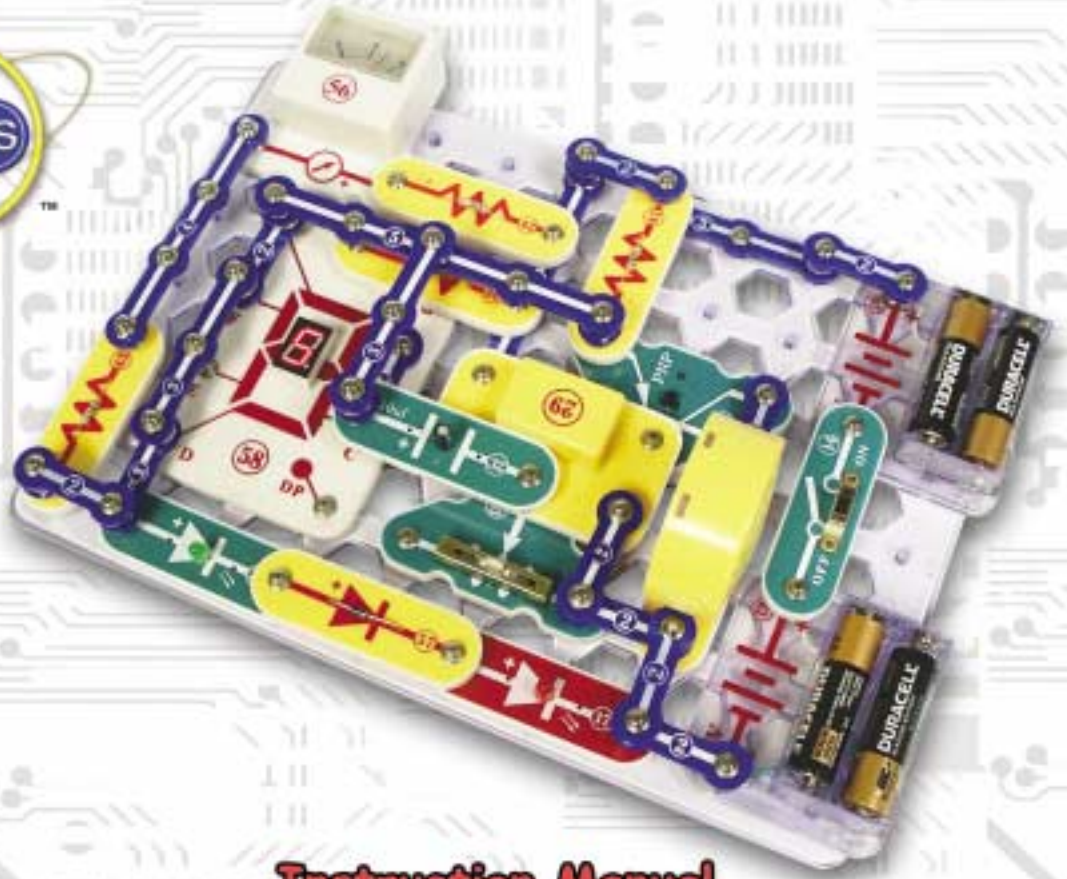
ELECTRONIC SNAP CIRCUITS™

Experiments 306-511



Instruction Manual

Elenco™ Electronics, Inc.

753104

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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.

B a s i c

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.**
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).

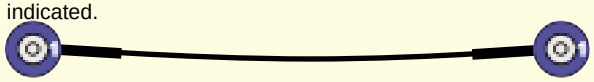
A large clear plastic base grid is included with this kit to help keep the circuit block together. You will see evenly spaced posts that the different blocks snap into. You do not need this base to build your circuits, but it does help in keeping your circuit together neatly. The base has rows labeled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

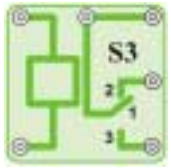
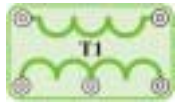


Note: While building the projects, be careful not to accidentally make a direct connection across the battery holder (a "short circuit"), as this will damage and/or quickly

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	(M2)	Analog Meter		6SCM2
☐ 1	(5)	5-Snap Wire		6SC05	☐ 1	(Q3)	SCR		6SCQ3
☐ 1	(D3)	Diode 1N4001		6SCD3	☐ 1	(S3)	Relay		6SCS3
☐ 1	(D7)	7-Segment LED Display		6SCD7	☐ 1	(T1)	Transformer		6SCT1
☐ 1	(FM)	FM Module		6SCFM	☐ 1	(U6)	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).

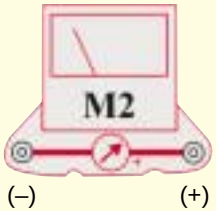
The **FM module (FM)** contains an integrated FM radio circuit. Refer to the figure below for the pinout description:

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.

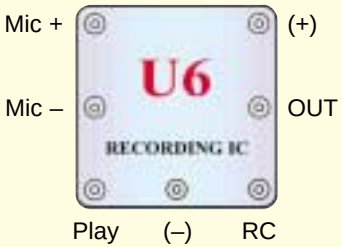
The **meter (M2)** The meter is a very important indicating and measuring device. You'll use it to measure the amount of current or voltage depending on the circuit configuration. Notice the meter has + sign, indicating the positive terminal (+ power from the batteries). The other snap is the negative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

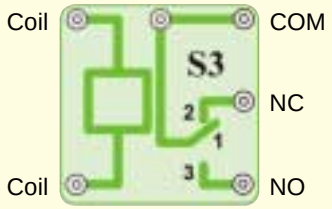


Recording IC Module:

(+) - 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).

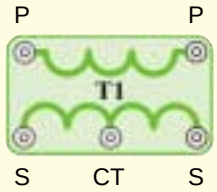


Relay:

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 coils 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:

P - primary (input)
P - primary (input)
S - secondary (output)
S - secondary (output)
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:

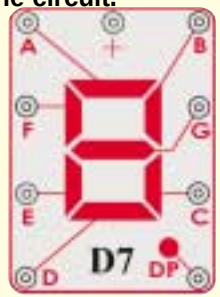
Anode - (+)
Cathode - (–)

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

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.

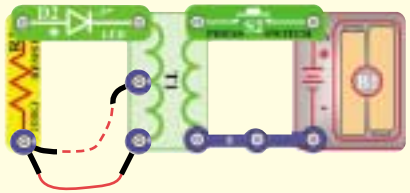
21. **FM Module (FM):** Build project #307, you should hear FM radio stations.

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

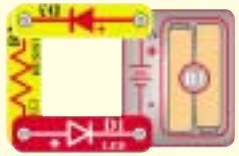
23. **Recording IC (U6):** Build project 308. Make an 8 second recording, then listen to the three prerecorded songs.

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

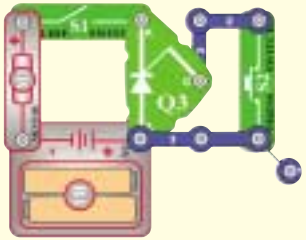
25. **Transformer (T1):** Build the mini-circuit shown here. Pressing the switch (S2) flashes the LED. Connect the jumper wire to the CT point. Pressing the switch (S2) flashes the LED.



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 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.

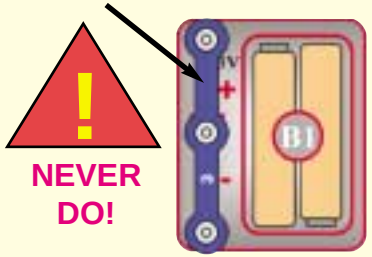
NEVER leave a circuit unattended when it is turned on.

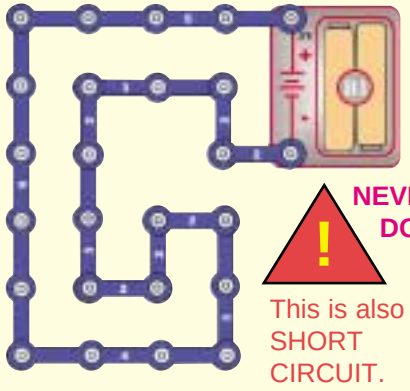
NEVER touch the motor when it is spinning at high speed.

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!!!

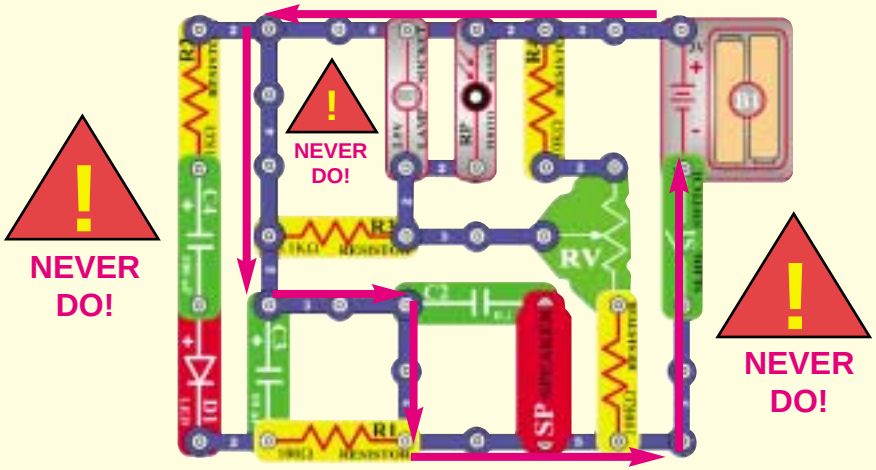
Placing a 3-snap wire directly across the batteries is a SHORT CIRCUIT.





This is also 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 #
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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	Oscillation Sounds	36
332	Display #3	17	366	Display Capital Letter “S”	27	400	Oscillation Sounds (II)	36
333	Display #4	17	367	Display Capital Letter “U”	27	401	Oscillation Sounds (III)	36
334	Display #5	18	368	Display Capital Letter “C”	27	402	Oscillation Sounds (IV)	36
335	Display #6	18	369	Display Capital Letter “E”	27	403	Touch-Control Oscillator	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 #
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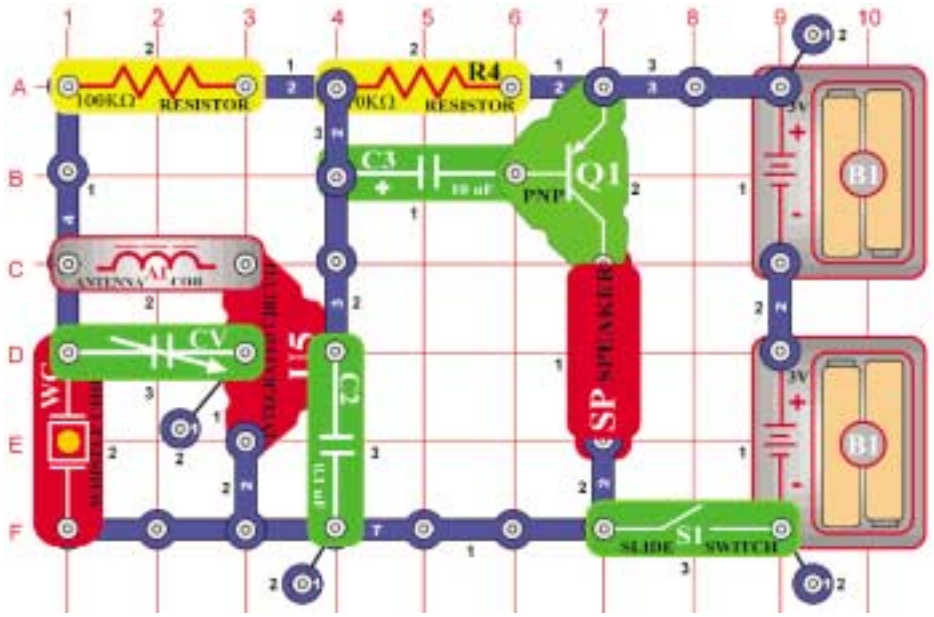
409	Transistor Tester	38	444	Flashing “b & c”	46	479	Variable Oscillator (III)	53
410	Adjustable Voltage Divider	38	445	Flashing “d & e”	46	480	Variable Oscillator (IV)	53
411	Automatic Display Capital Letter “C”	39	446	Flashing “h & o”	46	481	Photo Variable Oscillator	53
412	Automatic Display Capital 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, LED, & Bulb	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

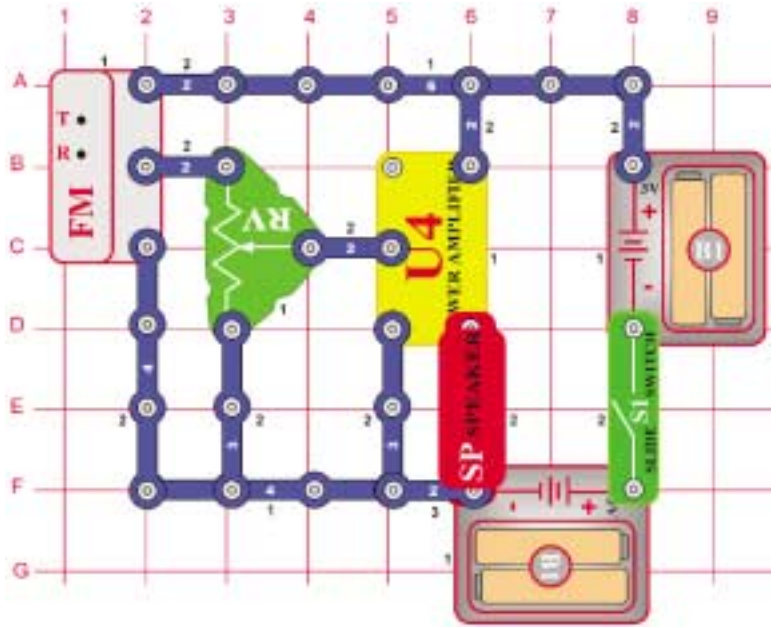


OBJECTIVE: To build a one IC AM radio.

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

Project #307

Adjustable Volume FM Radio



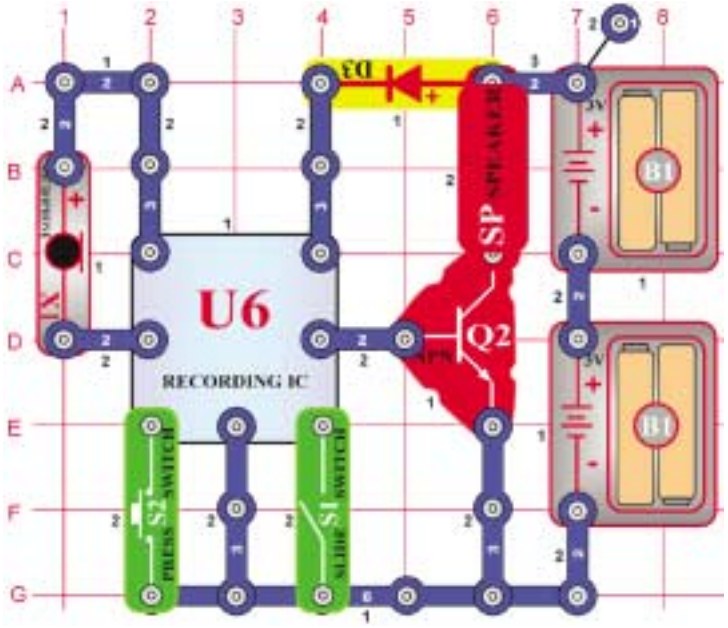
OBJECTIVE: To build a working FM radio with adjustable volume.

Turn on the switch (S1) and press the R and then the T button. When a station is heard, adjust the volume using the variable resistor (RV). The resistor controls the amount of signal into the power amp.

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 songs on the recording IC.

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 circuit that uses light to control the recording IC.

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.

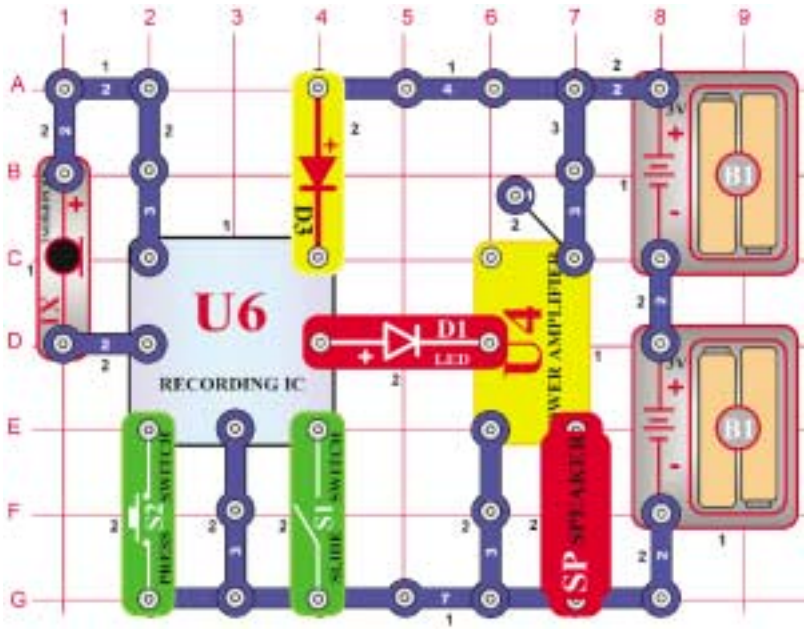
Project #311

Touch-Controlled Music

OBJECTIVE: To build circuit that lets you control the recording IC with your fingers.

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

OBJECTIVE: To build a circuit that amplifies the recording IC.

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 recording IC.

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 312.

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

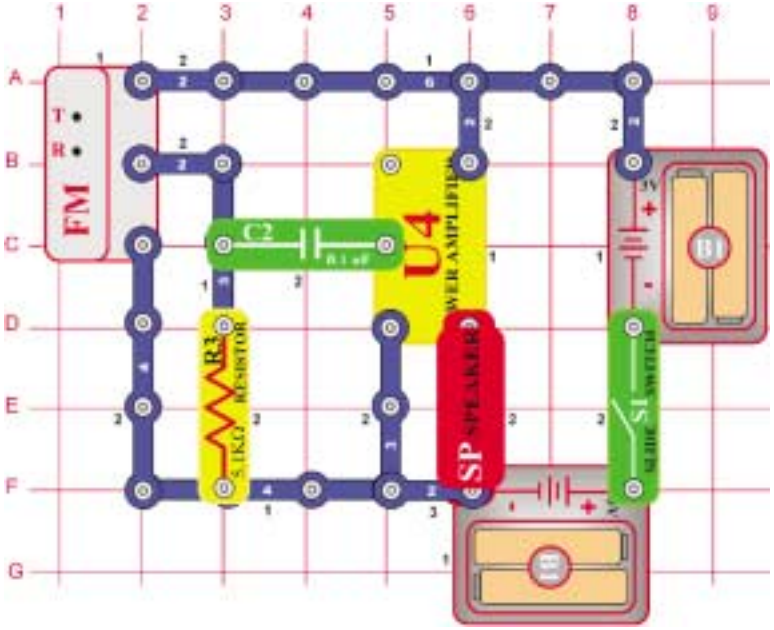
Power Touch-Controlled Music

OBJECTIVE: Show variations of project 312.

