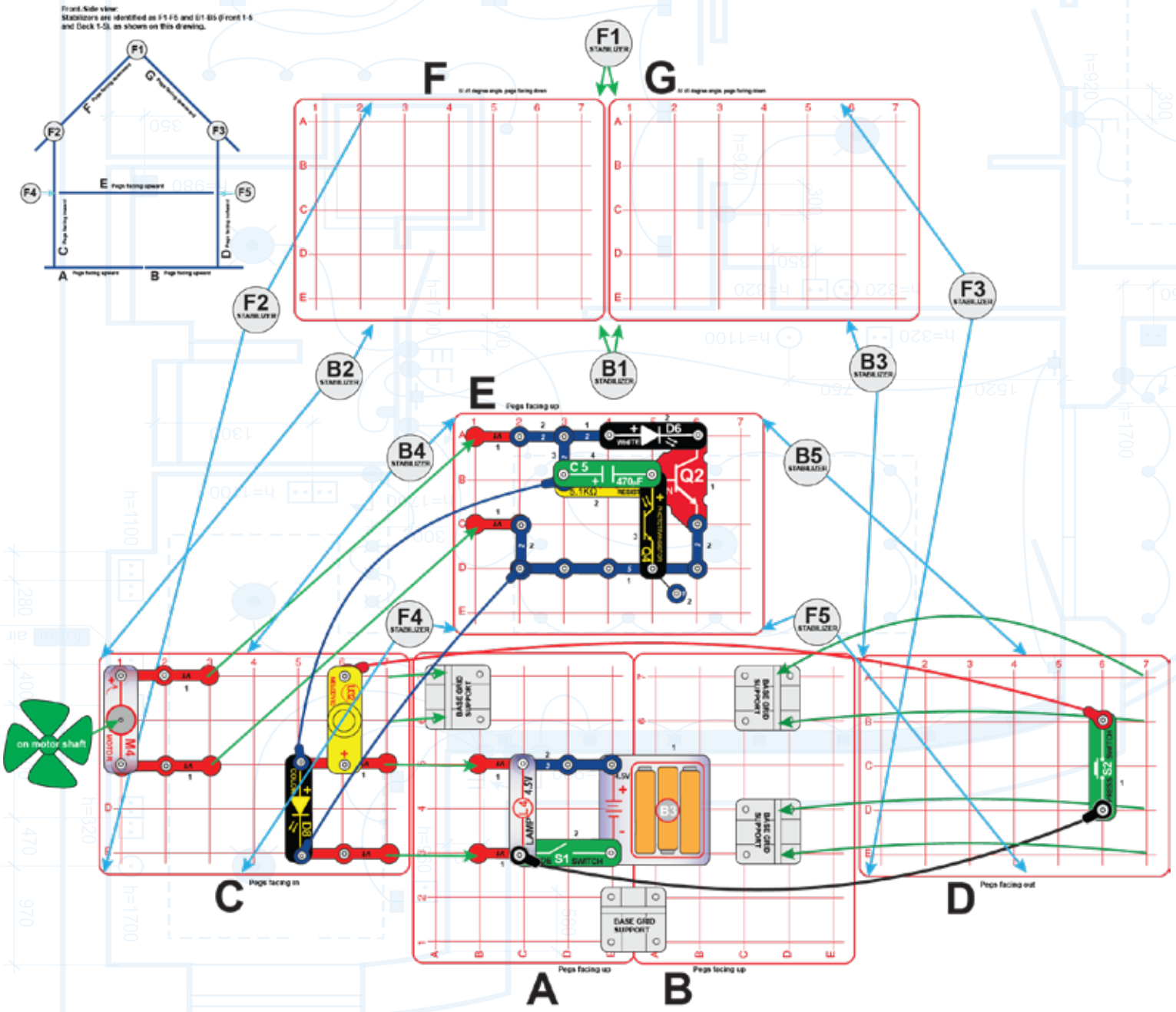
Project 30 | 2-STORY HOUSE



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.

