

ELECTRONIC SNAP CIRCUITS®

DELUXE SNAP ROVER®



Projects 1-63
Instruction Manual



Elenco® Electronics, Inc.

Table of Contents

Basic Troubleshooting	1	Advanced Troubleshooting	9
Parts List	2	Project Listings	10
How to Use It	3	Projects #1-63	11-43
About Your Snap Circuits® Parts	4, 5	Other Snap Circuits® Products	44
How It Works	6, 7	Bonus Projects B1 & B2	45
General Operating Instructions	7	Parts Map	46
DO's and DON'Ts of Building Circuits	8		



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

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 in the Rover body and remote control unit.
 5. Keep the wheels clean and free of lint, thread, or dirt.
 6. If the disc launcher jams, turn the circuit off and remove all discs.
- Elenco® Electronics 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 9 to determine which ones need replacing.



WARNING FOR DISC LAUNCHER (DL) - Moving parts. Keep your face and eyes away from the front of the disc launcher and from flying discs. Do not place anything into the disc launcher except the foam discs. Do not reach inside the disc launcher during operation. Do not launch discs at people, animals, or objects. Eye protection is recommended.

A NOTE ABOUT THE FCC

The Federal Communications Commission (FCC) regulates use of the radio frequency spectrum in the United States to prevent products from interfering with each other.

Deluxe Snap Rover® 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. Deluxe Snap Rover® 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 Deluxe Snap Rover® does cause harmful interference to radio or television reception, which can be determined by turning Deluxe Snap Rover® off and on, try to correct the interference by:

1. Moving Deluxe Snap Rover® away from the receiver.
2. Contacting Elenco® Electronics for help by calling (800) 533-2441, or e-mail us at help@elenco.com.

FCC regulations for your Deluxe Snap Rover® require you to accept any interference from authorized sources and that you shut down if you are causing interference with other authorized products.

You should never modify the electrical circuit components inside your Deluxe Receiver (RX2) or Remote Control transmitter as this may cause malfunctions or violate FCC regulations for this product.

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.



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

Conforms to
ASTM F963-96A

BATTERIES:

- Use only 1.5V AA type in the Rover body and 9V in the remote control (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 alkaline, standard (carbon-zinc), or rechargeable (nickel-cadmium) batteries.
- Do not mix old and new 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.



Warning to Snap Circuits® Owners: Do not use parts from other Snap Circuits® sets with this kit. Deluxe Snap Rover® uses higher voltage which could damage those parts. Page 44 and our website www.snapcircuits.net has approved circuits that you can use.

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.

Qty.	ID	Name	Symbol	Part #	Qty.	ID	Name	Symbol	Part #
□ 5	(1)	1-Snap Wire		6SC01	□ 1	(R4)	10KΩ Resistor		6SCR4
□ 11	(2)	2-Snap Wire		6SC02	□ 1	(R5)	100KΩ Resistor		6SCR5
□ 1	(3)	3-Snap Wire		6SC03	□ 1		Rover Body		6SCRB
□ 1	(4)	4-Snap Wire		6SC04	□ 1	(RX2)	Deluxe Receiver IC		6SCRX2
□ 1	(6)	6-Snap Wire		6SC06	□ 1	(S1)	Slide Switch		6SCS1
□ 1		Base Grid (11.0" x 7.7")		6SCBG	□ 1	(S2)	Press Switch		6SCS2
□ 1	(C7)	1μF Capacitor		6SCC7	□ 1		Remote Control Unit		6SCTX1
□ 1	(C4N)	100μF Capacitor (non-polarized)		6SCC4N	□ 1		Antenna for Remote Control		6SCTX1A
□ 1	(D4)	White LED		6SCD4	□ 1	(U9)	Sound & Recording IC		6SCU9
□ 1	(DL)	Disc Launcher		6SCDL	□ 1 □ 1		Jumper Wire (Red) Jumper Wire (Black)	 	6SCJ1 6SCJ2
□ 15		Foam Discs		6SCDISC	□ 1 □ 1	Note: Colors may vary and are interchangeable.	Jumper Wire (Orange) Jumper Wire (Yellow)	 	6SCJ3A 6SCJ3B
□ 1	(R1)	100Ω Resistor		6SCR1	□ 1 □ 1		Jumper Wire (Green) Jumper Wire (Purple)	 	6SCJ3C 6SCJ3D
□ 1	(R2)	1KΩ Resistor		6SCR2	□ 1 □ 1		Jumper Wire (Gray) Jumper Wire (White)	 	6SCJ3E 6SCJ3F

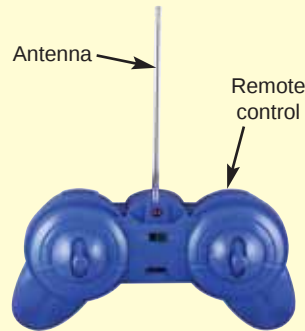
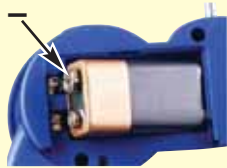
You may order additional / replacement parts at our website: www.snapcircuits.net

How To Use It

Install six “AA” batteries (not included) into the bottom of the Rover body and one 9V battery (not included) into the remote control unit. Install the antenna into the remote control unit by screwing it in.



← Front of Rover



The Deluxe Snap Rover® 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, LED 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 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.



This is a wire block which is blue and comes in different wire lengths. This one has the number ②, ③, ④, ⑤, ⑥, or ⑦ on it depending on the length of the wire connection required.



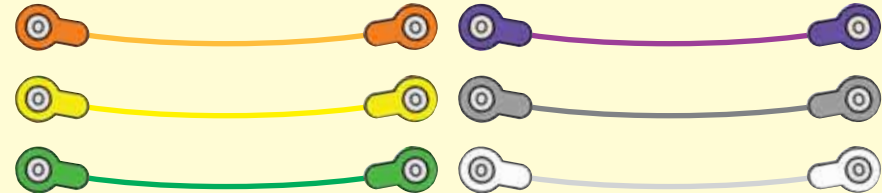
There is also a 1-snap wire that is used as a spacer or for interconnection between different layers.



A large clear plastic base grid is included with this kit to keep the circuit blocks together, it fits on top of the Rover body. You will see evenly spaced posts that the different blocks snap onto, these keep your circuit together. 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.

Jumper wires are used to connect your circuits to the batteries and motors in the Rover body. Snap them on as shown in the projects. The colors are interchangeable, so it doesn't matter which color you use (however the red and black wires are longer than the rest).



Note: While building the projects, be careful not to accidentally make a direct electrical connection across the + and – snaps for the batteries (a “short circuit”), as this may damage and/or quickly drain the batteries.

Warning to Snap Circuits® owners: Do not use parts from other Snap Circuits® sets with this kit unless directed to do so. The Snap Rover® uses higher voltage which could damage those parts. Page 44 and our website www.snapcircuits.net has approved circuits that you can use.

About Your Snap Circuits® Parts



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(Part designs are subject to change without notice).

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

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, black, white, orange, yellow, green, gray, and purple **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. The different colored wires all work the same way, and are interchangeable. Wires transport electricity just like pipes are used to transport water.

The **batteries** (in the Rover body) produce an electrical voltage using a chemical reaction. This “voltage” can be thought of as electrical pressure, pushing electrical “current” 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” 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. It turns on electricity just like a faucet turns on water from a pipe.

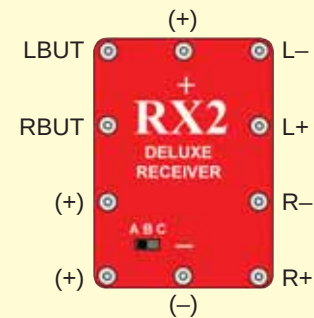
The **press switch (S2)** connects (pressed) or disconnects (not pressed) the wires in a circuit, just like the slide switch does.

Resistors, such as the **100Ω (R1)**, **1KΩ (R2)**, **10KΩ (R4)**, and **100KΩ (R5) resistors**, “resist” the flow of electricity and are used to control or limit the electricity in a circuit. Note that “K” means 1000, so R4 is really 10,000Ω. Increasing circuit resistance reduces the flow of electricity.

The **LED (D4)** 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 3V); 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.

The **1μF (C7) and 100μF (C4N) capacitors** are components that can store electrical pressure (voltage) for periods of time, higher values have more storage. Because of this storage ability they block unchanging voltage signals and pass fast changing voltages. Capacitors are used for filtering and delay circuits.

The **Deluxe Receiver (RX2)** is a complex module containing a radio receiver circuit, a specialized radio decoder integrated circuit, and other supporting components. It includes resistors, capacitors, inductors, and transistors that are always needed together. This was done to simplify the connections you need to make, otherwise this circuitry would not fit on the base grid. A description for this module is given here for those interested, see Project #1 for a connection example:



Deluxe Receiver:

(+) - power from batteries

(-) - power return to batteries

LBUT - left button function (active low)

RBUT - right button function (active low)

L - left backward motor drive

L+ - left forward motor drive

R - right backward motor drive

R+ - right forward motor drive

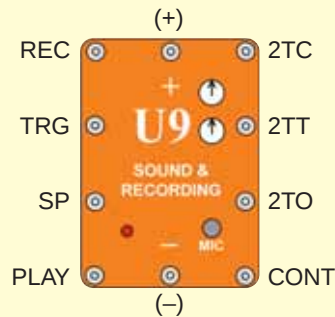
ABC switch - selects radio channel



Only connect this part as shown in the projects!

About Your Snap Circuits® Parts (continued)

The **Sound & Recording IC (U9)** module contains an integrated recording circuit, a dual timer integrated circuit for making audio tones, microphone, speaker, filtering circuitry, and other supporting components. It includes resistors (adjustable and fixed), capacitors, transistors and diodes that are needed to make the recordings and play all the sounds. Recording time is up to 12 seconds. A description for this module is given here for those interested, see Project #1 for a connection example and for instructions on how to use it:



Only connect this part as shown in the projects!

Sound & Recording IC:

(+) - power from batteries

(-) - power return to batteries

REC - recording control

TRG - main tone activation/disable

SP - external speaker control

PLAY - play recording

2TC - modulating tone control

2TT - modulating tone activation/disable

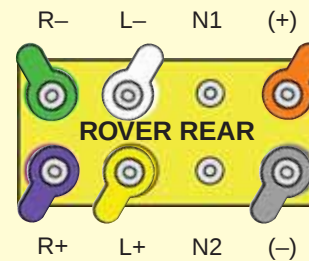
2TO - modulating tone output

CONT - main tone control

Knobs: upper controls modulating tone
lower controls main tone frequency

Red light: this is a recording indicator

The **motors** (in the Rover body) convert electricity 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 a coil of wire with many loops wrapped around metal plates. 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 coil, it magnetizes the metal plates and they repel from the magnet on the motor shell - spinning the shaft. A small gear is on the end of the shaft and spins with it.



Rover Rear:

(+) - power from batteries

(-) - power return to batteries

L+ - left forward motor drive

L- - left backward motor drive

R+ - right forward motor drive

R- - right backward motor drive

N1, N2 - not used



Only connect this part as shown in the projects!

The **Disc Launcher (DL)** contains two motors. One motor starts first and spins a cylinder at high speed. Another motor starts a few seconds later and slowly moves a disc into launch position using gears and a hook. When the disc enters launch position the cylinder grabs it and propels it out of the launcher. The motors are controlled by an integrated circuit along with resistors, capacitors, and transistors. The same circuit also controls the lights in the "eyes". A description for this module is given here for those interested, see Project #1 for a connection example:



Disc Launcher:

(+) - power from batteries

(-) - power return to batteries

CONT - control input (active low)

EXT - external device control (active low)



Only connect this part as shown in the projects!

How It Works

Remote Control Transmitter:

When the levers in the Remote Control Unit are pushed, electrical contacts are made connecting the 9V battery power to the transmitter, indicating which commands the user wants sent to the Rover. Forwards/Backwards commands for each set of wheels and two extra functions are controlled by different levers or buttons. Each of these use a different set of electrical contacts which encode a sequence of electrical pulses; the pulse sequence depends on which command(s) are being sent. The spacing between the sequences represents which channel setting (A-B-C) the remote control is on. This allows three units to use the same operating frequency in the same room at the same time without interfering with each other. An electrical circuit that is tuned to a frequency of 27 MHz creates a signal that is sent to the antenna when the pulses are active. The antenna converts this electrical energy into radio energy, creating a stream of radio energy bursts, which travel through the air and are picked up by, and understood by, the radio receiver in the car. The frequency of 27 MHz was selected for your Rover with the approval of the FCC (the US government) to minimize radio interference between this product and all other electrical products.

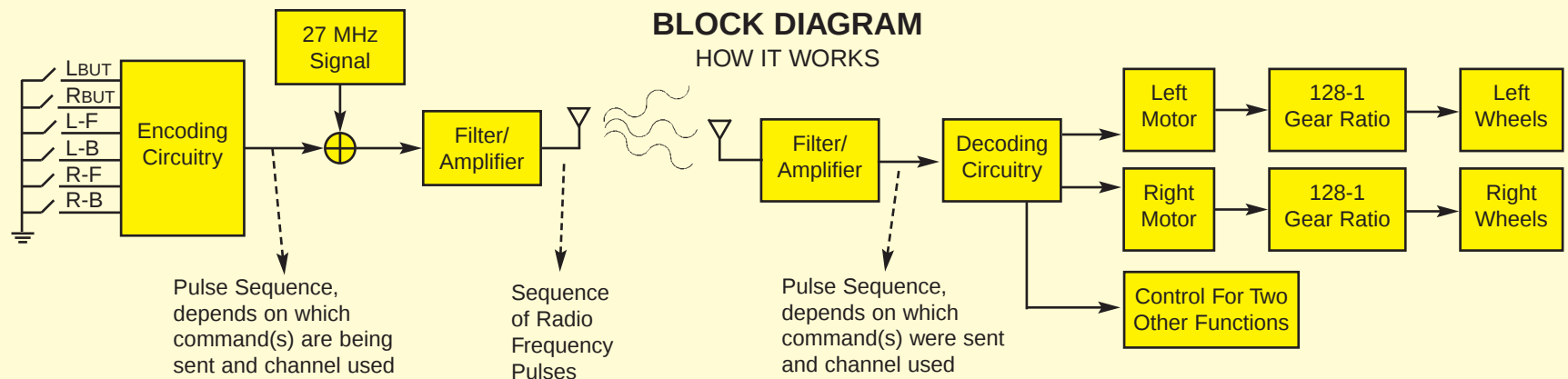
Radio Receiver:

The Rover antenna collects radio energy and converts it back into electrical energy. If the Rover is turned on, then the radio receiver in the Rover is continuously monitoring the radio energy from its antenna. The receiver is basically a filter which is tuned to amplify any energy around 27 MHz and block energy the antenna picks up outside this region. If the Remote Control Transmitter is sending commands, then its radio signal

will be picked up by the receiver and converted back into the original pulse sequence. Decoding circuitry then determines which commands were sent by examining the pulses in the sequence. Signals are then sent to motors that drive the wheels to execute the commands, or the other R/C Receiver outputs to control other functions. Commands sent to other receivers using a different channel setting (A-B-C) are ignored.

Characteristics of Radio Reception:

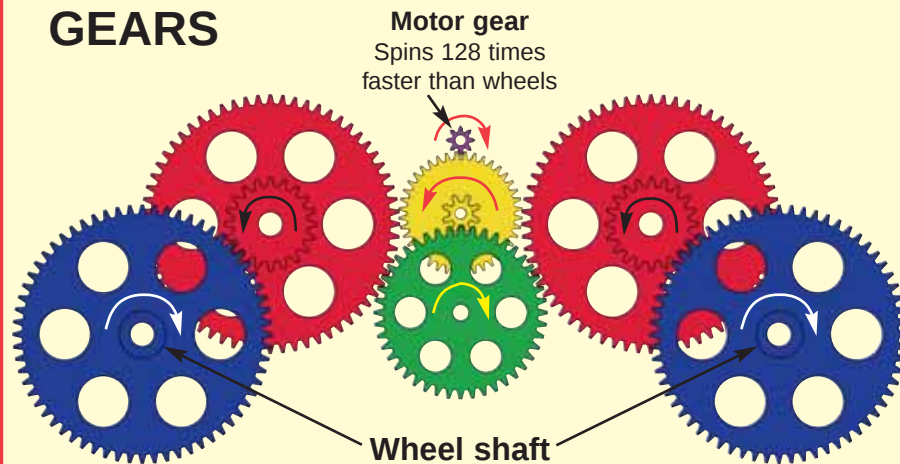
Many factors affect the ability of the Rover to receive commands from its Remote Control Transmitter. A weak battery in the Transmitter will result in a weaker transmitted signal; if the battery is very weak then the Transmitter may not function at all. The Transmitter's ability to convert electrical energy to radio energy is best when its antenna is fully extended and degrades as the antenna length is reduced. The same thing also applies to the Rover antenna's ability to convert the radio signal back into electrical energy for the receiver. The Transmitter's antenna transmits energy in all directions so as the range between it and the Rover is increased, less energy is received at the Rover. When operated with strong batteries and in an open area, the range will be at least 25 ft. Obstacles such as walls, furniture, and trees will degrade the radio signal's ability to travel through air and reduce the operating range, but will never block it completely. In some cases more radio energy may travel from the Transmitter to the Rover by going around obstacles than by going through them. In the Rover, weak batteries will reduce power to the motor and degrade the receiver's ability to filter, amplify, and decode commands from the Transmitter.



How It Works (continued)

Rover Drive Mechanism:

The small gear on the Motor drives a larger gear, which drives a larger gear, which drives two larger gears (one on each side), which drive larger gears. The last, largest gears are fixed on shafts that are attached to the front and back wheels, making them move. Note that interlocking gears spin in opposite directions. Also notice that in the sets of interlocking gears between the Motor and the gears on the wheel shafts, the number of “teeth” is increased each time (40-8, 44-8, 64-44, and 64-20), for 128:1 gear ratio overall. This means the Motor must rotate 128 times to rotate the wheels once. The reason for this is that if the Motor were to drive the wheels directly then the Rover would be so fast that it would be impossible to control. Using the gears to reduce the speed also makes the wheels move with much greater force, preventing the Rover from getting stuck in rough terrain and allowing it to carry heavy loads uphill.



General Operating Instructions

Build the circuit for Project #1. Set the channel switches on the remote control unit and Deluxe Receiver module (RX2) to the same setting (A, B, or C). Place the Rover on a flat, open area, turn the ON/OFF switch on the remote control unit and the slide switch (S1) to ON, and extend the antenna on the Remote Control.

Push both levers forward to make Snap Rover® go forward.

Push both levers backward to go backward.

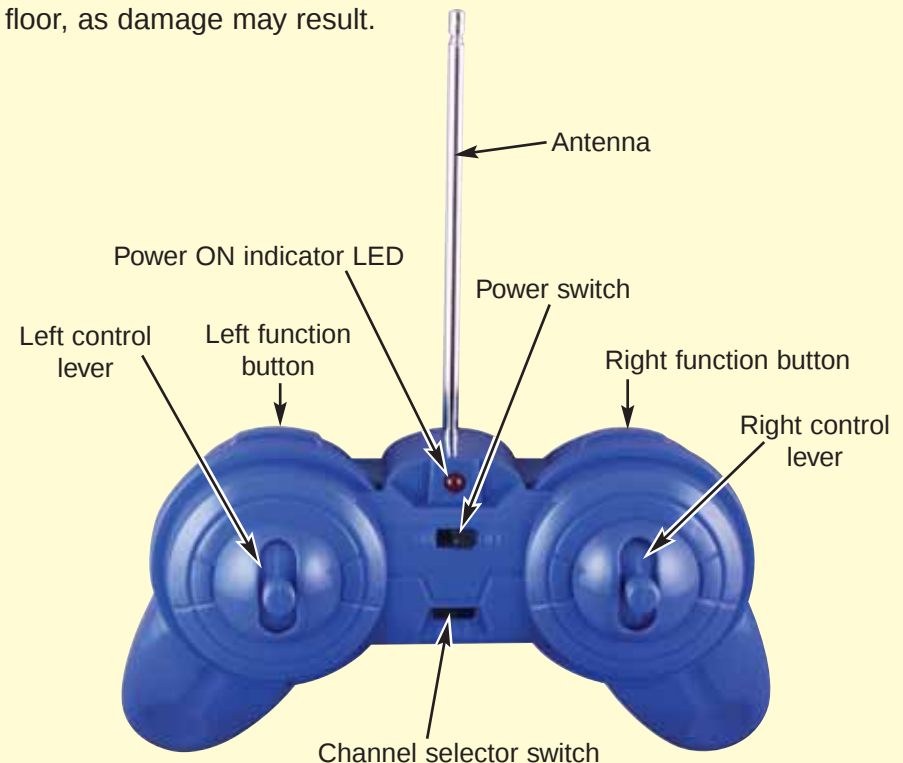
Push the left lever backward and the right lever forward to turn left.

Push the left lever forward and the right lever backward to turn right.

The buttons on the remote control unit are used to control the disc launcher, sounds, or other special functions as described in the projects. The functions of the sound & recording IC (U9) are described in Project #1.

Never operate Snap Rover® in the street.

Never drive your Rover in rain, snow, mud, sand, dirt, or on a wet floor, as damage may result.