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



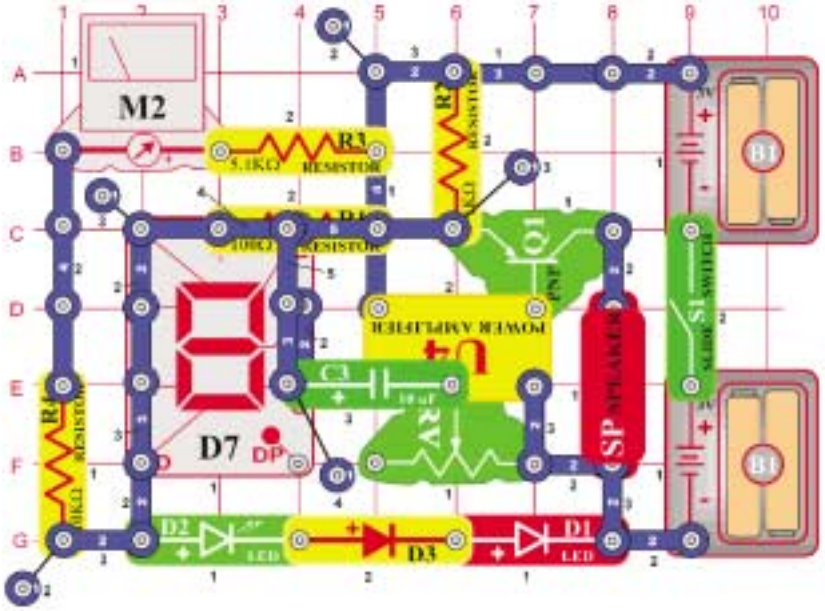
OBJECTIVE: To build a working FM radio.

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

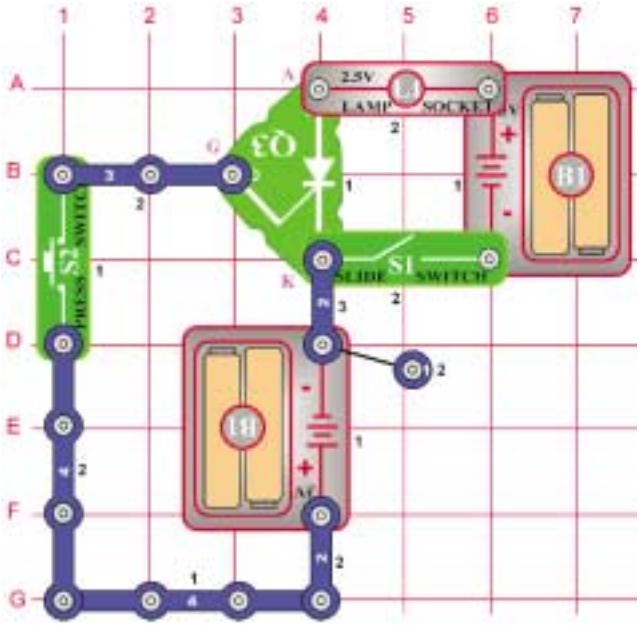


OBJECTIVE: To build a complex circuit.

This is an example of using many parts to create an unusual circuit. 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 (M2) 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



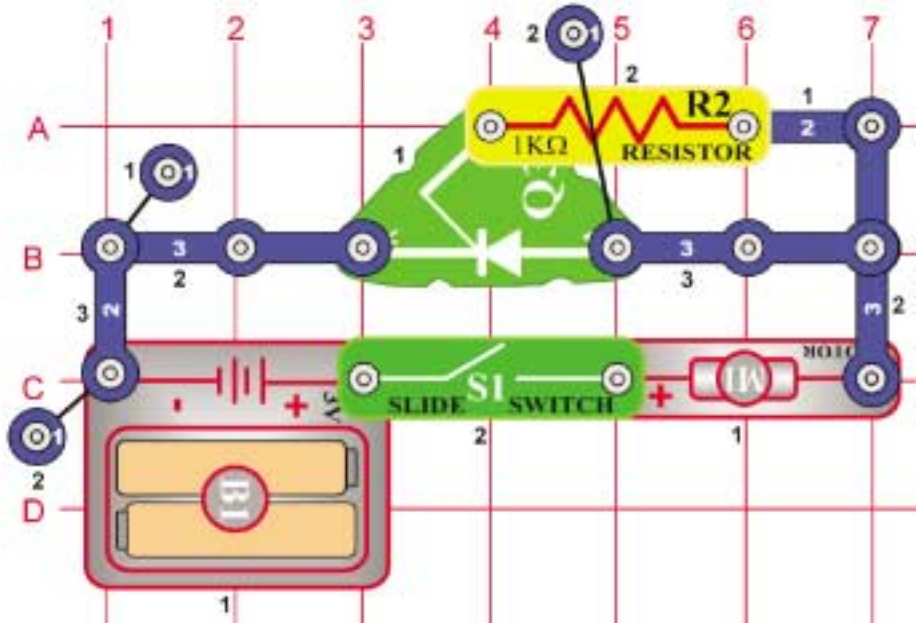
OBJECTIVE: To learn the principle of an SCR.

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

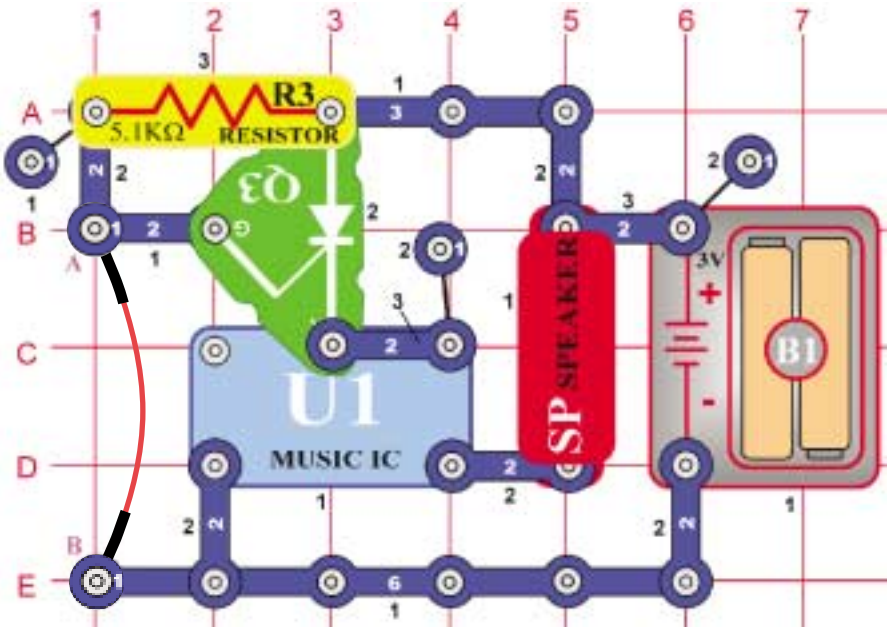


OBJECTIVE: To activate a motor using an SCR.

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

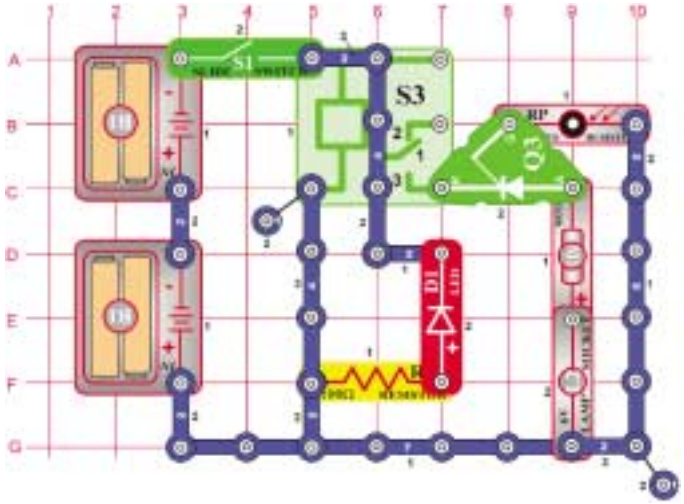
Light-Music Alarm

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



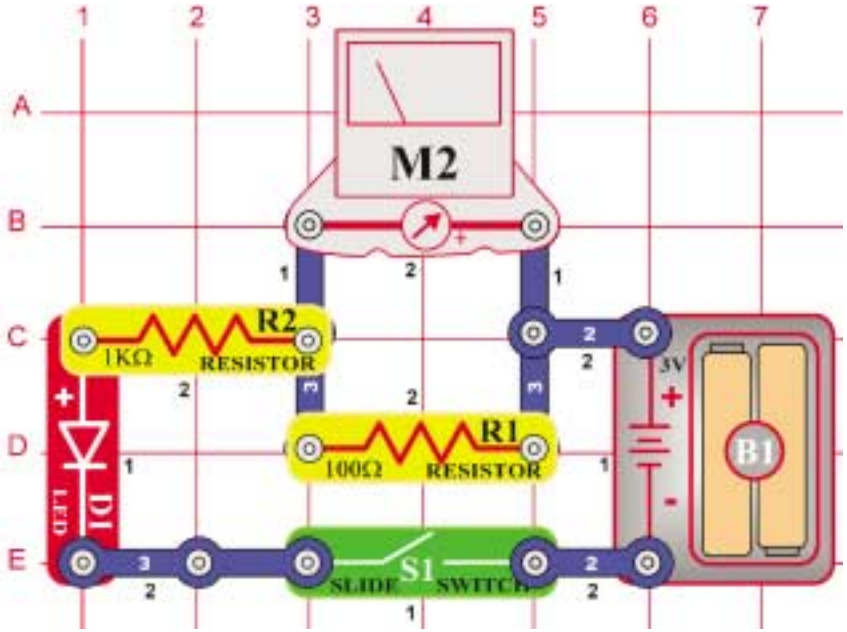
OBJECTIVE: To build a circuit that activates a bulb and motor with the amount of light present.

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



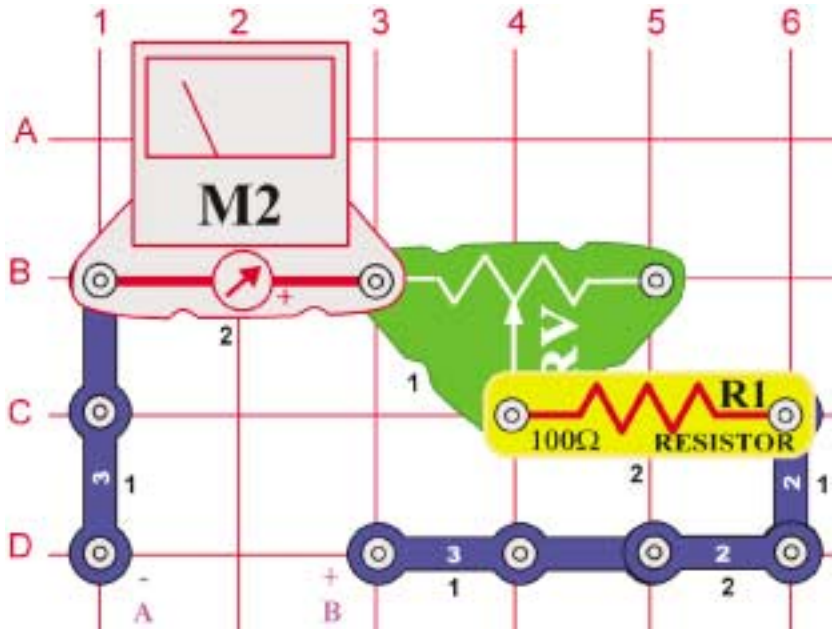
OBJECTIVE: To build a 1mA meter circuit.

Inside the meter (M2), 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 300μA or 0.3V. To increase its range, resistors are connected in parallel or in series to the meter.

Build the circuit shown. Placing the 100Ω 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

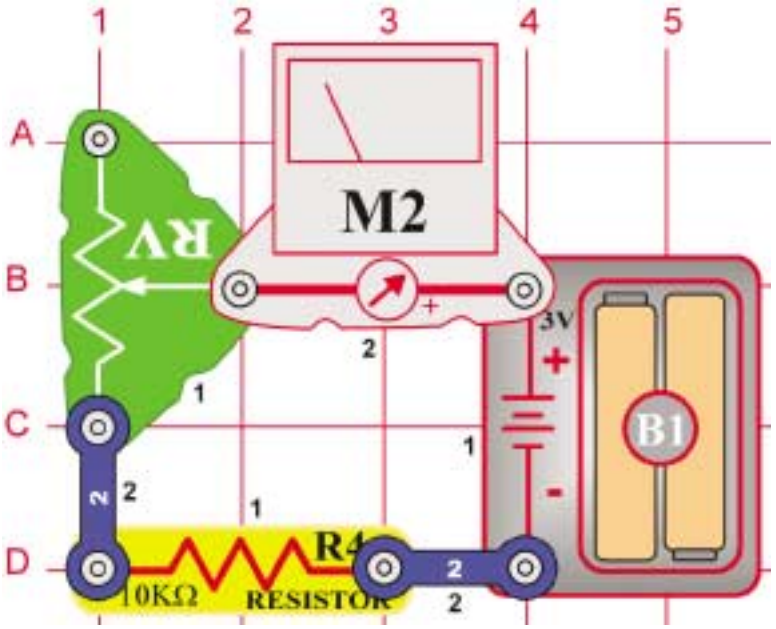


OBJECTIVE: To build a voltmeter.

Build this 0-3V voltmeter circuit. 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

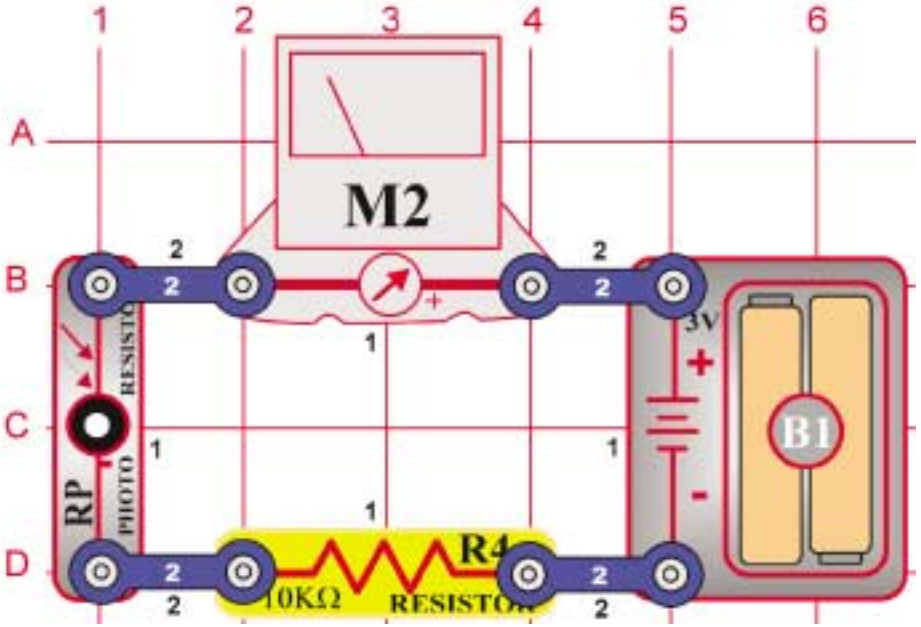
OBJECTIVE: To understand the function of the variable resistor.

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.

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, (50kΩ for your part).

Adjust the variable resistor (RV) for maximum resistance by setting the knob to the top. The meter (M2) only deflects ¼ of the way. As you move the knob down, decreasing the resistance, the meter deflects more.

Project #326



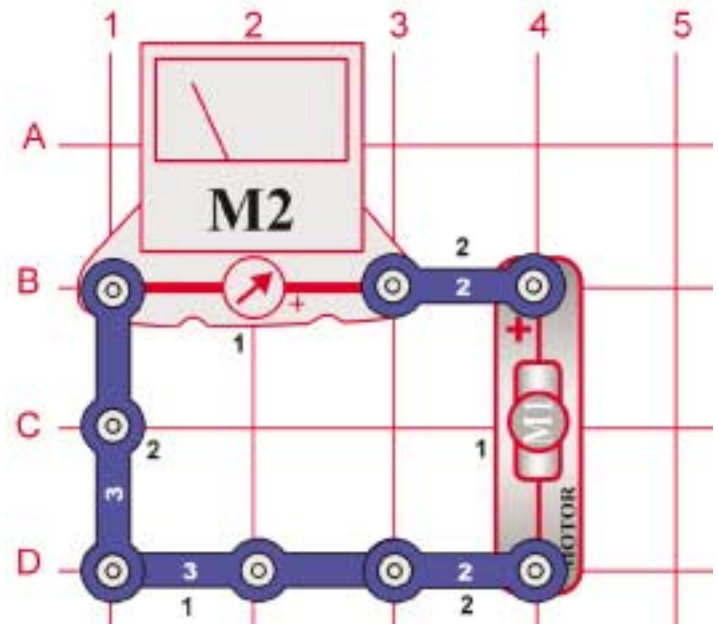
Function of Photo Resistor

OBJECTIVE: To understand the function of the photo resistor.

Build the circuit shown. 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 (M2) 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

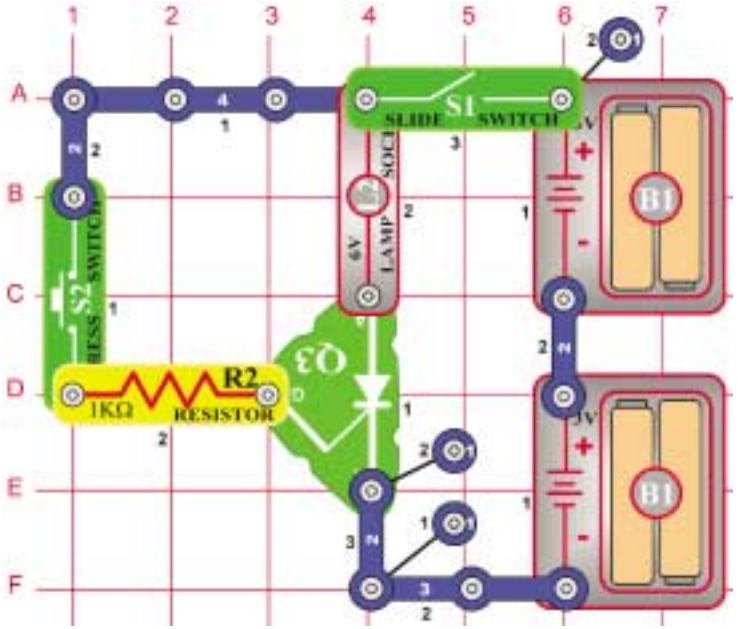


Meter Deflect by Motor

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

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 (M2) deflects to the right. Now spin the motor counterclockwise, and the meter deflects to the left.