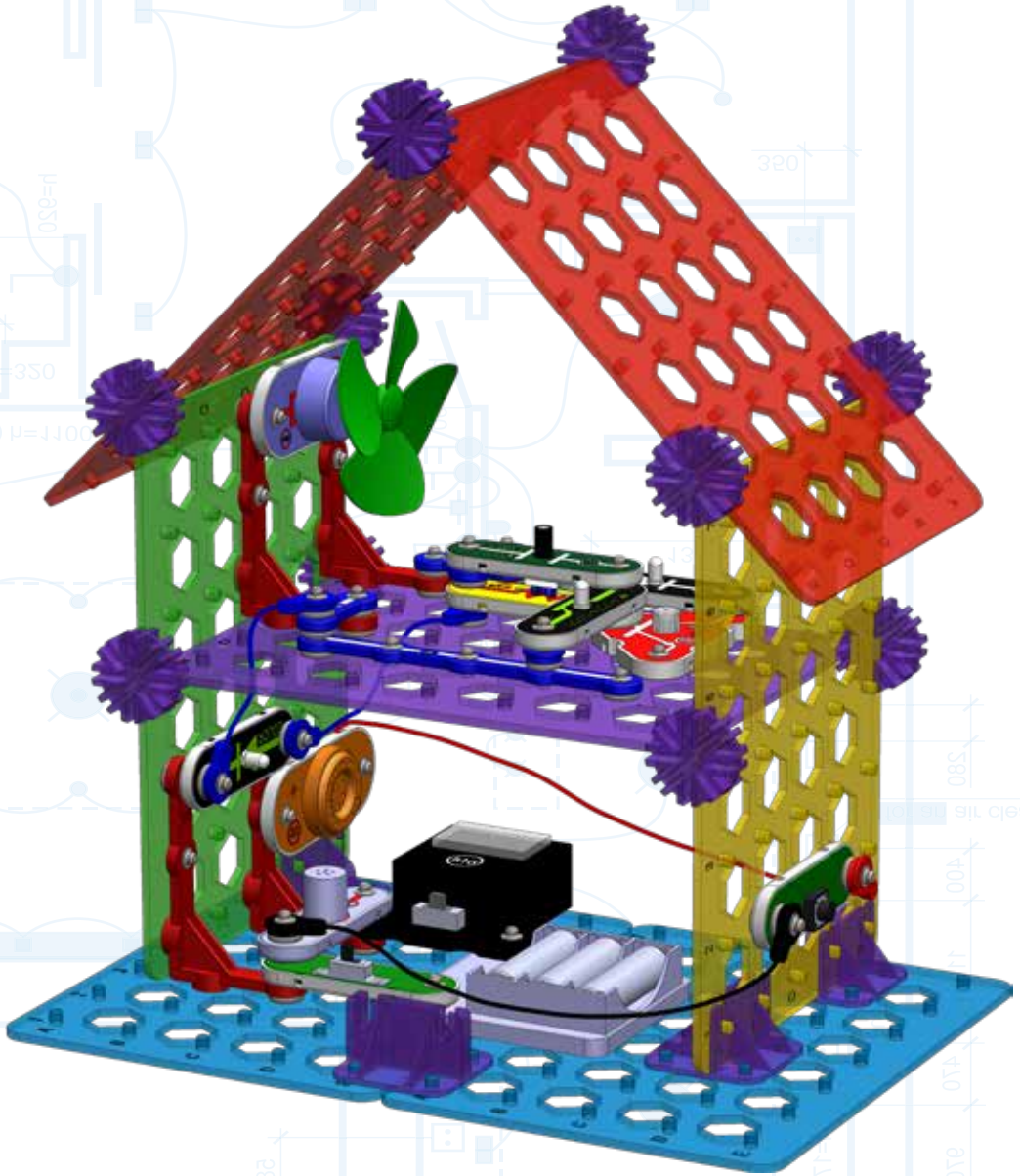
2. Place parts (except for the jumper wires) on base grids C & D, and install into base grid supports on grids A & B. The pegs should be facing inward for grid C and outward for grid D.

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.