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, 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® Electronics is not responsible for parts damaged due to incorrect wiring.**

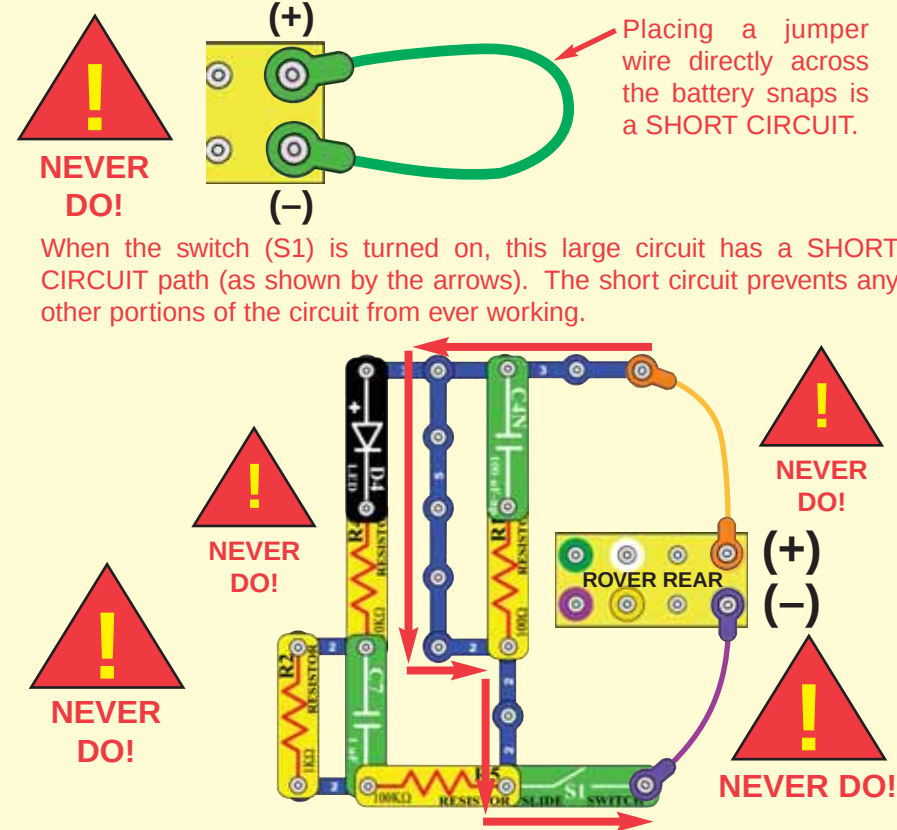
Here are some important guidelines:

- 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 resistor, motor, or the disc launcher, RX2, and U9 modules (which must be connected properly).
- 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 the disc launcher, RX2, and U9 modules 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.

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

Examples of SHORT CIRCUITS - NEVER DO THESE!!!



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® Electronics.

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.

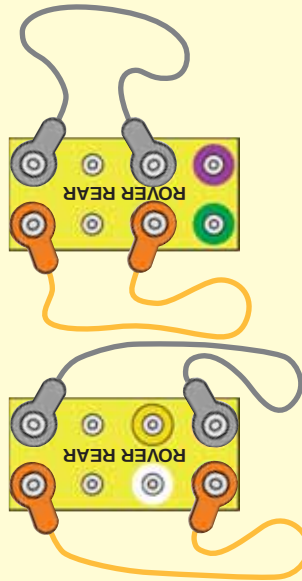
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Advanced Troubleshooting (Adult supervision recommended)

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

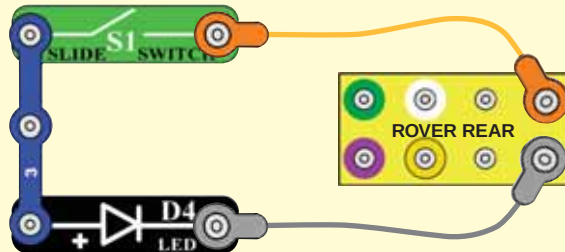
If you suspect you have damaged parts, you can follow this procedure to systematically determine which ones need replacing:

1. **Rover body and jumper wires:** Flip the Rover body upside down and make sure the wheel mechanisms are clean. Install batteries in the Rover body and connect jumper wires to the Rover rear as shown; two wheels should move. Replace the orange and gray jumper wires with each of the other colors to see if any of the jumpers are damaged. If the wheels don't move for any combination of wires, then the Rover body is damaged. Remove the gray wire; four LEDs on the side should light.



Now move the jumper wires to test the other two wheels, if they don't move then the Rover body is damaged. Remove the gray wire; four LEDs on the side should light.

2. **Slide switches (S1) and press switch (S2):** Build Project #51 (Helpless Rover) and test each slide switch by making it turn the wheels on/off. Replace the slide switch with the press switch; it works the same way.
3. **Snap wires:** Build Project #6 but replace the switch with each of the snap wires (including the 1-snaps), test them one at a time.
4. **White LED (D4) and 100Ω, 1KΩ, 10KΩ, and 100KΩ resistors (R1, R2, R4, R5):** Build this mini-circuit and turn on the switch, the LED should be bright or it is damaged. Replace the 3-snap with each of the resistors (one at a time), the LED should be bright with R1, slightly dimmer with R2, much dimmer with R4, and very dim with R5; if not then the resistor is defective.



5. **Disc Launcher (DL) module:** Build Project #42 (Disc Launcher). The launcher should start up and launch discs as described. If the launcher is jammed, turning off the circuit and removing all discs can usually fix it.
6. **Sound & Recording IC (U9) and the 1μF and 100μF capacitors (C7, C4N):** Build Project #62 (Lunar Messenger); the parts should work as described in it.
7. **Remote control unit and Deluxe Receiver (RX2):** Build Project #36 (Remote Control Right Lite) and test that the wheels and white LED (D4) can be controlled by the remote control unit as described. Be sure you have built the circuit correctly and have good batteries in both the Rover body and remote control. Have the A-B-C switches on the remote control and deluxe receiver set to the same channel, have turned on the remote control turned on and its antenna extended, and make sure it is not being interfered with by other remote control transmitters.

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

Project Listings

Project #	Description	Page #	Project #	Description	Page #
1	Space Rover.....	11	33	Switched Tone Blinker.....	27
2	Sound Disable Rover.....	12	34	Recording Blinker.....	28
3	Fun Sounds Rover.....	13	35	Tri-Switch Blinker.....	28
4	Spooky Sounds Rover.....	14	36	Remote Control Flasher.....	29
5	Simple Sounds.....	15	37	Disc Launcher.....	29
6	Not So Simple Sounds.....	15	38	Remote Control Right Lite.....	30
7	Space Sounds.....	16	39	Remote Control Left Lite.....	30
8	Audio Recorder.....	16	40	Current Diverter.....	31
9	One Sound.....	17	41	Two Tone Flash.....	31
10	Lighthouse Rover.....	17	42	Multi-Tone Rover.....	32
11	Remote Sound.....	18	43	Remote Sound & Light.....	32
12	Remote Sound Switcher.....	18	44	Double Launcher.....	33
13	Parallel Pitch Reducer.....	19	45	Remote Control Launcher.....	33
14	Series Pitch Reducer.....	19	46	Groovy Launcher.....	34
15	Resistor Row.....	20	47	Martian Monster.....	34
16	Ways to Light a Light.....	20	48	Venus Visitor.....	35
17	Nightlite Rover.....	21	49	Easy Rover.....	36
18	Remote Drive Rover.....	21	50	2-to-1 Tone.....	36
19	Tone Flicker.....	22	51	Jupiter Jumble.....	37
20	Clicker Flicker.....	22	52	Helpless Rover.....	37
21	Volume Control.....	22	53	Generator.....	38
22	Electronic Metronome.....	23	54	Lost Explorer.....	38
23	Flickering Metronome.....	23	55	Write Your Parts.....	39
24	Not So Often Timer.....	24	56	The Sound of Water.....	39
25	Stop & Light.....	24	57	Salt Pitch Changer.....	39
26	Quad Red Blinker.....	25	58	Frequency Resistors.....	40
27	Quick-Slow Blinker.....	25	59	Big Bully.....	41
28	Super Blinker.....	26	60	Little Bully.....	41
29	Goofy Blinker.....	26	61	Electricity Station.....	42
30	Noisy Flasher.....	26	62	Audio-Visual Morse Code.....	42
31	Simple Flasher.....	26	63	Lunar Messenger.....	43
32	Car Alarm.....	27			



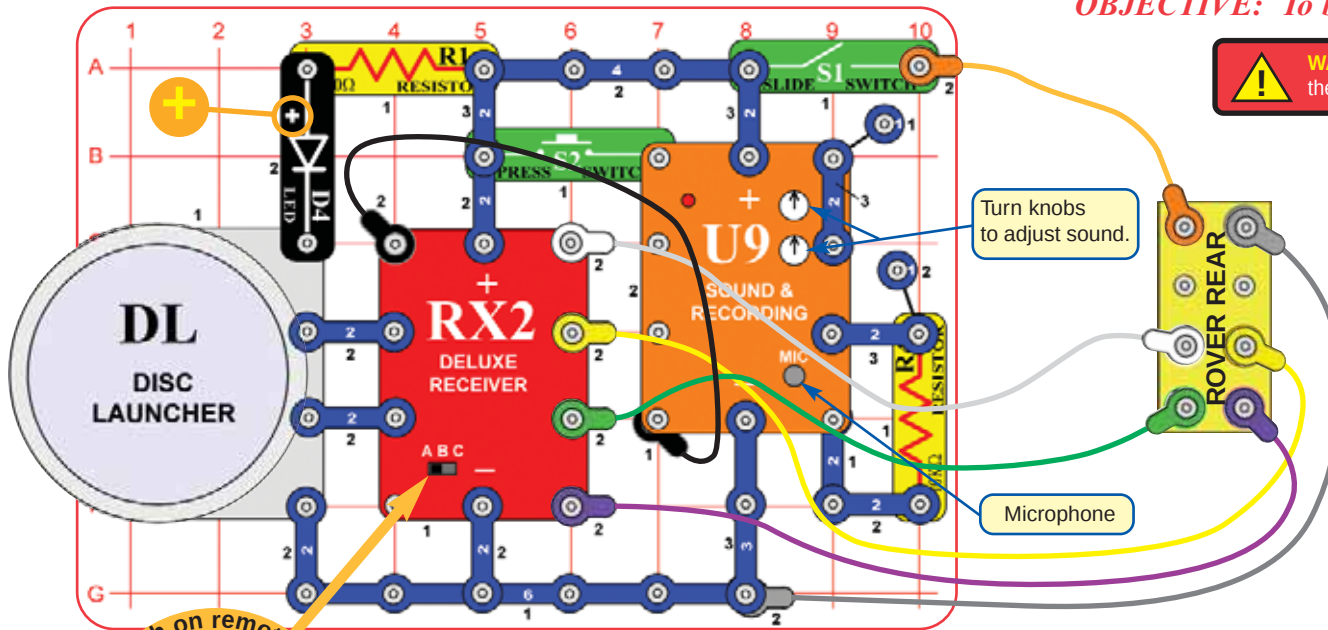
Project #1

Space Rover

OBJECTIVE: To build a remote control vehicle.



WARNING: Moving parts. Keep face and eyes away from the front of the disc launcher and from flying discs.

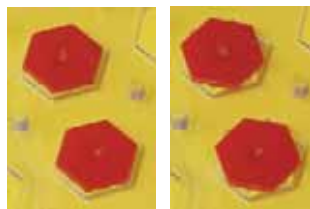


Be sure to route the jumper wires under U9 as shown.



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

Preparation: Install six (6) “AA” batteries into the bottom of the Rover body and one 9V battery into the remote control unit (batteries not included). Install the antenna into the remote control unit by screwing it in. Place the base grid on the Rover body; you may lock it into position by turning the hexagonal alignment posts (shown here), if desired.



Assembly: Build the circuit shown by placing all the parts with a black 1 next to them on the clear plastic base grid first. Then, assemble parts marked with a 2, and finally the parts marked with a 3. Be sure to place the D4 (black), RX2 (red), and U9 (orange) parts with their (+) side oriented as shown. Connect the black colored jumper wire as shown and connect the

other colored jumper wires to the rear of the body as shown (the colors are interchangeable). Set the channel switches on the remote control unit and Deluxe Receiver module (RX2) to the same setting (A, B, or C).

Recording & Sounds: Turn on the slide switch (S1). The recorded message (if any) will play, followed by space sounds. Turn either of the knobs on the sound & recording IC (U9) to adjust the tone and beat of the sounds. Push and hold the press switch (S2) and speak into the microphone on U9 to record a message of up to 12 seconds. The red light on U9 will be on while you are recording.

Remote Control: Turn on the remote control unit, extend the antenna, and use the levers to drive the Rover around. Press the left button on the remote control to play the recorded message (if any).

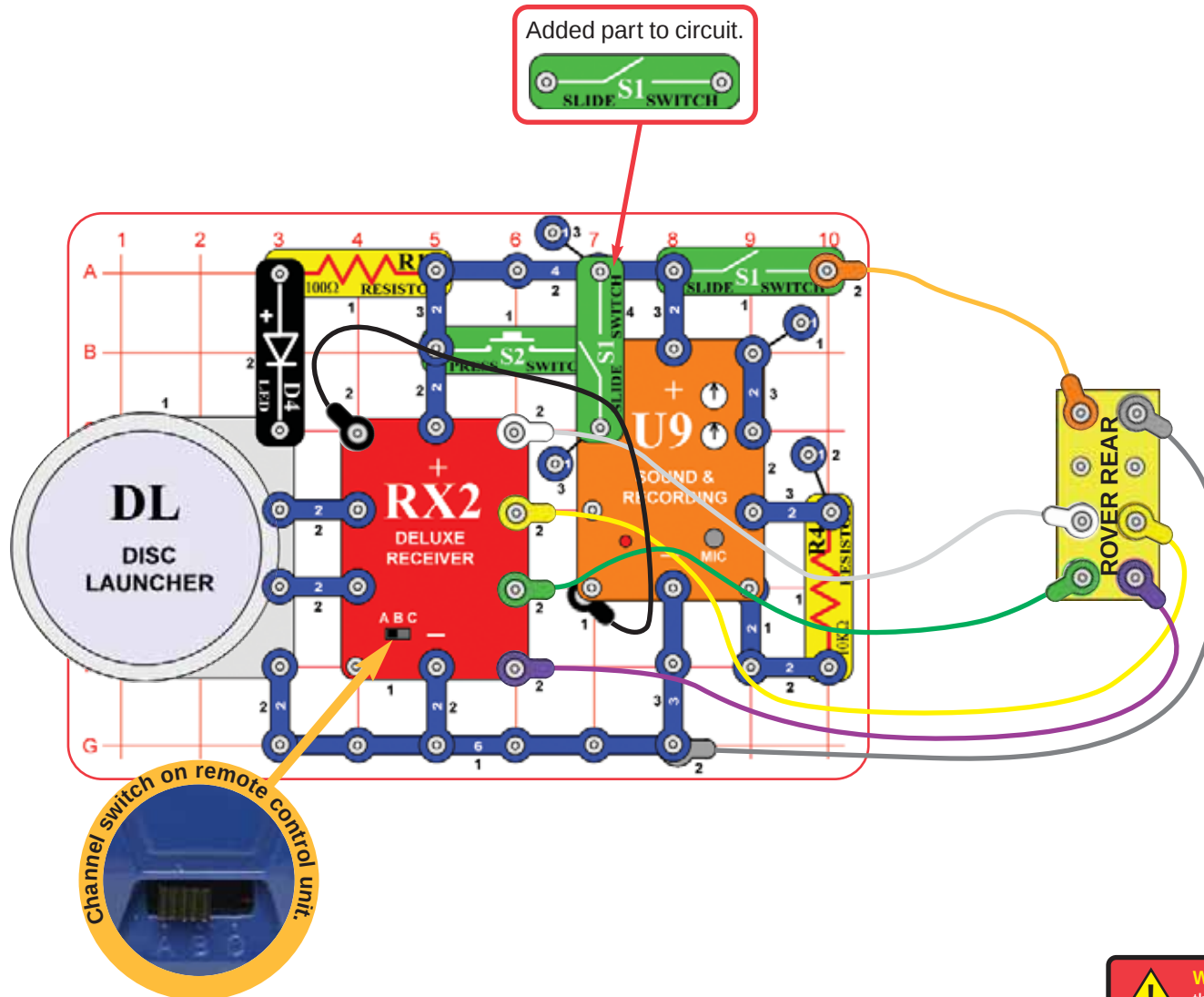
Launching Discs: Place some of the foam discs into the disc launcher (DL). Press the right button on the remote control to prepare the launcher; the eyes flash. The launcher takes a few seconds to get ready, then press the right button again to fire or hold it down to fire continuously. The launcher shuts off after a few seconds. If the launcher jams, just remove the discs to fix it. The white LED (D4) lights up when the launcher is active, so you can launch discs in the dark.



Project #2

Sound Disable Rover

OBJECTIVE: To turn off the space sounds when they get annoying.



Modify the Project #1 circuit by adding a second slide switch (S1) over the U9 sound and recording IC, using two 1-snaps as shown. The circuit works the same as before except turning on the new S1 switch shuts off the space sounds.

Now your Rover can sneak up on someone, play your recording, and launch the discs!

As an option, change the sound into just a simple tone by removing the 2-snap wire on the upper-right of U9 (on level 3).



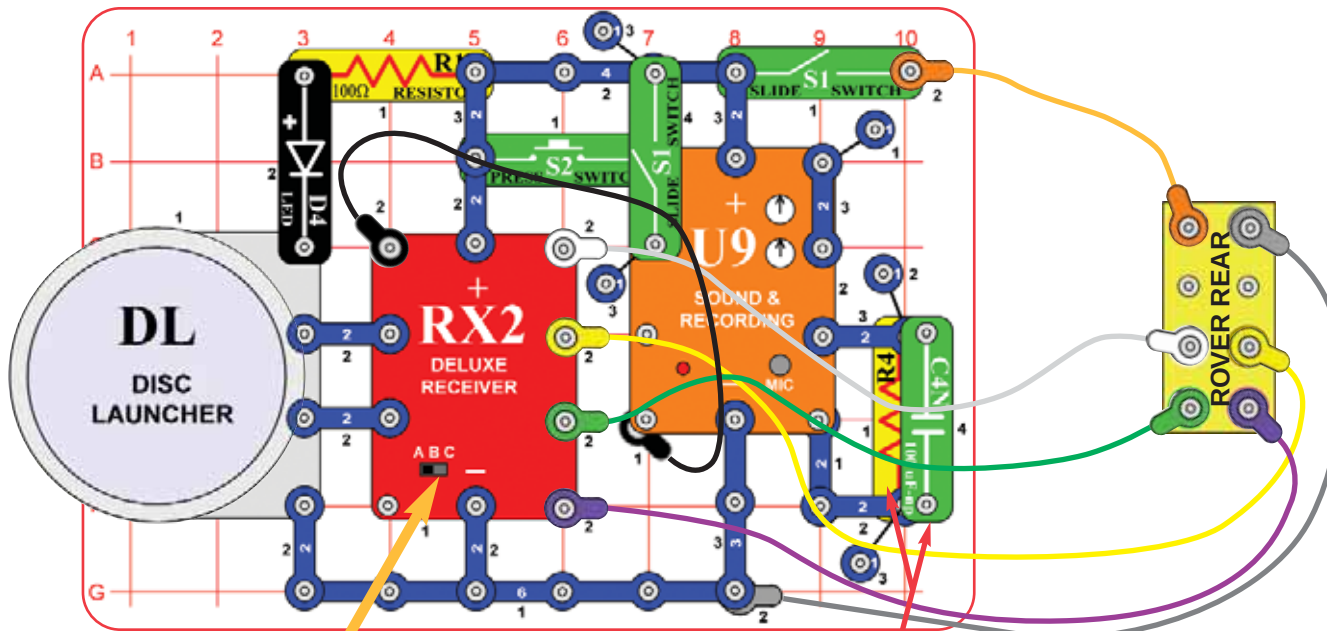
WARNING: Moving parts. Keep face and eyes away from the front of the disc launcher and from flying discs.



Project #3

Fun Sounds Rover

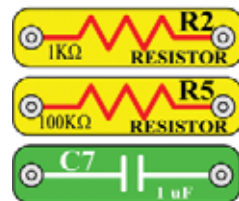
OBJECTIVE: To make cute sounds.



Parts in the circuit:



Parts you can replace them with:



Modify the Project #2 circuit by adding a the 100 μ F capacitor (C4N) over the 10K resistor (R4), using a 1-snap as shown. The circuit works the same as before except that the space sounds sound a little different. Turn knobs on U9 to change the sound.

Next replace the 10K resistor (R4) with either the 1K resistor (R2) or the 100K resistor (R5), and turn the knobs on U9 to see how the range of sounds has been changed.

Now replace the 100 μ F capacitor (C4N) with the 1 μ F capacitor (C7), and turn the knobs on U9 to see how the range of sounds has been changed. Try different combinations of resistor and capacitor values.

Changing the resistor and capacitor values adjusts an electronic delay, which changes the sound effects in an electrical signal controlling a speaker (SP).



WARNING: Moving parts. Keep face and eyes away from the front of the disc launcher and from flying discs.



Spooky Sounds Rover

[illegible]

Changing the resistor and capacitor values adjusts an electronic delay, which changes the sound effects in an electrical signal controlling a speaker (SP).



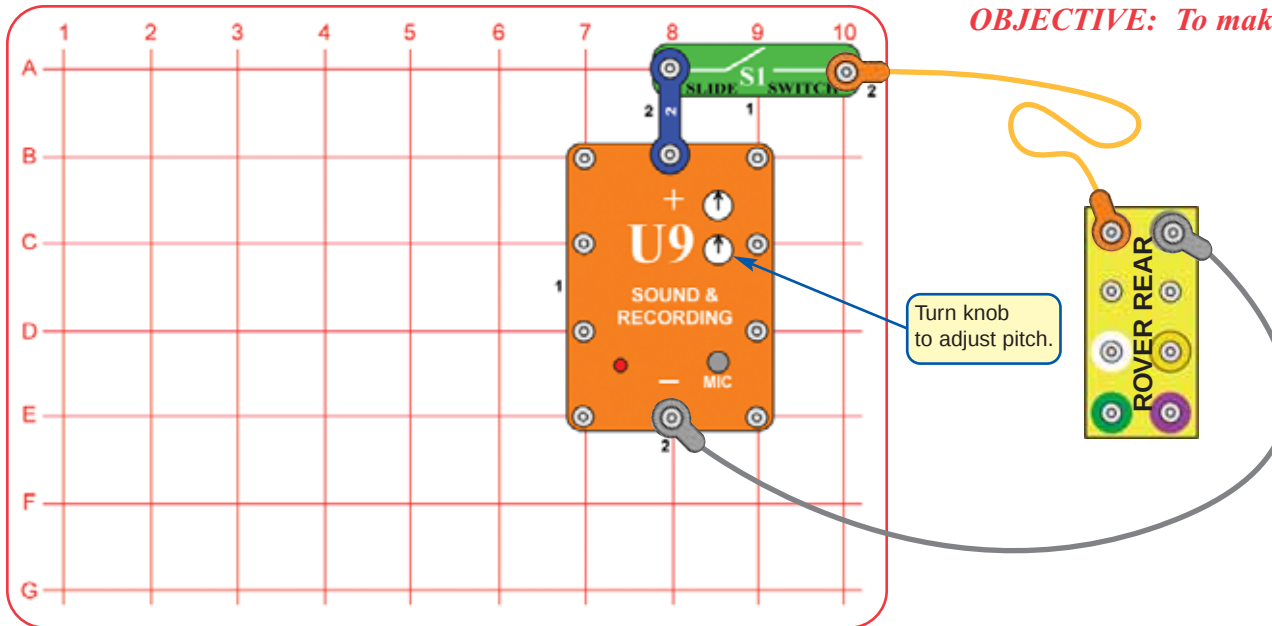
WARNING: Moving parts. Keep face and eyes away from the front of the disc launcher and from flying discs.



