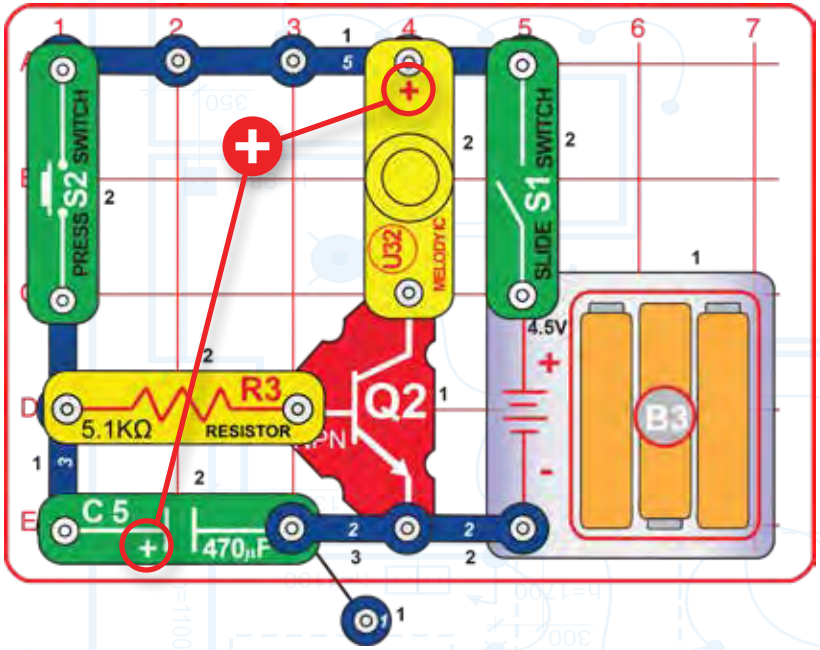
Project 15 | FADER



Build the circuit as shown, turn on the slide switch (S1), and then push the press switch (S2) to hear a melody. After you release the press switch the sound slowly fades out. Push the press switch to resume the sound.

Part B: Replace the melody IC (U32) with the motor (M4) and fan. The fan spins for a time after the press switch is released.

Part C: Replace the motor and fan with the white LED (D6). The LED slowly dims after you release the press switch.

Pressing S2 instantly charges up the 470µF capacitor (C5) and makes a control current flow into the NPN transistor (Q2), which turns on the melody IC. When S2 is released, the electricity stored in C5 slowly drains into Q2 through the 5.1kΩ resistor (R3), keeping the transistor and melody IC on for a short time until the capacitor has discharged. The white LED stays on longer than the melody IC or motor, because the white LED can operate at a lower current than the others.

Capacitors are used in fading circuits like this in your home, like when the light slowly fades as you leave the room or you hear a short stretch of music after you have turned off the radio.

Project 16 I TIMED WALL OF FUN

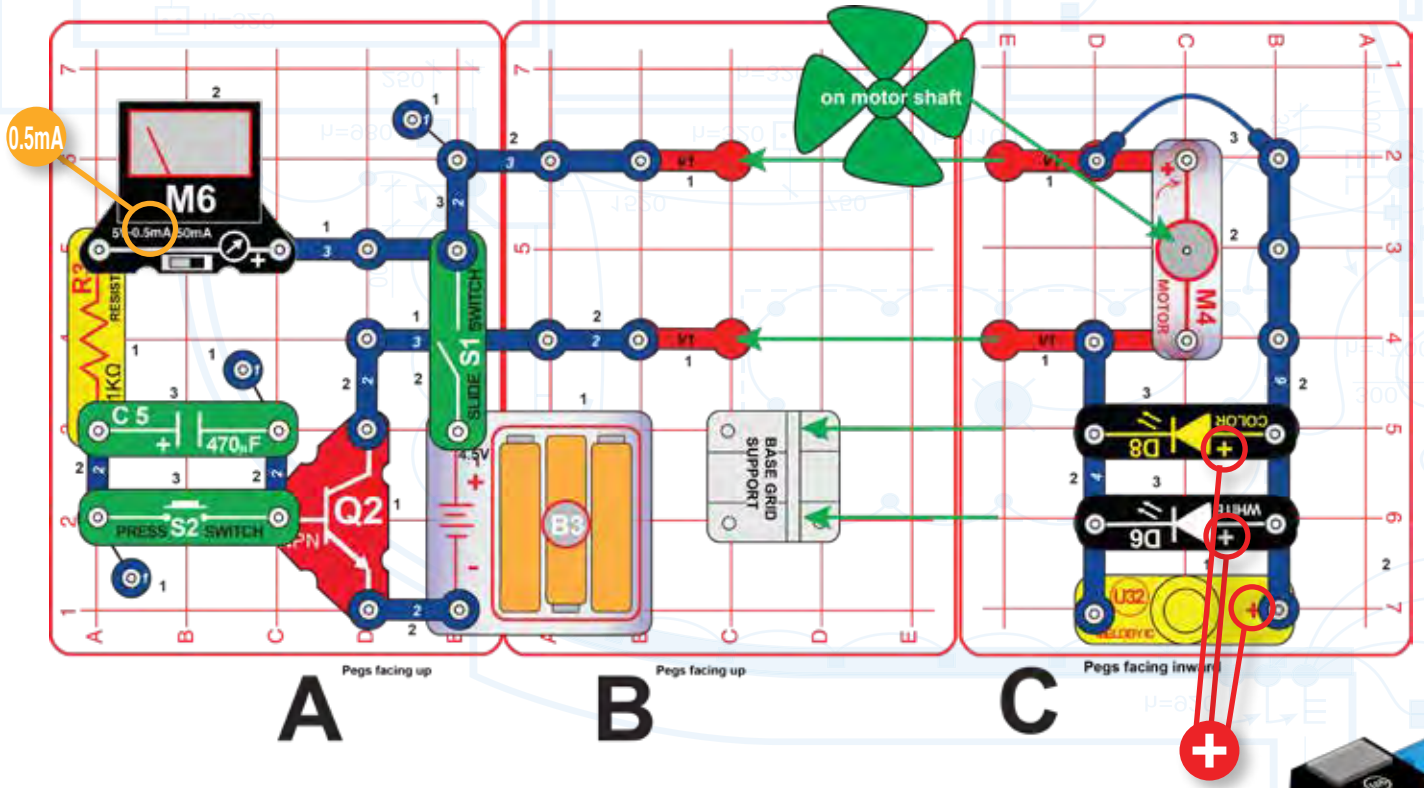
Assembly:

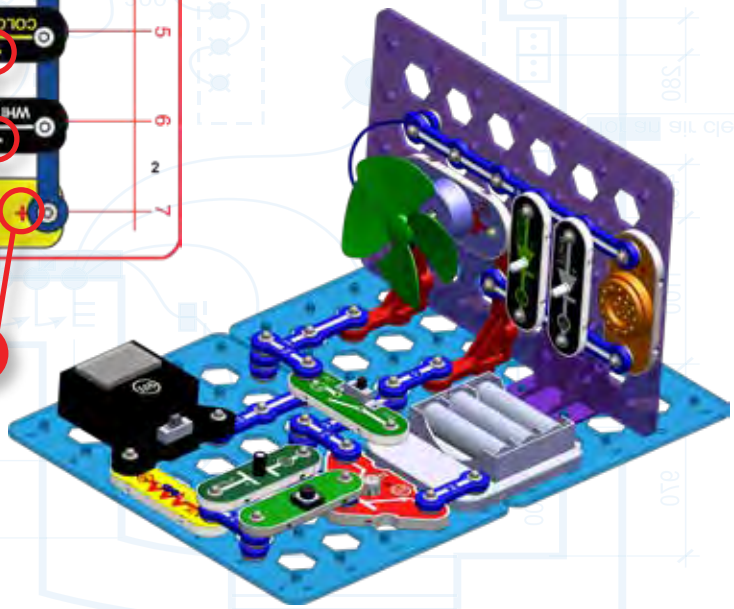
1. Place the base grid support on base grid B.

2. Place parts on grids C and install into base grid supports on grid B.

3. Install remaining parts on grids A&B.

Set the meter (M6) to the 0.5mA scale, push the press switch (S2), and then turn on the slide switch (S1). The motor (M4) spins the fan, the LEDs (D6 & D8) light, the melody IC (U32) plays a tune, and the meter measures the current charging the 470µF capacitor through the 5.1kΩ resistor. The meter shows the current decreasing and soon everything stops. Push the press switch to re-start the circuit.

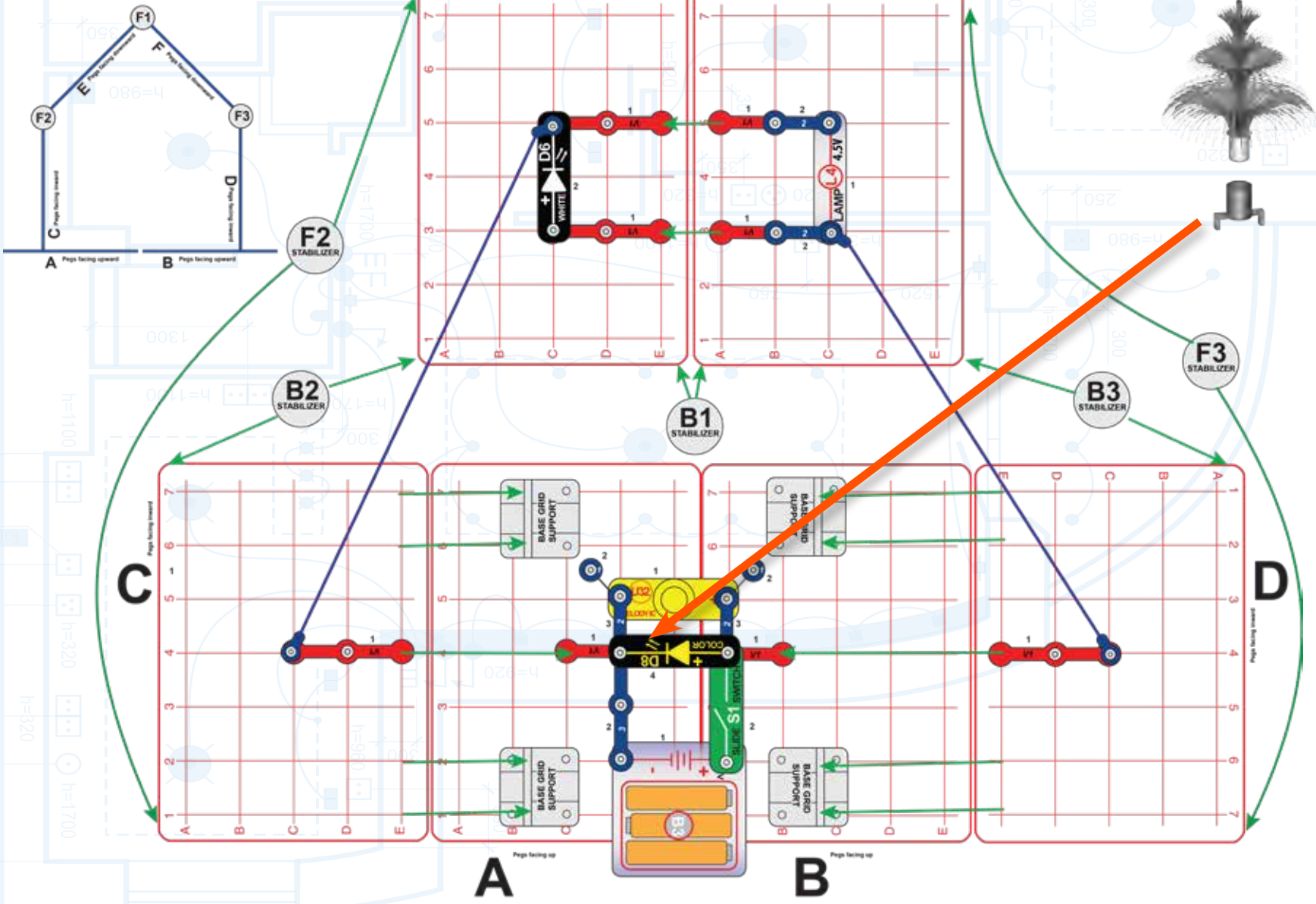




The lights, fan, and sound are on while capacitor C5 is charging, then stop as the capacitor gets fully charged. Pressing S2 instantly discharges the capacitor and resumes the fun. The circuit would run longer if you used a higher value resistor or capacitor, because then the charging would take longer.

Project 17 I FESTIVE HOUSE

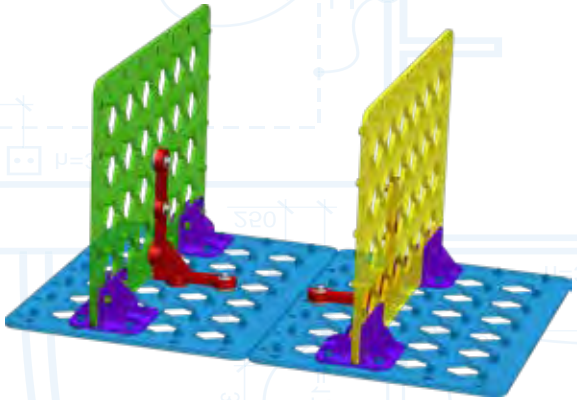
Do not leave the circuit for two minutes because the lamp will be hot.



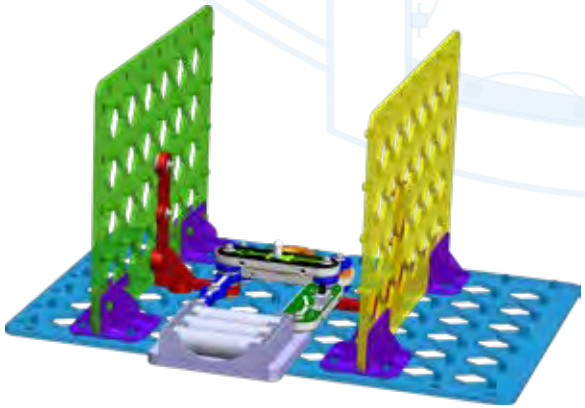
Assembly (adult supervision recommended):

1. Place base grid supports on base grids A & B.

2. Place parts (except for the blue jumper wires) on base grids C & D, and install into base grid supports on grids A & B. The pegs should be facing inward.