Project #328

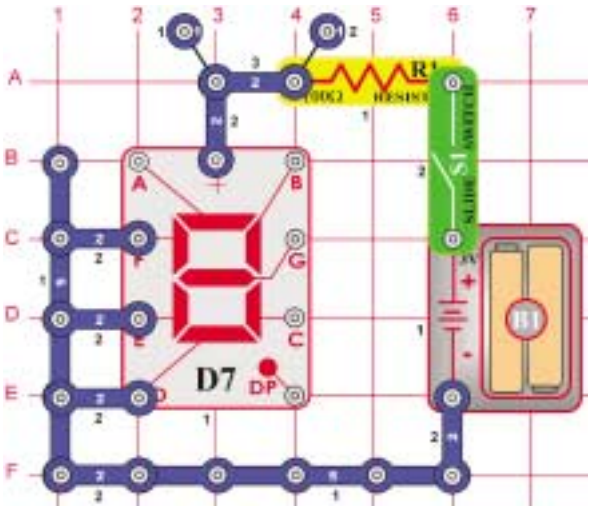


SCR 6V Bulb

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.

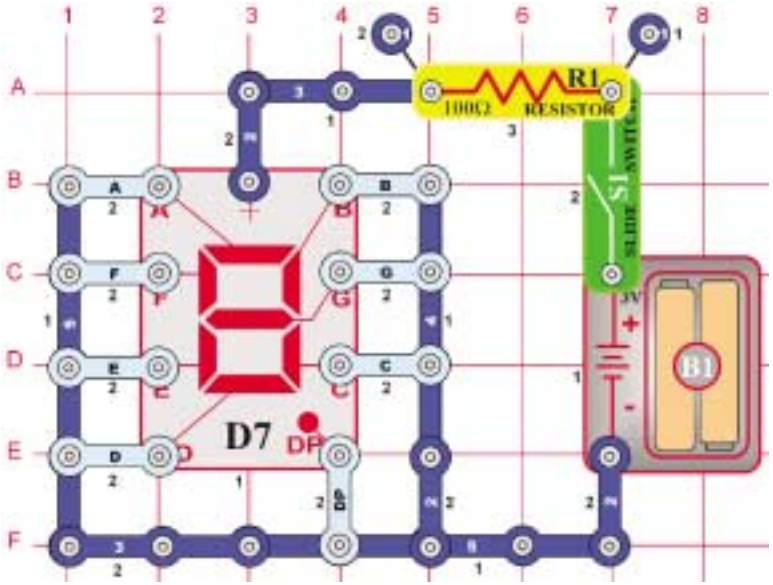
Project #329



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

Project #339

Display #0

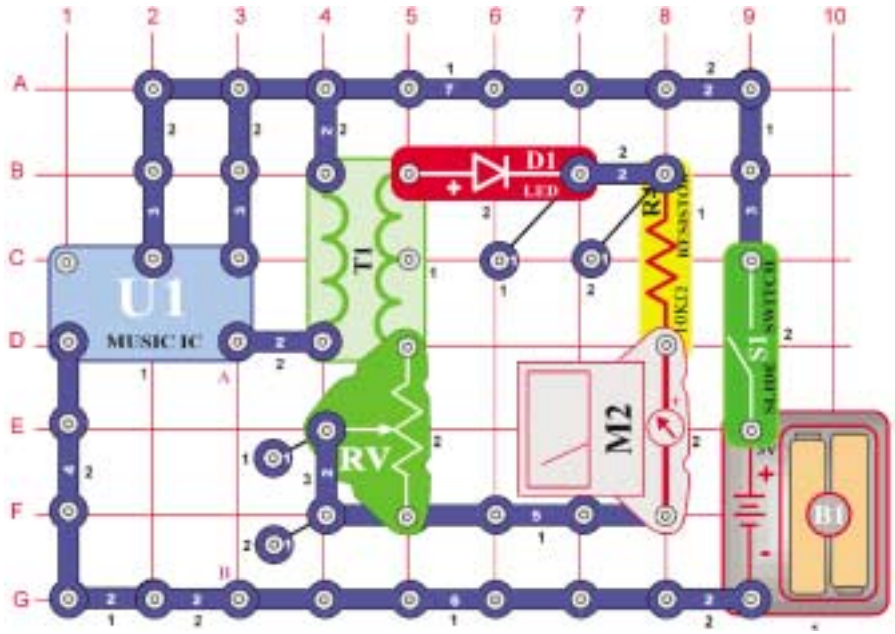
OBJECTIVE: To configure the seven segment to display the number 0.

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

Project #340

Music Meter

OBJECTIVE: See and hear the output of the music IC.

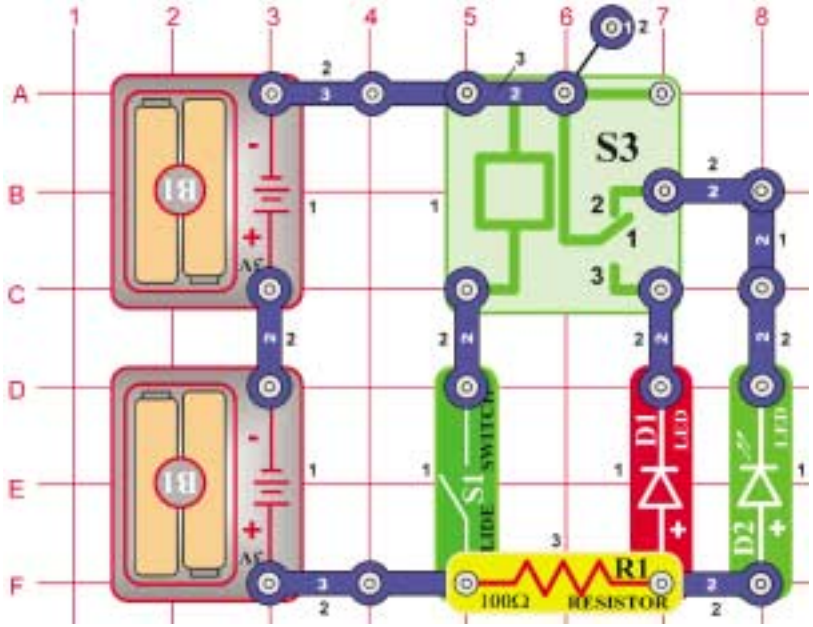


In this circuit, the output of the music IC (U1) is applied to the primary of the transformer (T1), which lights the LED (D1) and deflects the meter (M2).

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. Now you can hear and see the output of the music IC.

Project #341

LED & Relay



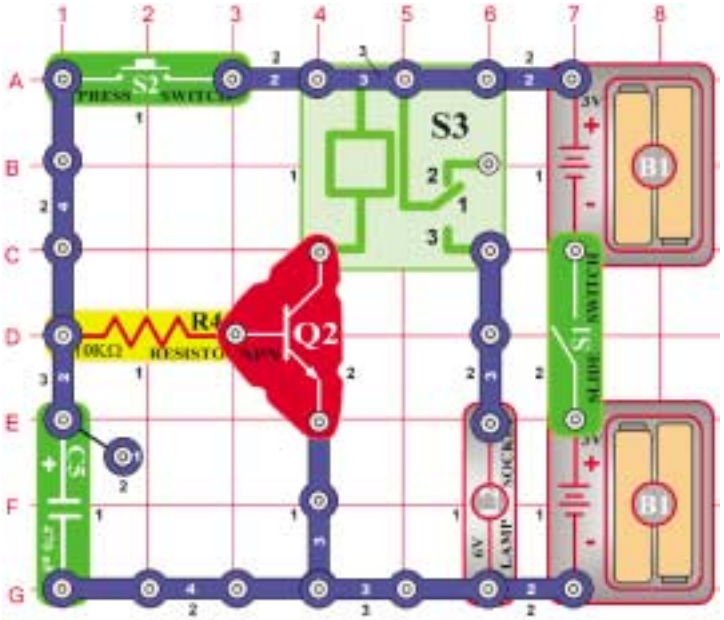
OBJECTIVE: Turn on and off LEDs using a relay.

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



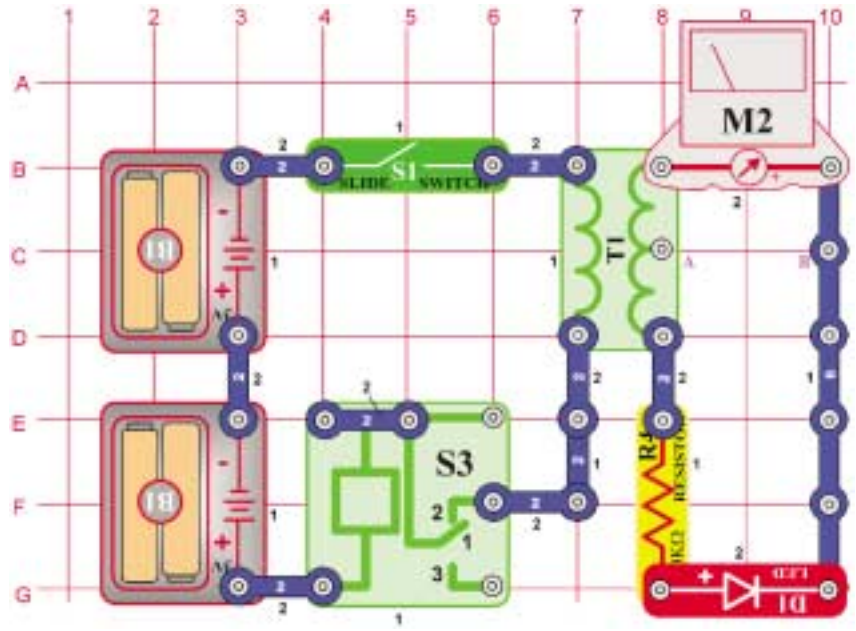
OBJECTIVE: To build a manual timer using a relay.

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.

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) to the secondary. We can measure the DC voltage on the transformer's secondary using a resistor (R4), a diode (D1), and an amp meter (M2). 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 secondary. 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

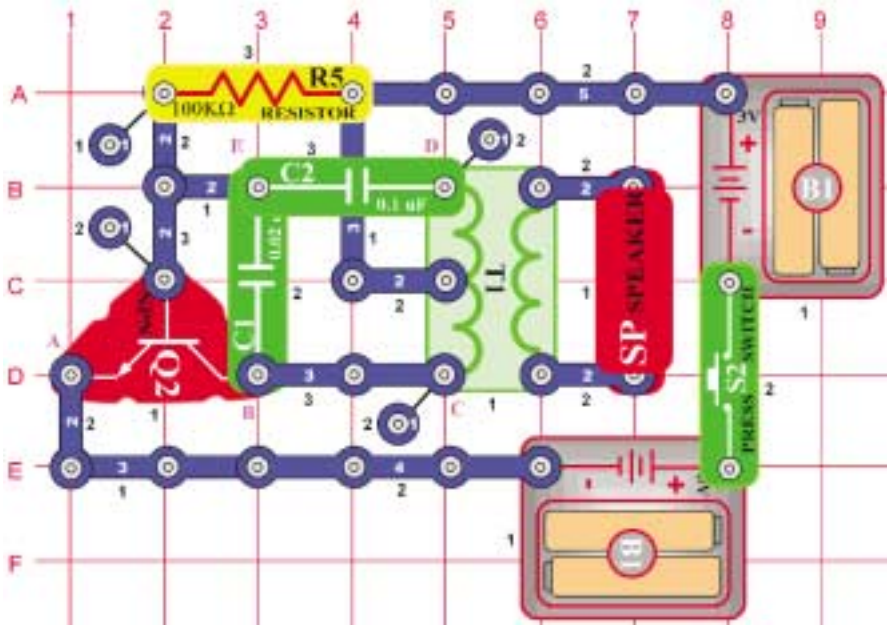
Current & Resistance

OBJECTIVE: See how resistance affects current.

Change the 10kΩ (R4) resistor to a 5.1kΩ (R3) and turn on the switch (S1). You will see that decreasing the resistance increases 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

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.

Project #351

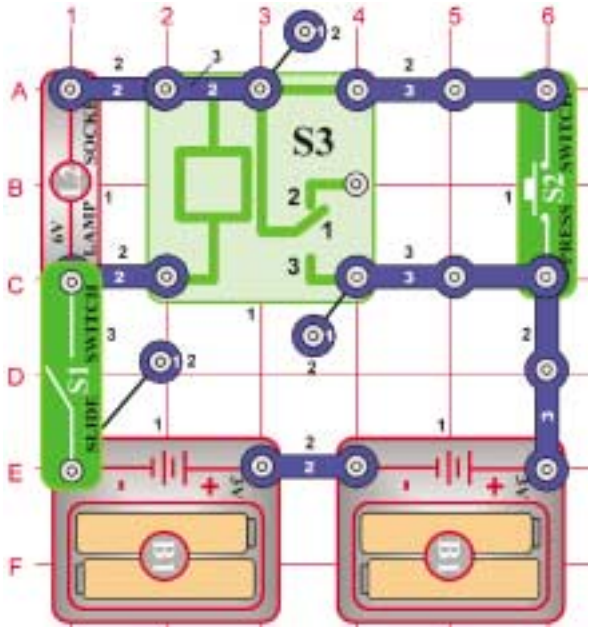
Touch-Control Mosquito Sound

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

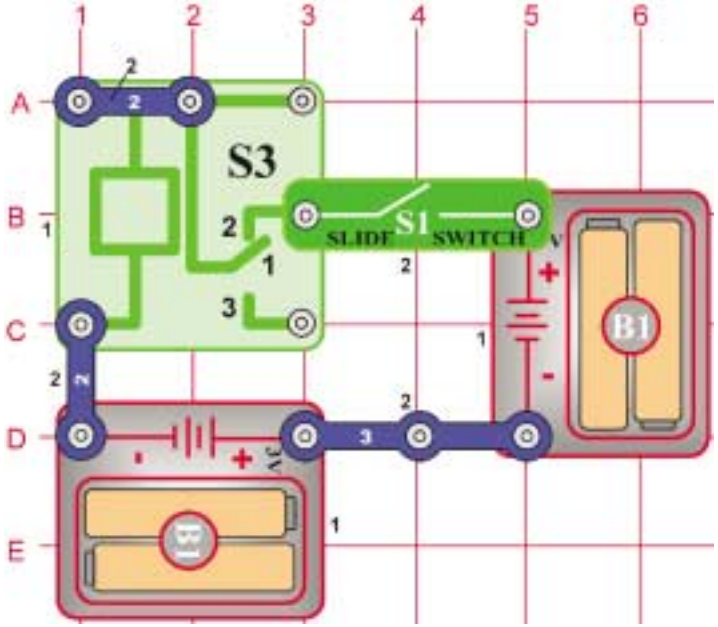


OBJECTIVE: Light a bulb using a relay.

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

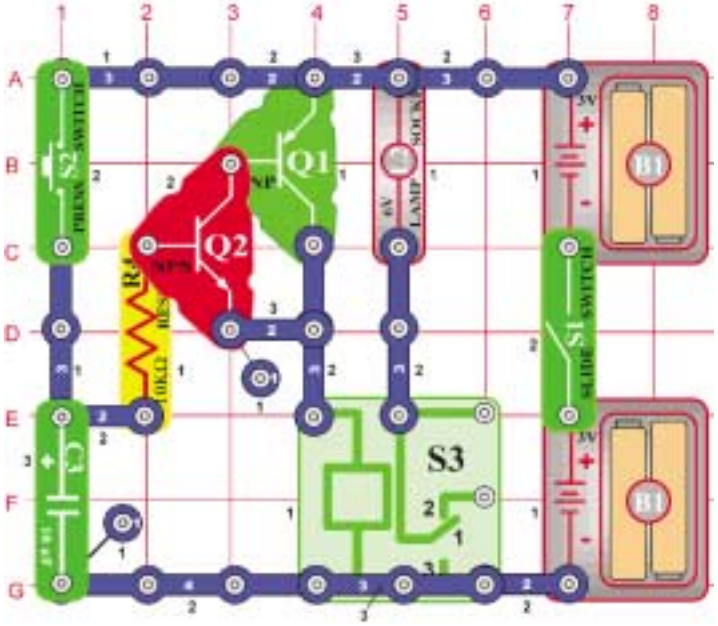


OBJECTIVE: To make a relay buzzer.

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

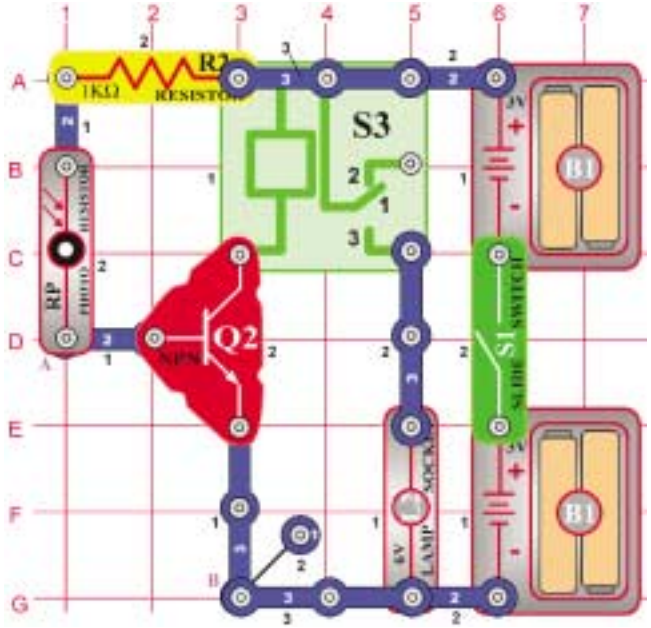


OBJECTIVE: To build a manual timer using a transistor in place of the relay.

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 (C5) 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.