Project #5

Simple Sounds

OBJECTIVE: To make sounds electronically.



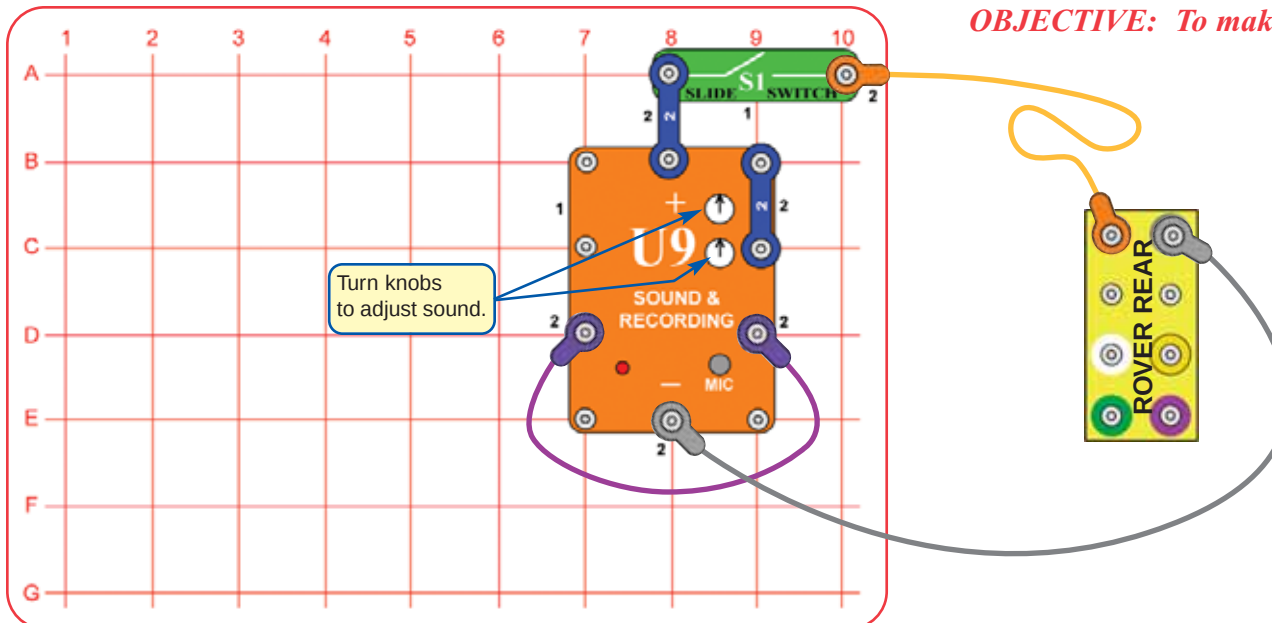
Build the circuit with the base grid centered on the Rover body, and connect the jumper wires as shown. Turn on the slide switch (S1). The recorded message may play, followed by a tone. Turn the lower knob on the sound & recording IC (U9) to adjust the pitch (frequency) of the tone.



Project #6

Not So Simple Sounds

OBJECTIVE: To make sounds electronically.



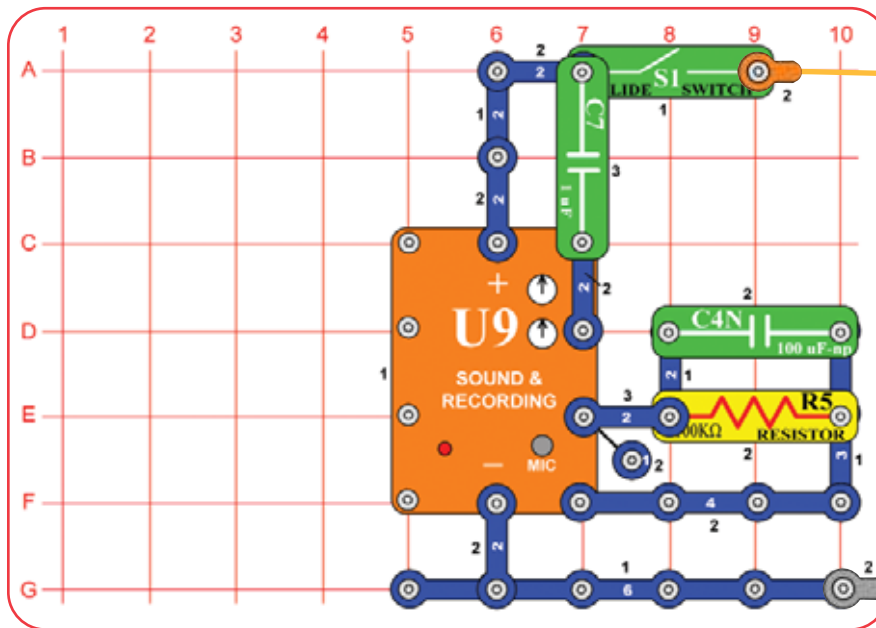
Build the circuit with the base grid centered on the Rover body, and connect the jumper wires as shown. Turn on the slide switch (S1). The recorded message may play, followed by a tone. Turn the knobs on the sound & recording IC (U9) to adjust the sound.



Project #7

Space Sounds

OBJECTIVE: To make exciting sounds.



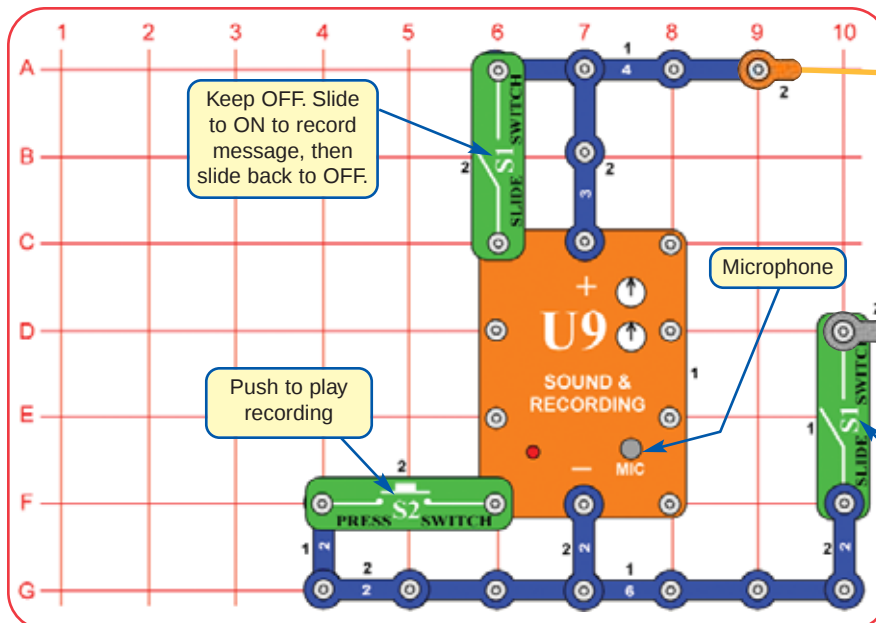
Build the circuit with the base grid centered on the Rover body, and connect the jumper wires as shown. Turn on the right slide switch (S1). Turn the knobs on the sound & recording IC (U9) to make a variety of space sounds.



Project #8

Audio Recorder

OBJECTIVE: To make an electronic recording and play it back.



Build the circuit with the base grid centered on the Rover body, and connect the jumper wires as shown. Turn off the left slide switch (S1) and turn on the right slide switch.

Turn on the left slide switch and talk into the microphone to make a recording; turn off the left switch when finished. The red light on U9 will be on while you record, it goes out when you finish or when the memory is full. Your recording can be up to 12 seconds long.

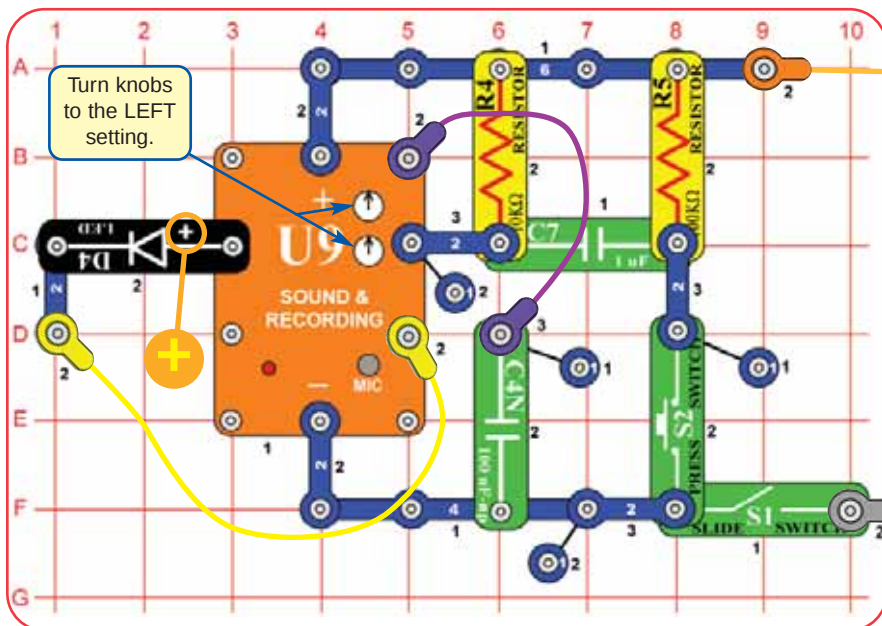
Push the press switch (S2) to play your recording.



Project #9

One Sound

OBJECTIVE: *To make sound for a while.*



Build the circuit with the base grid centered on the Rover body, and connect the jumper wires as shown. TURN THE KNOBS on U9 TO THE LEFT setting. Turn on the slide switch (S1), the recorded message (if any) may play.

Push the press switch; a tone is heard for a few seconds and then shuts off. You can adjust how long the tone plays for by turning the upper U9 knob a little to the right. You can adjust the pitch of the tone by turning the lower knob on U9 a little to the right.

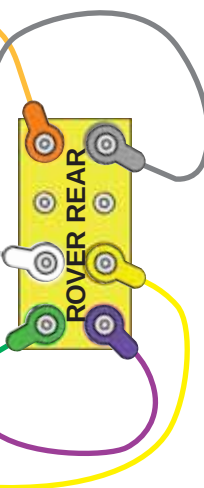
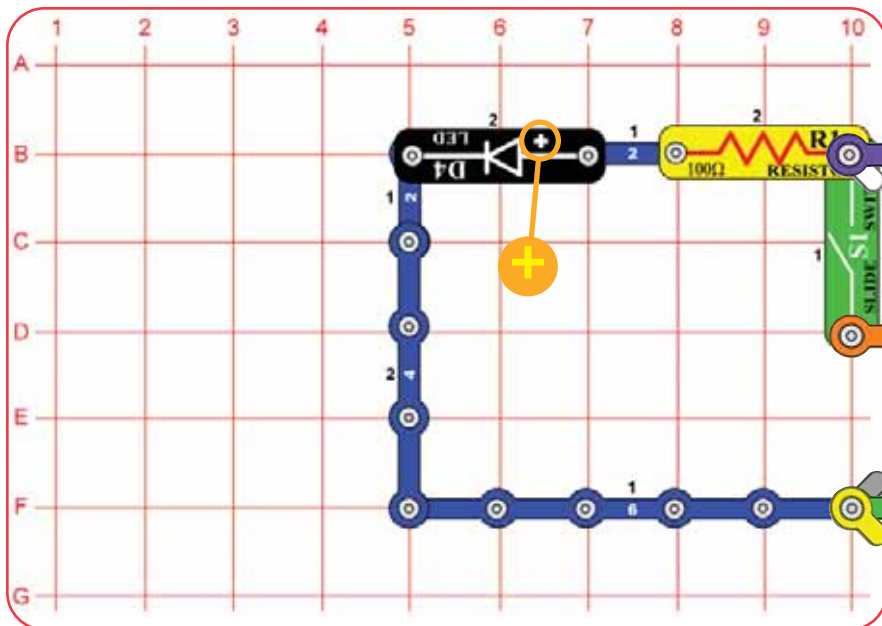
If the upper U9 knob is set too far to the right then the sound will seem to stay on forever. If the lower U9 knob is set too far to the right then you may not hear any sound.



Project #10

Lighthouse Rover

OBJECTIVE: *To make a rotating light.*



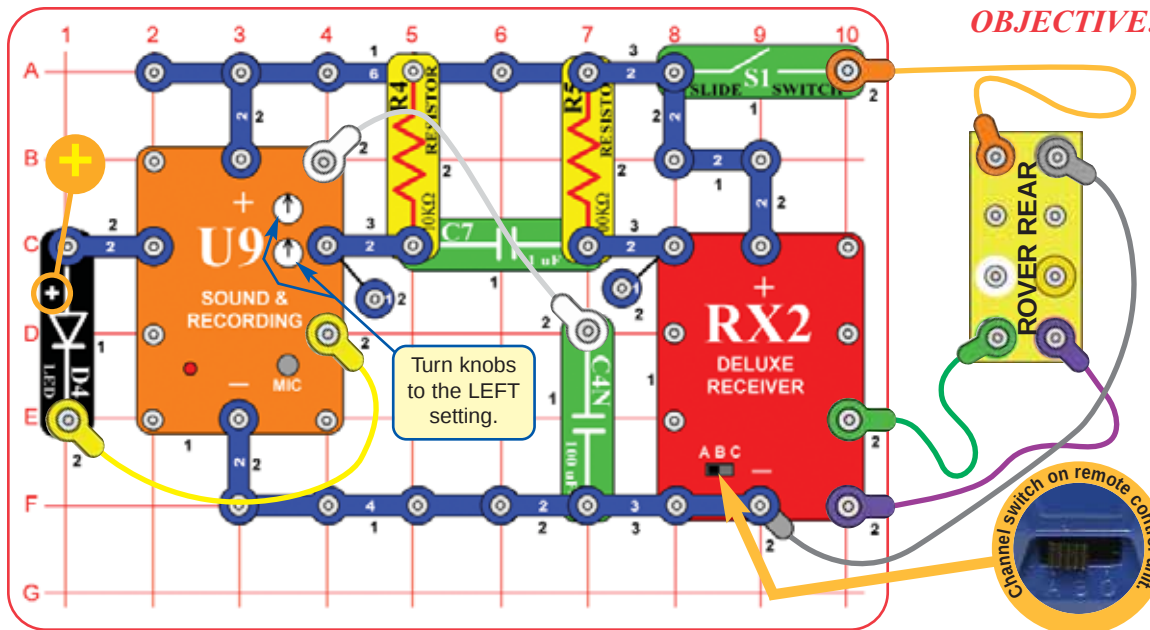
Build the circuit, place the base grid centered on the Rover body, and connect the jumper wires as shown. Place the Snap Rover® in the middle of a dimly lit room and turn on the slide switch (S1). The light will shine around the room as Snap Rover® spins.



Project #11

Remote Sound

OBJECTIVE: *To make sound for a while.*



Build the circuit with the base grid centered on the Rover body, and connect the jumper wires as shown. TURN THE KNOBS on U9 TO THE RIGHT setting. Turn on the slide switch (S1).

Turn on the remote control unit and extend the antenna. Push the right button on the remote control; a tone is heard for a few seconds and then shuts off. You can adjust how long the tone plays for by turning the upper U9 knob a little to the left. You can adjust the pitch of the tone by turning the lower knob on U9 a little to the left.

You can use the right remote control lever to move Rover in a circle, but the left wheels will not work.

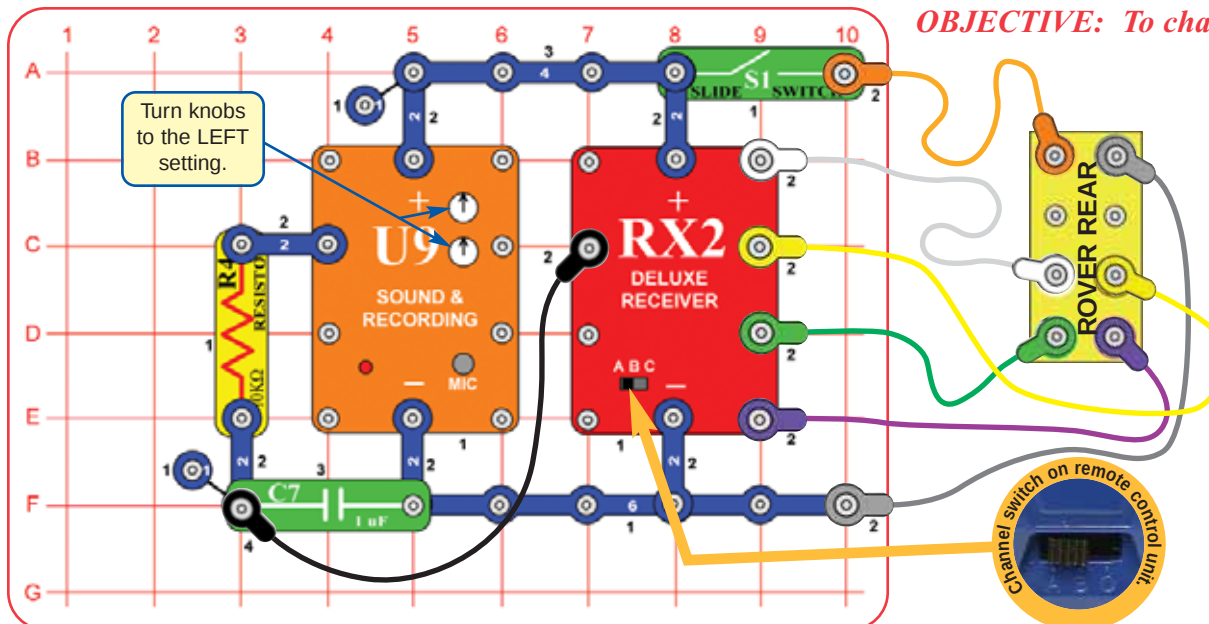
If the upper U9 knob is set too far to the left then the sound will seem to stay on forever. If the lower U9 knob is set too far to the left then you may not hear any sound.



Project #12

Remote Sound Switcher

OBJECTIVE: *To change sounds by remote control.*



Build the circuit with the base grid centered on the Rover body, and connect the jumper wires as shown. Turn on the remote control unit and extend the antenna. Turn on the slide switch (S1), you will hear a tone (a recording may play first). Turn the lower knob on U9 to the right for the best effects.

Push the left button on the remote control to change the sound. If the lower knob on U9 is set to the right then the pitch of the tone will change, otherwise the tone shut off.

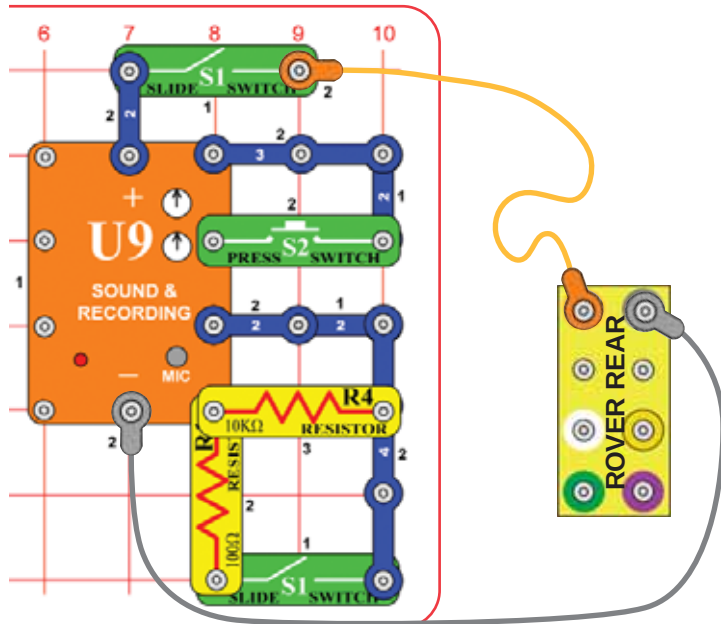
Replace the 10K resistor (R4) with any of the other resistors (R1, R2, or R5) or replace the 1 μ F capacitor (C7) with the 100 μ F capacitor (C4N) and see how the sound changes.



Project #13

Parallel Pitch Reducer

OBJECTIVE: To show how resistors work.



Turning on the switch places the 100 ohm resistor (R1) in parallel with the 10K ohm resistor (R4), changing the resistance which controls the pitch of the tone.



Build the circuit with the base grid centered on the Rover body, and connect the jumper wires as shown. Set the upper knob on the U9 to the middle and the lower knob to the right. Turn on the top slide switch (S1) to hear a tone (sometimes a recording will play first).

Turn on the lower slide switch (S1) to hear a lower-pitch tone or turn it off for a higher-pitch tone. Push the press switch (S2) to make the sound multi-tone.

The upper U9 knob changes the multi-tone effects and the lower U9 knob changes the tone pitch.