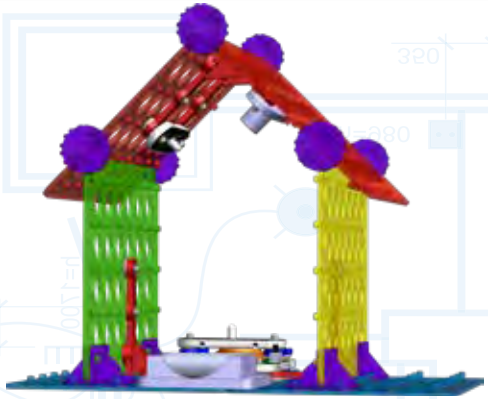


3. Place remaining parts on grid A & B.

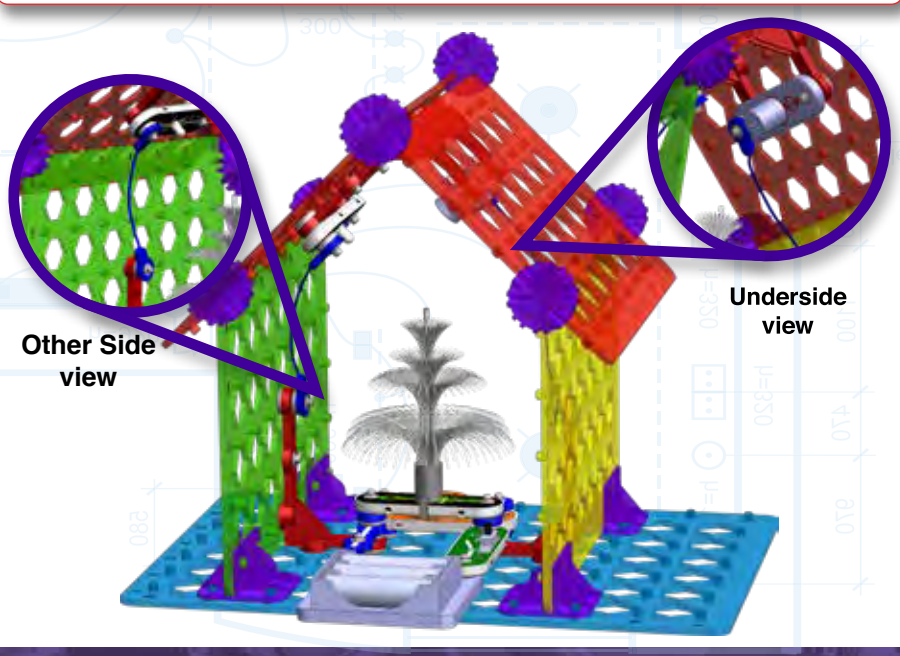


4. Mount grids E & F, at the angles shown and with pegs facing down, on top of grids C & D using 6 stabilizers, and attaching 2 vertical snap wires (V1) as you do it. Adjust the positions of the stabilizers as needed.

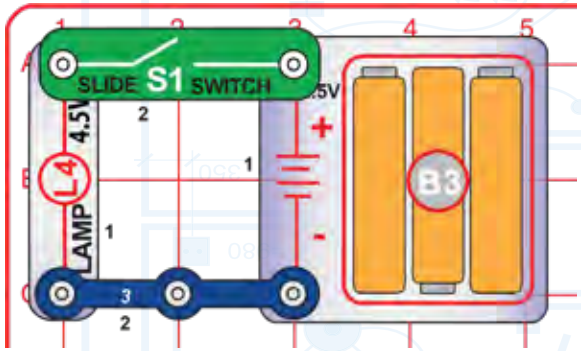
5. Add the remaining parts on grids E & F.



6. Add the 2 blue jumper wires, and place the fiber optic festive tree in its holder and on the color LED (D8). Turn on the slide switch (S1) to light the LEDs (D6 & D8) and lamp (L4).



Project 18 | ELECTRIC HEATER

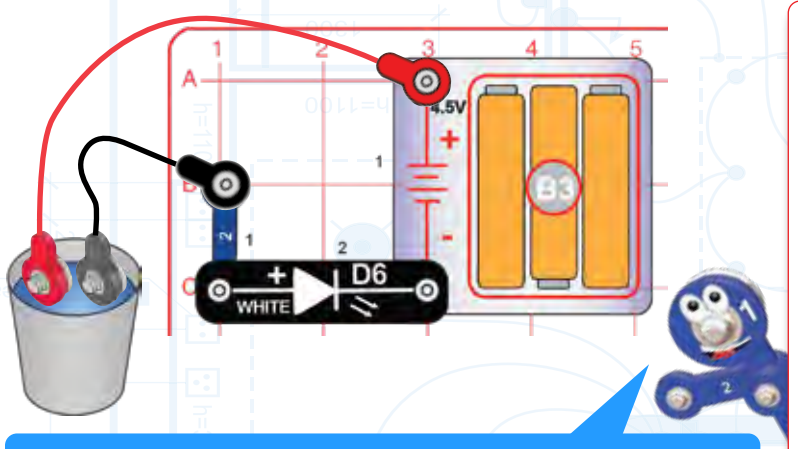


Turn on the slide switch (S1), cover the holes in the top of the lamp (L4) with your finger, and wait. After a minute or so you should feel the lamp heating up. *Do not leave the circuit for two minutes because the lamp will be hot.*

⚠ **CAUTION:** very warm lamp enclosure.

Incandescent light bulbs like L4 contain a special thin wire that gets so hot when electricity flows through it that it glows. Only about 5% of the electricity used in incandescent light bulbs is used to make light; the rest becomes heat, which is why you can feel the L4 lamp heat up when you cover its venting holes. Electric space heaters convert electricity to heat in a similar way to warm up a room.

Project 19 | WATER COMPLETES CIRCUIT



Distilled (or filtered) water has almost no impurities (or things other than water molecules) in it. Because of this, distilled water has a very high electrical resistance, meaning that current doesn't flow through it easily.

The water that comes out of your tap has chlorine, fluoride and other chemicals to make it safe for you to drink. Because of these impurities, tap water has a low electrical resistance, meaning that current flows through it rather easily.

Adding salt (sodium chloride) to the water decreases its resistance even more, because this adds sodium and chloride ions (or moveable charges) to the mix. This is why it is incredibly important that you don't enter a swimming pool when there's a chance of lightning. If lightning occurs anywhere near the pool, the high-energy electrons will follow the path of least resistance straight into the water and, because your body is mostly water, into you.

Build the circuit as shown, leaving the ends of the red & black jumper wires unconnected for now. Turn on the slide switch (S1); the white LED (D6) should be off.

Place the loose ends of the red & black jumper wires into a cup of water (but not distilled water), without them touching each other. The white LED should be on now, because water conducts electricity, completing this circuit.

Try dissolving some salt in the water or using different liquids, and see how the LED brightness changes. You can also replace the white LED with the color LED (D8).

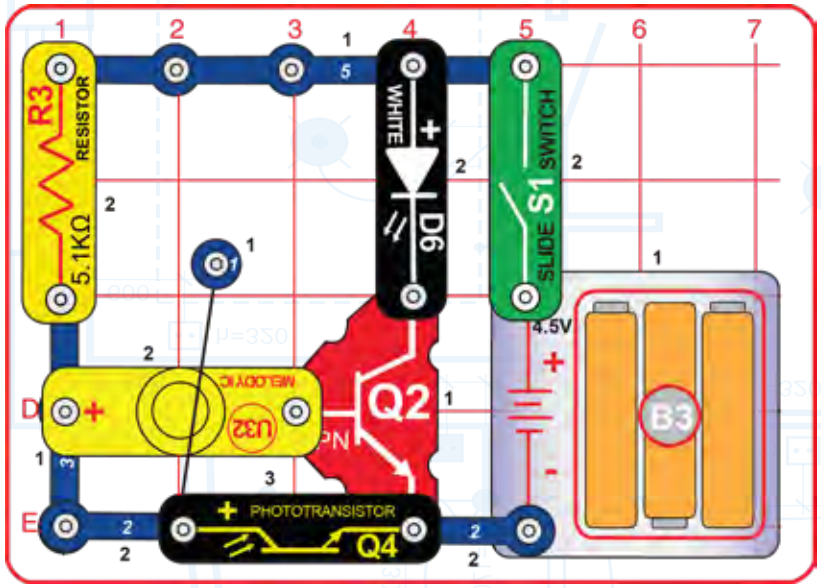
Don't drink any liquids used here.

There is no danger in touching the circuits you build with Snap Circuits because of the low-voltage batteries they use (4.5V). But the electricity from your electric company is a much higher voltage (120V), and it can seriously injure and even kill you if it enters your body. This is why it is important that you never touch a wire without disconnecting it from the electricity (by turning it off and unplugging it) or without placing proper insulation (materials that electrons cannot travel through) between you and the wire (which is why most of the wiring inside appliances has a colorful plastic coating).

Because tap water is **conductive** (low resistance), dropping a **live** wire (a wire that is plugged into your house's electricity) into your bath connects every wet part of your body to the 120V electricity flowing through the wiring in your house.

Part B: Instead of placing the red & black jumper wires in water, touch the metal part of each with your fingers, using your body to complete the circuit. Wet your fingers to get better electrical contact. The white LED (D6) should be on, but brightness may vary.

Project 20 I AUTOMATIC LIGHT

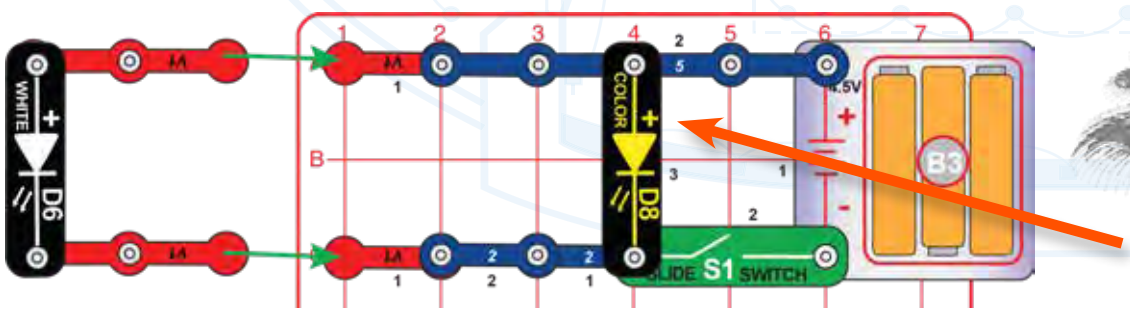


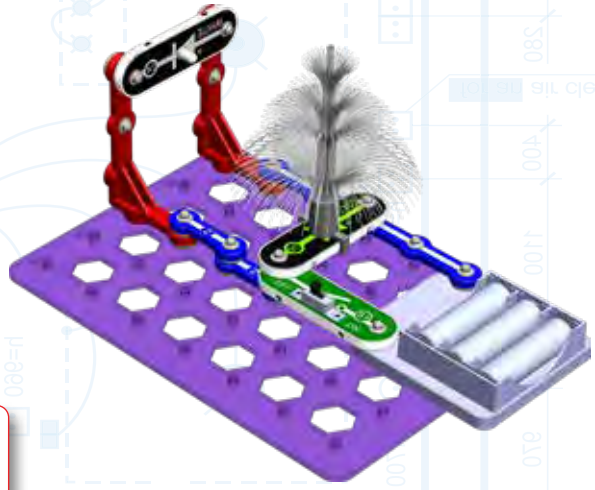
Build the circuit and turn on the slide switch (S1). The white LED (D6) will be on unless there is bright light on the phototransistor (Q4), so vary the amount of light shining on the phototransistor.

The melody IC (U32) will make little or no sound (it is used here to help control the phototransistor current).

This circuit automatically turns on the light when the room starts getting dark.

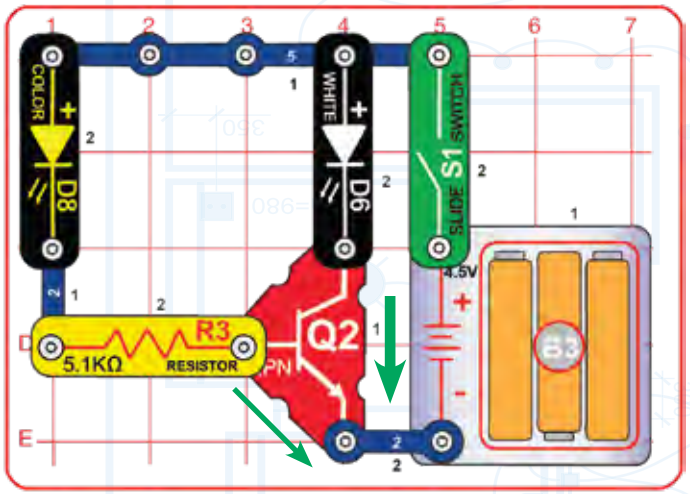
Project 21 I TREE LIGHTING





Use two vertical snap wires (V1) and mount the white LED (D6) on them so it will shine towards the festive fiber tree, mounted on the color LED (D8). Turn on the slide switch (S1) and place the circuit in a dimly lit room.

Project 22 | TRANSISTOR AMPLIFIER



Turn on the slide switch (S1). The color LED (D8) is dim but the white LED (D6) is bright.

Part B: Remove either LED (D6 or D8) and see what happens to the other one.

Part C: Swap the locations of the white LED (D6) and the color LED (D8).

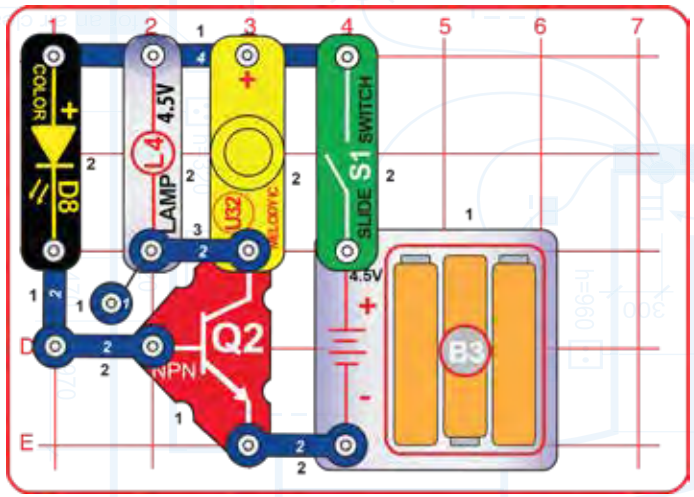
Part D: In the original circuit, replace the color LED with the press switch (S2). Notice that the white LED is only on when S2 is pressed.

The NPN transistor (Q2) is a current amplifier, meaning it takes a small current and makes it larger. When a small current flows into Q2 through the left branch (through D8), a larger current will flow into Q2 through the right branch (with D6). Green arrows show the current flow. This is why the LED on the right side will be brighter than the LED on the left side. In fact, the current in the right branch can be as much as100 times larger than the current in the left branch.

The left branch controls the right branch, so removing D8 turns off D6, but removing D6 does not affect D8.