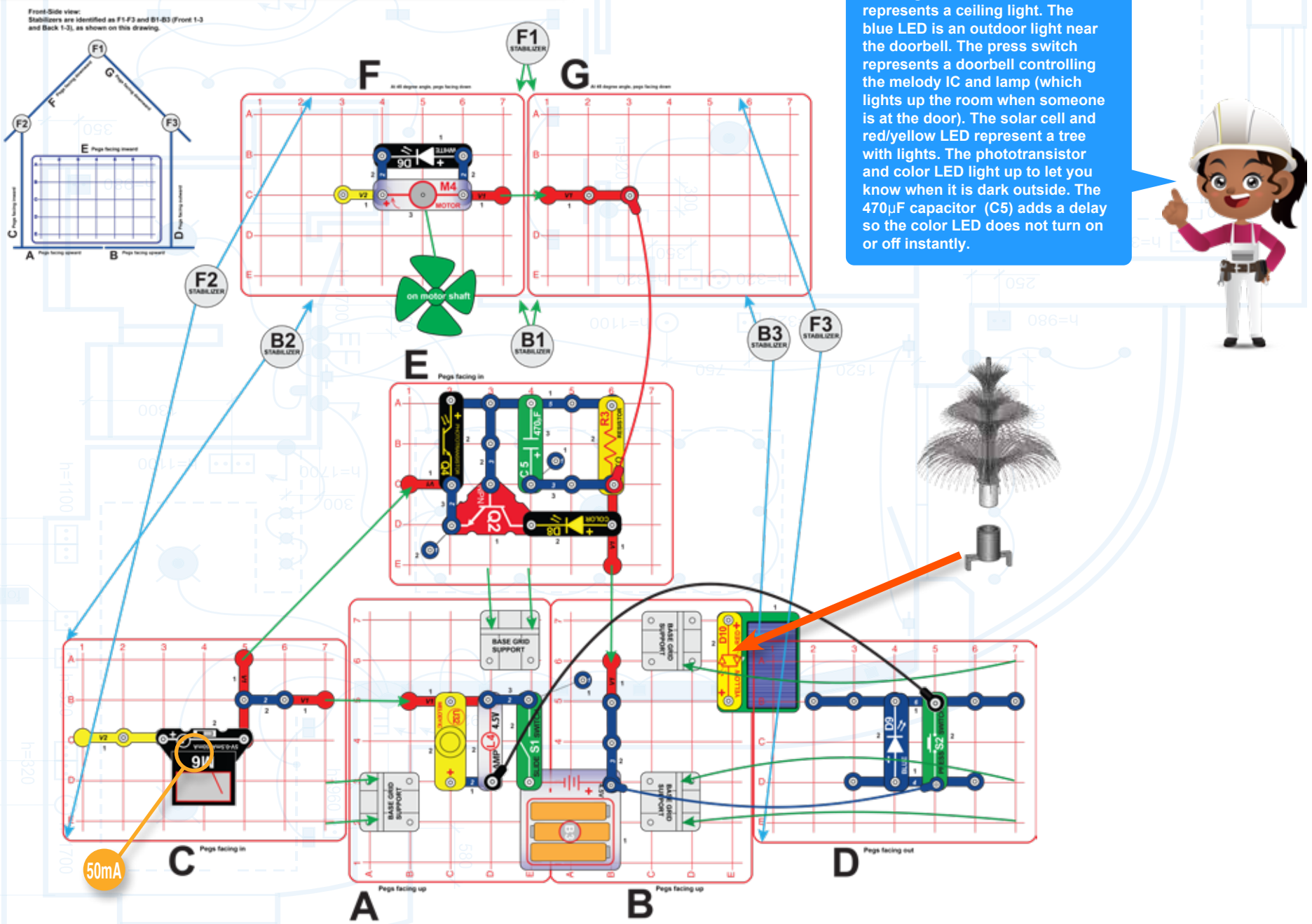
5. Mount grids F & G, at 45 degree angles and with pegs oriented down, on top of grids C & D using 6 stabilizers. Adjust the positions of the stabilizers as needed.

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

This circuit represents different things that may be happening in a home. The motor represents a ceiling fan. The white LED represents a ceiling light. The blue LED is an outdoor light near the doorbell. The press switch represents a doorbell controlling the melody IC and lamp (which lights up the room when someone is at the door). The solar cell and red/yellow LED represent a tree with lights. The phototransistor and color LED light up to let you know when it is dark outside. The 470µF capacitor (C5) adds a delay so the color LED does not turn on or off instantly.



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.