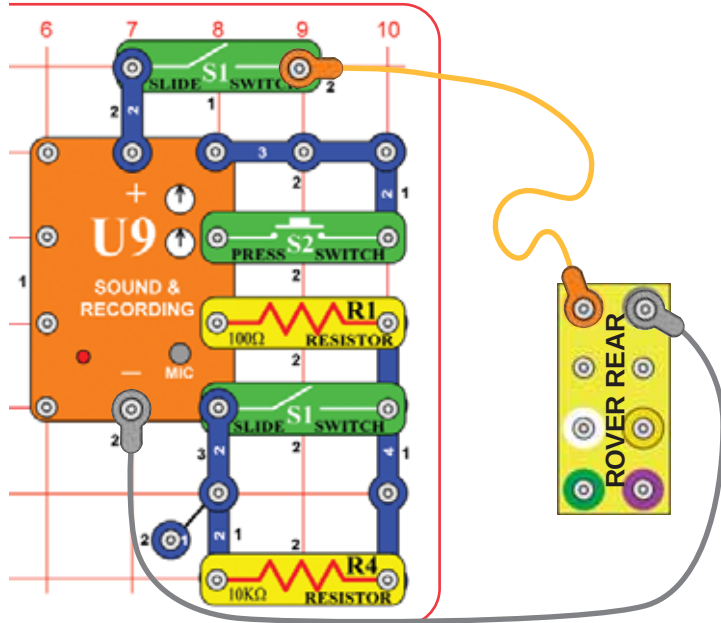
Option A: replace either resistor (R1 or R4) with the 1K ohm resistor (R2).



Project #14

Series Pitch Reducer

OBJECTIVE: To show how resistors work.



Turning off the switch places the 10K ohm resistor (R4) in series with the 100 ohm resistor (R1), changing the resistance which controls the pitch of the tone.



Modify the preceding circuit to match this one. It works the same way even though the resistors are arranged differently.

Option A: replace either resistor (R1 or R4) with the 1K resistor (R2).

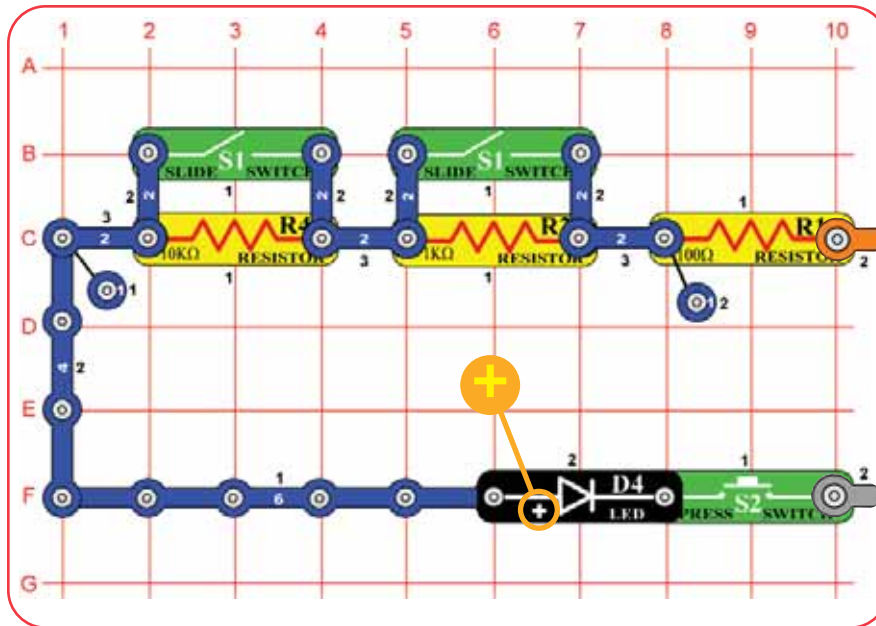




Project #15

Resistor Row

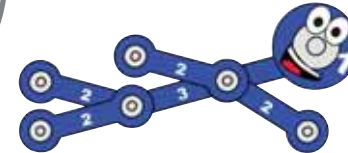
OBJECTIVE: To learn about resistors.



When the slide switches are off the larger resistors (R2 and R4) are connected in a series, limiting the flow of electricity to the white LED. Turning on the slide switches bypasses the larger resistors and the LED gets brighter. Connecting resistors in a series increases the resistance.

Build the circuit and connect the jumper wires as shown. Push the press switch (S2) to turn on the white LED (D4), and use the slide switches (S1) to vary the brightness.

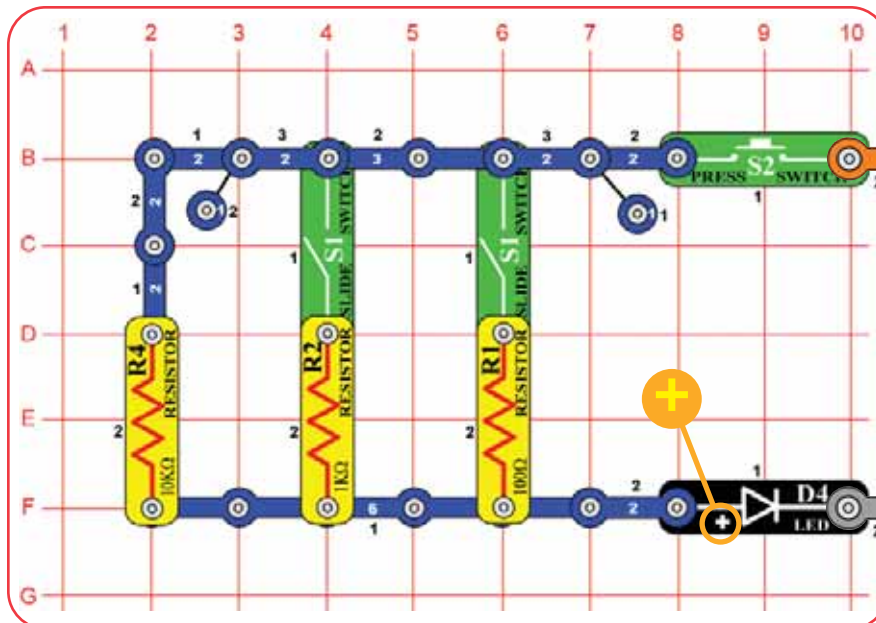
If you replace one of the resistors with the much larger 100K resistor (R5), the white LED may not light at all.



Project #16

Ways to Light a Light

OBJECTIVE: To learn about resistors.



When the slide switches are on the smaller resistors (R1 and R2) are connected in parallel with the larger one (R4), increasing the flow of electricity to the white LED. Turning on the slide switches provides alternate paths around the largest resistor and the LED gets brighter. Connecting resistors in parallel decreases the resistance.

Build the circuit and connect the jumper wires as shown. Push the press switch (S2) to turn on the white LED (D4), and use the slide switches (S1) to vary the brightness.

If you replace one of the resistors with the much larger 100K resistor (R5), it will be almost the same as leaving that one out of the circuit.

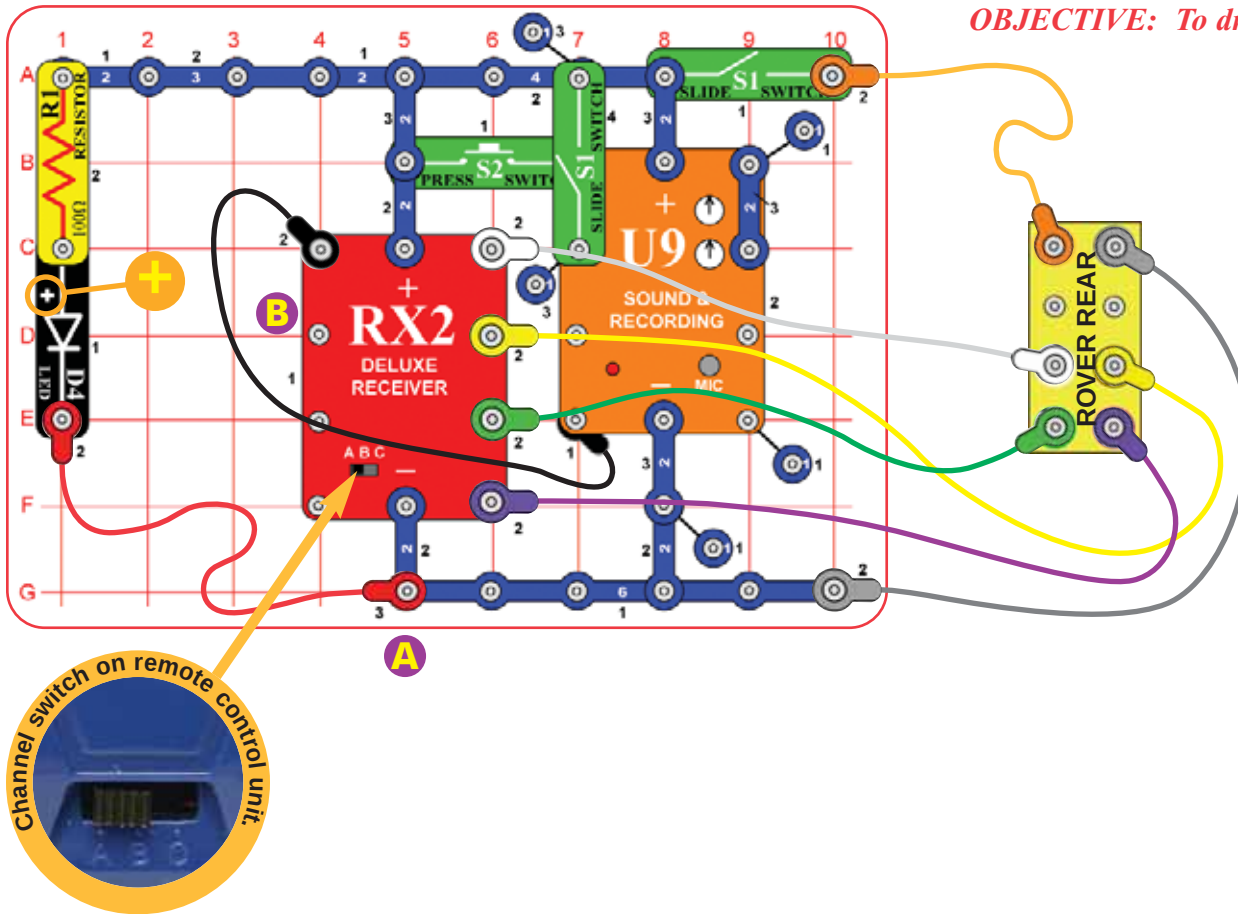




Project #17

Nightlite Rover

OBJECTIVE: *To drive around in the dark.*



Build the circuit (being sure to connect all eight colored jumper wires), and turn on the right slide switch (S1). Use the levers on the remote control unit to drive Rover around. The white LED (D4) in front acts as a headlight, so you can use it in a dark room.

If the left slide switch is off then you will hear a tone. Turn the knobs on the sound & recording IC (U9) to change the tone.

Press the left button on the remote control to play the recorded message. Push the press switch (S2) and talk into the microphone on U9 (sound & recording IC) to change the recording.



Project #18

Remote Drive Rover

OBJECTIVE: *To build a remote control vehicle.*

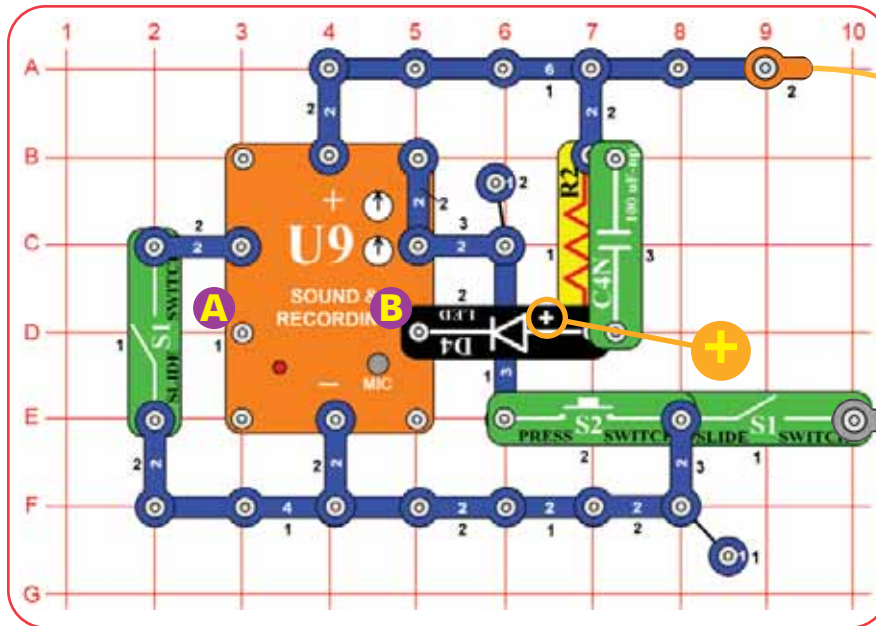
Move the end of the red jumper wire that is at the location marked **A** to the location marked **B** (on RX2). Now the white LED is controlled by the right button on the remote control unit.



Project #19

Tone Flicker

OBJECTIVE: To hear sounds and flash lights.



Build the circuit and connect the jumper wires as shown, note that the 1KΩ resistor (R2) is underneath the 100µF capacitor (C4N). Turn on the right slide switch (S1), you hear a tone and the white LED (D4) flashes. Turn on the left slide switch to shut off the tone and push the press switch (S2) to stop the flashing.



Project #20

Clicker Flicker

OBJECTIVE: To hear sounds and flash lights.

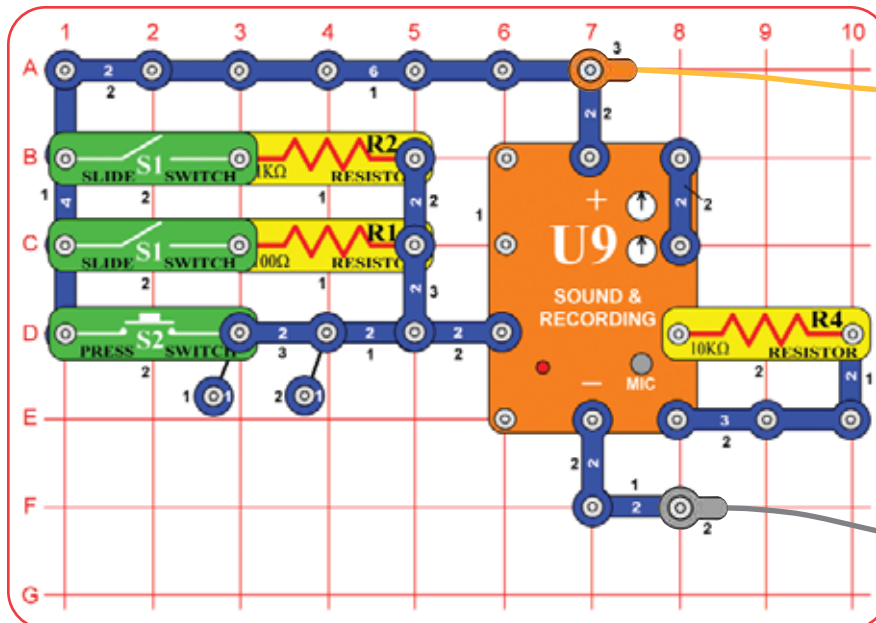
Add the purple jumper wire across the points marked **A** & **B** over the sound & recording IC (U9). The circuit works the same way except you hear a clicking sound instead of a musical tone.



Project #21

Volume Control

OBJECTIVE: To control the volume of sound.



Build the circuit and connect the jumper wires as shown. You hear a tone, use the switches (S1 and S2) to adjust the volume.

Turning on the switches diverts some electrical energy away from the speaker, reducing the volume of the sound.

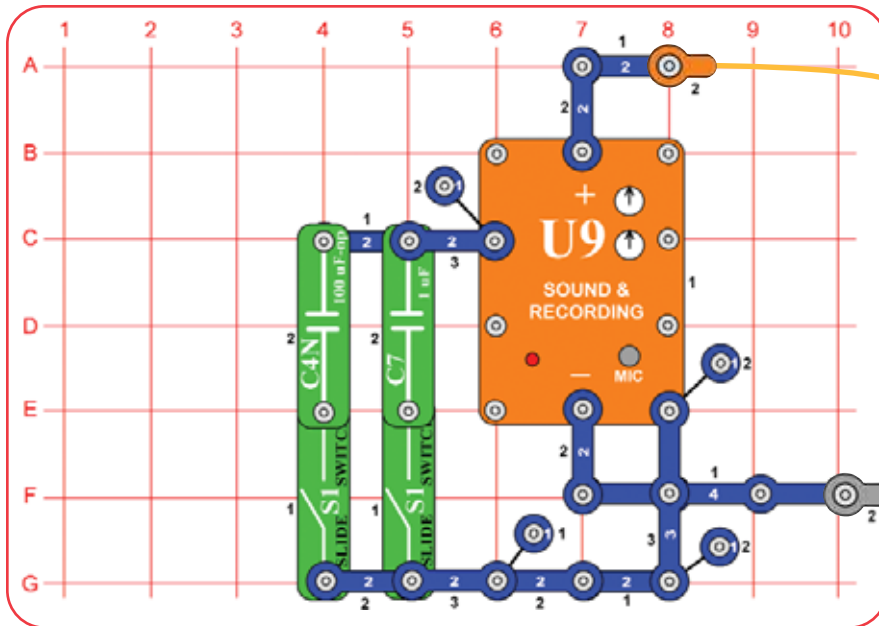
Use the knobs on the sound & recording IC (U9) if you want to change the tone.



Project #22

Electronic Metronome

OBJECTIVE: To learn about metronomes.



Build the circuit and connect the jumper wires as shown. Turn on one of the slide switches (S1) and adjust lower knob on the sound & recording IC (U9).

The left switch adds the 100µF capacitor (C4N) to the circuit, which regulates the sound to be a slow clicking. The left switch adds the smaller 1µF capacitor (C7) to the circuit, giving a much faster clicking. If the U9 knob is set so the clicking is fast, the sound appears to be a continuous tone.

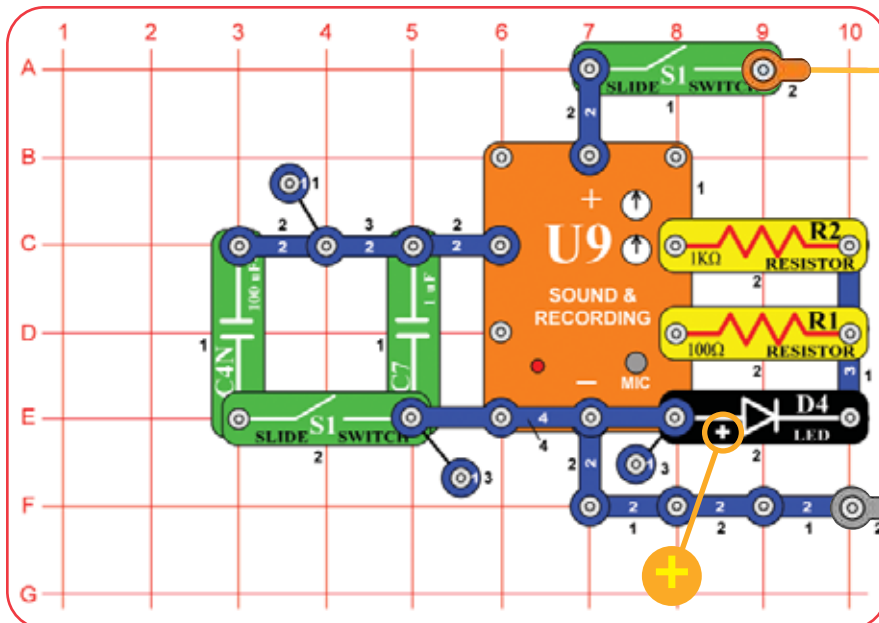
When the circuit is clicking about once a second then it feels like the “beat” of a song. It is like a metronome, which is used to keep time for the rhythm of a song.



Project #23

Flickering Metronome

OBJECTIVE: To learn about metronomes.



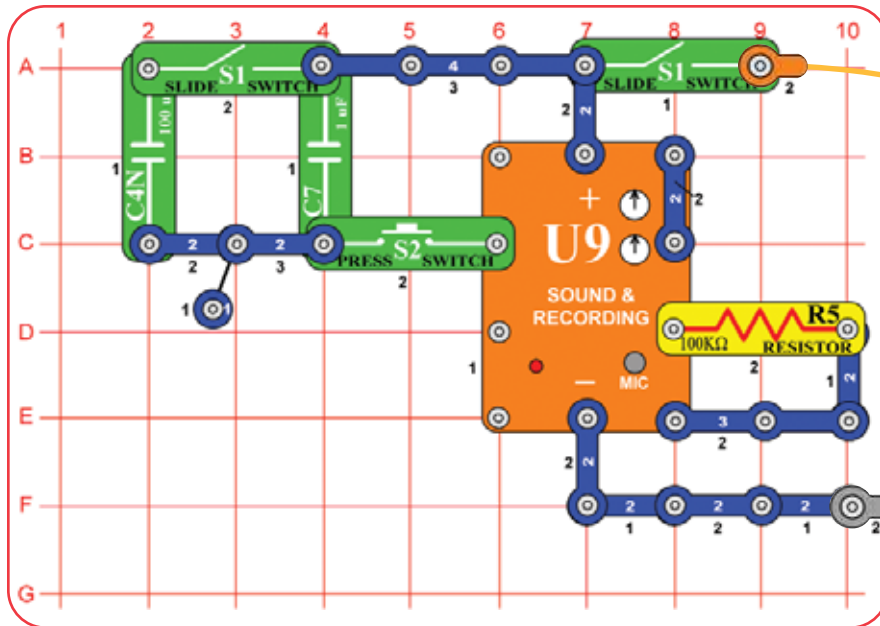
This is a metronome like the preceding circuit; it makes a clicking sound. Use the lower knob on the sound & recording IC (U9) and the left slide switch (S1) to adjust the click rate. The white LED (D4) is also flickering at the same rate; you may need to look closely at it to see the light.



Project #24

Not So Often Timer

OBJECTIVE: *To make cute sounds.*



Build the circuit and turn on the right slide switch (S1). Use the knobs on the sound & recording IC (U9) to adjust the tone.