A small electric current may be flowing through the color LED even when it appears to be off. This small current, when it pass through the NPN transistor (Q2) and gets amplified, can be enough to keep the white LED on.

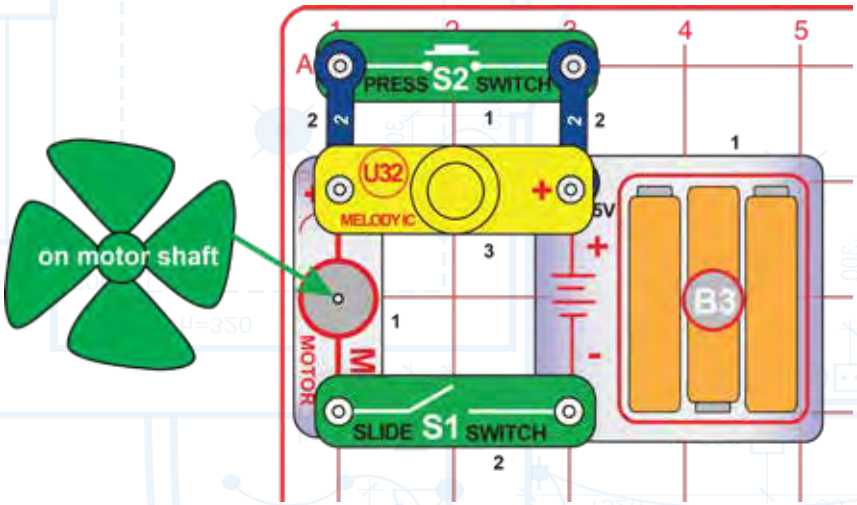
Project 23 | LIGHT & SOUND



Turn on the slide switch (S1) to get a blinking light with funky sounds. You can change the sound by removing the lamp (L4).

This circuit uses the blinking pattern of the color LED (D8) to control the current flowing through the lamp (L4) and melody IC (U32), making them go on and off. The NPN transistor (Q2) allows D8 to control the other electrical components. The melody IC does not start up instantly, so the blinking pattern of the color LED produces unusual sound effects in the melody IC.

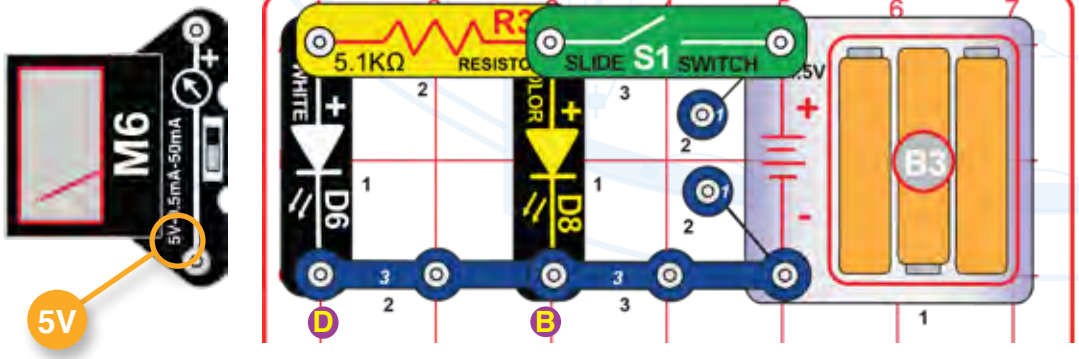
Project 24 I AUDIO FAN SPEED ADJUSTER



Turn on the slide switch (S1). The fan should spin and there should be sound from the melody IC (U32). If the fan does not spin then push the press switch (S2) to get the fan started.

The speed of the fan varies depending on the current flowing into the melody IC, and the melody IC current depends on the sound it is making.

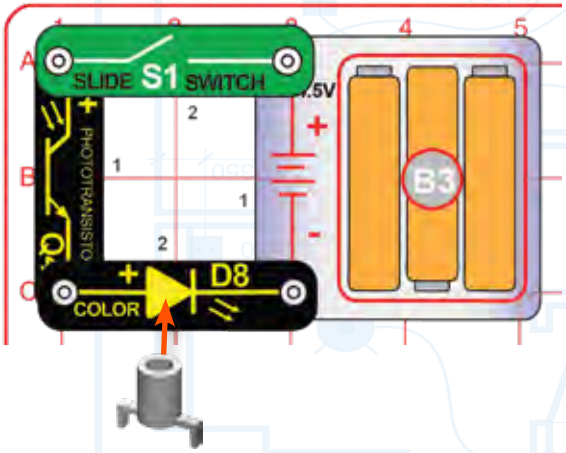
Project 25 I DISTANCE LOSS SIMULATOR



This circuit is intended to simulate electrical transmission loss over long distances. Turn on the slide switch (S1). The color LED (D8) is bright but the white LED (D6) is not at full brightness. Set the meter (M6) to the 5V setting and place it across points A & B to measure the voltage across the color LED, and then across points C & D to measure the voltage across the white LED.

The color LED is only separated from the batteries by the slide switch (S1), so it gets the full battery voltage (pressure) when the switch is on. The white LED is separated from the batteries by the 5.1kΩ resistor R3 (which represents the loss of electrical energy when it is transmitted over long distances); this slows down the current so that the white LED has a noticeably lower voltage across it.

Project 26 | LIGHT-CONTROLLED LIGHT



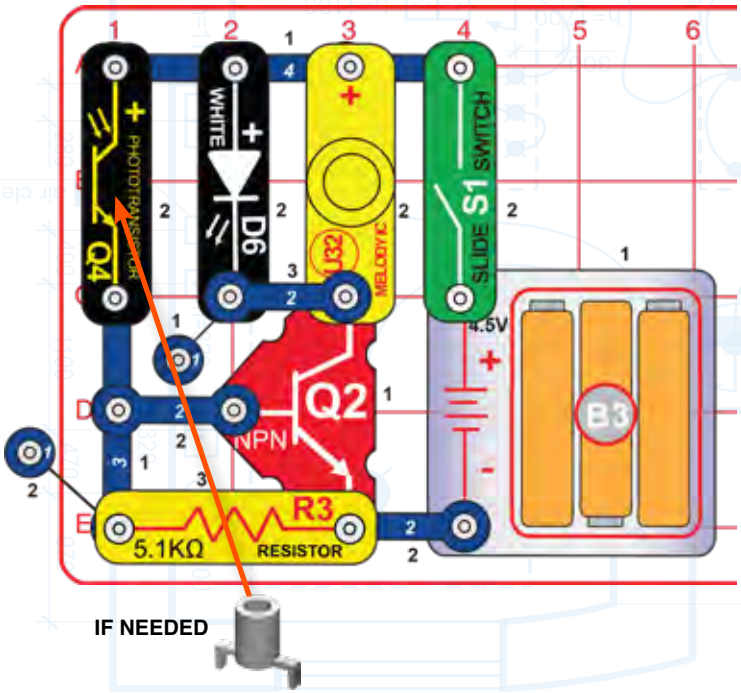
Turn on the slide switch (S1) and vary the amount of light shining on the phototransistor (Q4). The brighter the light on the phototransistor, the brighter the color LED (D8) should be. The Q4 attachment is placed on D8, to make it easier to see if it is dim.

Next, replace the color LED (D8) with the white LED (D6). Compared to the color LED, the white LED requires more light on Q4 to turn on, but gets brighter when there is a lot of light on Q4.

The phototransistor uses light to control electric current. When more light shines on the phototransistor, the current flowing through it increases, making the LED glow more brightly.

Project 27 | PHOTO CONTROL

In this project, the phototransistor is able to control other devices (like the LEDs) much more easily than in the preceding project. This is because the NPN transistor (Q2) is used to amplify (or increase) the current, enabling the small current that passes through the phototransistor to control the much larger electric current that passes through the LEDs.



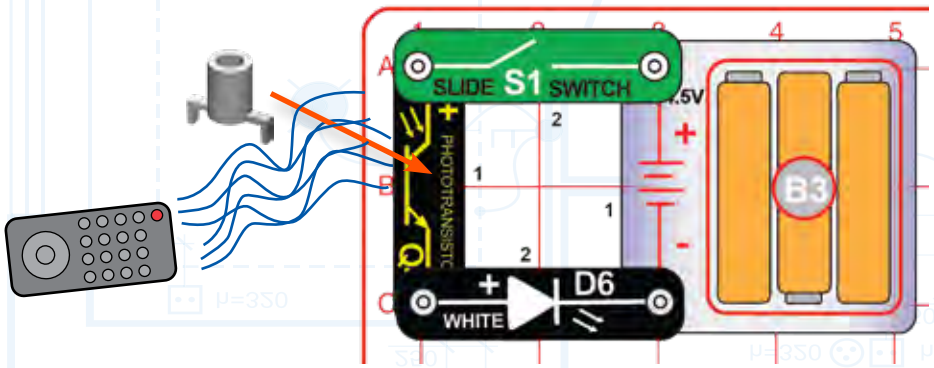
Build the circuit and turn on the switch (S1). The white LED (D6) and melody IC (U32) will be on if there is light on the phototransistor (Q4); cover the phototransistor to turn them off. If the LED and horn turn on too easily then place the Q4 attachment on Q4 to restrict the light to it. You can also replace D6 or U32 with the color LED (D8) or the lamp (L4).

Part B: Remove the resistor (R3), and see how its sensitivity to light changes. (The resistor (R3) diverts some current from the phototransistor to keep the circuit from being too sensitive to light.)

Part C, Adjustable Speed Fan: In the original circuit, replace the melody IC (U32) with the motor (M4) and fan. Vary the amount of light shining on the phototransistor to adjust the fan speed.

Part D: In the original circuit, swap the locations of Q4 and R3 (for Q4, put "+" on left). Now the light control is opposite.

Project 28 | INFRARED-CONTROLLED LIGHT

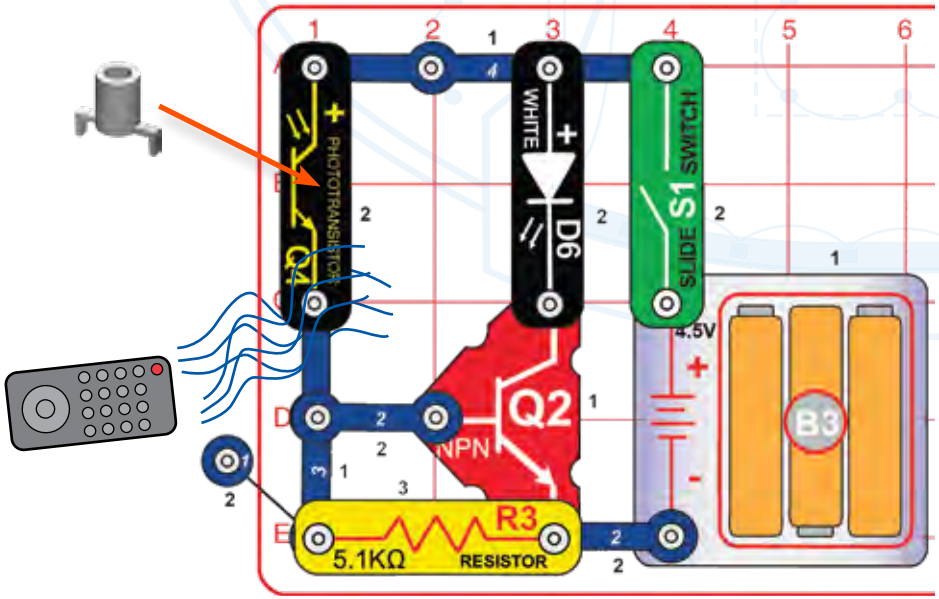


You need an infrared remote control for this project, such as any TV/ stereo/DVD remote control in your home.

Build the circuit and turn on the switch (S1). Place the Q4 attachment on the phototransistor (Q4). Position the circuit away from lights in the room so that the white LED (D6) is off. Point your remote control directly into the Q4 attachment, and press any button to turn on the white LED. The LED may not get very bright.

The phototransistor detects light, including infrared light that is invisible to the human eye.

Project 29 | IR CONTROL



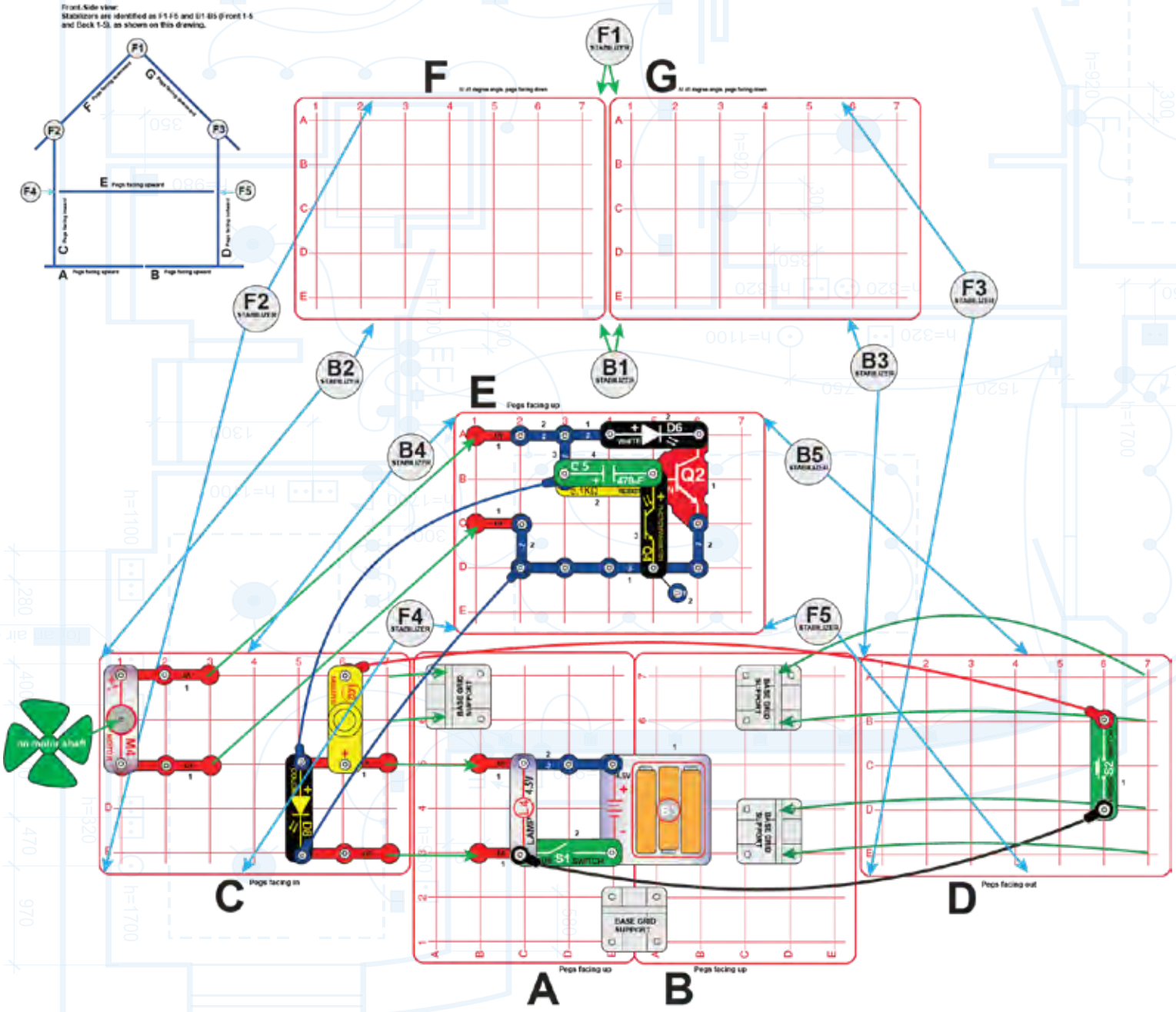
You need an infrared remote control for this project, such as any TV/ stereo/DVD remote control in your home.

