Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!

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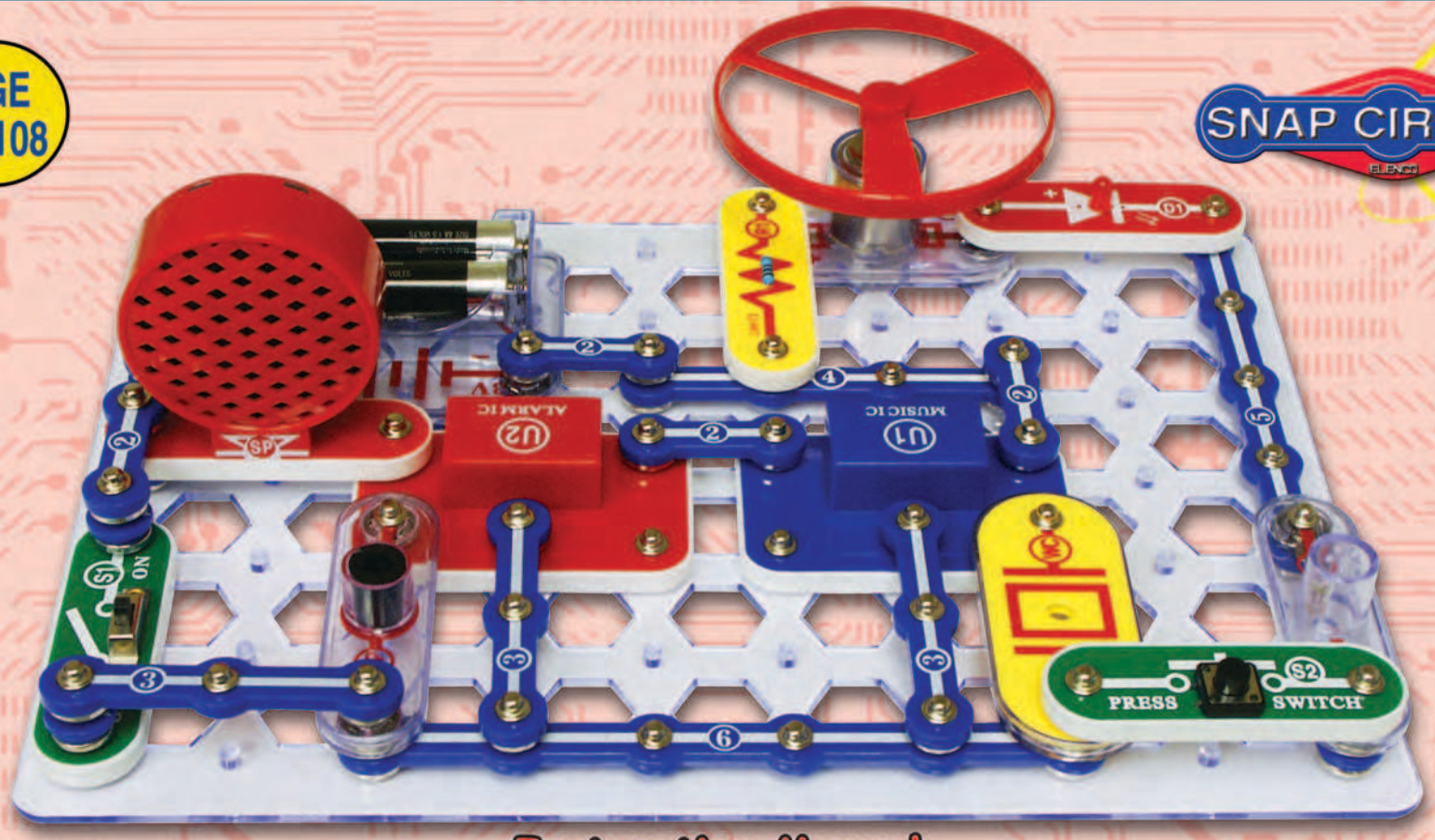
ELECTRONIC SNAP CIRCUITS®

Experiments 1-101

AGE 8 - 108



Instruction Manual

Project 58

ELENCO®

REV-H Revised 2012
Patent # 7144255
753102

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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 ASTM F963-96A

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.
5. If the motor spins but does not balance the fan, check the black plastic piece with three prongs on the motor shaft. Be sure that it is at the top of the shaft.

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 6 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:

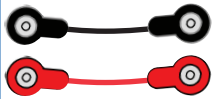
- Use only 1.5V AA type, alkaline batteries (not included).
- Insert batteries with correct polarity.
- Non-rechargeable batteries should not be recharged. Rechargeable batteries should only be charged under adult supervision, and should not be recharged while in the product.
- Do not mix old and new 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.

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

Note: If you have the more advanced Models SC-300, SC-500, or SC-750, there are additional part lists in the other project manuals.

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.

Qty.	ID	Name	Symbol	Part #
❒ 1		Base Grid (11.0" x 7.7")		6SCBG
❒ 3	(1)	1-Snap Wire		6SC01
❒ 6	(2)	2-Snap Wire		6SC02
❒ 3	(3)	3-Snap Wire		6SC03
❒ 1	(4)	4-Snap Wire		6SC04
❒ 1	(5)	5-Snap Wire		6SC05
❒ 1	(6)	6-Snap Wire		6SC06
❒ 1	(WC)	Whistle Chip		6SCWC
❒ 1	(S1)	Slide Switch		6SCS1
❒ 1	(S2)	Press Switch		6SCS2
❒ 1	(RP)	Photoresistor		6SCRP

Qty.	ID	Name	Symbol	Part #
❒ 1	(D1)	Red Light Emitting Diode (LED)		6SCD1
❒ 1	(L1)	2.5V Lamp		6SCL1
❒ 1	(B1)	Battery Holder - uses 2 1.5V type AA (not included)		6SCB1
❒ 1	(SP)	Speaker		6SCSP
❒ 1	(U1)	Music Integrated Circuit		6SCU1
❒ 1	(U2)	Alarm Integrated Circuit		6SCU2
❒ 1	(U3)	Space War Integrated Circuit		6SCU3
❒ 1 ❒ 1	(M1)	Motor Fan		6SCM1 6SCM1F
❒ 1	(R1)	100Ω Resistor		6SCR1
❒ 1 ❒ 1		Jumper Wire (Black) Jumper Wire (Red)		6SCJ1 6SCJ2

You may order additional / replacement parts at our website: www.snapcircuits.net

How To Use It

The Electronic Snap Circuits® kit has 101 projects. They are simple to build and understand.

The Snap Circuits® kit 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, lamp blocks, battery blocks, different length wire blocks, etc. These blocks are in different colors and have numbers on them so that you can easily identify them. The circuit you will build is shown in color and with numbers, identifying the blocks that you will use and snap together to form a circuit.

For Example:

This is the switch block which is green and has the marking (S1) on it as shown in the drawings. Please note that the drawing doesn't reflect the real switch block exactly (it is missing the ON and OFF markings), but gives you the general idea of which part is being used in the circuit.

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.

To build each circuit, you have a power source block number (B1) that needs two (2) "AA" batteries (not included with the Snap Circuits® kit).

A large clear 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. You do not need this base to build your circuits, but it does help in keeping your circuit together neatly. 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.

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.

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

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.

About Your Snap Circuits® Parts

Our Student Guides give much more information about your parts along with a complete lesson in basic electronics. See www.snapcircuits.net/learn.htm or page 45 for more information.

(Part designs are subject to change without notice).

Note: If you have the more advanced Models SC-300, SC-500, or SC-750, there is additional information in your other project manual(s).

The **base grid** functions like the printed circuit boards found in most electronic products. It is a platform for mounting parts and wires (though the wires are usually "printed" on the board.

The blue **snap wires** are just wires used to connect other 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 and black **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 (like the projects using water).

The **batteries (B1)** produce an electrical voltage using a chemical reaction. This "voltage" can be thought of as electrical pressure, pushing electrical "current" through a circuit. This voltage is much lower and much safer than that used in your house wiring. Using more batteries increases the "pressure" and so more electricity flows.

The **slide switch (S1)** connects (ON) or disconnects (OFF) the wires in a circuit. When ON it has no effect on circuit performance.

The **press switch (S2)** connects (pressed) or disconnects (not pressed) the wires in a circuit, just like the slide switch does.

Resistors, such as the **100Ω resistor (R1)**, "resist" the flow of electricity and are used to control or limit the electricity in a circuit. Increasing circuit resistance reduces the flow of electricity.

The **photoresistor (RP)** is a light-sensitive resistor, its value changes from nearly infinite in total darkness to about 1000Ω when a bright light shines on it.

A light bulb, such as in the **2.5V lamp (L1)**, contains a special wire that glows bright when a large electric current passes through it. Voltages above the bulb's rating can burn out the wire.

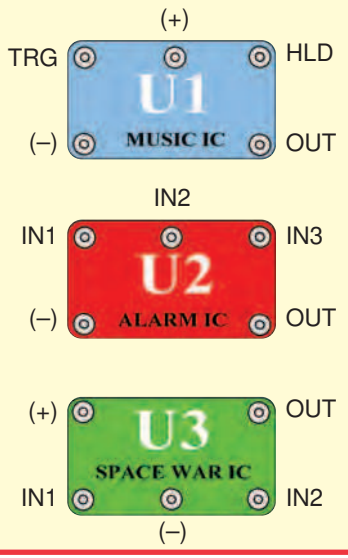
The **motor (M1)** converts elecricity into mechanical motion. Electricity is closely related to magnetism, and an electric current flowing in a wire has a magnetic field similar to that of a very, very tiny magnet. Inside the motor is three coils of wire with many loops. If a large electric current flows through the loops, the magnetic effects become concentrated enough to move the coils. The motor has a magnet inside so, as the electricity moves the coils to align them with the permanent magnet, the shaft spins.

The **speaker (SP)** converts electricity into sound. It does this by using the energy of a changing electrical signal to create mechanical vibrations (using a coil and magnet similar to that in the motor), these vibrations create variations in air pressure which travel across the room. You "hear" sound when your ears feel these air pressure variations.

The **whistle chip (WC)** contains two thin plates. When an electrical signal is applied across them they will stretch slightly in an effort to separate (like two magnets opposing each other), when the signal is removed they come back together. If the electrical signal applied across them is changing quickly, then the plates will vibrate. These vibrations create variations in air pressure that your ears feel just like sound from a speaker.

The **LED (D1)** is a light emitting diode, and may be thought of as a special one-way light bulb. In the "forward" direction (indicated by the "arrow" in the symbol) electricity flows if the voltage exceeds a turn-on threshold (about 1.5V); brightness then increases. A high current will burn out the LED, so the current must be limited by other components in the circuit. LEDs block electricity in the "reverse" direction.

Some types of electronic components can be super-miniaturized, allowing many thousands of parts to fit into an area smaller that your fingernail. These "integrated circuits" (ICs) are used in everything from simple electronic toys to the most advanced computers. The music, alarm, and space war ICs (U1, U2, and U3) in Snap Circuits® are actually modules containing 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. The descriptions for these modules are given here for those interested, see the projects for connection examples:



Music IC:

(+) - power from batteries
(–) - power return to batteries
OUT - output connection
HLD - hold control input
TRG - trigger control input

Music for a few seconds on power-up, then hold HLD to (+) power or touch TRG to (+) power to resume music.