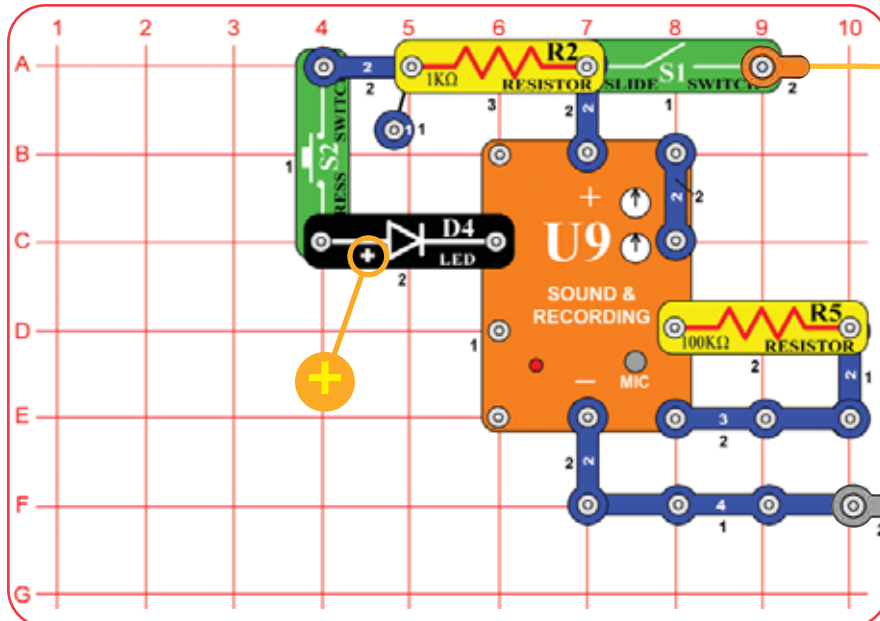
Push and hold the press switch (S2) to change the sound from a tone to clicking. Turn on the left slide switch to lower the clicking rate, by adding the 100µF capacitor (C4N) to the circuit.



Project #25

Stop & Light

OBJECTIVE: *To make cute sounds.*



Build the circuit and turn on the slide switch (S1). Use the knobs on the sound & recording IC (U9) to adjust the tone.

Push and the press switch (S2) to stop the sound and light the white LED (D4).

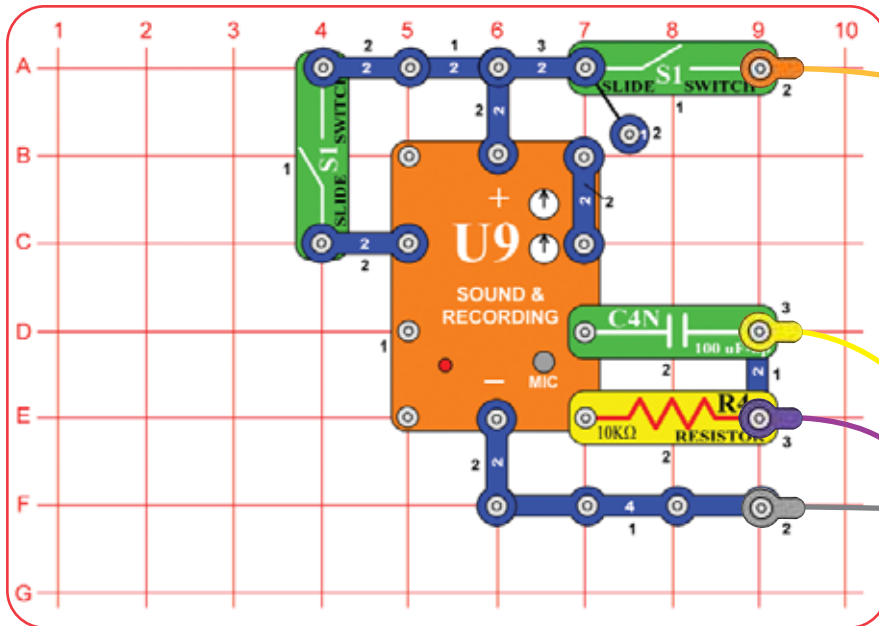
You can change the sound by adding the 100µF capacitor (C4N) directly over the 100KΩ resistor (R5) using two 1-snaps.



Project #26

Quad Red Blinker

OBJECTIVE: To make cute sounds and flash lights.



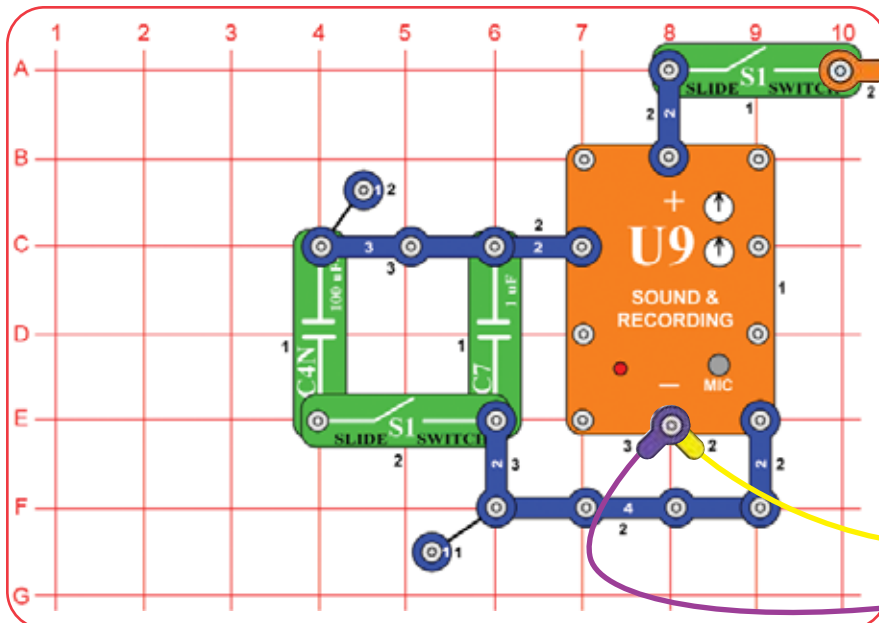
Build the circuit and turn on the right slide switch (S1). The red lights in the Rover body are blinking and a tone is heard. Use the knobs on the sound & recording IC (U9) to adjust the blink rate and tone. Turn on the left slide switch to shut off the sound.



Project #27

Quick-Slow Blinker

OBJECTIVE: To make cute sounds and flash lights.

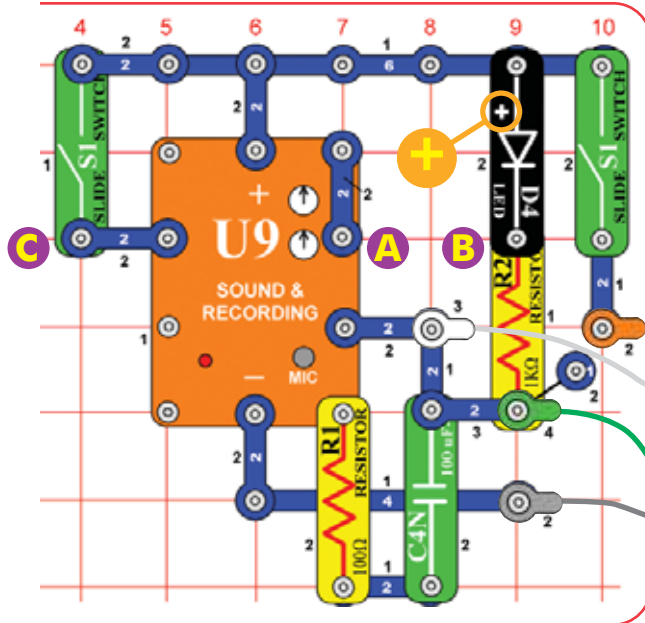


Build the circuit and turn on the right slide switch (S1). Lights in the Rover body are blinking and a tone is heard. Use the lower knob on the sound & recording IC (U9) to adjust the blink rate and tone. Turn on the left slide switch to slow down the blink rate by adding a much larger capacitor to the circuit.

Project #28

Super Blinker

OBJECTIVE: To make a flashing circuit.



Build the circuit and connect the jumper wires as shown. Turn on the right slide switch (S1) to flash lights and make sound. Use the knobs on the sound & recording IC (U9) to adjust the blink rate and tone. You can shut off the sound by turning on the left slide switch.

You can change the sound by replacing the 100Ω resistor (R1) with the 10KΩ resistor (R4).

Project #29 Goofy Blinker

OBJECTIVE: To make a flashing circuit with weird sounds.

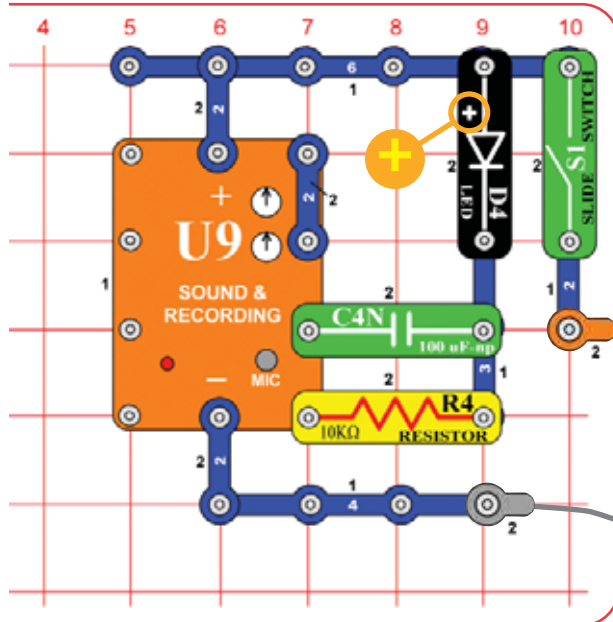
Add the 1µF capacitor (C7) between the points marked **A** & **B**. This creates some unusual sound effects.

To change the sound again, add the 10KΩ resistor (R4) between the points marked **B** & **C** using the red and black jumper wires.

Project #30

Noisy Flasher

OBJECTIVE: To make a flashing circuit with sounds.



Build the circuit and connect the jumper wires as shown. The white LED (D4) flashes and tones are heard. Adjust the knobs on the sound & recording IC (U9) to change the sound.

You can replace the 10KΩ resistor (R4) with one of the colored jumper wires or another resistor for different sounds.

Project #31 Simple Flasher

OBJECTIVE: To make a flashing circuit with simple sounds.

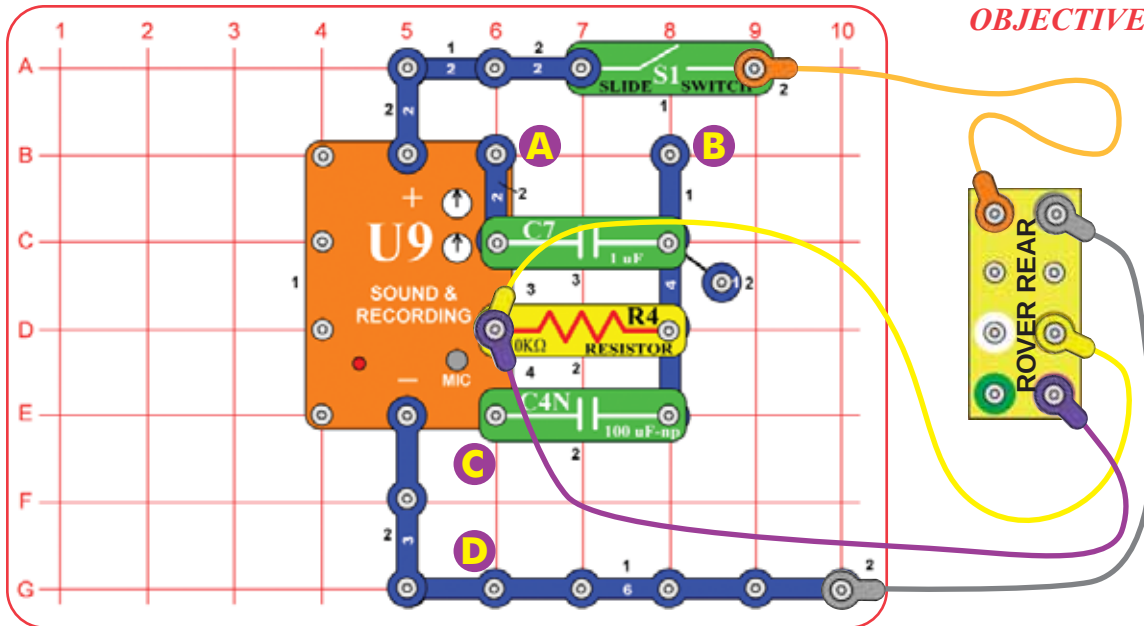
Remove the 10KΩ resistor (R4) and replace the 100µF capacitor (C4N) with the 100Ω resistor (R1). Now the LED is brighter and the sound is a simple tone.



Project #32

Car Alarm

OBJECTIVE: To make cute sounds and flash lights.



Build the circuit and turn on the slide switch (S1). Lights in the Rover body are blinking and a sound like a car alarm is heard. Use the knobs on the sound & recording IC (U9) to adjust the blink rate and tone.

For more fun, add the 1KΩ resistor (R2) across the points marked **A** & **B** using a single snap.

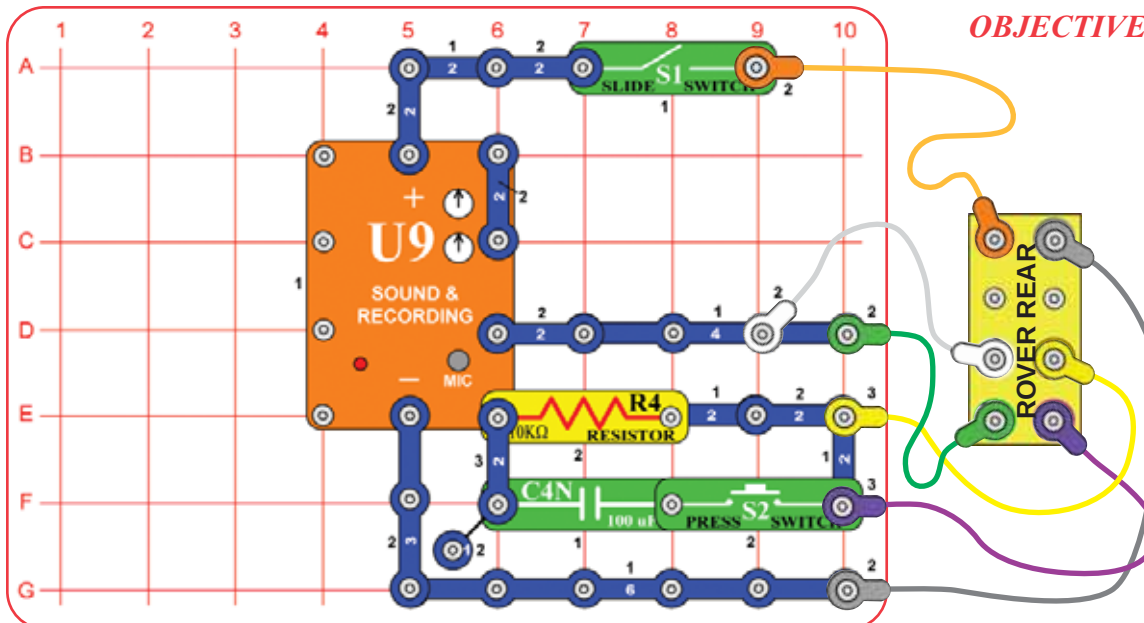
For yet more fun, add the white LED (D4) across the points marked **C** & **D** using a single snap (the "+" side of D4 goes to point **C**).



Project #33

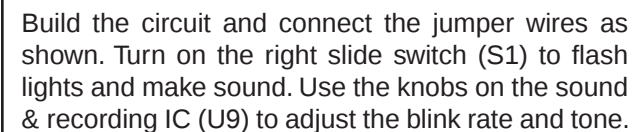
Switched Tone Blinker

OBJECTIVE: To make cute sounds and flash lights.



Build the circuit and turn on the slide switch (S1). Lights in the Rover body are blinking and sound is heard. Use the knobs on the sound & recording IC (U9) to adjust the blink rate and tone. Push the press switch (S2) to change the frequency of the tone.

OBJECTIVE: *To make a flashing circuit.*

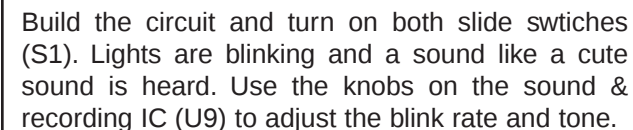


Push the press switch (S2) to play the recording. Turn on the left slide switch and talk into the microphone to change the recording; turn it off when finished.

Replace the 100 μ F capacitor (C4N) with the 1 μ F capacitor (C7) to change the sound.

10

OBJECTIVE: *To make cute sounds and flash lights.*



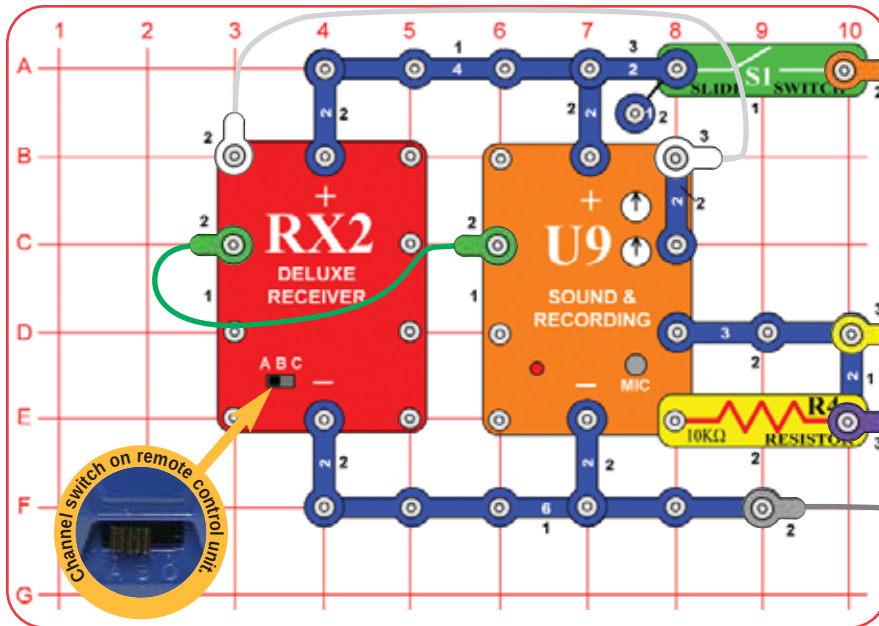
Push the press switch (S2) to stop the sound. Turn off the lower slide switch to stop the sound and blinking.



Project #36

Remote Control Flasher

OBJECTIVE: To sounds and lights remotely.



Build the circuit and connect all the jumper wires as shown. Be sure the deluxe receiver (RX2) and remote control unit are set to the same channel and turn on the slide switch (S1). Lights in the Rover body are blinking and a tone is heard. Use the knobs on the sound & recording IC (U9) to adjust the blink rate and tone.

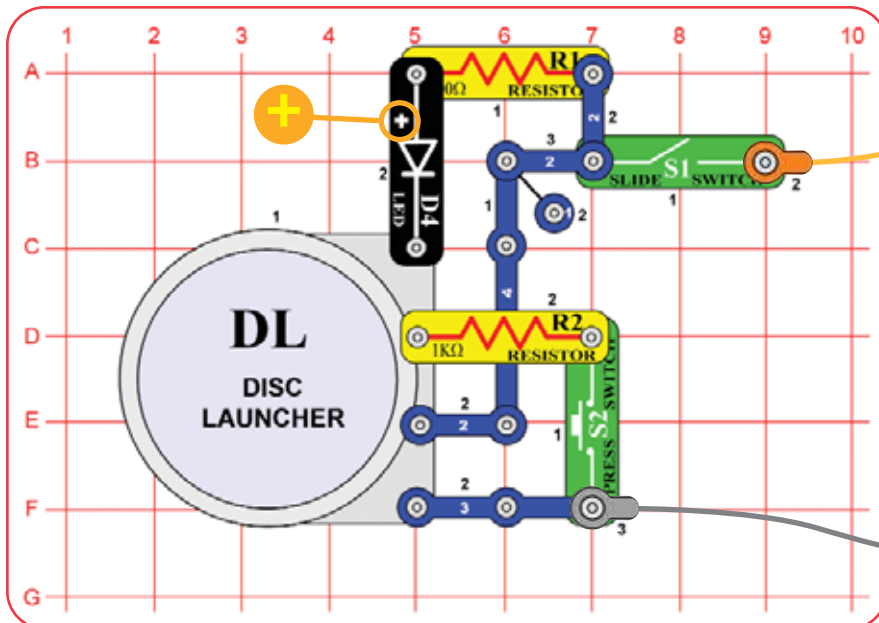
Use the buttons on the remote control unit to stop the sound or blinking.



Project #37

Disc Launcher

OBJECTIVE: To send foam discs flying.



Build the circuit and place discs inside the disc launcher (DL). Turn on the slide switch (S1) - nothing happens yet.

Push the press switch (S2); a motor starts up, the "eyes" start blinking, and the white LED (D4) lights. If you hold down the press switch then the foam discs will be launched into the air.

Position the launcher so that discs will not fly toward people, animals, or objects.

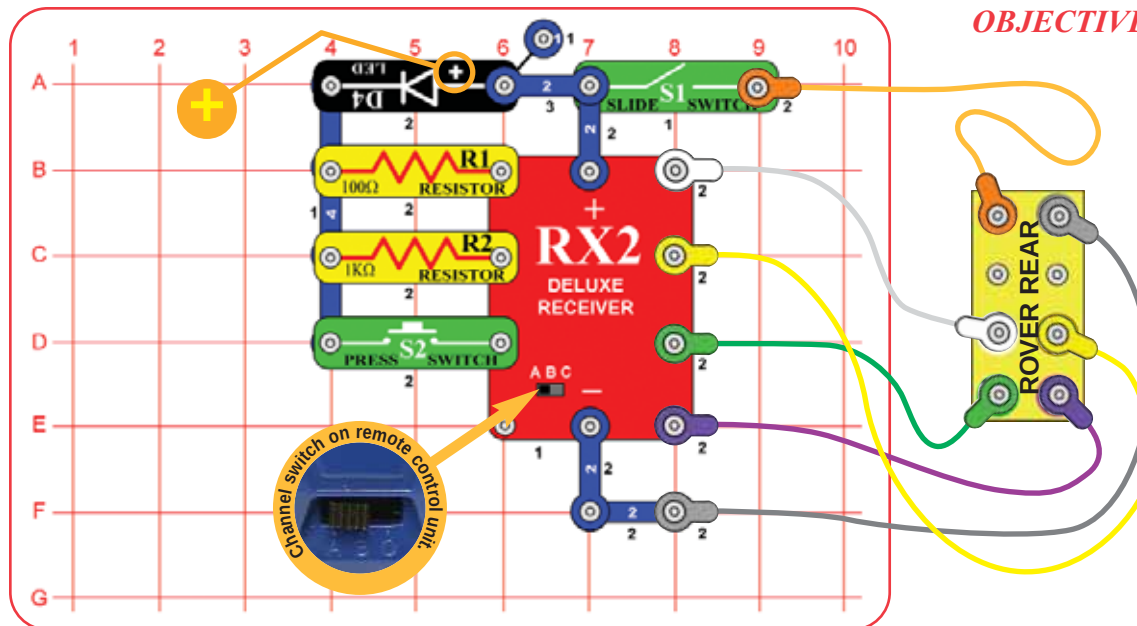
WARNING: Moving parts. Keep face and eyes away from the front of the disc launcher and from flying discs.