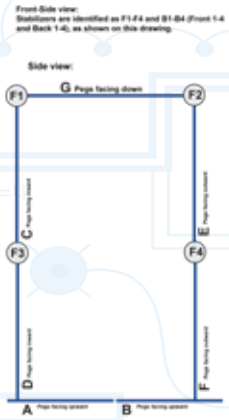
5. Connect a vertical snap wire (V1) between grids F & G, and mount those grids at 45 degree angles and with pegs oriented down on top of grids C & D using 6 stabilizers, connecting to the angled snap wire (V2) as you do it. Adjust the positions of the stabilizers as needed.

6. Place the remaining parts on grid F.

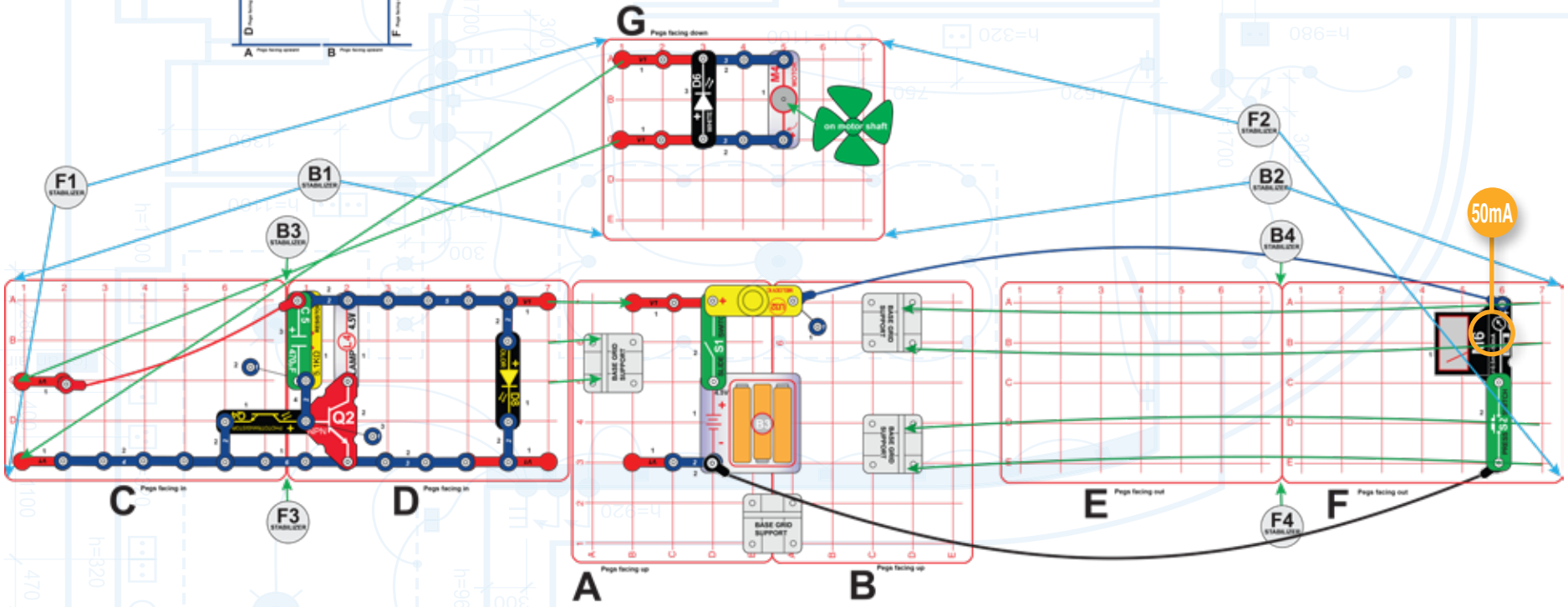
7. Add the remaining jumper wires (1 blue, 1 black, and 1 red).

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). The blue LED (D9) lights unless the doorbell is on. The red/yellow LED (D10) lights up the fiber optic festive tree if there is sunlight on the solar cell (B7). If desired, place the light covers with a slide on any of the LEDs or the lamp.

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.