Alarm IC:

IN1, IN2, IN3 - control inputs
(–) - power return to batteries
OUT - output connection

Connect control inputs to (+) power to make five alarm sounds, see project 22 for configurations.

Space War IC:

(+) - power from batteries
(–) - power return to batteries
OUT - output connection
IN1, IN2 - control inputs

Connect each control input to (–) power to sequence through 8 sounds.

DO's 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, lamp, 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 the speaker, lamp, whistle chip, ICs (which must be connected properly), motor, photoresistor, or resistor.

ALWAYS use the LED and 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.

ALWAYS connect ICs using configurations given in the projects or as per the connection descriptions for the parts.

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

NEVER leave a circuit unattended when it is turned on.

NEVER touch the motor when it is spinning at high speed.

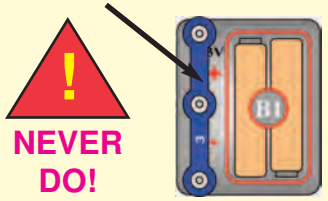
Note: If you have the more advanced Models SC-300, SC-500, or SC-750, there are additional guidelines in your other project manual(s).

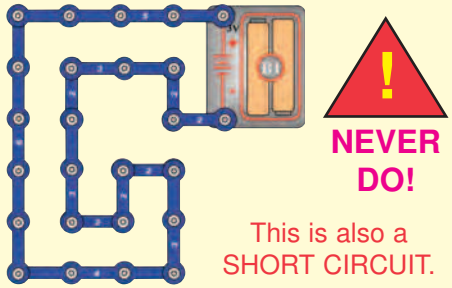
For all of the projects given in this book, the parts may be arranged in different ways without changing the circuit. For example, the order of parts connected in series or in parallel does not matter — what matters is how combinations of these sub-circuits are arranged together.

Warning to Snap Rover owners: Do not connect your parts to the Rover body except when using our approved circuits, the Rover body has a higher voltage which could damage your parts.

Examples of SHORT CIRCUITS - NEVER DO THESE!!!

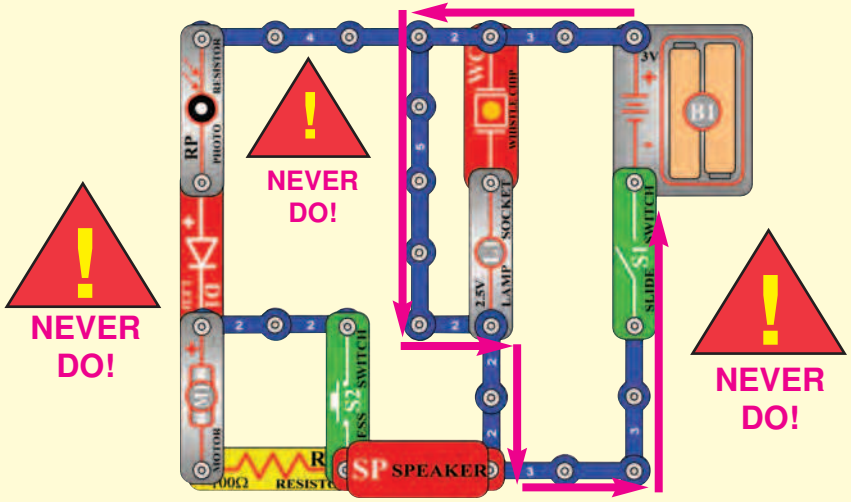
Placing a 3-snap wire directly across the batteries is a SHORT CIRCUIT.





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 you create. If they are unique, we will post them with your name and state on our website at **www.snapcircuits.net/kidkreations.htm**. Send your suggestions to Elenco®.

Elenco® provides a circuit designer so that you can make your own Snap Circuits® drawings. This Microsoft® Word document can be downloaded from **www.snapcircuits.net/SnapDesigner.doc** or through the **www.snapcircuits.net** website.

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

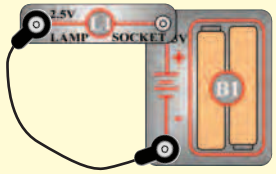
Advanced Troubleshooting (Adult supervision recommended)

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

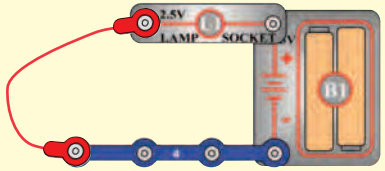
If you suspect you have damaged parts, you can follow this procedure to systematically determine which ones need replacing:

1. **2.5V lamp (L1), motor (M1), speaker (SP), and battery holder (B1):** Place batteries in holder. Place the 2.5V lamp directly across the battery holder, it should light. Do the same with the motor (motor + to battery +), it should spin to the right at high speed. "Tap" the speaker across the battery holder contacts, you should hear static as it touches. If none work, then replace your batteries and repeat, if still bad then the battery holder is damaged.

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



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



4. **Slide switch (S1) and Press switch (S2):** Build project #1, if the lamp (L1) doesn't light then the slide switch is bad. Replace the slide switch with the press switch to test it.

5. **100Ω resistor (R1) and LED (D1):** Build project #7 except initially use the speaker (SP) in place of the resistor, the LED should light. Then replace the speaker with the resistor; the LED should still light.

6. **Alarm IC (U2):** Build project #17, you should hear a siren. Then place a 3-snap wire between grid locations A1 and C1, the sound is different. Then move the 3-snap from A1-C1 to A3-C3 to hear a 3rd sound.

7. **Music IC (U1):** Build project #74 but use the press switch (S2) in place of the photoresistor (RP). Turn it on and the LED (D1) flickers for a while and stops, it resumes if you press and hold down the press switch. Then touch a 3-snap wire across base grid points A1 and C1 and the flickering resumes for a while.

8. **Space war IC (U3) and photoresistor (RP):** Build project #19, both switches (S1 and S2) should change the sound. Then replace the slide switch with the photoresistor, waving your hand over it should change the sound.

9. **Whistle chip (WC):** Build project #61 and if there is light on the photoresistor (RP) then you will hear sound from the whistle chip.

Note: If you have the more advanced models SC-300, SC-500, or SC-750, there are additional tests in your other project manual(s).

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You may order additional / replacement parts at: www.snapcircuits.net

Project Listings

Project #	Description	Page #	Project #	Description	Page #	Project #	Description	Page #
1	Electric Light & Switch	8	35	Motor Space Light	20	69	Space War Siren	34
2	DC Motor & Switch	8	36	Space Battle (II)	21	70	Quiet Water Alarm	34
3	Sound Activated Switch	9	37	Silent Space Battle	21	71	Light-Controlled Lamp	35
4	Adjusting Sound Level	9	38	Periodic Sounds	21	72	Voice-Controlled Lamp	35
5	Lamp & Fan in Series	10	39	Blinking Double Flashlight	21	73	Motor-Controlled Lamp	35
6	Lamp & Fan in Parallel	10	40	Motor-Controlled Sounds	22	74	Light-Controlled LED	36
7	Light Emitting Diode	11	41	More Motor Sounds	22	75	Sound-Controlled Time Delay LED	36
8	One Direction for LED	11	42	More Motor Sounds (II)	22	76	Motor-Controlled Time Delay LED	36
9	Conduction Detector	12	43	More Motor Sounds (III)	22	77	Space War Flicker LED	37
10	Space War Alarm Combo	12	44	More Motor Sounds (IV)	22	78	Music AND Gate	37
11	Flying Saucer	13	45	Light-Controlled Flicker	23	79	Flash and Tone	37
12	Decreasing Saucer Lift	13	46	More Sound Effects	23	80	Lamp, Speaker & Fan in Parallel	38
13	Two-Speed Fan	14	47	This OR That	24	81	Pencil Alarm	38
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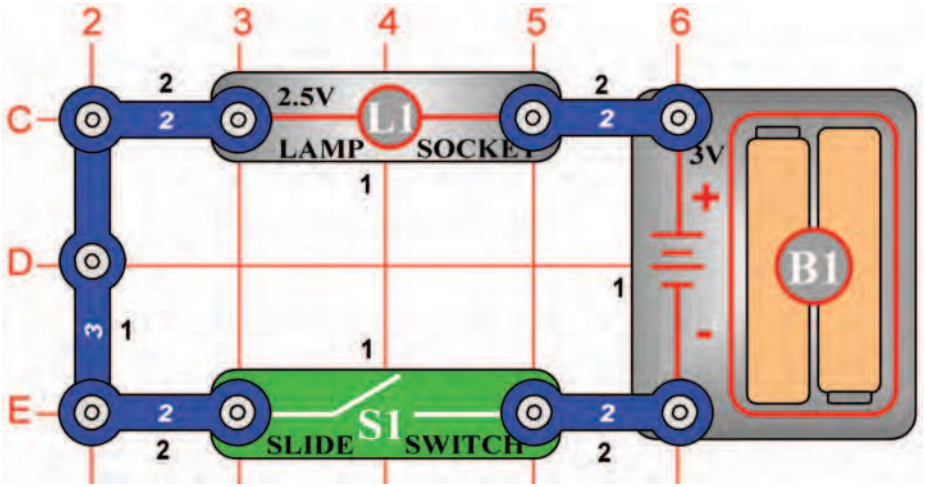
15	Musical Doorbell	15	49	Neither This NOR That	25	83	Fun with the Alarm IC	39
16	Momentary Alarm	15	50	NOT This AND That	25	84	Motor Sounds Combo	39
17	Alarm Circuit	16	51	Reflection Detector	26	85	Motor Sounds Combo (II)	39
18	Laser Gun	16	52	Quieter Reflection Detector	26	86	Music Alarm Combo	40
19	Space War	17	53	Flashing Laser Light with Sound	27	87	Bomb Sound	40
20	Light Switch	17	54	Space War Flicker	27	88	Bomb Sound (II)	40
21	Paper Space War	17	55	Spinning Rings	28	89	Light-Controlled LED (II)	41
22	Light Police Siren	18	56	Strobe the House Lights	28	90	Touch Light	41
23	More Loud Sounds	18	57	Race Game	29	91	Touch Sound	41
24	More Loud Sounds (II)	18	58	Using Parts as Conductors	29	92	Wacky Sounds	41
25	More Loud Sounds (III)	18	59	Spin Draw	30	93	Wackier Sounds	42
26	More Loud Sounds (IV)	18	60	Space War Flicker Motor	30	94	Really Wacky Sounds	42
27	Clap Sounds	19	61	Light-Controlled Sounds	31	95	Noisier Water Space War	43
28	More Clap Sounds	19	62	Light-Controlled Sounds (II)	31	96	Light/Water Space War	43
29	More Clap Sounds (II)	19	63	Light-Controlled Sounds (III)	31	97	OR/AND Space War Light	43
30	More Clap Sounds (III)	19	64	Light-Controlled Sounds (IV)	31	98	Simple Water Alarm	44
31	More Clap Sounds (IV)	19	65	Light-Controlled Sounds (V)	31	99	Simple Salt Water Alarm	44
32	Voice Light Diode	20	66	Electronic Bombing Game	32	100	Ambulance Water Alarm	44
33	Voice Control	20	67	Quiet Zone Game	33	101	Ambulance Contact Alarm	44
34	Motor Space Sounds	20	68	Space War Music Combo	33			