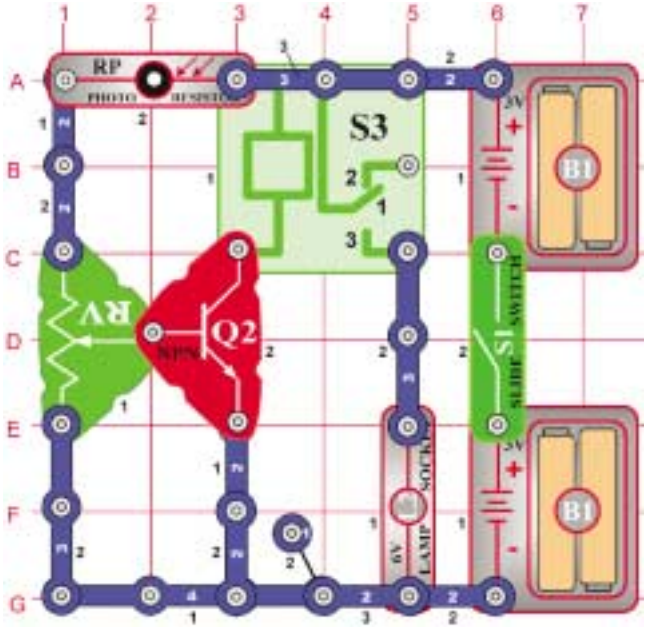
Project #356

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

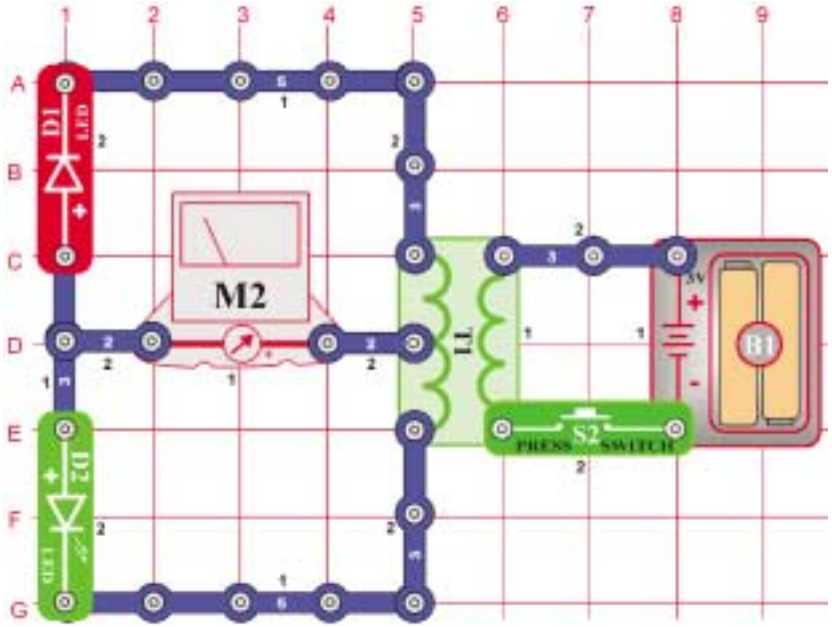


Adjustable Light Control

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

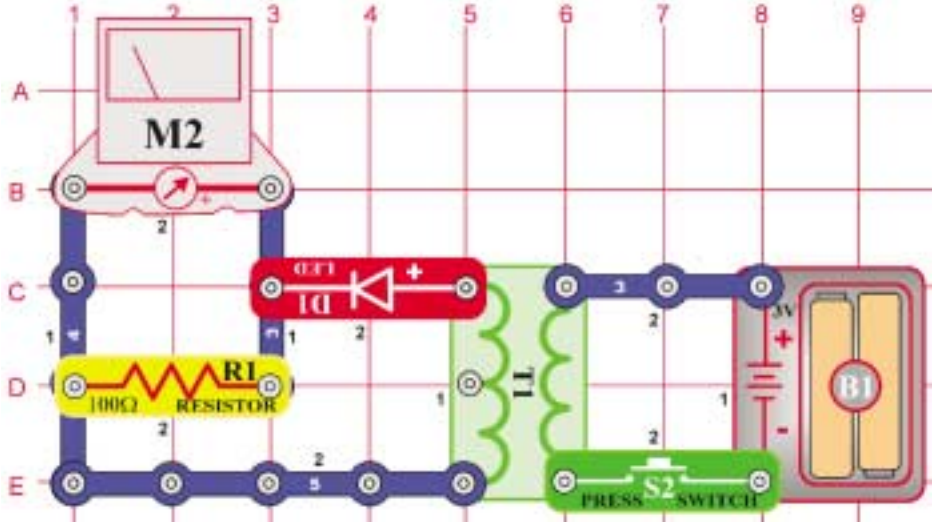
OBJECTIVE: To demonstrate the properties of a transformer.

Pressing and releasing the press switch (S2) generates a DC current on the secondary of the transformer (T1). The current lights the LEDs (D1 & D2) and deflects the meter (M2) 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.

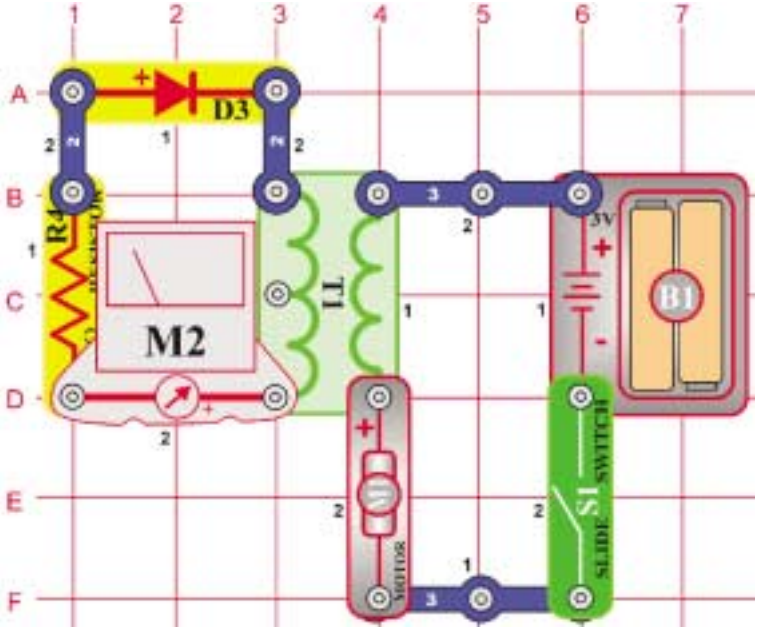


Pressing and releasing the press switch (S2) continuously generates an AC current. The LED (D1) is used to convert the AC current to DC current because it only allows the current to flow in one direction. The LED should light as the meter (M2) deflects to the right only. Without the LED, the meter would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

Project #360

Current Meter

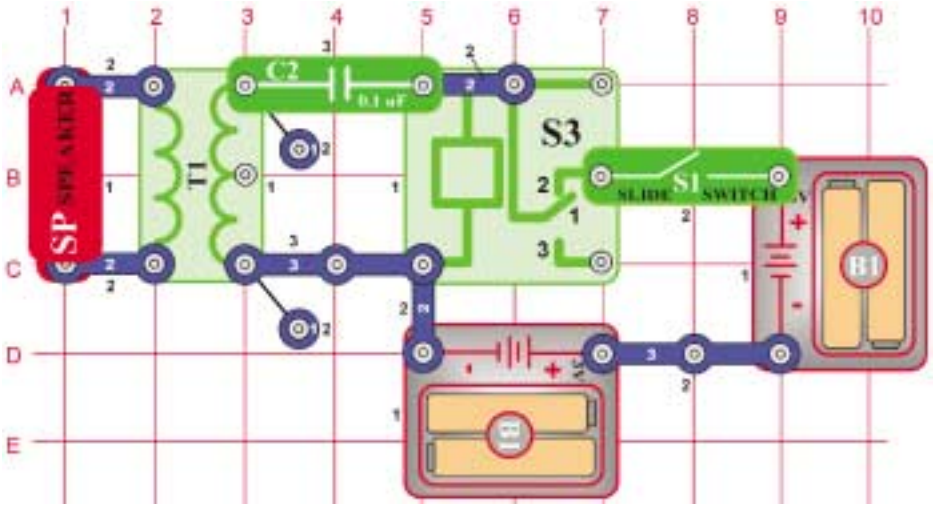
OBJECTIVE: To measure the current through a transformer.



By placing the meter (M2), 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. Current flows through the primary and secondary of the transformer.

Project #361

Buzzer, Relay, & Transformer



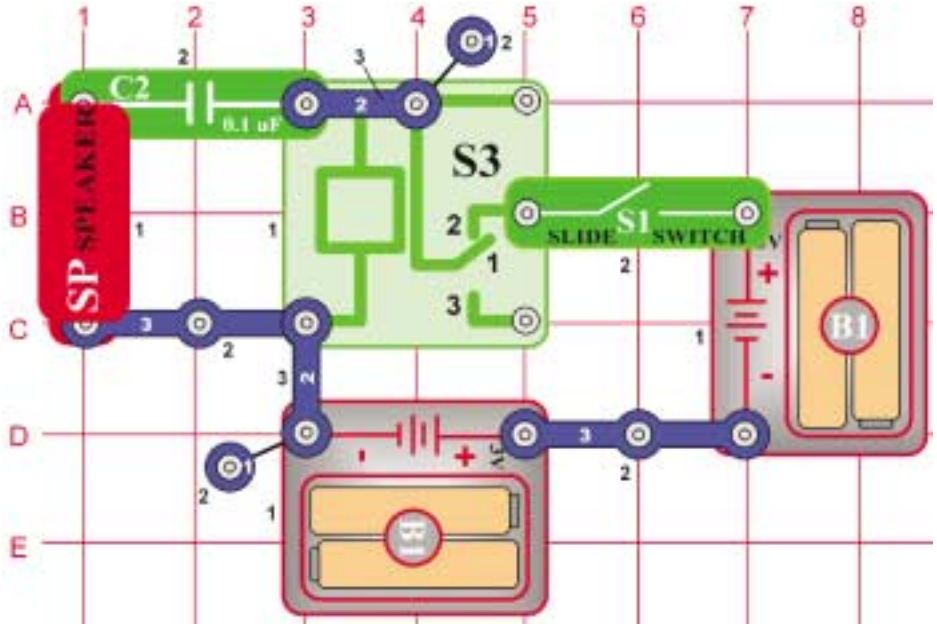
OBJECTIVE: To use a transformer for a louder buzzer.

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 secondary 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.

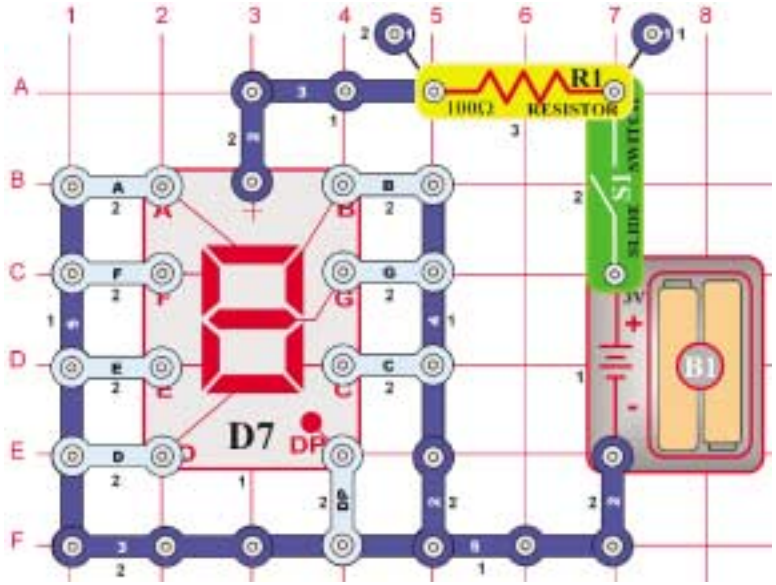
Project #362

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".

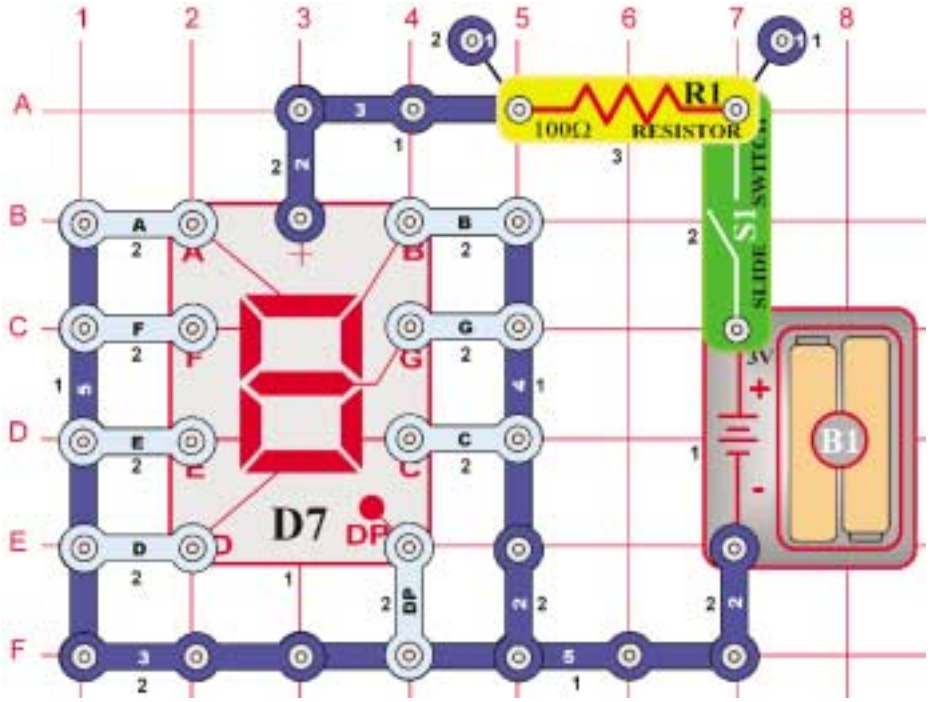
Connect A, D, E, F, & G to the negative of the battery.

☐ 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.

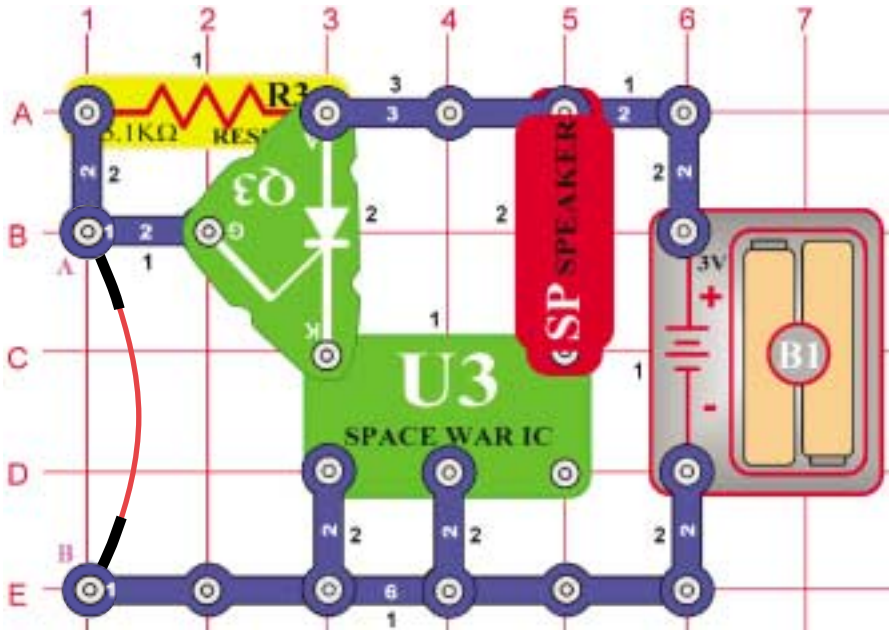
☐ Project #376

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.

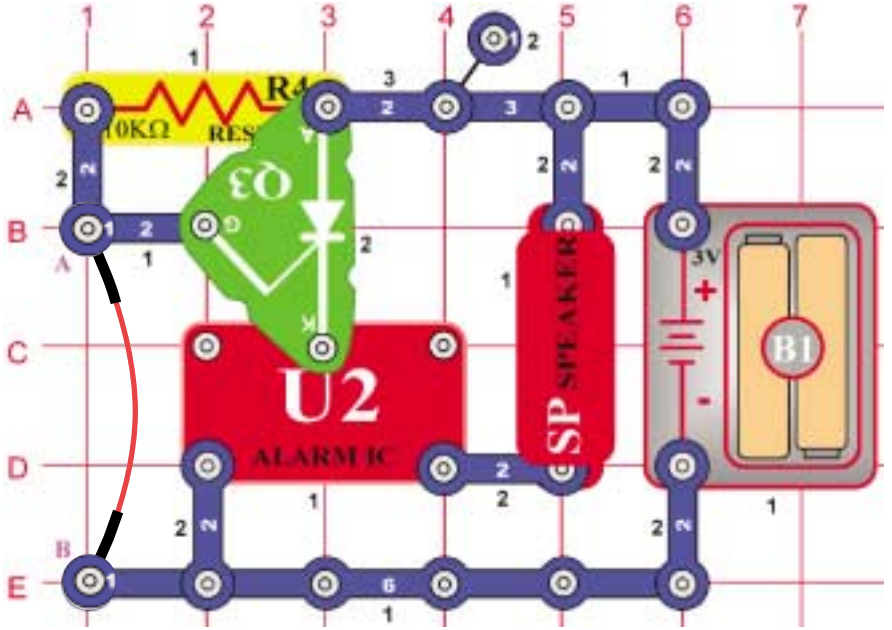
Project #378

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

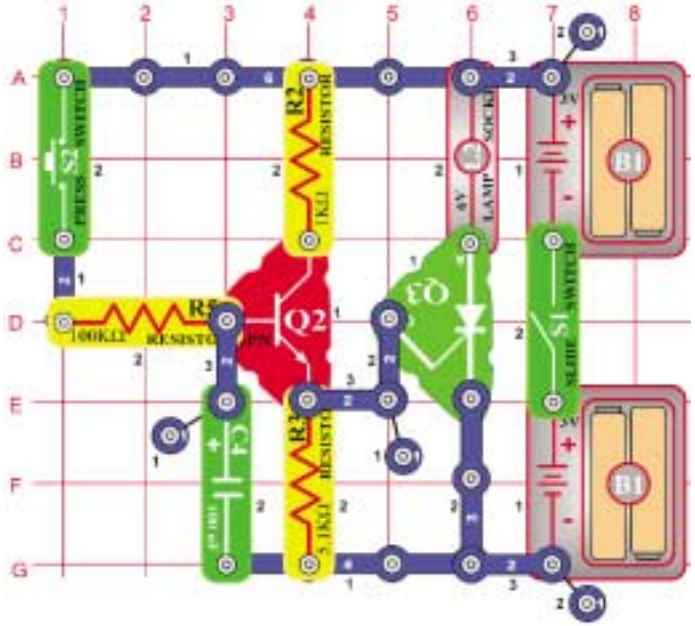
Light & Alarm IC

OBJECTIVE: To build an alarm circuit.

Use the circuit in project 377. 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 on. The values R5 and C5 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.

