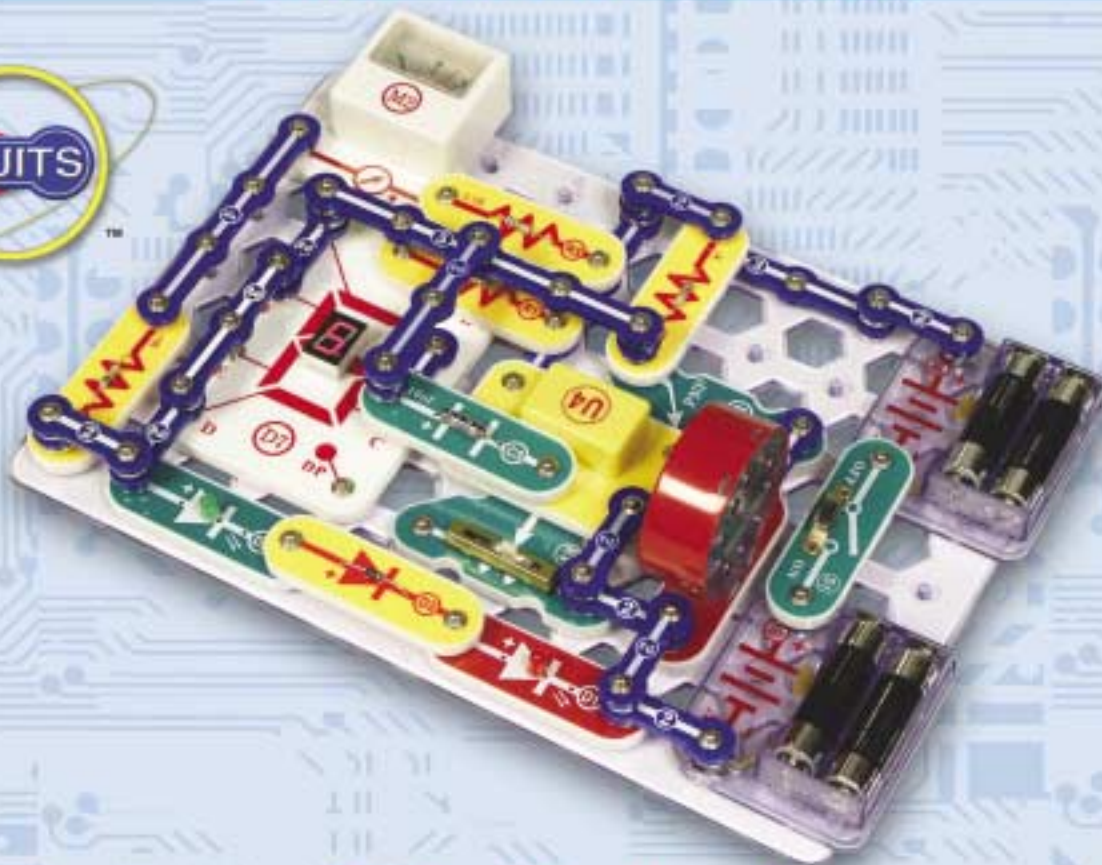


ELECTRONIC SNAP CIRCUITS™

Experiments 306-511



Instruction Manual

Elenco™ Electronics, Inc.

Table of Contents

Basic Troubleshooting	1	MORE DO's and DON'Ts of Building Circuits	5
Parts List	2	Project Listings	6, 7
MORE About Your Snap Circuits Parts	3	Experiments 306-511	9 - 57
MORE Advanced Troubleshooting	4	More Snap Circuits Projects	58



WARNING: SHOCK HAZARD - Never connect snap circuits to the electrical outlets in your home in any way!

WARNING: Always check your wiring before turning on a circuit. Never touch the motor when it is spinning at high speed. Never leave a circuit unattended while the batteries are installed. Never connect additional batteries or any other power sources to your circuits.

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. Sometimes the light bulbs come loose, tighten them as needed. Use care since glass bulbs can shatter.
4. Be sure that all connections are securely snapped.
5. Try replacing the batteries.

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 5 to determine which ones need replacing.

How To Use It

The snap circuit 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 numbers, identifying the blocks that you will use and snap together to form a circuit.

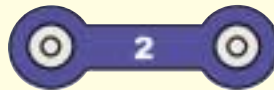
For Example:

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.



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

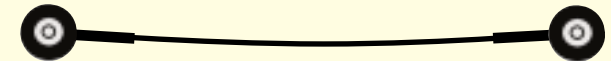
A large clear plastic base grid is included with this kit to help keep the circuit block together. You will see evenly spaced posts that the different blocks snap into. You do not need this base to build your circuits, but it does help in keeping your circuit together neatly. The base has rows labeled 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.

The 2.5V and 6V bulbs come packaged separate from their sockets. Install the 2.5V bulb in the lamp socket (L1), and the 6V bulb in the lamp socket (L2) whenever those parts are used.

Place the fan on the motor (M1) whenever that part is used, unless the project you are building says not to use it.

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






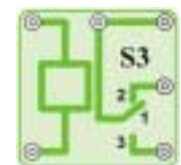

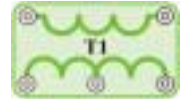




Note: While building the projects, be careful not to accidentally make a direct connection across the battery holder (a "short circuit"), as this will damage and/or quickly drain the batteries.

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

Note: There are additional part lists in your other project manuals. Part designs are subject to change without notice.

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 W. Carpenter Ave. • Wheeling, IL 60090 U.S.A.

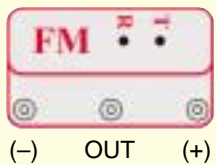
Qty.	ID	Name	Symbol	Part #	Qty.	ID	Name	Symbol	Part #
□ 3	②	2-Snap Wire		6SC02	□ 1	Ⓜ2	Analog Meter		6SCM2
□ 1	⑤	5-Snap Wire		6SC05	□ 1	Ⓚ3	SCR		6SCQ3
□ 1	ⓓ3	Diode 1N4001		6SCD3	□ 1	Ⓢ3	Relay		6SCS3
□ 1	ⓓ7	7-Segment LED Display		6SCD7	□ 1	Ⓣ1	Transformer		6SCT1
□ 1	ⓕM	FM Module		6SCFM	□ 1	Ⓤ6	Recording Integrated Circuit		6SCU6

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

MORE About Your New Snap Circuits Parts (Note: There is additional information in your other project manuals).

(Part designs are subject to change without notice).

The **FM module (FM)** contains an integrated FM radio circuit. Refer to the figure below for the pinout description:

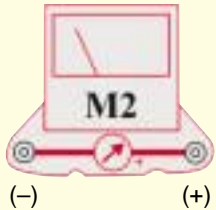


FM Module:

- (+) - power from batteries
- (-) - power return to batteries
- T - tune up
- R - reset
- OUT - output connection

See project 307 for example of proper connections.

The **meter (M2)** The meter is a very important indicating and measuring device. You'll use it to measure the amount of current or voltage depending on the circuit configuration. Notice the meter has + sign, indicating the positive terminal (+ power from the batteries). The other snap is the negative terminal (- power return to batteries).



Meter:

- (+) - power from batteries
- (-) - power return to batteries

The **recording IC module (U6)** contains an integrated recording circuit. You can record a message up to eight seconds long. There are also three pre-recorded songs. Refer to the figure below for the pinout descriptions:

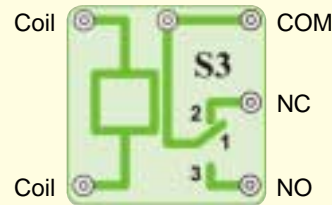


Recording IC Module:

- (+) - power from batteries
- (-) - power return to batteries
- RC - record
- Play - play
- OUT - output connection
- Mic + - microphone input
- Mic - - microphone input

See project 308 for example of proper connections.

The **relay (S3)** is an electronic switch with contacts that can be closed or opened. It contains a coil that generates a magnetic field when current flows through it. The magnetic field attracts an iron armature, which switches the contacts (see figure).

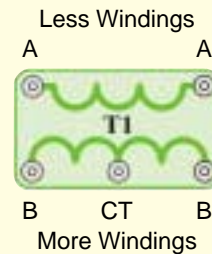


Relay:

- Coil - connection to coil
- Coil - connection to coil
- NC - normally closed contact
- NO - normally open contact
- COM - Common

See project 341 for example of proper connections.

The **transformer (T1)** consists of two coil windings on one core. One coil is called the Primary (input) and other the Secondary (output). The purpose of the transformer is to increase the amount of AC voltage applied to the primary. This transformer is a step-up transformer. The secondary has more windings than the primary.



Transformer:

- A - less windings side
- A - less windings side
- B - more windings side
- B - more windings side
- CT - center tap

See project 347 for example of proper connections.

Diode (D3) - You can think of a diode as a one-way valve that permits current flow in the direction of the arrow. The anode (arrow) is the positive side, and the cathode (bar) is the negative. The diode conducts or turns on when the voltage at the anode is 0.7V or greater.



Diode:

- Anode - (+)
- Cathode - (-)

MORE About Your Snap Circuits Parts (continued)

SCR (Q3) - An SCR is a three pin (anode, cathode and gate) controlled silicon diode. Like a standard diode, it permits current flow in only one direction. It will only conduct in the forward direction when triggered by a short pulse or steady voltage applied to between the gate and cathode terminals. **A high current may damage this part, so the current must be limited by other components in the circuit.**



SCR:

A - Anode
K - Cathode
G - Gate

The **7-segment display (D7)** is found in many devices today. It contains 7 LEDs that have been combined into one case to make a convenient device for displaying numbers and some letters. The display is a common anode version. That means that the positive leg of each LED is connected to a common point which is the snap marked +. Each LED has a negative leg that is connected to one snap. To make it work you need to connect the + snap to positive three volts. Then to make each segment light up, connect the snaps of each LED to ground. In the projects, a resistor is always connected to the + snap to limit the current. **A high current may damage this part, so the current must be limited by other components in the circuit.**



7-segment Display:

(+) - power from batteries
A - Segment A
B - Segment B
C - Segment C
D - Segment D
E - Segment E
F - Segment F
G - Segment G
DP - Decimal Point

See project 337 for example of proper connections.

MORE 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 - 20. Refer to project manuals 1 & 2 (projects 1-101, 102-305) for testing steps 1-20, then continue below.

21. **FM Module (FM):** Build project #307, you should hear FM radio stations.

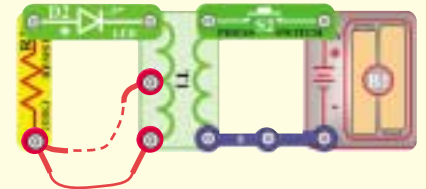
22. **Meter (M1):** Build the mini-circuit shown here, the meter (M2) should deflect full scale.



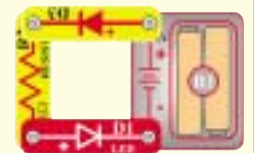
23. **Recording IC (U6):** Build project 308. Make an 8 second recording, then listen to the three prerecorded songs.

24. **Relay (S3):** Build project #353. Turn on the switch (S1) and you should hear a buzzing sound from the relay.

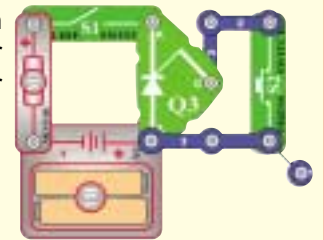
25. **Transformer (T1):** Build the mini-circuit shown here. Pressing the switch (S2) flashes the LED. Connect the jumper wire to the CT point. Pressing the switch (S2) flashes the LED.



26. **Diode (D3):** Build the mini-circuit shown here, the LED should light. Reverse the direction of D3, the LED should not light now.



27. **SCR (Q3):** Build the mini-circuit shown here. Turn on the switch (S1) and the motor should not spin. Press switch S2, the motor should start spinning. Now open and close switch S1, the motor should not spin.



28. **7-Segment Display (D7):** Build project #337. All segments light, displaying the number 8.

MORE 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™ Electronics is not responsible for parts damaged due to incorrect wiring.**

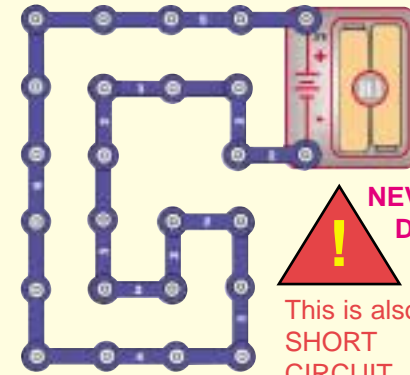
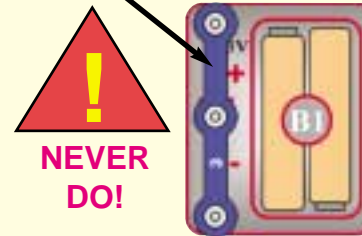
Here are some important guidelines:

- 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 the speaker, lamp, whistle chip, capacitors, ICs (which must be connected properly), motor, microphone, photo resistor, or fixed resistors.
- ALWAYS** use the **7-segment display**, LEDs, transistors, the high frequency IC, the **SCR**, the antenna, 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** connect the adjustable resistor so that if set to its 0 setting, the current will be limited by other components in the circuit.
- ALWAYS** connect position capacitors so that the "+" side gets the higher voltage.
- 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, the FM module, and the SCR** using configurations given in the projects or as per the connection descriptions for the parts.
- NEVER** try to use the high frequency IC as a transistor (the packages are similar, but the parts are different).
- NEVER** use the 2.5V lamp in a circuit with both battery holders unless you are sure that the voltage across it will be limited.
- 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.

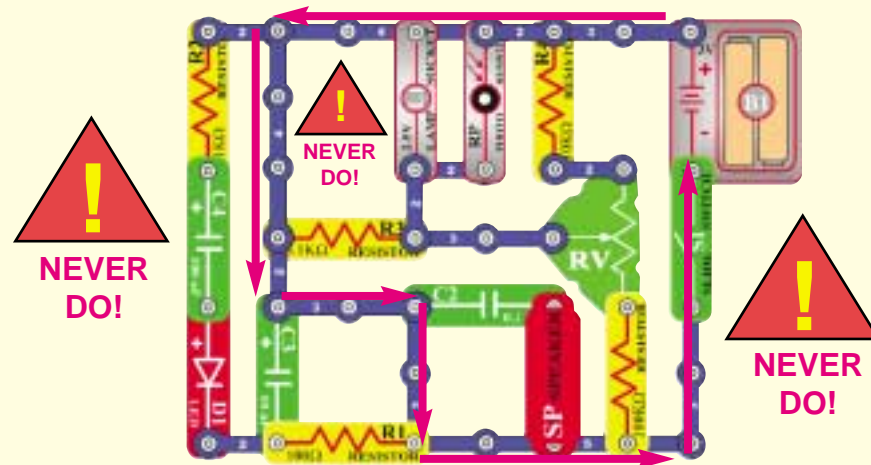
For all of the projects given in this book, the parts may be arranged in different ways without changing the circuit. For example, the order of parts connected in series or in parallel does not matter — what matters is how combinations of these sub-circuits are arranged together.

Examples of SHORT CIRCUITS - NEVER DO THESE!!!

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



When the 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. Upon review, we will post them with your name, age, and hometown in a special section on our website. If we use them in future manual revisions, we will send you a copy of the manual so you can show your family and friends. Send your suggestions to Elenco™ Electronics.



WARNING: SHOCK HAZARD - Never connect snap circuits to the electrical outlets in your home in any way!

Project Listings

Project #	Description	Page #	Project #	Description	Page #	Project #	Description	Page #
306	AM Radio	8	340	Music Meter	18	374	Display Letter "e"	28
307	Adjustable Volume FM Radio	8	341	LED & Relay	19	375	Display Letter "h"	28
308	Playback & Record	9	342	Manual 7 Second Timer	19	376	Display Letter "o"	28
309	Playing Music	9	343	Half Wave Rectifier Circuit	20	377	Alarm by SCR	29
310	Light-Controlled Music	9	344	Half Wave Rectifier Circuit (II)	20	378	Light Space War Alarm	29
311	Touch-Controlled Music	9	345	LED vs. Diode	20	379	Alarm by SCR	29
312	Power Amplified Playing Music	10	346	Current & Resistance	20	380	Light & Alarm IC	29
313	Power Playback & Record	10	347	Telegraph	21	381	Delay Light	30
314	Power Light-Controlled Music	10	348	Mosquito Sound	21	382	Delay Fan	30
315	Power Touch-Controlled Music	10	349	Mosquito Sound (II)	21	383	Delay Fan (II)	30
316	FM Radio	11	350	Mosquito Sound (III)	21	384	Recording LED Indicator	31
317	Mega Circuit	11	351	Touch-Control Mosquito Sound	21	385	Playback & Record with Meter	31
318	SCR 2.5V Bulb	12	352	Bulb & Relay	22	386	Alarm Light	32
319	SCR & Motor	12	353	Relay Buzzer	22	387	Alarm Light (II)	32
320	Music Alarm	13	354	Transistor Timer	23	388	Night Police Car	33
321	Light-Music Alarm	13	355	Light-Controlled Relay	23	389	Night Machine Gun	33
322	Light-Controlled SCR	13	356	Bulb Alert Relay	23	390	Night Fire Engine	33
323	1mA Meter	14	357	Adjustable Light Control	24	391	Night Ambulance	33
324	0-3V Meter	14	358	Meter Deflection	24	392	Daytime Light Police Car	34
325	Function of Variable Resistor	15	359	AC to DC Current	25	393	Daytime Light Machine Gun	34
326	Function of Photo Resistor	15	360	Current Meter	25	394	Daytime Light Fire Engine	34
327	Meter Deflect by Motor	16	361	Buzzer, Relay, & Transformer	26	395	Daytime Light Ambulance	34
328	SCR 6V Bulb	16	362	Buzzer & Relay	26	396	Flashing 8	35
329	Principle of Segment LED	17	363	Display Capital Letter "F"	27	397	Flashing 8 with Sound	35
330	Display #1	17	364	Display Capital Letter "H"	27	398	Musical Space War	35
331	Display #2	17	365	Display Capital Letter "P"	27	399	Electronic Noisemaker	36
332	Display #3	17	366	Display Capital Letter "S"	27	400	Electronic Noisemaker (II)	36
333	Display #4	17	367	Display Capital Letter "U"	27	401	Bee	36
334	Display #5	18	368	Display Capital Letter "C"	27	402	Bee (II)	36
335	Display #6	18	369	Display Capital Letter "E"	27	403	Bee (III)	36
336	Display #7	18	370	Display "."	27	404	Oscillator Sound	37
337	Display #8	18	371	Display Letter "b"	28	405	Oscillator Sound (II)	37
338	Display #9	18	372	Display Letter "c"	28	406	Oscillator Sound (III)	37
339	Display #0	18	373	Display Letter "d"	28	407	Oscillator Sound (IV)	37

Project Listings

Project #	Description	Page #	Project #	Description	Page #	Project #	Description	Page #
408	Oscillator Sound (V)	37	443	Flashing "U & L"	46	478	Variable Oscillator (II)	53
409	Transistor Tester	38	444	Flashing "b & c"	46	479	Variable Oscillator (III)	53
410	Adjustable Voltage Divider	38	445	Flashing "d & e"	46	480	Variable Oscillator (IV)	53
411	Automatic Display Capital Letter "C"	39	446	Flashing "h & o"	46	481	Photo Variable Oscillator	53
412	Automatic Display Capital Letter "E"	39	447	Bird Sounds	47	482	Photo Variable Whistle Chip Oscillator	53
413	Automatic Display Capital Letter "F"	39	448	Bird Sounds (II)	47	483	Slow Adjusting Tone	53
414	Automatic Display Capital Letter "H"	39	449	Bird Sounds (III)	47	484	Slow Adjusting Tone (II)	53
415	Automatic Display Capital Letter "P"	39	450	Bird Sounds (IV)	47	485	Fixed-Voltage Divider	54
416	Automatic Display Capital Letter "S"	39	451	Bird Sounds (V)	47	486	Simple Illumination Meter	54
417	Automatic Display Capital Letter "U"	39	452	Touch-Control Bird Sound	47	487	LED Voltage Drop	55
418	Automatic Display Capital Letter "L"	39	453	Motor Sound Recording	48	488	Open/Closed Door Indicator	55
419	Whistle Chip Sounds	40	454	Motor Sound Indicator	48	489	Hand-Control Meter	56
420	Whistle Chip Sounds (II)	40	455	Relay & Buzzer	49	490	Light-Control Meter	56
421	Whistle Chip Sounds (III)	40	456	Relay & Speaker	49	491	Electric-Control Meter	56
422	Whistle Chip Sounds (IV)	40	457	Relay & Lamp	49	492	Sound-Control Meter	56
423	Whistle Chip Sounds (V)	40	458	Electronic Cat	50	493	Fixed-Voltage Divider	57
424	Whistle Chip Sounds (VI)	40	459	Electronic Cat (II)	50	494	Resistor Measurement	57
425	LED Music	41	460	Electronic Cat (III)	50	495	Automatic Display Letter "b"	58
426	Light-Controlled LED Time Delay	41	461	Electronic Cat (IV)	50	496	Automatic Display Letter "c"	58
427	Touch-Controlled LED Time Delay	41	462	Buzzer Cat	50	497	Automatic Display Letter "d"	58
428	Alarm Recorder	42	463	Buzzer Cat (II)	50	498	Automatic Display Letter "e"	58
429	Alarm Recorder (II)	42	464	Buzzer Cat (III)	50	499	Automatic Display Letter "h"	58
430	Machine Gun Recorder	42	465	Lazy Cat	50	500	Automatic Display Letter "o"	58
431	Time Delay 1-7 Seconds	43	466	Meter Deflection (II)	51	501	Hand-Control Display 1 & 4	59
432	Time Delay	43	467	Automatic Display #1	51	502	Hand-Control Display 1 & 0	59
433	Manual 7 Second Timer (II)	44	468	Automatic Display #2	51	503	Hand-Control Display 1 & 7	59
434	15 Second Alarm	44	469	Automatic Display #3	52	504	Hand-Control Display 1 & 8	59
435	Flashing "1 & 2"	45	470	Automatic Display #4	52	505	Hand-Control Display 1 & 9	59
436	Flashing "3 & 4"	45	471	Automatic Display #5	52	506	Monitor a Capacitor Charging & Discharging	60
437	Flashing "5 & 6"	45	472	Automatic Display #6	52	507	Hand-Control Space Meter	60
438	Flashing "7 & 8"	45	473	Automatic Display #7	52	508	Rhythm Swinging Meter	61
439	Flashing "9 & 0"	45	474	Automatic Display #8	52	509	Police Car Sound with Whistle Chip	61
440	Flashing "C & E"	46	475	Automatic Display #9	52	510	Fire Engine Sound with Whistle Chip	61
441	Flashing "F & H"	46	476	Automatic Display #0	52	511	Ambulance Sound with Whistle Chip	61
442	Flashing "P & S"	46	477	Variable Oscillator	53			



Project #306

AM Radio

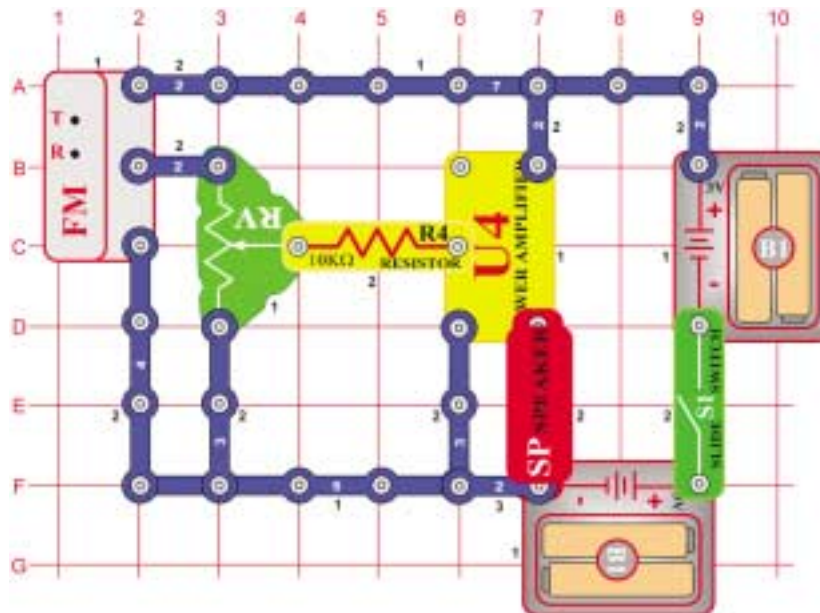


Turn on the slide switch (S1) and adjust the variable capacitor (CV) for a radio station.



Project #307

Adjustable Volume FM Radio

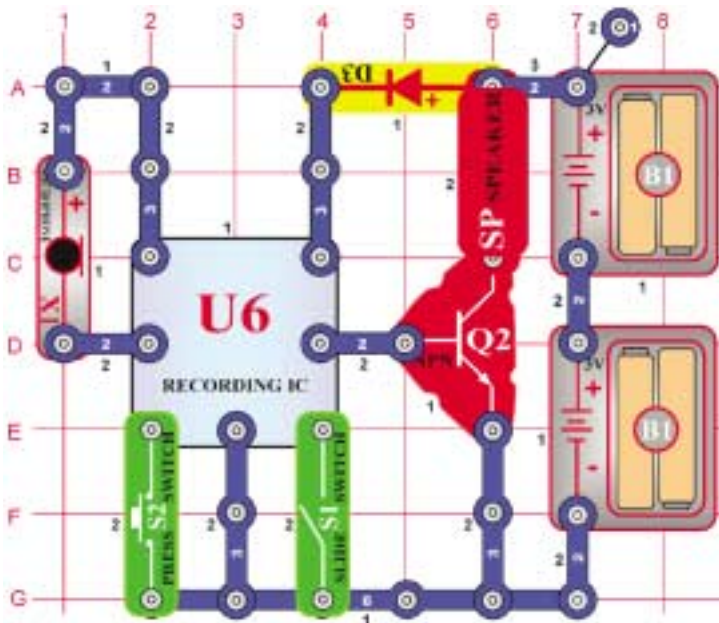


OBJECTIVE: To build a working FM radio with adjustable

Turn on the switch (S1) and press the R button. Now press the T button and FM module scans for a radio station. When a station is found, it locks on to it and you hear it on the speaker. Adjust the volume using the variable resistor (RV). The resistor controls the amount of signal into the power amp. Press the T button again for the next radio station. The module will scan up to 108MHz, the end of the FM band, and stop. You must then press reset to start at 88MHz again.



