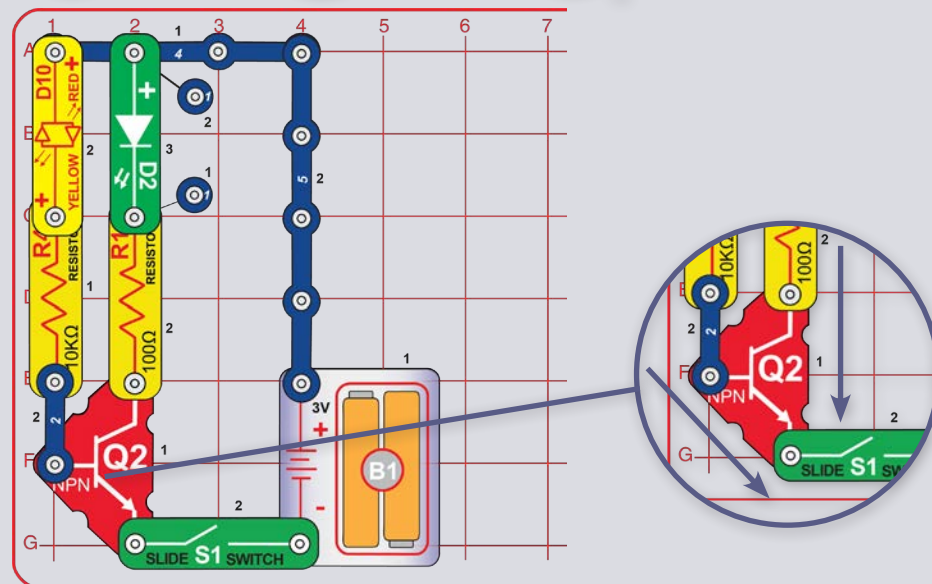
Build the circuit as shown, and turn on the slide switch (S1). The left LED is on and the right one is off.

Now remove the left LED (which is across points labeled A & B) and place it across the points labeled B & C (positioned in either direction), or leave it disconnected (which is functionally the same as connecting across points B & C). Now the left LED is off and the right one is on.

Notice that the two LEDs are opposites - when one is on, the other is off.

Transistors like your NPN transistor (Q2) use a small current to control a larger current and are used in switching and amplifier circuits. In this circuit a small current flows into Q2 through R2, controlling a larger current into Q2 through R1. This control allows the right LED to be opposite of the left LED or inverted. The transistor will later be used to invert a voltage in coding project 15.

PROJECT 6

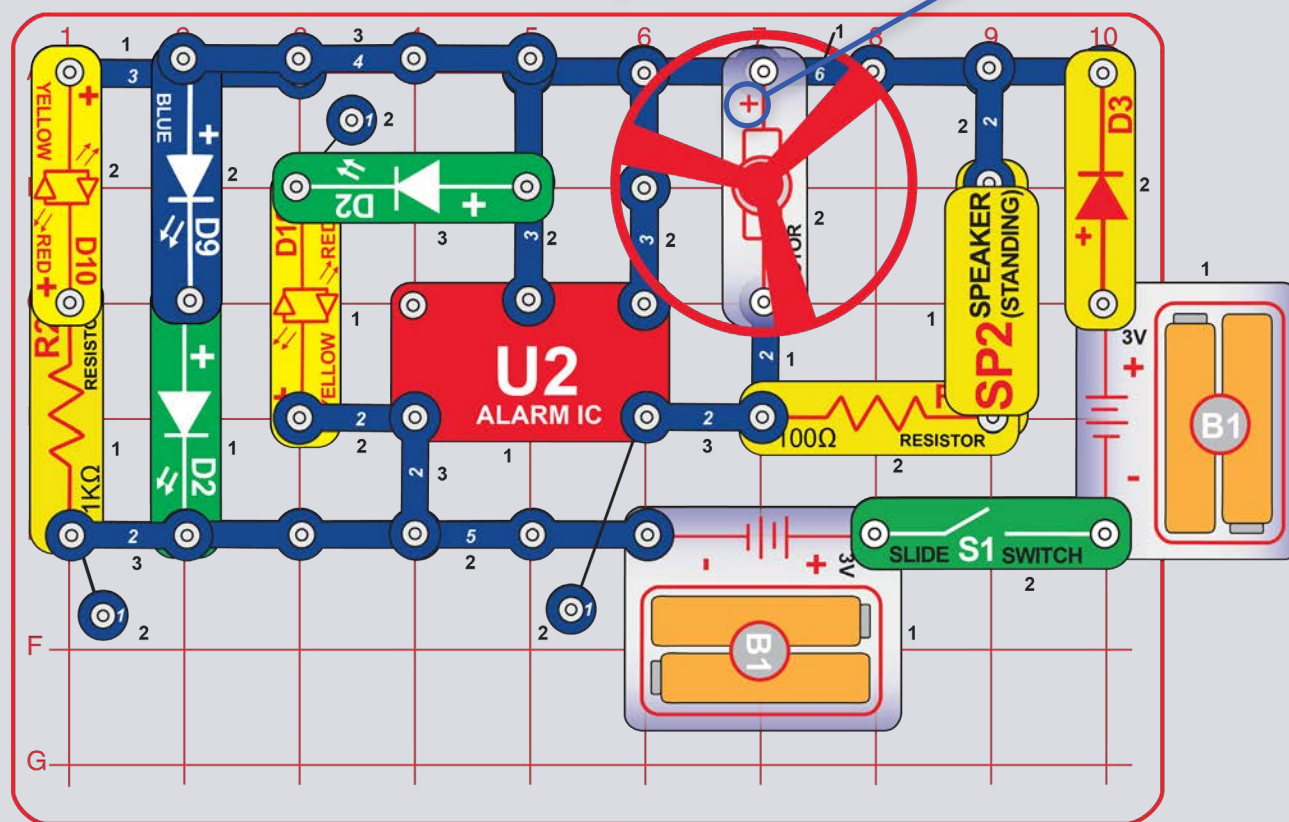


TRANSISTOR CURRENTS

Build the circuit as shown, and turn on the slide switch (S1). The red/yellow LED (D10) is dim and the green LED (D2) is bright. Try removing each LED and see if the other still lights.

A small current flowing into the left connection of the NPN transistor controls a larger current flowing into the top connection. Both currents exit out of the bottom connection.

PROJECT 7



FUN CIRCUIT

Build the circuit as shown and turn on the slide switch (S1). Lights shine, the motor (M1) spins, and a machine gun sound is heard.

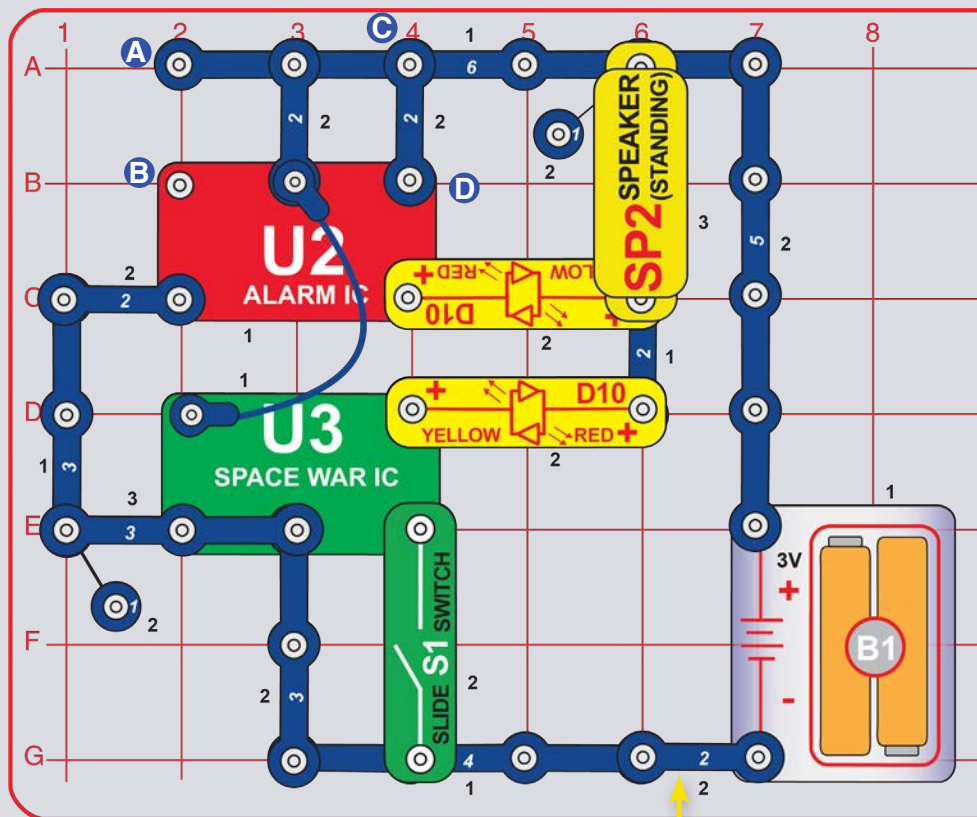
If you swap the locations of the 100Ω resistor (R1) and 1kΩ resistor (R2) then the red/yellow LED (D10) will be brighter and the sound will not be as loud.

WARNING: Moving parts. Do not touch the fan or motor during operation. Do not lean over the motor. Fan may not rise until switch is released. Eye protection is recommended for this circuit.

Why do the LEDs flicker? When the fan starts to spin, the battery voltage drops a little due to the added load of driving the motor and speaker. If you remove the motor from the circuit then the LED flicker will be much less and there would be no LED flicker at all, if you removed the motor and the speaker.



PROJECT 8



DOUBLE SOUNDS

Build the circuit as shown, but connect the 2-snap wire at bottom last. The sound starts immediately. Turn the slide switch (S1) on and off several times to add space war sounds.

Change the sound by removing the 2-snap wire at points C & D or moving it to points A & B.



Build the circuit as shown. Turn on the slide switch (S1) until the motor reaches full speed, then turn it off. The fan blade should rise and float through the air like a flying saucer. Be careful not to look directly down on fan blade when it is spinning.

If the fan doesn't fly off, then turn the switch on and off several times rapidly when it is at full speed. You may need to have new alkaline batteries for the fan to fly.

Part B: “Super Flying Saucer”: Replace the 3-snap wire with another battery holder (B1). The fan will spin faster and fly higher, making it easy to lose your fan. Elenco® Electronics Inc. is not responsible for lost or broken fans! You may purchase replacement fans at www.elenco.com/replacement-parts.

Part C: “Fan”: Use either of the preceding circuits but reverse the position of the motor (M1), so its “+” is on the right. Now it acts like a fan, but does not fly.

NOTE: See project 10 to launch the fan using coding, and see how much more control coding gives you.

⚠ WARNING: Moving parts. Do not touch the fan or motor during operation. Do not lean over the motor. Fan may not rise until switch is released. Eye protection is recommended for this circuit.

The air is being blown down through the blade and the motor rotation locks the fan on the shaft. When the motor is turned off, the blade unlocks from the shaft and is free to act as a propeller and fly through the air. If speed of rotation is too slow, the fan will remain on the motor shaft because it does not have enough lift to propel it.

In part C ("Fan"), the fan is blowing air upward; place your hand a short distance above the motor and you should be able to feel it.

In this project electrical power was changed into mechanical power. Motors like this one are used in battery powered equipment requiring rotary motion, such as a cordless drill, electric toothbrush, and toys. An electric motor is much easier to control than gas or diesel engines.



10



The diagram shows the SP2 SPEAKER (STANDING) module connected to the D10 module. The D10 module has a yellow output labeled 'D10' with a '+' sign and a red output labeled 'RED' with a '-' sign. The SP2 module has a yellow input labeled 'SP2' with a '+' sign and a red input labeled 'RED' with a '-' sign. The connections are as follows:

- The D10 '+' output is connected to the SP2 '+' input (yellow).
- The D10 '-' output is connected to the SP2 '-' input (red).