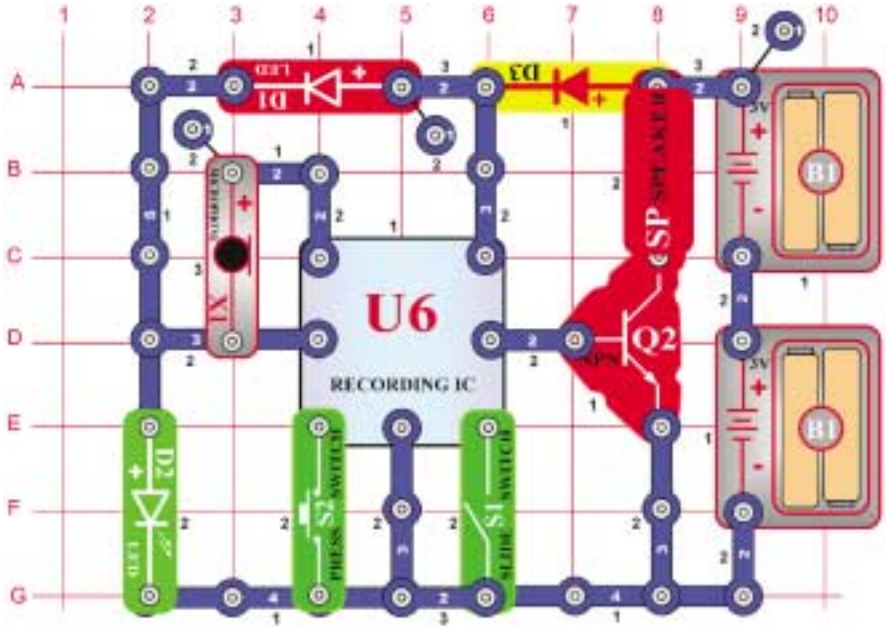
Project #383

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

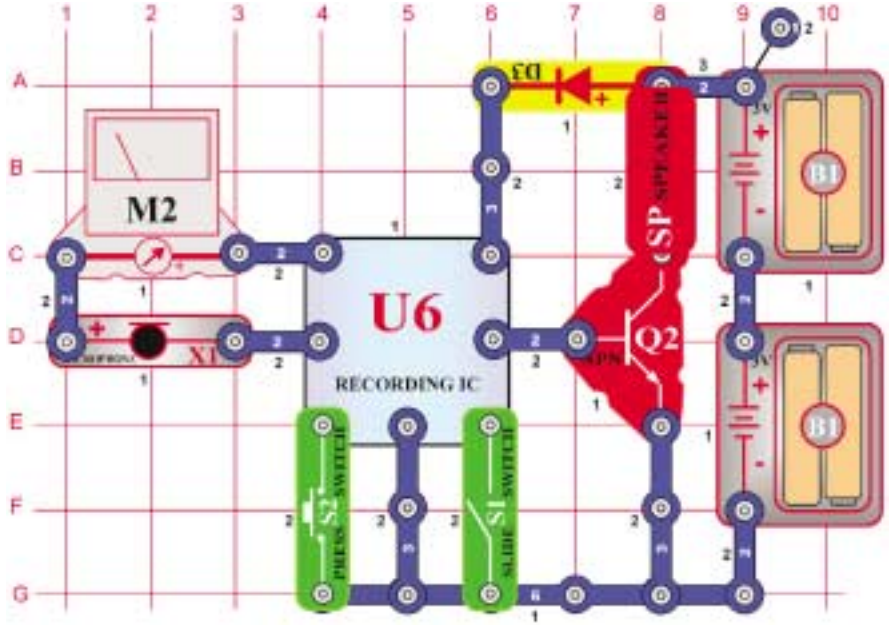


Recording LED Indicator

OBJECTIVE: To build a circuit that lights an LED to indicate the recording mode.

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

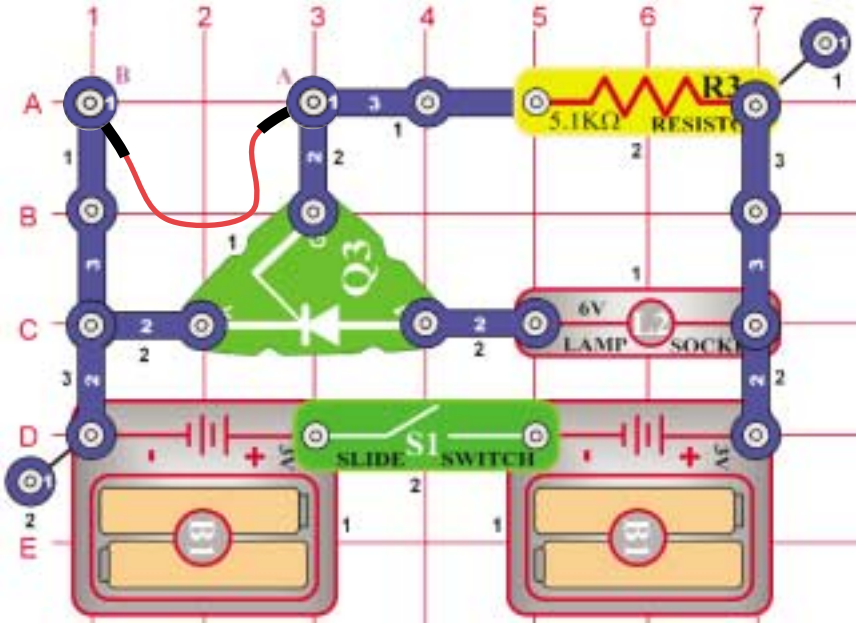
OBJECTIVE: To add a volt meter to the playback and record circuit.

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

Turn on the switch (S1) and the meter defects 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

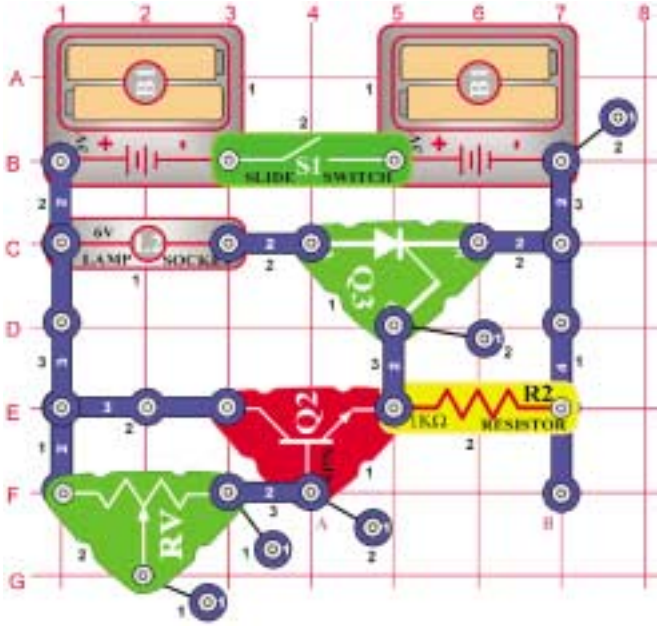


OBJECTIVE: To light a bulb to indicate an open circuit.

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)

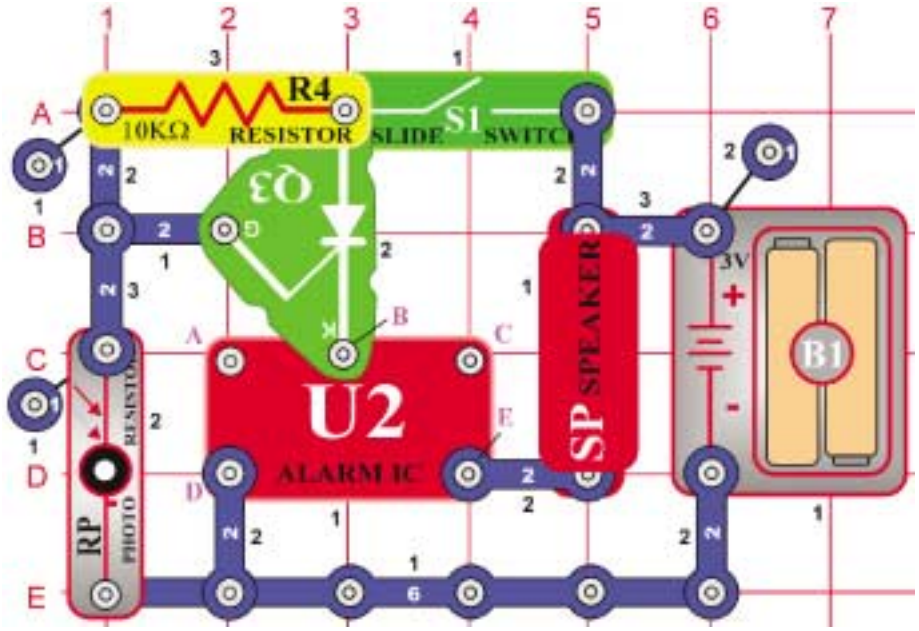


OBJECTIVE: To light a bulb to indicate an open circuit.

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

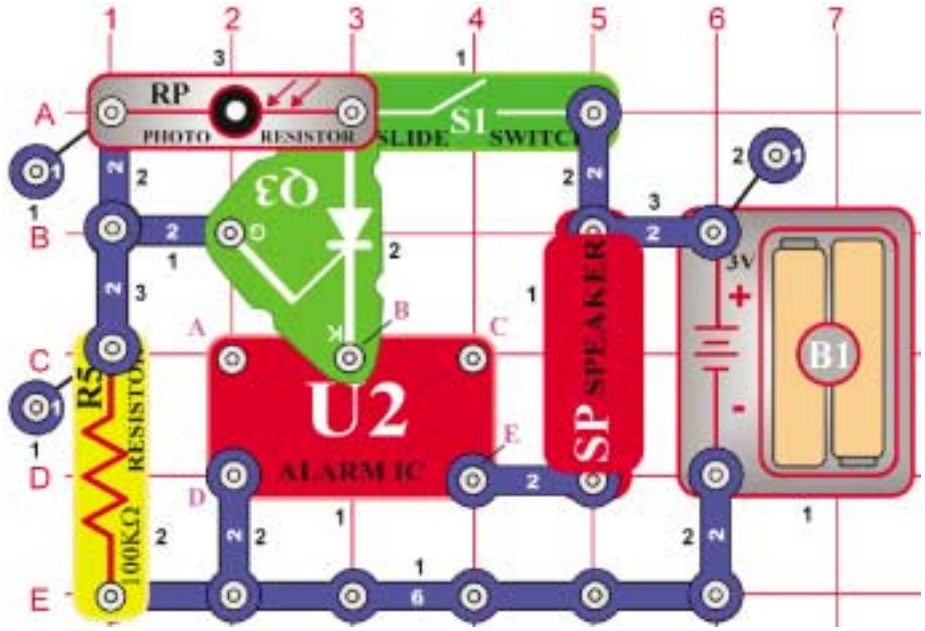
Night Ambulance

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

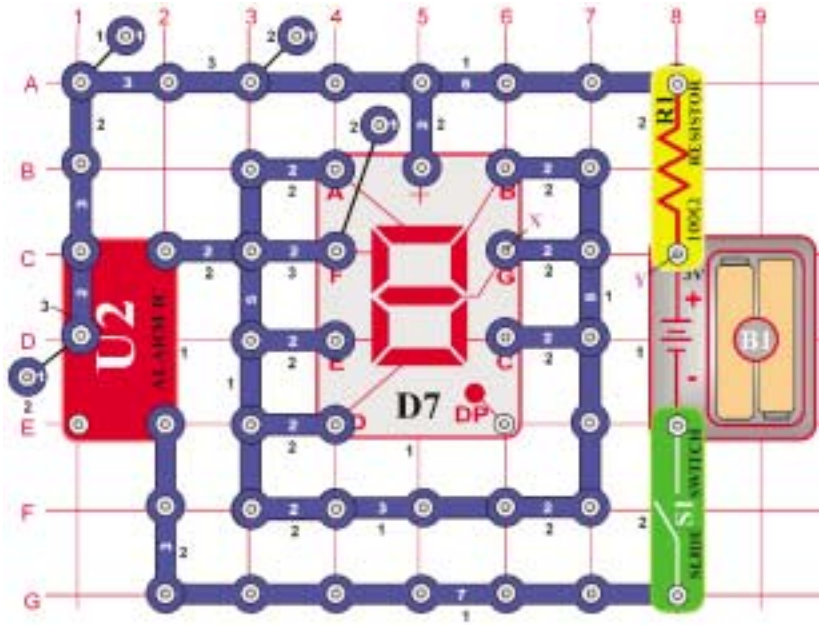
Daytime Light Ambulance

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

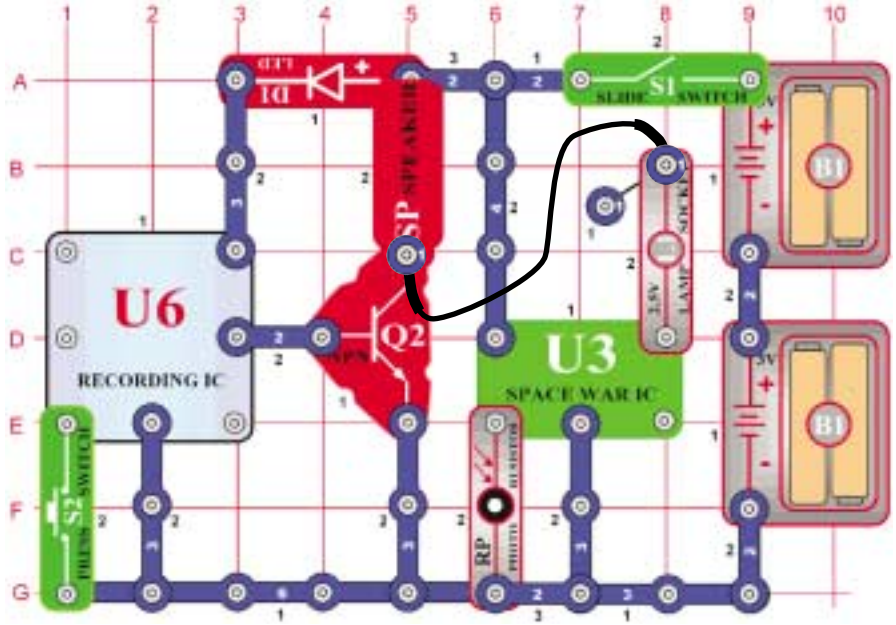
Flashing 8 with Sound

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.

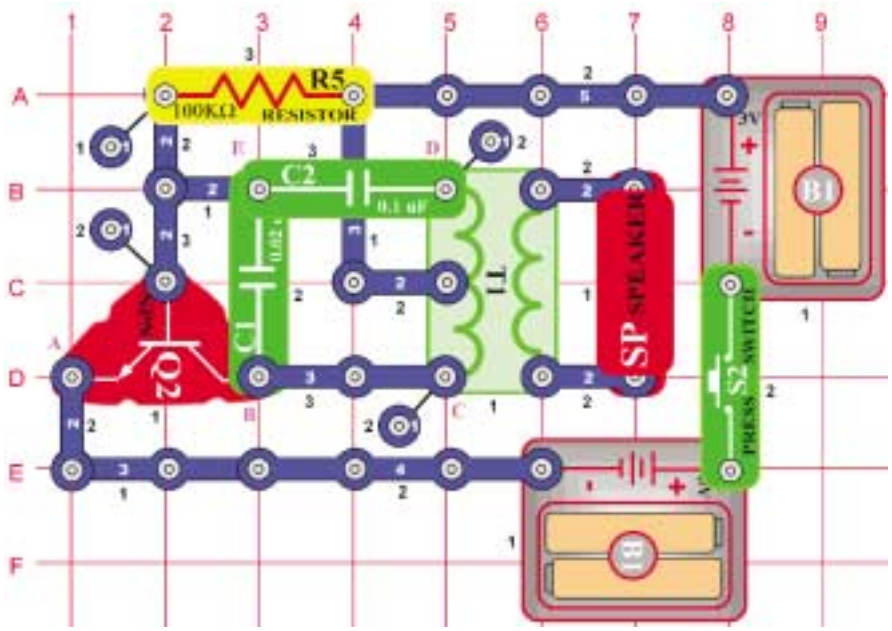
Turn on the switch (S1) and you hear space war sounds as the lamp (L1) flashes. If you wave your hand over the photo resistor (RP), the sound changes. If you keep the photo resistor covered, then the sound will stop.

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

Oscillation Sounds



OBJECTIVE: To make sounds with an oscillator circuit.

Turn on the switch (S1) and the speaker (SP) emits an oscillating sound. Now connect the whistle chip (WC) across points A & B and the sound changes.

Project #400

Oscillation Sounds (II)

OBJECTIVE: Show variations of project 399.

Use the circuit in project 399. Connect the whistle chip (WC) across points C & D.

Project #401

Oscillation Sounds (III)

OBJECTIVE: Show variations of project 399.

Use the circuit in project 399. Connect the whistle chip (WC) across points B & E.

Project #402

Oscillation Sounds (IV)

OBJECTIVE: Show variations of project 399.

Use the circuit in project 399. Install the whistle chip under capacitor C2. Turn on the switch (S1) and the circuit oscillates at another frequency.

Project #403

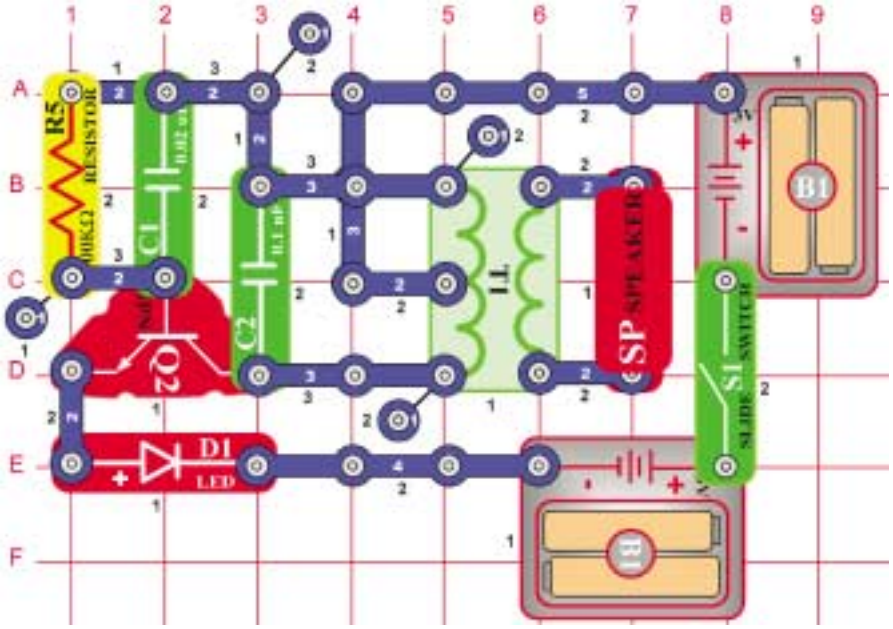
Touch-Control Oscillator

OBJECTIVE: Show variations of project 399.

Using project 399, replace the 100kΩ resistor (R5) with the photo resistor (RP). Wave your hand over the resistor and the frequency changes.

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 then the previous projects.

Project #408

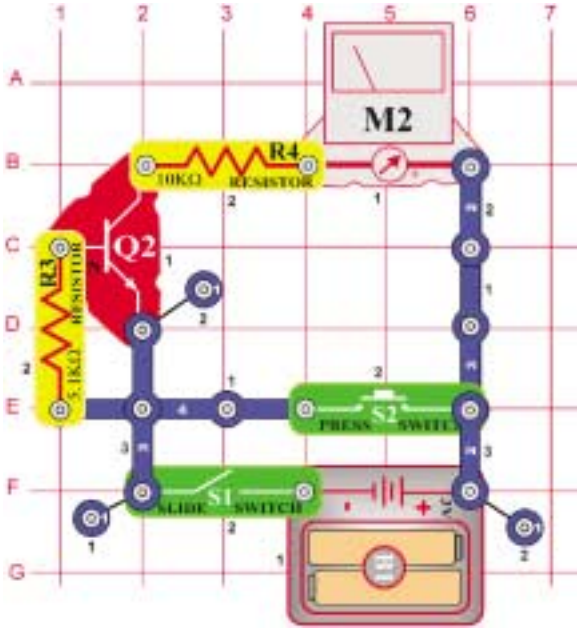
Oscillator Sound (V)

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

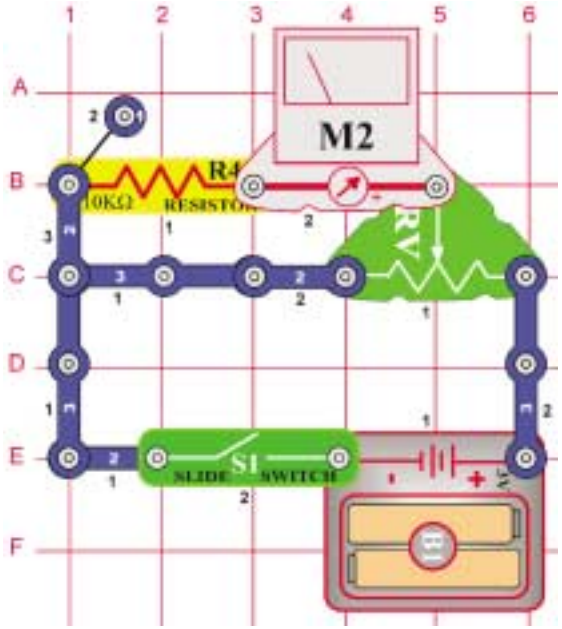


OBJECTIVE: To build a circuit that checks the transistor.