Project #38

Remote Control Right Lite

OBJECTIVE: To use remote control.



Build the circuit and connect the jumper wires as shown. Turn on the remote control unit and extend the antenna. Turn on the slide switch (S1) and use the remote control levers to drive Rover around.

Press the buttons on the remote control to light the white LED (D4), note that it shines to the side. The left button will make it brighter.

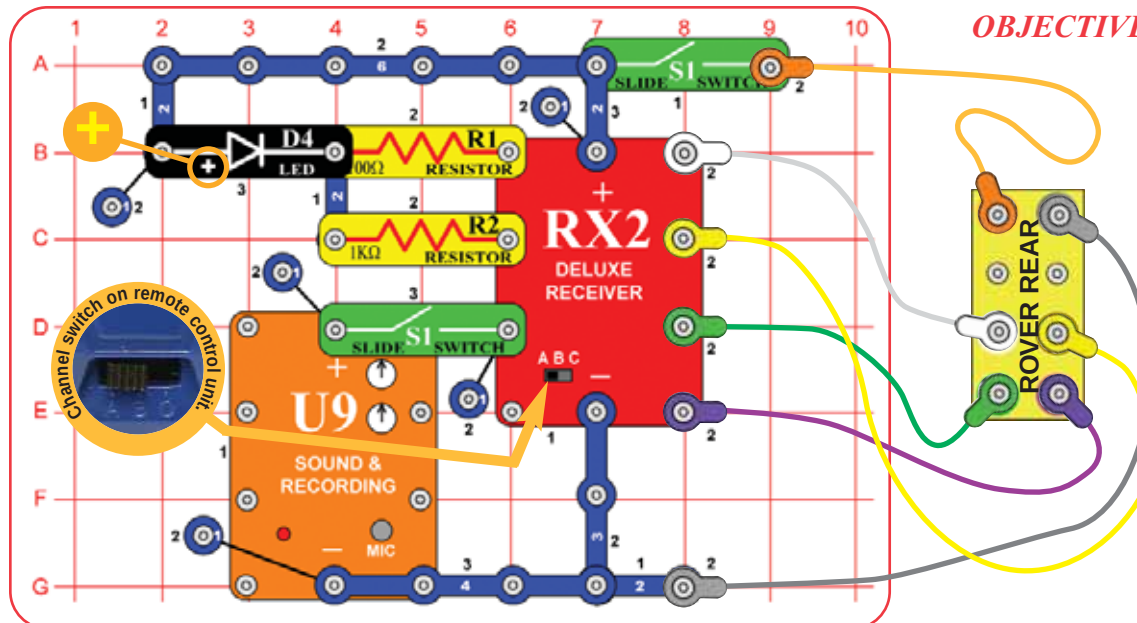
If you push the press switch (S2), then the remote control buttons do not light the LED.



Project #39

Remote Control Left Lite

OBJECTIVE: To use remote control.



Build the circuit and connect the jumper wires as shown. Turn on the remote control unit and extend the antenna. Turn on the right slide switch (S1) and use the remote control levers to drive Rover around.

Press the buttons on the remote control to light the white LED (D4), note that it shines to the side. The left button will make it brighter.

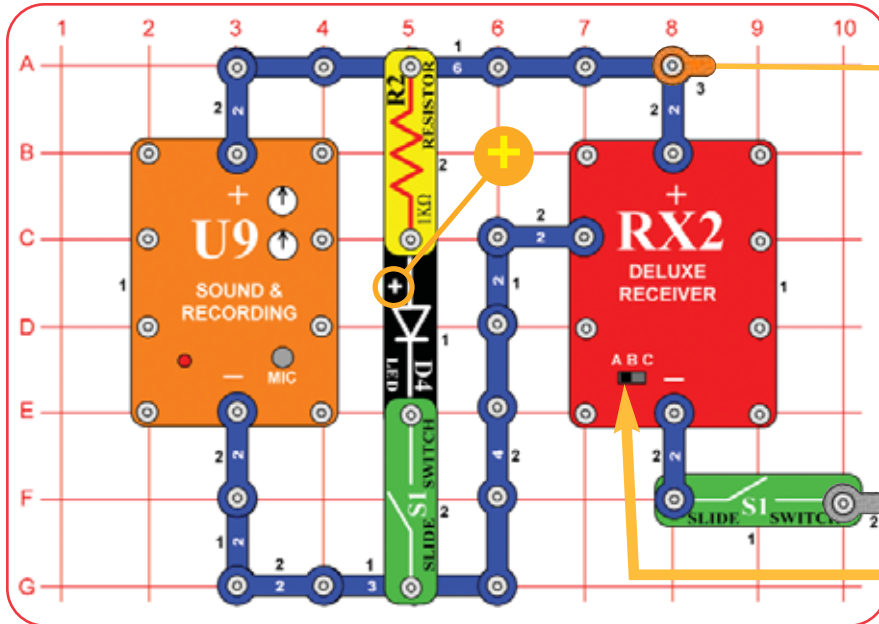
Turn on the left slide switch to hear tones form the sound & recording IC (U9).



Project #40

Current Diverter

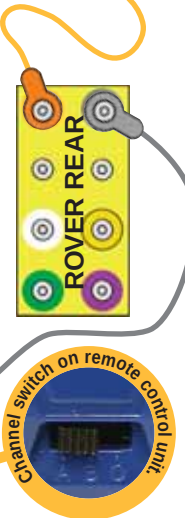
OBJECTIVE: To learn about electric current.



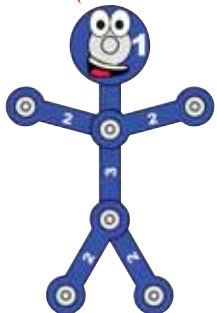
Build the circuit and connect the jumper wires as shown. Turn on the remote control unit and extend the antenna. Turn on the right slide switch (S1) and hold down the right button on the remote control unit; you hear a tone (it may be preceded by a recording).

Turn on the left slide switch to change the tone and light the white LED (D4). If you replace the 1KΩ resistor (R2) with any of the other resistors then the tone will be a little different.

If you connect the white, yellow, green, and purple jumper wires between the deluxe receiver (RX2) and the Rover rear then you can use the remote control levers to drive Rover around.



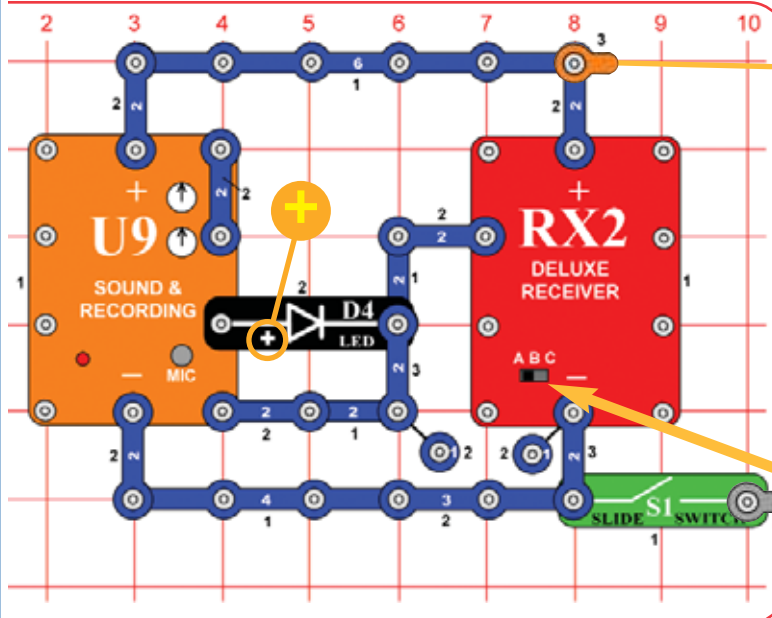
Turning on the left switch changes the sound because a resistor inside RX2 limits the current. The current paths through U9 and D4 both lead into RX2, so turning on the D4 path reduces the current in the U9 sound-making path.



Project #41

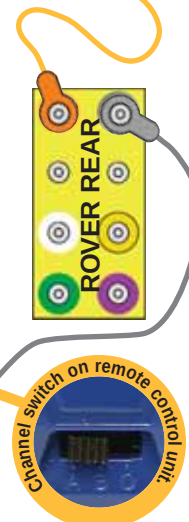
Two Tone Flash

OBJECTIVE: To change sound using remote control.



Build the circuit and connect the jumper wires as shown. Turn on the remote control unit and extend the antenna. Turn on the slide switch (S1) to hear a tone. Press the right button on the remote control unit to change the tone and light the white LED (D4).

If you connect the white, yellow, green, and purple jumper wires between the deluxe receiver (RX2) and the Rover rear then you can use the remote control levers to drive Rover around.

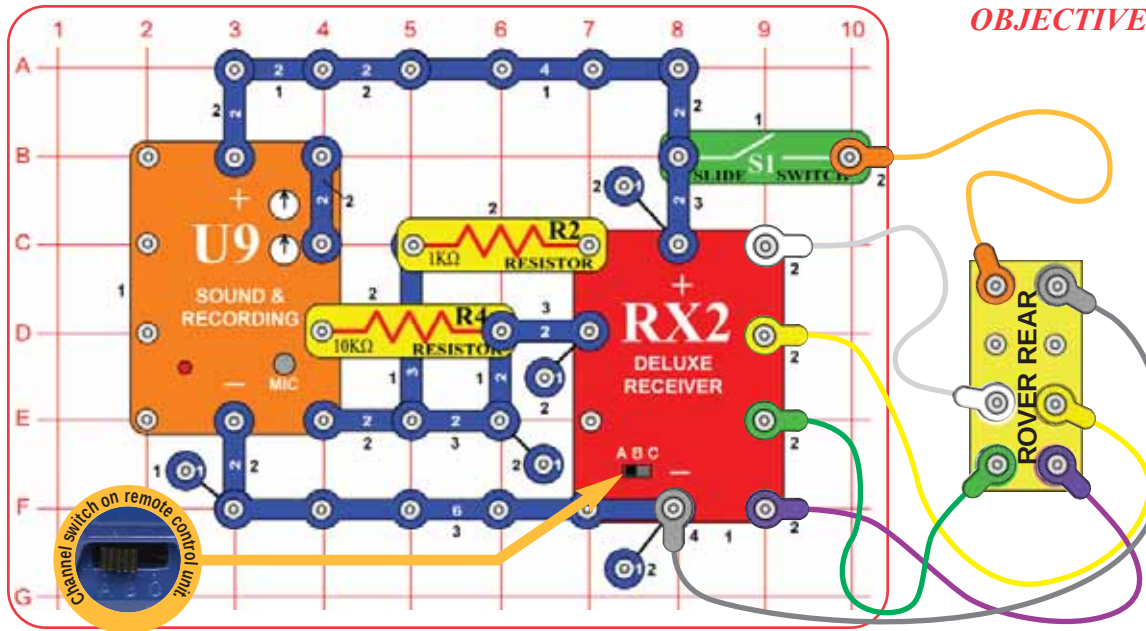




Project #42

Multi-Tone Rover

OBJECTIVE: To control sounds using remote control.



Build the circuit and connect the jumper wires as shown. Turn on the remote control unit and the slide switch (S1). Use the remote control levers to drive Rover around.

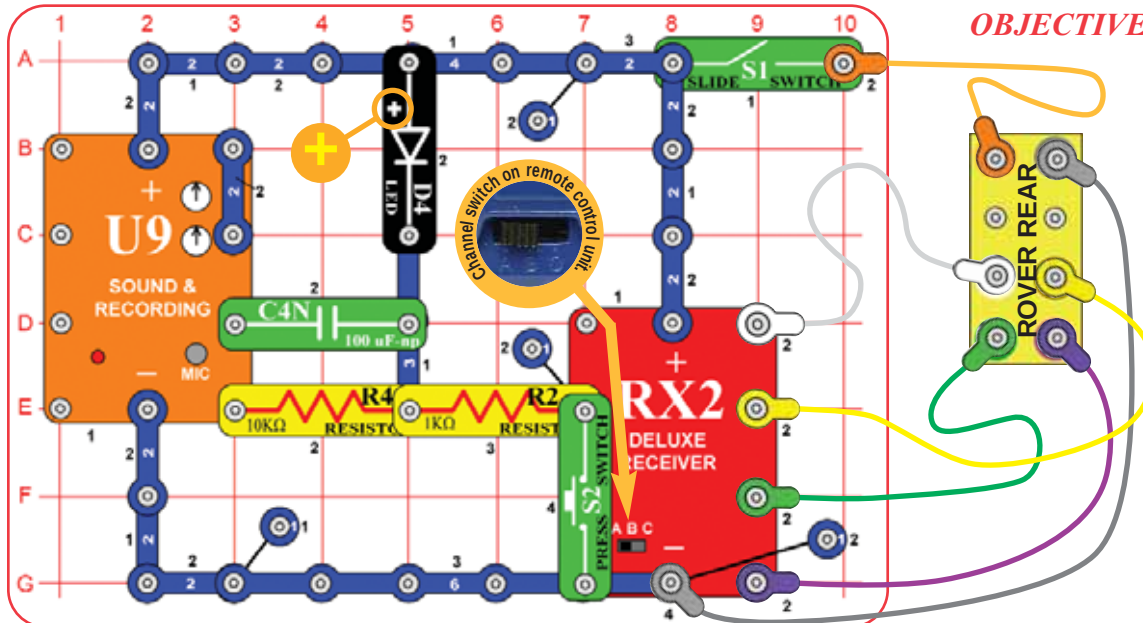
Press the buttons on the remote control to change the tone. You can also adjust the tone using the knobs on the sound & recording IC (U9).



Project #43

Remote Sound & Light

OBJECTIVE: To use remote control in different ways.



Build the circuit and connect the jumper wires as shown. Turn on the remote control unit and the slide switch (S1). Use the remote control levers to drive Rover around.

Press the right button on the remote control or push the press switch to change the tone. You can also adjust the tone using the knobs on the sound & recording IC (U9).

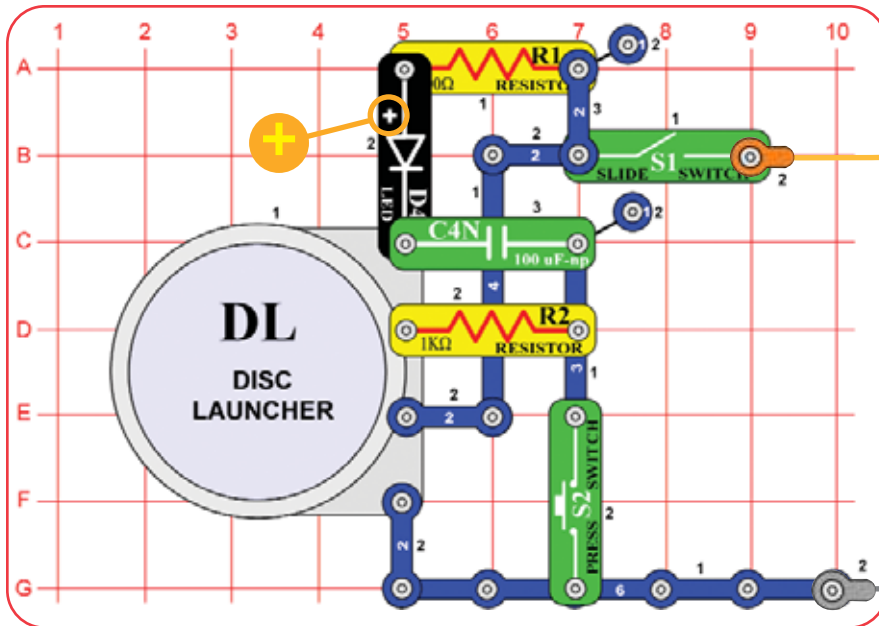
For variations, replace the 100µF capacitor (C4) with the 1µF capacitor (C7), or place C7 directly over the 10KΩ resistor (R4) using a 1-snap.



Project #44

Double Launcher

OBJECTIVE: To send two foam discs flying at a time.



Build the circuit and place discs inside the disc launcher (DL). Turn on the slide switch (S1) - nothing happens yet.

Push the press switch (S2) for a moment; a motor starts up, the "eyes" start blinking, and the white LED (D4) lights. Push the press switch again and usually two discs are launched (not just one).

This is a double disc launcher because the 100µF capacitor (C4N) simulates you pressing the launch button (S2) for longer than you actually did.

Position the launcher so that discs will not fly toward people, animals, or objects.

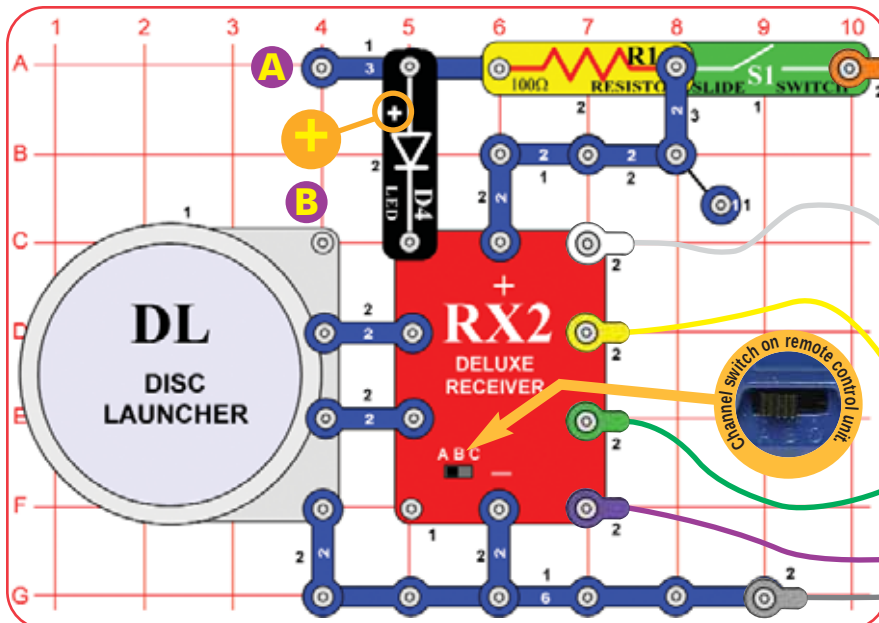
WARNING: Moving parts. Keep face and eyes away from the front of the disc launcher and from flying discs.



Project #45

Remote Control Launcher

OBJECTIVE: To launch foam discs using remote control.



Build the circuit and connect the jumper wires as shown. Turn on the remote control unit and extend the antenna. Turn on the slide switch (S1) and use the remote control levers to drive Rover around.

Press the left remote control button to light the white LED (D4). Press the right remote control button once to start up the disc launcher, then again to launch a disc. Hold the button down to launch continuously.

If you move the white LED to the points marked **A** & **B**, then it will instead come on when the disc launcher turns on.

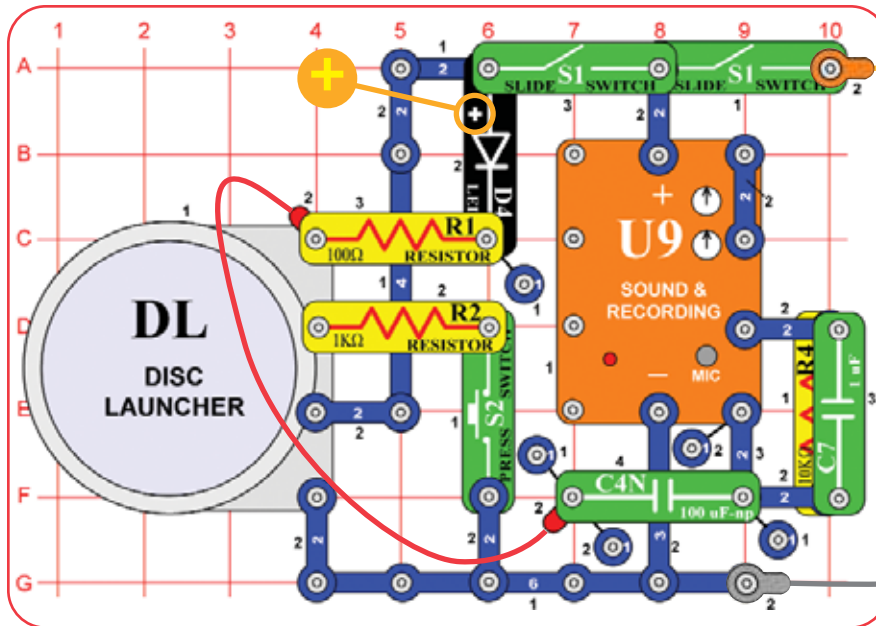
WARNING: Moving parts. Keep face and eyes away from the front of the disc launcher and from flying discs.



Project #46

Groovy Launcher

OBJECTIVE: To send foam discs flying and play tones.



Build the circuit and place discs inside the disc launcher (DL). Turn on both slide switches (S1). Adjust the knobs on the sound & recording IC (U9) for sounds you like. The white LED (D4) blinks rapidly.

Push the press switch (S2) to start up the disc launcher and then again to launch discs.

Position the launcher so that discs will not fly toward people, animals, or objects.