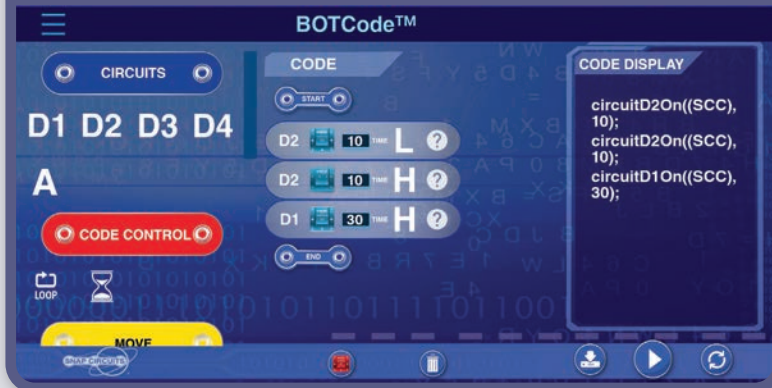
- Make the right LED flash several times, turn on fan and launch it.
- Make fan spin in short bursts in opposite directions, but not fly off.
- Get the fan to fly to different heights.

Build the circuit shown here and turn on the switch (S1). Open the Snap Circuits® Coding app, connect to the SC Controller, and use Circuit Control mode to spin the fan and light the LEDs. See project 1 and pages 34-42 to review how to use the app.

The fan can fly off if it is controlled properly. Be careful not to look directly down on fan blade when it is spinning. If the fan doesn't fly off, then turn the switch on and off several times rapidly when it is at full speed. You may need to have new alkaline batteries for the fan to fly.

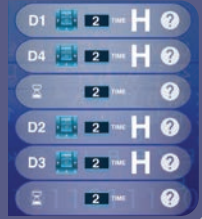
Next, put the app in BOTCode™ mode and create some code to light the LEDs and spin the fan. Experiment with changing parameters for commands, such as the time duration.

BOTCode™ Screen: Turn on LED & fan, speed up the fan, then reverse the fan and make it fly.

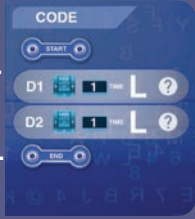


Part B, Beep & Flash: Replace motor (M1) with the speaker (SP2), then create the program shown here.

Turn on the LEDs, alternately between yellow and red.



**Beep & flash.
Run this
program
continuously.**

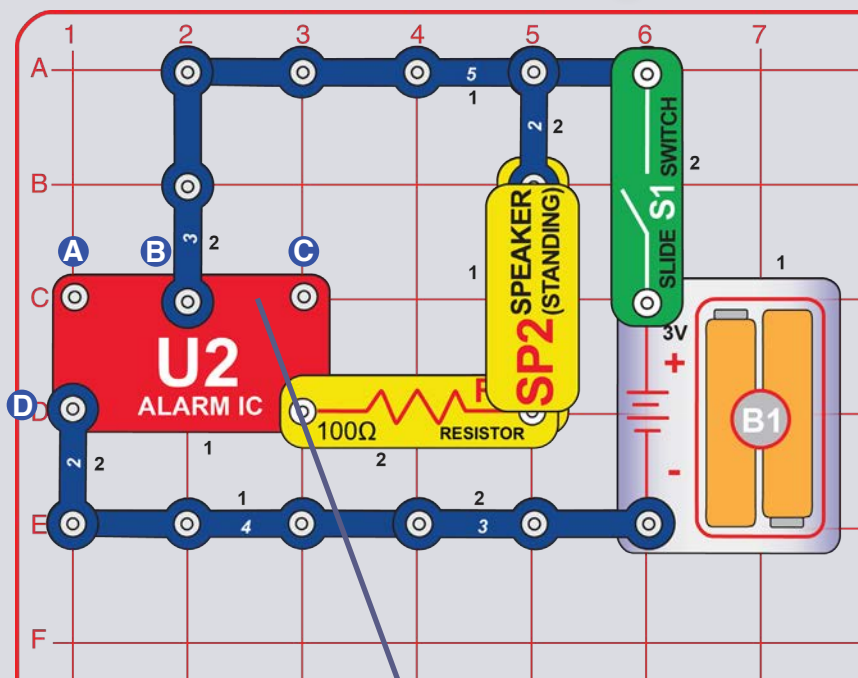


Control Screen in Circuit Mode

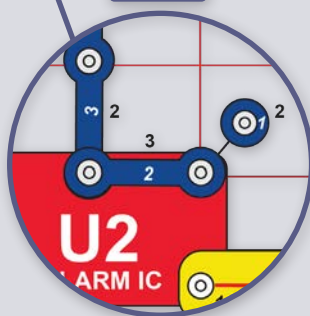


WARNING: Moving parts. Do not touch the fan or motor during operation. Do not lean over the motor. Fan may not rise until switch is released. Eye protection is recommended for this circuit.

11



Part B



Turn on the slide switch (S1), siren sounds.

Part B: Add a connection between the points marked B & C using a 1-snap wire and a 2-snap wire (or you can use the red jumper wire). Now it sounds like a machine gun.

Part C: Remove the connection between B & C, and add a connection between A & B. Now it sounds like a fire engine.

Part D: Remove the connection between A & B, and add a connection between A & D. Now it sounds like a European siren.

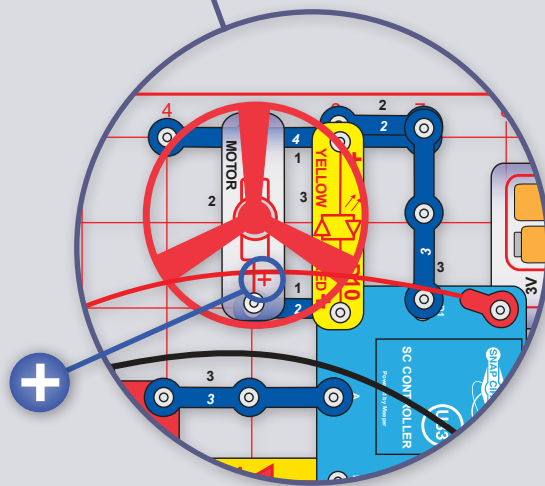
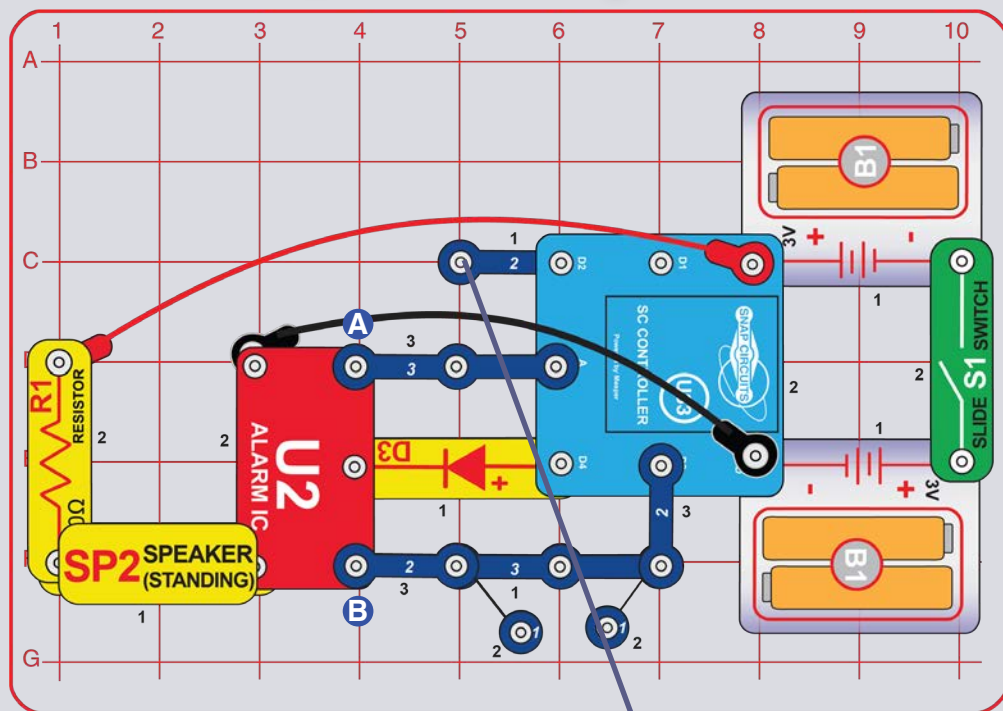
Part E: For any of the above circuits replace the 100Ω resistor (R1) with a 3-snap wire to make the sound louder, or with the $1k\Omega$ resistor (R2) to make the sound softer.

Part F: Use the part B circuit but replace the 100Ω resistor (R1) with the red/yellow LED (D10, in either direction) or the green LED (D2, “-” on right). Now the LED is blinking as the machine gun sounds.

NOTE: See projects 12-13 to control the alarm IC using coding, and see how much more control coding gives you.

The lower-right snap of the alarm IC (U2) is like an electrical gate, opening and closing quickly to let small bursts of electric current flow in. The bursts of electric current also flow through the speaker (which produces sound). The alarm IC produces the different siren sounds by adjusting the pattern of current bursts through the speaker.





SIRENS CODING

Build the circuit shown here and turn on the switch (S1). Open the Snap Circuits® Coding app, connect to the SC Controller (U33), and use Circuit Control mode to activate sirens by turning on output D4, outputs A & D4, or outputs D3 & D4. See project 1 and pages 34-42 to review how to use the app.

Next, put the app in BOTCode™ mode and create some code to sound different sirens. Experiment with changing parameters for commands, such as the time duration.

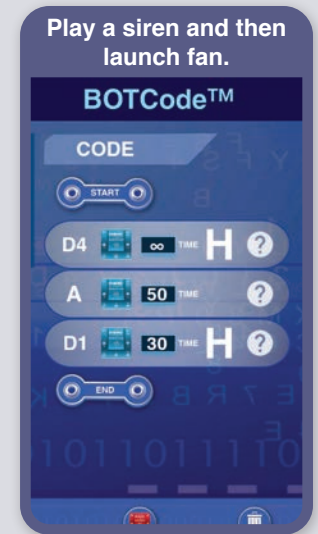
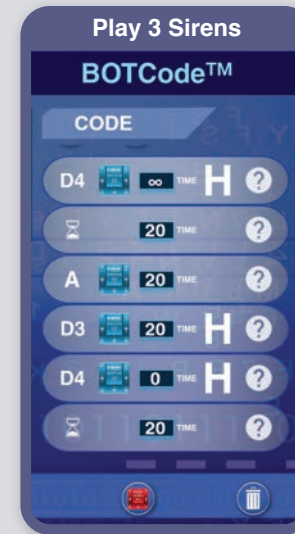
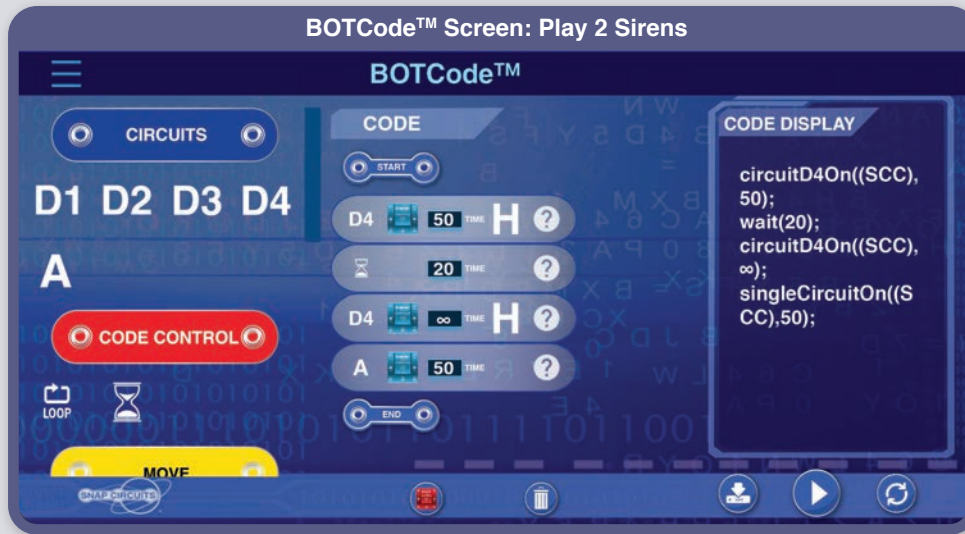
The alarm IC (U2) can produce four siren sounds, as shown in project 4. Those sirens can be produced by controlling the SC Coder outputs as follows:

- Siren 1. D4 on, A and D3 off.
- Siren 2. D4 and A on, D3 off.
- Siren 3. D4 and D3 on, A off.
- Siren 4. D4 on, and change the circuit by removing the snap wires from points labeled A and B on the alarm IC.