Turn on the switch (S1), the meter (M2) 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.

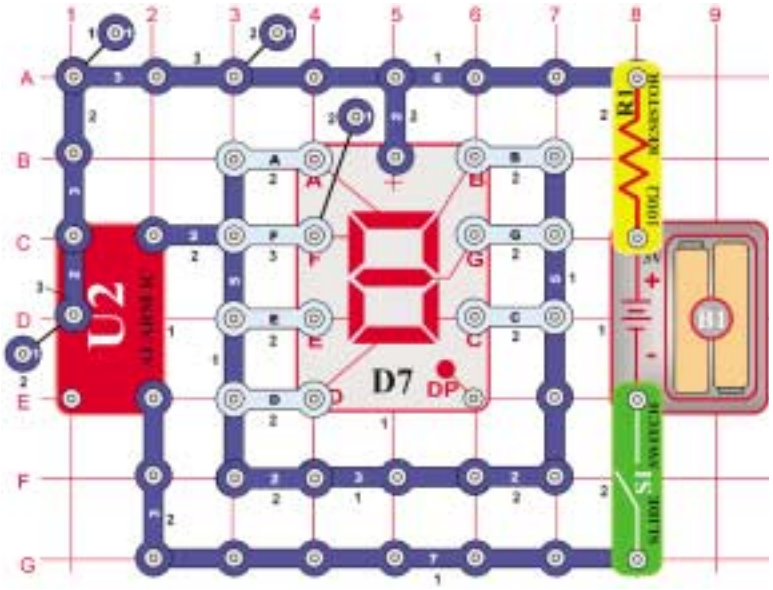
Project #410

Adjustable Voltage Divider



OBJECTIVE: To make an adjustable current path.

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 (M2) deflects less, as the voltage decreases.



Project #411

Automatic Display Capital Letter “C”

OBJECTIVE: To construct a light controlled display for capital letters.

Connect segments A, 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 capital letter C lights.

Project #412

Automatic Display Capital Letter “E”

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

Use the circuit from project 411. Connect A, 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 capital letter E lights.

Project #413

Automatic Display Capital Letter “F”

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

Use the circuit from project 411. Connect A, 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 capital letter F lights.

Project #414

Automatic Display Capital Letter “H”

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

Use the circuit from project 411. Connect 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 capital letter H lights.

Project #415

Automatic Display Capital Letter “P”

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

Use the circuit from project 411. Connect A, B, 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 capital letter P lights.

Project #416

Automatic Display Capital Letter “S”

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

Use the circuit from project 411. Connect A, F, 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 capital letter S lights.

Project #417

Automatic Display Capital Letter “U”

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

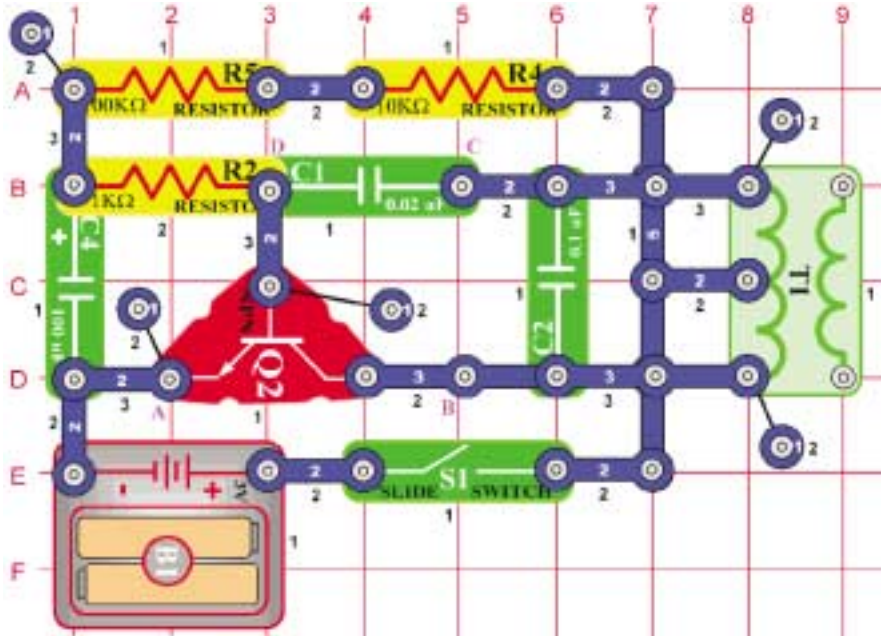
Use the circuit from project 411. Connect B, C, D, E, & F to the circuit. Turn on the switch (S1), the display should be off. Place your hand over the photo resistor (RP), now the capital letter U lights.

Project #418

Automatic Display Capital Letter “L”

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

Use the circuit from project 411. Connect 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 capital letter L lights.



☐ 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. Replace the 10µF capacitor (C3) with the 470µF capacitor (C5). Connect the whistle chip (WC) across points A & B and turn on the switch (S1). There is a small delay, then the whistle chip (WC) sounds for a minute and stops. The circuit then starts up again.

☐ Project #423
Whistle Chip Sounds (V)

OBJECTIVE: Show variations of project 419.

Use the circuit in project 419. Connect the whistle chip (WC) across points B & C. The time the sounds on is shorter then in project 421.

☐ Project #424
Whistle Chip Sounds (VI)

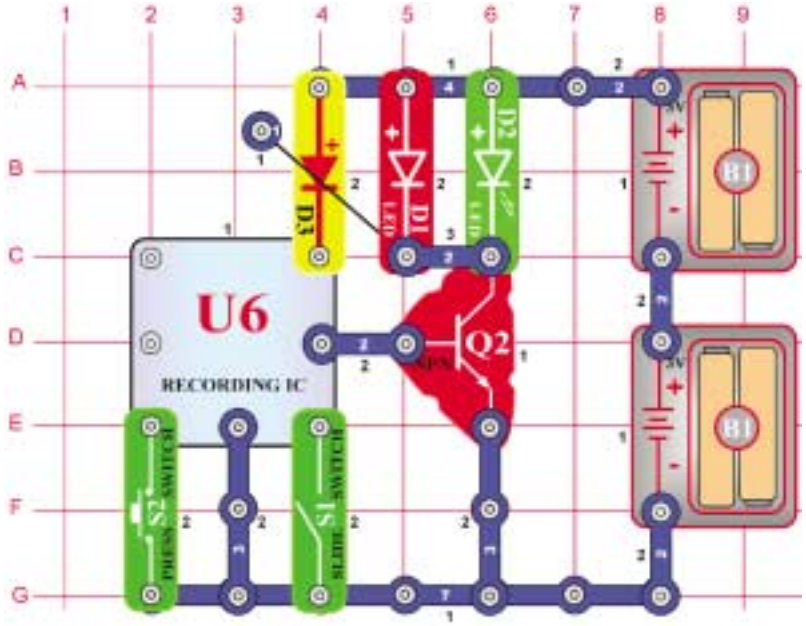
OBJECTIVE: Show variations of project 419.

Use the circuit in project 419. Connect the whistle chip (WC) across points C & D. In this project, the whistle chip sound is the shortest.

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

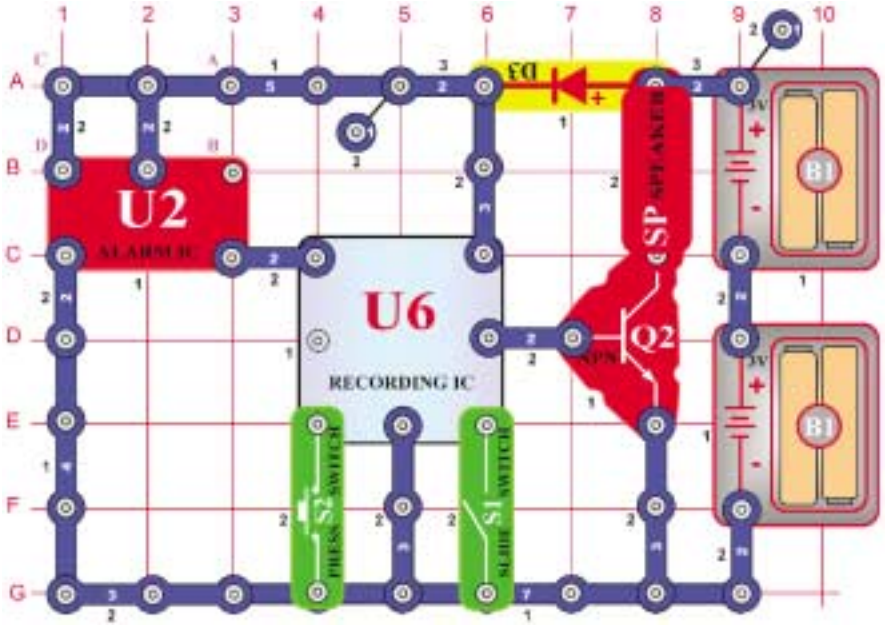
Touch-Controlled LED Time Delay

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.

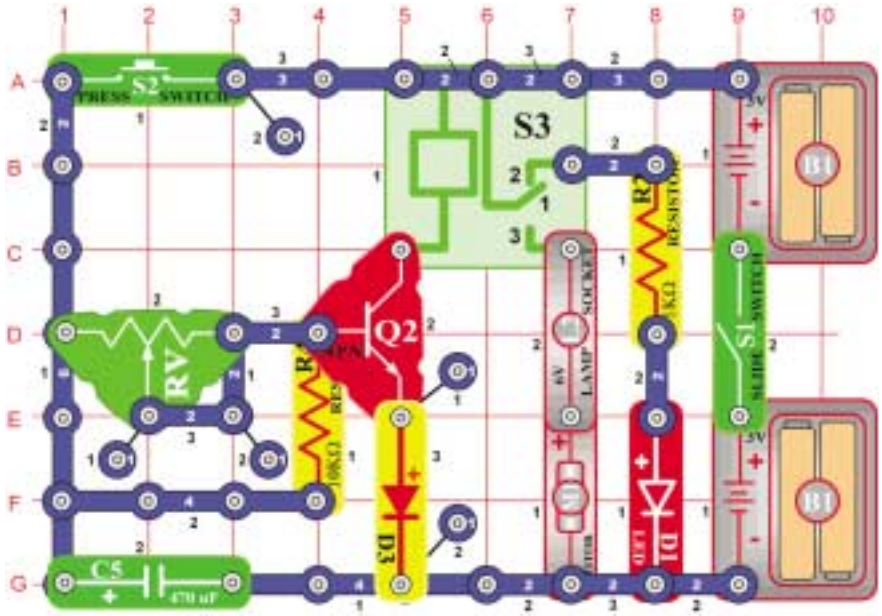
Use the circuit in project 428. Remove the 2-snap from A1 to B1. Turn on the switch (S1). The first beep indicates that the IC (U6) has begun recording. When you hear two beeps, turn off the switch (S1), press the switch (S2), and the new recording plays.

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 470µF 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.

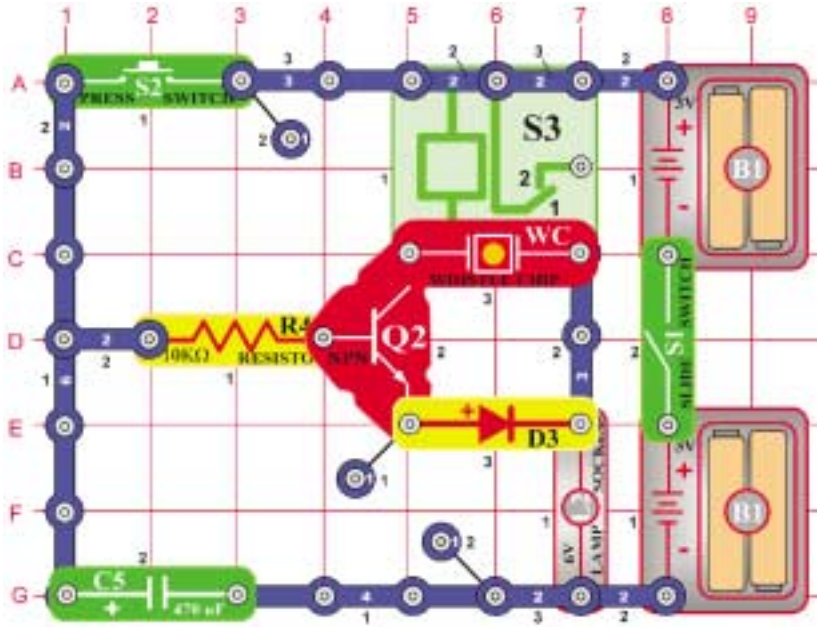
Turn on the switch (S1), the red LED (D1) lights. Now press and release the switch (S2), the bulb lights and the motor spins.

Project #432
Time Delay

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

Use the circuit in project 431. Replace the 470µF capacitor (C5) with the 100µF 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

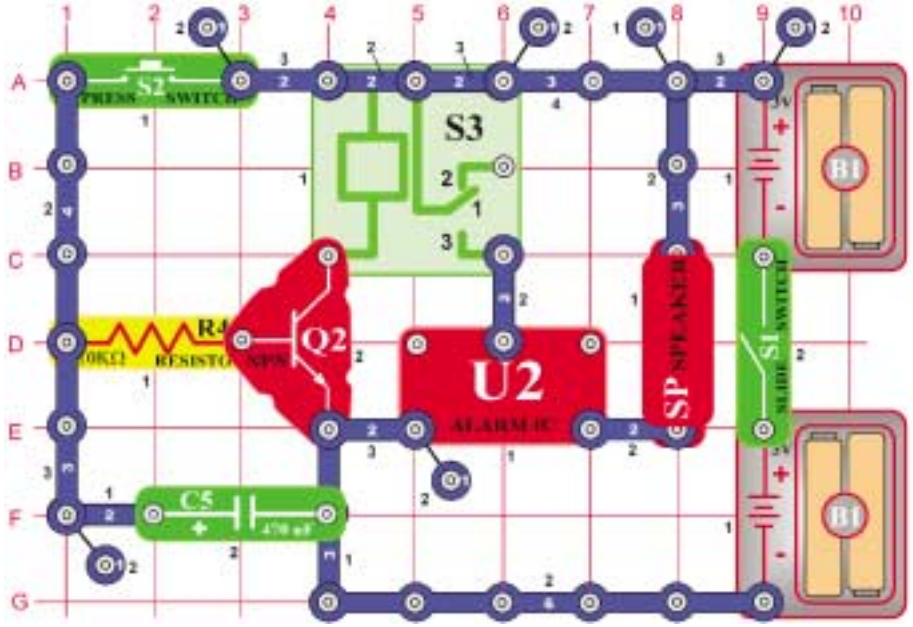


Manual 7 Second Timer (II)

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

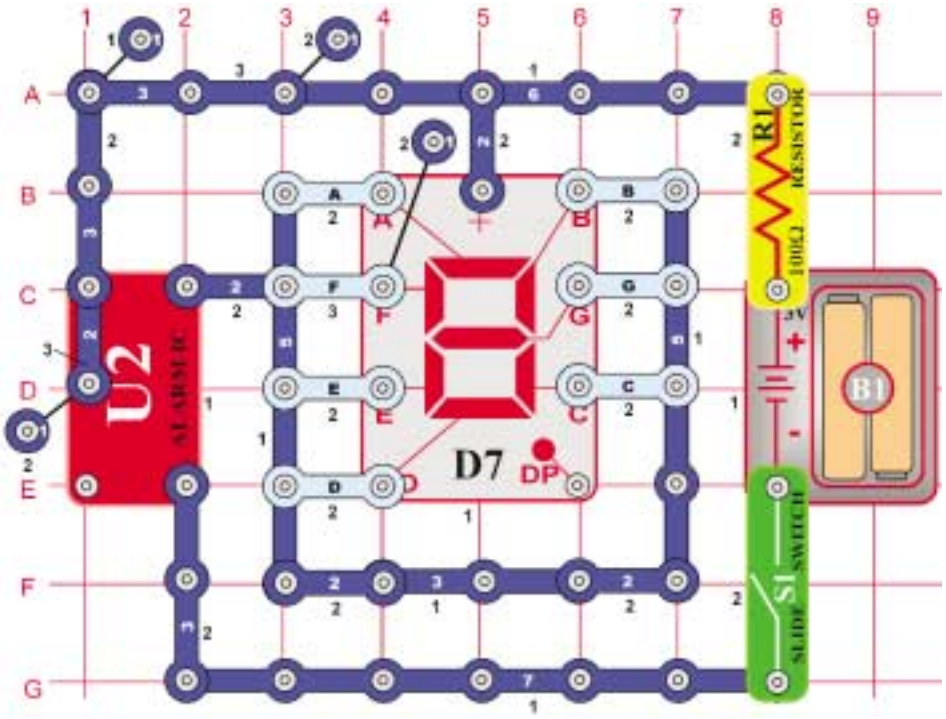


15 Second Alarm

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 #435

Flashing "1 & 2"

OBJECTIVE: Use the Alarm IC as a switch to flash the numbers "1 & 2".

Connect segments B & C to the circuit. Turn on the switch (S1) and the number "1" should be flashing. Now, connect A, B, G, E, & D to flash the number "2".

Project #436

Flashing "3 & 4"

OBJECTIVE: Use the Alarm IC as a switch to flash the numbers "3 & 4".

Use the circuit in project 435. Connect A, B, G, C, & D to the circuit. Turn on the switch (S1) and the number "3" should be flashing. Now, connect C, B, G & F to flash the number "4".

Project #437

Flashing "5 & 6"

OBJECTIVE: Use the Alarm IC as a switch to flash the numbers "5 & 6".

Use the circuit in project 435. Connect A, F, G, C & D to the circuit. Turn on the switch (S1) and the number "5" should be flashing. Now, connect A, C, D, E, F & G to flash the number "6".

Project #438

Flashing "7 & 8"

OBJECTIVE: Use the Alarm IC as a switch to flash the numbers "7 & 8".

Use the circuit in project 435. Connect A, B, & C to the circuit. Turn on the switch (S1) and the number "7" should be flashing. Now, connect A, B, C, D, E, F & G to flash the number "8".