Project #1

Electric Light & Switch



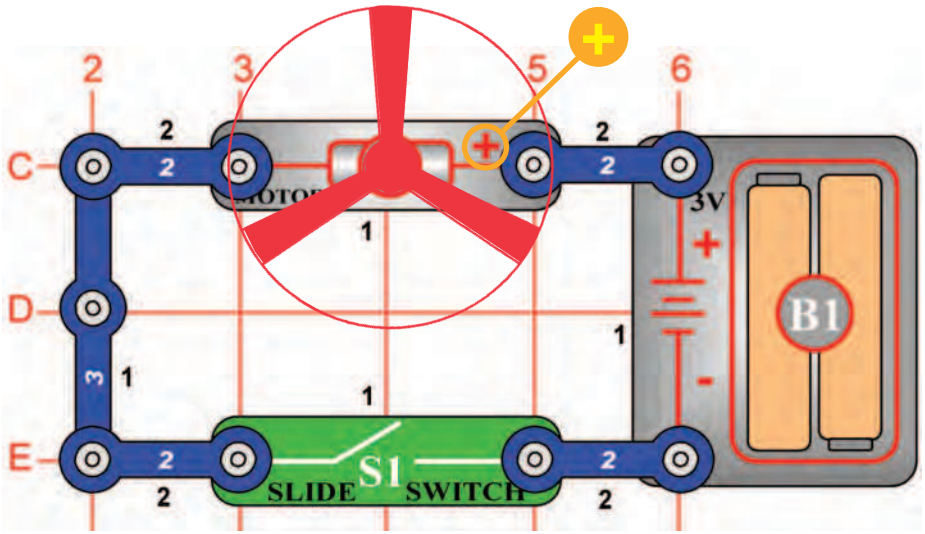
OBJECTIVE: To show how electricity is turned "ON" or "OFF" with a switch.

Build the circuit shown on the left by placing all the parts with a black 1 next to them on the base grid first. Then, assemble parts marked with a 2. Install two (2) "AA" batteries (not included) into the battery holder (B1).

When you close the slide switch (S1), current flows from the batteries through the lamp and back to the battery through the switch. The closed switch completes the circuit. In electronics this is called a closed circuit. When the slide switch is opened, the current can no longer flow back to the battery, so the lamp goes out. In electronics this is called an open circuit.

Project #2

DC Motor & Switch



OBJECTIVE: To show how electricity is used to run a Direct Current (DC) Motor.

Build the circuit shown on the left by placing all the parts with a black 1 next to them on the base grid first. Then, assemble parts marked with a 2.

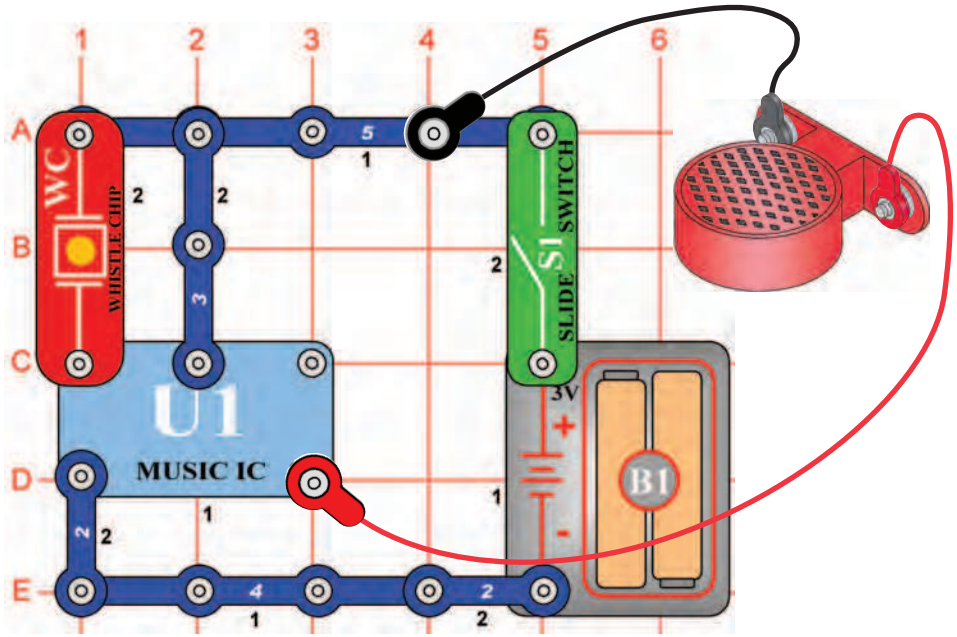
When you close the slide switch (S1), current flows from the batteries (B1) through the motor (M1) making it rotate. Place the fan blade on the motor shaft and close the slide switch. The motor will rotate forcing the fan blade to move air past the motor.

In this project, you changed electrical power into mechanical power. DC motors are used in all the battery powered equipment requiring rotary motion, such as a cordless drill, electric toothbrush, and toy trains that run on batteries just to name a few. An electric motor is much easier to control than gas or diesel engines.

WARNING: Moving parts. Do not touch the fan or motor during operation. Do not lean over the motor.

Project #3

Sound Activated Switch



OBJECTIVE: To show how sound can turn "ON" an electronic device.

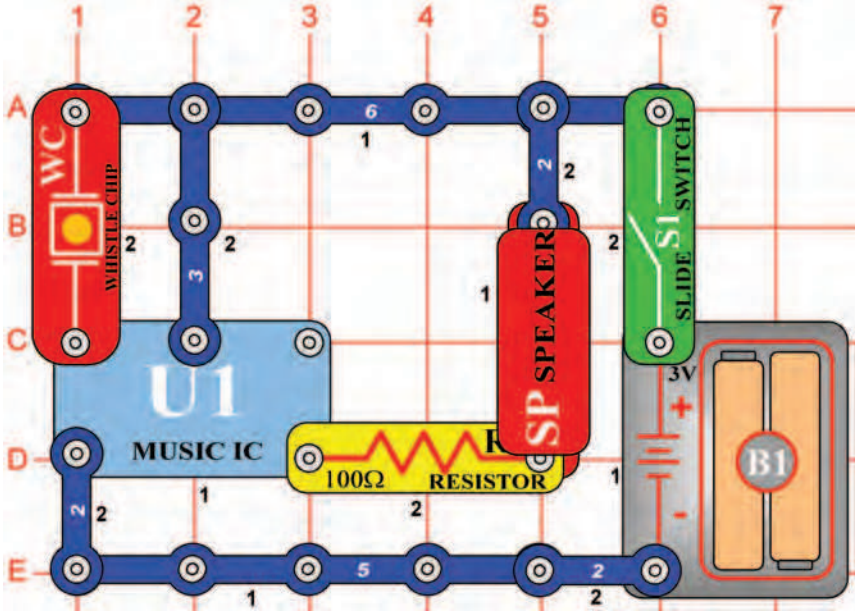
Build the circuit shown on the left by placing all the parts with a black 1 next to them on the base grid first. Then, assemble parts marked with a 2. Finally, lay the speaker (SP) on the table and connect it to the circuit using the jumper wires as shown.

When you close the slide switch (S1), the music may play for a short time, and then stop. After the music has stopped, clap your hands close to the whistle chip (WC) or tap the base with your finger. The music should play again for a short time, then stop. Blow on the whistle chip and the music should play.

You could connect the speaker using snap wires instead of the jumper wires, but then the speaker may create enough sound vibrations to re-activate the whistle chip.

Project #4

Adjusting Sound Level



OBJECTIVE: To show how resistance can lower the sound from the speaker.

Build the circuit shown on the left. When you close the slide switch (S1), the music may play for a short time and then stop. After the music has stopped, clap your hands close to the whistle chip (WC) or tap the base with your finger. The music should play again for a short time, then stop.

In this project, you changed the amount of current that goes through the speaker (SP) and reduced the sound output of the speaker. Resistors are used throughout electronics to limit the amount of current that flows.

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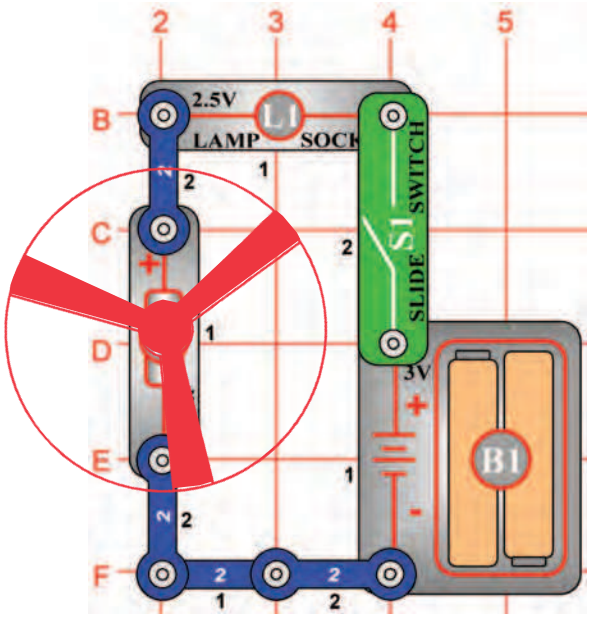
Project #5



Lamp & Fan in Series

OBJECTIVE: To show how a lamp can indicate when a fan is running.

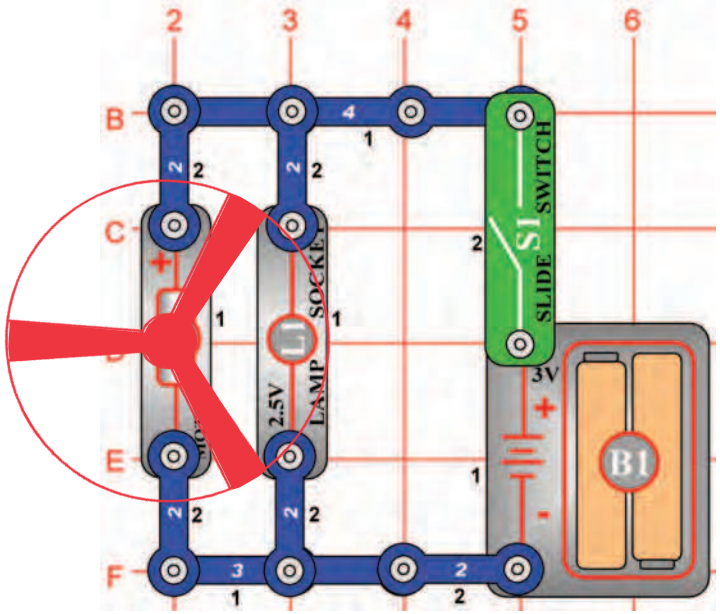
Build the circuit shown on the left by placing all the parts with a black 1 next to them on the base grid first. Then, assemble parts marked with a 2. Finally, place the fan blade on the motor (M1).