You can make the sound louder by replacing the 100Ω resistor (R1) with a 2-snap wire, or make the sound softer by replacing R1 with the 1kΩ resistor (R2) or an LED ("+" on top).

Part B: Add the motor (M1), fan, and red/yellow LED (D10).

⚠ WARNING: Moving parts. Do not touch the fan or motor during operation. Do not lean over the motor. Fan may not rise until switch is released. Eye protection is recommended for this circuit.

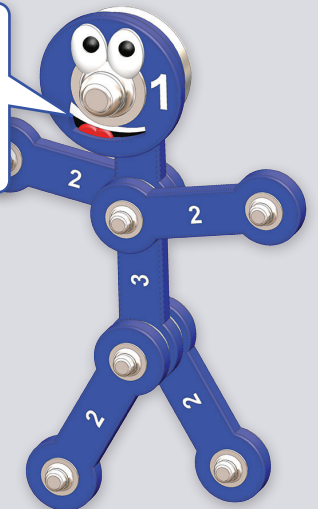


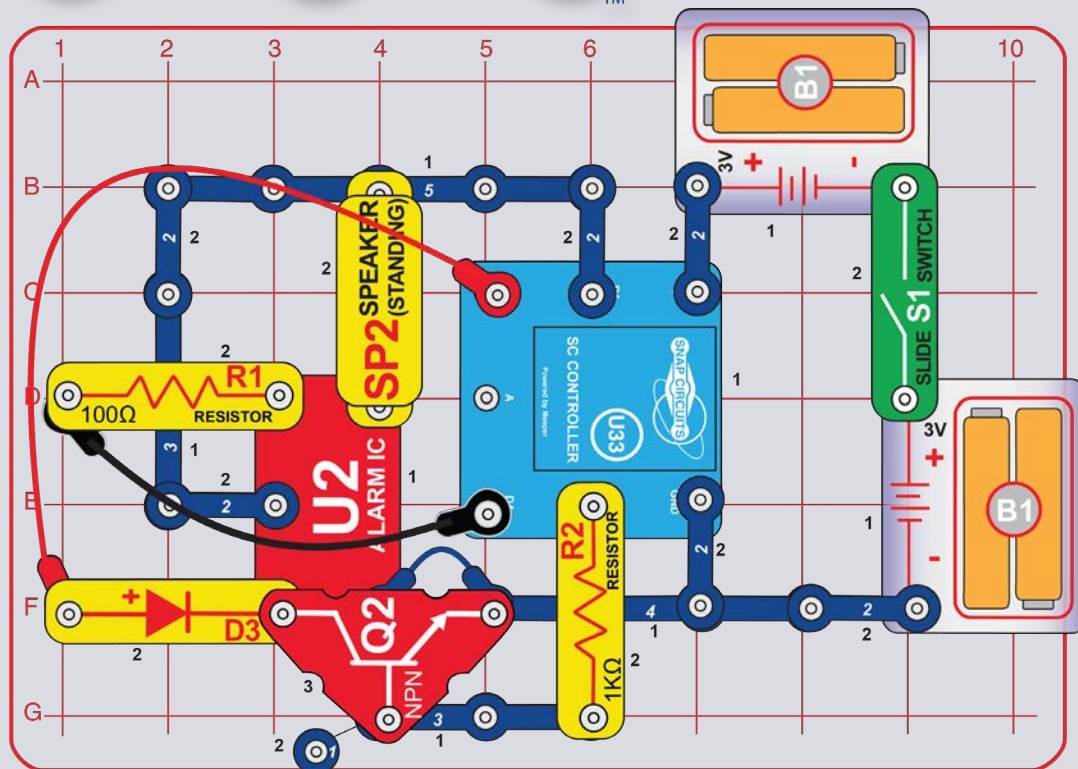
NOTE: If your batteries are weak then turning on the motor(M1)/fan may reset the SC Controller (making the blue Bluetooth light start flashing instead of staying on); if this happens then replace your batteries.

CODING CHALLENGE

- Play a siren for different durations using the same program.
- Turn motor forwards and then backwards.

The diode (D3) blocks electricity from flowing from the A or D3 outputs (when they are turned on) on the SC Controller through the alarm IC, and back into the D4 output (when it is turned off) on the SC Controller. The alarm IC would not operate properly if that happened.





4 SIRENS CODING

Build the circuit shown here, note that the blue jumper wire is connected beneath the NPN transistor (Q2). Turn on the switch (S1). Open the Snap Circuits® Coding app, connect to the SC Controller, and use Circuit Control mode to activate sirens. See project 1 and pages 34-42 to review how to use the app.

Next, put the app in BOTCode™ mode and create some code to sound different sirens. Experiment with changing parameters for commands, such as the time duration.

The alarm IC (U2) can produce four siren sounds, as shown in project 11. Those sirens can be produced by controlling the SC Controller outputs as follows:

- Siren 1. D1 on, others off.
- Siren 2. D1 and D2 on, others off.
- Siren 3. D1 and D3 on, others off.
- Siren 4. D1 and D4 on, others off.

What do you think the NPN transistor (Q2) is used for in this circuit?



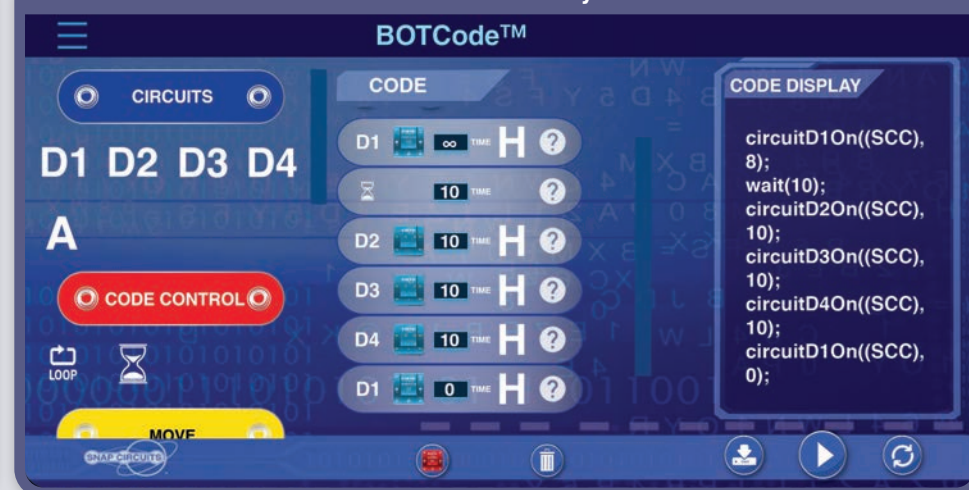
CODING CHALLENGE

- Play different sirens for different durations in the same program.

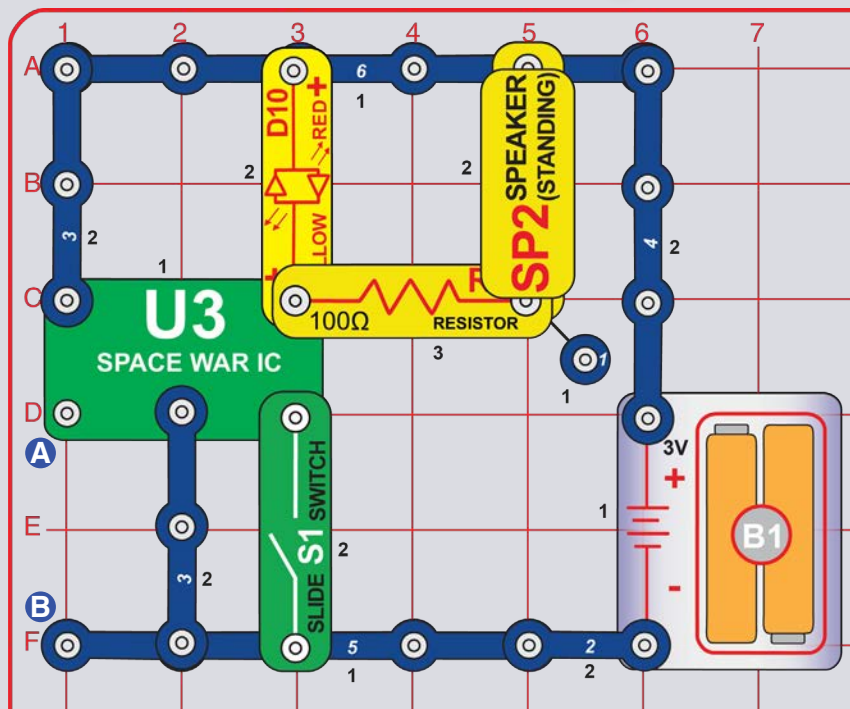
Control Screen in Circuit Mode



BOTCode™ Screen: Play 4 Sirens



PROJECT 14



SPACE WAR

Build the circuit as shown. Activate it and change the sound by turning the slide switch (S1) on and off repeatedly. The red/yellow LED (D10) also lights.

Next add a 3-snap wire across the points marked A & B; connect and disconnect it several times, and do it in combination with the slide switch. You will hear an exciting range of sounds, as if a space war is raging!

You can make the sound louder by replacing the 100Ω resistor (R1) with the blue jumper wire, or make it softer by replacing R1 with the 1kΩ resistor (R2).

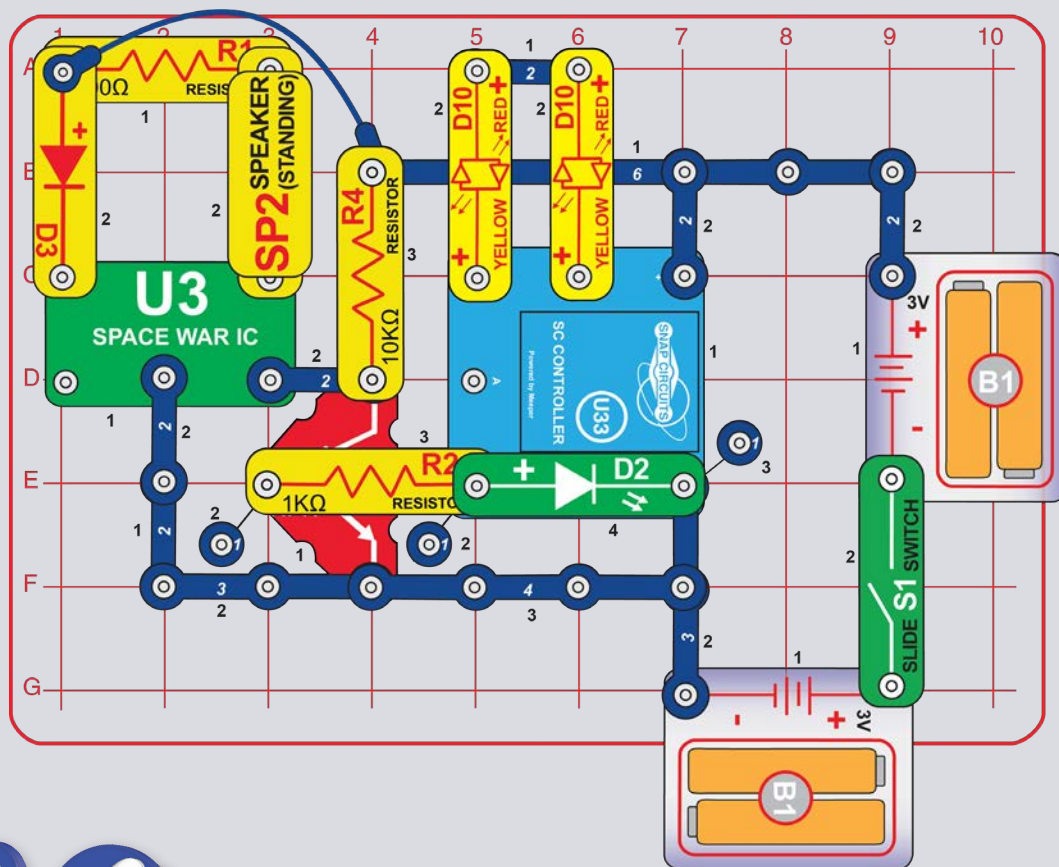
NOTE: See projects 15-16 to control the space war IC using coding, and see how much more control coding gives you.