Project #308



Playback & Record

OBJECTIVE: To demonstrate the capabilities of the recording integrated circuit.

Build the circuit shown. Turn on the switch (S1), you hear a beep signaling that you may begin recording. Talk into the microphone (X1) up to 8 seconds, and then turn off the switch (S1) (it also beeps after the 8 seconds expires).

Press the switch S2 for playback. It plays the recording you made followed by one of three songs. If you press the switch (S2) before the song is over, music will stop. You may press the switch (S2) several times to play all three songs.



Project #309 Playing Music

OBJECTIVE: To play the three built-in

Use the circuit in project #308. Turn on the switch (S1), then press the switch (S2) to start the first song. When the music stops, press the switch (S2) again to hear the second song. When the second song stops, press the switch (S2) again, the third song plays.



Project #310 Light- Controlled Music

OBJECTIVE: To build a circuit that uses

Use the circuit in project #308. Replace the switch (S2) with the photo resistor (RP), then turn on the switch (S1). Turn the music on and off by waving your hand over photo resistor.



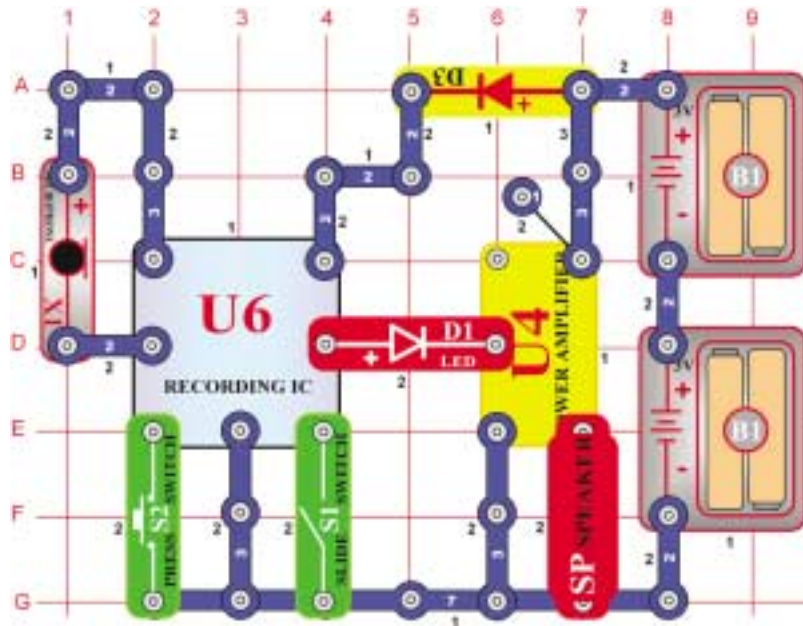
Project #311 Touch- Controlled Music

OBJECTIVE: To build a circuit that lets you

Use the circuit in project #308. Replace the switch (S2) with the PNP transistor (Q1) and then turn on the switch (S1). Turn the music on and off by touching the base and collector at the same time. You may need to wet your fingers.



Project #312



Power Amplified Playing Music

Connecting the power amp IC (U4) to the output of the recording IC (U6), you can make much louder music than project #308.

Turn on the switch (S1), you hear a beep signaling that you may begin recording. Talk into the microphone up to 8 seconds, and then turn open the switch (it also beeps after the 8 seconds expires).

Press the switch (S2) for playback. It plays the recording you made followed by one of three songs. If you press switch (S2) before the song is over, music will stop. You may press the switch (S2) several times to play all three songs.



Project #313

Power Playback & Record

OBJECTIVE: To amplify the output of the

Use the circuit in project #312. Turn on the switch (S1), then press the switch (S2) to start the first song. When the music stops, press the switch (S2) again to hear the second song. When the second song stops, press the switch (S2) again, the third song plays.



Project #314

Power Light-Controlled Music

OBJECTIVE: Show variations of project

Use the circuit in project #312. Replace the switch (S2) with the photo resistor (RP), then turn on the switch (S1). Turn the music on and off by waving your hand over photo resistor.



Project #315

Power Touch-Controlled Music

OBJECTIVE: Show variations of project

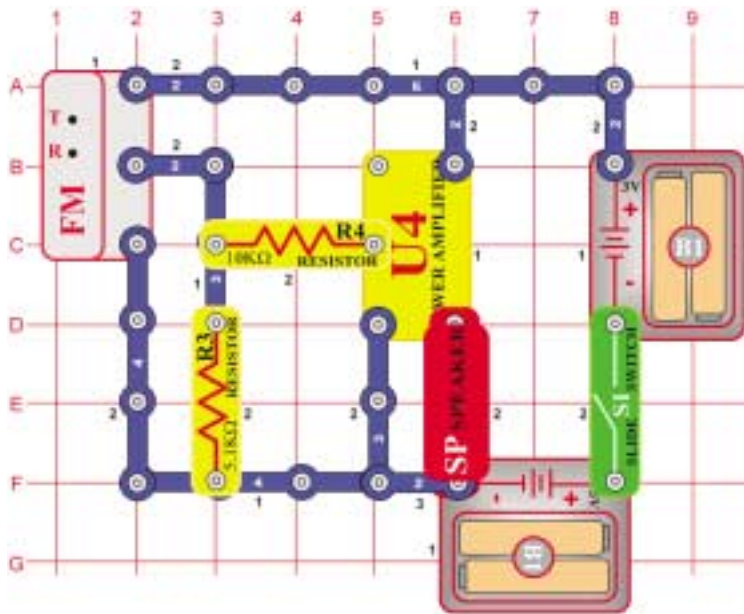
Use the circuit in project #312. Replace the switch (S2) with the PNP transistor (Q1) and then turn on the switch (S1). Turn the music on and off by touching the base and collector at the same time. You may need to wet your fingers.



Project #316

FM Radio

OBJECTIVE: To build a working FM radio.



The FM module (FM) contains a scan (T) and a reset (R) button. The R button resets the frequency to 88MHz. This is the beginning of the FM range. Press the T button, the module scans for the next available radio station.

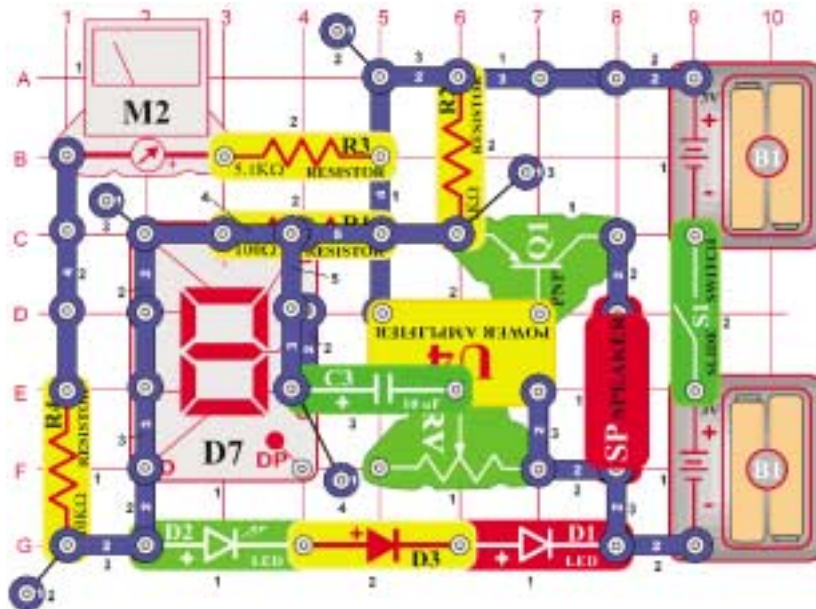
Turn on the switch (S1) and press the R button. Now press the T button and the FM module scans for an available radio station. When a station is found, it locks on to it and you hear it on the speaker. Press the T button again for the next radio station. The module will scan up to 108MHz, the end of the FM band, and stop. You must then press the reset (R) button to start at 88MHz again.



Project #317

Mega Circuit

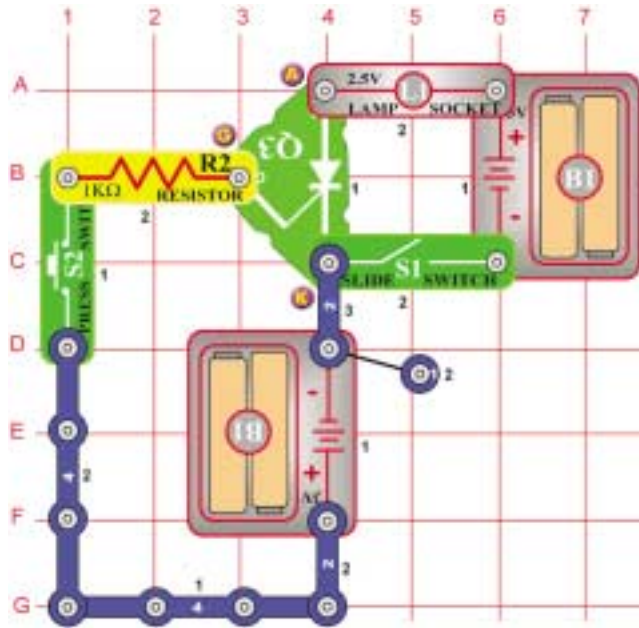
OBJECTIVE: To build a complex circuit.



This is an example of using many parts to create an unusual circuit. Set the meter (M2) to the 10MA scale. Turn on the switch (S1). As the circuit oscillates, the 7-segment display (D7) flashes the number 5 and the LEDs flash as well. The meter deflects back and forth and the speaker sounds a low tone at the same rate. The frequency of the circuit can be changed by adjusting the variable resistor.



Project #318



SCR 2.5V Bulb

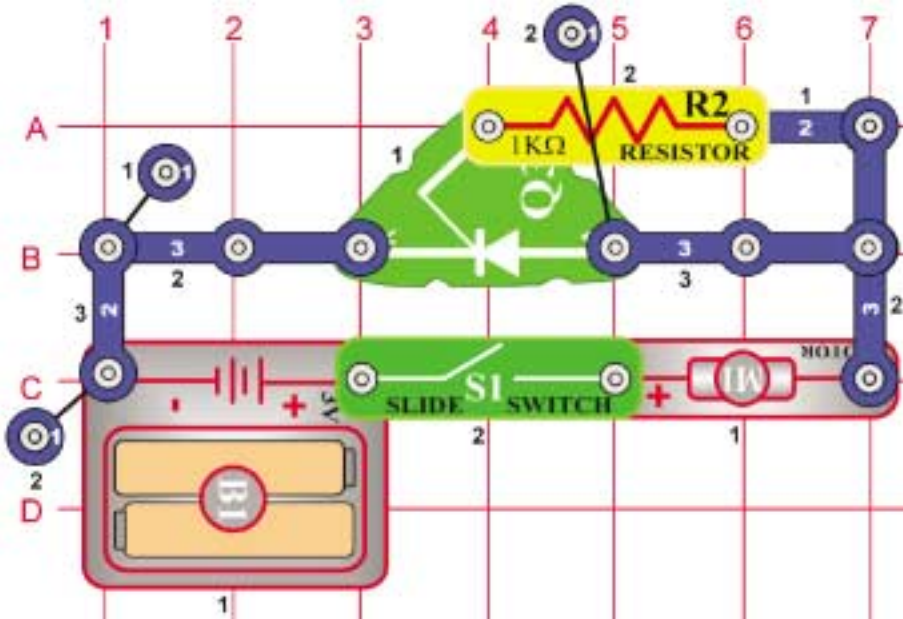
OBJECTIVE: To learn the principle of an SCR.

This circuit demonstrates the principle of the SCR (Q3). The SCR can be thought of as an electronic switch with three leads: anode, cathode, and gate. Like a standard diode, it permits current flow in only one direction. It will only conduct in the forward direction when triggered by a short pulse or steady voltage applied between the gate and cathode terminals. One set of batteries powers the lamp, the other is used to trigger the SCR.

Turn on the switch (S1) and the bulb (L1) should not light. Now press the press switch (S2); the SCR turns on and lights the bulb. To turn off the bulb you must turn off the slide switch (S1).



Project #319



SCR & Motor

OBJECTIVE: To activate a motor using an SCR.

In this circuit, the gate is connected to the battery through resistor R2. When the switch (S1) is turned on, it triggers the gate, the SCR conducts, and the motor (M1) spins. The motor continues to spin until the switch is turned off.



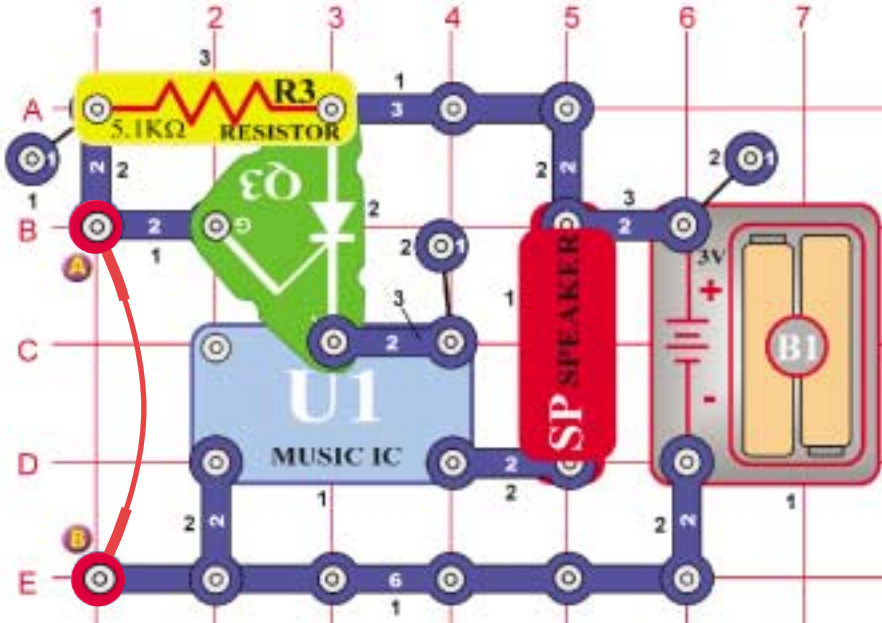
Project #320

Music Alarm

OBJECTIVE: *To build a music alarm.*

The alarm circuit activates when you remove the jumper wire from points A & B. The jumper wire shorts the SCR's (Q3) gate to ground and the SCR does not conduct. Removing the jumper wire places a voltage on the gate and the SCR conducts. This connects the battery to the music IC (U1) and music is played.

Construct the circuit and you should hear no music. Now remove the jumper wire and the music starts playing.



Project #321 Light-Music Alarm

OBJECTIVE: *To build a light-music alarm.*

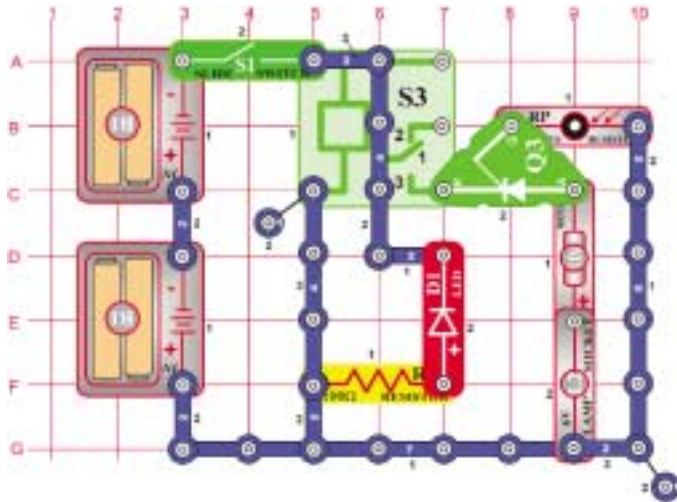
Use the circuit in project #320. Replace the resistor R3 with the photo resistor (RP) and remove the jumper wire. Cover the photo resistor with your hand. Now slowly remove your hand. When enough light hits the resistor, the music plays.



Project #322

Light-controlled SCR

OBJECTIVE: *To build a circuit that activates a bulb and motor with the amount of light present.*

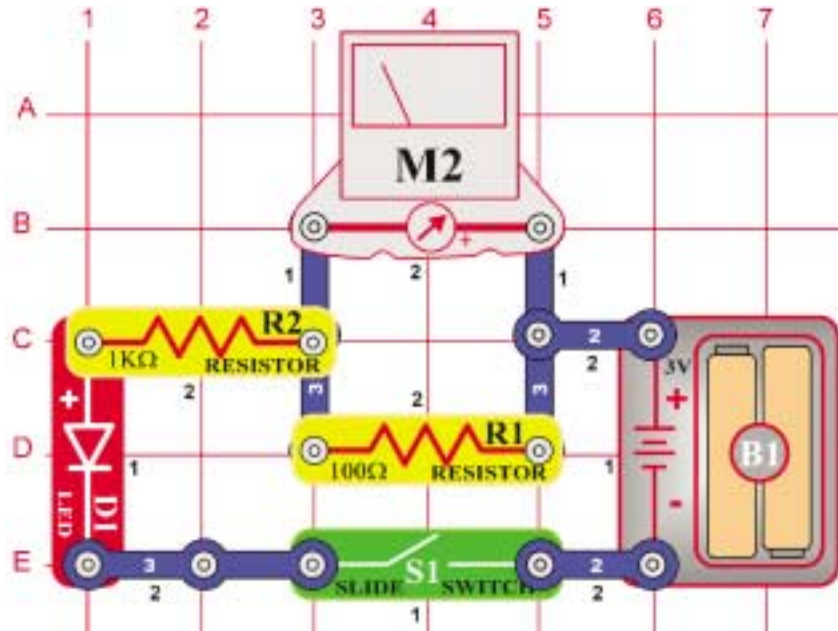


Cover the photo resistor (RP) with your finger. Turn on the switch (S1), and only the LED (D1) lights. The relay (S3) connects the motor (M1) and the bulb (L2) to the batteries, but the motor and bulb are powerless until a voltage is applied to the SCR's gate.

Remove your finger, as light hits the photo resistor, its resistance decreases and a voltage appears on the gate of the SCR (Q3). The SCR conducts and the motor and bulb work now.



Project #323



1mA Meter

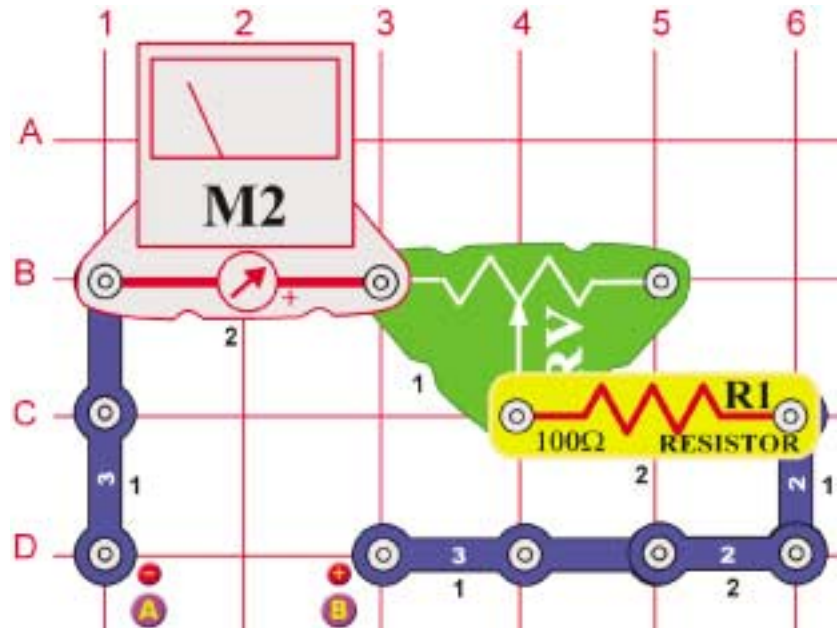
OBJECTIVE: To build a 1mA meter circuit.

Set the meter (M2) to the 10MA scale. Inside the meter, there is a fixed magnet and a moveable coil around it. As current flows through the coil, it creates a magnetic field. The interaction of the two magnetic fields cause the coil (connected to the pointer) to move (deflect). By itself, the meter can measure 300 μ A or 0.3V. To increase its range, resistors are connected in parallel or in series to the meter.

Build the circuit shown. Placing the 100 Ω resistor (R1) in parallel with the meter increases the range to 1mA. More current flows through the resistor than the meter. The lower the resistor value, the wider the range of the meter.



Project #324



0-3V Voltmeter

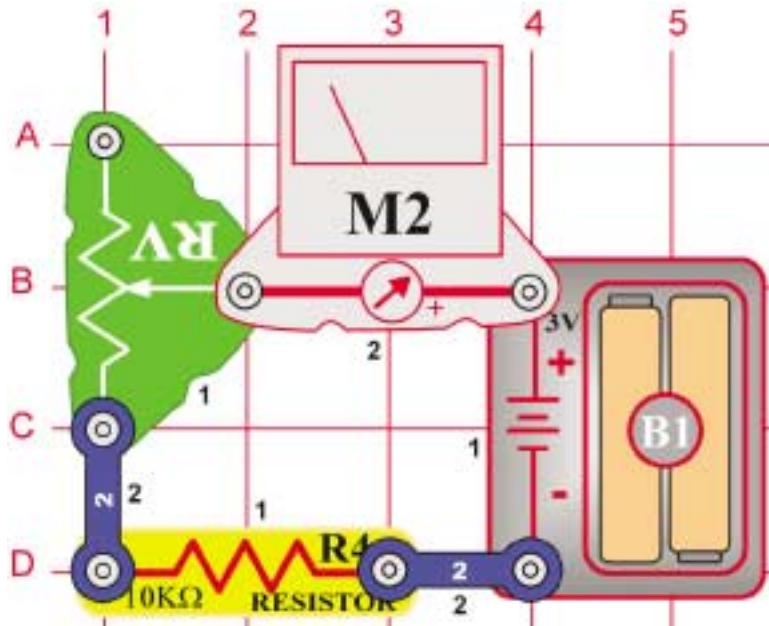
OBJECTIVE: To build a voltmeter.

Build this 0-3V voltmeter circuit. Set the meter (M2) to the 10MA scale. Using new batteries, place the battery holder between points A & B. Adjust the variable resistor (RV) so the meter deflects full scale.

Now you can check your other "AA" batteries by inserting them into the battery holder.



Project #325



Function of Variable Resistor

OBJECTIVE: To understand the function of the variable resistor.

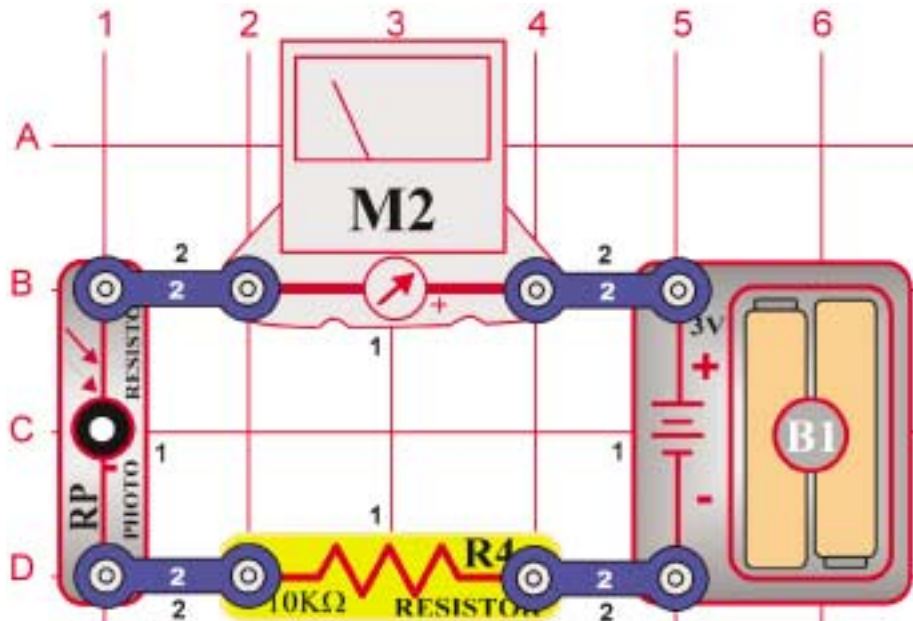
A variable resistor is a normal resistor with an additional arm contact. The arm moves along the resistive material and taps off the desired resistance.

Set the meter (M2) to the 10MA scale. The knob on the variable resistor moves the arm contact and sets the resistance between the left and center pins. The remaining resistance of the part is between the center and right pins. For example, when the dial is turned fully to the left, there is minimal resistance between the left and center pins (usually 0Ω) and maximum resistance between the center and right pins. The resistance between the left and right pins will always be the total resistance, ($50k\Omega$ for your part).

Adjust the variable resistor (RV) for maximum resistance by setting the knob to the top. The meter only deflects part of the way. As you move the knob down, decreasing the resistance, the meter deflects more.