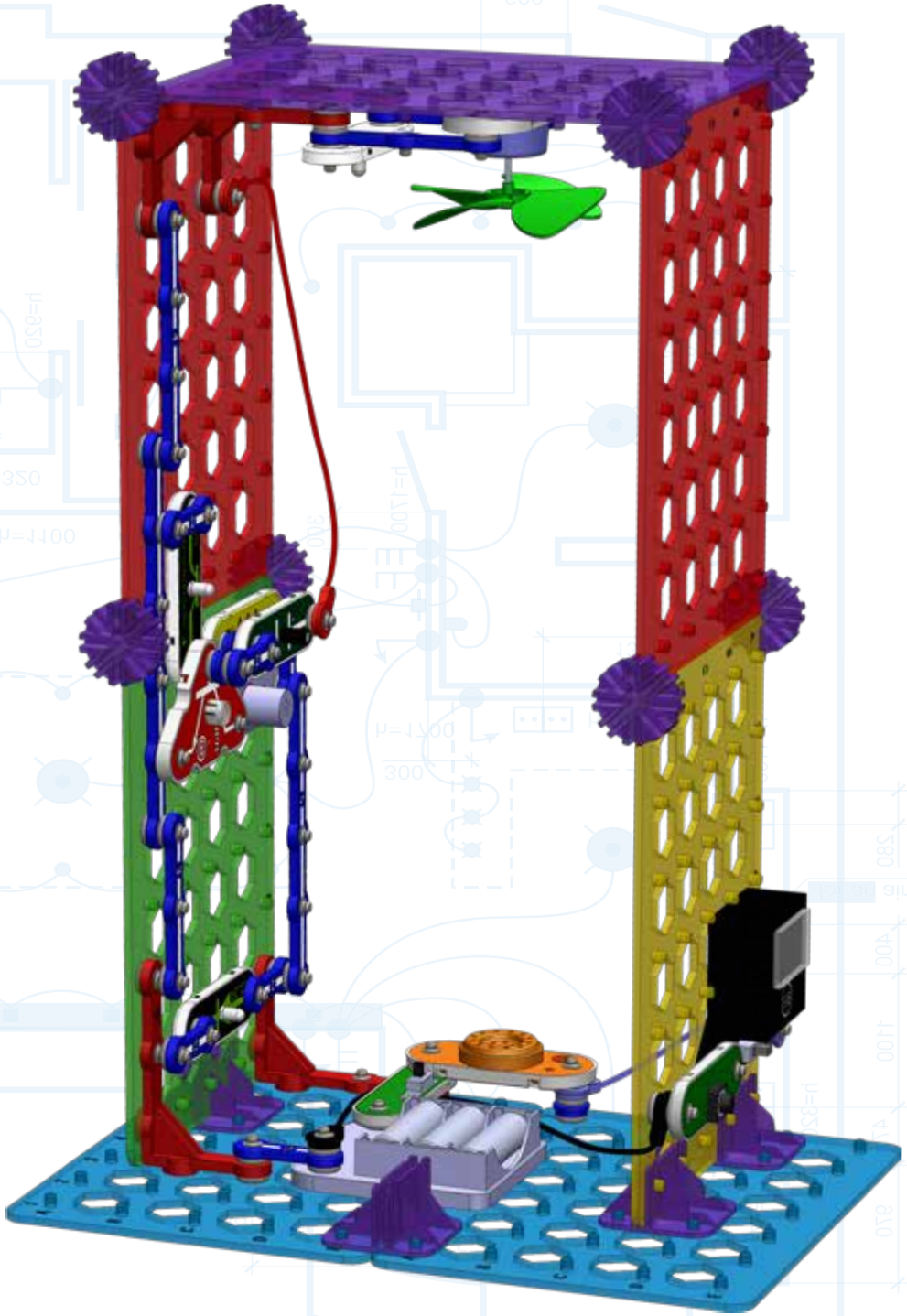
3. Place remaining parts on grids A & B, including the blue and black jumper wires that connect to parts on grid F.

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.