Like the other integrated circuits, the space war IC is a super-miniaturized electronic circuit that can play a variety of cool sounds stored in it by using just a few extra components.

In movie studios, technicians are paid to insert these sounds at the precise instant a gun is fired. Try making your sound occur at the same time an object hits the floor. It is not as easy as it sounds.

The upper-right snap of the space war IC is like an electrical gate, opening and closing quickly to let small bursts of electric current flow in. The bursts of electric current also flow through the speaker (which produces sound). The space war IC produces the different sounds by adjusting the pattern of two separate current bursts through the speaker.





What do you think the NPN transistor (Q2) is used for in this circuit?

CODING CHALLENGE

- Play a space war sound for a second, then wait 5 seconds and play another.

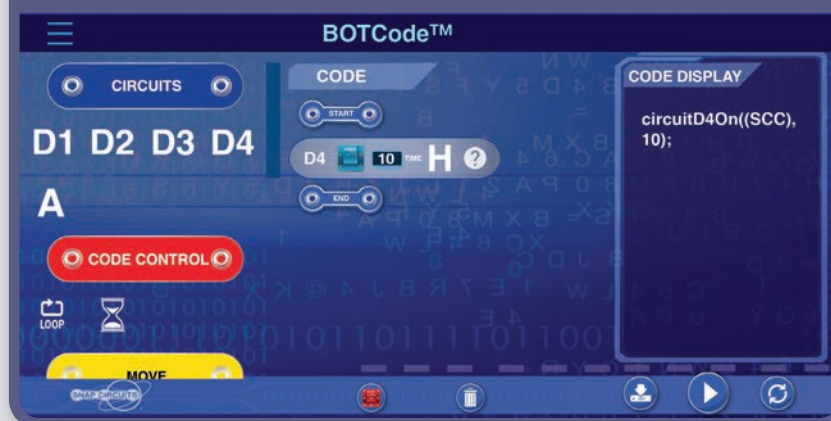
SPACE WAR CODING

Build the circuit shown here and turn on switch (S1). Open the Snap Circuits® Coding app, connect to the SC Controller, and use Circuit Control mode to activate and change the sound. See project 1 and page 34-42 to review how to use the app.

Next, put the app in BOTCode™ mode and create code to sound different sirens. Experiment with changing parameters for commands, such as the time duration.

You can make the sound louder by replacing the 100Ω resistor (R1) with a 3-snap wire or make the sound softer by replacing R1 with an LED ("+" on left).

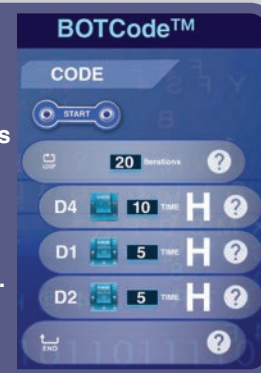
BOTCode™ Screen: Change Sound [Run this program continuously.]



Control Screen in Circuit Mode

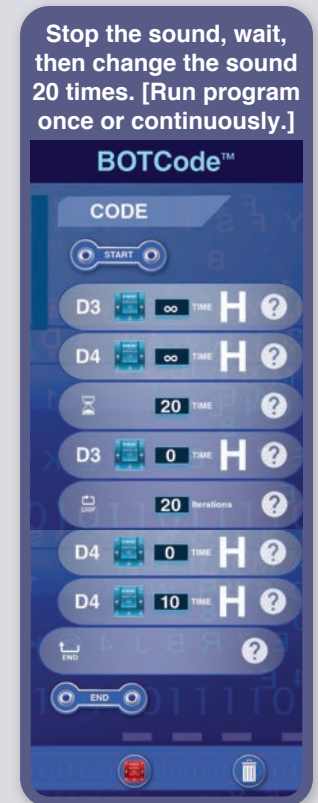
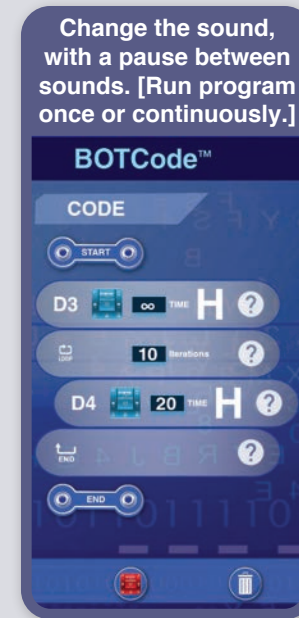
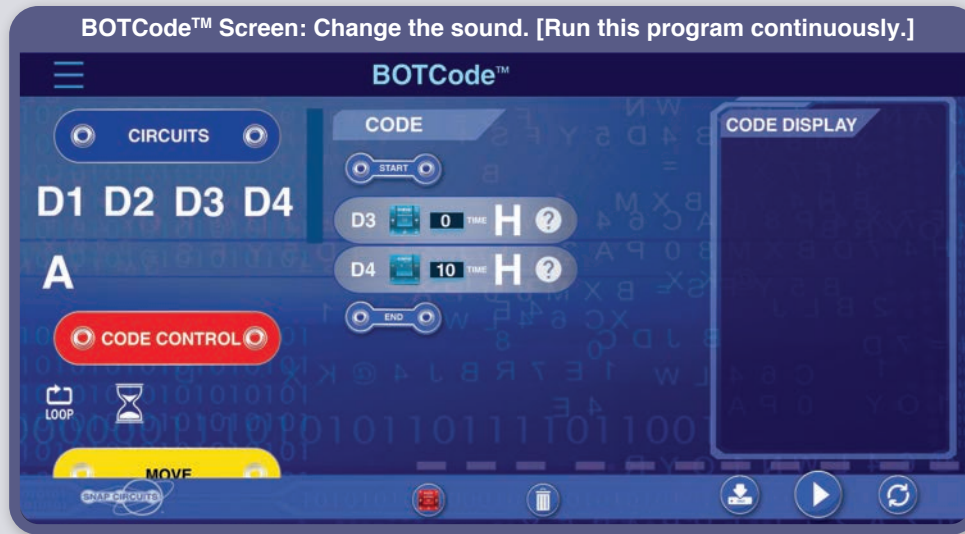


Change the sound 20 times and flash LEDs. Run this program once (not continuously).

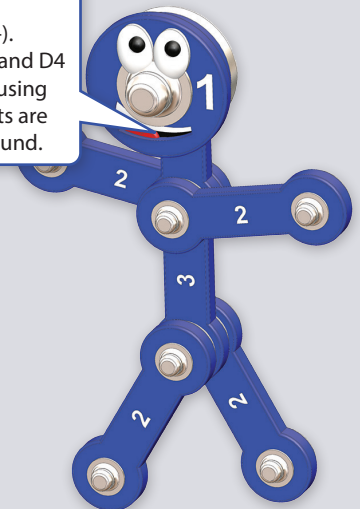




You can make the sound louder by replacing the 100Ω resistor (R1) with a jumper wire, or make the sound softer by replacing R1 with the $1k\Omega$ resistor (R2) or an LED (“+” on left).

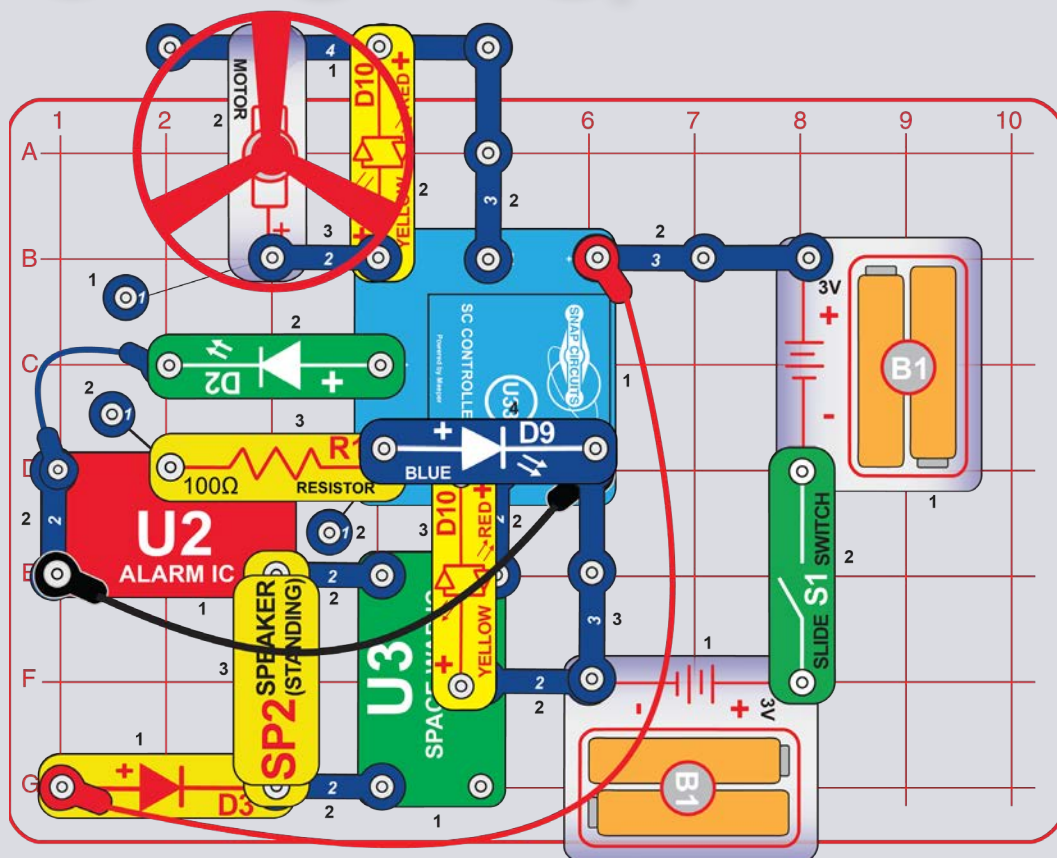


The space war IC (U3) sound is activated by connecting its control snaps to 0V (battery -). When the SC Controller is turned on, its D3 and D4 outputs are off (0V) until you turn them on using the app. So when the SC Controller's outputs are off, they are activating the space war IC's sound.



CODING CHALLENGES

- Play sounds for only a short time each. How short can you make them?
- Play each sound for 5 seconds or longer.
- Count how many different space war sounds there are.



WARNING: Moving parts. Do not touch the fan or motor during operation. Do not lean over the motor. Fan may not rise until switch is released. Eye protection is recommended for this circuit.

BOX COVER CIRCUIT

This project combines most of your set's features into one circuit. Build the circuit shown (it is also pictured on the cover of your box and this booklet) and turn on the switch (S1). Open the Snap Circuits® Coding app, connect to the SC Controller, and use Circuit Control mode to activate sirens. See project 1 and pages 34-42 to review how to use the app.

Next, put the app in BOTCode™ mode and create some code to sound different sirens. Experiment with changing parameters for commands, such as the time duration.