Turn on the slide switch (S1) and place the Q4 attachment on the phototransistor (Q4). Position the circuit away from lights in the room so that the white LED (D6) is off. Point your remote control directly into the Q4 attachment, and press any button to turn on the white LED.

Note that when the phototransistor (Q4) is activated by room lights the white LED is on continuously, and when the phototransistor is activated by your infrared remote control LED will be blinking.

The phototransistor detects light, including infrared light that is invisible to the human eye. The white LED blinks even if you press the remote control continuously, because the signal that is coming from your remote control is a stream of infrared light bursts. Each burst of infrared light causes a burst of current to flow through the LED, making it blink.

Project 30 | 2-STORY HOUSE



The light covers and slides may be placed on the LEDs (D6 and D8) or lamp (L4) as decoration. Fold the slides as indicated and slide them into the slots on the cover, as shown.



Assembly (adult supervision recommended):

1. Place base grid supports on base grid A & B.

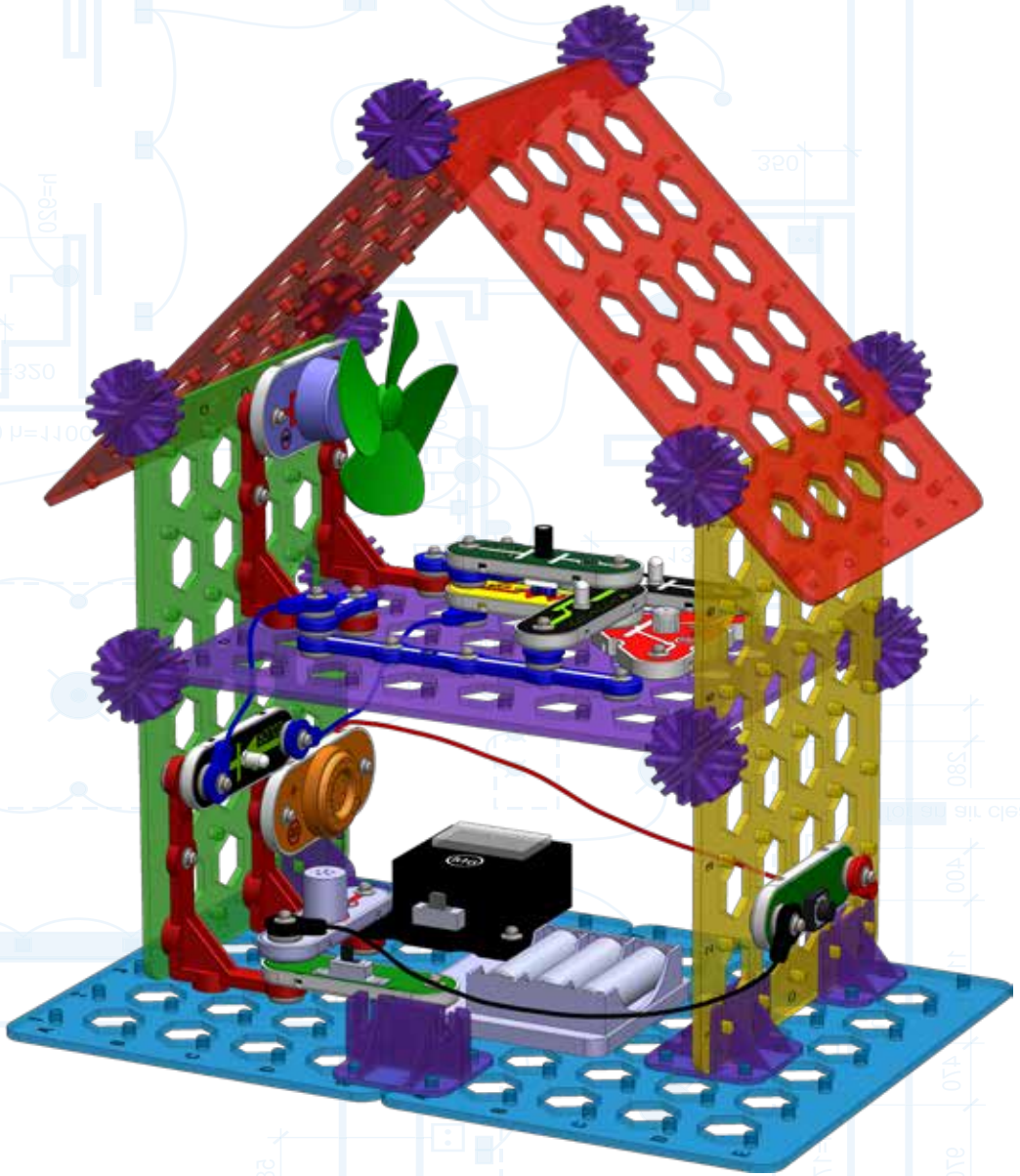
2. Place parts (except for the jumper wires) on base grids C & D, and install into base grid supports on grids A & B. The pegs should be facing inward for grid C and outward for grid D.

3. Place remaining parts on grids A & B.

4. Place parts on grid E, and mount grid E onto grids C & D using 4 stabilizers, connecting to the vertical snap wires (V1) on grid C as you do this. Adjust the positions of the stabilizers as needed. Attach all jumper wires if you have not done so already.

5. Mount grids F & G, at 45 degree angles and with pegs oriented down, on top of grids C & D using 6 stabilizers. Adjust the positions of the stabilizers as needed.

Turn on the slide switch (S1). The lamp (L4), motor (M4), and color LED (D8) should be on. Push the press switch (S2) to hear a doorbell (from the melody IC (32)). The white LED (D6) is bright if room is dark, and gets dim as you shine light on phototransistor (Q4); shine a bright light on Q4 to turn off D6. If desired, place the light covers with a slide on any of the LEDs or the lamp. *Do not leave the circuit for two minutes because the lamp will be hot.*

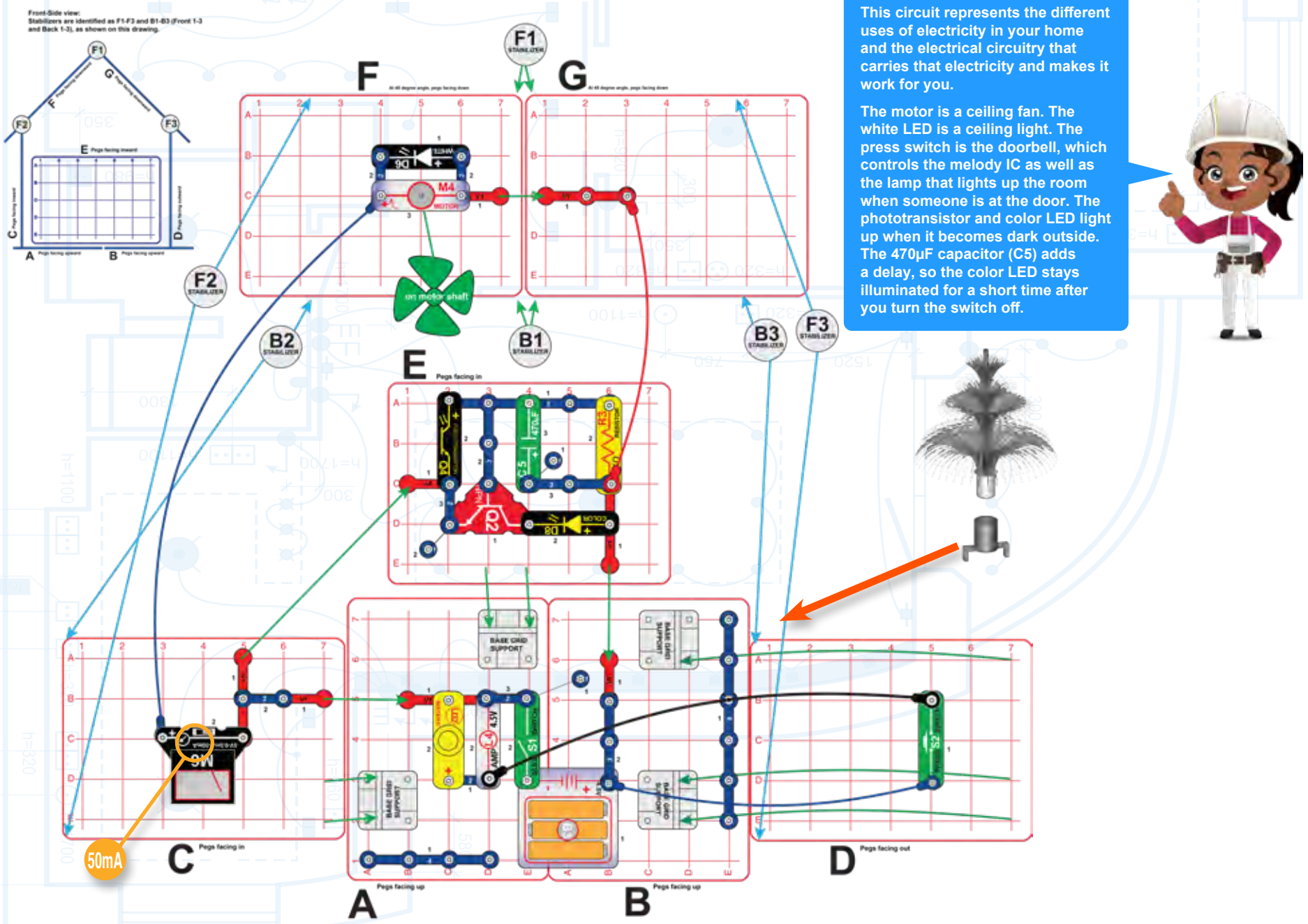


Project 31 | 3-WALL HOUSE

The circuit built in this project is pictured on the front of your box and manual, so you can use that picture as a guide here.

This circuit represents the different uses of electricity in your home and the electrical circuitry that carries that electricity and makes it work for you.

The motor is a ceiling fan. The white LED is a ceiling light. The press switch is the doorbell, which controls the melody IC as well as the lamp that lights up the room when someone is at the door. The phototransistor and color LED light up when it becomes dark outside. The 470µF capacitor (C5) adds a delay, so the color LED stays illuminated for a short time after you turn the switch off.



The light covers and slides may be placed on the LEDs (D6 and D8) or lamp (L4) as decoration. Fold the slides as indicated and slide them into the slots on the cover, as shown.



Assembly (adult supervision recommended):

1. Place base grid supports on base grid A & B.

2. Place parts on base grids C & D (leaving one end of the jumper wires unconnected for now), and install into base grid supports on grids A & B. The pegs should be facing inward on grid C and outward on grid D.

3. Place parts on grid E, and install into the base grid support on grid A, connecting to the vertical snap wire (V1) on grid C as you do this.

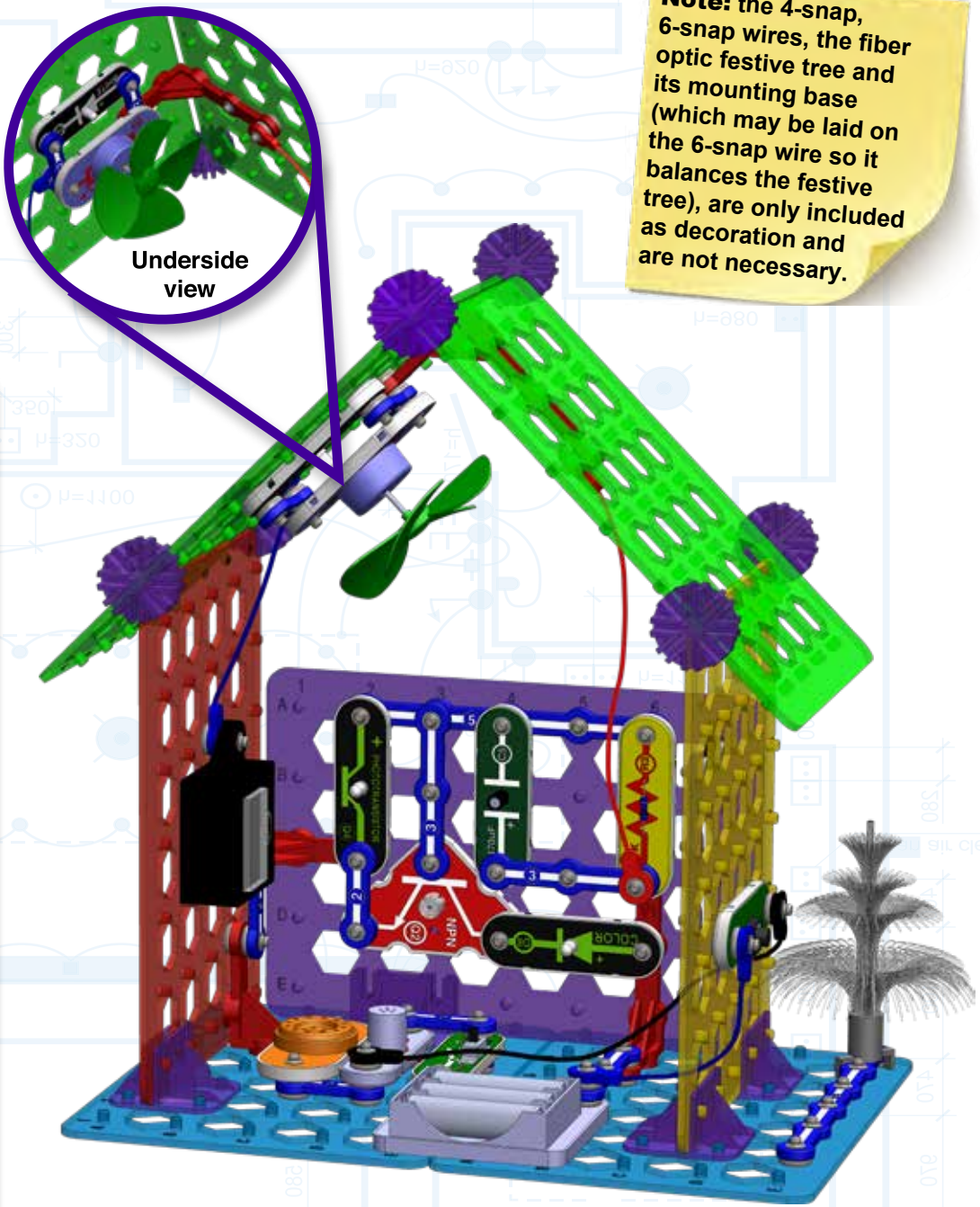
4. Place remaining parts on grids A & B.