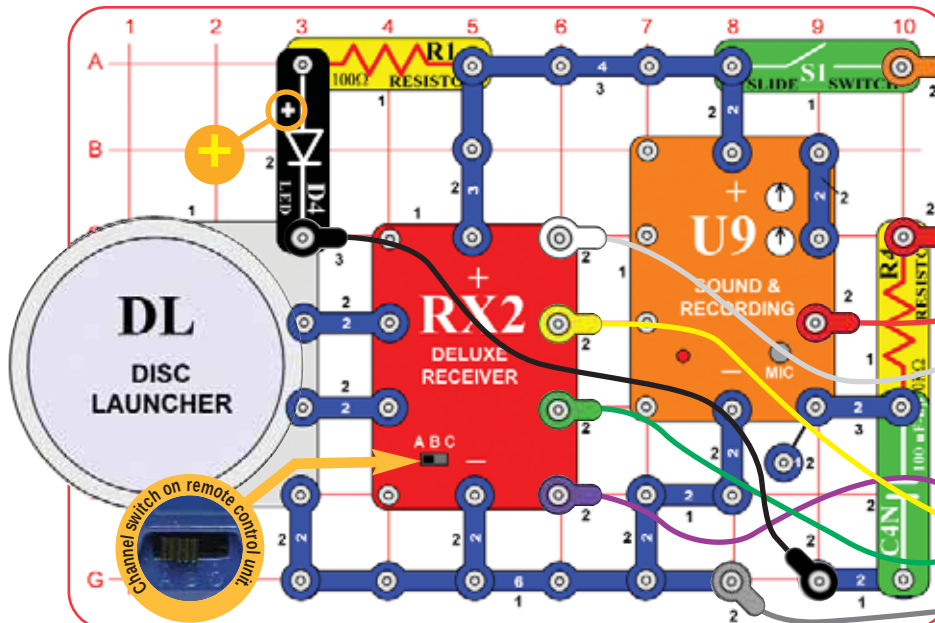
WARNING: Moving parts. Keep face and eyes away from the front of the disc launcher and from flying discs.



Project #47

Martian Monster

OBJECTIVE: To build a remote control vehicle with cute sounds - like a monster from Mars!



Build the circuit and connect the 8 jumper wires as shown. Turn on the remote control unit and the slide switch (S1). Use the remote control levers to drive Rover around and adjust the tone sounds using the knobs on the sound & recording IC (U9).

Push the press switch (S2) to start up the disc launcher and then again to launch discs. The tones change when you press S2.

Add the 1μF capacitor (C7) directly over the 10KΩ resistor (R4) using a 1-snap. Now the white LED (D4) will be blinking.

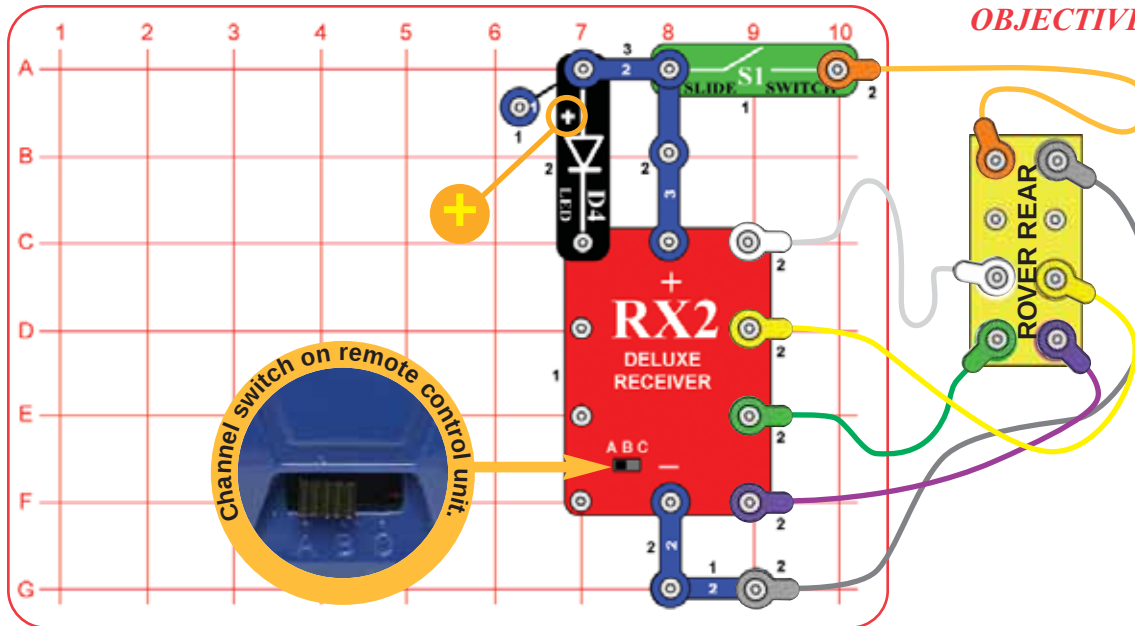
WARNING: Moving parts. Keep face and eyes away from the front of the disc launcher and from flying discs.



Project #49

Easy Rover

OBJECTIVE: To build a simple remote control vehicle.



Build the circuit and connect the jumper wires as shown. Turn on the remote control unit and extend the antenna. Turn on the slide switch (S1) and use the remote control levers to drive Rover around.

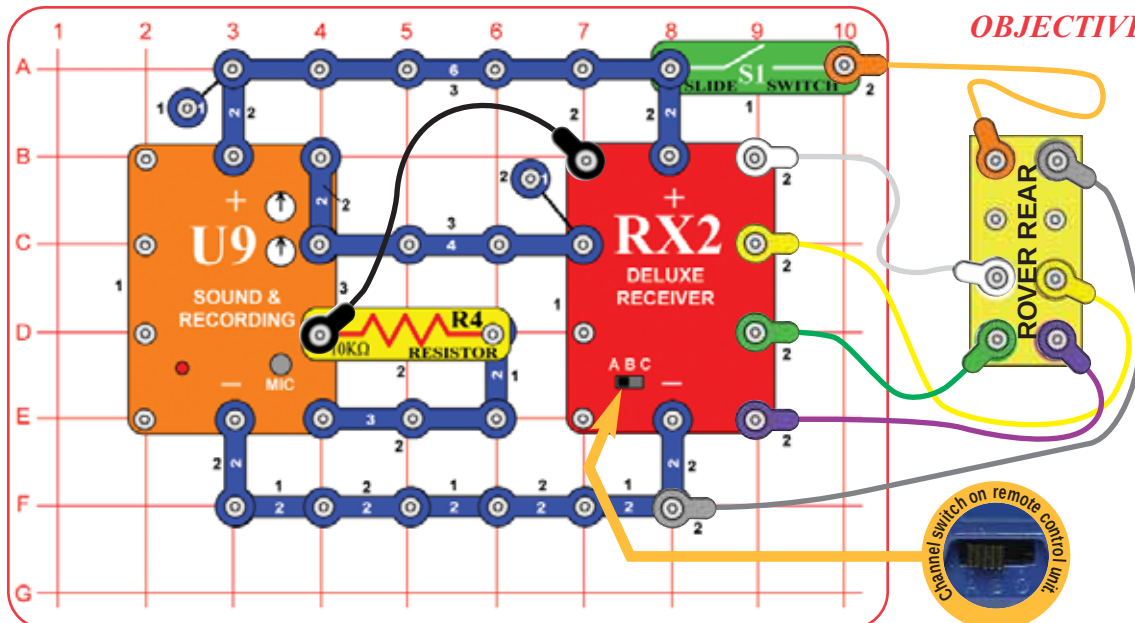
Press the left button on the remote control to light the white LED (D4). You can use it to see ahead when exploring in the dark.



Project #50

2-to-1 Tone

OBJECTIVE: To change sounds on a remote control vehicle.



Build the circuit and connect the jumper wires as shown. Turn on the remote control unit and the slide switch (S1). Use the remote control levers to drive Rover around and adjust the tone sounds using the knobs on the sound & recording IC (U9).

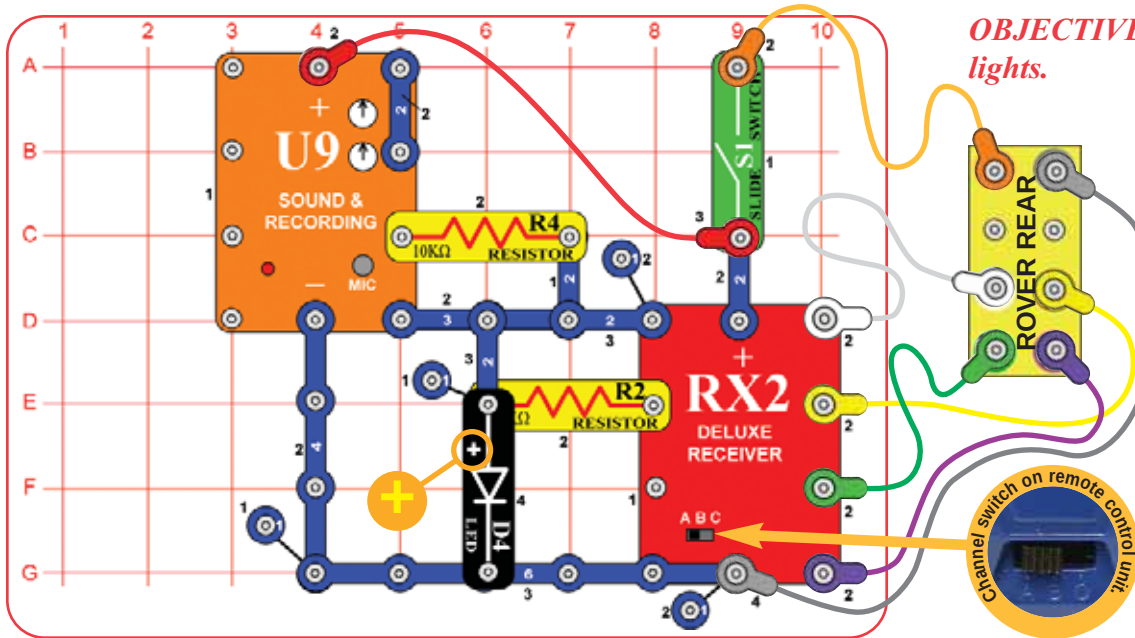
Press the left button on the remote control to change the “two-tone” sound into a single tone. Press the right remote control button to change the frequency of the tone.

If you move the end of the black jumper wire from the 10KΩ resistor (R4) to the point marked A, then the right remote control button shuts off the sound.



Project #51

Jupiter Jumble



OBJECTIVE: To build a remote control vehicle with sounds and lights.

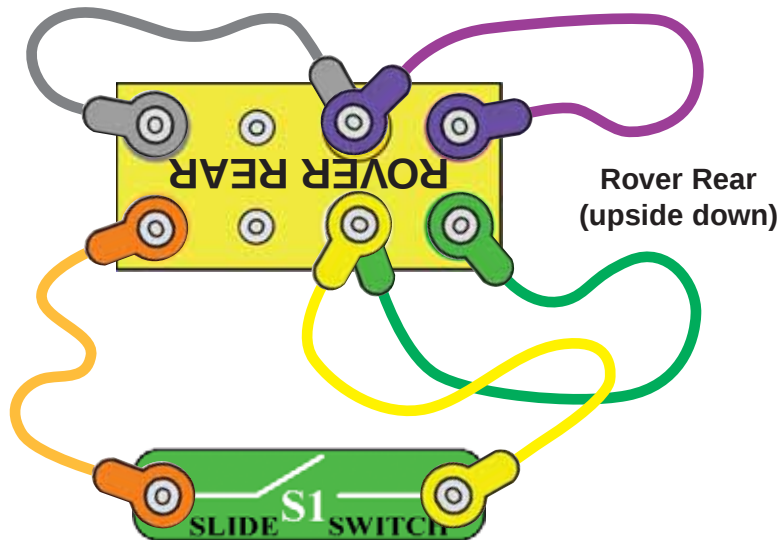
Build the circuit and connect the jumper wires as shown. Turn on the remote control unit and the slide switches (S1). Use the remote control levers to drive Rover around and adjust the tone sounds using the knobs on the sound & recording IC (U9). The white LED (D4) will be flashing on some settings.

Press the buttons on the remote control to change the tones.



Project #52

Helpless Rover



OBJECTIVE: To look at the gears.

Flip the Rover body so it is upside down and connect the jumper wires to the body and slide switch (S1) as shown. Turn on the switch to watch the wheels and gears move.

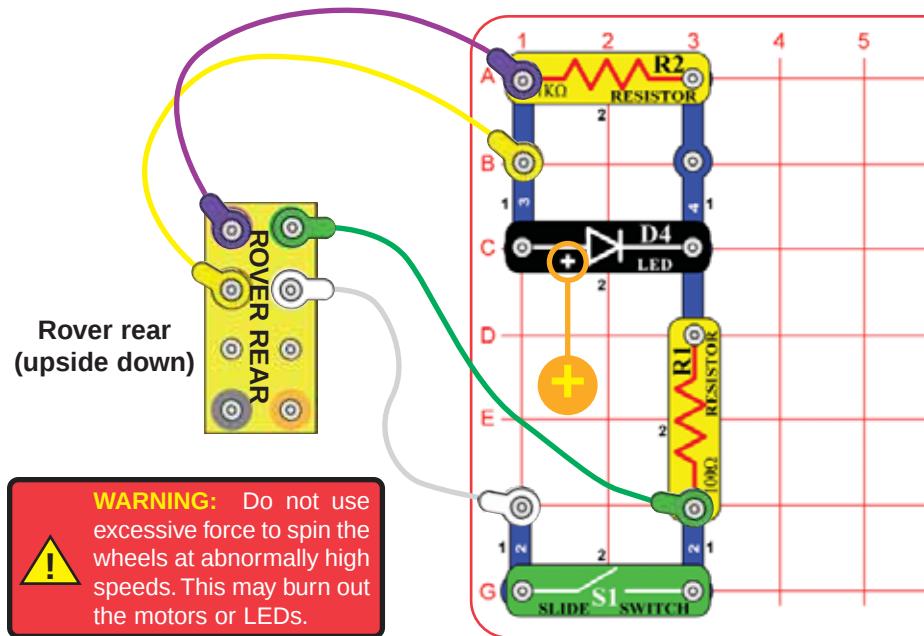
Notice that the smaller gears are spinning much faster than the larger gears and wheels. The smallest gears (on the motor) are actually spinning 128 times faster than the wheels. See page 6 for more information about the gears.

Option A: Swap the connection points of the gray and orange jumper wires on the Rover rear. Now the wheels and gears spin in the opposite direction.



Project #53

Generator



OBJECTIVE: To produce electricity by spinning the wheels.

Flip the Rover body so it is upside down and connect the jumper wires to the body and circuit as shown. Turn off the slide switch (S1) for the time being.

Spin the right wheels with your hands. Depending on how fast you spin and in which direction, you may light the LEDs in the car body and the white LED (D4).

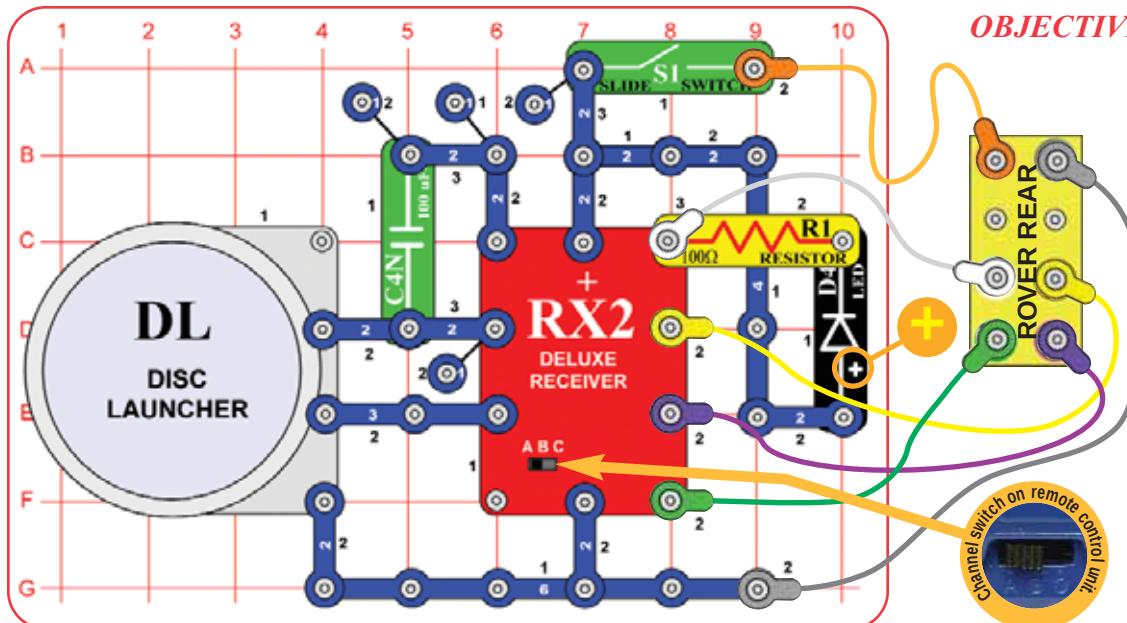
Now turn on the slide switch (S1) and spin the right wheels again. The wheels now take more effort to spin, and cause the left wheels to also spin.

Spinning the right wheels makes all the inter-connected gears spin, and spins the shaft on the right motor. The spinning motor shaft creates electricity using magnetism (opposite to how electricity through the motor spins the shaft), which powers the LEDs. With the switch on, the electricity created in the right motor also powers the left motor, which spins the left wheels. The wheels are harder to spin now because magnetic fields in both motors must be overcome. No batteries are used.



Project #54

Lost Explorer



OBJECTIVE: To see if you can adapt to unusual controls.

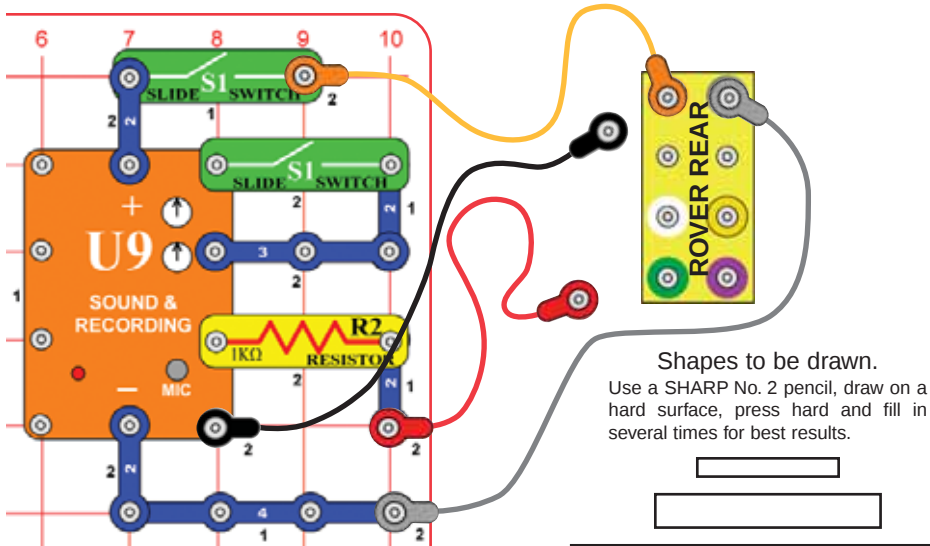
Build the circuit shown and turn on the slide switch (S1). Turn on the remote control unit, extend the antenna, and use the levers to try to drive the Rover around. Try using both buttons on the remote control to start the disc launcher and launch discs. The wiring has been changed so that the levers do not control Snap Rover® in the ways you'd expect, see how long it takes you to adjust.

Option A: Swap the connection points of the white and yellow jumper wires.

WARNING: Moving parts. Keep face and eyes away from the front of the disc launcher and from flying discs.



Project #55



Write Your Parts

OBJECTIVE: To draw resistors in different shapes.

Build the circuit at left and connect the jumper wires to it, but leave the loose ends of the red and black jumper wires unconnected for now. There is one more part you need and you are going to draw it. Take a pencil (No. 2 type is best but other types will also work). **SHARPEN IT**, and fill in some of the shapes shown. You will get better results if you place a **hard**, flat surface directly beneath this page while you are drawing. Press **hard** (but don't rip the paper), and fill in the shape **several times** to be sure you have a **thick, even layer** of pencil lead.

Turn on the slide switches (S1) and take the loose ends of the jumpers, press them to one of the shapes and move them around over it. If you don't hear any sound then add another layer of pencil lead, or put a drop of water on the jumper ends to get better contact. Create some shapes of your own and see how they work.

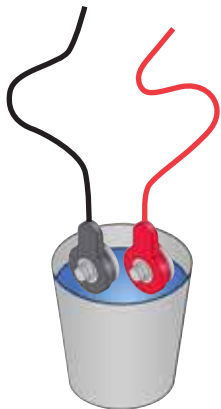
Use the knobs on the sound & recording IC (U9) and the lower slide switch to change the sounds.

This shape can make sounds like a kazoo.



Project #56 The Sound of Water

OBJECTIVE: To show how water conducts electricity.



Use the preceding circuit but take the loose ends of the red and black jumper wires and place them in a cup of water, without letting them touch each other. The sound changes when both wires are in the water, so you have a water detector!

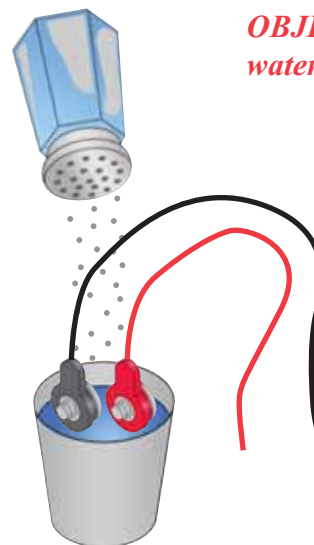
Now spread some water on a table in puddles of different shapes. Touch the jumper wires to points at the ends of the puddles and compare the sound.

The sound may vary depending upon your local water supply. Pure water (like distilled water) has very high resistance, but drinking water has impurities mixed in that increase electrical conduction.



Project #57 Salt Pitch Changer

OBJECTIVE: To show how adding salt to water changes water's electrical characteristics.



Use the preceding circuit and cup of water. Slowly add salt to the water and see how the sound changes, mix it a little so it dissolves. The pitch (frequency) of the sound will become lower as you add more salt. You can use this circuit as a saltwater detector! You can then increase the pitch by adding more water to dilute the salt.