Project #326



Function of Photo Resistor

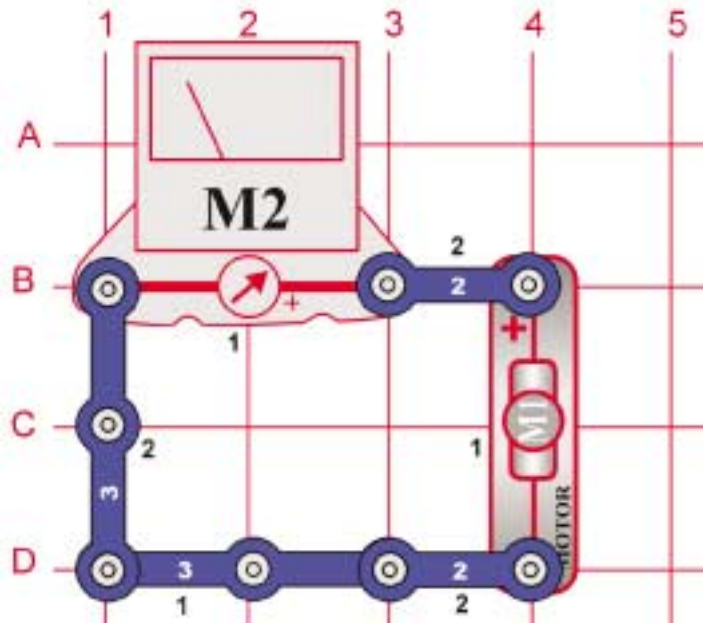
OBJECTIVE: To understand the function of the photo resistor.

Build the circuit shown. Set the meter (M2) to the 10MA scale. The photo resistor (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.

The meter reading changes as the resistance changes in the circuit. When the lights are on, the meter points to the right of the 5 on the scale. When the lights are OFF, the pointer will be to the left of the 5. This means that the resistance of the photo resistor is changing according to the amount of light in the room.



Project #327



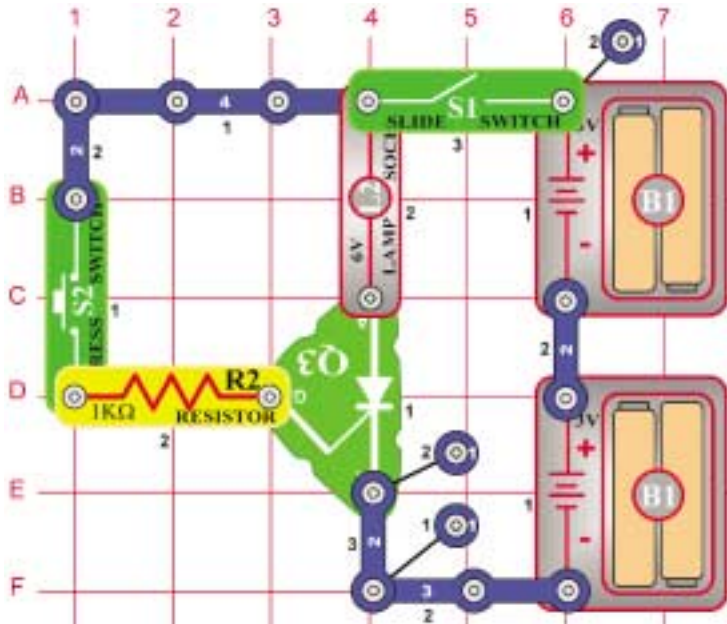
Meter Deflect by Motor

OBJECTIVE: To change the direction of current flow using a motor.

Set the meter (M2) to the 10MA scale. A motor generates a current when it rotates. The rotation of the motor determines the direction current flows. Quickly spin the motor (M1) clockwise with your hand; the meter deflects to the right. Now spin the motor counterclockwise, and the meter deflects to the left.



Project #328



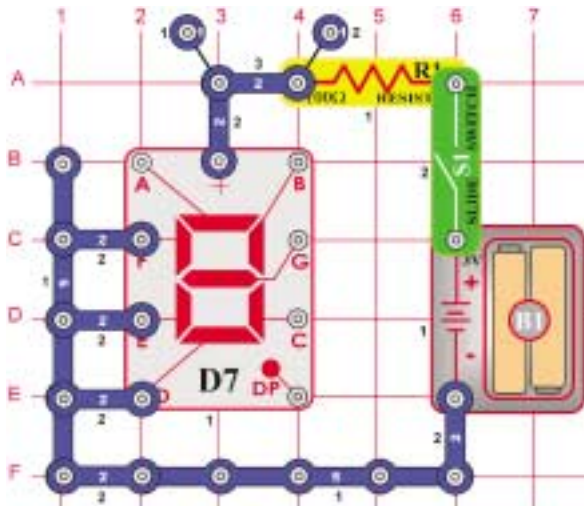
SCR 6V Bulb

OBJECTIVE: To learn the principle of an SCR.

In this circuit, the 6-volt bulb (L2) will not light until the SCR (Q3) is triggered. Turn on the switch (S1) and the bulb will not light. Now press the switch (S2) to light the bulb. The bulb will stay lit until the slide switch is turned off. To protect the SCR, a current limiting 1kΩ resistor (R2) is placed in series with the gate.



Project #329



Principle of Segment LED

OBJECTIVE: To demonstrate how a seven segment LED works.

The display (D7) is made up of seven segments. Each segment contains an LED connected to an input snap. When the snap is connected to the negative of the battery the segment lights. For example, connect the circuit as shown and the letter "L" lights.

Project #330 Display #1

OBJECTIVE: To configure the seven segment to display the number 1.

Connect B & C to the negative of the battery.

Project #331 Display #2

OBJECTIVE: To configure the seven segment to display the number 2.

Connect A, B, G, E, & D to the negative of the battery.

Project #332 Display #3

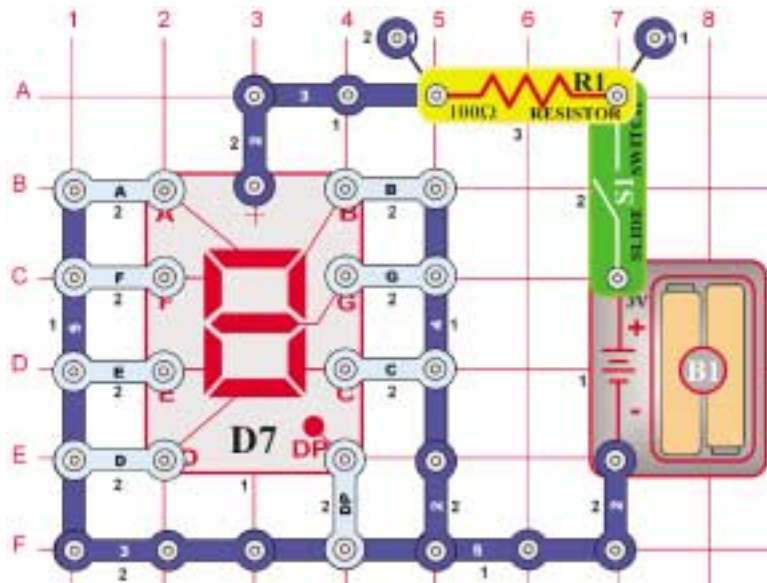
OBJECTIVE: To configure the seven segment to display the number 3.

Connect A, B, G, C, & D to the negative of the battery.

Project #333 Display #4

OBJECTIVE: To configure the seven segment to display the number 4.

Connect B, C, F, & G to the negative of the battery.



Project #334 Display #5

OBJECTIVE: To configure the seven segment to display the number 5.

Connect A, F, G, C, & D to the negative of the battery.

Project #335 Display #6

OBJECTIVE: To configure the seven segment to display the number 6.

Connect A, C, D, E, F, & G to the negative of the battery.

Project #336 Display #7

OBJECTIVE: To configure the seven segment to display the number 7.

Connect A, B, & C to the negative of the battery.

Project #337 Display #8

OBJECTIVE: To configure the seven segment to display the number 8.

Connect A, B, C, D, E, F & G to the negative of the battery.

Project #338 Display #9

OBJECTIVE: To configure the seven segment to display the number 9.

Connect A, B, C, F, & G to the negative of the battery.

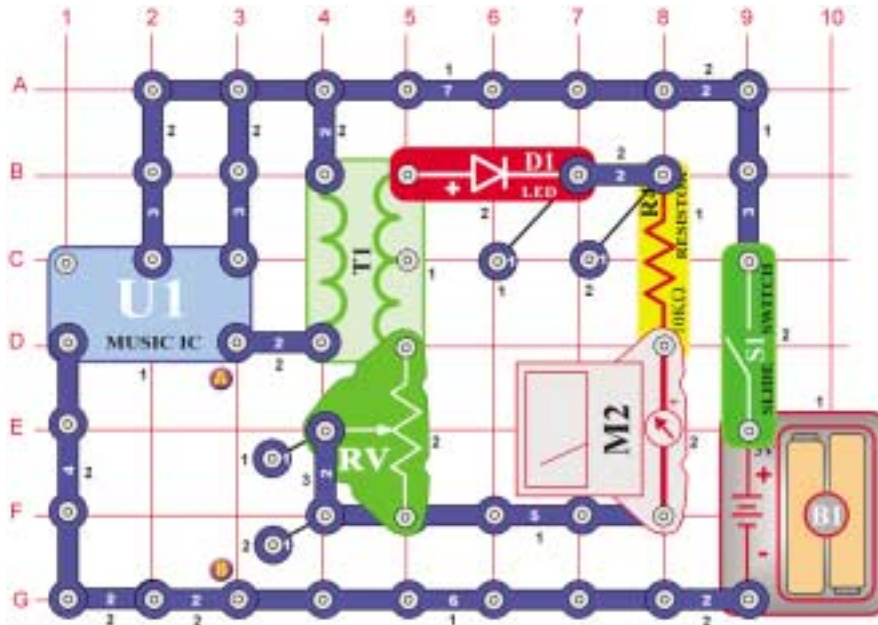
Project #339 Display #0

OBJECTIVE: To configure the seven segment to display the number 0.

Connect A, B, C, D, E, & F to the negative of the battery.

Project #340

Music Meter



Set the meter (M2) to the 10MA scale. In this circuit, the output of the music IC (U1) is applied to the less windings side of the transformer (T1), which lights the LED (D1) and deflects the meter.

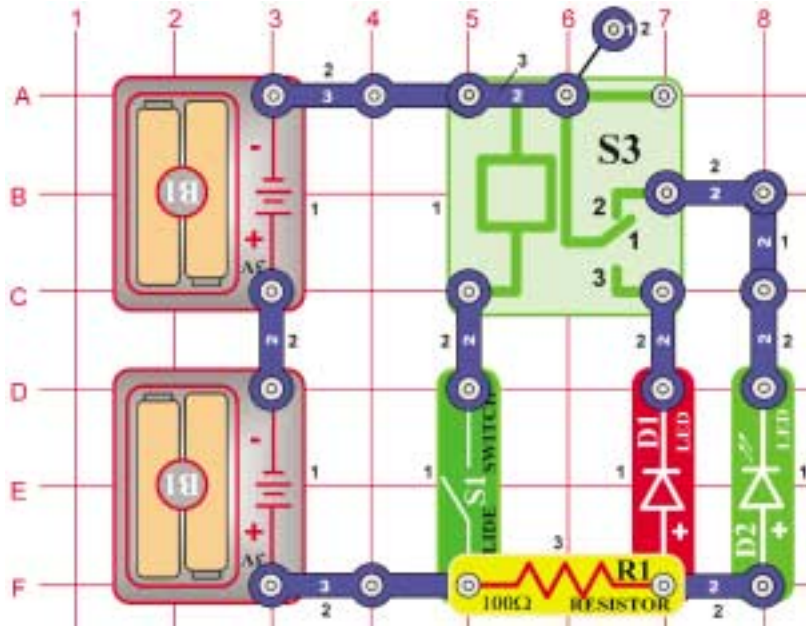
Place the variable resistor (RV) to the bottom position and turn on the switch (S1). Adjust the variable resistor upwards. This increases the voltage across the LED and meter. The LED brightens and the meter deflects more towards 10. Place the speaker (SP) across points A & B and use a jumper wire to complete the connection. Now you can hear and see the output of the music IC.



Project #341

LED & Relay

OBJECTIVE: Turn on and off LEDs using a relay.



A relay is an electronic switch with contacts that are opened or closed using voltage. It contains a coil that generates a magnetic field when a current flows through it. The magnetic field attracts an iron armature which switches the contacts. Contact #2 is normally closed, connecting the green LED (D2) and the resistor across the batteries.

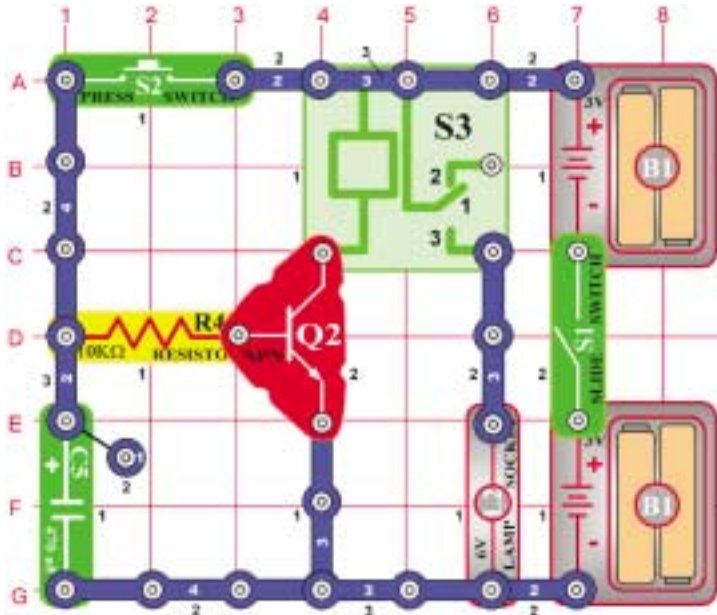
With the slide switch (S1) turned off, the green LED should light. Now turn on the switch, contact #1 on the relay (S3) will switch to contact #3, lighting the red LED (D1).



Project #342

Manual 7 Second Timer

OBJECTIVE: To build a manual timer using a relay.



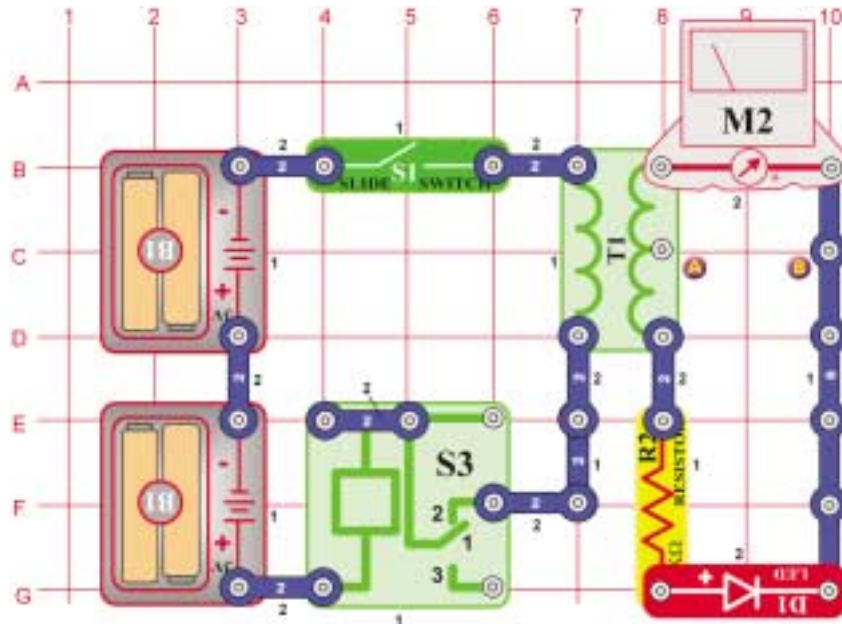
The transistor (Q2) acts as a switch, connecting the relay (S3) to the batteries. As long as there is positive voltage on the transistor's base, the bulb (L2) will light.

Turn on the switch (S1) and hold down the press switch (S2). The transistor turns on, capacitor C5 charges up, and the bulb lights. When the press switch is released, the capacitor discharges through the base, keeping the transistor on. The transistor will turn off when the capacitor is almost discharged, about 10 seconds. The relay contacts will switch and the bulb will turn off.

Change the value of the capacitor and see what happens.



Project #343



Half Wave Rectifier Circuit

OBJECTIVE: To build a half wave rectifier circuit.

Set the meter (M2) to the 10mA scale. A rectifier changes an AC voltage into a DC voltage. A diode (D1) is used because it allows current to flow in only one direction, for one polarity of applied voltage. As the contacts open and close, it generates an AC voltage across the transformer (T1). We can measure the DC voltage on the transformer's output using a resistor (R4), a diode (D1), and an amp meter. Turn on the switch (S1), the LED lights as the meter points past the 5 scale.



Project #344 Half Wave Rectifier Circuit (II)

OBJECTIVE: Measure the voltage using the center-tap.

Use the circuit in project #343. Now see what happens if you connect to the center-tap on the side with more windings. Place the meter (M2) across points A & B, then turn on the switch (S1). The needle should be below the 5 scale, half as much as project #343. As you use less windings, the output decreases.



Project #345 LED vs. Diode

OBJECTIVE: To see the voltage difference between an LED and diode.

Use the circuit in project #343. Replace the LED (D1) with the diode (D3) and turn on the switch (S1). The needle deflects higher, because the voltage across the diode is less than the voltage across the LED.



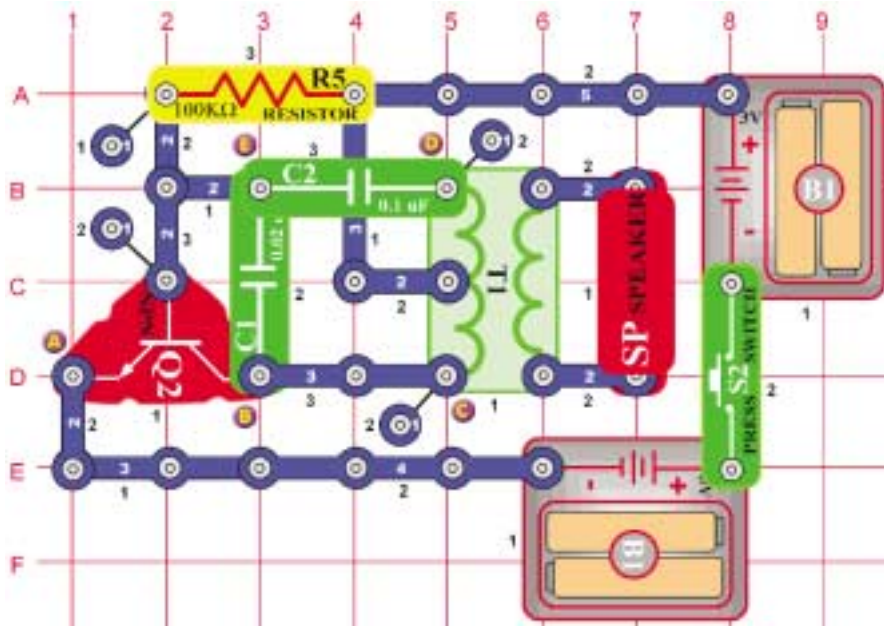
Project #346 Current & Resistance

OBJECTIVE: See how resistance affects current.

Change the 1k Ω (R2) resistor to a 5.1k Ω (R3) and turn on the switch (S1). You will see that increasing the resistance decreases the voltage across the meter (M2).



Project #347



Telegraph

OBJECTIVE: Making telegraph sounds.

Press the switch (S2) down. The circuit oscillates and the AC voltage generated from the transformer (T1) drives the speaker (SP). To make a telegraph sound, depress the switch for long and short periods.



Project #348 Mosquito Sound

OBJECTIVE: Use the whistle chip to make a mosquito sound.

Use the circuit in project #347. Remove the speaker (SP). Connect the whistle chip (WC) across points C & D to make a mosquito sound.



Project #349 Mosquito Sound (II)

OBJECTIVE: Show variations of project #347.

Use the circuit in project #347. Connect the whistle chip (WC) across points B & E.



Project #350 Mosquito Sound (III)

OBJECTIVE: Show variations of project #347.

Use the circuit in project #347. Connect the whistle chip (WC) across points E & D (place it beneath capacitor (C2) or use the jumper wires).



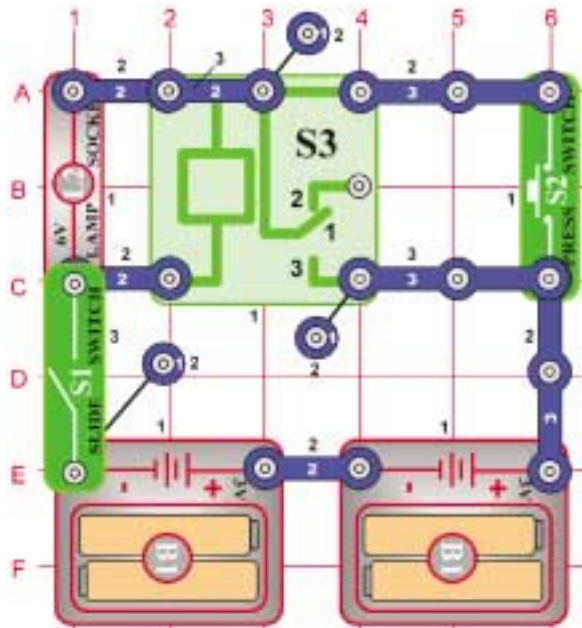
Project #351 Touch-Control Mosquito Sound

OBJECTIVE: To use the photo resistor to adjust the oscillator sound.

Use the circuit in project #347. Replace the 100kΩ resistor (R5) with the photo resistor (RP). Wave your hand over the resistor and the sound changes.



Project #352



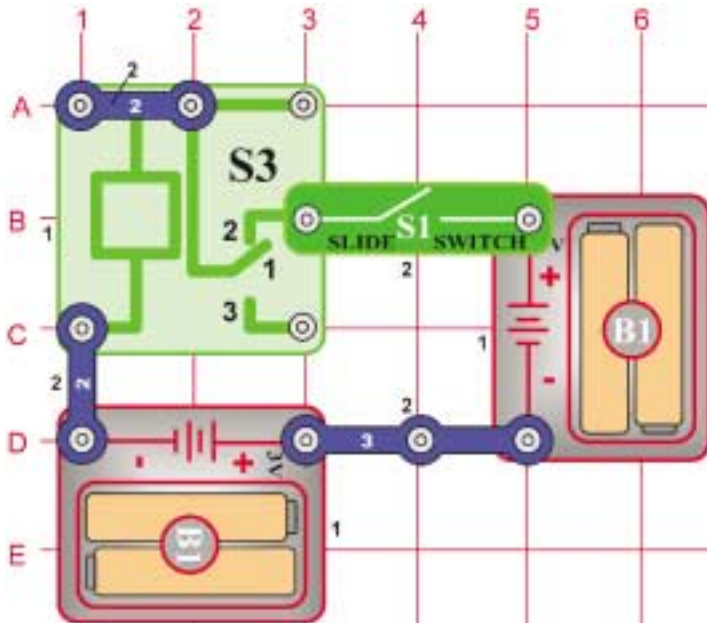
Bulb & Relay

OBJECTIVE: Light a bulb using a relay.

Turn off the slide switch (S1). If you press switch (S2), the bulb (L2) will not light. Turn on switch (S1) and press switch (S2) again; the bulb lights. The relay (S3) and bulb can be powered as long as the switch (S1) is turned on.



Project #353



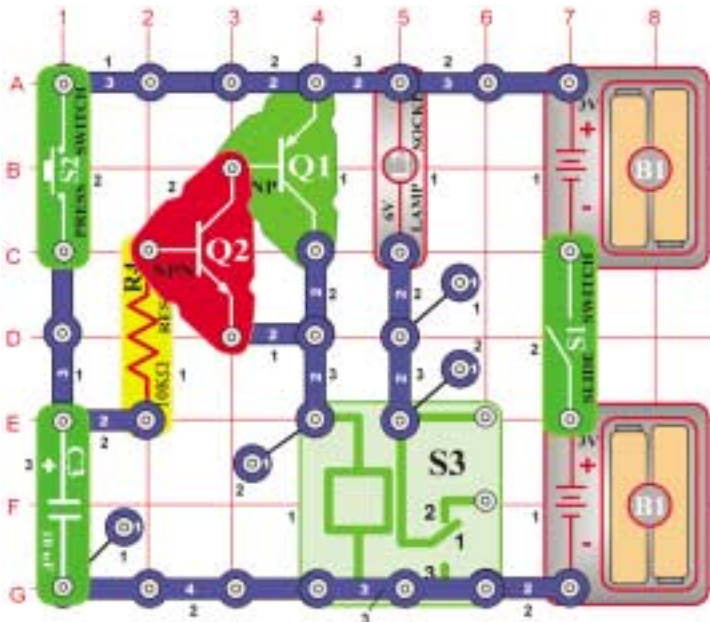
Relay Buzzer

OBJECTIVE: To make a relay buzzer.

When you turn on the switch (S1), you should hear a buzzing sound from the relay (S3). The sound is caused by the relay's contacts opening and closing at a fast rate.



Project #354



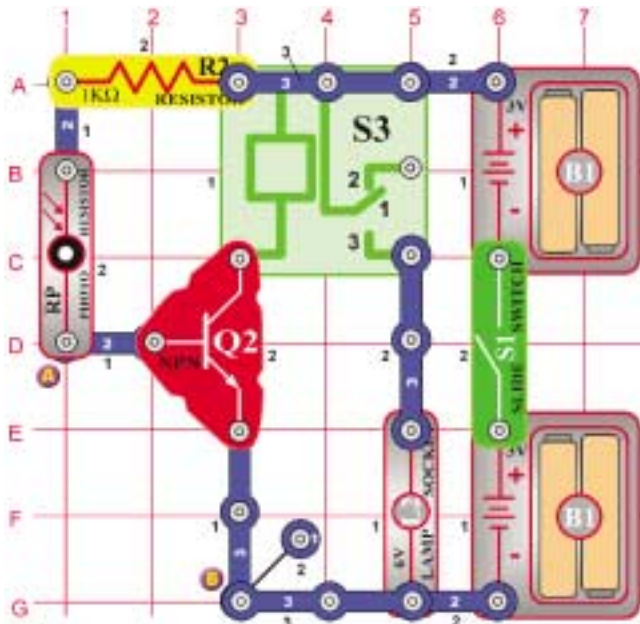
Transistor Timer

OBJECTIVE: To build a manual timer using a transistor in place of the relay.