5. Connect a vertical snap wire (V1) between grids F & G, and mount those grids at 45 degree angles and with pegs oriented down on top of grids C & D using 6 stabilizers. Adjust the positions of the stabilizers as needed.

6. Place the remaining parts on grid F, and connect to the blue jumper wire on grid C.

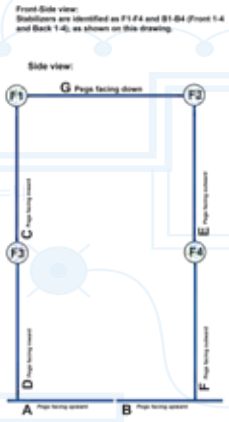
7. Add the remaining jumper wires (1 blue, 1 black, and 1 red).

Set the meter to the 50mA scale and turn on the slide switch (S1). The motor (M4) spins the fan and white LED (D6) lights; the meter measures the current through them. The color LED (D8) is bright if room is dark, and gets dim as you shine light on phototransistor (Q4); shine a bright light on Q4 to turn off D8. Push the press switch (S2) to hear a doorbell sound from the melody IC (32) and light the lamp (L4). If desired, place the light covers with a slide on any of the LEDs or the lamp.

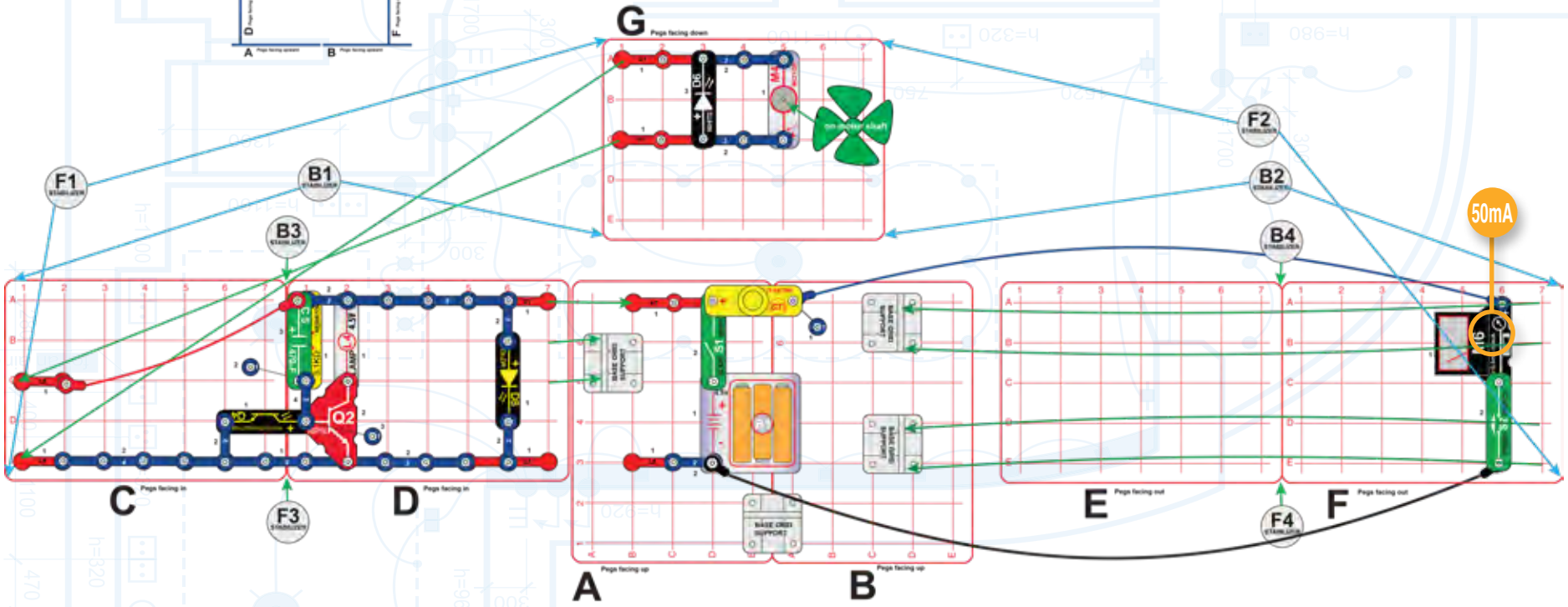


Note: the 4-snap, 6-snap wires, the fiber optic festive tree and its mounting base (which may be laid on the 6-snap wire so it balances the festive tree), are only included as decoration and are not necessary.

Project 32 I HIGH CEILING HOUSE



The "doorbell" circuit (melody IC, Meter, and push switch) can be activated even if the main switch (S1) is turned off. S1 turns on and off the color LED (D8) on the wall, the white LED (D6), and motor (M4) in the ceiling. Transistor Q2 inverts (or flips) the way the light on the phototransistor controls the lamp; as long as the light shining on the phototransistor (Q4) is dim, lamp (L4) will be on when S1 is on.



The light covers and slides may be placed on the LEDs (D6 and D8) or lamp (L4) as decoration. Fold the slides as indicated and slide them into the slots on the cover, as shown.



Assembly (adult supervision recommended):

1. Place base grid supports on base grids A & B.

2. Place parts (except for the jumper wires) on base grids D & F, and install into base grid supports on grids A & B. The pegs should be facing inward on grid D and outward on grid F.

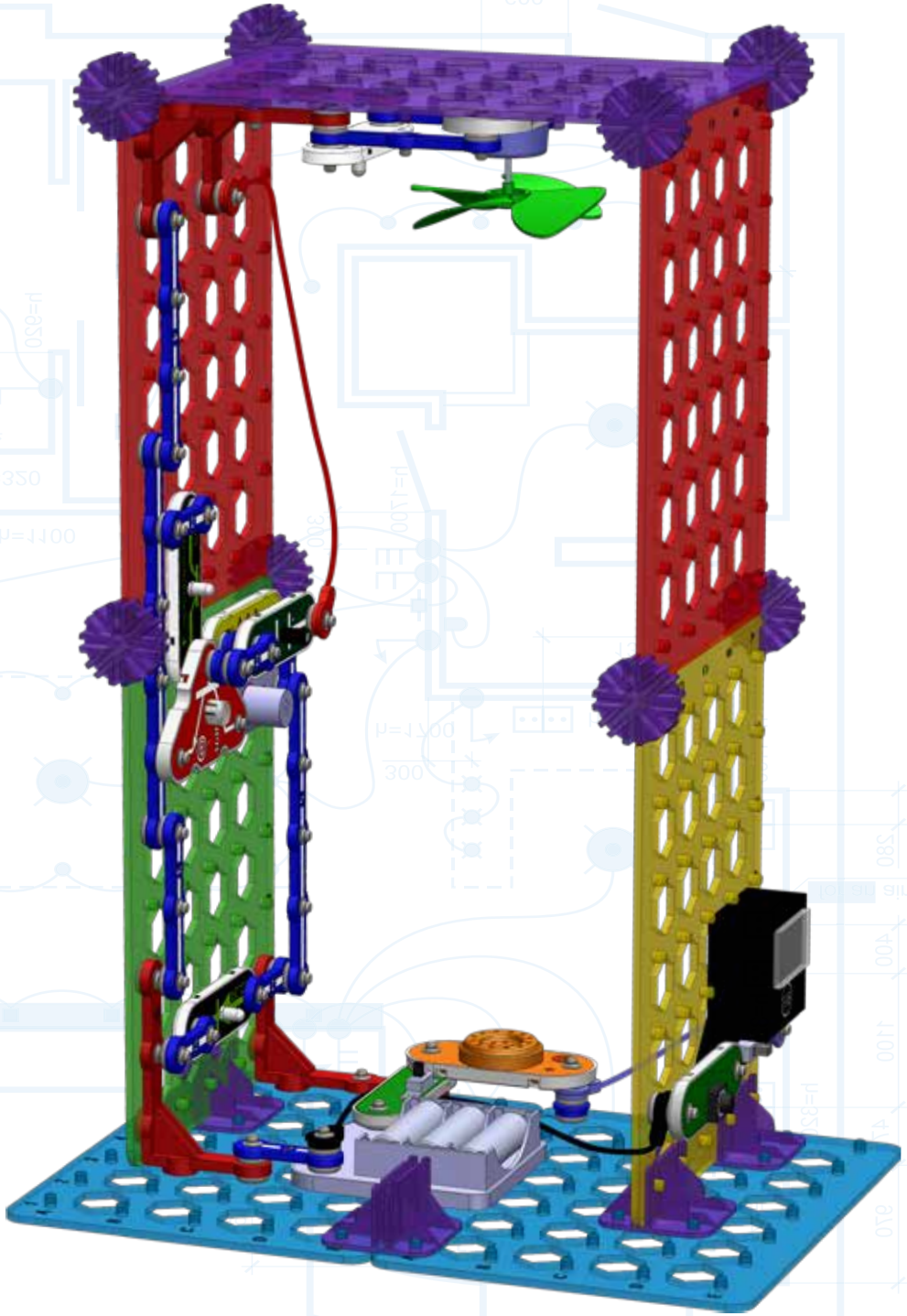
3. Place remaining parts on grids A & B, including the blue and black jumper wires that connect to parts on grid F.

4. Place parts on base grids C & E, and install on top of grids D & F using 4 stabilizers, as shown. The pegs should be facing inward on grid C and outward on grid E. Also connect the red jumper wire.

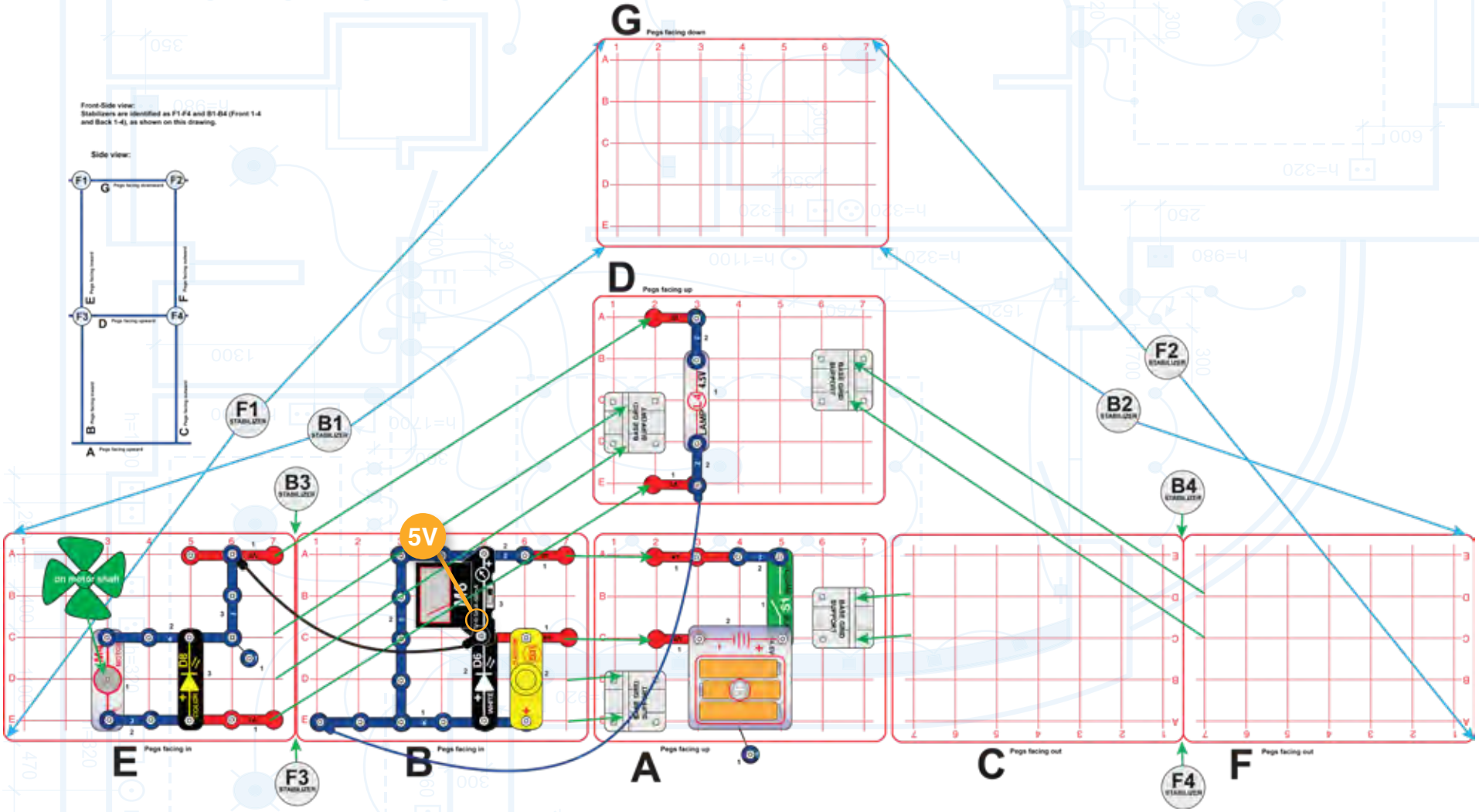
5. Mount grid G, with pegs oriented down, on top of grids C & E using 4 stabilizers, attaching to the vertical snap wires (V1) on grid C as you do this. Adjust the positions of the stabilizers as needed.

6. Connect the remaining parts on grid G.

Set the meter (M6) to the 50mA scale and turn on the slide switch (S1). The white LED (D6) and color LED (D8) are on while the motor (M4) spins the fan. Push the press switch (S2) to play a doorbell on the melody IC (U32); the meter measures the doorbell current. The lamp (L4) is bright if room is dark, and gets dim as you shine light on phototransistor (Q4); shine a bright light on Q4 to turn off L4. If desired, place the light covers with a slide on any of the LEDs or the lamp.