When you close the slide switch (S1), the fan will spin and the lamp (L1) should turn on. The fan will take a while to start turning due to inertia. Inertia is the property that tries to keep a body at rest from moving and tries to keep a moving object from stopping.

The light helps protect the motor from getting the full voltage when the slide switch is closed. Part of the voltage goes across the lamp and the rest goes across the motor. Remove the fan and notice how the lamp gets dimmer when the motor does not have to spin the fan blade.

WARNING: Moving parts. Do not touch the fan or motor during operation. Do not lean over the motor.

Project #6



Lamp & Fan in Parallel

OBJECTIVE: To show how an indicator light can be connected without affecting the current in the motor.

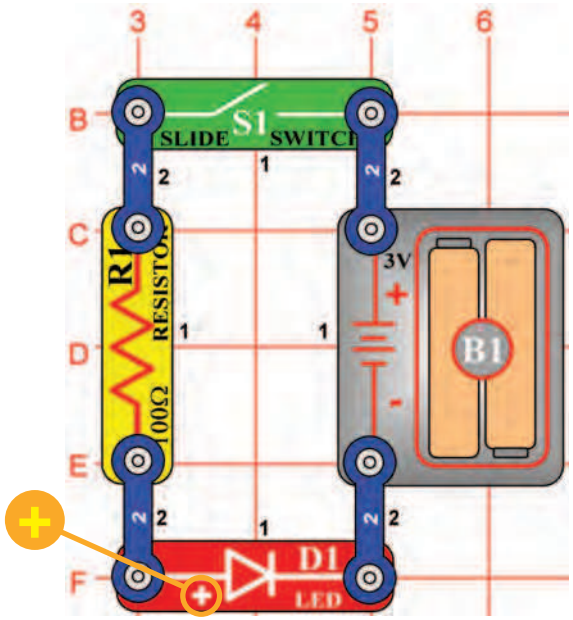
Build the circuit shown on the left.

When you close the slide switch (S1), both the fan and the lamp (L1) should turn on. The fan will take a while to start turning due to inertia. In this connection, the lamp does not change the current to the motor (M1). The motor should start a little faster than in Project #5.

Remove the fan and notice how the lamp does not change in brightness as the motor picks up speed. It has its own path to the battery (B1).

WARNING: Moving parts. Do not touch the fan or motor during operation. Do not lean over the motor.

Project #7



Light Emitting Diode

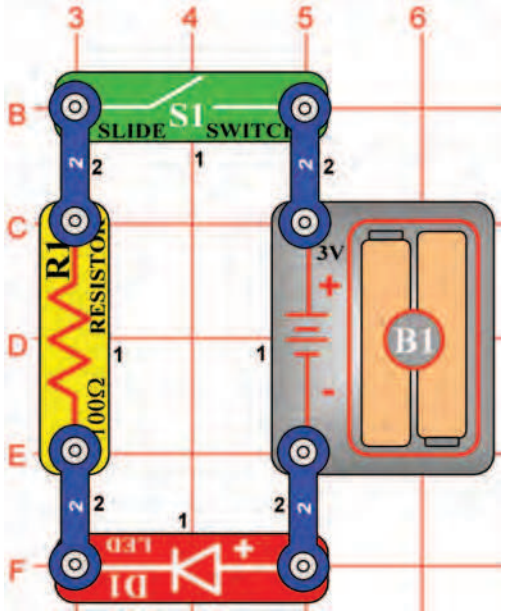
OBJECTIVE: To show how a resistor and LED are wired to emit light.

Build the circuit shown on the left by placing all the parts with a black 1 next to them on the base grid first. Then, assemble parts marked with a 2.

When you close the slide switch (S1), current flows from the batteries (B1) through the slide switch, through the resistor (R1), through the LED (light emitting diode, D1) and back to the battery. The closed slide switch completes the circuit. The resistor limits the current and prevents damage to the LED. NEVER PLACE AN LED DIRECTLY ACROSS THE BATTERY! If no resistor is in the circuit, the battery may push enough current through the LED to damage the semiconductor that is used to produce the light. LEDs are used in all types of electronic equipment to indicate conditions and pass information to the user of that equipment.

Can you think of something you use everyday that has an LED in it?

Project #8



One Direction for LED

OBJECTIVE: To show how electricity can only pass in one direction through an LED.

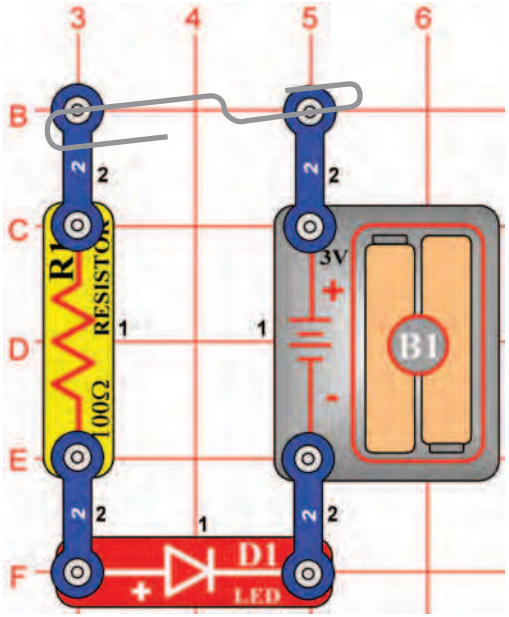
Rebuild the circuit used in Project #7 but put the LED (D1) in as shown on the left.

When you close the slide switch (S1), current should flow from the batteries (B1) through the resistor and then through the LED. When current flows through an LED, it lights up. Since the LED is in backwards, current cannot flow. The LED is like a check valve that lets current flow in only one direction.

In this project, you changed the direction of current through the LED. An electronic component that needs to be connected in one direction is said to have polarity. Other parts like this will be discussed in future projects. Placing the LED in backwards does not harm it because the voltage is not large enough to break down this electronic component.

Project #9

Conduction Detector



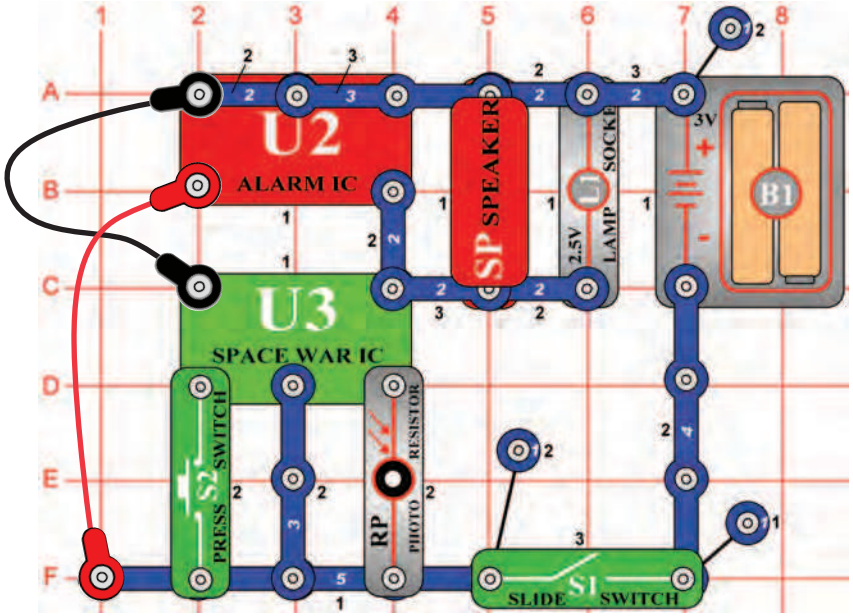
OBJECTIVE: To make a circuit that detects the conduction of electricity in different materials.

Rebuild the circuit from Project #7 but leave the slide switch (S1) out as shown on the left.

When you place a metal paper clip across the terminals as shown in the picture on the left, current flows from the batteries (B1) through the resistor (R1), through the LED (D1), and back to the battery. The paper clip completes the circuit and current flows through the LED. Place your fingers across the terminals and the LED does not light. Your body has too high of a resistance to allow enough current to flow to light the LED. If the voltage, which is electrical pressure, was higher, current could be pushed through your fingers and the LED would light. This detector can be used to see if a material like plastic is a good conductor or a poor conductor.

Project #10

Space War Alarm Combo

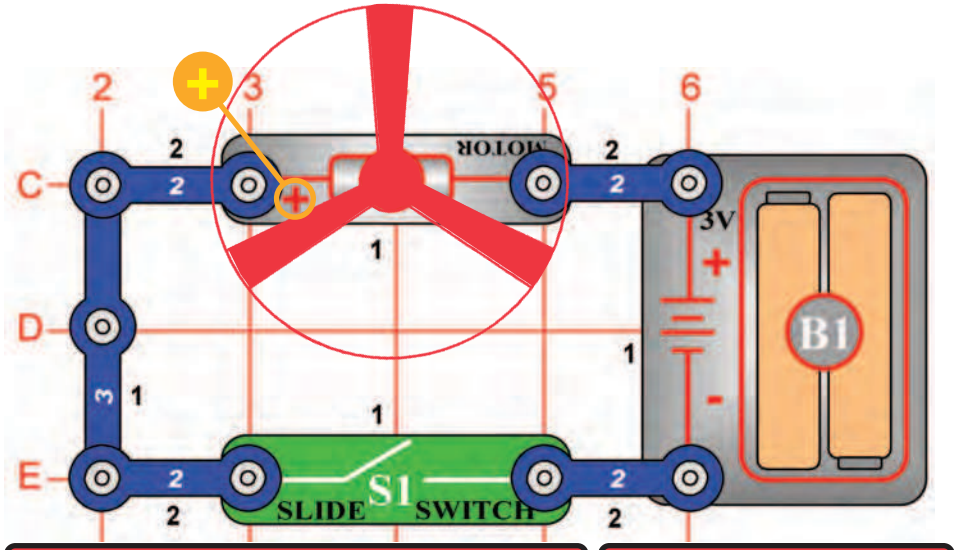


OBJECTIVE: To combine the sounds from the space war and alarm integrated circuits.

Build the circuit shown and add the jumpers to complete it. Turn it on, press the press switch (S2) several times, and wave your hand over the photoresistor (RP) to hear all the sound combinations. If the sound is too loud you may replace the speaker (SP) with the whistle chip (WC).

Project #11

Flying Saucer



WARNING: Moving parts. Do not touch the fan or motor during operation. Do not lean over the motor.

WARNING: Fan may not rise until switch is released.

OBJECTIVE: To make a circuit that launches the fan blade to simulate a flying saucer.

Rebuild the circuit from Project #2, but reverse the polarity on the motor (M1) so the negative (–) on the motor goes to the positive (+) on the battery (B1). New alkaline batteries are recommended for this project.