This circuit is similar to project #342 except now two transistors are used. Turn on the switch (S1) and hold down the press switch (S2). The transistors (Q1 & Q2) turn on, the capacitor (C3) charges up, and the bulb (L2) lights. When the press switch (S2) is released, the capacitor discharges through the base, keeping the transistors on. The transistors will turn off when the capacitor is almost discharged (about 1 minute). The relay (S3) contacts will switch and the bulb will turn off.



Project #355



Light-controlled Relay

OBJECTIVE: To use a photo resistor to control a relay.

Under normal light, the resistance of the photo resistor (RP) is low, allowing a voltage at the base of the transistor (Q2). This turns the transistor on, connecting the relay (S3) across the batteries, and the bulb (L2) lights. If the light decreases, the resistance increases and the voltage to Q2 drops. If the voltage at Q2 decreases enough, the transistor turns off.

Turn on the switch (S1) and the bulb lights. Now as you block the light from the photo resistor, the bulb turns on and off.



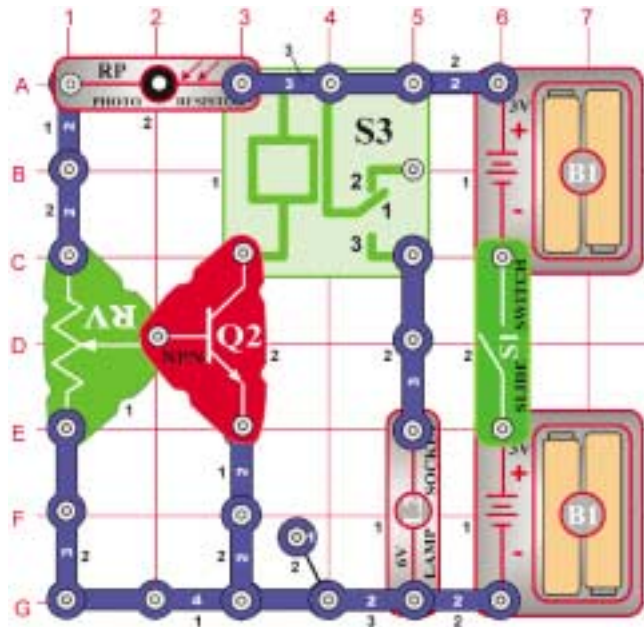
Project #356 Bulb Alert Relay

OBJECTIVE: Make a warning system that lights the bulb.

Replace the photo resistor (RP) with a 10kΩ resistor (R4). Connect the wire to points A & B. As long as the wire is connected, the transistor (Q2) is off and the relay (S3) and bulb (L2) are not powered. Disconnect the wire. The relay contacts will switch and the bulb will light.



Project #357



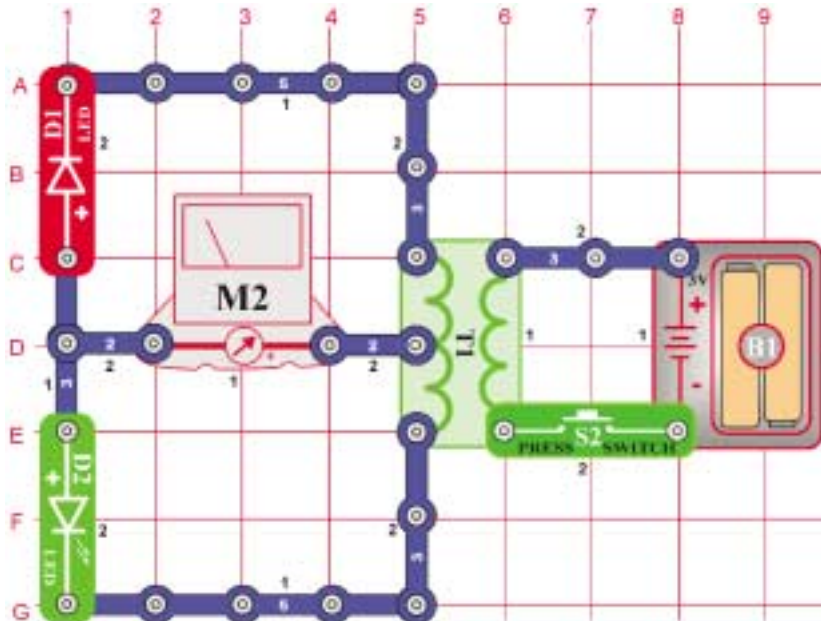
Adjustable Light Control

OBJECTIVE: Build an adjustable light-controlled relay.

You can set the amount of light it takes to keep the bulb (L2) on by adjusting the variable resistor (RV). Set the variable resistor to the top position and turn on the switch. The bulb lights. Cover the photo resistor (RP) and the bulb turns off. Set the variable resistor to different positions and then cover the photo resistor. Note that only the top half of the variable resistor affects the circuit. If you position it below the middle, the bulb stays off.



Project #358



Meter Deflection

OBJECTIVE: To demonstrate the properties of a transformer.

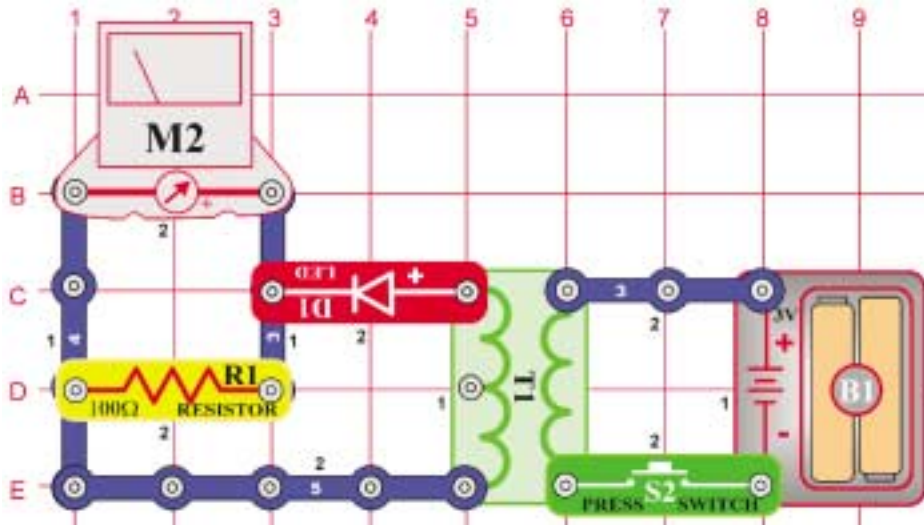
Set the meter (M2) to the 10MA scale. Pressing and releasing the press switch (S2) generates a DC current on the left side of the transformer (T1). The current lights the LEDs (D1 & D2) and deflects the meter to the right. There are two current paths as shown by the arrows. Placing the meter in series with both current paths measures the total current. If you remove one LED, the meter deflects half the amount.



Project #359

AC to DC Current

OBJECTIVE: To convert an AC current to DC using an LED.



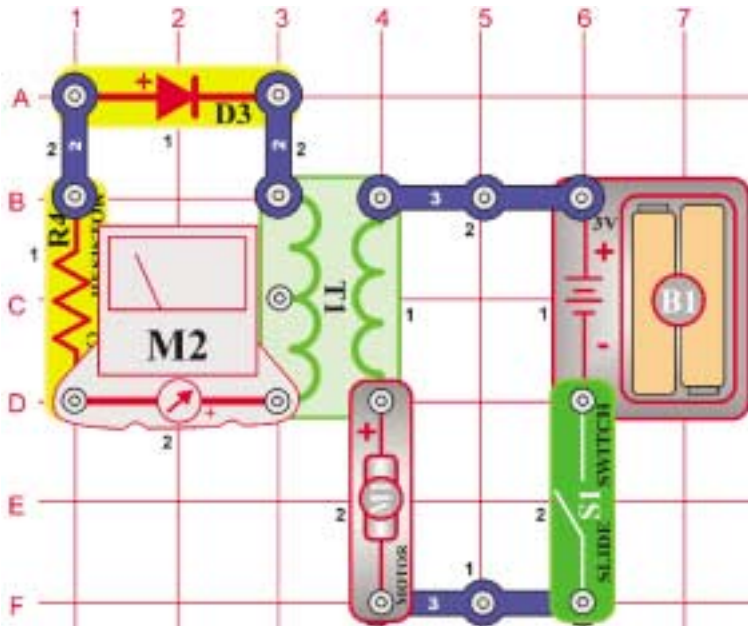
Set the meter (M2) to the 10MA scale. Pressing and releasing the press switch (S2) continuously generates an AC current. The LED (D1) is used to convert the AC current to DC current because it only allows the current to flow in one direction. The LED should light as the meter deflects to the right only. Without the LED, the meter would deflect in both directions.



Project #360

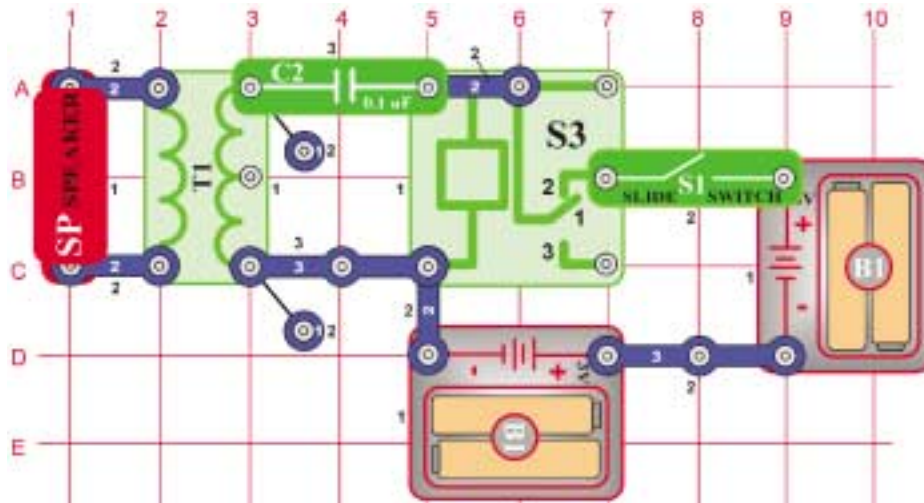
Current Meter

OBJECTIVE: To measure the current through a transformer.



Set the meter (M2) to the 10MA scale. By placing the meter, diode (D3) and current limiting resistor (R4) on the transformer (T1), you can measure the current. Turn on the slide switch (S1) and the motor (M1) starts spinning. The current on the right side of the transformer creates a current on the left side using magnetism.

Project #361



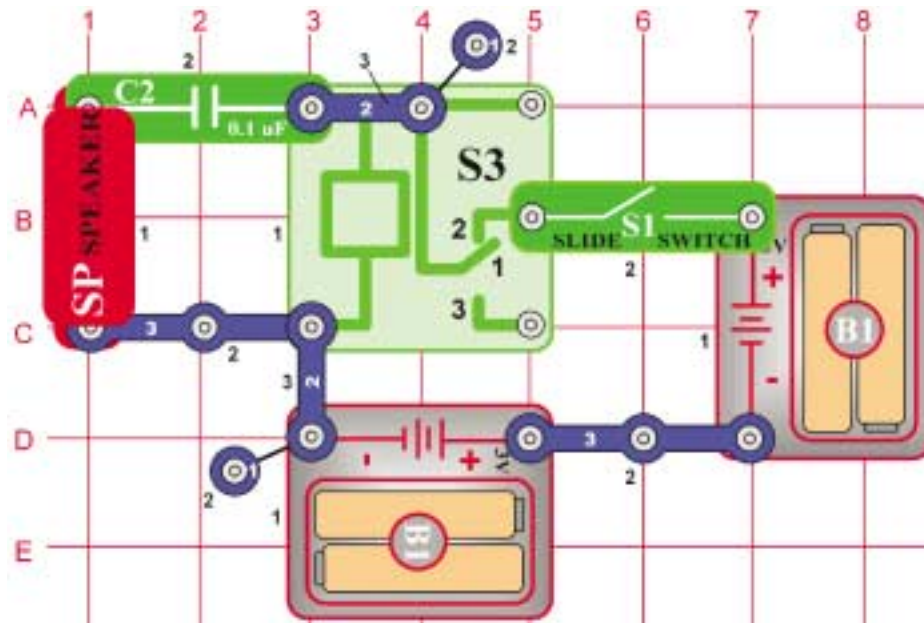
Buzzer, Relay, & Transformer

OBJECTIVE: To use a transformer for a louder buzzer.

Turn on the switch (S1). The speaker (SP) generates a buzzer sound. As in project #353, the relay (S3) is rapidly switched on and off. This causes an AC voltage on the left side of the transformer (T1). The voltage is stepped-down and applied to the speaker, generating the sound.

To make the sound a little louder, replace the 0.1µF capacitor (C2) with a 3-snap wire.

Project #362



Buzzer & Relay

OBJECTIVE: Make a relay buzzer with speaker.

A speaker (SP) and capacitor (C2) are placed across the coil of the relay (S3). When the switch (S1) is turned on, the relay's contacts open and close as in project #353. As the capacitor (C2) charges and discharges, the speaker generates a buzzing sound.

Project #363 Display Capital Letter "F"

OBJECTIVE: To configure the seven segment to display the capital letter "F".

Connect A, E, F, & G to the negative of the battery.

Project #364 Display Capital Letter "H"

OBJECTIVE: To configure the seven segment to display the capital letter "H".

Connect B, C, E, F, & G to the negative of the battery.

Project #365 Display Capital Letter "P"

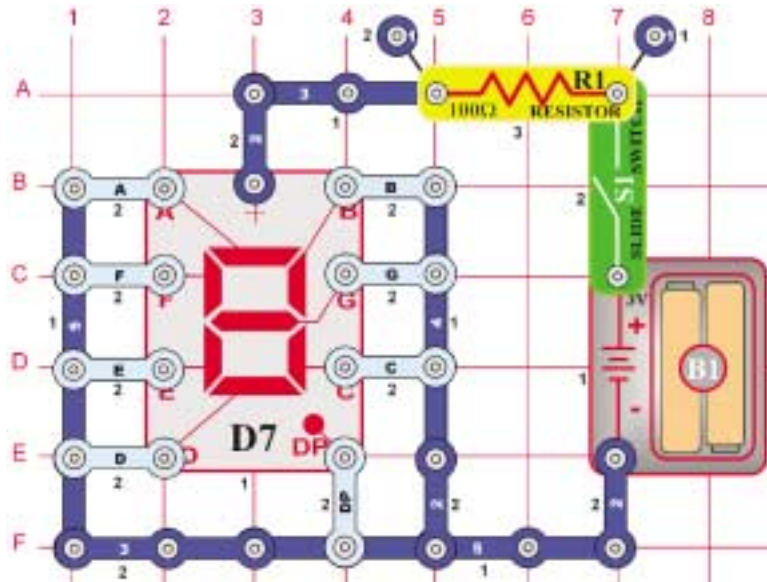
OBJECTIVE: To configure the seven segment to display the capital letter "P".

Connect A, B, E, F, & G to the negative of the battery.

Project #366 Display Capital Letter "S"

OBJECTIVE: To configure the seven segment to display the capital letter "S".

Connect A, F, G, C, & D to the negative of the battery.



Project #367 Display Capital Letter "U"

OBJECTIVE: To configure the seven segment to display the capital letter "U".

Connect B, C, D, E, & F to the negative of the battery.

Project #368 Display Capital Letter "C"

OBJECTIVE: To configure the seven segment to display the capital letter "C".

Connect A, D, E, & F to the negative of the battery.

Project #369 Display Capital Letter "E"

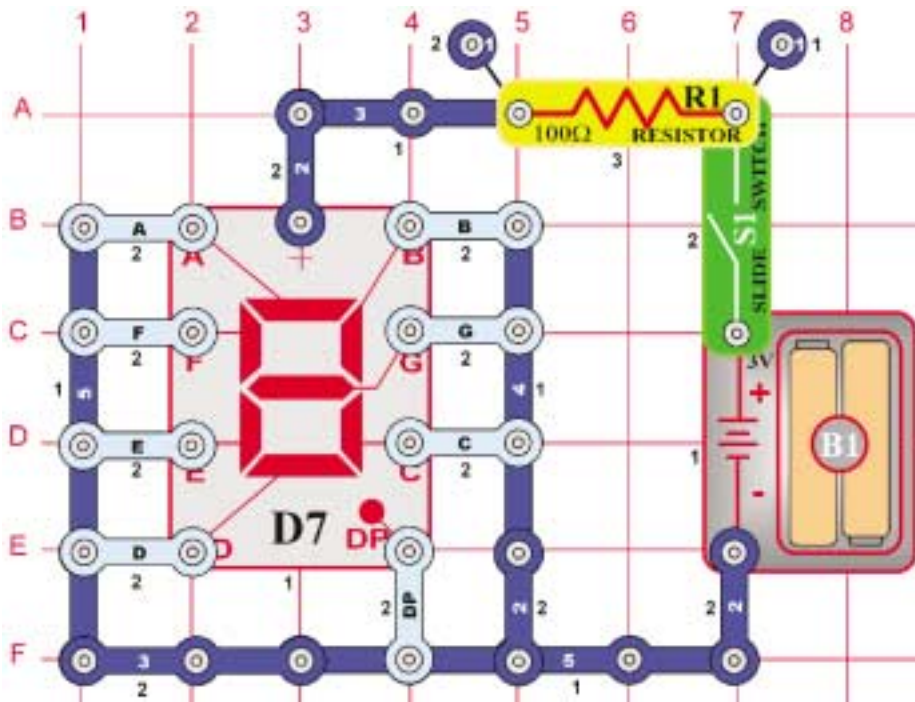
OBJECTIVE: To configure the seven segment to display the capital letter "E".

Connect A, D, E, F, & G to the negative of the battery.

Project #370 Display "."

OBJECTIVE: To configure the seven segment to display the decimal (DP).

Connect DP to the negative of the battery.



Project #371 Display Letter “b”

OBJECTIVE: To configure the seven segment to display the letter “b”.

Connect C, D, E, F, & G to the negative of the battery.



Project #372 Display Letter “c”

OBJECTIVE: To configure the seven segment to display the letter “c”.

Connect A, F, & G to the negative of the battery.



Project #373 Display Letter “d”

OBJECTIVE: To configure the seven segment to display the letter “d”.

Connect B, C, D, E, & G to the negative of the battery.



Project #374 Display Letter “e”

OBJECTIVE: To configure the seven segment to display the letter “e”.

Connect A, B, D, E, F, & G to the negative of the battery.



Project #375 Display Letter “h”

OBJECTIVE: To configure the seven segment to display the letter “h”.

Connect F, E, G, & C to the negative of the battery.



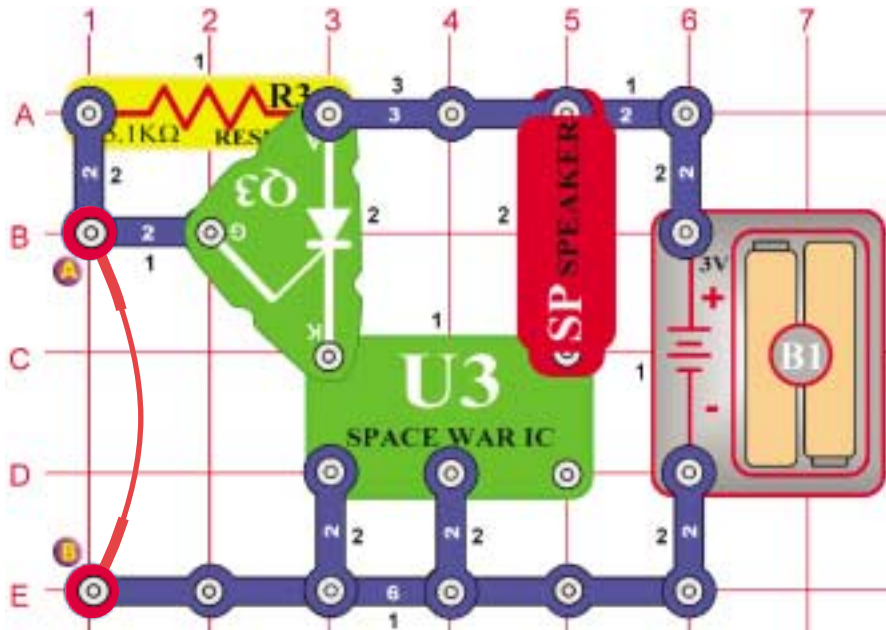
Project #376 Display Letter “o”

OBJECTIVE: To configure the seven segment to display the letter “o”.

Connect C, D, E, & G to the negative of the battery.



Project #377



Alarm by SCR

OBJECTIVE: To build an alarm circuit.

The circuit uses the space war IC (U3) and works the same way as project #320. Remove the jumper wire and a space war sound plays.



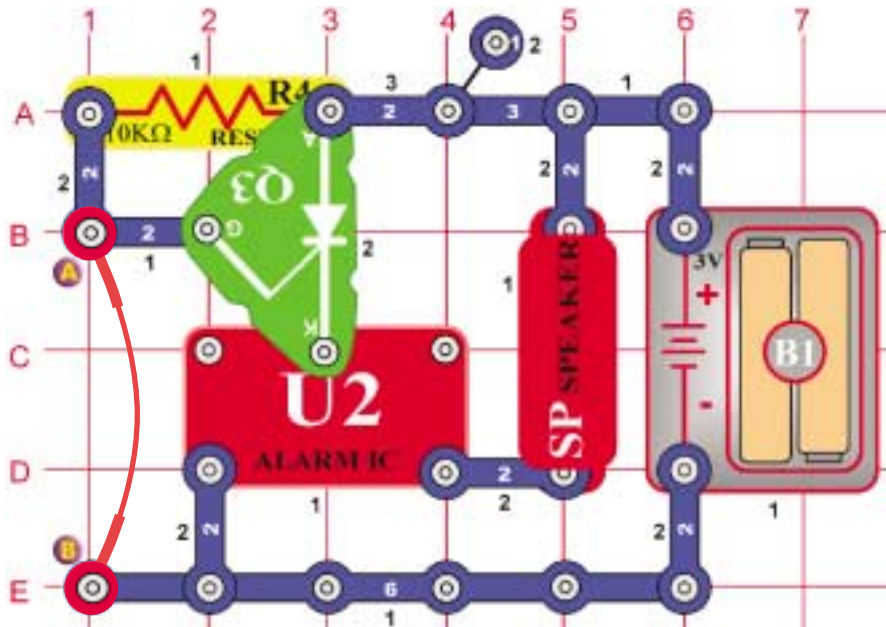
Project #378 Light Space War Alarm

OBJECTIVE: To build an alarm circuit.

Use the circuit in project #377. Replace the resistor (R3) with the photo resistor (RP) and remove the jumper wire. Cover the photo resistor with your hand. Now slowly remove your hand. The music plays when enough light hits the resistor.



Project #379



Alarm by SCR

OBJECTIVE: To build an alarm circuit.

The circuit uses the alarm IC (U2) and works the same way as project #377. Remove the jumper wire and an alarm IC sounds.



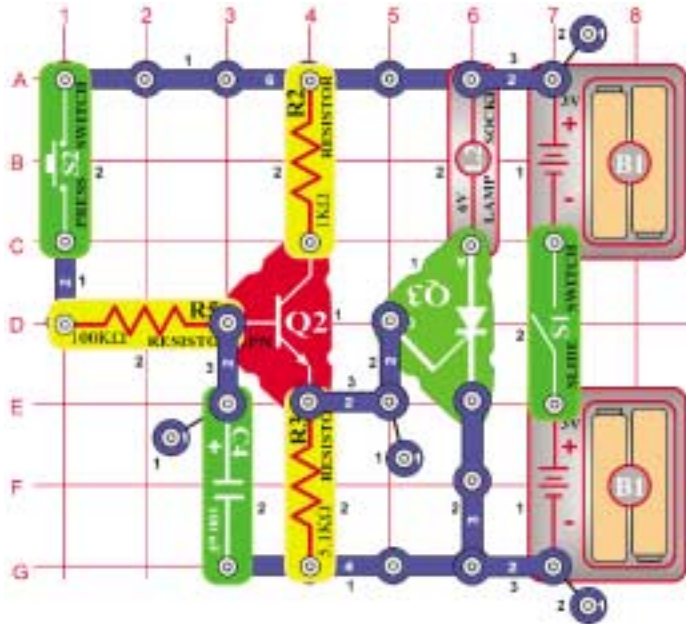
Project #380 Light & Alarm IC

OBJECTIVE: To build an alarm circuit.

Use the circuit in project #379. Replace the 10kΩ resistor (R4) with the photo resistor (RP) and remove the jumper wire. When enough light strikes the photo resistor, the Alarm IC (U2) plays. Cover the photo resistor with your hand. Now slowly remove it, when enough light hits the resistor, the IC plays.



Project #381



Delay Light

OBJECTIVE: To construct a time delay circuit.

Turn on the slide switch (S1) and the bulb (L2) does not light. Press switch (S2) and slowly the bulb lights.

When the switch (S2) is pressed, current flows to the base of the transistor (Q2) and charges the 100μF capacitor (C4). When the capacitor charges up to more than 1 volt, the transistor (Q2) turns on and triggers the SCR (Q3). The bulb will stay lit until the slide switch (S1) is turned off. The values R5 and C4 determine the time it takes until the transistor turns on. The larger the capacitor value, the more time it takes to turn on.



Project #382 Delay Fan

OBJECTIVE: To construct a time delay fan.

Use the circuit in project #381. Replace the bulb (L2) with the motor (M1) and fan. Turn on switch (S1) and press down switch (S2) to start the motor.



Project #383 Delay Fan (II)

OBJECTIVE: To construct another type of time delay fan.