Project 33 | 2-STORY BUILDING



The light covers and slides may be placed on the LEDs (D6 and D8) or lamp (L4) as decoration. Fold the slides as indicated and slide them into the slots on the cover, as shown.



Assembly (adult supervision recommended):

1. Place base grid supports on base grids A & D.

2. Place parts (except for the jumper wires) on base grid B, and install grids B & C into base grid supports on grid A. The pegs should be facing inward on grids B and C.

3. Place parts (except for the jumper wires) on base grid E, and install grids E & F into base grid supports on grid D. The pegs should be facing inward on grids E and F.

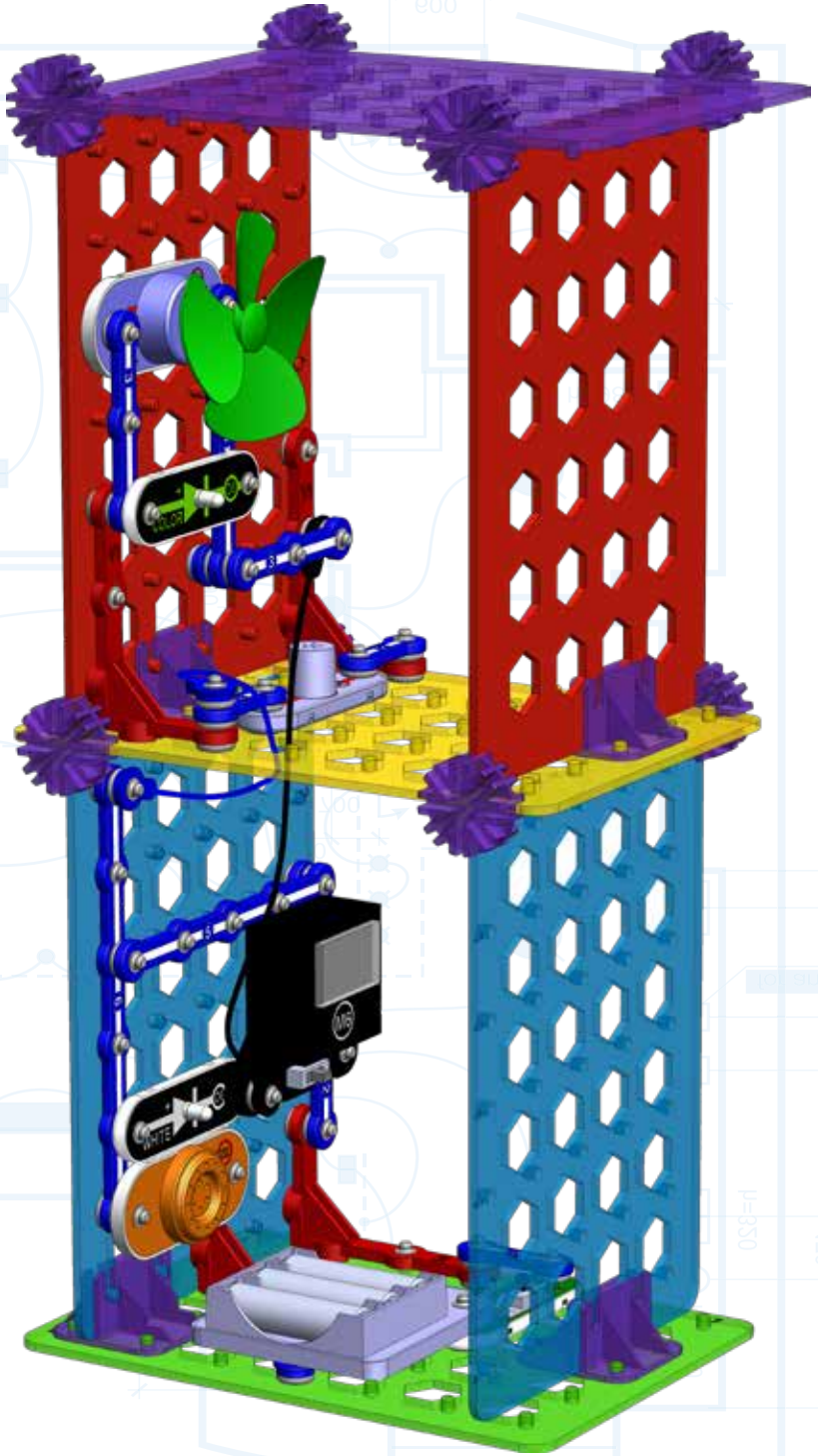
4. Place remaining parts on grids A & D.

5. Mount grids D-E-F assembly on grids B & C using 4 stabilizers, as shown. Adjust the positions of the stabilizers as needed.

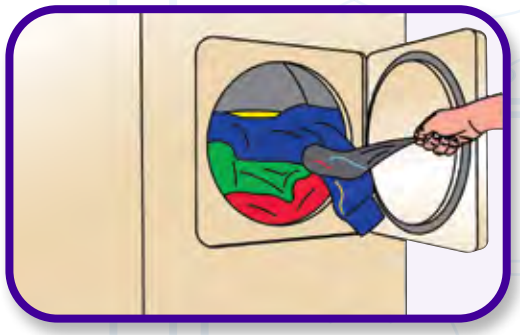
6. Mount grid G on grids E & F using 4 stabilizers, as shown. The pegs on grid G should be facing down. Adjust the positions of the stabilizers as needed.

7. Connect the blue and black jumper wires as shown.

Set the meter (M6) to the 5V scale and turn on the slide switch (S1). The lamp (L4) and LEDs (D6 & D8) light, the melody IC plays a tune, the motor (M4) spins the fan, and the meter measures the battery voltage. You can place a slide on one of the light covers and place it on the color LED or lamp. The LEDs, lamp, and melody IC can be re-arranged as desired. *Do not leave the circuit for two minutes because the lamp will be hot.*



Project 34 | STATIC ELECTRICITY



Find clothes that cling together in the dryer, and try to uncling them.

Rub a sweater (wool is best) and see how it clings to other clothes.

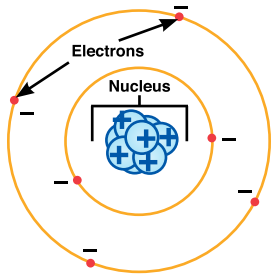
Take off a sweater (wool is best) and listen for crackling noises. Try it in a dark room and see if you see sparks. Compare the effects with different fabrics (wool, cotton, etc.).

Note: this project works best on a cold dry day. If the weather is humid, the water vapor in the air allows the static electric charge to dissipate, and this project may not work.

Electricity exists everywhere, because electrical charges (electrons and nuclei) are everywhere. But usually the positive and negative charges are so well balanced (or nearly equal) that you don't notice the tiny amount of electrons jumping around. But under certain conditions, like the dry heat inside your house in winter, electrical charges can build up in certain materials and sparks can fly.

These effects are caused by electricity. We call this static electricity because the electrical charges are static (not moving). When electricity flows (usually through wires) we call it an electric current. And electric current flows because of the attraction and repulsion of the charged particles in conducting materials that are physically connected.

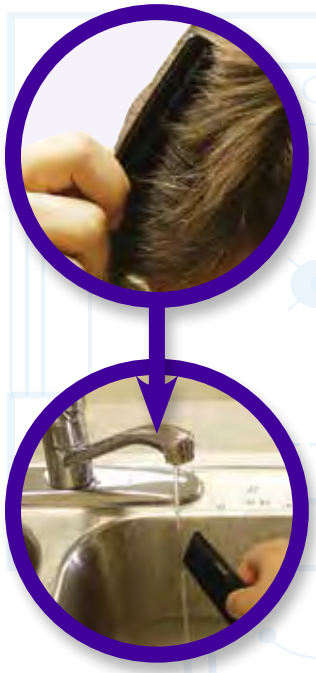
Atoms are the smallest amount of matter that can exist independently in our world. All materials are made out of atoms, and they are really, really tiny. Atoms contain a central nucleus (which has a positive electrical charge) that is surrounded by tiny electrons (which are negative electrical charges).



When you rub two materials together, electrons can move from one material to the other, causing a charge imbalance; in other words, one material becomes more negatively charged and the other material becomes more positively charged. When the materials come in close contact again, electrons will flow back to their original material in order to balance things out again.

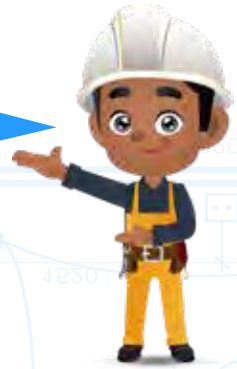
If you pull two fuzzy sweaters apart in the wintertime, you'll likely hear a sound like static on the radio. Like the thunder that accompanies lightning, this crackling sound is the sound of electrons traveling through the air from one sweater to the other. We call this static electricity.

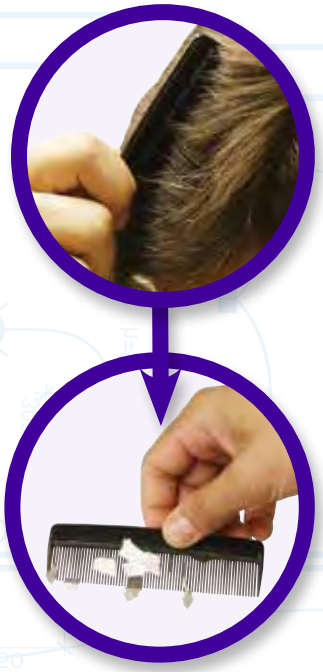
Static electricity can build up in people too; the shock you sometimes feel when someone touches you is just the sensation of electrons flowing from their body into yours. Sometimes the static electricity (or buildup of electrons) becomes so great that, when it discharges (or flows into something else), it can produce light and even fire (like lightning).



You need a comb (or plastic ruler) and a water faucet for this part. Run the comb through your hair several times then hold it next to a slow, thin stream of water from a faucet. The water will bend towards it. You can also use a plastic ruler. Rub it on your clothes (wool works best).

Rubbing the comb through your hair builds up a static electrical charge on it, which attracts the water.





Find a comb (or plastic ruler) and paper. Rip up the paper into small pieces. Run the comb through your hair several times then hold it near the paper pieces to pick them up. You can also use a pen or plastic ruler, rub it on your clothes (wool works best).

Notice how your hair can "stand up" or be attracted to the comb when the air is dry. How will this change if you wet your hair? (Try it.)

Rubbing the comb through your hair pulls electrons from your hair onto the comb. These give the comb a static charge, which attracts the paper.

Take a piece of newspaper or other thin paper and rub it vigorously with a sweater or pencil. It will stick to a wall.

Cut the paper into two long strips, rub them, then hang them next to each other. See if they attract or repel each other.

Rub two balloons on a sweater and hang the rubbed sides next to each other. They repel away. You could also use the balloons to pick up tiny pieces of paper.

HOW TO USE YOUR SNAP CIRCUITS®

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

For Example:

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

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

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

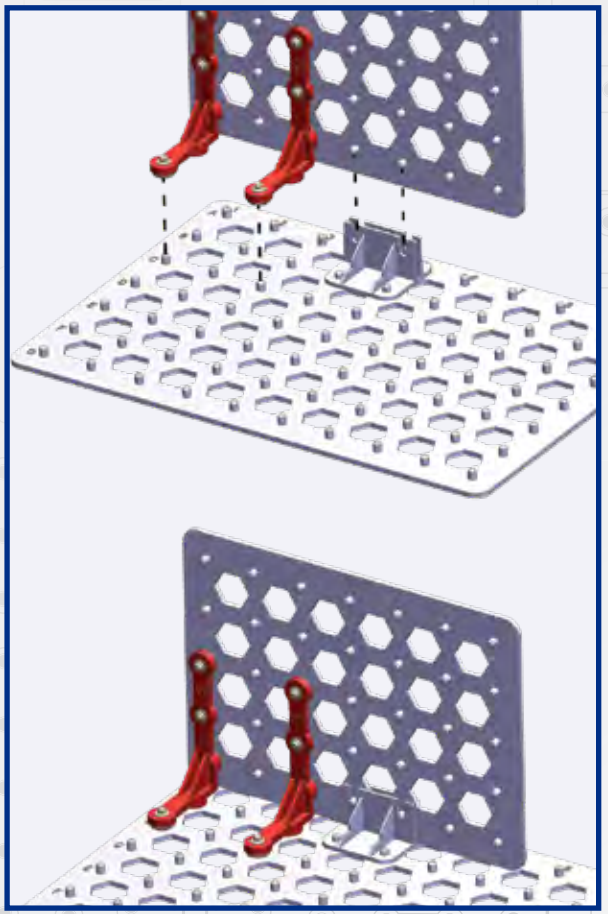
You need a power source to build each circuit. This is labeled (B3) and requires three (3) 1.5V "AA" batteries (not included).

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

Seven colored plastic base grids are included with this kit to help keep the circuit blocks properly spaced. You will see evenly spaced posts that the different blocks snap into. The base has rows labeled A-E and columns labeled 1-7. The colored grids are interchangeable, so you can use any colors you want in any project.

Next to each part in every circuit drawing is a small number in black. This tells you which level the component is placed at. Place all parts on level 1 first, then all of the parts on level 2, then all of the parts on level 3, etc.
Some circuits use the jumper wires to make unusual connections. Just clip them to the metal snaps or as indicated.

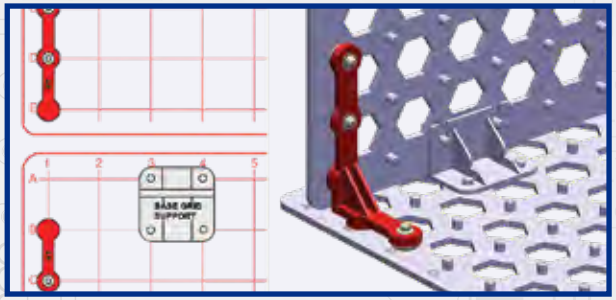
When assembling the 3D circuits, the order in which parts are installed is important. In particular, the vertical snap wires (V1) need to be snapped onto the mini base grid first and then the mini base grid is slid into the base grid support as shown below.