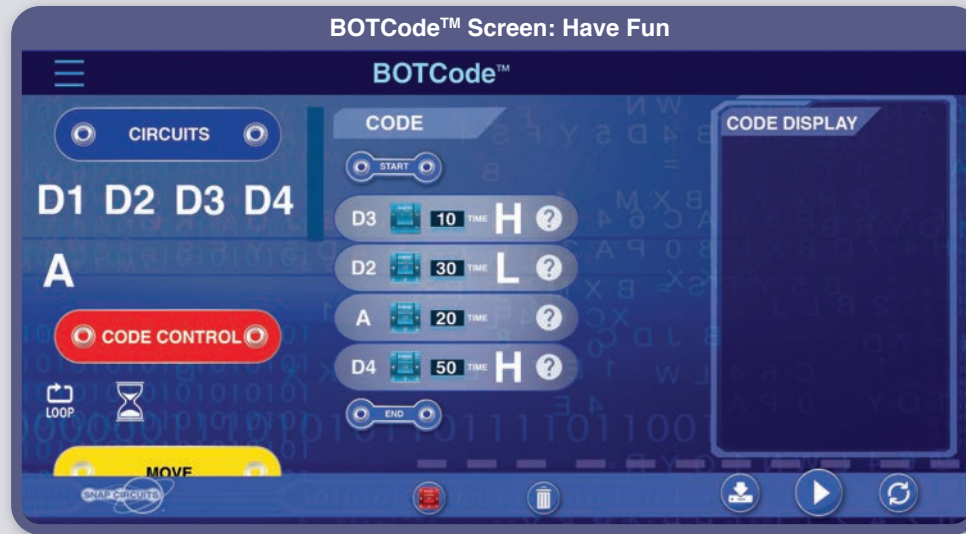
Note: In this circuit the space war sounds begin immediately, so you must turn on SC Controller output D3 to stop the sound.

Note: If your batteries are weak then turning on the motor (M1)/fan may reset the SC Controller (making the blue Bluetooth light on it flashing instead of staying on); if this happens then replace your batteries.

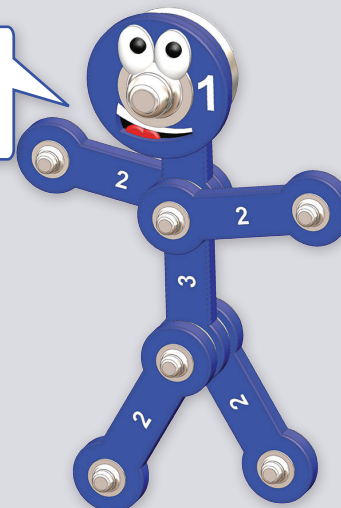
Features controlled by the SC Controller (U33) outputs:

- D1 controls the fan (and can make it fly) and makes the top LED (D10) red.
- D2 controls the fan (but does not make it fly) and makes the top LED yellow.
- The A output controls the green LED (D2).
- D3 controls the space war IC (U3) sounds and makes the bottom LED red. Note that the space war sounds begin on and can only be turned off by turning on D3.
- D4 controls the alarm IC (U2) sound and the blue LED (D9).

If you want to stop the sound while you create code, remove the speaker (SP2) or replace it with your extra green LED (D2, "+" on bottom).

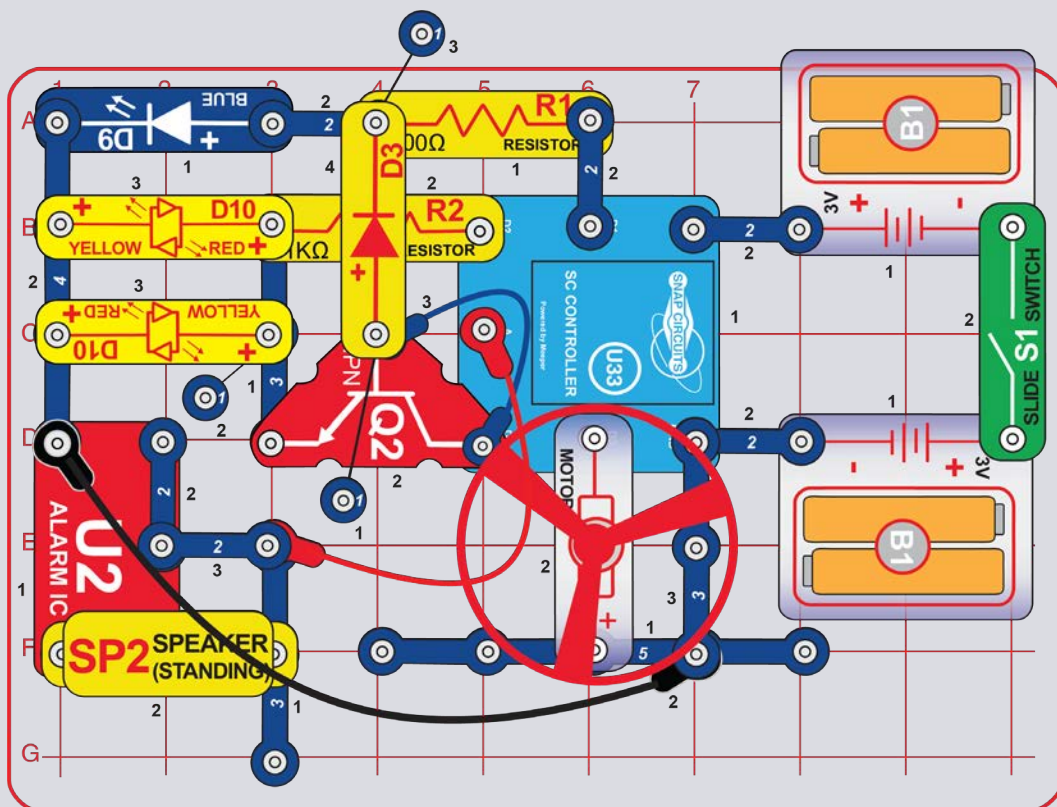


This complex circuit is shown on the cover of your box and manual, use that picture as a guide in building it.



CODING CHALLENGE

- Flash lights and play sounds, then launch the fan.



 **WARNING:** Moving parts. Do not touch the fan or motor during operation. Do not lean over the motor. Fan may not rise until switch is released. Eye protection is recommended for this circuit.

CODING CHALLENGE

- Spin the fan, play a siren, and light 3 LEDs at the same time.

COUNTDOWN

Build the circuit shown here, note that the blue jumper wire is connected beneath the NPN transistor (Q2). Turn on the switch (S1). Open the Snap Circuits® Coding app, connect to the SC Controller, and use Circuit Control mode to activate lights, a siren, or the motor (M1) and fan. See project 1 and pages 34-42 to review how to use the app.

Next, put the app in BOTCode™ mode and create some code to activate lights, sound, or motion, or use the “Countdown” program shown below. Experiment with changing parameters for commands, such as the time duration.

What to do next?

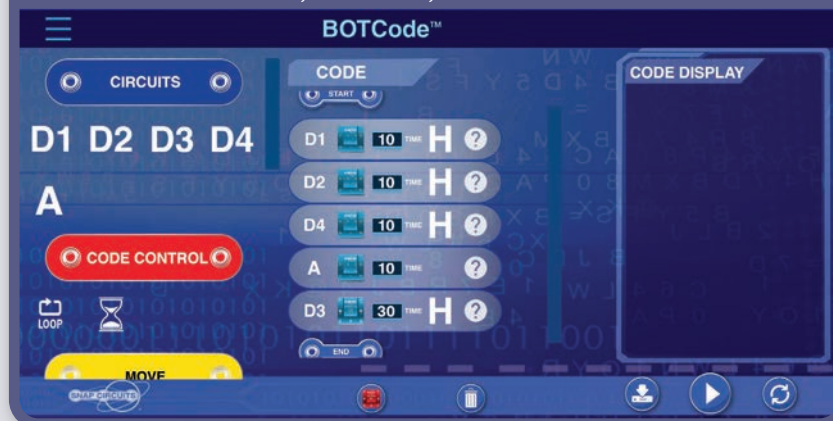
Repeat the preceding projects using BLOCKLY coding. BLOCKLY is described at the end of project 1.

Now you are ready to
code on your own!



Control Screen in Circuit Mode

BOTCode™ Screen: Countdown: light 1 LED, then 2 LEDs, then 3 LEDs, then siren, then launch fan



SNAP CIRCUITS® CODING APP INSTRUCTIONS:



MEET THE SC CONTROLLER

The SC Controller module (U33) has 5 outputs (D1, D2, D3, D4, and A) that are controlled through Bluetooth using an app on your device. D1-D2 and D3-D4 are paired so they can each control a motor in both directions and can be set to either of two output voltage levels, called H (Higher) and L (Lower). Output A has low power and cannot control most motors.

The SC Controller can be controlled from the Snap Circuits® Coding App on your Bluetooth device in three ways:

1. Control (remote control in real-time).
2. BOTCode™ (simple graphical coding).
3. BLOCKLY coding.

SC CONTROLLER:

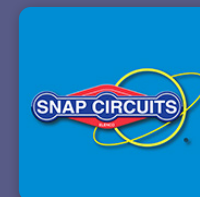
- (+) - power input from batteries
- GND - power return to batteries
- D1 - output connection for a motor, paired with D2, higher & lower levels
- D2 - output connection for a motor, paired with D1, higher & lower levels
- A - output connection for low current uses, 4V output level
- D3 - output connection for a motor, paired with D4, higher & lower levels
- D4 - output connection for a motor, paired with D3, higher & lower levels

DOWNLOAD THE SNAP CIRCUITS® CODING APP:



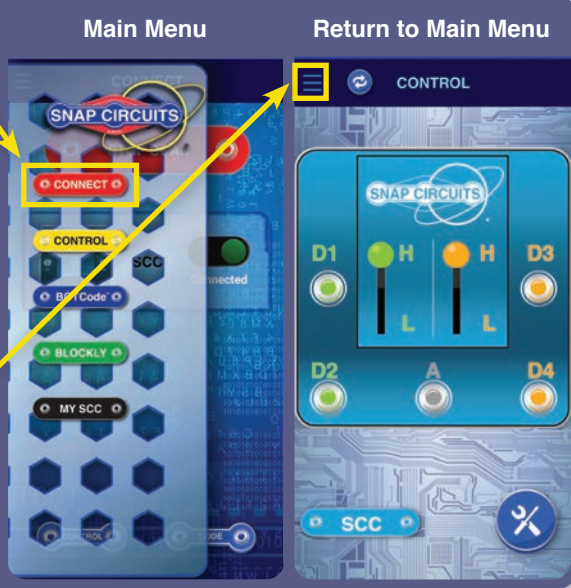
Go to the App Store on your device. The most recent version of the Snap Circuits® Coding App is available on iOS and Android, and may also be available on other devices. Check the Discover Coding product page at www.elenco.com/discover-coding.com for more information on what devices support the Snap Circuits® Coding App.

Search for 'Snap Circuits Coding'. Look for a page like the one shown here. Download the app, install it, and open it. Contact Elenco® if you have any problems.

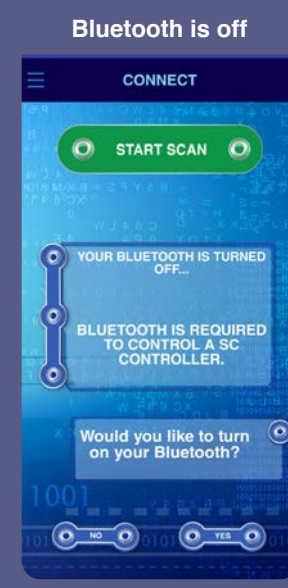


CONNECT TO THE SNAP CIRCUITS® CODING APP:

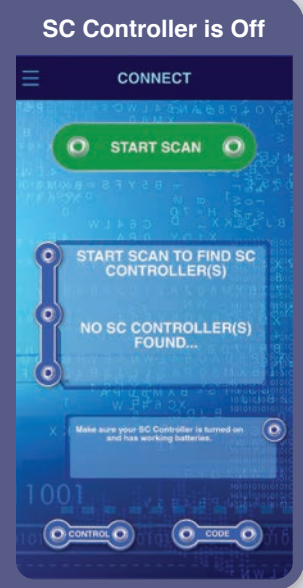
1. Open the Snap Circuits® Coding App, it should be showing the connect screen. (If you already had the app open then tap the icon in the upper-left corner and tap "Connect" on the menu.)