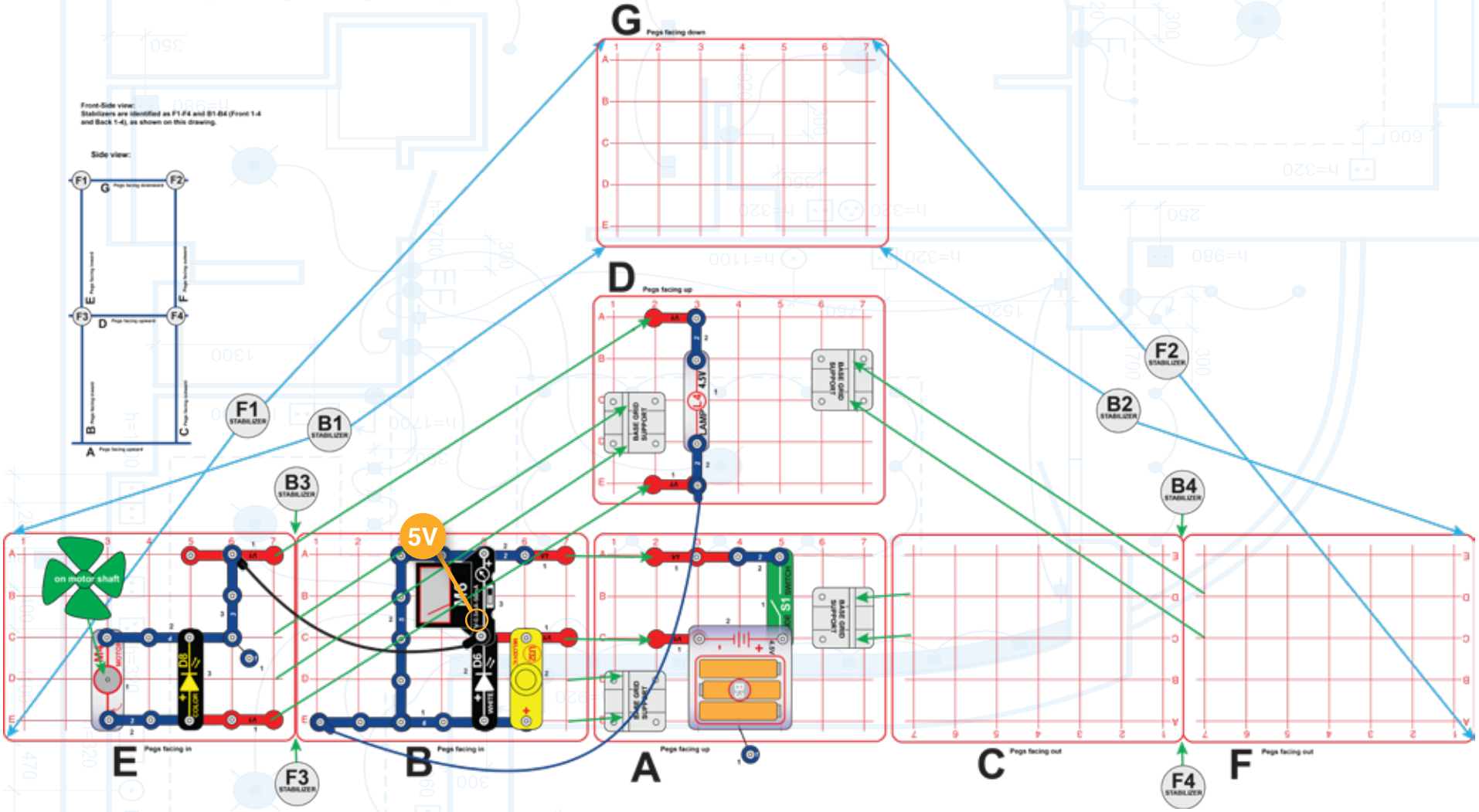
5. Mount grid G, with pegs oriented down, on top of grids C & E using 4 stabilizers, attaching to the vertical snap wires (V1) on grid C as you do this. Adjust the positions of the stabilizers as needed.

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 I 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.