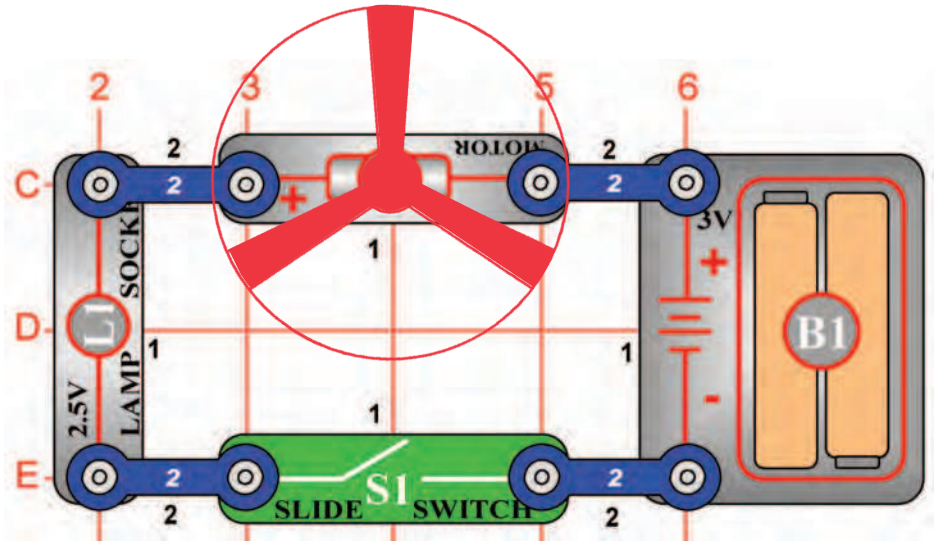
When you close the slide switch (S1), the motor will slowly increase in speed. When the motor has reached maximum rotation, turn the slide switch off. The fan blade should rise and float through the air like a flying saucer. Be careful not to look directly down on fan blade when it is spinning.

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 motor shaft because it does not have enough lift to propel it. The motor will spin faster when both batteries are new.

If the fan doesn't fly off, then turn the switch on and off several times rapidly when it is at full speed.

Project #12

Decreasing Saucer Lift



OBJECTIVE: To show how voltage affects speed of a DC motor and can decrease the lift of the saucer.

Change the circuit in Project #11 by adding the lamp (L1) in series with the motor as shown in the diagram on the left.

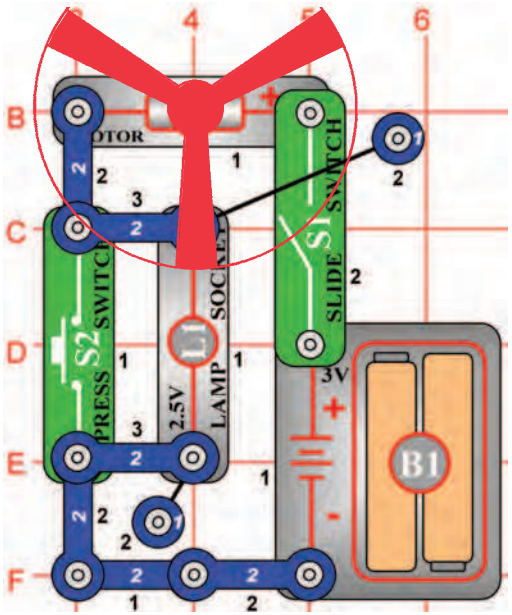
When you place the lamp in series with any electronic device, it will draw less current because it adds resistance. In this case, the lamp in series reduces the current through the motor, and that reduces the top speed of the motor. Close the slide switch (S1), and wait until the fan reaches maximum speed. Open the switch and observe the difference in the height due to the lamp. In most cases, it may not even launch.

WARNING: Moving parts. Do not touch the fan or motor during operation. Do not lean over the motor.

WARNING: Fan may not rise until switch is released.

Project #13

Two-Speed Fan



OBJECTIVE: To show how switches can increase or decrease the speed of an electric fan.

WARNING: Moving parts. Do not touch the fan or motor during operation. Do not lean over the motor.

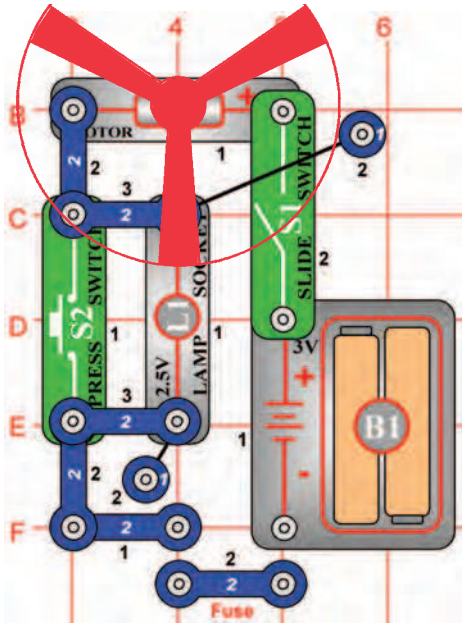
Build the circuit shown on the left by placing all the parts with a black 1 next to them on the board first. Then, assemble parts marked with a 2. Finally, add the 2-snap wires that are marked for level three.

When you close the slide switch (S1), current flows from the batteries through the slide switch (S1), motor (M1), the lamp (L1), and back to the battery (B1). When the press switch (S2) is closed, the lamp is shorted and motor speed increases.

The principle of removing resistance to increase motor speeds is only one way of changing the speed of the motor. Commercial fans do not use this method because it would produce heat in the resistor and fans are used to cool circuits by moving air over them. Commercial fans change the amount of voltage that is applied to the motor using a transformer or other electronic device.

Project #14

The Fuse



OBJECTIVE: To show how a fuse is used to break all current paths back to the voltage source.

WARNING: Moving parts. Do not touch the fan or motor during operation. Do not lean over the motor.

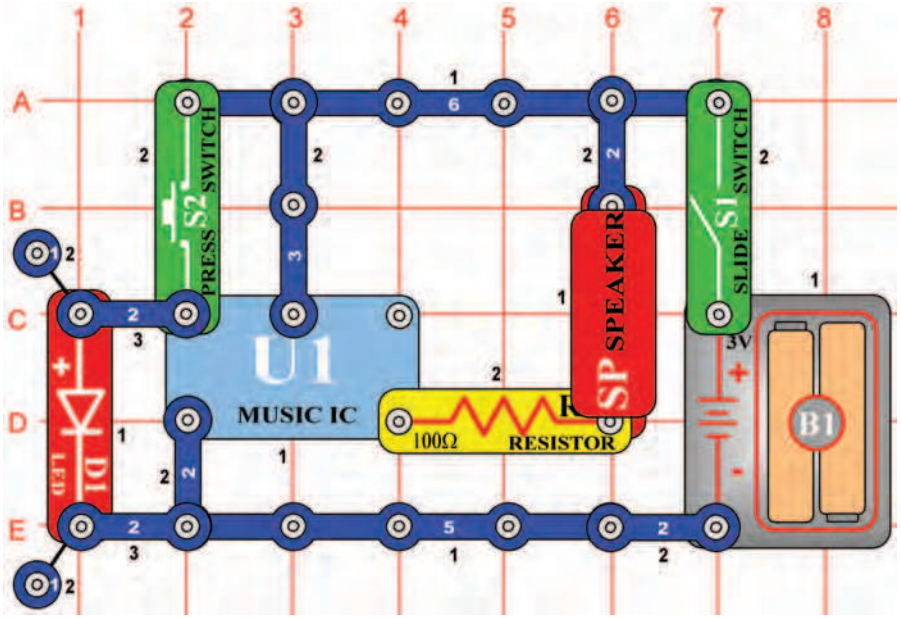
Use the circuit built in Project #13.

When you close the slide switch (S1), current flows from the batteries through the slide switch (S1), the lamp (L1), motor (M1), and back to the battery (B1). Pretend the 2-snap wire marked fuse in the drawing on the left is a device that will open the circuit if too much current is taken from the battery. When press switch (S2) is closed, the light is shorted and motor speed increases due to an increase in current to the motor. While still holding press switch (S2) down, remove the 2-snap wire marked fuse and notice how everything stops. Until the fuse is replaced, the open circuit path protects the electronic parts. If fuses did not exist, many parts could get hot and even start fires. Replace the 2-snap wire and the circuit should return to normal.

Many electronic products in your home have a fuse that will open when too much current is drawn. Can you name some?

Project #15

Musical Doorbell



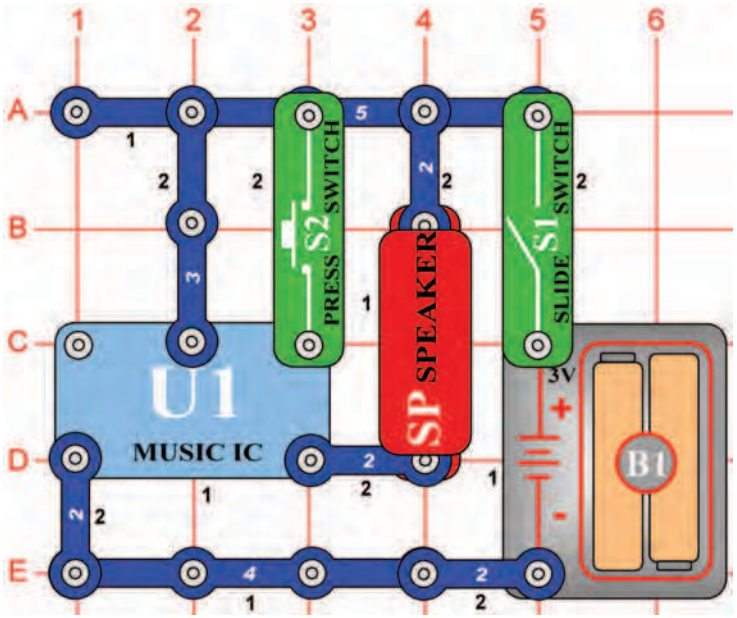
OBJECTIVE: To show how an integrated circuit can be used as a musical doorbell.

Build the circuit shown on the left. When you close the slide switch (S1), the music integrated circuit (U1) may start playing one song then stop. Each time you press the press switch "doorbell button" (S2) the song will play again and stop. Even if you let go of the press switch (S2), the integrated circuit keeps the song playing until it has reached the end of the song.

Musical integrated circuits are used to entertain young children in many of the toys and chairs made to hold infants. If the music is replaced with words, the child can also learn while they are entertained. Because of great advances in miniaturization, many songs are stored in a circuit no bigger than a pinhead.

Project #16

Momentary Alarm



OBJECTIVE: To show how integrated circuits can also create loud alarm sounds in case of emergencies.

Modify the circuit used in Project #15 to look like the one shown on the left.

When you close the slide switch (S1), the music integrated circuit (U1) may start playing one song then stop. The song will be much louder than in the previous project because it is now being used as an alarm. Each time you press the press switch "alarm button" (S2) after the song stops playing, the song will play again, but only while you hold the button down.