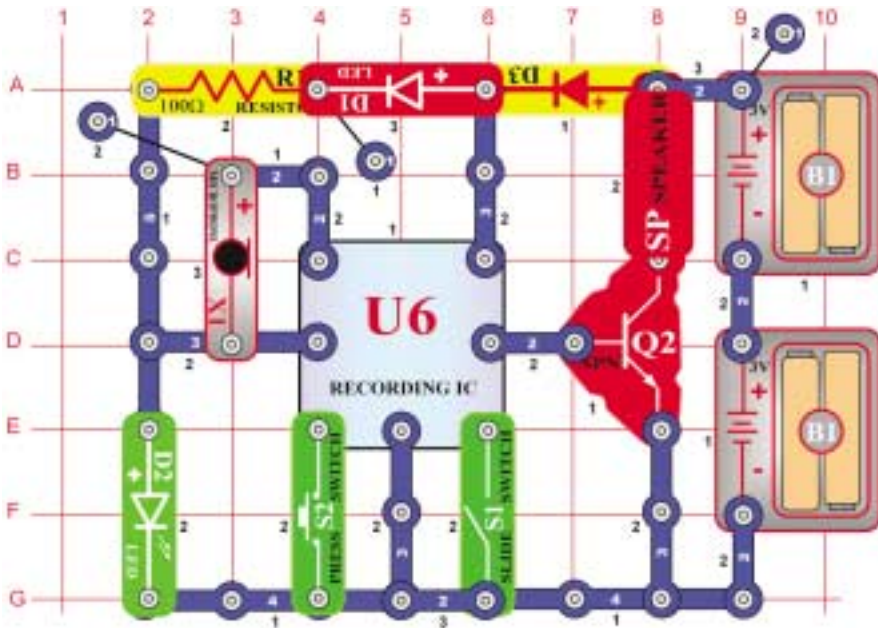
Use the circuit in project #381. Replace the 100μF capacitor (C4) with the 470μF capacitor (C5). Turn on switch (S1) and press switch (S2). See how long it takes until the motor (M1) spins.



Project #384

Recording LED Indicator

OBJECTIVE: To build a circuit that lights an LED to indicate



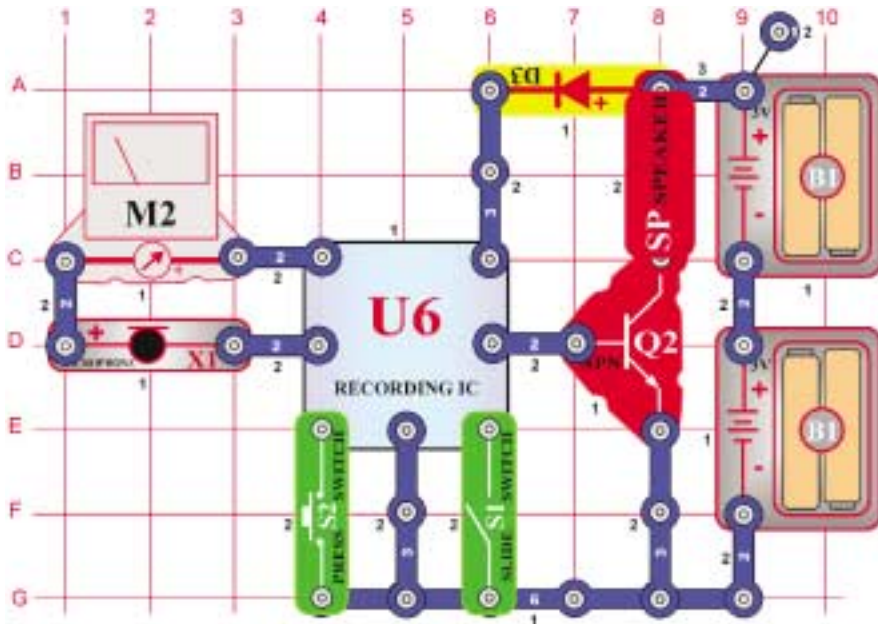
The circuit uses sound (beep) and light (LED) to indicate that you are recording. Build the circuit; the red (D1) and green (D2) LEDs should light. Now turn on switch (S1). You hear one beep and the green LED turns off. Speak into the microphone (X1) to record a message. When you turn off switch (S1), or the circuit beeps twice (indicating the recording is finished), the green LED turns on again. Press the switch (S2) to hear your recording.



Project #385

Playback & Record with Meter

OBJECTIVE: To add a volt meter to the playback and record

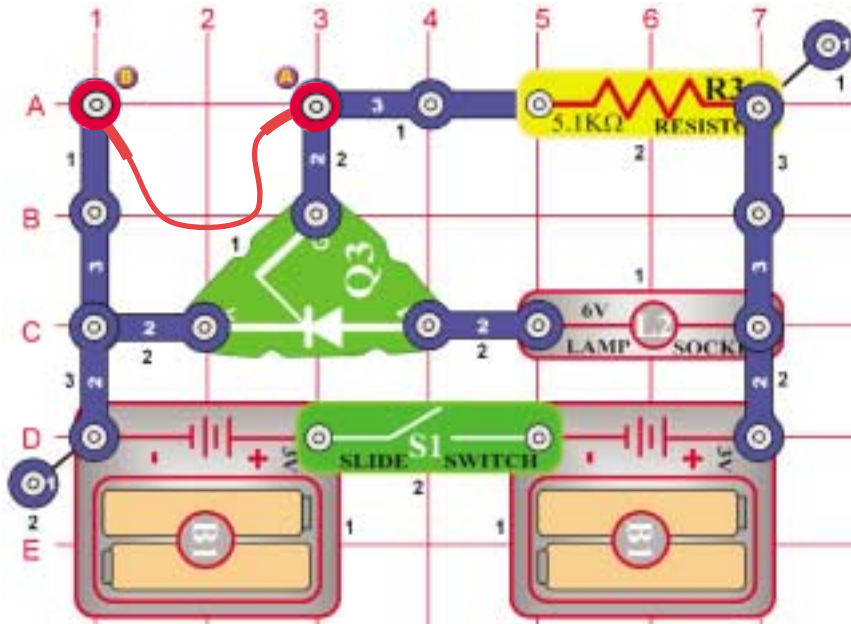


Set the meter (M2) to the 10MA scale. When recording, if the input signal into the microphone (X1) is too high, distortion can occur. To monitor the level, a meter is placed in series with the microphone.

Turn on the switch (S1) and the meter deflects to the right. As you speak into the microphone, the meter indicates the change in voltage. Turn the switch off and then on to record again, but this time speak louder. You will find that the louder you speak, the more the meter deflects.



Project #386



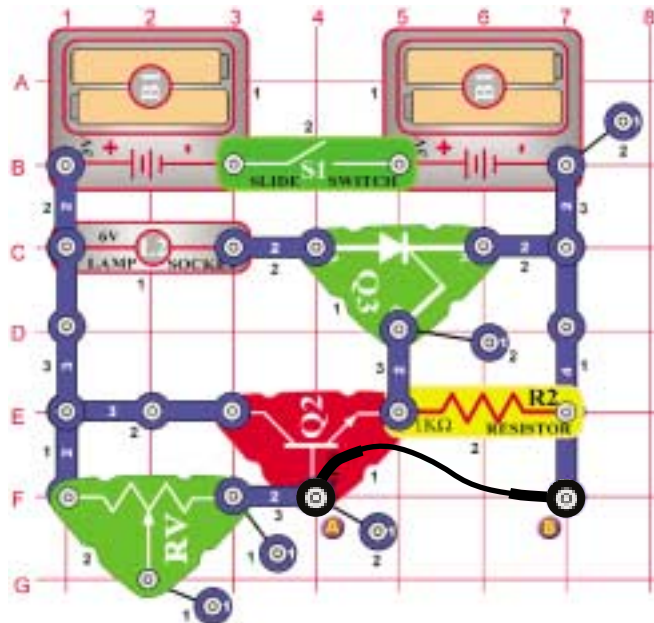
Alarm Light

OBJECTIVE: To light a bulb to indicate an open circuit.

This is another example of a alarm that activates when the circuit is broken. Connect the jumper wire across points A & B and then turn on the switch (S1). The bulb (L2) will not light until the jumper wire is disconnected. Turn off the switch to turn the bulb off again.



Project #387



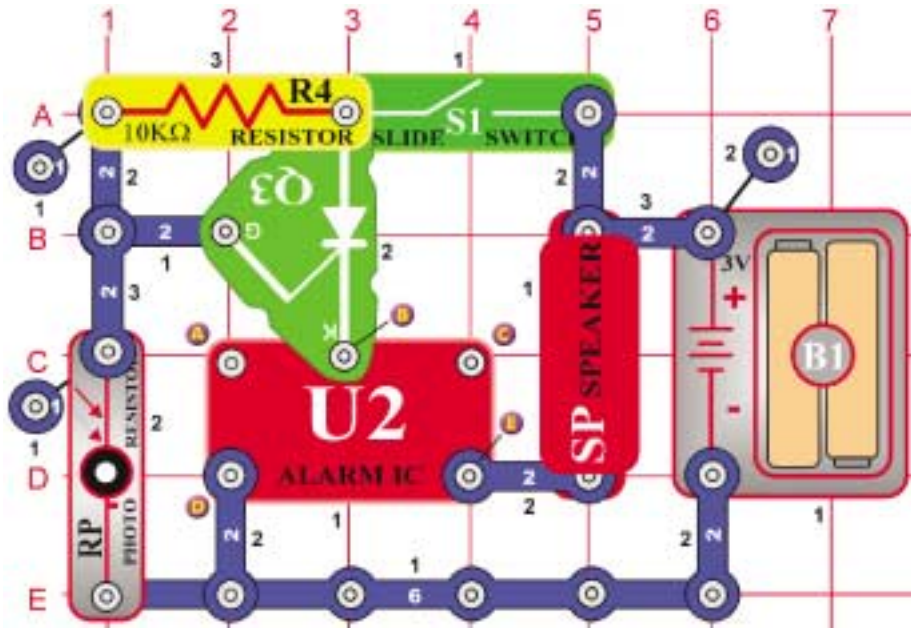
Alarm Light (II)

OBJECTIVE: To light a bulb to indicate an open circuit.

This project is similar to project #386, but uses a transistor (Q2). The bulb (L2) will not light until the jumper wire is disconnected. The jumper wire grounds the base of the transistor, keeping it off. Remove the jumper and the voltage on the base rises; turning the transistor and SCR (Q3) on, and lighting the bulb. Note, the variable resistor (RV) is used as a fixed value.



Project #388



Night Police Car

OBJECTIVE: To build a night-sensitive police car sound.

As the photo resistor (RP) is exposed to light, its resistance is very low, thereby connecting the gate of the SCR (Q3) to ground. This prevents the SCR from conducting, connecting the alarm IC (U2) to the batteries. The alarm IC remains off until the light is blocked, triggering the SCR.

Wave your hands over the photo resistor. Block the light with your hand and the speaker (SP) sounds.



Project #389

Night Machine Gun

OBJECTIVE: To build a night-sensitive machine gun sound.

Use the circuit from project #388. Connect the jumper wire to points B & C for a machine gun sound.



Project #390

Night Fire Engine

OBJECTIVE: To build a night-sensitive fire engine sound.

Use the circuit from project #388. Connect the jumper wire to points A & B for a fire engine sound.



Project #391

Night Ambulance

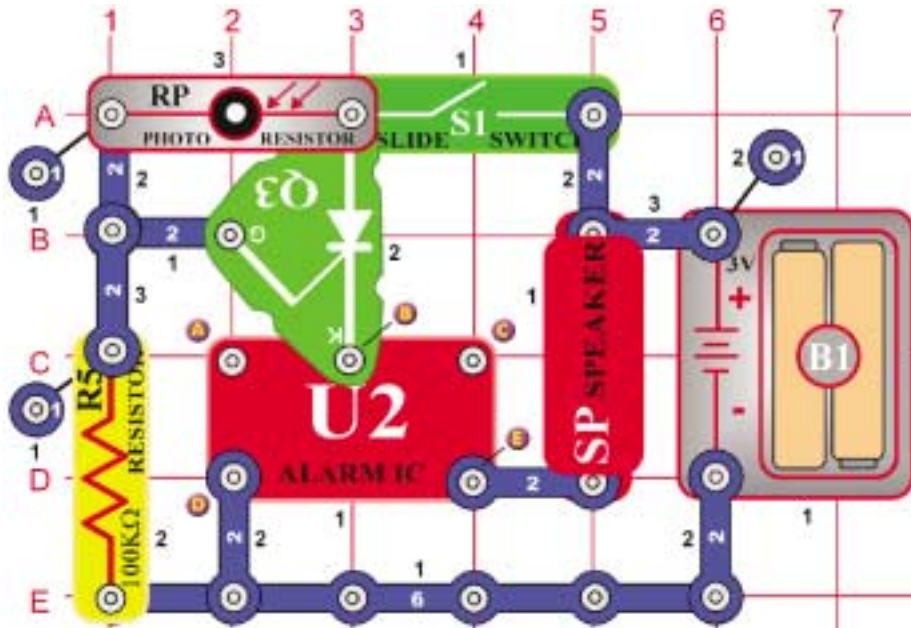
OBJECTIVE: To build a night-sensitive ambulance sound.

Use the circuit from project #388. Connect the jumper wire to points A & D for an ambulance sound.



Project #392

Daytime Light Police Car



OBJECTIVE: To build a light-sensitive police car sound.

As long as the photo resistor (RP) is exposed to light, the alarm IC (U2) outputs a signal to the speaker (SP). Block the light with your hand and the sound will stop.



Project #393

Daytime Light Machine Gun

OBJECTIVE: To build a light-sensitive machine gun sound.

Use the circuit from project #392. Connect the jumper wire to points B & C. The sound of a machine gun will be heard when the room is dark.



Project #394

Daytime Light Fire Engine

OBJECTIVE: To build a light-sensitive fire engine sound.

Use the circuit from project #392. Connect the jumper wire to points A & B for a fire engine sound.



Project #395

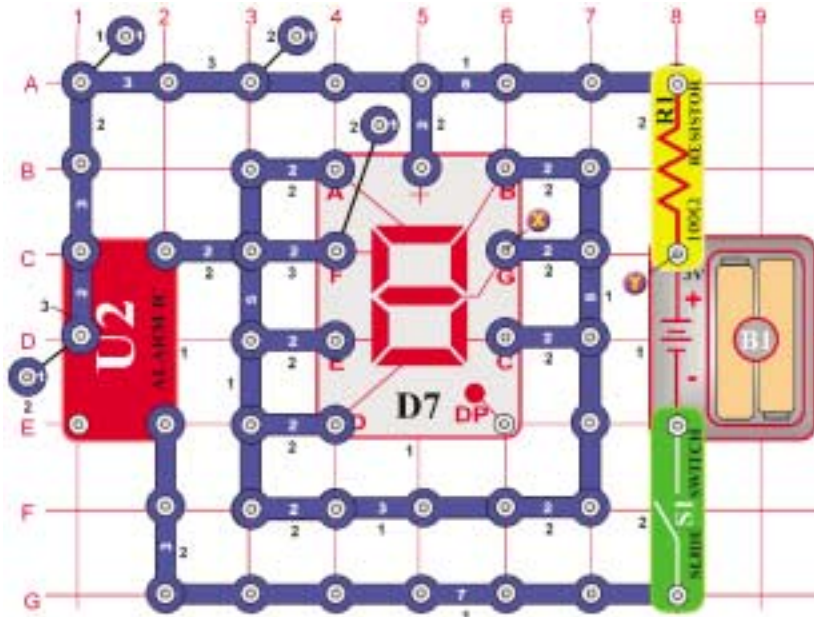
Daytime Light Ambulance

OBJECTIVE: To build a light-sensitive ambulance sound.

Use the circuit from project #392. Connect the jumper wire to points A & D for an ambulance sound.



Project #396



Flashing 8

OBJECTIVE: Use the Alarm IC as a switch to flash the number “8”.

Turn on the switch (S1) and the number 8 starts flashing. The segments are powered by connecting them to the IC's (U2) output.



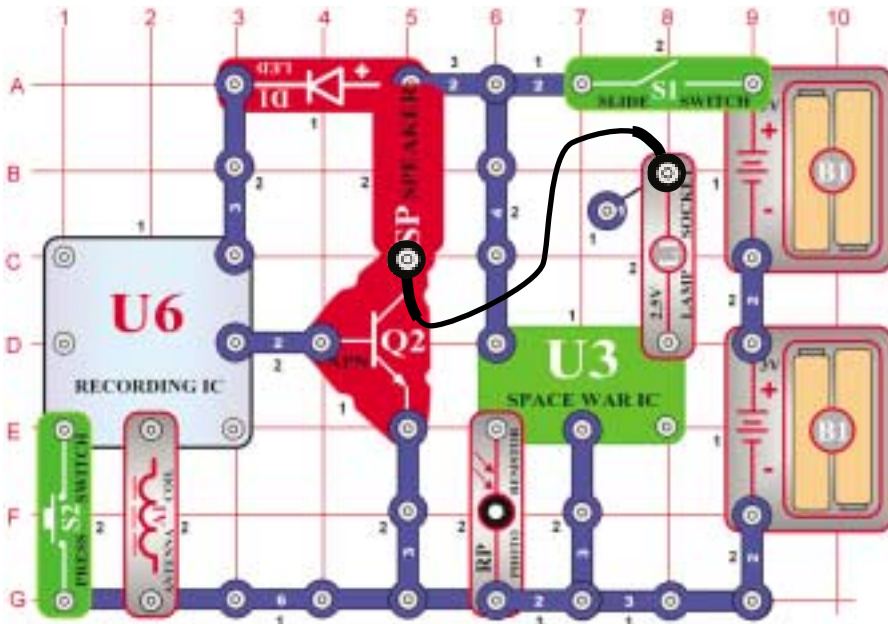
Project #397 Flashing 8 with Sound

OBJECTIVE: To build a circuit so you can hear and see the 8 flash.

Use the circuit in project #396. Connect the speaker (SP) across points X & Y to see and hear the IC's (U2) output.



Project #398



Musical Space War

OBJECTIVE: To combine the sound effects of the recorder and space war integrated circuits.

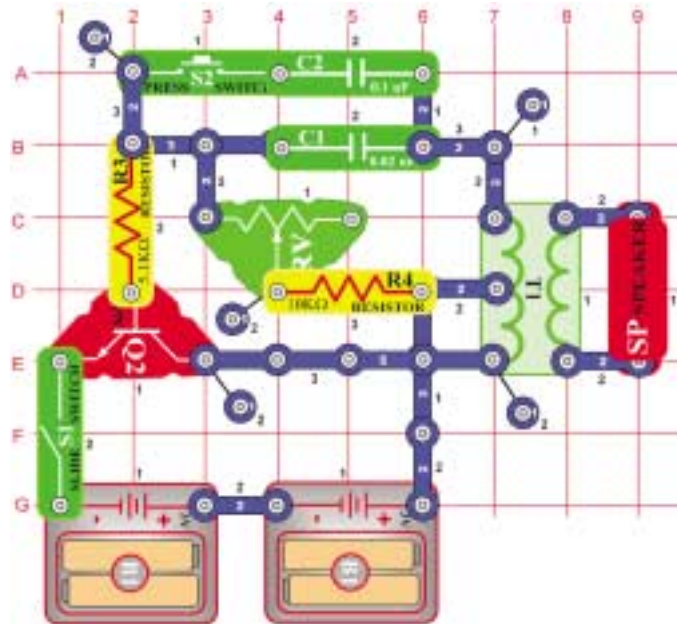
Turn on the switch (S1) and you hear space war sounds as the lamp (L1) flashes. If you wave your hand over the photo resistor (RP), the sound changes. If you keep the photo resistor covered, then the sound will stop.

Press the switch (S2) and you will hear music in addition to any space war sounds that are playing. Press the switch (S2) again to change the music. You will also hear any recording you had made previously with project #386.

Replace the lamp with the 100Ω resistor (R1) to reduce the loudness.



Project #399



Electronic Noisemaker

Build the circuit and turn on the slide switch (S1), you hear a high-frequency tone. Press the press switch (S2) and move the adjustable resistor (RV) control around to change to frequency of the tone. Replace the 0.1µF capacitor (C2) with the 10µF capacitor (C3) to lower the frequency of the tone.



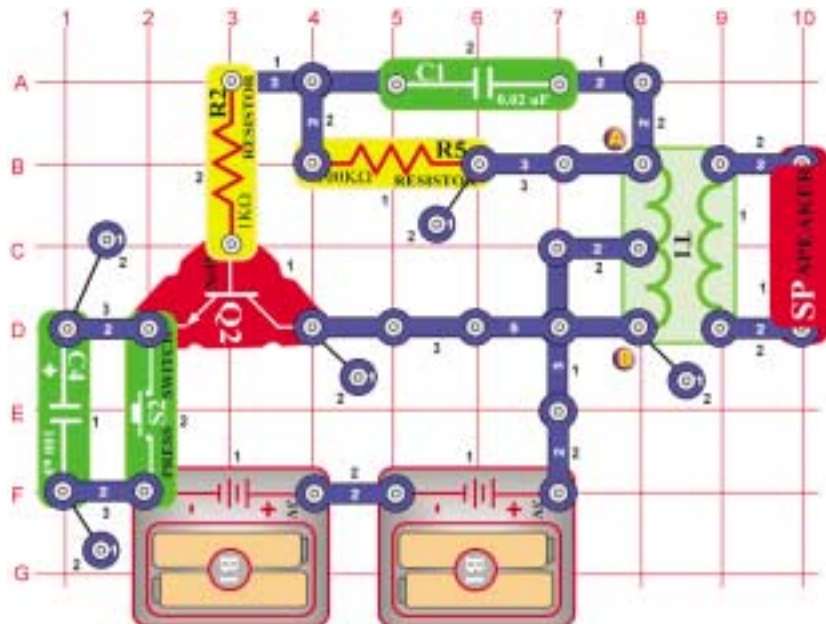
Project #400

Electronic Noisemaker (II)

You can also change the frequency by changing the resistance in the oscillator. Replace the 10KΩ resistor (R4) with the 100KΩ resistor (R5), this can be done with either the 0.1µF (C2) or 10µF (C3) capacitors in the circuit.



Project #401



Bee

Build the circuit and press the press switch (S2) a few times, you hear cute sounds like a bumble bee. Replace the 0.02µF capacitor (C1) with 0.1µF



Project #402

Bee (II)

Place the 0.02µF capacitor (C1) back in the circuit. Remove the speaker (S1) from the circuit and place the whistle chip (WC) across the transformer (T1) at points labeled A & B on the circuit layout. Listen to the sounds as you press the press switch (S2). Replace the 0.02µF capacitor (C1) with 0.1µF capacitor (C2) or 10µF capacitor (C3) to change the sound.



Project #403

Bee (III)

Replace the 100µF capacitor (C4) with the 10µF capacitor (C3) or the 470µF capacitor (C5) to change the duration of the sound. Use either the speaker circuit in project #401 or the whistle chip circuit in project #402.

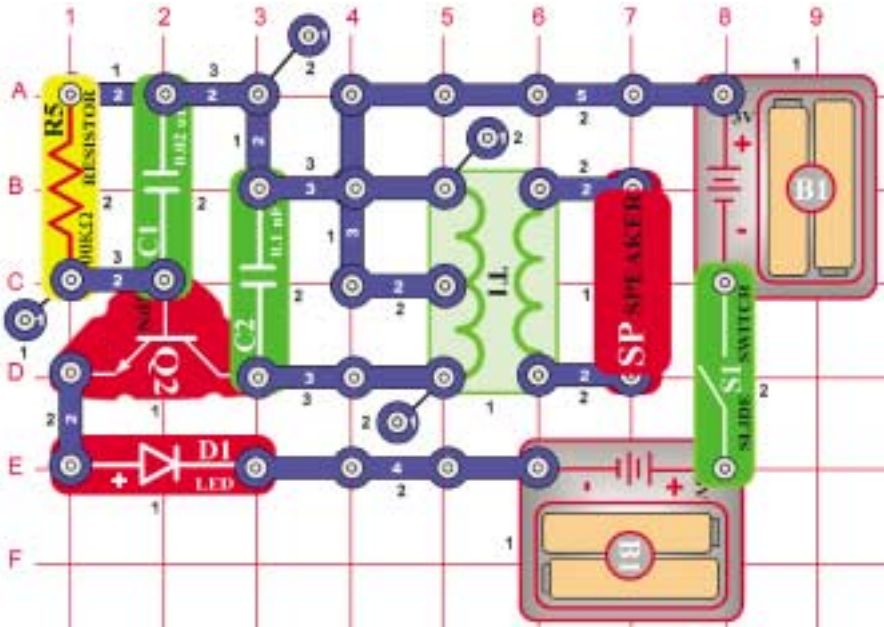


Project #404

Oscillator Sound

OBJECTIVE: Build an oscillator circuit.

Turn on the switch (S1) and the LED (D1) lights as the speaker (SP) emits a tone. The circuit oscillates and generates an AC voltage across the speaker through the transformer (T1).



Project #405 Oscillator Sound (II)

OBJECTIVE: Show variations of project #404.

Use the circuit in project #404. In this circuit, you will change the tone by adding more capacitance. Place the whistle chip (WC) on top of capacitor (C1). Turn on the switch (S1) and you now hear a lower tone. Adding the more capacitance lowers the oscillating frequency.



Project #406 Oscillator Sound (III)

OBJECTIVE: Show variations of project #404.

Use the circuit in project #404. Place the whistle chip (WC) in parallel with the capacitor (C2) by placing it on the left side of the transformer (T1). Turn on the switch (S1) and you now hear a lower tone.



Project #407 Oscillator Sound (IV)

OBJECTIVE: Show variations of project #404.

Use the circuit in project #404. Place the 10µF capacitor (C3) on top of the 0.02µF capacitor (C1). Turn on the switch (S1) and you should hear a much lower sound than the previous projects.