Project #439

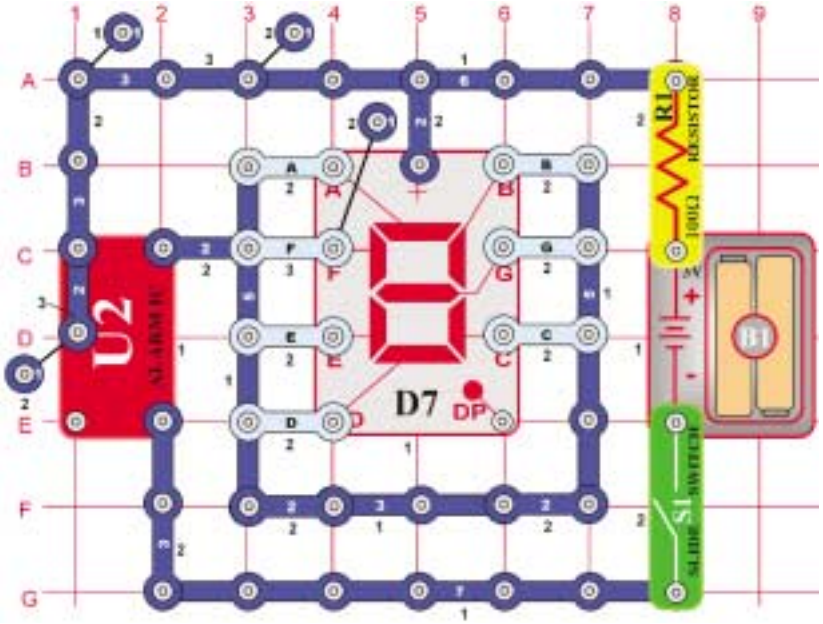
Flashing "9 & 0"

OBJECTIVE: Use the Alarm IC as a switch to flash the numbers "9 & 0".

Use the circuit in project 435. Connect A, B, C, D, F, & G to the circuit. Turn on the switch (S1) and the number "9" should be flashing. Now, connect A, B, C, D, E, & F to flash the number "0".

Project #440

Flashing “C & E”



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

Use the circuit in project 435. 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”.

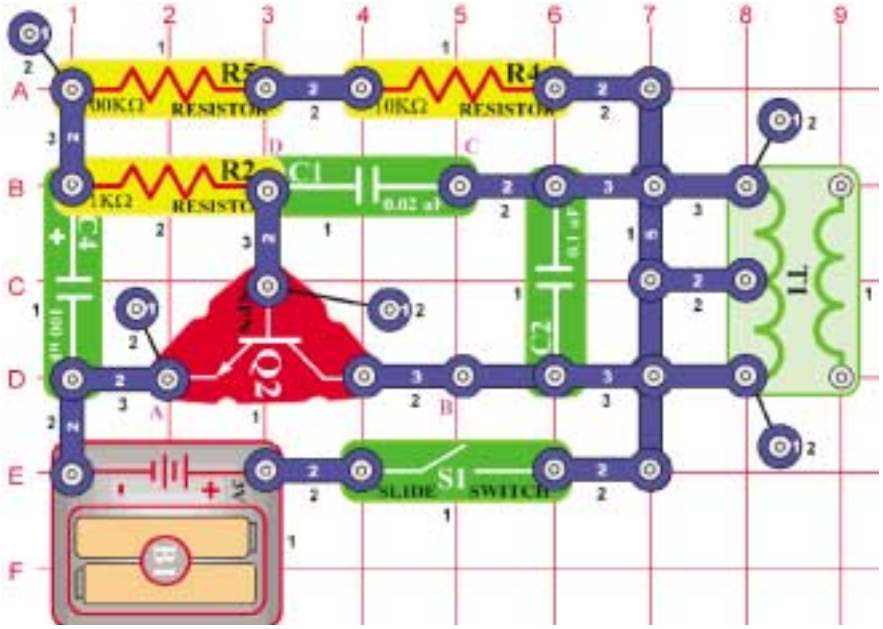
Use the circuit in project 440. Connect B, C, D, E, & G to the circuit. Turn on the switch (S1) and the letter “d” should be flashing. Now, connect A, B, D, E, F & G to flash the letter “e”.

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 100µF (C4) capacitor with the 10µF capacitor (C3), the tone should be much higher. Now use the 470µF 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.

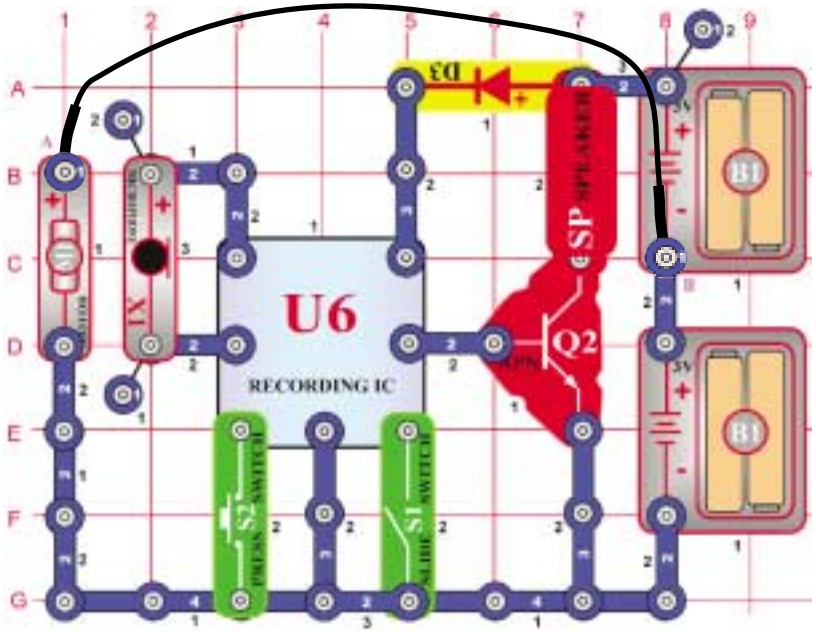
Project #452

Touch-Control Bird Sound

OBJECTIVE: Show variations of project 447.

Use the circuit in project 447. Replace the 100kΩ 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

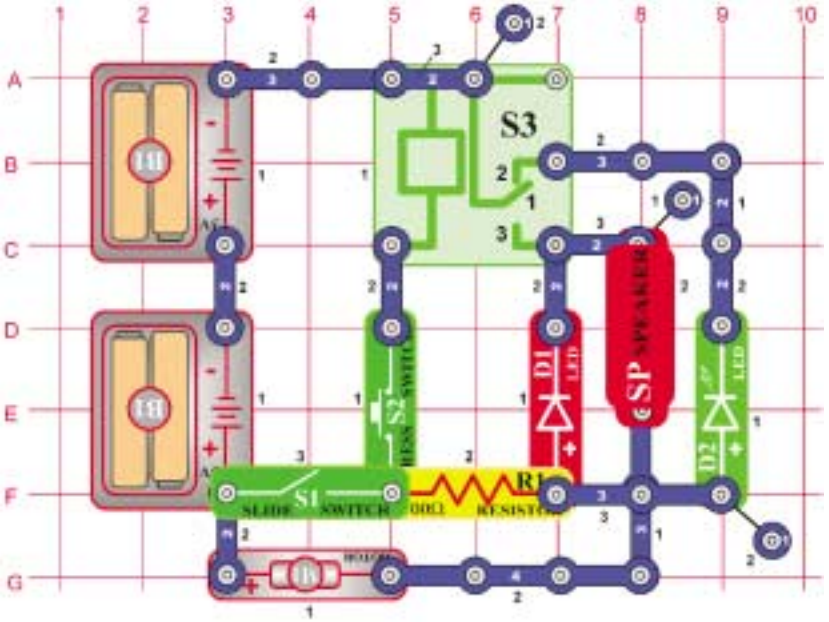


Motor Sound Recording

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

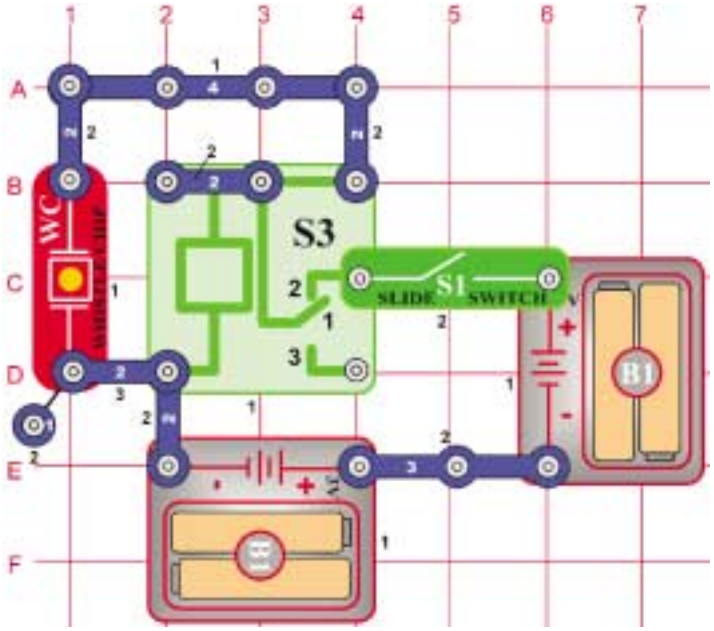
OBJECTIVE: To build a circuit that generates sound as a motor is spinning.

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



OBJECTIVE: Use the whistle chip and relay to make sound.

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

OBJECTIVE: Use the speaker and relay to make sound.

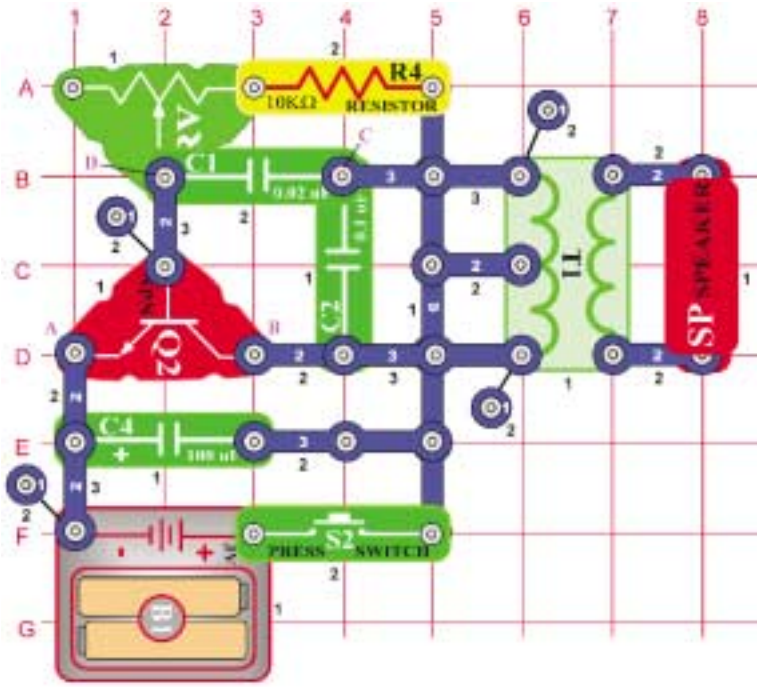
Use the circuit from project 455. Replace the whistle chip (WC) with the speaker (SP). Turn on the switch (S1) and now you generate a louder sound using the speaker.

Project #457

Relay, LED, & Bulb

OBJECTIVE: Light the LED and Bulb using the relay.

Use the circuit from project 455. Replace the whistle chip (WC) with the red LED (D1). Turn on the switch (S1) and the LED lights. Replace the LED with the 6V bulb (L2), turn on the switch (S1) and the bulb 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.

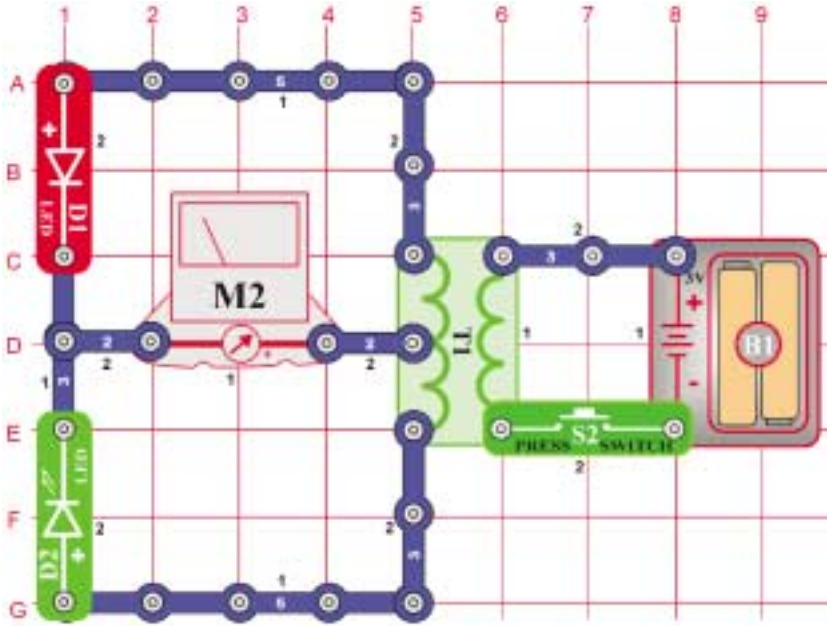
☐ Project #465
Lazy Cat

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.

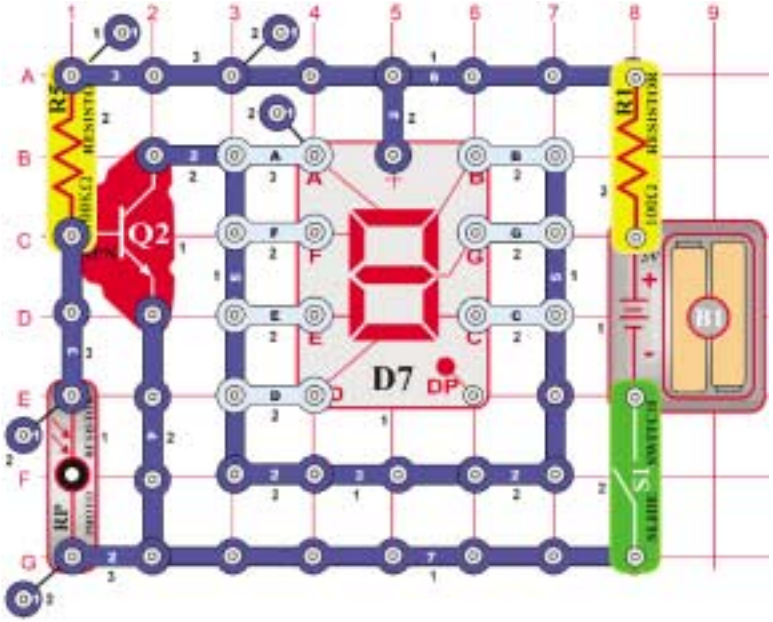
Project #466

Meter Deflection (II)



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

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 (M2) 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, 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 C, B, 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 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.

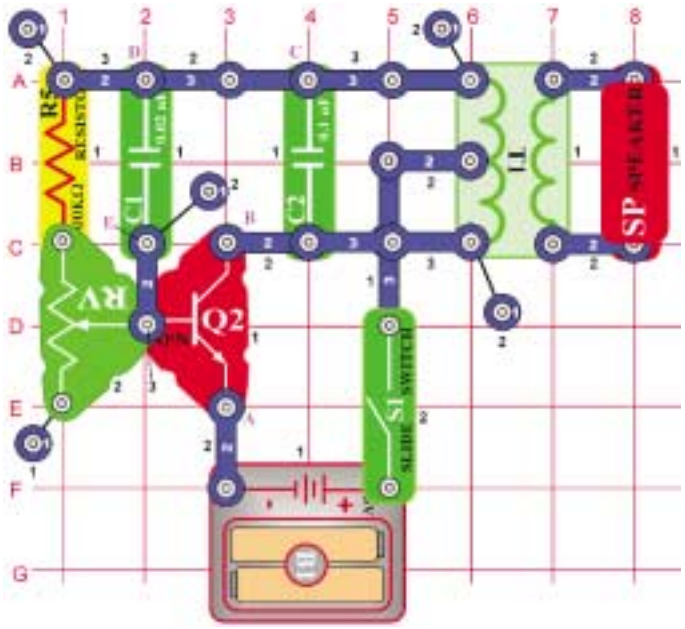
Use the circuit from project 467. Connect A, B, F, G, & C to the circuit. Turn on the switch (S1), the display should be off. Place your hand over the photo resistor (RP), now the number 9 lights.

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.

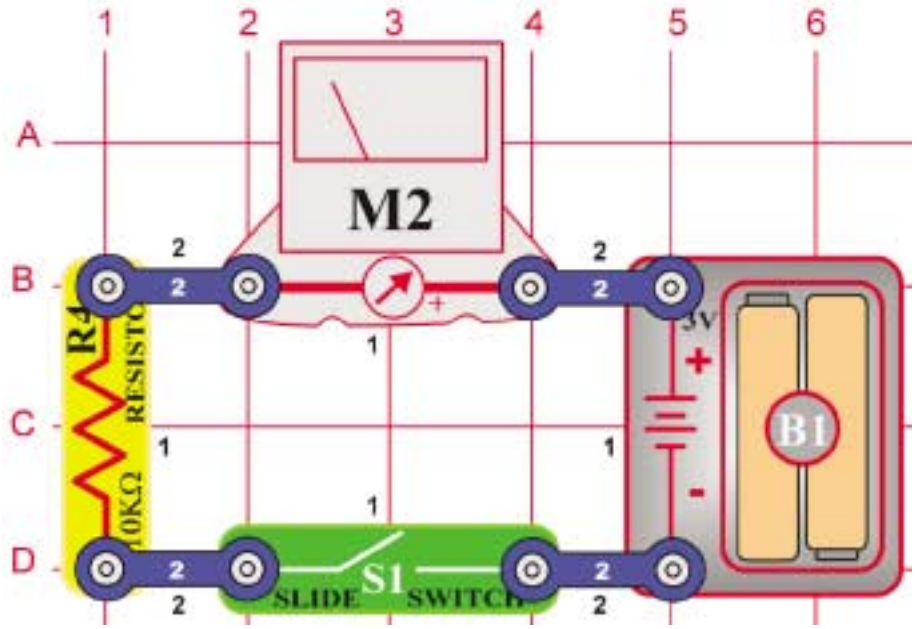
☐ Project #484
Slow Adjusting Tone (II)

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

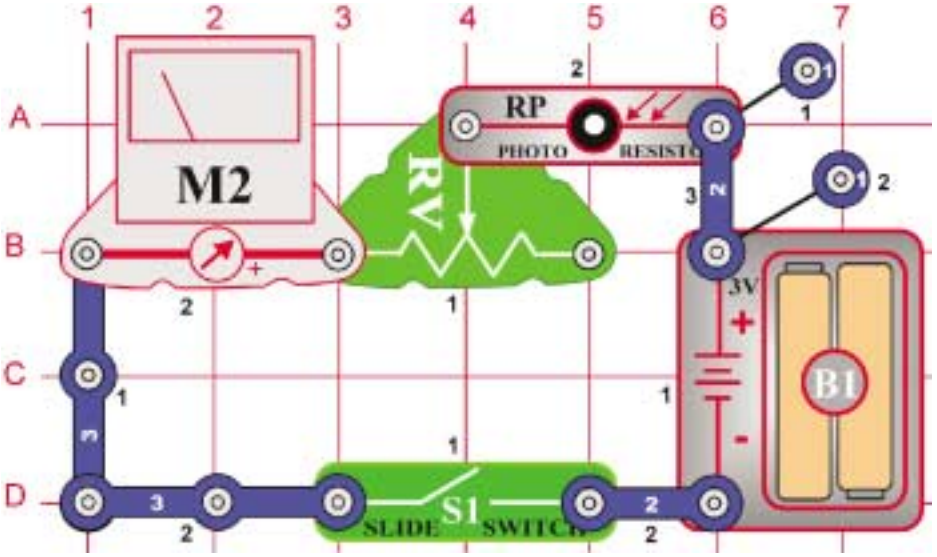


OBJECTIVE: To make a fixed current path.