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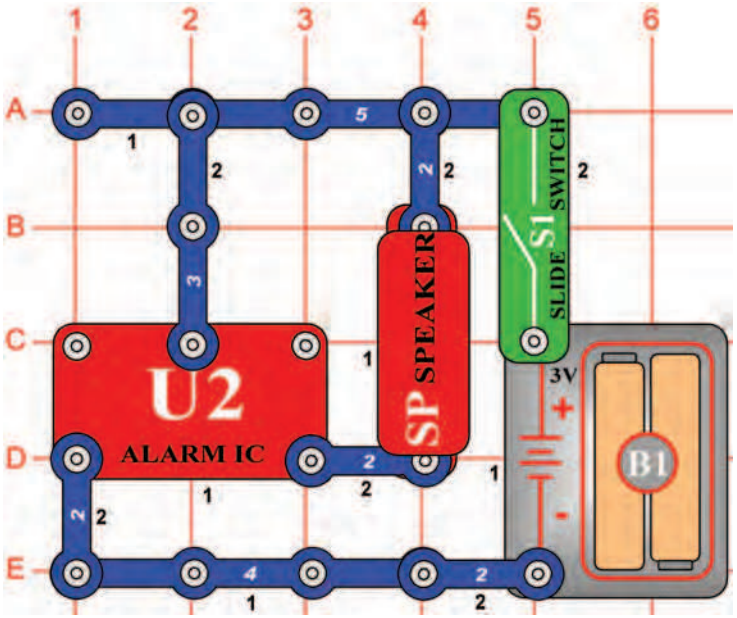
Project #17



Alarm Circuit

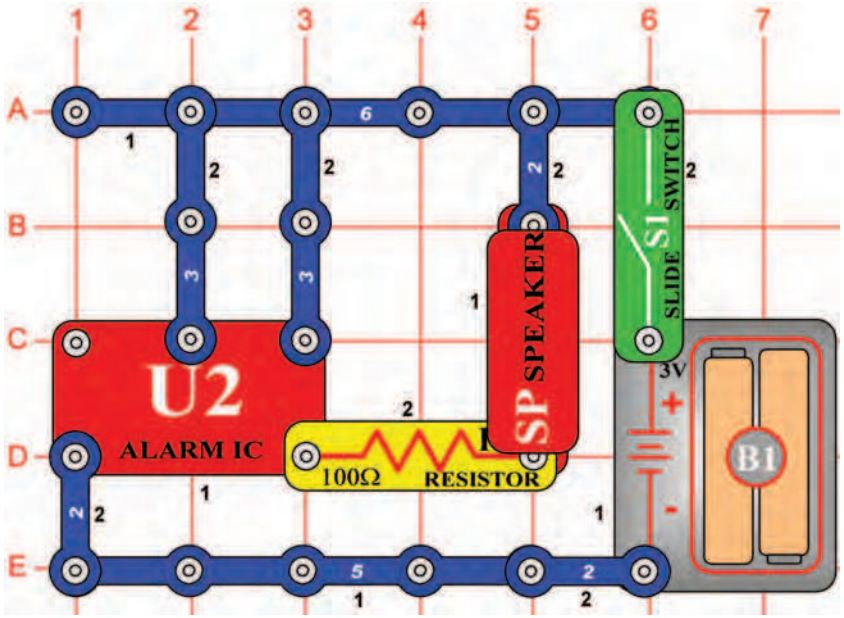
OBJECTIVE: To show how an integrated circuit can be used to make real alarm sounds.

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.

When you close the slide switch (S1), the integrated circuit (U2) should start sounding a very loud alarm sound. This integrated circuit is designed to sweep through all the frequencies so even hard of hearing people can be warned by the alarm.

If the alarm sound was passed through an amplifier and installed into a police car, it would also serve as a good police siren.

Project #18



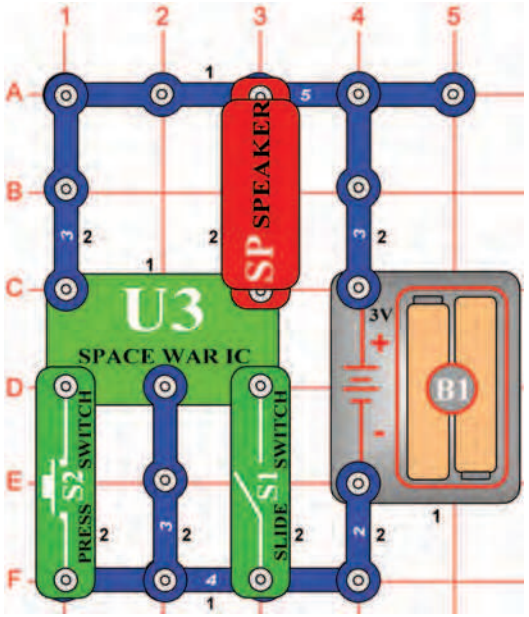
Laser Gun

OBJECTIVE: To show how integrated circuits sound can easily be changed to exciting space war sounds.

Build the circuit shown on the left by placing all the parts with a black 1 next to them on the base grid first. Then, assemble parts marked with a 2.

When you close the slide switch (S1), the integrated circuit (U2) should start sounding a laser gun sound. This integrated circuit is designed to produce different sounds that can easily be changed. You can even switch the sound on and off quickly to add sound effects to your games or recordings.

Project #19 Space War



OBJECTIVE: To introduce you to the space war integrated circuit and the sounds it can make.

Build the circuit shown on the left, which uses the space war integrated circuit (U3). Activate it by flipping the slide switch (S1) or pressing the press switch (S2); do both several times and in combination. You will hear an exciting range of sounds, as if a space war is raging!

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.

Project #20 Light Switch

OBJECTIVE: To show how light can control a circuit using a photoresistor.

Use the circuit from Project #19 above, but replace the slide switch (S1) with the photoresistor (RP). The circuit immediately makes noise. Try turning it off. If you experiment, then you can see that the only ways to turn it off are to cover the photoresistor, or to turn off the lights in the room (if the room is dark). Since light is used to turn on the circuit, you might say it is a "light switch".

The photoresistor contains material that changes its resistance when it is exposed to light. As it gets more light, the resistance of the photoresistor decreases. Parts like this are used in a number of ways that affect our lives. For example, you may have streetlights in your neighborhood that turn on when it starts getting dark and turn off in the morning.

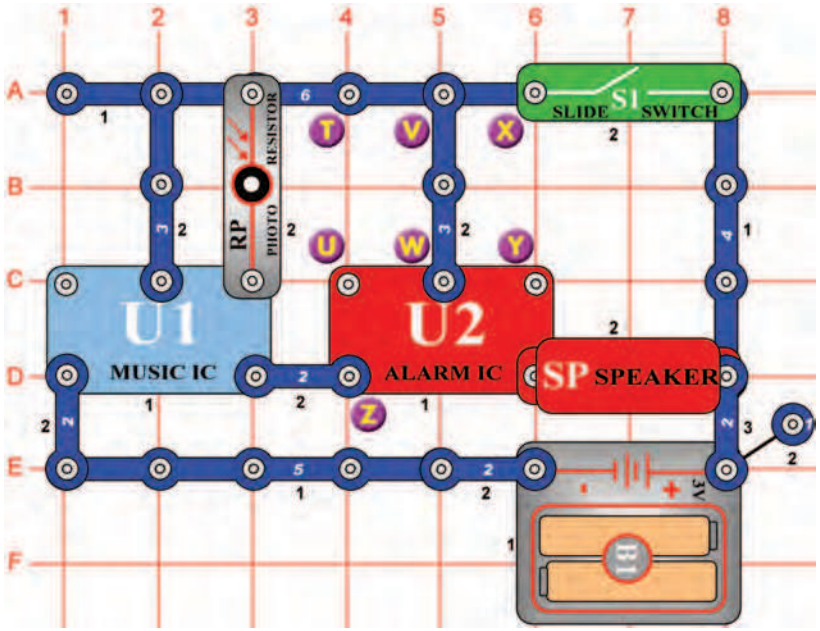
Project #21 Paper Space War

OBJECTIVE: To give a more dramatic demonstration of using the photoresistor.

Use the same circuit as for Project #20. Find a piece of white paper that has a lot of large black or dark areas on it, and slowly slide it over the photosensitive resistor. You should hear the sound pattern constantly changing, as the white and dark areas of the paper control the light to the photosensitive resistance. You can also try the pattern below or something similar to it:

Project #22

Light Police Siren



OBJECTIVE: To build a police siren that is controlled by light.

Build the circuit shown on the left by placing all the parts with a black 1 next to them on the base grid first. Then, assemble parts marked with a 2. Finally, insert the parts with a 3 last on level 3.

Cover the photoresistor (RP) and turn on the slide switch (S1). A police siren with music is heard for a while and stops, then you can control it by covering or uncovering the photoresistor.

Project #23

More Loud Sounds

OBJECTIVE: To show variations of the circuit in Project #22.

Modify the Project #22 by connecting points X & Y. The circuit works the same way but now it sounds like a machine gun with music.

Project #24

More Loud Sounds (II)

OBJECTIVE: To show variations of the circuit in Project #22.

Now remove the connection between X & Y and then make a connection between T & U. The circuit works the same way but now it sounds like a fire engine with music.

Project #25

More Loud Sounds (III)

OBJECTIVE: To show variations of the circuit in Project #22.

Now remove the connection between T & U and then make a connection between U & Z. The circuit works the same way but now it sounds like an ambulance with music.

Project #26

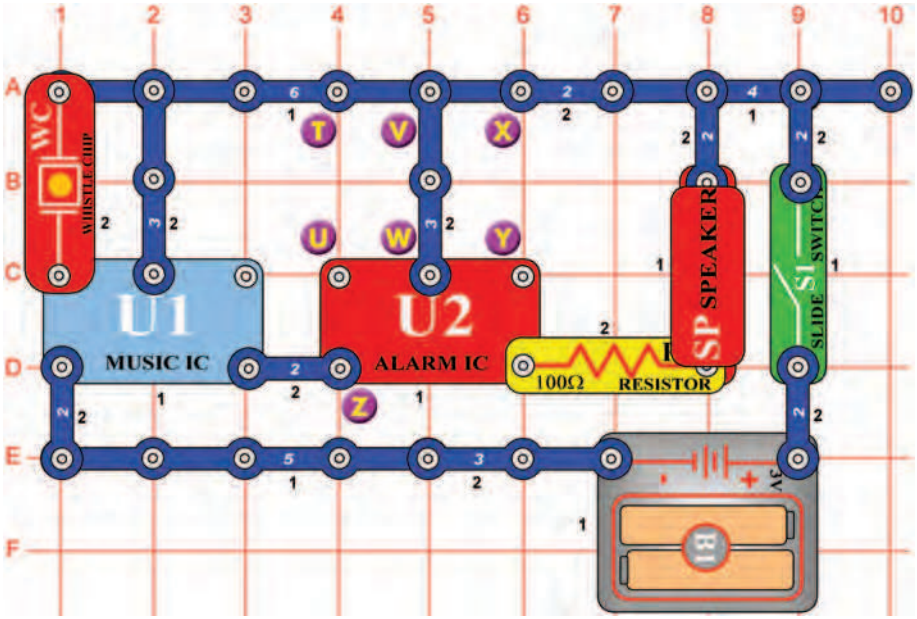
More Loud Sounds (IV)

OBJECTIVE: To show variations of the circuit in Project #22.

Now remove the connections between U & Z and between V & W, then make a connection between T & U. The circuit works the same way but now it sounds like a familiar song but with static.

Project #27

Clap Sounds



OBJECTIVE: To build a police siren and other sounds that are controlled by clapping your hands.