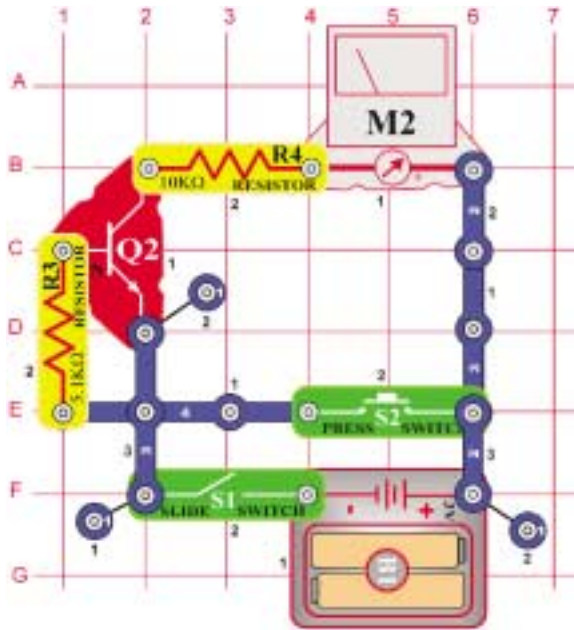
Project #408 Oscillator Sound (V)

OBJECTIVE: Show variations of project #404.

Use the circuit in project #404. Replace the 100kΩ resistor (R5) with the photo resistor (RP). Wave your hand over the photo resistor. Now, as the resistance changes, so does the oscillator frequency.



Project #409



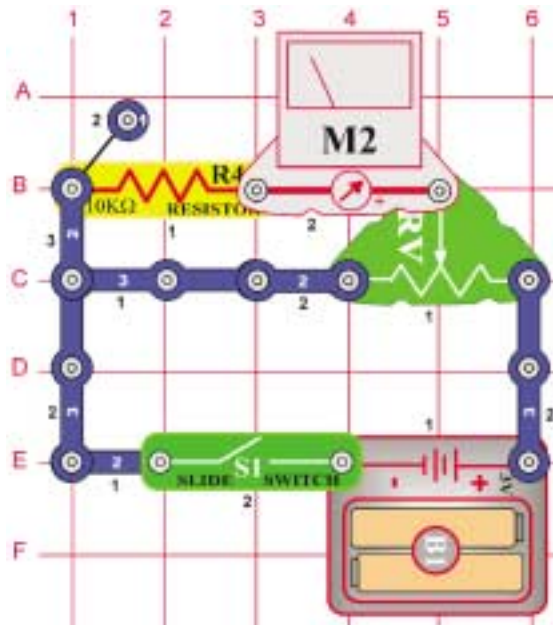
Transistor Tester

OBJECTIVE: To build a circuit that checks the transistor.

Set the meter (M2) to the 10MA scale. Turn on the switch (S1), the meter does not move. Press the switch (S2), the meter deflects and points to 10. This indicates the transistor (Q2) is GOOD. The meter would only deflect a little or not at all for a BAD transistor.



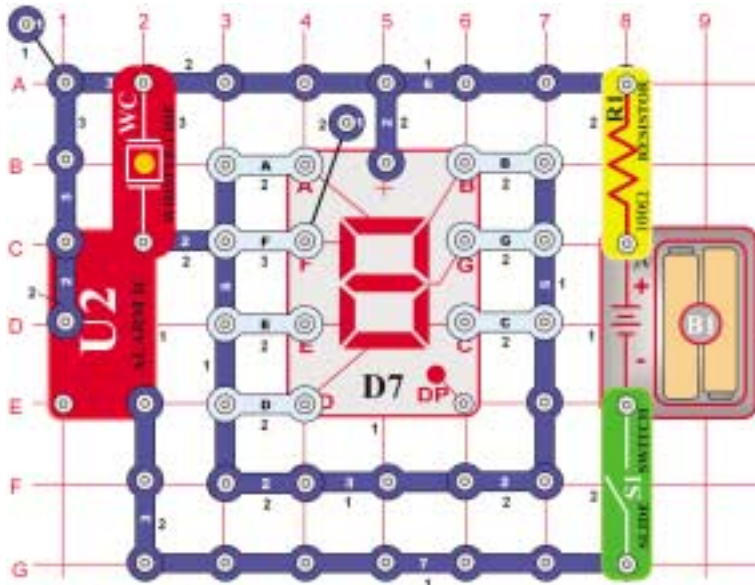
Project #410



Adjustable Voltage Divider

OBJECTIVE: To make an adjustable current path.

Set the meter (M2) to the 10MA scale. This circuit is a simple voltage divider. When the variable resistor (RV) is set to the far right, the voltage across the resistors (R4) and (RV) are equal. Adjust resistor (RV) to the left, the meter deflects less, as the voltage decreases.



Project #411 Automatic Display Capital Letter “C”

OBJECTIVE: To construct a flashing display for the capital letter C.

Connect segments A, D, E & F to the circuit. Turn on the switch (S1), the display flashes and the whistle chip (WC) buzzes on and off.

Project #412 Automatic Display Capital Letter “E”

OBJECTIVE: To construct a flashing display for the capital letter E.

Use the circuit from project #411. Connect A, D, E, F, & G to the circuit. Turn on the switch (S1), the display flashes and the whistle chip (WC) buzzes on and off.

Project #413 Automatic Display Capital Letter “F”

OBJECTIVE: To construct a flashing display for the capital letter F.

Use the circuit from project #411. Connect A, E, F, & G to the circuit. Turn on the switch (S1), the display flashes and the whistle chip (WC) buzzes on and off.

Project #414 Automatic Display Capital Letter “H”

OBJECTIVE: To construct a flashing display for the capital letter H.

Use the circuit from project #411. Connect B, C, E, F, & G to the circuit. Turn on the switch (S1), the display flashes and the whistle chip (WC) buzzes on and off.

Project #415 Automatic Display Capital Letter “P”

OBJECTIVE: To construct a flashing display for the capital letter P.

Use the circuit from project #411. Connect A, B, E, F, & G to the circuit. Turn on the switch (S1), the display flashes and the whistle chip (WC) buzzes on and off.

Project #416 Automatic Display Capital Letter “S”

OBJECTIVE: To construct a flashing display for the capital letter S.

Use the circuit from project #411. Connect A, F, G, C, & D to the circuit. Turn on the switch (S1), the display flashes and the whistle chip (WC) buzzes on and off.

Project #417 Automatic Display Capital Letter “U”

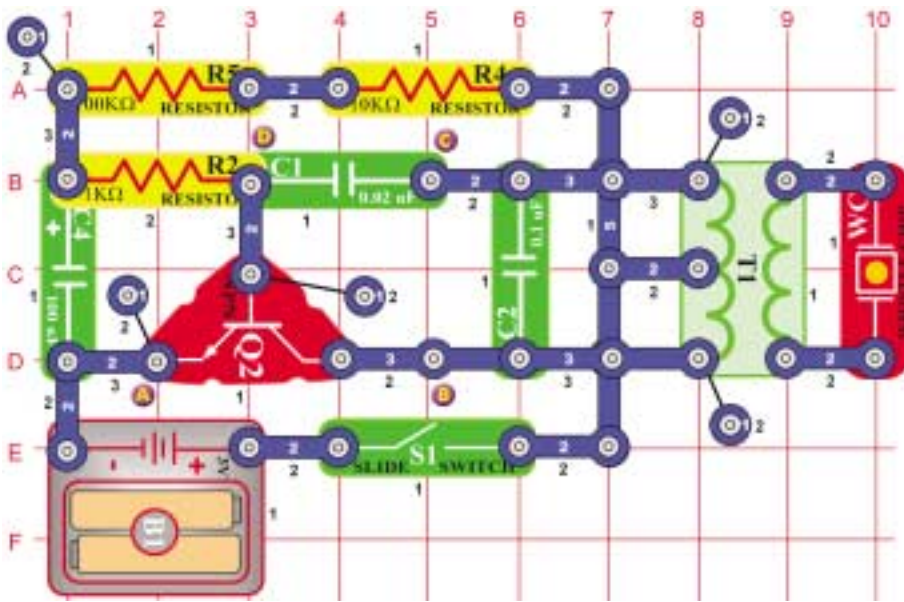
OBJECTIVE: To construct a flashing display for the capital letter U.

Use the circuit from project #411. Connect B, C, D, E, & F to the circuit. Turn on the switch (S1), the display flashes and the whistle chip (WC) buzzes on and off.

Project #418 Automatic Display Capital Letter “L”

OBJECTIVE: To construct a flashing display for the capital letter L.

Use the circuit from project #411. Connect D, E, & F to the circuit. Turn on the switch (S1), the display flashes and the whistle chip (WC) buzzes on and off.



Project #419 Whistle Chip Sounds

OBJECTIVE: *To make sounds from the whistle chip.*

Turn on the switch (S1). As the circuit oscillates, the plate in the whistle chip vibrates and generates sound.

Project #420 Whistle Chip Sounds (II)

OBJECTIVE: *Show variations of project #419.*

Connect the whistle chip (WC) across points B & C.

Project #421 Whistle Chip Sounds (III)

OBJECTIVE: *Show variations of project #419.*

Use the circuit in project #419. Connect the whistle chip (WC) across points C & D. You should hear a faster sound.

Project #422 Whistle Chip Sounds (IV)

OBJECTIVE: *Show variations of project #419.*

Use the circuit in project #419, but replace the 100μF capacitor (C4) with

Project #423 Whistle Chip Sounds (V)

OBJECTIVE: *Show variations of project #419.*

Use the circuit in project #419, but replace the 100μF capacitor (C4) with

Project #424 Whistle Chip Sounds (VI)

OBJECTIVE: *Show variations of project #419.*

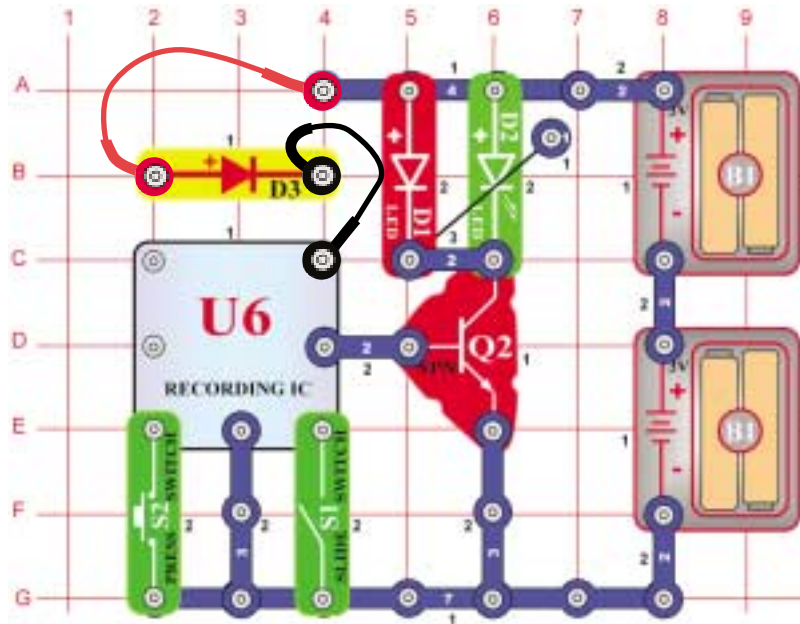
Use the circuit in project #419, but replace the 100μF capacitor (C4) with the 10μF capacitor (C3) and connect the whistle chip across points B & C. You can also connect the whistle chip across points C & D.



Project #425

LED Music

OBJECTIVE: To light the LEDs using the recording IC.



The recording IC (U6) lights the LEDs (D1 & D2) instead of driving the speaker (SP). Press the switch (S2) once. The LEDs light and then turn off after a while. Press the switch (S2) again and see how long the second song plays. When the second song stops, press the switch (S2) again to play the third song.



Project #426 Light-controlled LED Time Delay

OBJECTIVE: Show variations of project #425.

Use the circuit in project #425. Replace the press switch (S2) with the photo resistor (RP). Turn the LEDs on and off by waving your hand over the photo resistor.



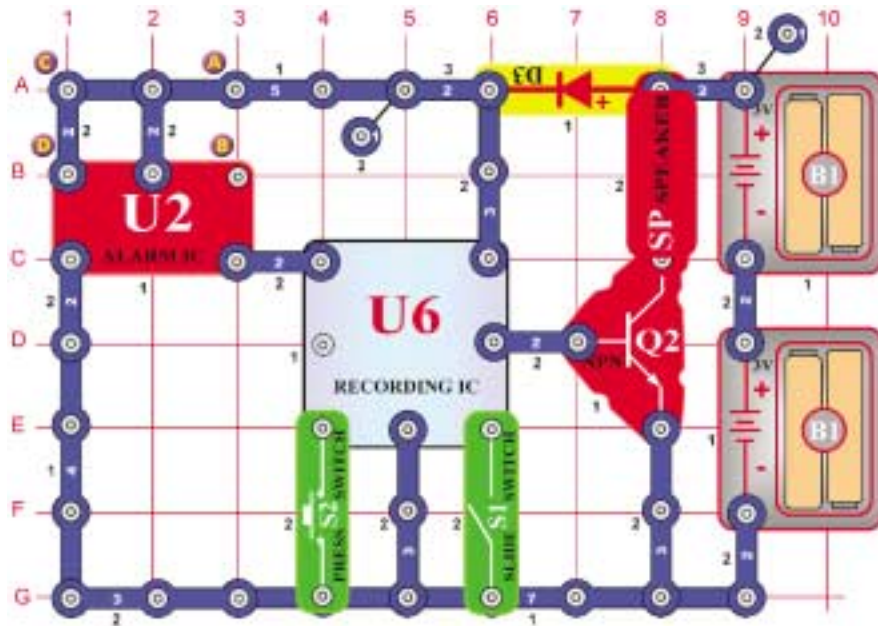
Project #427 Touch-controlled LED Time Delay

OBJECTIVE: Show variations of project #425.

Use the circuit in project #425. Replace the press switch (S2) with the PNP transistor (Q1). Turn the LEDs on and off by touching the base and collector at the same time. You may need to wet your fingers.



Project #428



Alarm Recorder

OBJECTIVE: To record the sound from the alarm IC.

The circuit records the sound from the alarm IC (U2) into the recording IC (U6). Turn on the switch (S1). The first beep indicates that the IC has begun recording. When you hear two beeps, the recording has stopped. Turn off the switch (S1) and press the switch (S2). You will hear the recording of the alarm IC before each song is played.



Project #429 Alarm Recorder (II)

OBJECTIVE: Record the sound from the alarm IC.

Use the circuit in project #428. Remove the 2-snap from A1 to B1. Turn on the switch (S1). The first beep indicates that the IC (U6) has begun recording. When you hear two beeps, turn off the switch (S1), press the switch (S2), and the new recording plays.



Project #430 Machine Gun Recorder

OBJECTIVE: To record the sound of a machine gun.

Use the circuit in project #428. Move the 2-snap from A1 - B1 to 3A - 3B. Turn on the switch (S1). The first beep indicates that the IC (U6) has begun recording. When you hear two beeps, turn off the switch (S1), press the switch (S2), and the machine gun sound plays.



Project #431

Time Delay

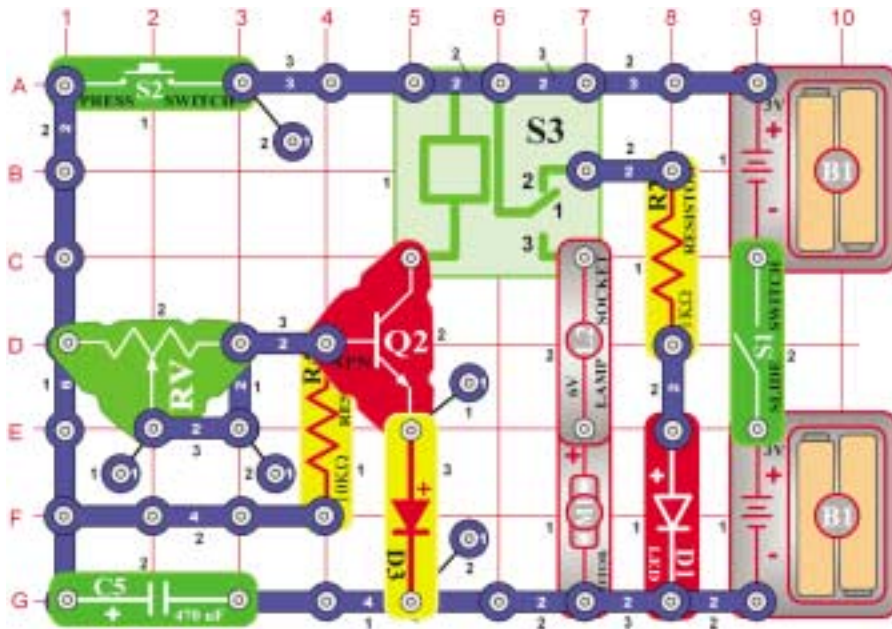
1-7 Seconds

OBJECTIVE: *To build a time delay circuit.*

The length of time the motor (M1) runs depends on the position of the variable resistor (RV). When the press switch (S2) is pressed, the 470 μ F capacitor (C5) charges. As the press switch is released, C5 discharges through the resistors R4 and RV, turning the transistor (Q2) on. Transistor Q2 connects the relay (S3) to the batteries, the contacts switch, and the motor (M1) spins. As the voltage decreases, Q2 will turn off and the motor will stop spinning.

Setting RV to the right (large resistance) sets a long discharge time. To the left, a short discharge time.

Turn on the switch (S1), the red LED (D1) lights. Now press and release the switch (S2), the bulb lights and the motor spins.



Project #432

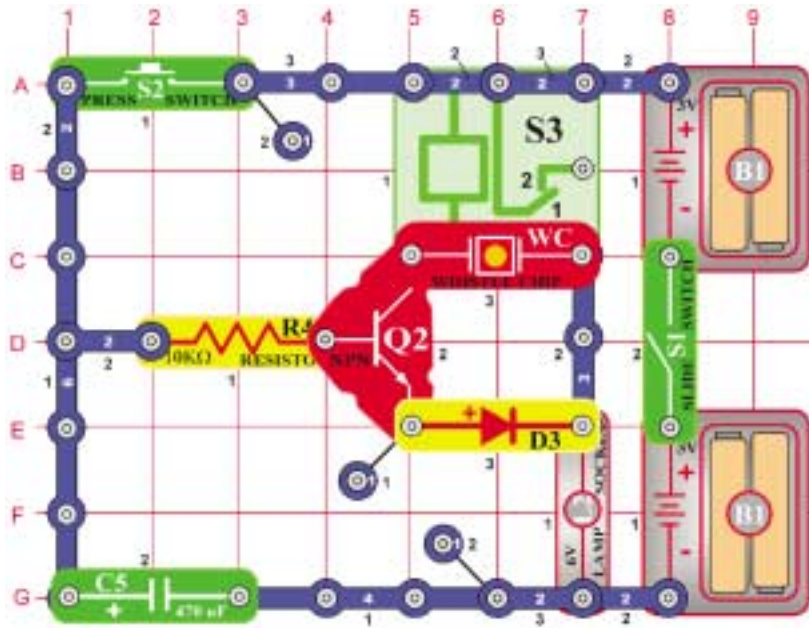
Time Delay

OBJECTIVE: *To see how the capacitor value affects the time.*

Use the circuit in project #431. Replace the 470 μ F capacitor (C5) with the 100 μ F capacitor (C4). Set the variable resistor (RV) to the far right, turn on the switch (S1), then press and release the switch (S2). The motor (M1) spins and bulb (L2) lights for about 3 seconds. Adjust the variable resistor to the left for a much shorter time.



Project #433



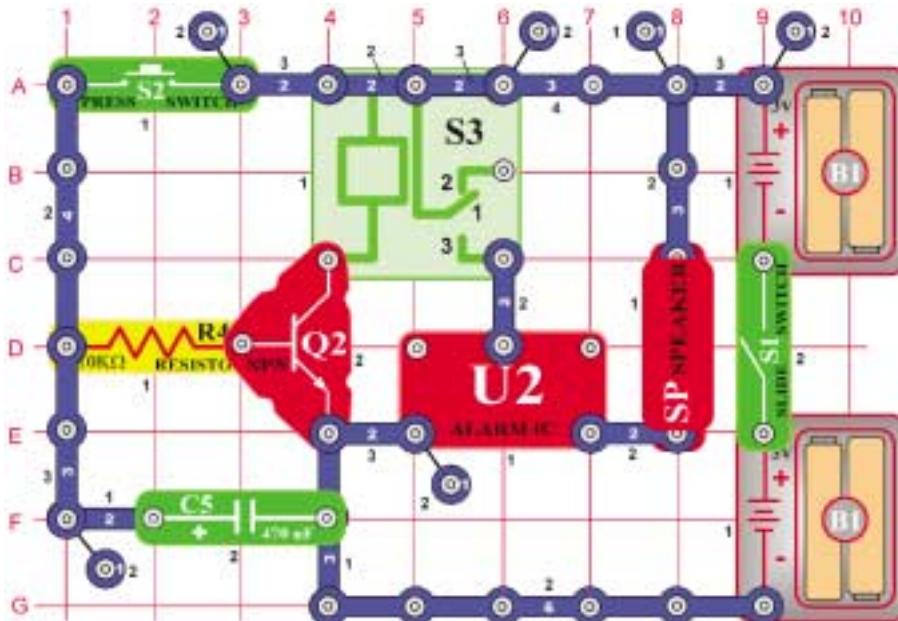
Manual 7 Second Timer (II)

OBJECTIVE: To build a manual timer using a relay and whistle chip.

This circuit is similar to project #431 except now the whistle chip (WC) will also make sound.



Project #434



15 Second Alarm

OBJECTIVE: To build a circuit that sounds the speaker for 15 seconds.

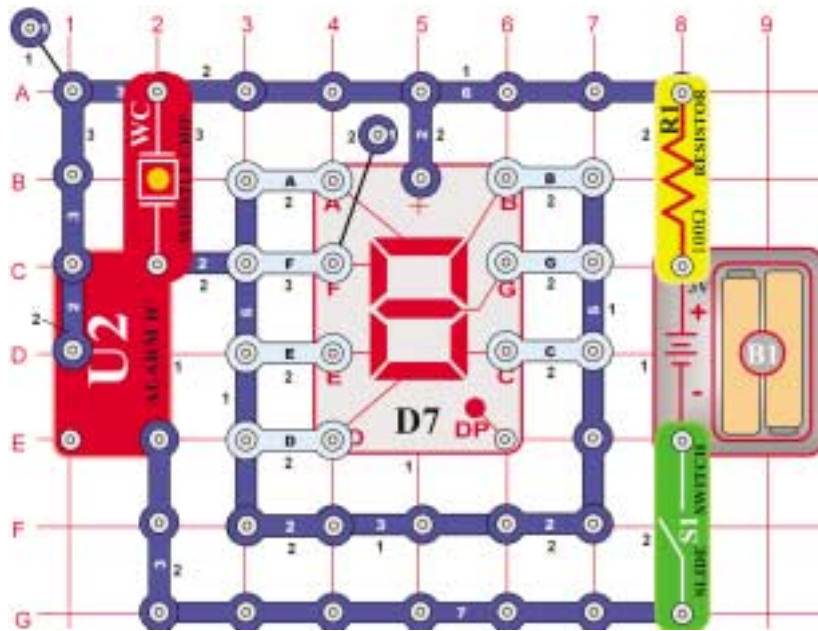
As in project #431, the transistor (Q2) acts as a switch, connecting the relay (S3) and the alarm IC (U2) to the batteries. As long as there is a voltage on the transistor's base, the alarm IC sounds.

Turn on the switch (S1) and then press the switch (S2). The transistor turns on, the capacitor (C5) charges up, and the alarm sounds. Release the press switch (S2). As the capacitor discharges, it keeps the transistor on. The transistor will turn off when the capacitor is almost discharged, about 10 seconds. The relay contacts will switch and the alarm will turn off.



Project #440

Flashing "C & E"



OBJECTIVE: Use the Alarm IC as a switch to flash the letters "C & E".

Connect A, D, E, & F to the circuit. Turn on the switch (S1) and the capital letter "C" should be flashing. Now, connect A, D, E, F, & G to flash the capital letter "E".



Project #441 Flashing "F & H"

OBJECTIVE: Use the Alarm IC as a switch to flash the letters "F & H".

Use the circuit in project #440. Connect A, E, F, & G to the circuit. Turn on the switch (S1) and the capital letter "F" should be flashing. Now, connect B, C, E, F & G to flash the capital letter "H".



Project #442 Flashing "P & S"

OBJECTIVE: Use the Alarm IC as a switch to flash the letters "P & S".

Use the circuit in project #440. Connect A, B, E, F, & G to the circuit. Turn on the switch (S1) and the capital letter "P" should be flashing. Now, connect A, C, D, F, & G to flash the capital letter "S".



Project #443 Flashing "U & L"

OBJECTIVE: Use the Alarm IC as a switch to flash the letters "U & L".

Use the circuit in project #440. Connect B, C, D, E & F to the circuit. Turn on the switch (S1) and the capital letter "U" should be flashing. Now, connect D, E, & F to flash the capital letter "L".



Project #444 Flashing "b & c"

OBJECTIVE: Use the Alarm IC as a switch to flash the letters "b & c".

Use the circuit in project #440. Connect C, D, E, F & G to the circuit. Turn on the switch (S1) and the letter "b" should be flashing. Now, connect A, F & G to flash the letter "c".



Project #445 Flashing "d & e"

OBJECTIVE: Use the Alarm IC as a switch to flash the letters "d & e".