HOW TO USE YOUR SNAP CIRCUITS®

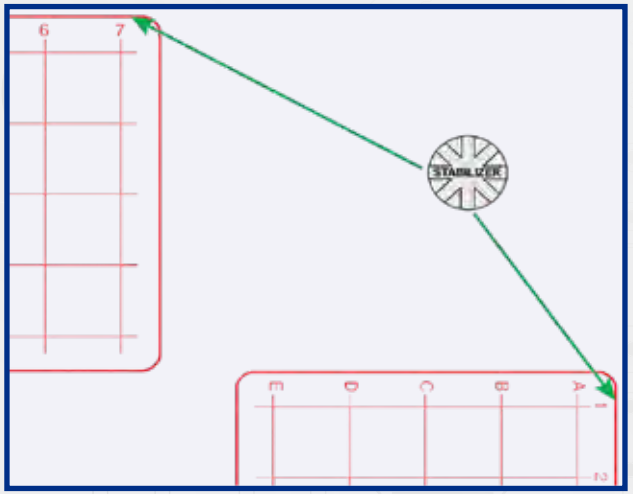
Due to the complex nature of building 3D circuits, the circuit diagrams use special symbols that may need additional clarification. One such example is the symbol for the vertical snap wire (V1). It consists of two parts, the horizontal base and vertical stem. In the illustration below, the base is attached to the large base grid and the stem is attached to the mini base grid. The symbol makes V1 appear as two separate parts, but in reality the symbol is connected at the red circular ends.

Another symbol of note is the base grid support. It is important to pay attention to the orientation of the part in the diagram since it is not symmetrical. The figure below shows the symbol with the narrow channel on top. This corresponds to the 3D rendering showing the base grid support orientation.

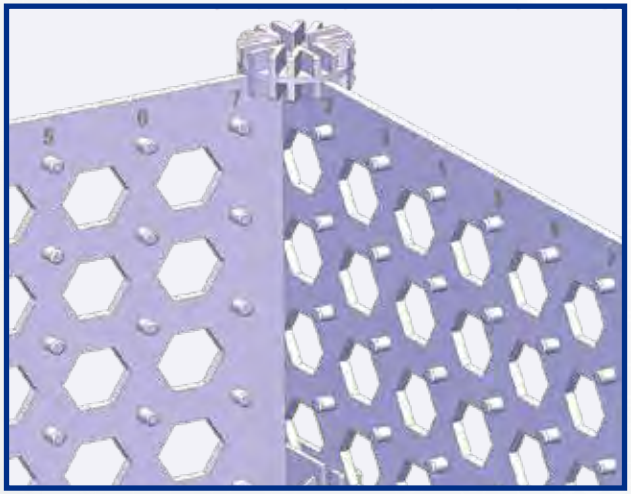


When inserting the base grid into the base grid support, it is a good idea to insert an area on the base grid that doesn't have raised letters or numbers. The raised text can interfere with the insertion or cause a tight fit between the base grid and base grid support.

To install the base grid support onto the base grid, align the holes of the support with the base grid pegs in the desired location on the base grid and press down firmly on the base grid support. Make sure that the base grid support is fully seated on the base grid.



The stabilizer is used to connect base grids on their corners or edges. With eight slots, the stabilizer allows the base grids to be mounted in increments of 45 degrees.

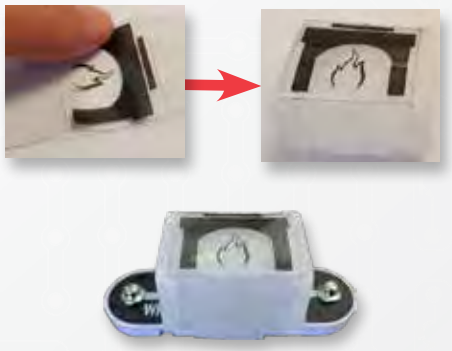


To attach the stabilizer to the base grid, simply align the desired grooves in the stabilizer with the edges of the base grids and press down. The figure below shows how the stabilizer symbol is presented in the manual and the 3D rendering of the stabilizer mounted to two base grids.

Note: go to: www.elenco.com/MyHome/ for interactive 3D pictures to help with building the 3D circuits.

HOW TO USE YOUR SNAP CIRCUITS®

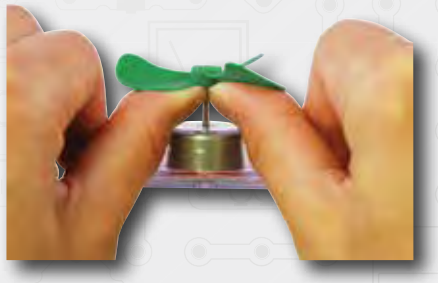
The light covers and slides may be placed on the LEDs (D6 and D8) or lamp (L4) as decoration. Fold the slides as indicated and slide them into the slots on the cover, as shown.



The fiber optic festive tree can be mounted on the LEDs (D6 and D8) to enhance their light effects. The fiber optic festive tree must be mounted using the mounting base, as shown.

Fiber Optic Festive Tree

The clear motor (M4) will often have the wind fan mounted on it; simply push the fan onto the shaft. To remove it, push up on it with a screwdriver or your thumbs, being careful not to break it.



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

Batteries:

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

PARTS LIST (COLORS AND STYLES MAY VARY)

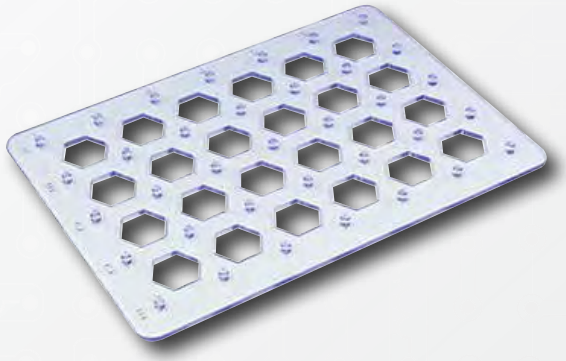
Important: If any parts are missing or damaged, **DO NOT RETURN TO RETAILER**. Call toll-free (800) 533-2441 or e-mail us at: help@elenco.com. Customer Service: 150 Carpenter Ave., Wheeling, IL 60090 U.S.A. • You may order additional / replacement parts at www.elenco.com/replacement-parts

Qty.	ID	Name	Symbol	Part #	Qty.	ID	Name	Symbol	Part #
❒ 3	1	1- Snap Wire		6SC01	❒ 1		Jumper Wire, Black		6SCJ1
❒ 6	2	2- Snap Wire		6SC02	❒ 1		Jumper Wire, Red		6SCJ2
❒ 3	3	3- Snap Wire		6SC03	❒ 2		Jumper Wire, Blue		6SCJ4
❒ 1	4	4- Snap Wire		6SC04	❒ 1	L4	Lamp, 4.5V		6SCL4
❒ 1	5	5- Snap Wire		6SC05	❒ 2		Light Cover		6SCLCOV
❒ 1	6	6- Snap Wire		6SC06	❒ 1		Slides for Light Cover Set of 3		6SCLCOVSL
❒ 1	B3	Battery Holder - uses three (3) 1.5V type "AA" (not Included)		6SCB3	❒ 1	M4	Motor		6SCM4
❒ 2		Base Grid Mini (7.7" x 5.5") Red Tint		6SCBGMRD	❒ 1		Green Fan		6SCM4B
❒ 1		Base Grid Mini (7.7" x 5.5") Yellow Tint		6SCBGMYL	❒ 1	M6	Meter		6SCM6
❒ 1		Base Grid Mini (7.7" x 5.5") Green Tint		6SCBGMGR	❒ 1	Q2	NPN Transistor		6SCQ2
❒ 2		Base Grid Mini (7.7" x 5.5") Blue Tint		6SCBGMBL	❒ 1	Q4	Phototransistor		6SCQ4
❒ 1		Base Grid Mini (7.7" x 5.5") Purple Tint		6SCBGMPL	❒ 1	R3	5.1kΩ Resistor		6SCR3
❒ 1		Base Grid Support Purple Tint		6SCBGSUPPR	❒ 1	S1	Slide Switch		6SCS1
❒ 1	C5	470µF Capacitor		6SCC5	❒ 1	S2	Press Switch		6SCS2
❒ 1	D6	White LED		6SCD6	❒ 10		Stabilizer Purple Tint		6SCSTABPR
❒ 1	D8	Color LED		6SCD8	❒ 1	U32	Melody IC		6SCU32
❒ 1		Mounting Base		6SCFMB	❒ 4	V1	Vertical Snap Wire		6SCV1
❒ 1		Fiber Optic Festive Tree		6SCFT2					

ABOUT YOUR SNAP CIRCUITS® PARTS

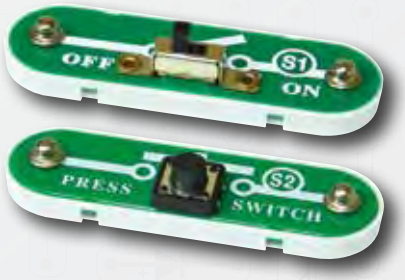
BASE GRID

The **base grids** are platforms for mounting parts and wires. They function like the printed circuit boards used in most electronic products, or like how the walls are used for mounting the electrical wiring in your home. The base grids can be placed together to form larger grids.



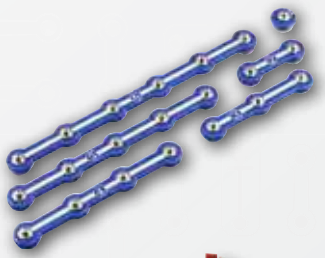
SLIDE & PRESS SWITCHES

The **slide & press switches (S1 & S2)** connect (pressed or "ON") or disconnect (not pressed or "OFF") the wires in a circuit. When ON they have no effect on circuit performance. Switches turn on electricity just like a faucet turns on water from a pipe.



Slide & Press Switches (S1 & S2)

SNAP WIRES, VERTICAL SNAP WIRES, & JUMPER WIRES



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

The **vertical snap wires (V1)** make connections between two dimensions, allowing electricity to go up a wall.

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

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

(Part designs are subject to change without notice).

BATTERY HOLDER

The **batteries (B3)** produce an electrical voltage using a chemical reaction. This "voltage" can be thought of as electrical pressure, pushing electricity through a circuit just like a pump pushes water through pipes. This voltage is much lower and much safer than that used in your house wiring. Using more batteries increases the "pressure", therefore, more electricity flows.

Battery Holder (B3)

RESISTORS

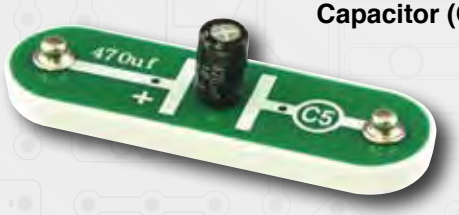
Resistors "resist" the flow of electricity and are used to control or limit the current in a circuit. This set includes a **5.1kΩ resistor (R3)** ("k" symbolizes 1,000, so R3 is really 5,100Ω). Materials like metal have very low resistance (<1 Ω), while materials like paper, plastic, and air have near-infinite resistance. Increasing circuit resistance reduces the flow of electricity.

5.1kΩ Resistor (R3)

ABOUT YOUR SNAP CIRCUITS® PARTS

CAPACITOR

The **470µF capacitors (C5)** can store electrical pressure (voltage) for periods of time. This storage ability allows them to block stable voltage signals and pass changing ones. Capacitors are used for filtering and delay circuits.



Capacitor (C5)

LAMP

A light bulb, such as in the **4.5V lamp (L4)**, contains a special thin high-resistance wire. When a lot of electricity flows through, this wire gets so hot it glows bright. Voltages above the bulb's rating can burn out the wire.

4.5V Lamp (L4)

TRANSISTORS

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

NPN Transistor (Q2)

The **phototransistor (Q4)** is a transistor that uses light to control electric current.

Phototransistor (Q4)

LEDs

The **white and color LEDs (D6 & D8)** are light emitting diodes, and may be thought of as a special one-way light bulbs. In the "forward" direction, (indicated by the "arrow" in the symbol) electricity flows if the voltage exceeds a turn-on threshold brightness then increases. The color LED contains red, green, and blue LEDs, with a micro-circuit controlling then. A high current will burn out an LED, so the current must be limited by other components in the circuit (Snap Circuits® LEDs have internal resistors added, to protect them in case you make wiring mistakes). LEDs block electricity in the "reverse" direction.

LEDs (D6 & D8)

SOUND MODULE

The **melody IC (U32)** contains a specialized sound-generation integrated circuit (IC), a small speaker, and a few supporting components. The IC has a recording of the melody, which it makes into an electrical signal for the speaker. The speaker converts the signal into mechanical vibrations. The vibrations create variations in air pressure, which travel across the room. You "hear" sound when your ears feel these air pressure variations.

ABOUT YOUR SNAP CIRCUITS® PARTS

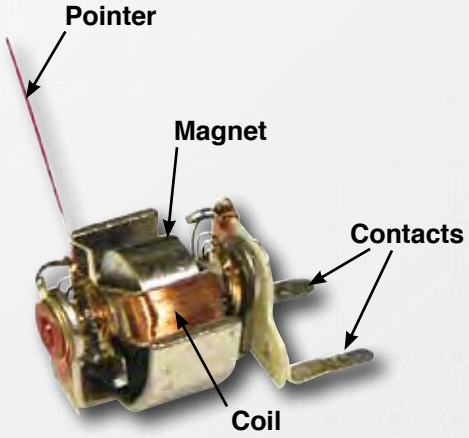
METER

The **meter (M6)** is an important measuring device. You use it to measure the voltage (electrical pressure) and current (how fast electricity is flowing) in a circuit.

Meter (M6)

The meter measures voltage when connected in parallel to a circuit and measures the current when connected in series in a circuit.

This meter has one voltage scale (5V) and two current scales (0.5mA and 50mA). These use the same meter but with internal components that scale the measurement into the desired range. Sometimes external components will be used to change the meter scale to one not shown.

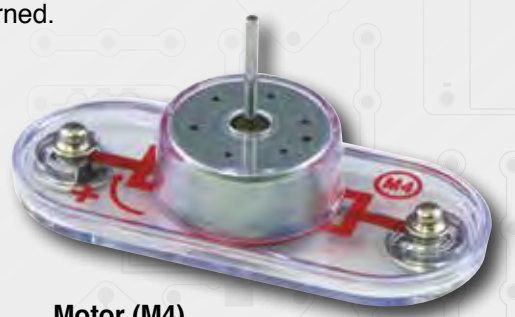


Inside the meter there is a fixed magnet and a moveable coil around it. As current flows through the coil, it creates a magnetic field. The interaction of the two magnetic fields causes the coil (connected to the pointer) to move (deflect).

MOTOR

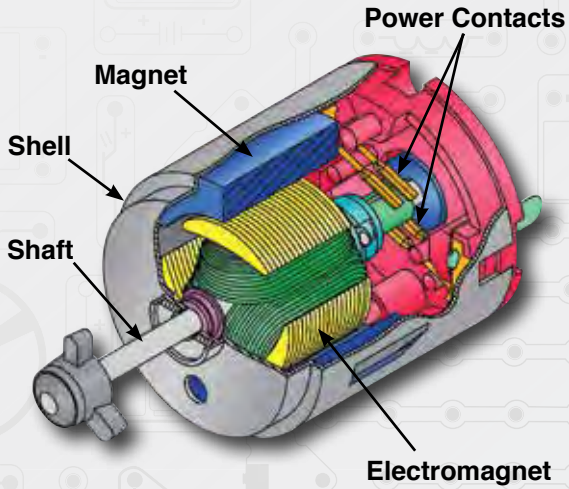
The **motor (M4)** converts electricity into mechanical motion. An electric current through the motor will turn the shaft.