Build the circuit shown on the left by placing all the parts with a black 1 next to them on the base grid first. Then, assemble parts marked with a 2.

Turn on the slide switch (S1) and a police siren is heard and then stops, clap your hands and it will play again. Note however that music can be heard faintly in the background of the siren. If clapping does not trigger the sound, tap the whistle chip (WC) with your finger.

Project #28

More Clap Sounds

OBJECTIVE: To show how ICs can do many jobs.

Modify the last circuit by connecting points X & Y using the black jumper wire. The circuit works the same way but now it sounds like a machine gun.

Project #29

More Clap Sounds (II)

OBJECTIVE: To show how ICs can do many jobs.

Now remove the connection between X & Y and then make a connection between T & U. The circuit works the same way but now it sounds like a fire engine.

Project #30

More Clap Sounds (III)

OBJECTIVE: To show how ICs can do many jobs.

Now remove the connection between T & U and then make a connection between U & Z. The circuit works the same way but now it sounds like an ambulance.

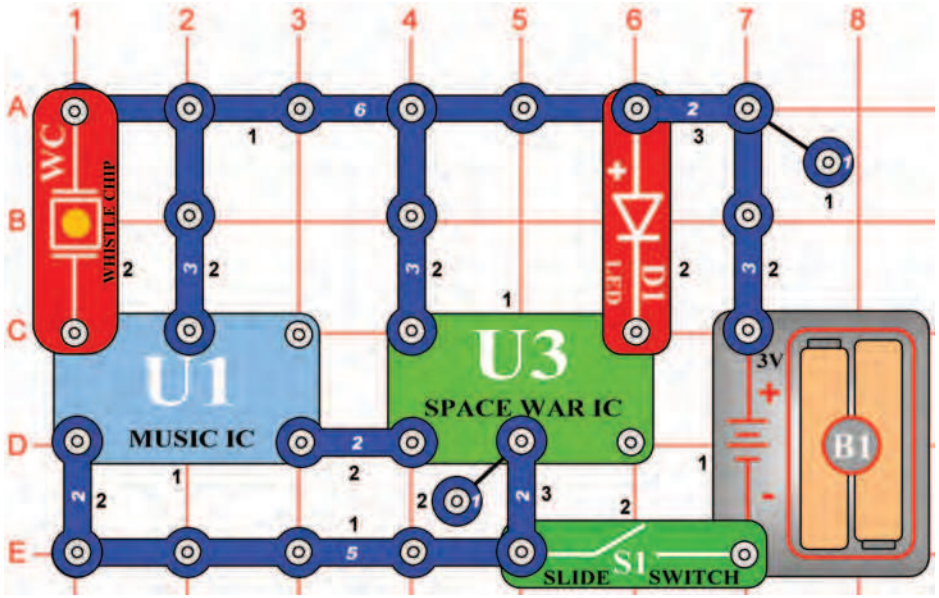
Project #31

More Clap Sounds (IV)

OBJECTIVE: To show how ICs can do many jobs.

Now remove the connections between U & Z and between V & W, then make a connection between T & U. The circuit works the same way but now it sounds like a familiar song but with static.

☐ Project #32 Voice Light Diode



OBJECTIVE: To build a circuit that uses your voice to control a light emitting diode.

Build the circuit shown on the left and turn on the slide switch (S1). The LED (D1) may be on for a while and then turn off. Clap or talk loud and the LED will light again and keep flickering for a little while.

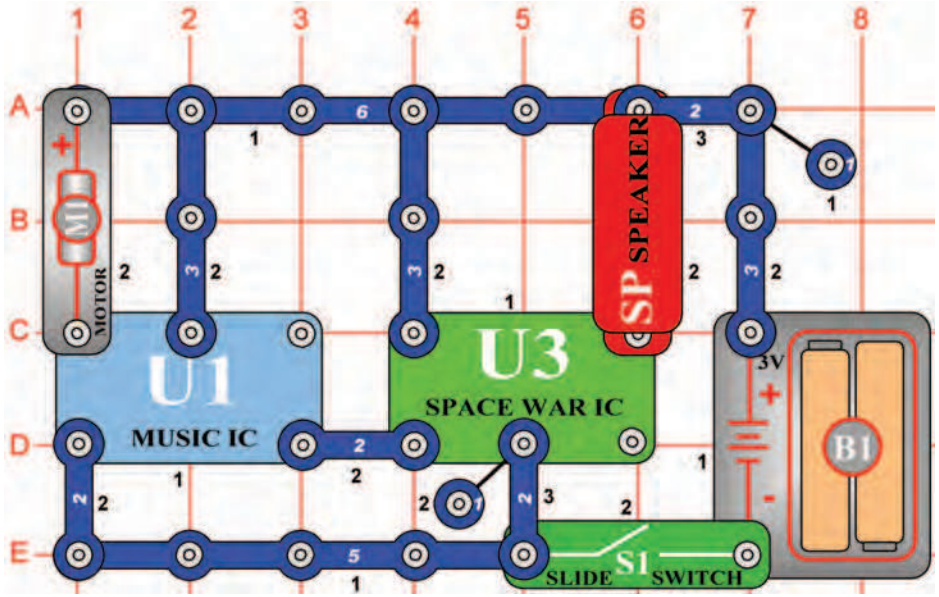
☐ Project #33 Voice Control

OBJECTIVE: To use your voice to control sounds.

The preceding circuit probably did not seem too exciting; so replace the LED (D1) with the speaker (SP). You hear a range of exciting sounds. Clap or talk loud and the sounds will resume.

If you find that the sound does not turn off, then vibrations created by the speaker may be activating the whistle chip (WC). Set the speaker on the table near the circuit and connect it to the same locations using the jumper wires to prevent this.

☐ Project #34 Motor Space Sounds



OBJECTIVE: To build a circuit that uses a motor to activate space war sounds.

Turn it on and wait for any sounds to stop then spin the motor (M1) and the sounds play again.

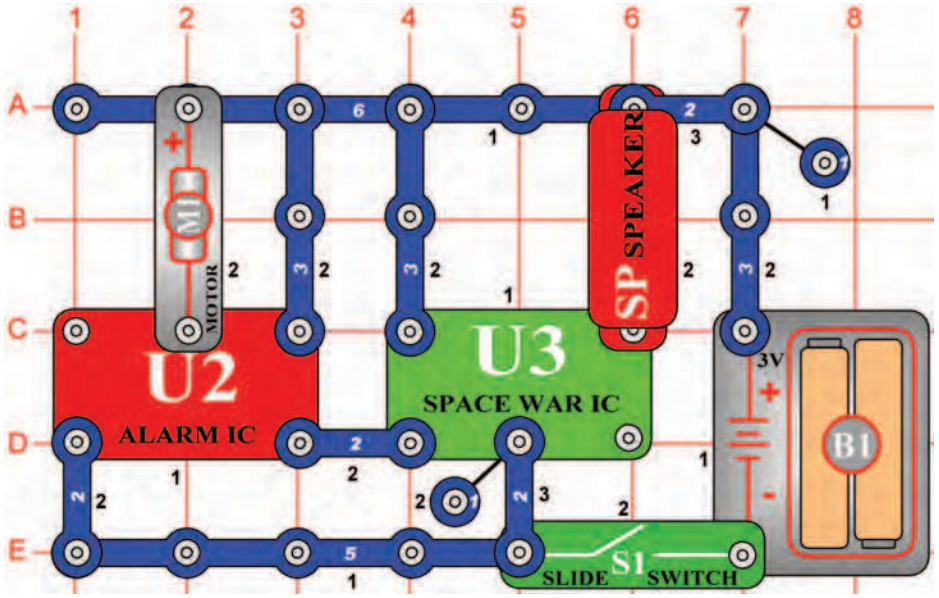
Do you know why turning the motor makes the sound play? Actually, the DC motor is also a DC generator and when you turn it, the motor generates a voltage that triggers the sound circuits.

☐ Project #35 Motor Space Light

OBJECTIVE: To build a circuit that uses a motor to activate a light diode.

This circuit is loud and may bother other people around you so replace the speaker with the LED (D1), (position it like in Project #32); the circuit operates in the same manner.

☐ Project #36 Space Battle (II)



OBJECTIVE: To show another way of using the space war integrated circuit.

Build the circuit shown on the left, which is based on the circuit in the Space War Project #19. Turn on the switch and you will hear exciting sounds, as if a space battle is raging!

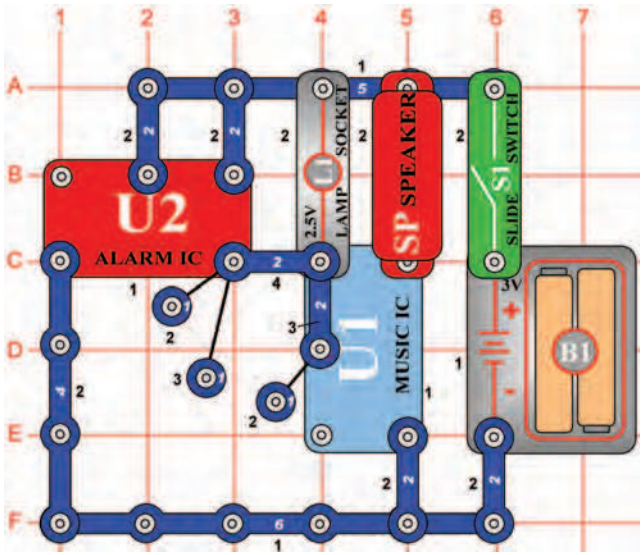
The motor is used here as a 3-snap wire, and will not spin.

☐ Project #37 Silent Space Battle

OBJECTIVE: To show another way of using the space war part.

The preceding circuit is loud and may bother people around you, so replace the speaker (SP) with the LED (D1), position it as in Project #32. Now you have a silent space battle.

☐ Project #38 Periodic Sounds



OBJECTIVE: To build a circuit with light and sound that change and repeat.

Build the circuit shown on the left and turn it on. The lamp (L1) alternates between being on and off while the speaker (SP) alternates between two musical tones . . . like someone is flipping a switch, but at a very consistent rate. Periodic signals like this are very important in electronics.

☐ Project #39 Blinking Double Flashlight

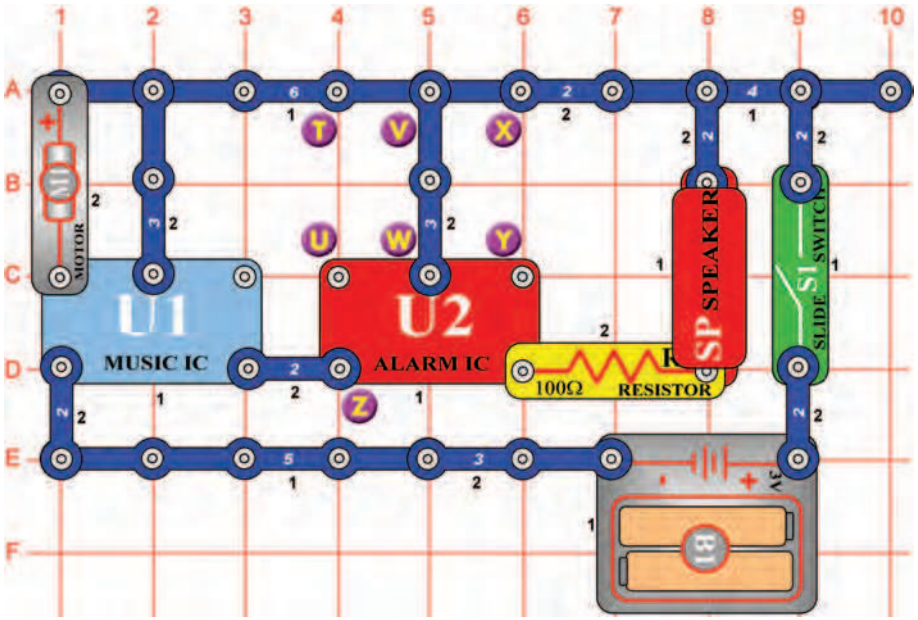
OBJECTIVE: To build a circuit with two lights that alternate.