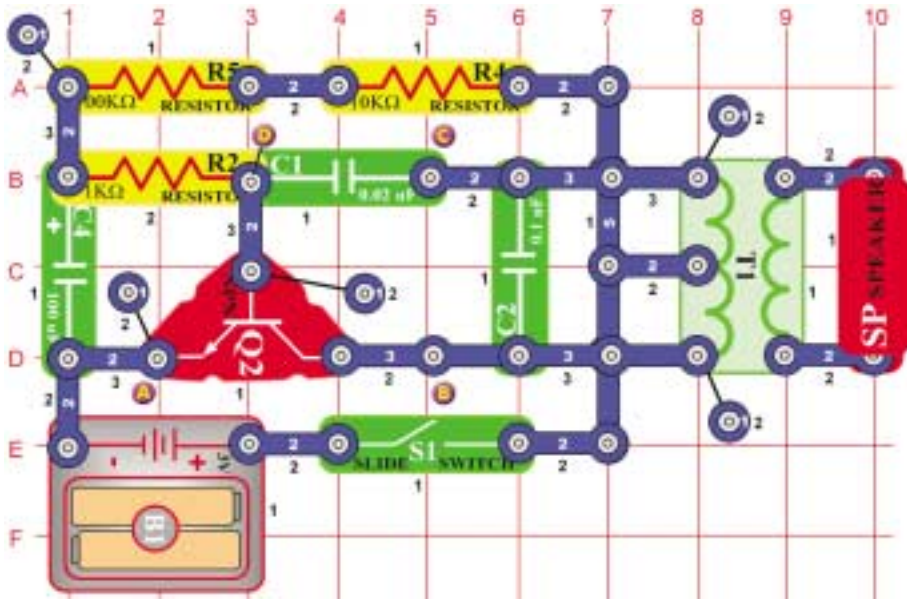
Use the circuit in project #440. Connect B, C, D, E, & G to the circuit. Turn on the switch (S1) and the letter "d" should be flashing. Now, connect A, B, D, E, F & G to flash the letter "e".



Project #446 Flashing "h & o"

OBJECTIVE: Use the Alarm IC as a switch to flash the letters "h & o".

Use the circuit in project #440. Connect C, E, F, & G to the circuit. Turn on the switch (S1) and the letter "h" should be flashing. Now, connect C, D, E, & G to flash the letter "o".



Project #447 Bird Sounds

OBJECTIVE: To create bird sounds.

Turn on the switch (S1). The circuit makes a bird sound.

Project #448 Bird Sounds (II)

OBJECTIVE: To create bird sounds.

Use the circuit in project #447. Replace the 100 μ F (C4) capacitor with the 10 μ F capacitor (C3), the tone should be much higher. Now use the 470 μ F capacitor (C5) and hear how low the tone gets.

Project #449 Bird Sounds (III)

OBJECTIVE: To create bird sounds.

Use the circuit in project #447. Connect the whistle chip (WC) across points A & B and the sound changes.

Project #450 Bird Sounds (IV)

OBJECTIVE: To create bird sounds.

Use the circuit in project #447. Connect the whistle chip (WC) across points B & C.

Project #451 Bird Sounds (V)

OBJECTIVE: To create bird sounds.

Connect the whistle chip (WC) across points C & D.

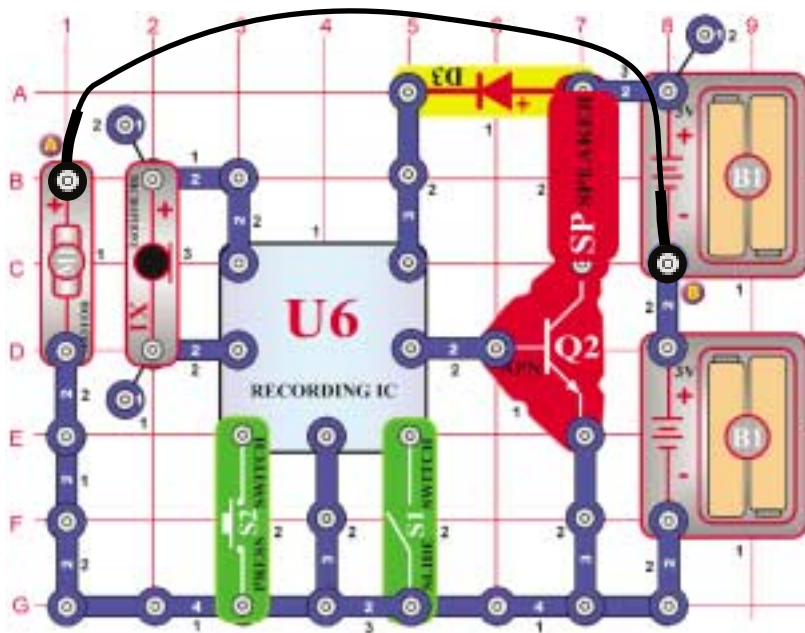
Project #452 Touch-Control Bird Sound

OBJECTIVE: Show variations of project #447.

Use the circuit in project #447. Replace the 100k Ω resistor (R5) with the photo resistor (RP). Wave your hand over the resistor and the sound changes. With the photo resistor installed, redo projects #448 - 452.



Project #453



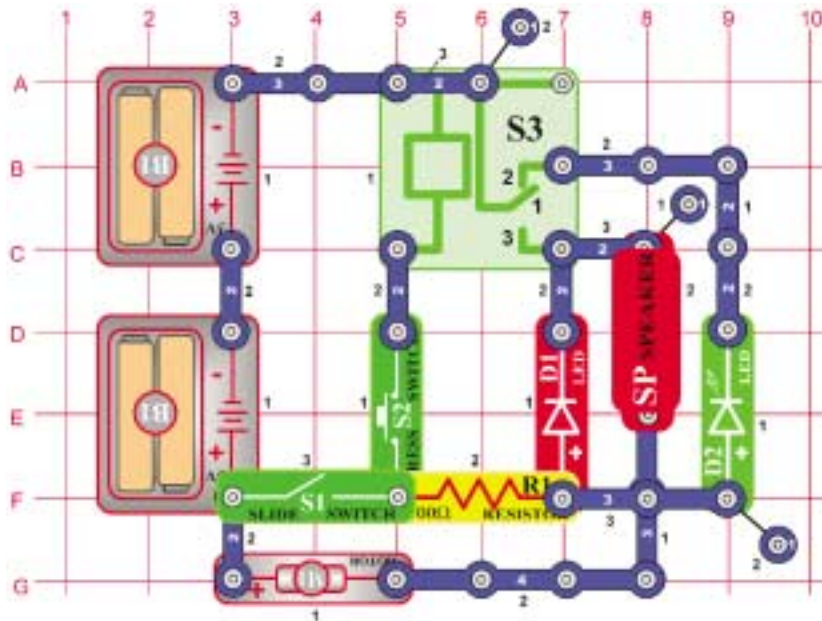
Motor Sound Recording

OBJECTIVE: Build a circuit that records the sound of the motor spinning.

Placing the motor (M1) (with the fan attached) next to the microphone (X1) enables you to record the sound as it spins. Turn off and then turn on the switch (S1). After the two beeps, turn off the switch (S1) again. Remove the jumper wire and press the press switch (S2) to hear the recording.



Project #454



Motor Sound Indicator

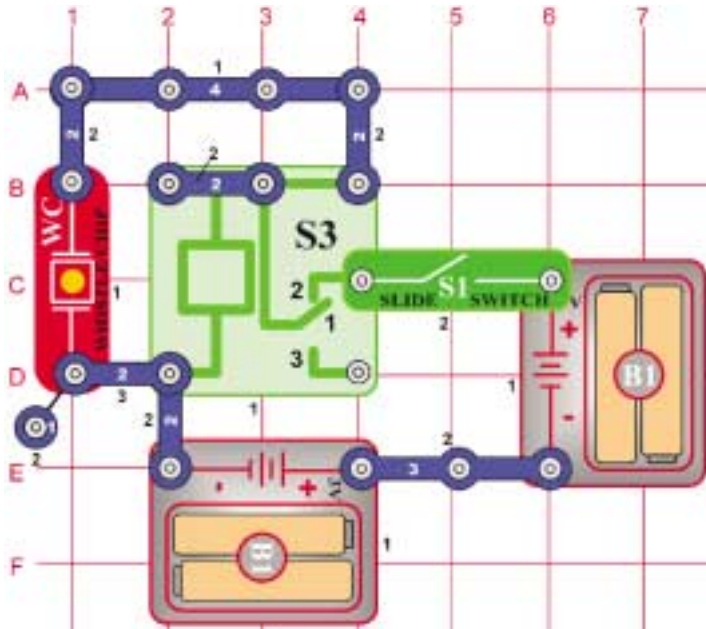
OBJECTIVE: To build a circuit that generates sound as a motor is spinning.

When the motor (M1) is spinning, the circuit will light an LED and you will hear the sound of the motor from the speaker (SP).

Turn off the switch (S1). There is no power; the LEDs and motor are off. Now turn on the switch (S1). Only the green LED (D2) lights, indicating power to the circuit. Press the switch (S2). The motor spins, the red LED (D1) lights, and you hear the motor sound from the speaker (SP).



Project #455



Relay & Buzzer

Turn on the switch (S1) and the relay (S3) opens and closes continuously. This creates an AC voltage across the whistle chip (WC), causing it to vibrate and sound.



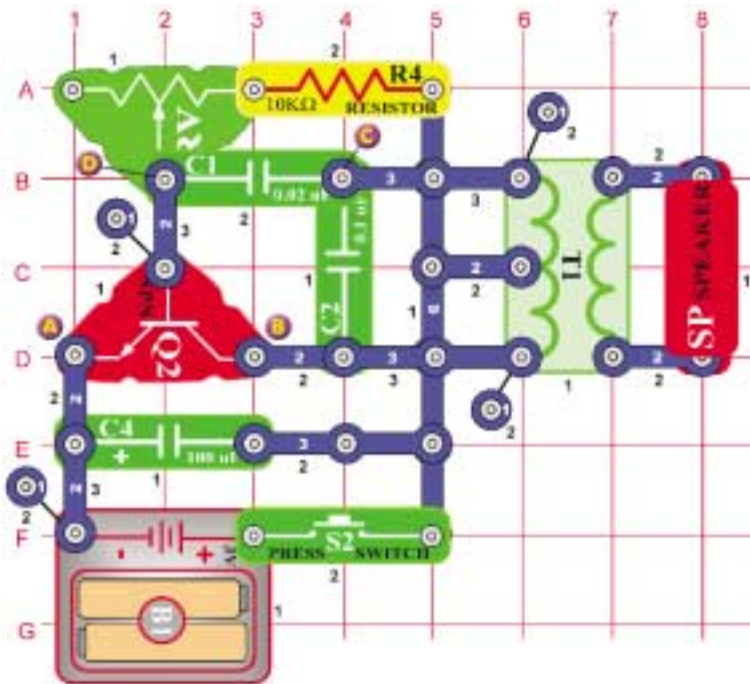
Project #456 Relay and Speaker

Use the circuit from project #455. Replace the whistle chip (WC) with the speaker (SP). Turn on the switch (S1) and now you generate a louder sound using the speaker.



Project #457 Relay & Lamp

Use the circuit from project #455. Replace the whistle chip (WC) with the 6V lamp (L2). Turn on the switch (S1) and the lamp lights.



Project #458 Electronic Cat

OBJECTIVE: *To create the sound of a cat.*

Set the variable resistor (RV) to the far left. Press and release the switch (S2). You should hear the sound of a cat from the speaker (SP). Now adjust the resistor and hear the different sounds.

Project #459 Electronic Cat (II)

OBJECTIVE: *Show variations of project #458.*

Use the circuit in project #458. Connect the whistle chip (WC) across points A & B. Press and release the the switch (S2). You hear sound from the whistle chip and speaker (SP). Adjust the resistor (RV) and hear the different sounds.

Project #460 Electronic Cat (III)

OBJECTIVE: *Show variations of project #458.*

Use the circuit in project #458. Connect the whistle chip (WC) across points B & C. Press and release the switch (S2). Adjust the resistor (RV) and hear the different sounds.

Project #461 Electronic Cat (IV)

OBJECTIVE: *Show variations of project #458.*

Use the circuit in project #458. Connect the whistle chip (WC) across points C & D. Press and release the switch (S2). Adjust the resistor (RV) and hear the different sounds.

Project #462 Buzzer Cat

OBJECTIVE: *Show variations of project #458.*

Use the circuit in project #458. Remove the speaker (SP) and connect the whistle chip (WC) across points A & B. Press and release the switch (S2) to hear the sounds.

Project #463 Buzzer Cat (II)

OBJECTIVE: *Show variations of project #458.*

Use the circuit in project #458. Remove the speaker (SP) and connect the whistle chip (WC) across points B & C. Press and release the switch (S2). Adjust the resistor (RV) and hear the different sounds.

Project #464 Buzzer Cat (III)

OBJECTIVE: *Show variations of project #458.*

Use the circuit in project #458. Remove the speaker (SP) and connect the whistle chip (WC) across points C & D. Press and release the switch (S2). Adjust the resistor (RV) and hear the different sounds.

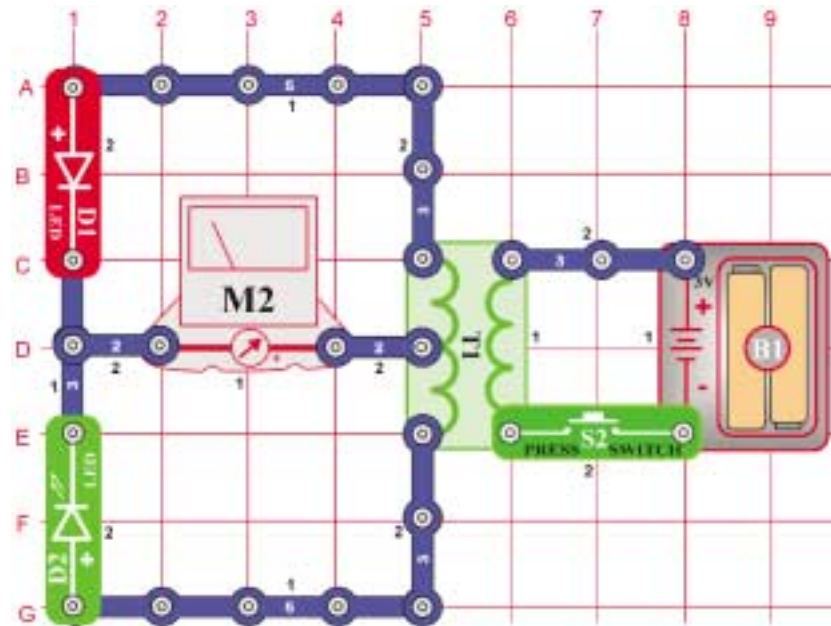
Project #465 Lazy Cat

OBJECTIVE: *Show variations of project #458.*

Use the circuit in project #458. Replace the 100µF capacitor (C4) with 470µF (C5). Repeat projects #459-465 and hear 6 different sounds.



Project #466



Meter Deflection (II)

OBJECTIVE: To build change the direction in which current flows.

Set the meter (M2) to the 10MA scale. Compare this circuit to project #358, which has the LED positions reversed. This changes the direction that current can flow. Press the press switch (S2) and now the meter deflects to the left.



Project #467 Automatic Display #1

OBJECTIVE: Construct a light-controlled display.

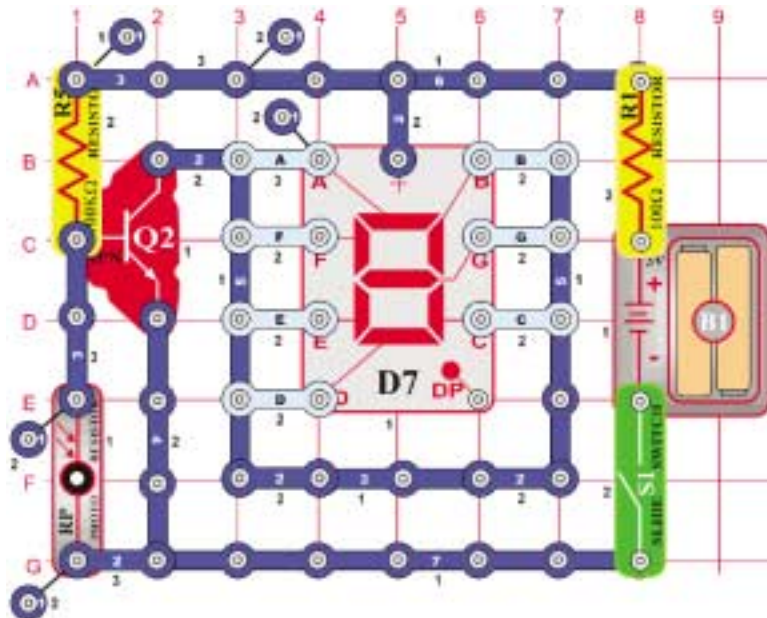
Connect segments B & C to the circuit. Turn on the switch (S1), the display should be off. Place your hand over the photo resistor (RP), now the number 1 lights.



Project #468 Automatic Display #2

OBJECTIVE: Light the number 2 using a light-controlled display.

Use the circuit from project #467. Connect A, B, G, E, & D to the circuit. Turn on the switch (S1), the display should be off. Place your hand over the photo resistor (RP), now the number 2 lights.



Project #469
Automatic Display #3

OBJECTIVE: Light the number 3 using a light-controlled display.

Use the circuit from project #467. Connect A, B, G, C, & D to the circuit. Turn on the switch (S1), the display should be off. Place your hand over the photo resistor (RP), now the number 3 lights.

Project #470
Automatic Display #4

OBJECTIVE: Light the number 4 using a light-controlled display.

Use the circuit from project #467. Connect B, G, C, & F to the circuit. Turn on the switch (S1), the display should be off. Place your hand over the photo resistor (RP), now the number 4 lights.

Project #471
Automatic Display #5

OBJECTIVE: Light the number 5 using a light-controlled display.

Use the circuit from project #467. Connect A, C, F, G, & D to the circuit. Turn on the switch (S1), the display should be off. Place your hand over the photo resistor (RP), now the number 5 lights.

Project #472
Automatic Display #6

OBJECTIVE: Light the number 6 using a light-controlled display.

Use the circuit from project #467. Connect A, C, D, E, F, & G to the circuit. Turn on the switch (S1), the display should be off. Place your hand over the photo resistor (RP), now the number 6 lights.

Project #473
Automatic Display #7

OBJECTIVE: Light the number 7 using a light-controlled display.

Use the circuit from project #467. Connect A, B, & C to the circuit. Turn on the switch (S1), the display should be off. Place your hand over the photo resistor (RP), now the number 7 lights.

Project #474
Automatic Display #8

OBJECTIVE: Light the number 8 using a light-controlled display.

Use the circuit from project #467. Connect A, B, C, D, E, F & G to the circuit. Turn on the switch (S1), the display should be off. Place your hand over the photo resistor (RP), now the number 8 lights.

Project #475
Automatic Display #9

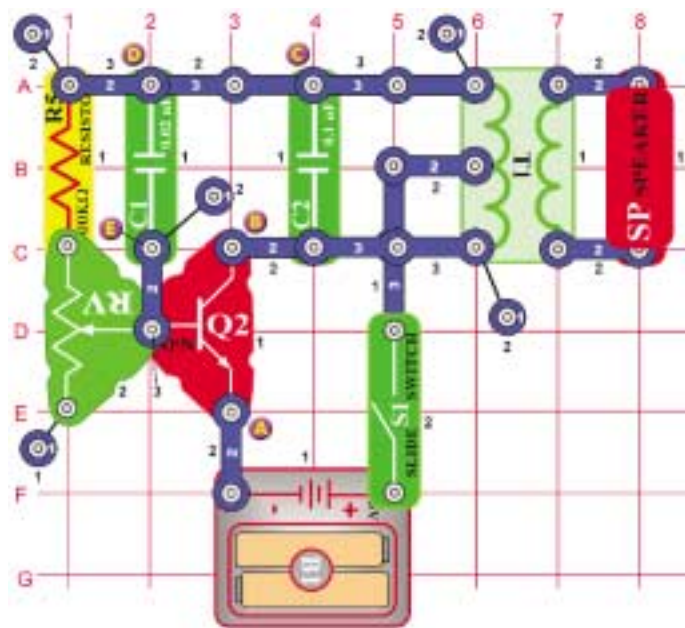
OBJECTIVE: Light the number 9 using a light-controlled display.

Use the circuit from project #467. Connect A, B, F, G, & C to the circuit. Turn on the switch (S1), the display should be off. Place your hand over the photo resistor (RP), now the number 9 lights.

Project #476
Automatic Display #0

OBJECTIVE: Light the number 0 using a light-controlled display.

Use the circuit from project #467. Connect A, B, C, D, E & F to the circuit. Turn on the switch (S1), the display should be off. Place your hand over the photo resistor (RP), now the number 4 lights.



Project #477 Variable Oscillator

OBJECTIVE: To change the tone using the variable resistor.

Set the variable resistor (RV) to the bottom position. Turn on the switch (S1) and you should hear sound from the speaker (SP). Adjust the resistor to hear the different sounds.

Project #478 Variable Oscillator (II)

OBJECTIVE: To change the tone using the variable resistor.

Use the circuit in project #477. Connect the whistle chip (WC) across points A & B and adjust the resistor (RV). You should hear a higher tone. This is generated by the whistle chip (WC).

Project #479 Variable Oscillator (III)

OBJECTIVE: Show variations of project #477.

Use the circuit in project #477. Connect the whistle chip (WC) across points B & C and adjust the resistor (RV).

Project #480 Variable Oscillator (IV)

OBJECTIVE: Show variations of project #477.

Use the circuit in project #477. Connect the whistle chip (WC) across points D & E and adjust the resistor (RV).

Project #481 Photo Variable Resistor

OBJECTIVE: Show variations of project #477.

Use the circuit in project #477. Replace the 100kΩ resistor (R5) with the photo resistor (RP). Wave your hand over the resistor and the sound changes. Adjust the resistor (RV) to make more sounds.

Project #482 Photo Variable Whistle Chip Oscillator

OBJECTIVE: Show variations of project #477.

Use the circuit in project #477, remove the speaker (SP). Make three more sounds by placing the whistle chip (WC) across points, A & B, B & C, and D & E.

Project #483 Slow Adjusting Tone

OBJECTIVE: Show variations of project #477.

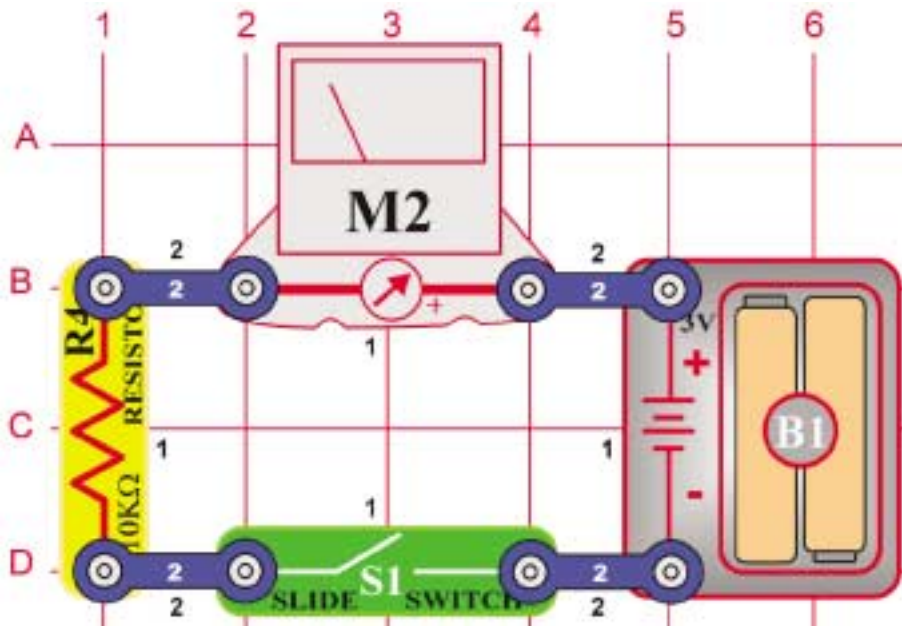
Use the circuit in project #477. Place the 10µF capacitor (C3) (+ towards the top) directly over the .02µF capacitor (C1). A tone is generated once or twice per second, depending on the resistor setting.

Project #484 Slow Adjusting Tone (II)

OBJECTIVE: Show a variation of project #483.

Use the circuit in project #483. Replace the 10µF capacitor (C3) with the 100µF capacitor (C4) and the tone is much slower. To make it even slower, replace the 100µF capacitor (C4) with the 470µF capacitor (C5).

Project #485

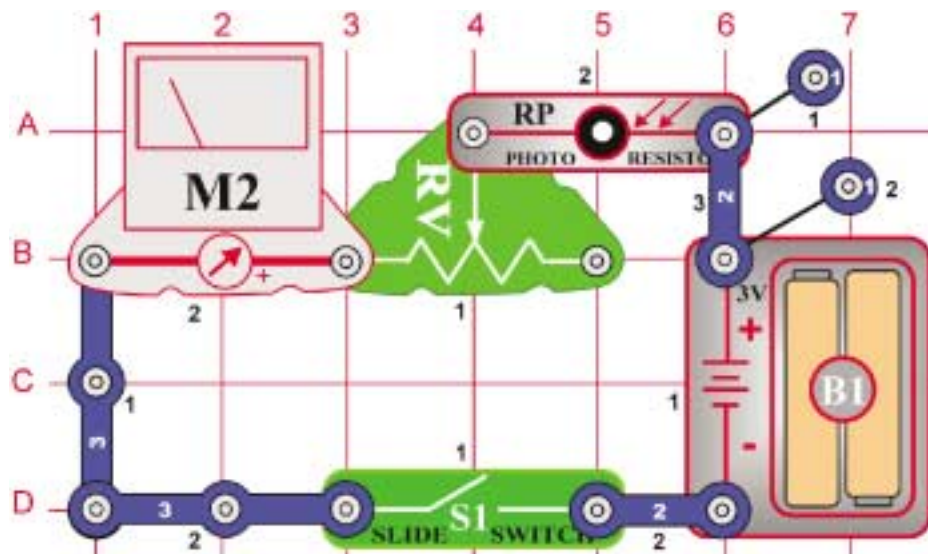


Fixed-Voltage Divider

OBJECTIVE: To make a fixed current path.