2. Make sure Bluetooth is turned on your device; If it's off, the app should prompt you to turn it on.

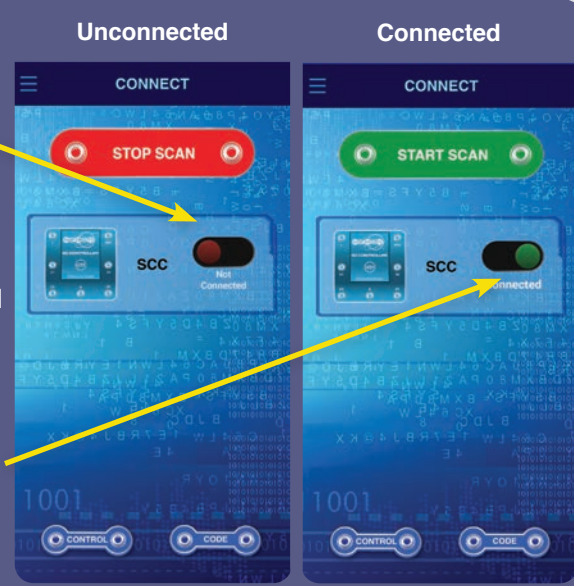


3. Turn on the slide switch (S1) in your circuit to turn on the SC Controller (U33). The Bluetooth connection light indicator on the top of the SC Controller will flash blue to indicate the SC Controller has power and the SC Controller's Bluetooth chip is waiting to be connected to a device.



4. The connect screen of the app will scan for available SC Controllers and within moments yours should appear as "Not Connected".

5. Tap on the red "Not Connected" dot to connect the app to your SC Controller. The red dot on the app should turn green, indicating your SC Controller module is now connected to the app. The Bluetooth indicator light on your SC Controller will now be a solid blue, indicating it is connected. You are now ready to Control or Code.

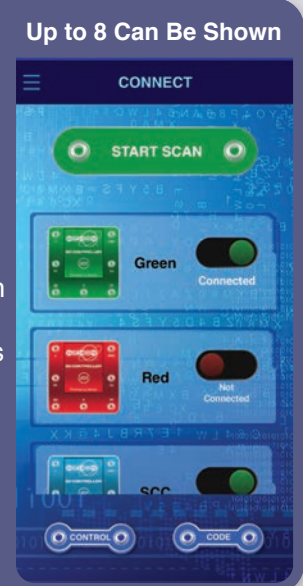


6. If connecting for the first time, by default your SC Controller name will be SCC. You can change your SC Controller name and other settings in the MY SCC screen. See page 39 for more details on personalizing your SC Controller.

7. You may select multiple SC Controllers (up to 8) to Connect to on this screen.

To Disconnect: Turn the SC Controller circuit off with the slide switch **OR** return to the Connect screen and tap the Connected button next to your SC Controller's name. This will disconnect your device from the SC Controller and someone else can now connect.

How to Reconnect: Turn on your SC Controller. Return to the Connect screen and select the SC Controller you wish to reconnect.

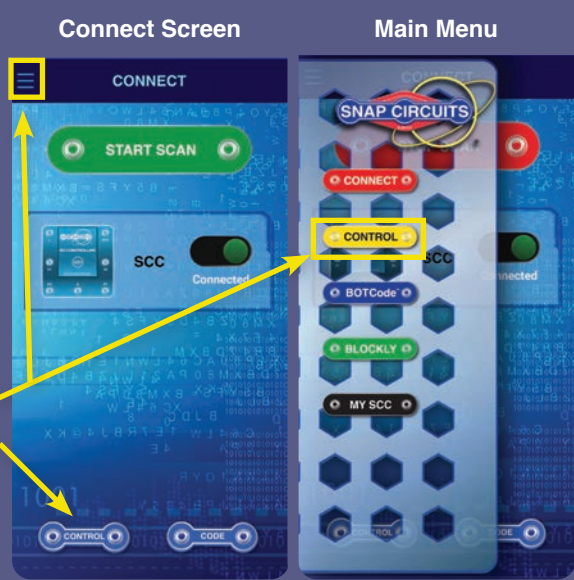


CONTROL:

The easiest way to use your SC Controller is with Control mode, which uses your device as a remote control.

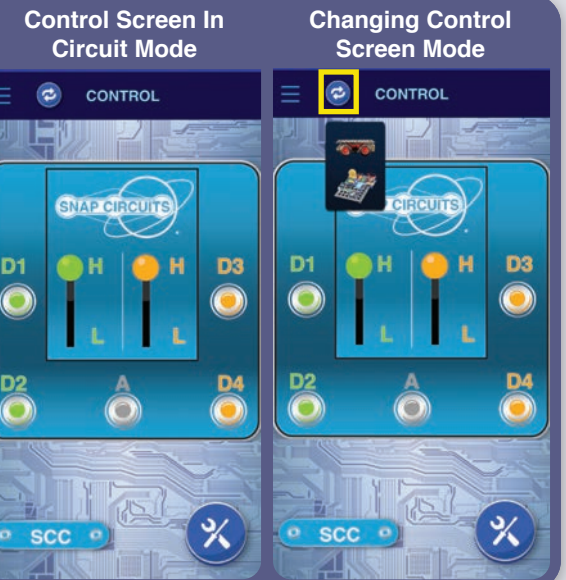
1. The Snap Circuits® Coding App should be open on your device and your SC Controller module should be connected to it as described above.

2. From the Connect screen, tap the Control button. (You can also use the navigation menu to go to the Control app screen from anywhere in the app.)



3. The Control screen begins in Circuit mode, you can switch to Drive mode using the mode icon. Circuit mode will be emphasized for the projects in this booklet. Drive mode is primarily intended for using your SC Controller with vehicles using two motors, which may be available in other sets. Drive Control mode is described on page 40.

4. Use the controls to turn the LEDs in your circuit on and off.



CIRCUIT MODE FEATURES:

- 5 outputs for controlling your circuits: D1, D2, D3, D4 and A. Simply press the button to turn on/off the circuit output. Use these to turn the LEDs in your circuit on and off.
- D1-D4 have Higher and Lower Voltage Level Controls (typically 5V and 3V but varies depending on your battery voltage). Select Higher (H) or Lower (L) voltage to change the output voltage level. D1 & D2, and D3 & D4, are paired and must always be the same voltage level (H or L). Use H and L to change the brightness of LEDs in your circuit that are turned on.
- The A output is 4V but can only supply low currents, so it cannot be used to control the motor (M1) directly.
- You can Control & Code circuit paths independently or together. You can turn on all 5 circuit outputs (controlling 5 LEDs in this circuit) at a time or turn them on/off individually.
- You can control 2 SC Controllers in the App at once (for up to 10 outputs).

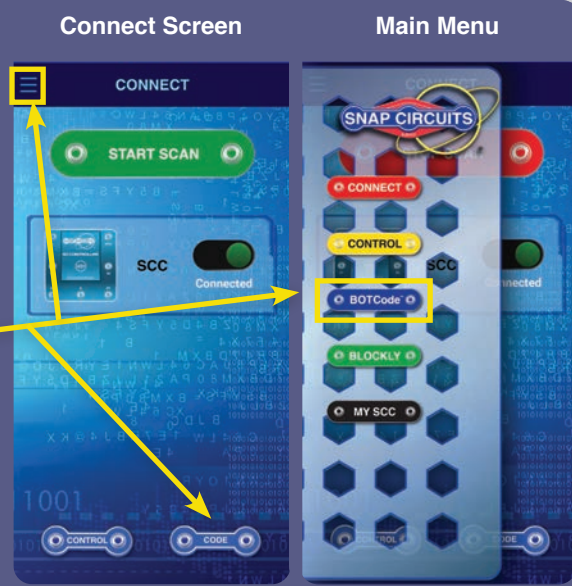


CREATE BOTCODE™:

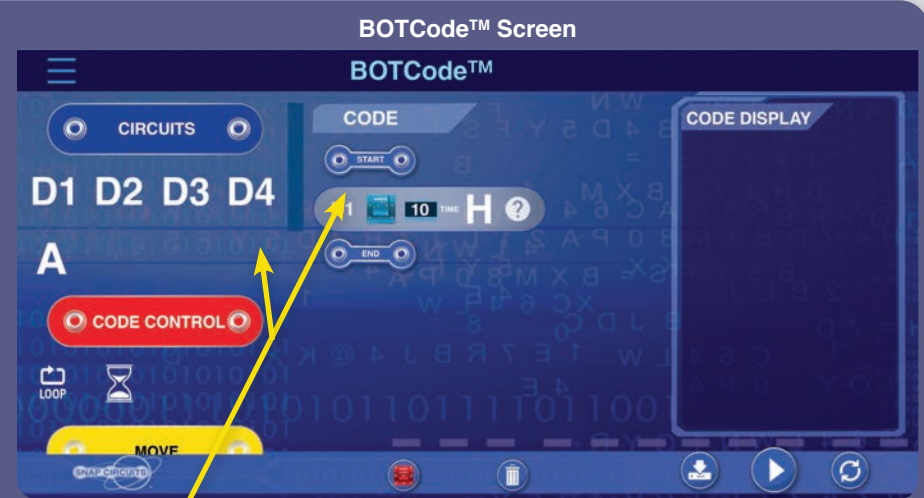
BOTCode™ uses Scratch-like drag and drop coding to make it easy to program the SC Controller. You can turn on lights, sounds, or motors, in any order or for different durations.

1. The Snap Circuits® Coding App should be open on your device and your SC Controller module should be connected to it as described earlier.

2. From the Connect screen, tap the Code button to get to the BOTCode™ screen. (You can also use the navigation menu to go to the Code screen from anywhere in the app.) With BOTCode™ you can program sequences of actions for your SC Controller and see them in action. Turn your device sideways – BOTCode™ will always be locked in landscape mode.



3. To start, tap & drag one of the actions from Code Control to the Code section.
4. If you want to rearrange actions in the sequence, just tap-n-drag those, too!
5. Now, tap the Button with the Play icon in the lower right hand corner. The SC Controller activates the LEDs in this circuit as per the program you entered.
6. Watch your Code execute in the BOTCode™ section.
 - a. The command that is running will be highlighted in the BOTCode™ section.
 - b. The Java code that is generated for that command is displayed in the Code Display section. Learn real Java Code with your BOTCode™ programs.
7. To repeat running the Code, hit the Loop Sequence button next to the Start button. To stop repeatedly running the Code hit the Loop Sequence button again.
8. Utilize different types of commands:
 - a. Circuits Control: commands to turn on and off the SC Controller outputs.
 - b. Code Control: commands to loop or delay your code.
 - c. Move & Turn Controls. commands for Forward, Reverse, Turns, & Spins for time durations or by rotations. These will mostly be used with vehicles.