In the circuit at left, replace the speaker (SP) with an LED (D1); position it as in Project #32. The lamp alternates between being on and off while the LED alternates between being dimmer and brighter.

To learn more about how circuits work, visit www.snapcircuits.net or page 45 to find out about our Student Guides.

Project #40

Motor-Controlled Sounds



OBJECTIVE: To show how motion can trigger electronic circuits.

This circuit is controlled by spinning the motor (M1) with your hands. Turn on the slide switch (S1). A police siren is heard and then stops. Spin the motor and it will play again. Note however, that music can be heard faintly in the background of the siren.

Project #41

More Motor Sounds

OBJECTIVE: To show how motion can trigger electronic circuits.

Modify the last circuit by connecting points X & Y with the lamp (L1). The circuit works the same way but now it sounds like a machine gun.

Project #42

More Motor Sounds (II)

OBJECTIVE: To show how motion can trigger electronic circuits.

Now remove the connection between X & Y and then make a connection between T & U with the lamp (L1). The circuit works the same way but now it sounds like a fire engine.

Project #43

More Motor Sounds (III)

OBJECTIVE: To show how motion can trigger electronic circuits.

Now remove the connection between T & U and then make a connection between U & Z. The circuit works the same way but now it sounds like an ambulance.

Project #44

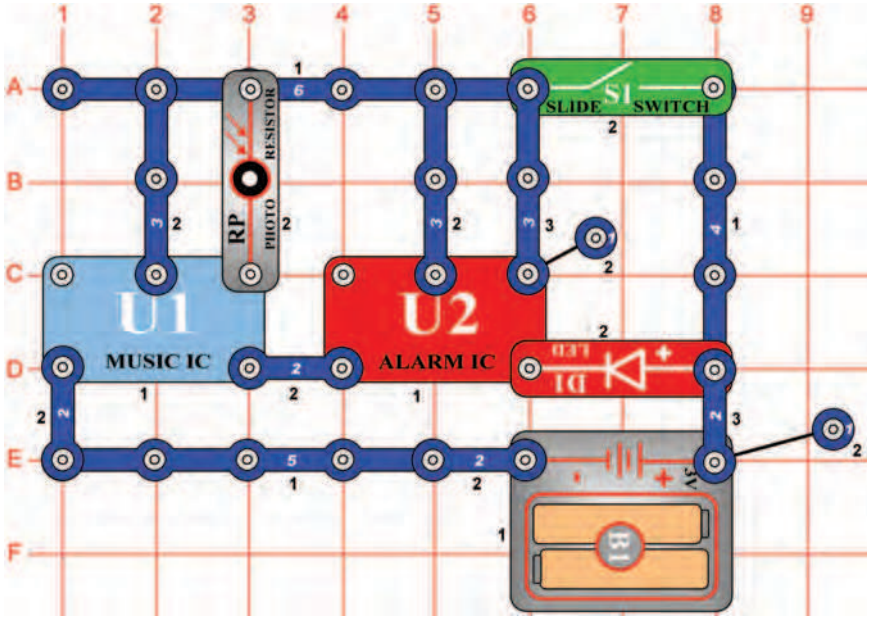
More Motor Sounds (IV)

OBJECTIVE: To show how motion can trigger electronic circuits.

Now remove the connections between U & Z and between V & W, then make a connection between T & U. The circuit works the same way but now it sounds like a familiar song but with static.

Project #45

Light-Controlled Flicker



OBJECTIVE: To make a circuit that uses light to control the blinking of another light.

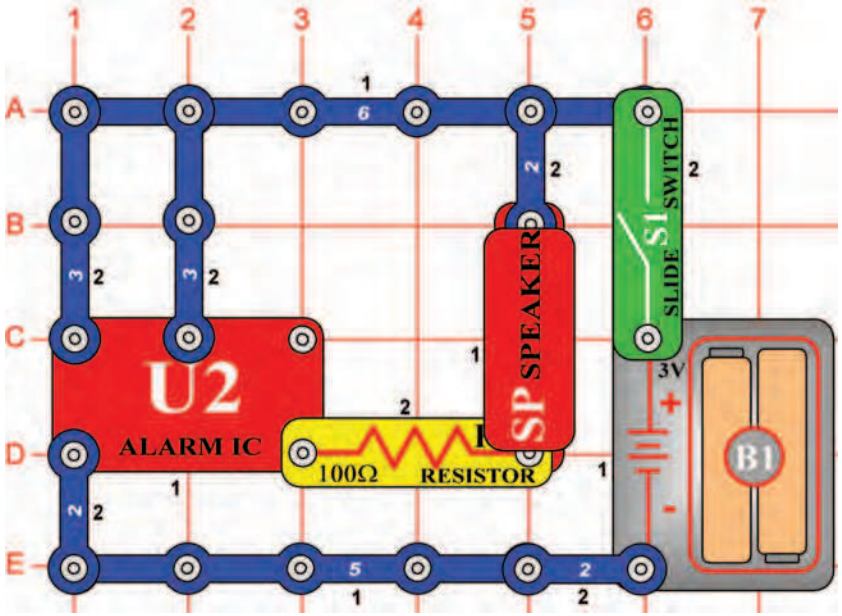
This circuit does not use the noisy speaker (SP) it uses a nice quiet LED (D1). Turn on the slide switch (S1), the LED flickers. Wait a few seconds, then cover the photoresistor (RP) and the flicker stops. The flicker is controlled by the photoresistor, uncover it and the flicker resumes.

People who are deaf need lights to tell them when a doorbell is ringing. They also use circuits like this to tell them if an alarm has been triggered or an oven is ready.

Can you think of other uses?

Project #46

More Sound Effects



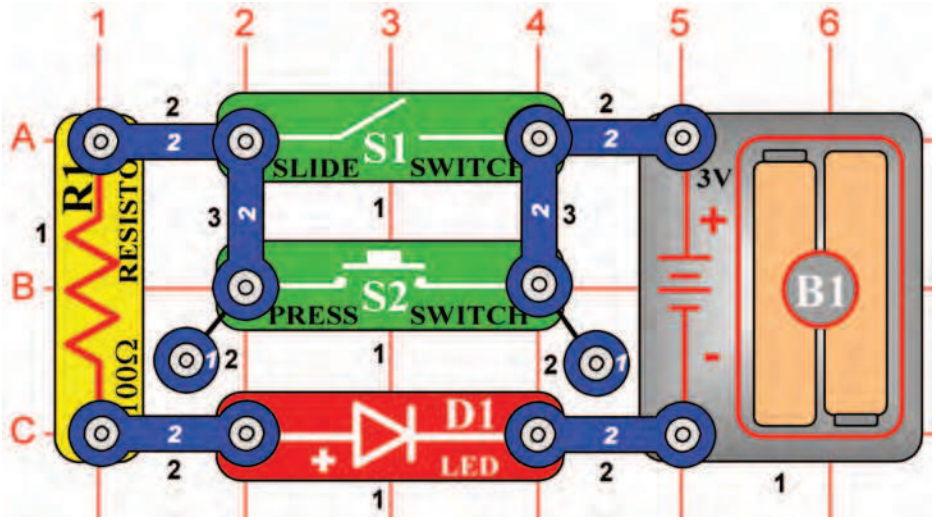
OBJECTIVE: To investigate the different sound effects available from the alarm integrated circuit.

Build the circuit shown on the left. When you close the slide switch (S1), the integrated circuit (U2) should start sounding an up-down siren. This is just one more sound effect that this integrated circuit is designed to produce. Different sounds that can easily be changed are very important when designing games and toys. Switch the sound on and off quickly and see if you can create even different effects. This mode will create many robotic sounds if switched quickly.

Project #47

This OR That

OBJECTIVE: To introduce you to the OR concept of electronic wiring.

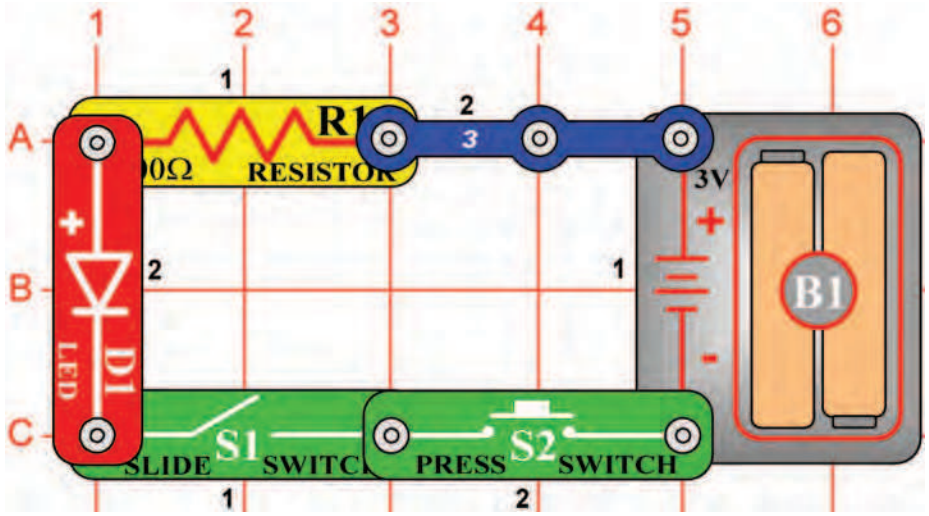


Build the circuit shown. Notice that if you turn on the slide switch (S1) OR press the press switch (S2) the LED (D1) lights up. There is no partially lit state here, the diode is either totally on or totally off. While this may seem very simple and boring, it represents an important concept in electronics. Two switches like this may be used to turn on a light in your house, or they might be two sensors at a railroad crossing used to start the ding-ding sound and lower the gate. You could also have more than two switches and the circuit would function the same way.

Project #48

This AND That

OBJECTIVE: To introduce you to digital circuits.



Build the circuit shown. Notice that if you turn on the slide switch (S1) AND press the press switch (S2) the LED (D1) lights up. Once again, there is no partially lit state here, the LED is either totally on or totally off. Two switches like this may be used to turn on the same light in your house, the room switch and the master switch in the electrical box. You could also have more than two switches and the circuit would function the same way.

Combinations of AND and OR circuits are used to add and multiply numbers together in modern computers. These circuits are made of tiny transistors in massive integrated circuits.