It can also be used as a generator, since it produces an electric current when the shaft is turned.



Motor (M4)

How does electricity turn the shaft in the motor? The answer is magnetism. Electricity is closely related to magnetism, and an electric current flowing in a wire has a magnetic field similar to that of a very, very tiny magnet. Inside the motor is a coil of wire with many loops. If a large electric current flows through the loops, the magnetic effects become concentrated enough to move the coil. The motor has a magnet inside, so as the electricity moves the coil to align it with the permanent magnet, the shaft spins.



When used as a generator, wind or water turns the shaft. A coil of wire is on the shaft, and as it spins past the permanent magnet an electric current is created in the wire.

Fan

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, melody IC, LED (which has an internal protection resistor), motor, lamp, 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. **Elenco® is not responsible for parts damaged due to incorrect wiring.**

Here are some important guidelines:

ALWAYS **USE EYE PROTECTION WHEN EXPERIMENTING ON YOUR OWN.**

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

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

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

ALWAYS check your wiring before turning on a circuit.

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

NEVER leave a circuit unattended when it is turned on.

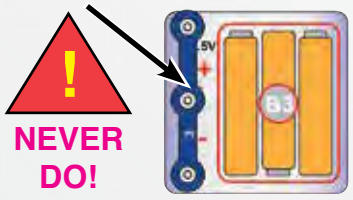
For all of the projects given in this book, the parts may be arranged in different ways without changing the circuit. For example, the order of parts connected in series or in parallel does not matter — what matters is how combinations of these sub-circuits are arranged together.

3D Construction: Motors or other parts that produce motion (which you may have from other snap Circuits® sets) should only be mounted overhead or on walls with great care, as the vibrations they produce could cause them to fall. The circuits in this set have been checked with the parts shown in them.

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

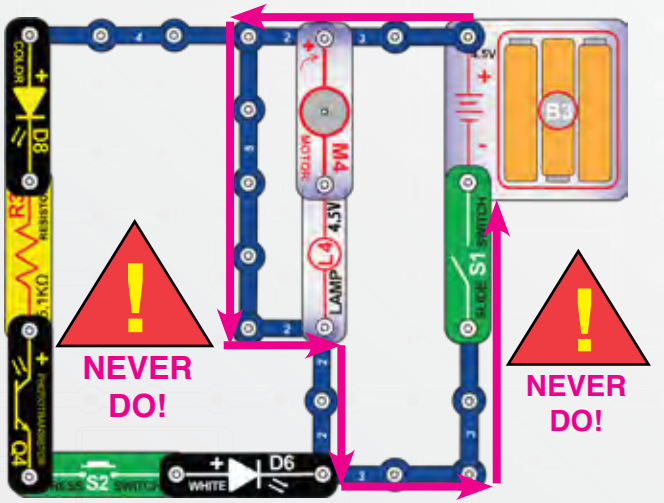
Examples of SHORT CIRCUITS - NEVER DO THESE!!!

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



T.

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



You are encouraged to tell us about new circuits you create. If they are unique, we will post them with your name and state on our website at **www.elenco.com/showcase**.
Send your suggestions (with photos) to **info@elenco.com**.

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

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

TROUBLESHOOTING (ADULT SUPERVISION RECOMMENDED)

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

Basic troubleshooting:

a. Most circuit problems are due to incorrect assembly, always double-check that your circuit exactly matches the drawing for it.

b. Be sure that parts with positive/negative markings are positioned as per the drawing.

c. Be sure that all connections are securely snapped.

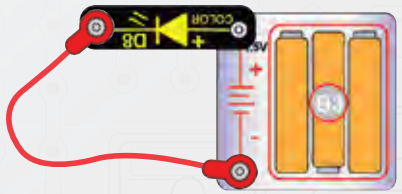
d. Try replacing the batteries.

e. For circuits using the phototransistor (Q4), if the alarm is always activated then it could be getting triggered by other lights in the room; try turning them off or moving to a different room.

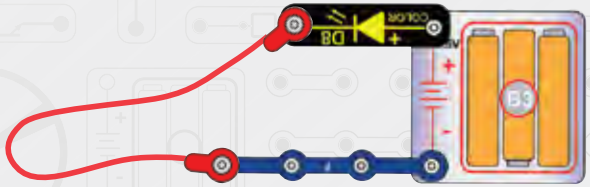
If you suspect you have damaged parts, you can follow this procedure to systematically determine which ones need replacing:

1. **White LED (D6), color LED (D8), lamp (L4), melody IC (U32), motor (M4), and battery holder (B3):** Place batteries in holder. Place the lamp directly across the battery holder, it should light. Place the white LED, and color LED directly across the battery holder (LED + to battery +), the LED should light. Similarly, place the melody IC directly across the battery holder (+ to +), it should make sound. Place the motor directly across the battery holder, the shaft should spin (you can place the green fan on the shaft so the spinning is easy to see). If none work, then replace your batteries and repeat, if still bad then the battery holder is damaged.

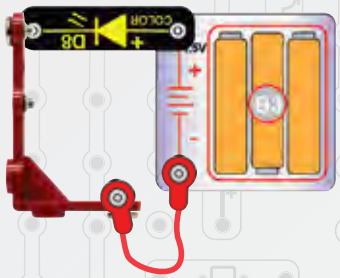
2. **Jumper wires:** Use this mini-circuit to test each jumper wire, the LED should light.



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



4. **Vertical snap wires (V1):** Use this mini-circuit to test each of the vertical snap wires, one at a time. The LED should light.



TROUBLESHOOTING (ADULT SUPERVISION RECOMMENDED)

5. **Slide switch (S1) and press switch (S2):** Build project 1 but replace the meter (M6) with a 3-snap wire; if the color LED (D8) doesn't light then the slide switch is bad. Replace the slide switch with the press switch to test it.

6. **Phototransistor (Q4) and 5.1kΩ resistor (R3):** Build project 26 and vary the amount of light shining on the phototransistor. The brighter the light on the phototransistor, the brighter the color LED (D8) should be. Then replace the phototransistor with the 5.1kΩ resistor; the color LED should light dimly.

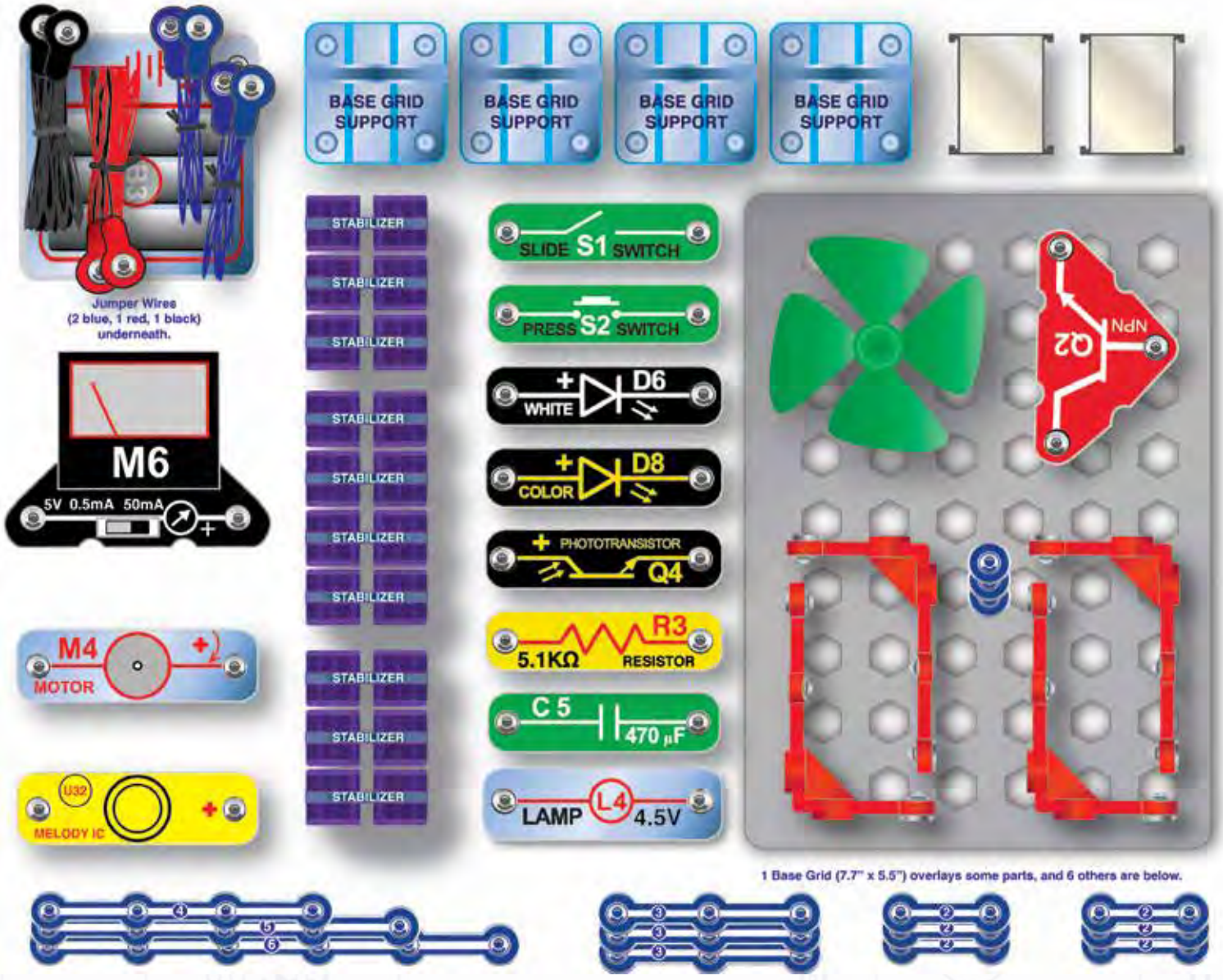
7. **NPN transistor (Q2):** Use project part D of project 22; the white LED (D6) should be on only if the press switch (S2) is pushed. If otherwise then Q2 is damaged.

8. **Meter (M6):** Build project 1.
   a. Set the meter to the 50mA scale and turn on the switch. The meter current should be above 0 but less than 5.
   b. Set the meter to the 1mA scale and turn on the switch. The reading should be over maximum.
   c. Replace the white LED (D6) with a 3-snap wire. Set the meter to the 5V scale and turn on the switch. The meter should read at least 2.5.

9. **470m F Capacitor (C5):** Use project 13; the meter current should drop as the capacitor charges up, as described in that project.

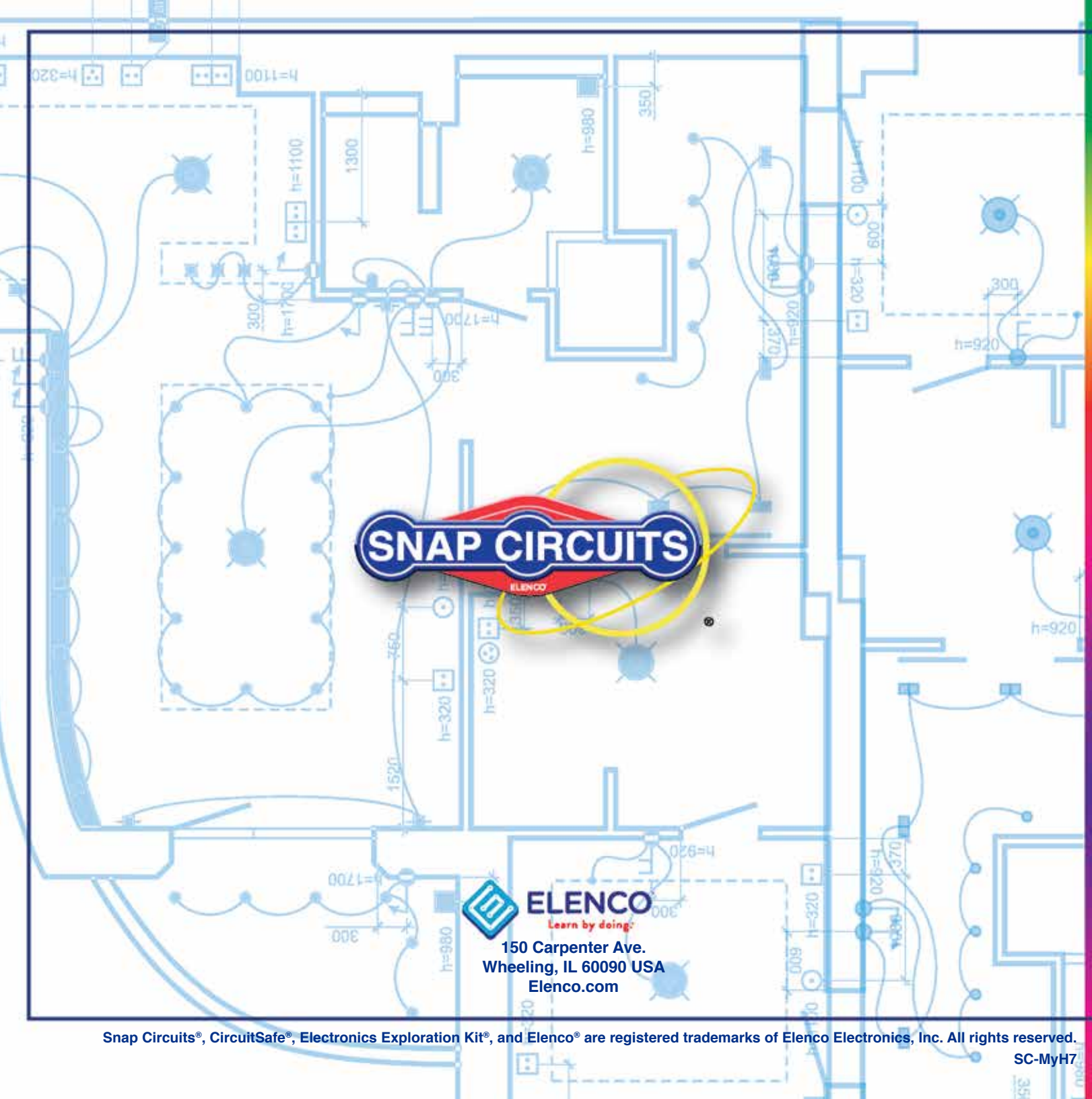
Notes

SC- MyH7 Parts Layout



Note: A complete parts list is on page 54 in this manual.

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



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