The meter (M2) 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



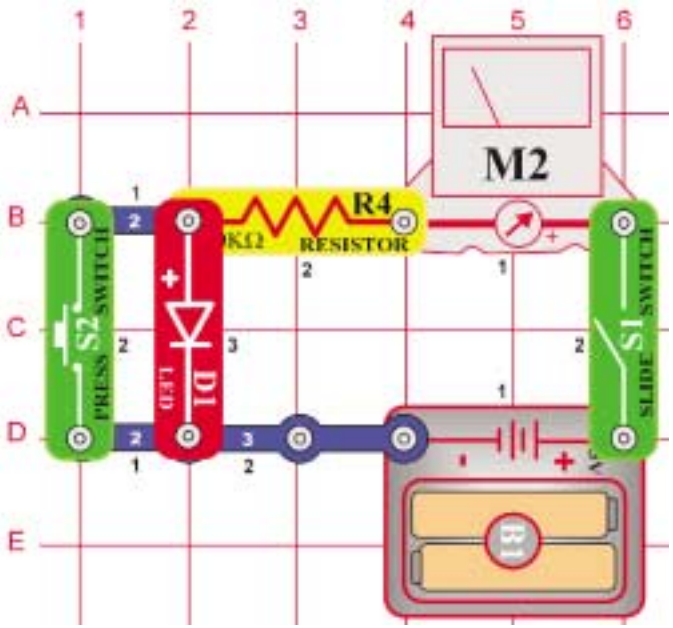
OBJECTIVE: To make a simple light meter.

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 though the meter (M2). 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

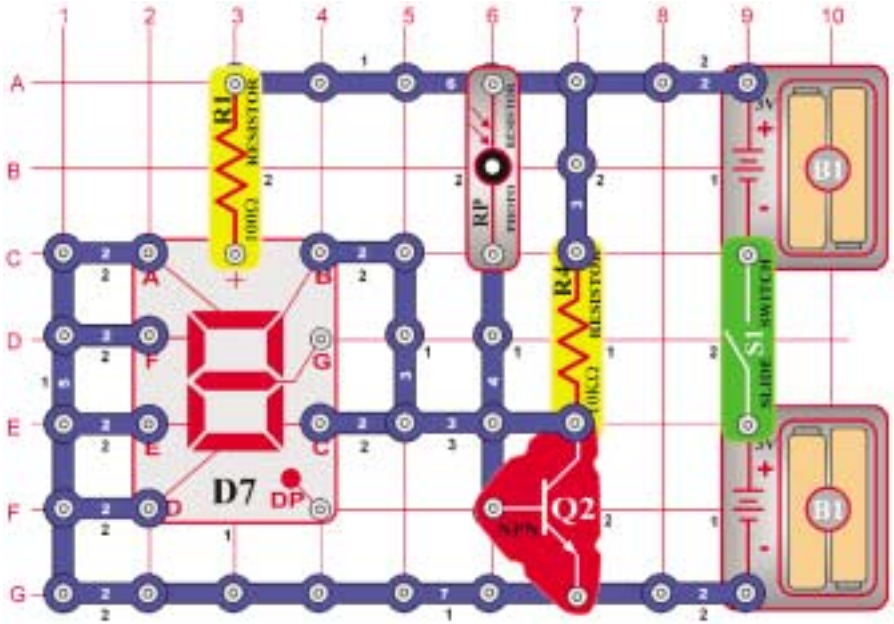


OBJECTIVE: To measure the voltage drop across diodes.

Turn on the switch (S1) and the LED (D1) lights as the meter (M2) 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.

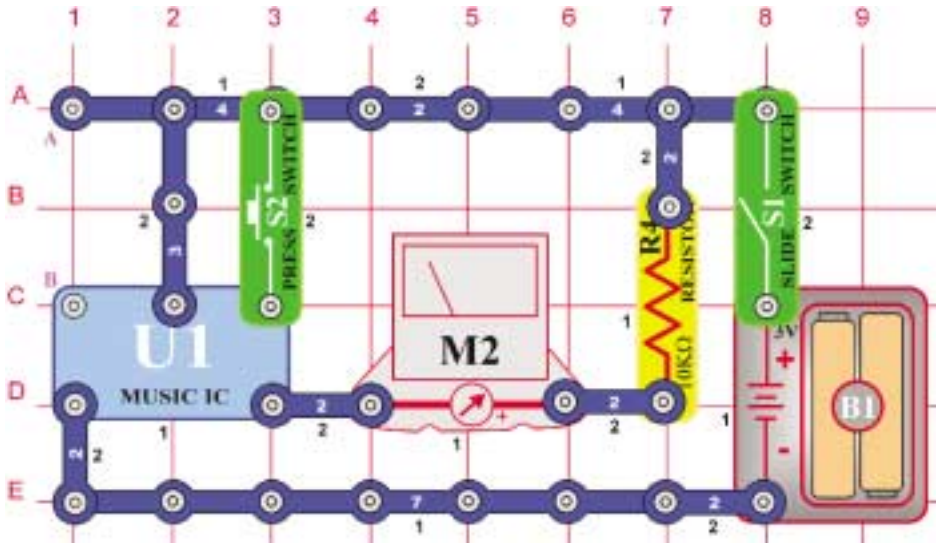
Using the photo resistor (RP) you can build a circuit that indicates if a door is open or closed. When the door is open and light is present, the letter "O" lights. When the door is closed and the room is dark, the letter C lights.

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.



Instead of driving a speaker (SP) with the music IC (U1), you can see it by using the meter (M2). Turn on the switch (S1) and the meter deflects according to the rhythm of music. When music stops, press switch (S2) once to start the music again.

☐ 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 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.

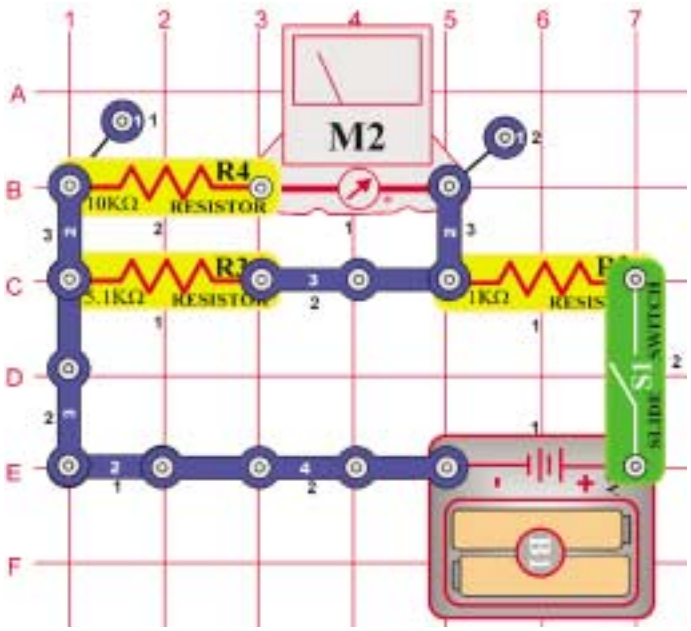
☐ Project #492 Sound-Control Meter

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



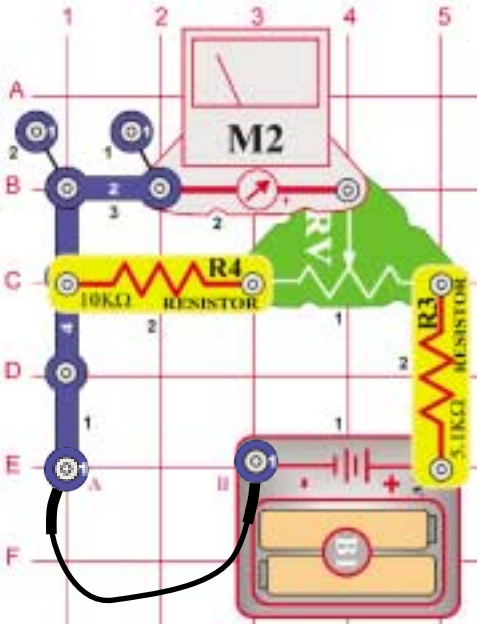
OBJECTIVE: To make a simple voltage divider.

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.

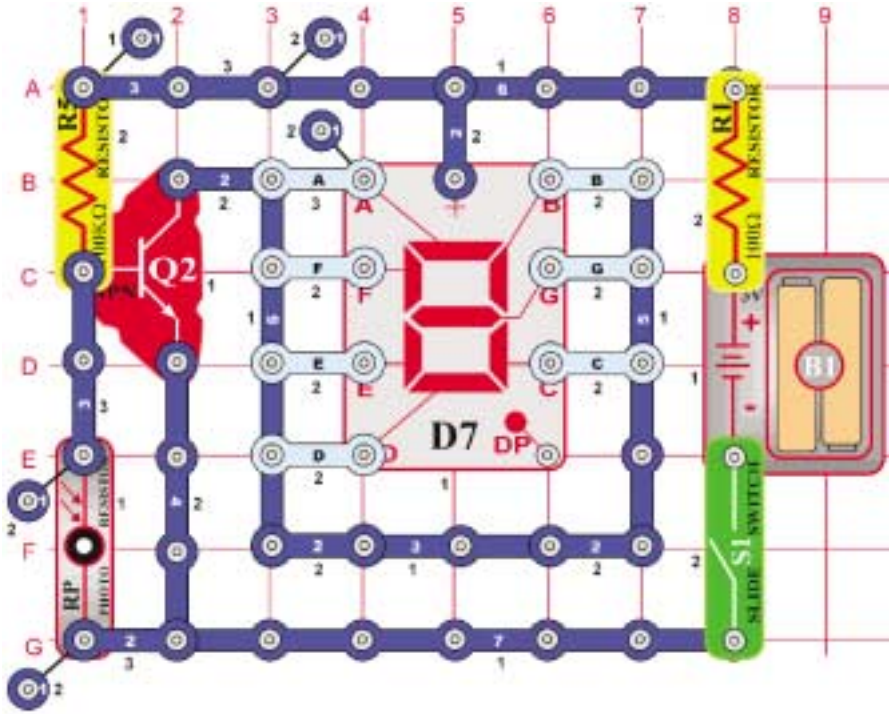
Project #494

Resistor Measurement



OBJECTIVE: To make a resistor checker.

Connect the jumper wire to points A & B. Adjust the variable resistor (RV) to so the meter (M2) 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.

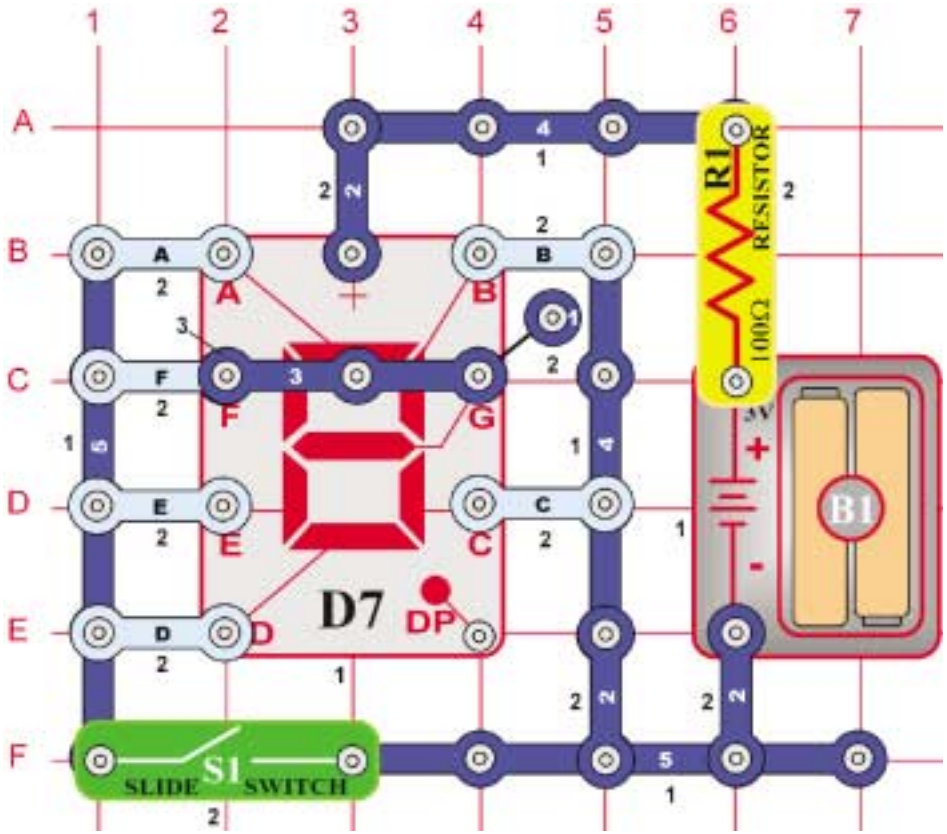
Use the circuit from project 495. Connect F, E, C, & G to the circuit. Turn on the switch (S1) the display should be off. Place your hand over the photo resistor (RP), now the letter “h” lights.

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.

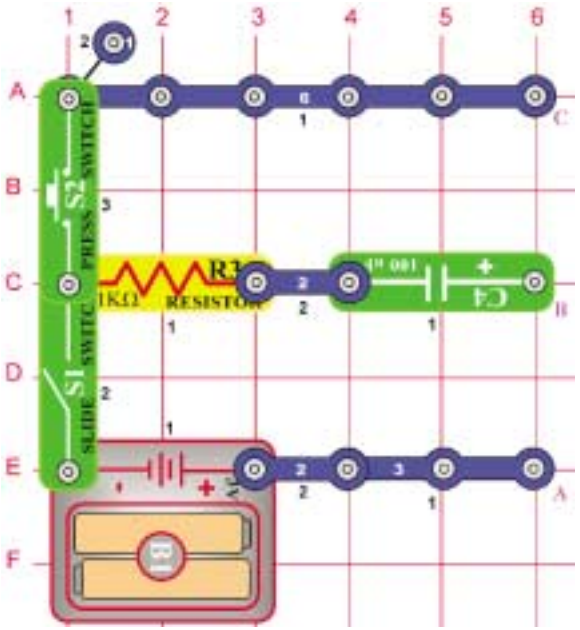
Project #505

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

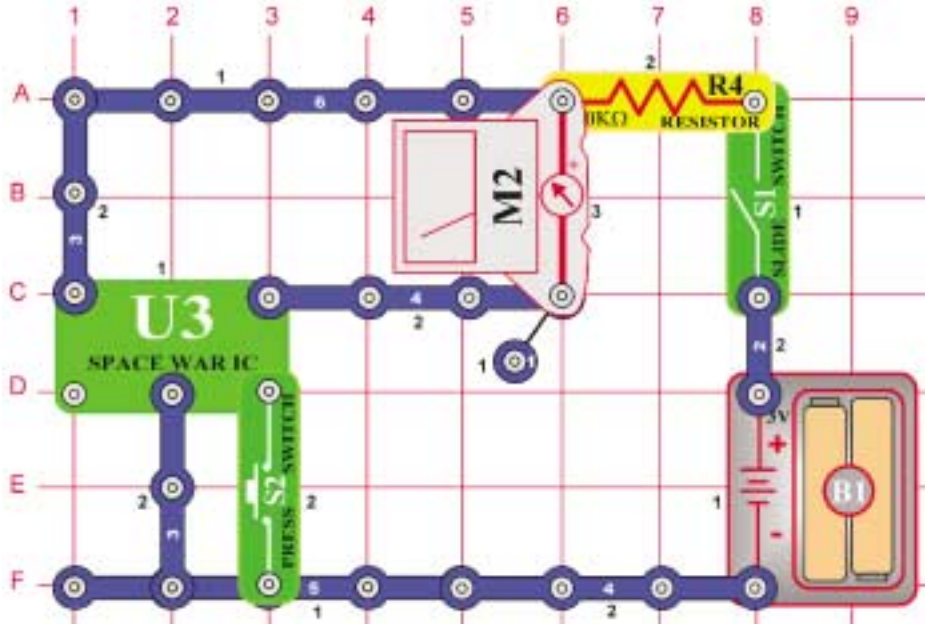
OBJECTIVE: View charging and discharging a capacitor.

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



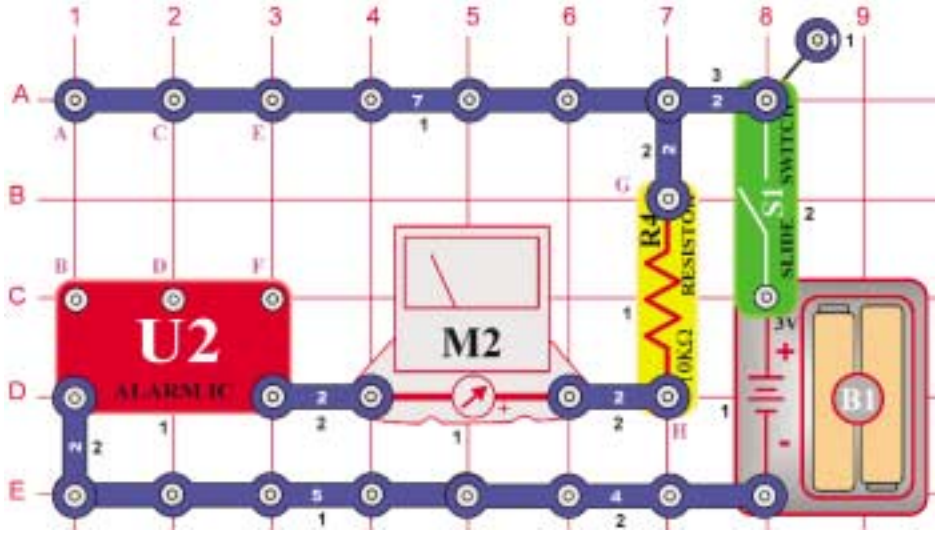
Hand-Control Space Meter

OBJECTIVE: Using the meter with the space war IC.

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.

Connect 3-snap wires to terminals E & F, and C & D. Turn on the switch (S1) and the meter (M2) swings rhythmically. You should hear a machine gun sound generated by the alarm IC (U2).

☐ 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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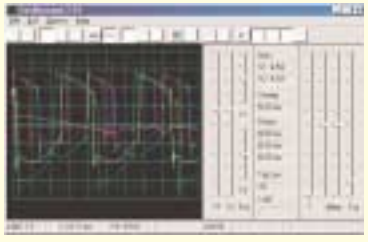

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