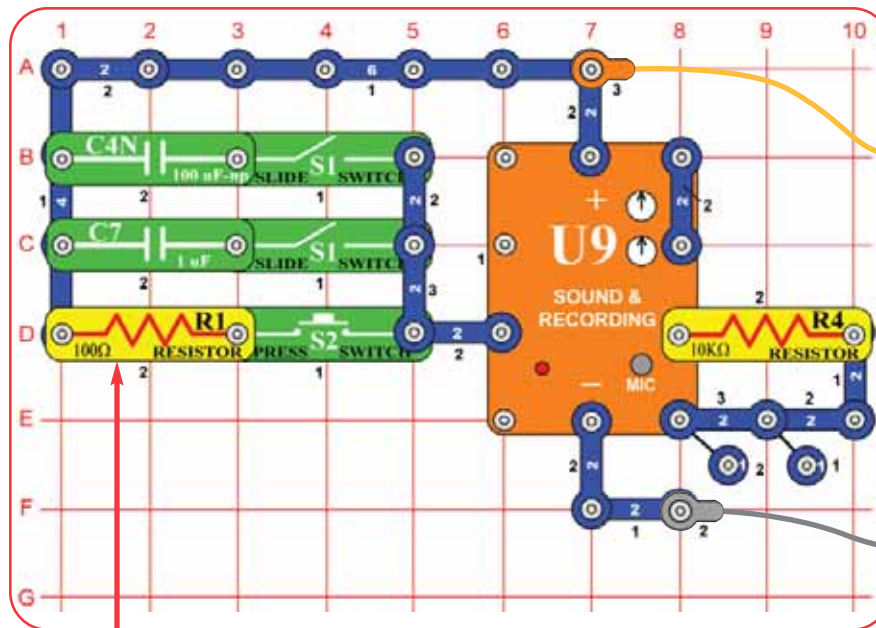
Take another cup of water and try adding other household substances like sugar to see if they change the sound as the salt did.



Project #58

Frequency Resistors

OBJECTIVE: To use capacitors like resistors to control the volume of sound.

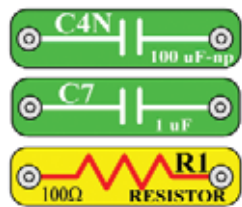


Build the circuit and connect the jumper wires as shown. You hear a tone, use the switches (S1 and S2) to adjust the volume.

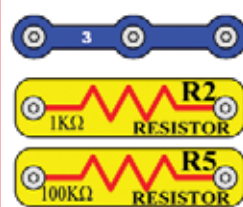
Turning on the switches diverts some electrical energy away from the speaker, reducing the volume of the sound. Compare how loud the sound is with different parts in the circuit, try one at a time using the switches. Compare the sound with the capacitors to the sound with the resistors and 3-snap wire.

Use the knobs on the sound & recording IC (U9) if you want to change the tone.

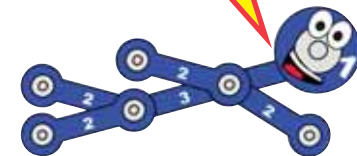
Parts in the circuit:



Parts you can replace them with:

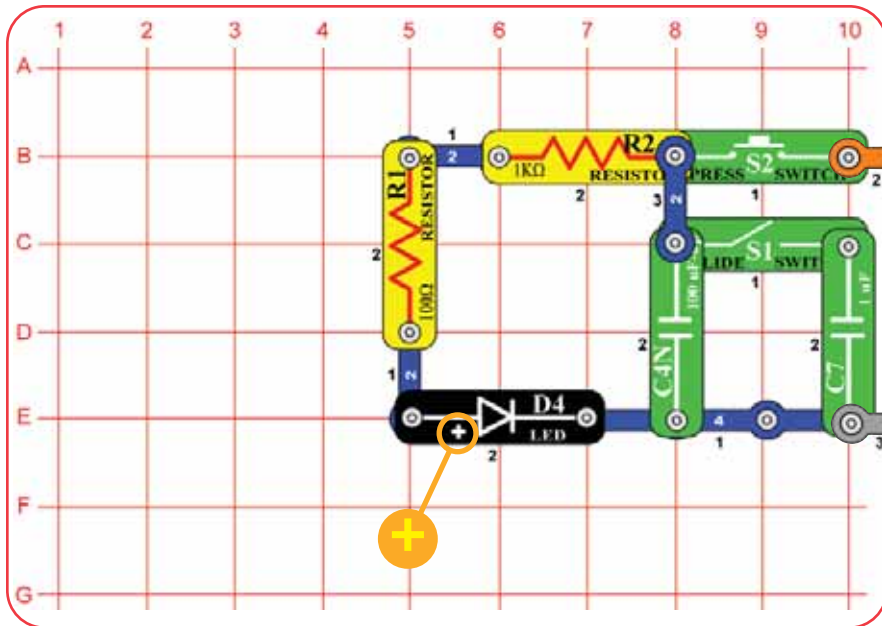


Capacitors can store electrical energy for short periods of time, an ability which results in them having high resistance to a constant voltage but lower resistance to a changing voltage. For the low-frequency sounds produced by the sound & recording IC (U9), the 1 μ F capacitor (C7) has about as much resistance as the 100 Ω resistor (R1) while the 100 μ F capacitor (C4N) has almost no resistance (like the 3-snap wire).





Project #59



OBJECTIVE: *To show how capacitors slow things down.*

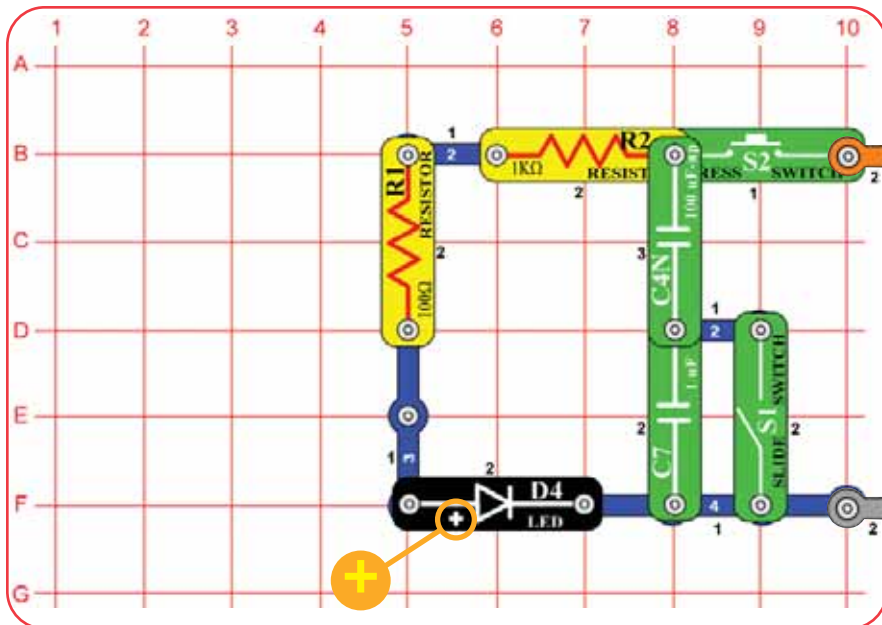
Build the circuit, place the base grid on the Rover body, and connect the jumper wires as shown. Push the press switch (S2) and the white LED (D4) is on, release the switch and the LED goes out slowly. Electricity stored in the 100μF capacitor (C4N) keeps the LED on after the batteries have been disconnected.

Turning on the slide switch (S1) places the small 1μF capacitor (C7) in parallel with the 100μF, which has no visible effect. Capacitors can store electricity similar to how water tanks can store water, so placing a small water tank next to a big one doesn't matter - the big one dominates.

If you remove the 100μF capacitor, the LED will turn off immediately when the switch is released.



Project #60



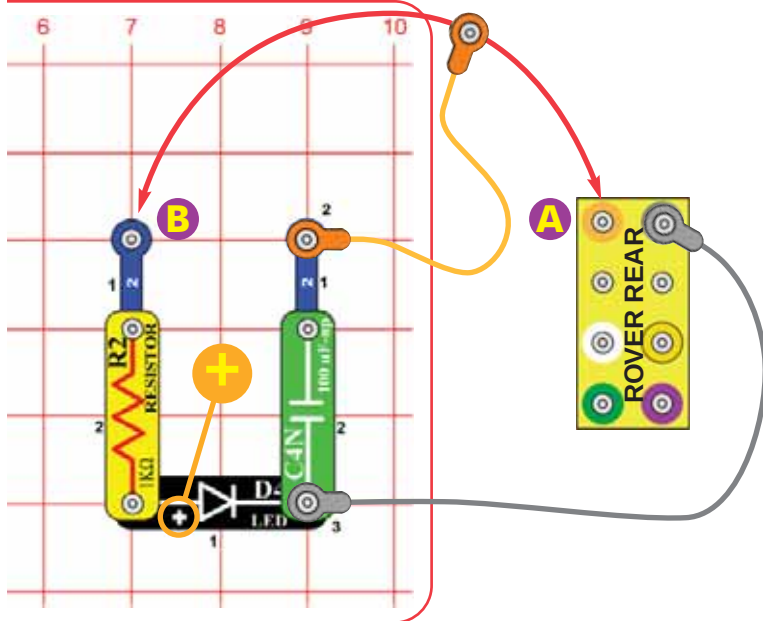
OBJECTIVE: *To compare how capacitors work when connected in series.*

This is the same circuit as the preceding project, but with the capacitors connected differently. Build the circuit and connect the jumper wires as shown. Push the press switch (S2) several times with the slide switch (S1) either on or off, watching how quickly the white LED (D4) turns off.

With the slide switch on the LED turns off immediately when you release the press switch. The slide switch places the small 1μF capacitor in series with the large 100μF capacitor (C4N). In this arrangement, electricity flows into both capacitors but stops as soon as one is full. The small capacitor fills up quickly, so it dominates the big one. The electricity stored in the capacitors is released to the LED when the press switch is released.



Project #61



Notice that a capacitor is not very efficient at storing electricity - compare how long the 100µFs kept the LED lit for with how your batteries run all of your projects! That is because capacitors store electrical energy while a battery stores chemical energy.



Electricity Station

OBJECTIVE: To show how capacitors can store electricity.

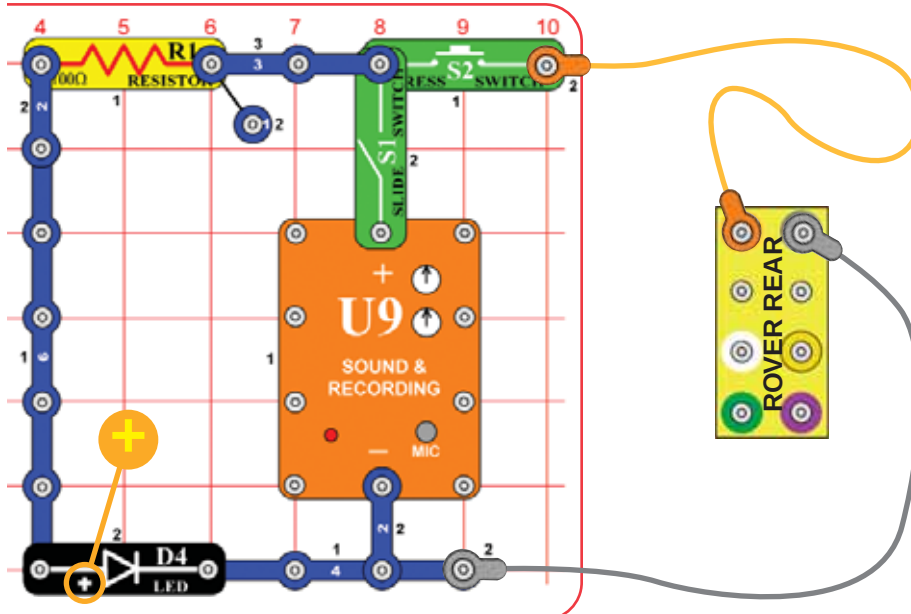
Build the circuit and connect the jumper wires, leaving one end of the orange jumper off as shown. Touch the loose end of the orange jumper to point **A** on the Rover rear for a moment. This fills up the 100µF capacitor (C4N) with electricity.

Now move the orange jumper from point **A** to point **B** on the 2-snap wire. The LED (D4) lights for a few seconds using the electricity stored in the capacitor. Move the orange jumper back to A to refill with electricity, and then to **B** several times.

If you replace the 1KΩ resistor (R2) with the 10KΩ resistor (R4) then the LED will stay on longer but not be as bright. If you replace R2 with the 100Ω resistor (R1), then the LED will flash more brightly but go out quickly.



Project #62



Audio-Visual Morse Code

OBJECTIVE: To learn about Morse code.

Build the circuit and turn on the slide switch (S1). Push the press switch (S2) to generate long or short bursts of sound (from the sound & recording IC) or light (from the D4 LED).

You can send secret messages to friends using Morse code, which uses a series of long and short bursts of sound or light to represent letters and numbers. A short burst is represented by a "•", and a long burst by a "—", as shown in this chart:

A • —	M — —	Y — • —
B • • •	N • —	Z — • •
C — • •	O — — —	1 • — — —
D — • •	P • — •	2 • — — —
E • —	Q — • —	3 • • — —
F • • —	R • — •	4 • • • —
G — • —	S • • —	5 • • • •
H • • • —	T — — —	6 — • • •
I • • —	U • • —	7 — • • •
J • — —	V • • • —	8 — • • •
K • — •	W • — •	9 — — • •
L • — •	X • — —	0 — — — —

Morse code was developed in the 19th century to send information over long distances using telegraph wires and early radios. This equipment had only two states - on or off (that is, transmitting or not transmitting), and could not send the range of frequencies contained in human voices or music. The code sent letters as a sequence of short or long transmit bursts.

During World War II Navy ships sometimes communicated by flashing Morse Code messages between ships using searchlights (they did this because radio transmissions might reveal their presence or position to the enemy).

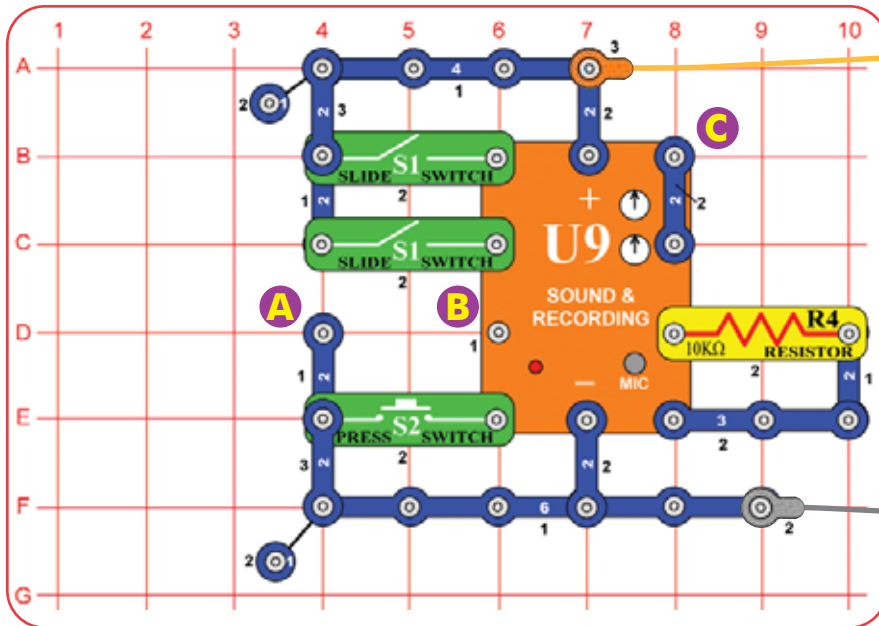
You can find more information about Morse code at websites such as http://en.wikipedia.org/wiki/Morse_code. You can also find websites that will translate and play back Morse code messages, such as <http://www.omnicron.com/~ford/java/NMorse.html>.



Project #63

Lunar Messenger

OBJECTIVE: To show all the features of the sound & recording IC.



Parts to add later:



Build the circuit as shown on turn off the slide switches (S1). You should hear a two-tone sound (it may be preceded by a recording); use both knobs on the sound & recording IC (U9) to change it. Removing the 2-snap wire at the point marked **C** should also change it.

Replace the 3-snap wire with the 100 μ F capacitor (C4N); the tone should be different. Add the 1 μ F capacitor (C7) across the points marked **A** & **B**, the sound should not be as loud now. Turn on the lower slide switch; this should shut off the sound completely.

Turn on the upper slide switch and talk into the microphone (marked "MIC" on U9) to record a message; turn off the switch when finished. Push the press switch (S2) to play the message you recorded.

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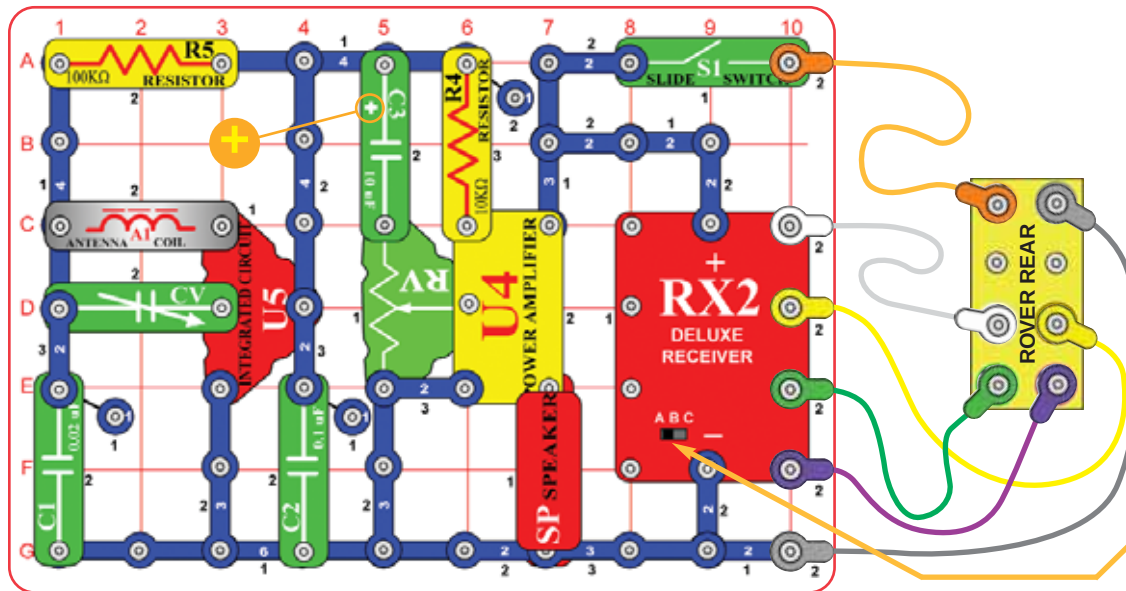
Snap Circuits® Mini Kits



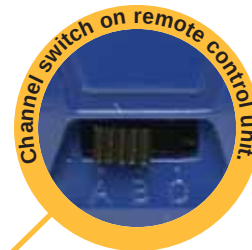
Music Box Model SCP-04 Space Battle Model SCP-05 Flying Saucer Model SCP-06

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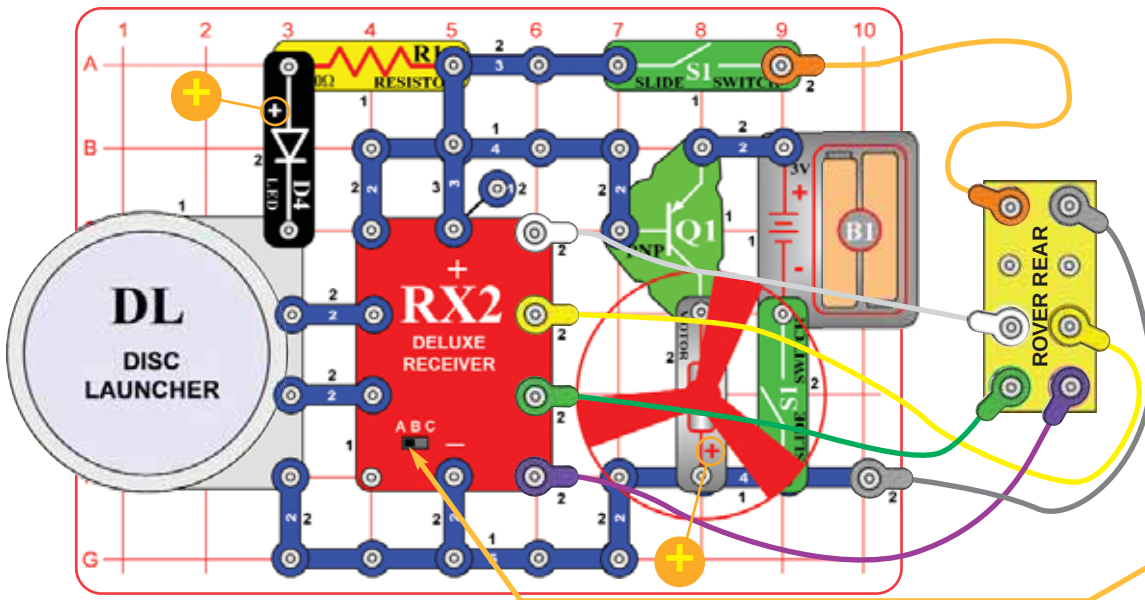
If you own Snap Circuits® Models SC-300, SC-500, or SC-750 (with 300+ experiments), then you may also build these circuits. Our website (www.snapcircuits.net) has additional circuits. DO NOT use parts from other Snap Circuits® kits with your Snap Rover® except in our approved circuits - the Snap Rover® uses higher voltage which could damage those parts.



Project #B1 Mobile Radio



Tune the variable capacitor (CV) to a local radio station and set the volume using the adjustable resistor (RV). Use the remote control levers to drive Rover around.



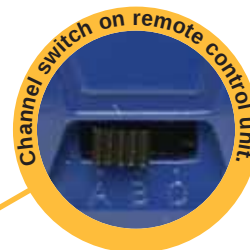
Project #B2 Mobile Launcher

The remote control activates the disc launcher (DL) and spins the fan (M1). Sometimes the fan may fly off.

WARNING: Do not lean over the motor.

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

WARNING: Moving parts. Keep face and eyes away from the front of the disc launcher and from flying discs.



SCROV-50 Snap Rover® Block Layout

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.