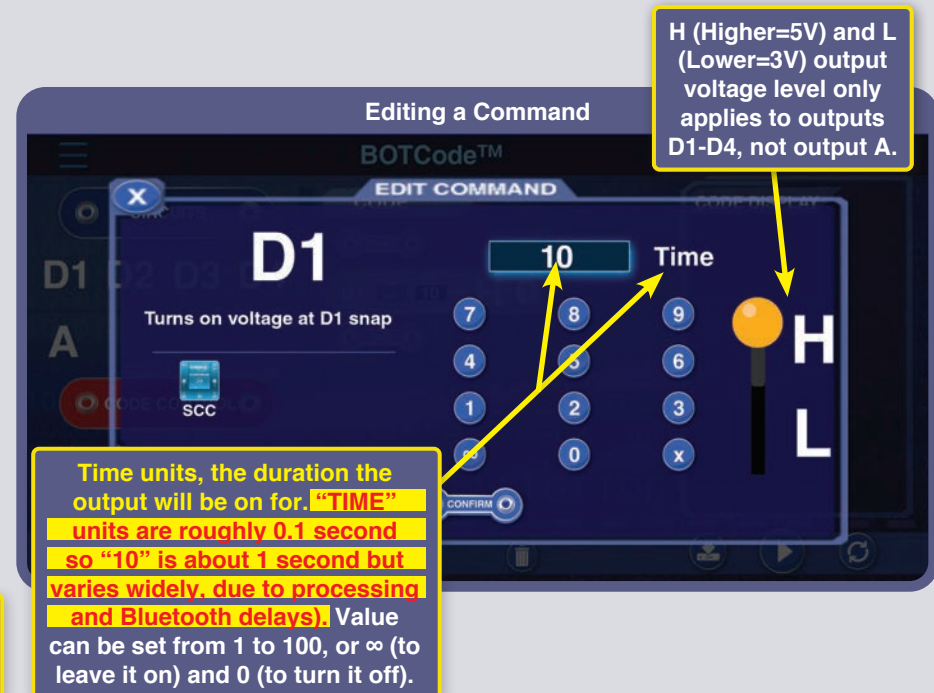
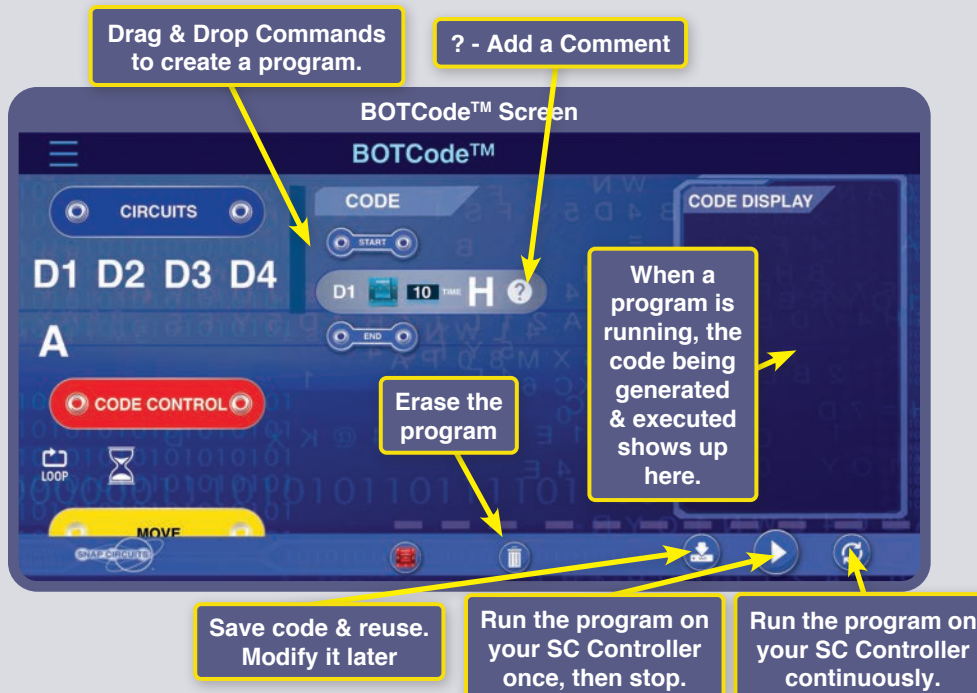
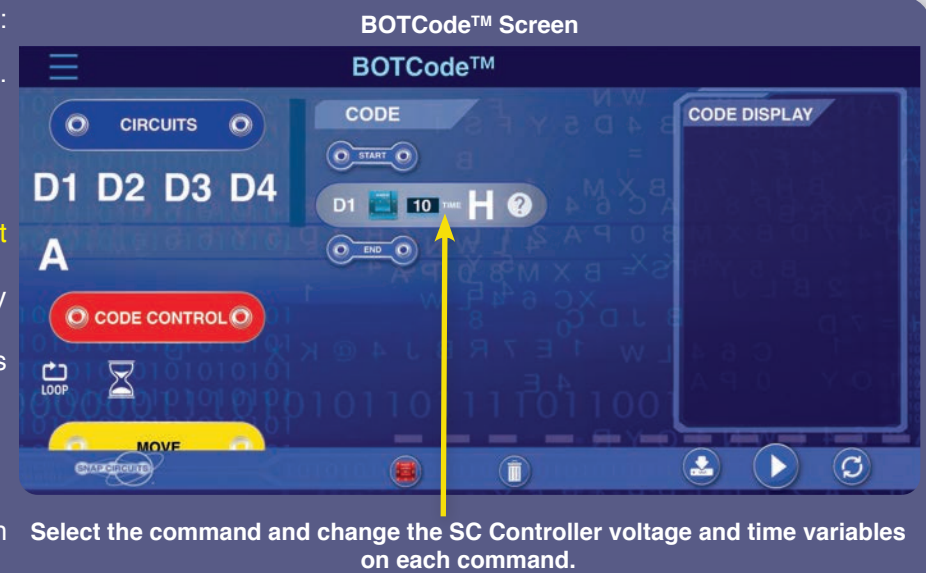
Drag & Drop Commands from the choices at the left to the CODE area in the center to create a program routine.

EDITING & SAVING BOTCODE™

You can change the duration or output voltage level for your BOTCode™ commands:

1. The App should be open to the BOTCode™ screen with some commands entered.
2. Tap that command in the CODE section.
3. The Edit Command screen will appear.
 - a. Change the duration of the command. "TIME" units are roughly 0.1 seconds but varies due to processing and Bluetooth delays.
 - b. Change whether the output voltage level is H (Higher) or L (Lower). This only applies to outputs D1-D4, not output A.
 - c. If you are running more than one SC Controller then select the SC Controllers that will run this command.
 - d. Press 'Confirm' to save your changes.
8. Run your code.

Note: You must be connected to your SC Controller in order to program it with commands.



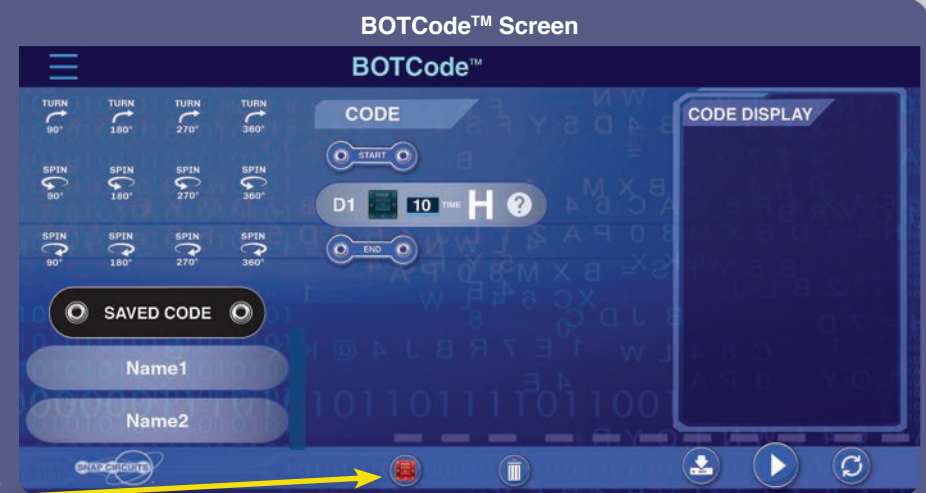
To Save your programs:

1. Tap the 'Save' Button in the lower right corner. Enter in the Name for your routine, then tap 'Save'. You have now saved your new routine to your device.
2. To find your newly saved masterpiece, go to the bottom of the commands menu (where you drag commands from). Your program will appear under the 'Saved Code' banner.

To run previously saved programs:

Drag the saved routine in to the CODE section, just like any other command. To save changes you make to a previously saved program, be sure that you call it the exact same name when you tap 'Save' again.

Note: Re-assign commands - if you do not have the same SC Controller connected when a command was added to the program (or if no SC Controller was connected) then BOTCode™ will ask you to reassign commands. What this does is take all connected SC Controllers and assign them to any unassigned commands. You can also press the Reassign Commands button.



Saved programs are below the commands menu

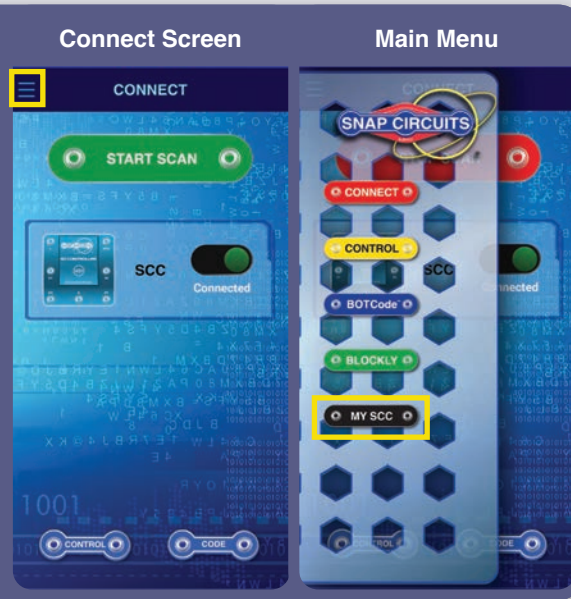
CODE SHARING: For instructions on how to import BOTCode™ programs that other people created, or to export your programs to others, go to www.elenco.com/discover-coding. Some of the sample programs in this booklet are available there.

PERSONALIZING YOUR SC CONTROLLER

You can change the name used for your SC Controller in the app, as well as change the icons and colors. This is not necessary, but makes it easy to know which SC Controller is which when multiple SC Controllers are nearby.

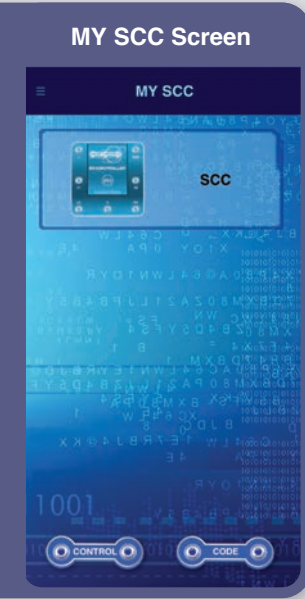
1. Open the SC Controllers app and connect your SC Controller module. (NOTE: In order to personalize any SC Controller you must be connected to it.

2. Navigate to the MY SCC screen using the icon in the upper left hand corner.



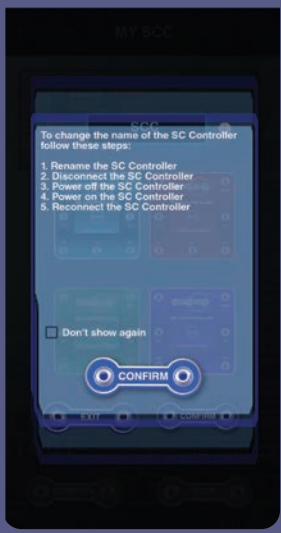
3. Your SC Controller should show up with an icon and name. If several SC Controllers are connected then all will be shown.

4. Tap your SC Controller to pull up the Edit instructions.



5. Read the instructions and tap "Confirm" button to proceed.

Change Instructions

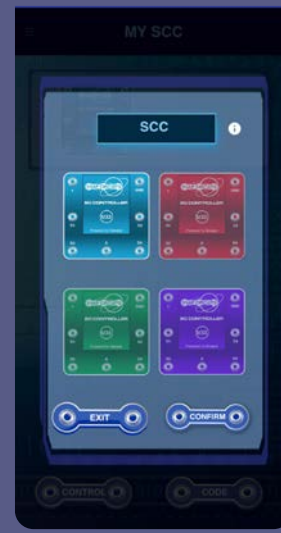


6. Tap the icon color you like and rename it.

7. To save your changes, tap the "Confirm" button.

8. To ensure that the changes were saved, disconnect the SC Controller, then turn off the SC Controller, then turn on the SC Controller, and then reconnect the SC Controller.