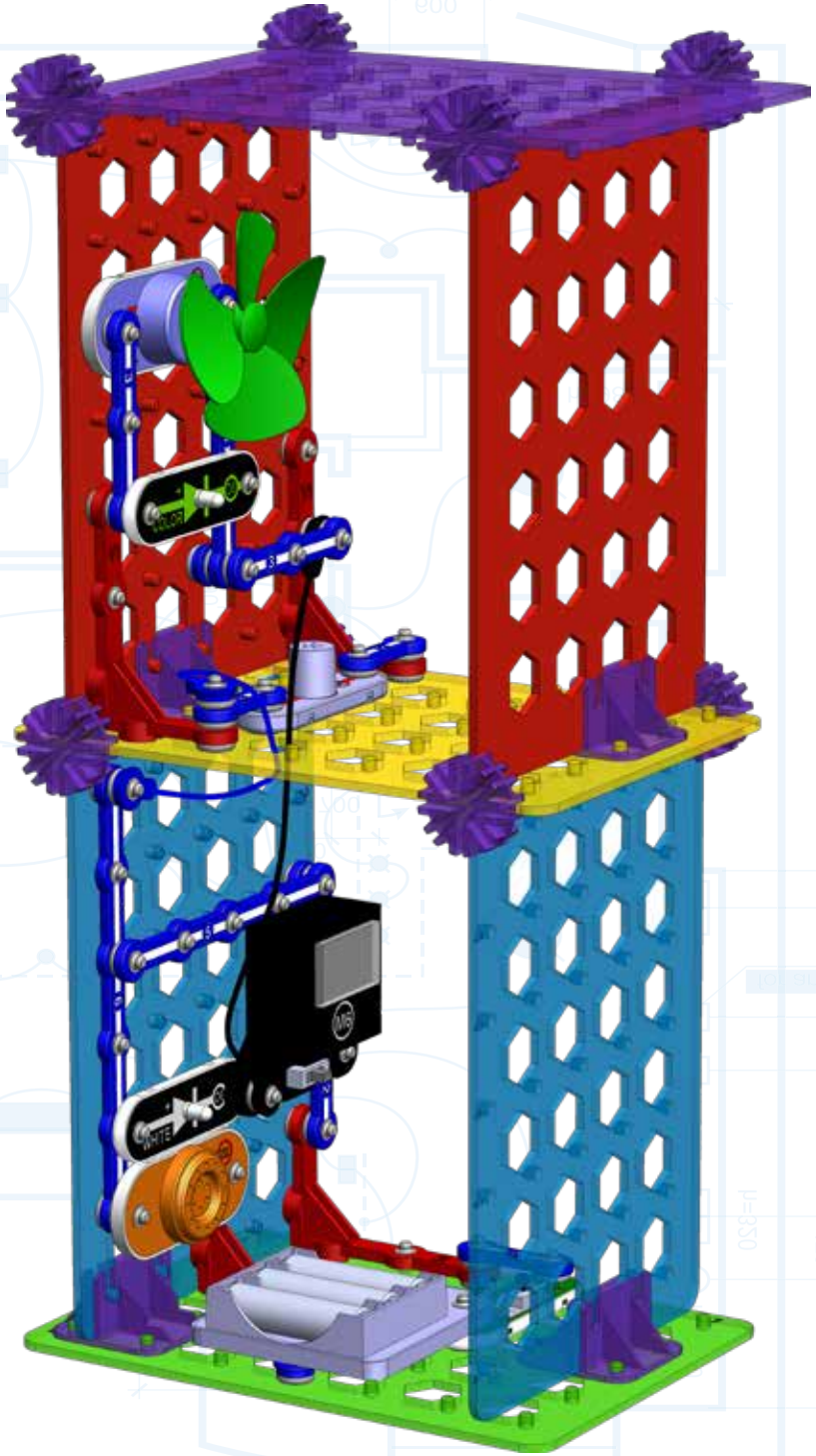
4. Place remaining parts on grids A & D.

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

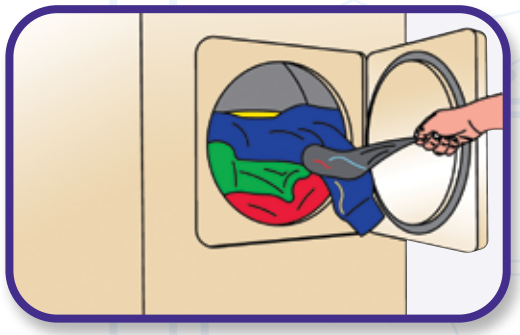
6. Mount grid G on grids E & F using 4 stabilizers, as shown. The pegs on grid G should be facing down. Adjust the positions of the stabilizers as needed.

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.

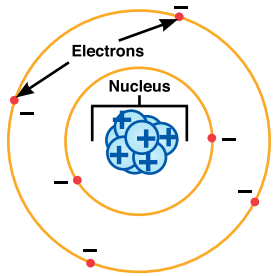
Take off a sweater (wool is best) and listen for crackling noises. Try it in a dark room and see if you see sparks. Compare the effects with different fabrics (wool, cotton, etc.).