Set the meter (M2) to the 10MA scale. The meter indicates the amount of current in the circuit. Turn on the switch (S1), the needle deflects indicating the amount of current. The 10kΩ resistor limits the current, otherwise the meter could be damaged.

Project #486



Simple Illumination Meter

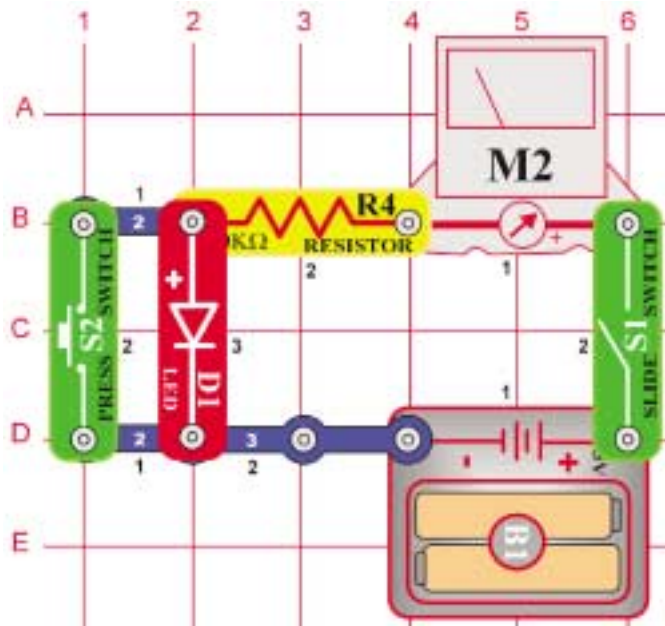
OBJECTIVE: To make a simple light meter.

Set the meter (M2) to the 10MA scale. Using only a few parts, you can make a simple light meter. The amount of light changes the resistance of the photo resistor (RP), which affects the current through the meter. As light increases, the resistance drops and the meter deflects to the right. Decreasing the light, the meter deflects to the left, indicating less current.

Set the variable resistor (RV) to the far left and turn on the switch (S1). The circuit is now very sensitive to light. Wave your hand over the photo resistor (RP) and the meter deflects to the left, almost to zero. Move the adjustable resistor to the far right and see how less sensitive the circuit is to light now.



Project #487



LED Voltage Drop

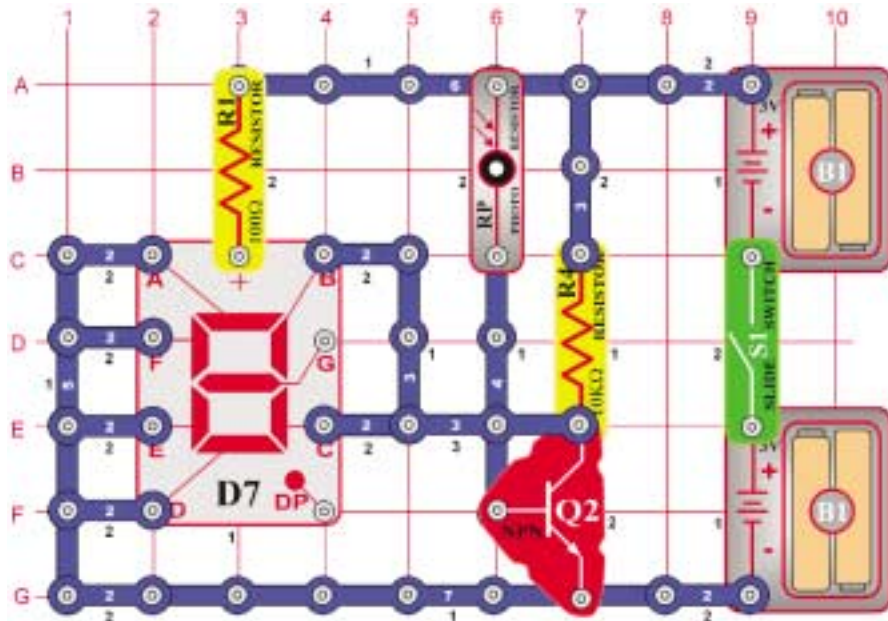
OBJECTIVE: To measure the voltage drop across diodes.

Set the meter (M2) to the 10MA scale. Turn on the switch (S1) and the LED (D1) lights as the meter deflects to the middle of the scale. The sum of the voltage drop across each components equals the battery voltage. Bypass the LED by pressing the switch (S2). The voltage across the 10kΩ resistor increases, as shown by the meter deflecting more to the right. Replace the red LED with the green LED (D2) and then the diode (D3), to see the different voltage drops.



Project #488

Open/Closed Door Indicator



OBJECTIVE: To make a circuit that indicates whether a door is open or closed.

Using the photo resistor (RP) you can build a circuit that indicates if a door is open or closed. When the door is open and light is present, the letter "O" lights. When the door is closed and the room is dark, the letter "C" lights.

The photo resistor turns the transistor (Q2) on or off, depending on the amount of light in the room. When the transistor is on (light present), segments B & C connect to the (-) side of the batteries and letter "O" lights. When the room is dark, the transistor is off and the letter "C" lights. Segments B & C are connected to the transistor.

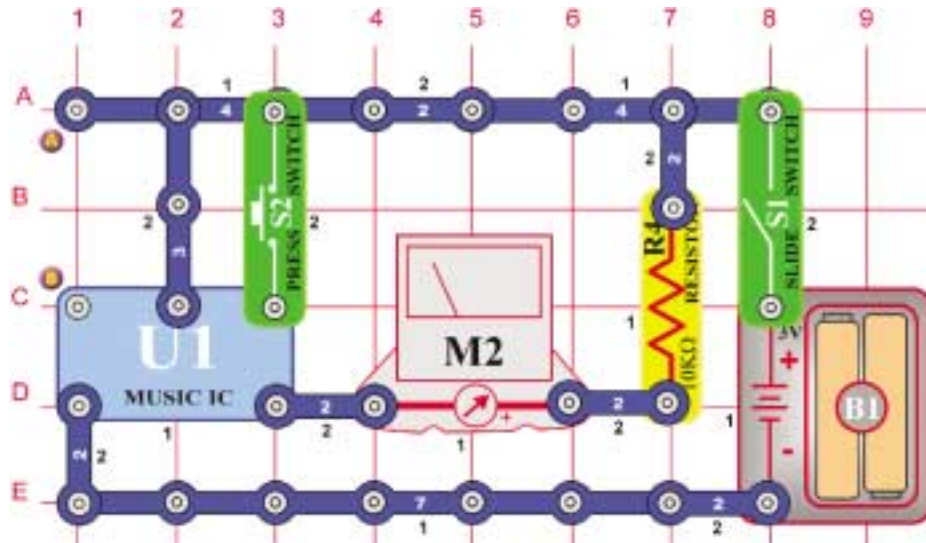
Turn the switch (S1) on and the letter "O" should light. Cover the photo resistor, simulating closing the door, and the letter "C" lights.



Project #489

Hand-control Meter

OBJECTIVE: To understand music deflection.



Set the meter (M2) to the 10MA scale. Instead of driving a speaker (SP) with the music IC (U1), you can see it by using the meter. Turn on the switch (S1) and the meter deflects according to the rhythm of music. After the music stops, hold down the press switch (S2) to make it continue.

Project #490

Light-control Meter

OBJECTIVE: To control the circuit using light.

Use the circuit in project #489. Replace the switch (S2) with the photo resistor (RP). The music IC (U1) outputs a signal, as long as a light is present on the photo resistor. The photo resistor is like a short, connecting the pin to the battery. Cover the photo resistor with your hand, the resistance goes up, and the music stops.

Project #491

Electric-control Meter

OBJECTIVE: To start the circuit using an electric motor.

Use the circuit in project #489. Place the motor (M1) across points A & B. Turn on the switch (S1) and the meter (M2) deflects and swings according to the rhythm of music. When deflection stops, rotate motor to start the music again. The voltage generated by the motor triggers the IC again.

Project #492

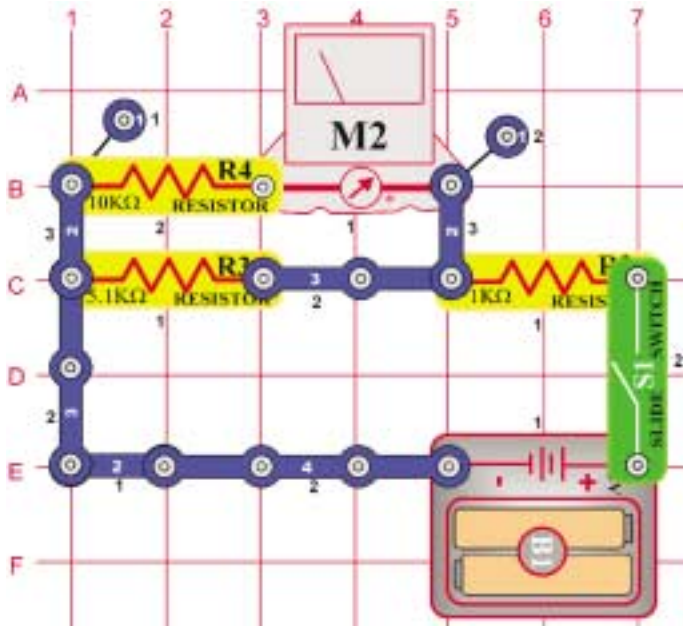
Sound-control Meter

OBJECTIVE: To start the circuit by using a speaker.

Use the circuit in project #489. Place the whistle chip (WC) across points A & B. Turn on the switch (S1) and the meter (M2) deflects and swings according to the rhythm of music. When deflection stops, clap your hands next to the speaker (SP), the music plays again. The clapping sound vibrates the plates in the whistle chip, creating the voltage needed to trigger the IC.



Project #493



Fixed-Voltage Divider

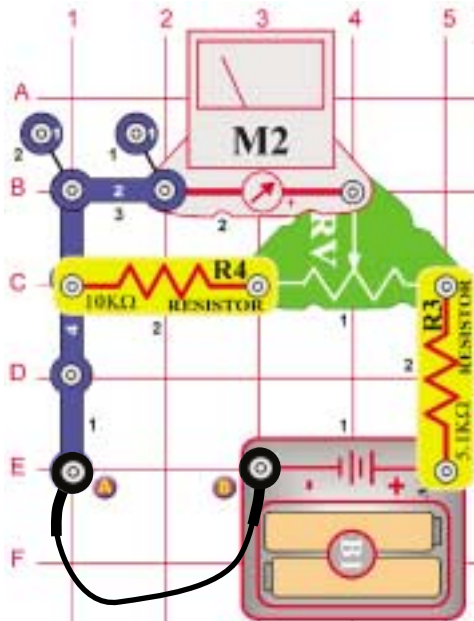
OBJECTIVE: To make a simple voltage divider.

Set the meter (M2) to the 10mA scale. This circuit is a simple voltage divider with parallel load resistors. The voltages across both resistors are the same. The current through both paths are different, due to the resistor values. Since resistor (R3) (5.1kΩ) is half the value of resistor (R4) (10kΩ), twice the current flows through R3.

The lights in a house are an example of this type of circuit. All are connected to the same voltage, but the current is dependent on the wattage of the bulb.



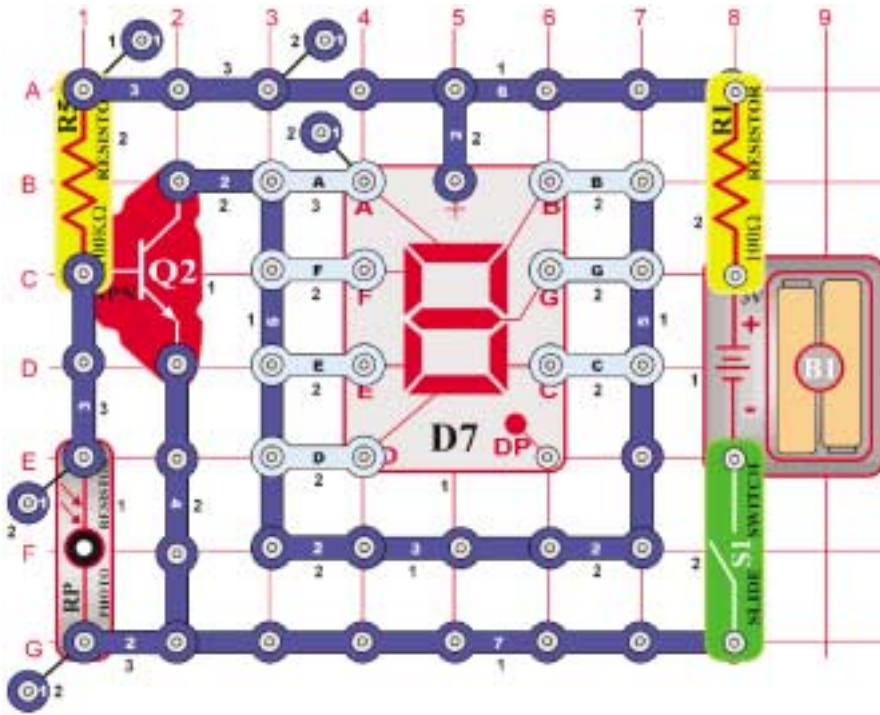
Project #494



Resistor Measurement

OBJECTIVE: To make a resistor checker.

Set the meter (M2) to the 10mA scale. Connect the jumper wire to points A & B. Adjust the variable resistor (RV) so the meter deflects to 10. The resistance between points A & B is zero. Remove the jumper wire and put the 100Ω resistor (R1) across points A & B. The meter deflects to the 10, indicating a low resistance. Now replace resistor (R1) with the other resistors. The meter will display different readings for each resistor.



Project #495 Automatic Display Letter “b”

OBJECTIVE: To construct a light-controlled display for lower case letters.

Connect C, D, E, F & G to the circuit. Turn on the switch (S1) and the display should be off. Place your hand over the photo resistor (RP), now the letter “b” lights.

Project #496 Automatic Display Letter “c”

OBJECTIVE: To light the letter “c” using a light-controlled display.

Use the circuit from project #495. Connect E, D, & G to the circuit. Turn on the switch (S1) and the display should be off. Place your hand over the photo resistor (RP), now the letter “c” lights.

Project #497 Automatic Display Letter “d”

OBJECTIVE: To light the letter “d” using a light-controlled display.

Use the circuit from project #495. Connect B, C, D, E, & G to the circuit. Turn on the switch (S1) and the display should be off. Place your hand over the photo resistor (RP), now the letter “d” lights.

Project #498 Automatic Display Letter “e”

OBJECTIVE: To light the letter “e” using a light-controlled display.

Use the circuit from project #495. Connect A, B, D, E, F, & G to the circuit. Turn on the switch (S1) and the display should be off. Place your hand over the photo resistor (RP), now the letter “e” lights.

Project #499 Automatic Display Letter “h”

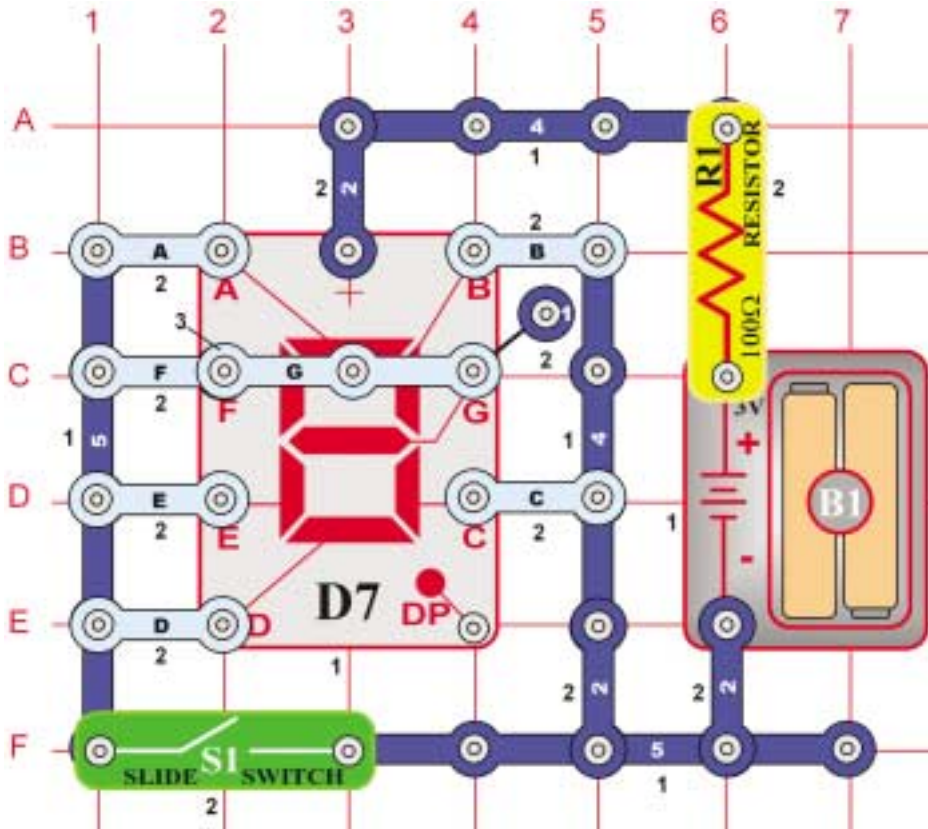
OBJECTIVE: To light the letter “h” using a light-controlled display.

Use the circuit from project #495. Connect F, E, C, & G to the circuit. Turn on the switch (S1) the display should be off. Place your hand over the photo resistor (RP), now the letter “h” lights.

Project #500 Automatic Display Letter “o”

OBJECTIVE: To light the letter “o” using a light controlled display.

Use the circuit from project #495. Connect C, D, E, and G to the circuit. Turn on the switch (S1) the display should be off. Place your hand over the photo resistor (RP), now the letter “o” lights.



Project #501 Hand-Control Display 1 & 4

OBJECTIVE: Display numbers 1 or 4 using the slide switch.

Using the diagram shown, connect 2-snap wires to segments B, C, F, & G. Turn the switch (S1) off and on, the display changes from numbers 1 to 4.

Project #502 Hand-Control Display 1 & 0

OBJECTIVE: Display numbers 1 or 0 using the slide switch.

Using the diagram shown, connect 2-snap wires to segments A, B, C, D, E, & F. Turn the switch (S1) off and on, the display changes from numbers 1 to 0.

Project #503 Hand-Control Display 1 & 7

OBJECTIVE: Display numbers 1 or 7 using the slide switch.

Using the diagram shown, connect 2-snap wires to segments A, B, & C. Turn the switch (S1) off and on, the display changes from numbers 1 to 7.

Project #504 Hand-Control Display 1 & 8

OBJECTIVE: Display numbers 1 or 8 using the slide switch.

Using the diagram shown, connect 2-snap wires to segments A, B, C, D, E, F, & G. Turn the switch (S1) off and on, the display changes from numbers 1 to 8.

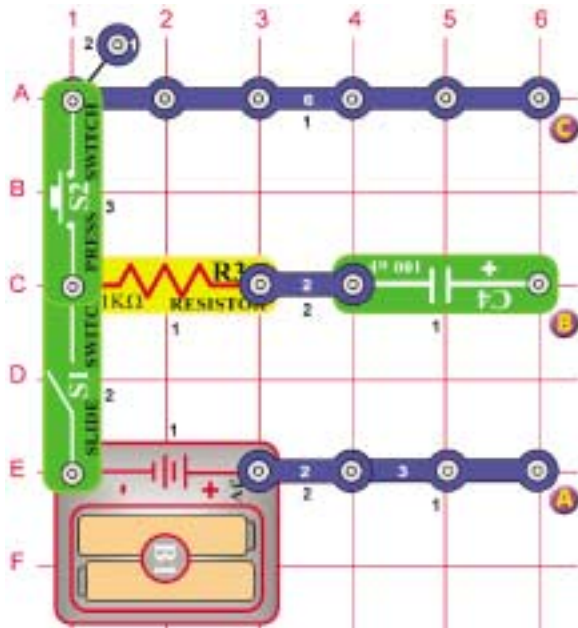
Project #505 Hand-Control Display 1 & 9

OBJECTIVE: Display numbers 1 or 9 using the slide switch.

Using the diagram shown, connect 2-snap wires to segments A, B, C, F, & G. Turn the switch (S1) off and on, the display changes from numbers 1 to 9.



Project #506



Monitor a Capacitor Charging & Discharging

OBJECTIVE: View charging and discharging a capacitor.

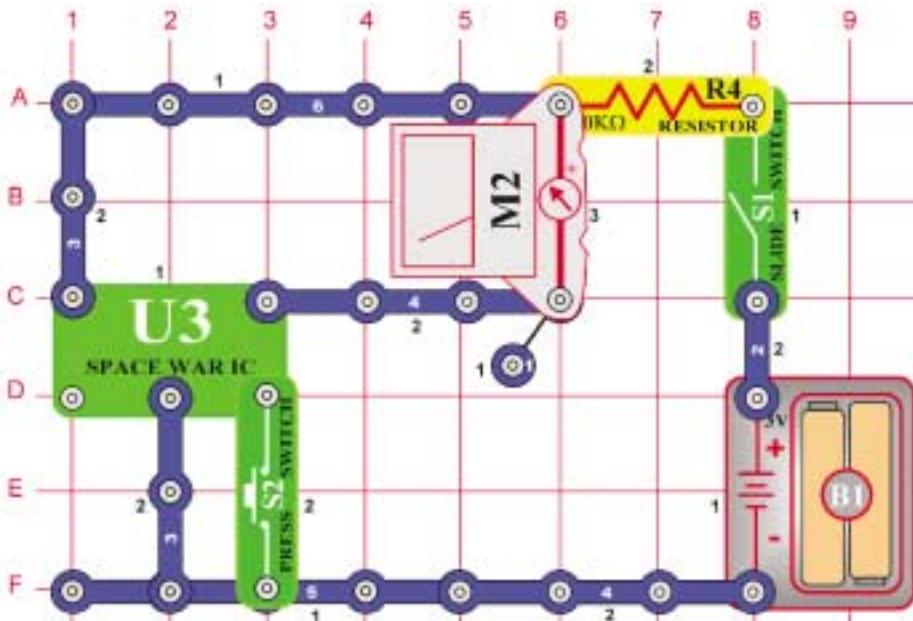
Using the meter (M2), we can monitor the charging and discharging of a capacitor. First turn off the switch (S1).

Charging: Connect the meter (M2) to points A & B (positive pole downward). Turn on the switch (S1). The 100µF capacitor (C4) charges and the meter deflects, slowly returning to zero.

Discharging: Connect the meter to points B & C (positive pole downward). Press the switch (S2). The capacitor discharges and the meter deflects, slowly returning to zero.



Project #507



Hand-Control Space Meter

OBJECTIVE: Using the meter with the space war IC.

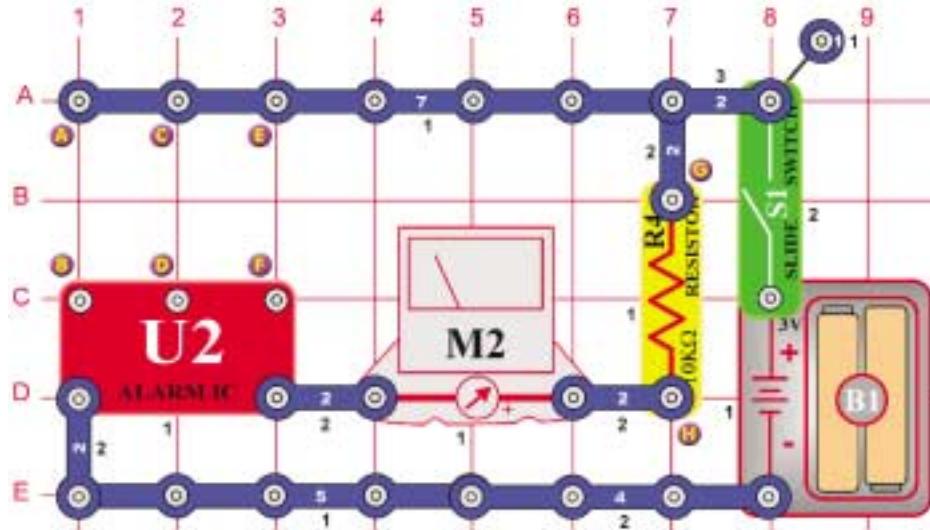
Set the meter (M2) to the 10MA scale. This is another circuit using the meter to monitor the output of an IC.

Turn on the switch (S1). Press switch (S2) to start the circuit. As the space war IC (U3) outputs a signal, the meter will deflect. When the circuit stops, start it again by pressing switch (S2).



Project #508

Rhythm Swinging Meter



OBJECTIVE: Use the meter with the alarm IC.

Set the meter (M2) to the 10MA scale. Connect 3-snap wires to terminals E & F, and C & D. Turn on the switch (S1) and the meter swings rhythmically.



Project #509 Police Car Sound with Whistle Chip

OBJECTIVE:
Show variations of project #508.

Use the circuit in project #508. Connect the whistle chip (WC) to points G & H. Connect a 3-wire snap to the terminals C & D and turn on the switch (S1).



Project #510 Fire Engine Sound with Whistle Chip

OBJECTIVE:
Show variations of project #508.

Connect 3-wire snaps to terminals C & D and A & B. Connect the whistle chip (WC) across points G & H. You should hear a fire engine sound generated by the alarm IC (U2).



Project #511 Ambulance Sound with Whistle Chip

OBJECTIVE:
Show variations of project #508.

Connect a jumper wire to terminals B & H. Connect a 3-wire snap to terminals C & D. Connect the whistle chip (WC) across points G & H. You should hear an ambulance sound generated by the alarm IC (U2).

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- Ringer with ON/OFF Switch
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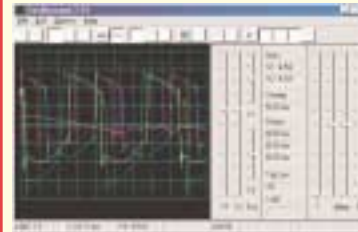
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