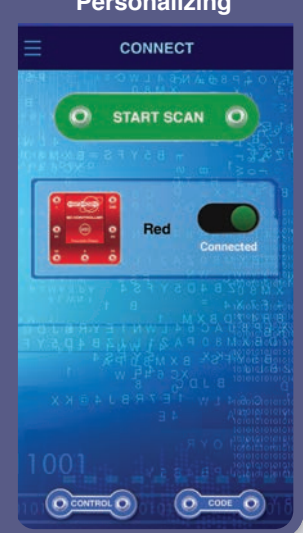
Personalize Screen



9. Your new SC Controller's name will now be displayed in the Connect, Control, and MY SCC screens.

10. Other users will see your SC Controller's new name when they return to the Connect screen in their app.

MY SCC Screen After Personalizing



DRIVE CONTROL MODE

The Control screen will usually be used in Circuit Control mode, but a Drive Control mode is also available. Drive Control mode is primarily intended for using your SC Controller with vehicles using two motors, which may be available in other sets. All the projects in this book use only Circuit Control mode, however Drive mode can be used with your Discover Coding set to turn on several outputs at once and produce some interesting effects.

1. The Control screen begins in Circuit mode, you can switch to Drive mode using the landscape icon.

Changing Control Screen Mode



2. There are 3 different Drive modes. You can experiment by having these control the 5 LEDs in project 1 circuit and others.

- Command Drive, is the easiest mode. Great to get started.
- Tank Drive, a two-handed drive control which gives you direct control over each of the back motors.
- Touch Drive, a super-responsive, joystick-like controller which lets you touch and drag where you want the vehicle to go (touch the center of the controls area and drag it in the direction you want to go).

3. The Driving Controls provide the commands for Forward/Reverse, Left/Right Turn and Left/Right Spin, replacing the D1-D4 controls in Circuit mode. The A output is available to control other functions, such as a horn.

4. Switch Drive modes using the left and right arrows above the Driving Controls.

Drive Control Mode



Select which SC Controller (if more than one)

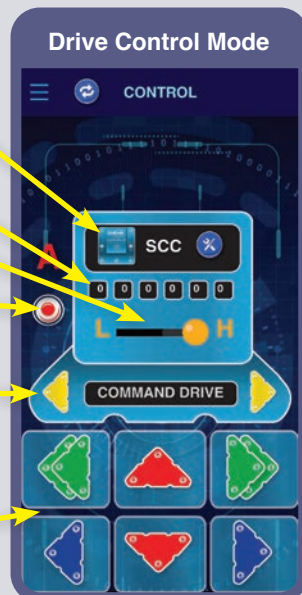
Odometer

Speed

A Output Control

Select which Drive mode (Command, Tank, or Touch)

Command Drive Controls



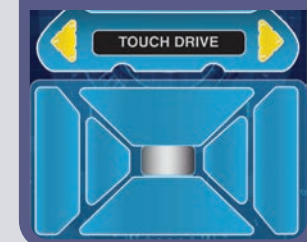
VEHICLE CONTROL WITH THE SC CONTROLLER (U33):

Vehicle commands assume that D1-D2 outputs on the SC Controller are connected to a vehicle's left motor (motor "+" or forward to D1), and that the D3-D4 outputs on the SC Controller are connected to a vehicle's right motor (motor "+" or forward to D3). The A output on the SC Controller is free to be used for sound, a light, or other functions.

Tank Drive Controls



Touch Drive Controls



Driving two or more vehicles:

1. Open the Snap Circuits® Coding App, connect two (or more) SC Controllers, and go to the Drive Control mode screen.
2. Once on the Drive screen (and with your vehicles on a safe surface), try to drive your vehicles. Each of them now drive in perfect sync with one another! Note: In DRIVE mode all SC Controllers receive the same control signals - they cannot be controlled independently at the same time.
3. If you want to select specific SC Controller vehicles to drive at once, simply tap that SC Controller's icon to Stop/Start driving it. The other SC Controller(s) will remain connected, but if it's faded, it won't receive a signal.
4. You can connect up to eight SC Controller vehicles and see what kinds of synchronized builds you can create!

Drive Mode With Several SC Controllers



SC Controllers not receiving Drive commands

SC Controllers receiving Drive commands

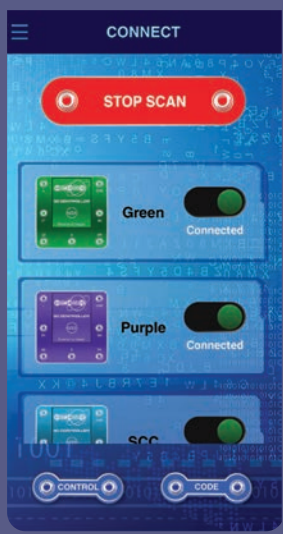
BOTCODE™ WITH MULTIPLE SC CONTROLLERS

If you have several sets then you can code multiple SC Controllers (which could be on separate vehicles of some form) to do the same or different commands.

The app should be open to the Code screen, with some commands entered, and the app connected to your SC Controllers.

1. When you edit a command to change the time or voltage level, you can also select which SC Controller(s) the command will apply to.
2. Assign one command to one SC Controller and another to your other SC Controller – tap their portrait to choose which SC Controllers execute the command.
3. Try running the code and watch your SC Controllers start to work in tandem!

Multiple SC Controllers Connected



Editing a Command



Select which SC Controllers to command, up to 8 may be controlled at once

DESCRIPTION OF BOTCODE™ COMMANDS

D1

Turn on D1 output (similar for D2, D3, D4) for the time duration shown and at the voltage level (H or L) shown.

A

Turn on A output for the time duration shown.



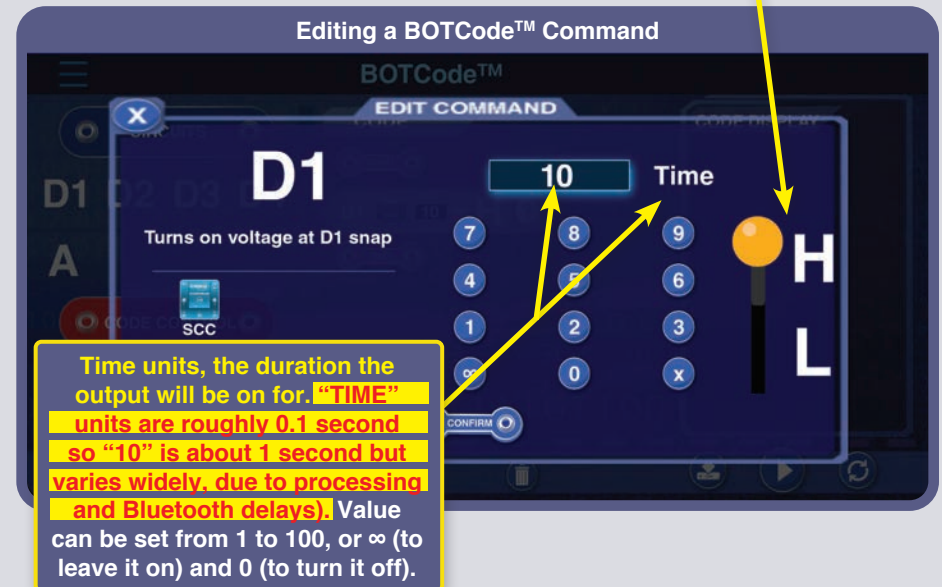
LOOP

Set up a group of commands to be executed for the specified number of times (1-100).



Wait for the time duration shown before executing any more commands. Time units are roughly 0.1 seconds (varies widely, due to processing and Bluetooth delays). Value can be set from 1 to 100.

H (Higher=5V) and L (Lower=3V) output voltage level only applies to outputs D1-D4, not output A.



VEHICLE COMMANDS WITH THE SC CONTROLLER (U33): Vehicle commands assume that the D1-D2 outputs on the SC Controller are connected to a vehicle's left motor (motor "+" or forward to D1), and that the D3-D4 outputs on the SC Controller are connected to a vehicle's right motor (motor "+" or forward to D3). The A output on the SC Controller is free to be used for sound, a light, or other functions.



BACK



TURN



SPIN



TURN
360°

NOTE: Turning on D1-D4 and A for a set time means the program will turn that output on, wait for that duration, then turn that output off before moving on to the next command. Set the duration to ∞ to turn an output on and leave it on (while the program performs other commands), then later set the duration to 0 if you want to turn it off later in the program.

NOTES:

NOTES:

CREATE YOUR OWN CHALLENGES:

CREATE YOUR OWN CHALLENGES:

CREATE YOUR OWN CHALLENGES:

FCC Regulatory Compliance

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.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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.

ISED Regulatory Compliance

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions: (1) This device may not cause interference. (2) This device must accept any interference, including interference that may cause undesired operation of the device.

RF Exposure Compliance

This equipment complies with FCC/IC radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

CAN ICES-3 (B)/NMB-3(B)

Other Snap Circuits® Products!

For a listing of local toy retailers who carry Snap Circuits® visit elenco.com or call us toll-free at 800-533-2441.

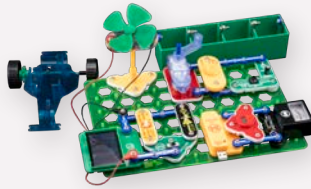
For Snap Circuits® accessories or additional parts visit elenco.com.

SNAP CIRCUITS® GREEN ENERGY

Model SCG-225

Let's help the environment and have fun learning about alternative energy, conserving energy, and how the electricity in your world works.

- Includes 45 parts build over 125 projects.
- Easy-to-follow color manual diagrammed like no other Snap Circuits® Kit.



SNAPINO

Model SC-SNAPINO

Snapino is an introduction to the open source Arduino® Hardware software environment. Learn to code and utilize your Snap Circuits modules at the same time!

- A great introduction to coding and the Arduino platform
- Arduino is a microcontroller used in robotics and other applications
- Includes over 15 parts build over 20 projects.

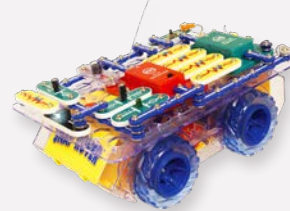


RC SNAP ROVER®

Model SCROV-10

Have FUN building your own RC Snap Rover®. This innovative kit offers a fun, hands-on education in electronics, allowing kids to create rovers and other fun devices by snapping together working circuitry. Guide your Snap Rover® with the easy-to-use remote control.

- Over 40 experiments & over 50 parts
- Run up to three Rovers at once
- Wireless Remote Control included



SNAP CIRCUITS® 3D ILLUMINATION

Model SC-3Di

SNAP CIRCUITS® 3D Illumination uses building blocks with snaps to build the different electrical and electronic circuits in the projects. Each block has a function: there are switch blocks, light blocks, battery blocks, different length wire blocks, etc.

- 3-Color Light Tunnel, Mirrors & Reflecting Circuits
- Projector With 6 Images



SNAP CIRCUITS® ARCADE

Model SCA-200

Snap Circuits® Arcade is an exciting introduction to problem solving, following directions and the satisfaction of a job well done.

- 30 Snap Modules included
- More than 200 projects
- Enjoy completing projects using a programmable Word Fan, Dual LED Display and a pre-programmed microcontroller.



SNAP CIRCUITS® LIGHT

Model SCL-175

- Contains over 55 parts. Build over 175 exciting projects.
- Color organ controlled by smart-phone, voice or finger.
- Enjoy your music as the lights change to the beat.
- Snap-together parts require no tools and ensure correct connections.
- Clear and concise illustrated manual included & available online



Smart-phone shown not included.

SNAP CIRCUITS® PRO

Model SC-500

- Over 75 parts and over 500 projects



SNAP CIRCUITS® MOTION

Model SCM-165

- Over 50 parts and over 165 projects



SNAP CIRCUITS®

Model SC-300

- Over 60 parts and over 300 projects



SNAP CIRCUITS® EXTREME

Model SC-750

- Over 80 parts and over 750 projects



Important: If any parts are missing or damaged, **DO NOT RETURN TO RETAILER.** Call toll-free at: (800) 533-2441 or e-mail us at: help@elenco.com.

Customer Service

150 Carpenter Ave. Wheeling, IL 60090 U.S.A.

Note: A complete parts list is on page 2 in this manual.

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SCD-303 Discover Coding Parts Layout