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.

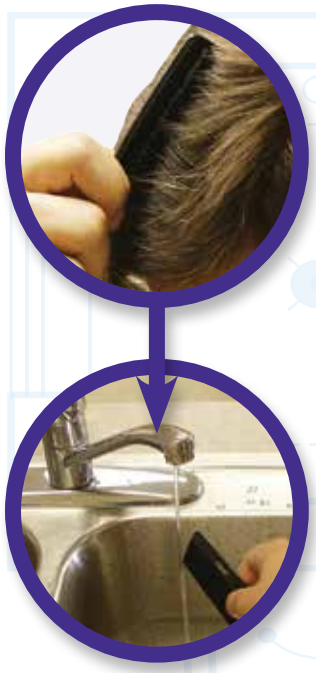
Atoms are the smallest amount of matter that can exist independently in our world. All materials are made out of atoms, and they are really, really tiny. Atoms contain a central nucleus (which has a positive electrical charge) that is surrounded by tiny electrons (which are negative electrical charges).



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.

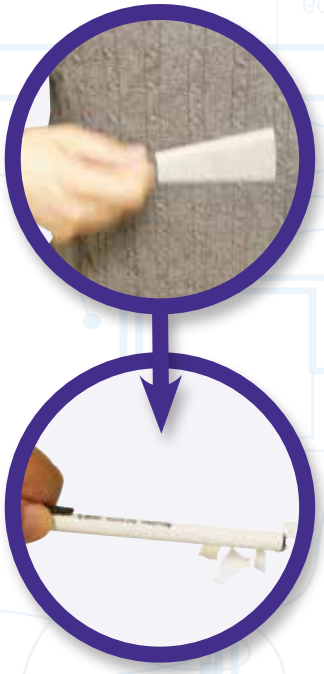
If you pull two fuzzy sweaters apart in the wintertime, you'll likely hear a sound like static on the radio. Like the thunder that accompanies lightning, this crackling sound is the sound of electrons traveling through the air from one sweater to the other. We call this static electricity.

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.



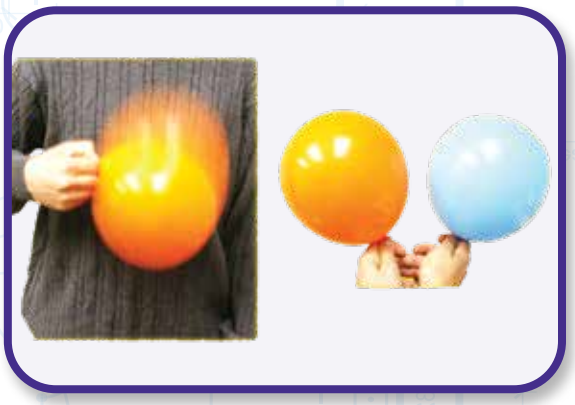
Find a comb (or plastic ruler) and paper. Rip up the paper into small pieces. Run the comb through your hair several times then hold it near the paper pieces to pick them up. You can also use a pen or plastic ruler, rub it on your clothes (wool works best).

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.

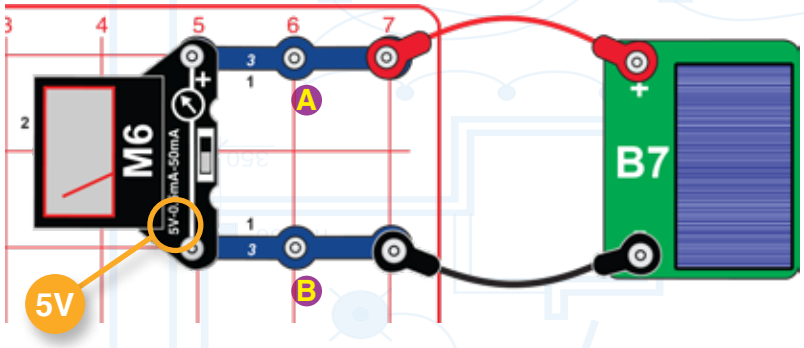
Take a piece of newspaper or other thin paper and rub it vigorously with a sweater or pencil. It will stick to a wall.

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.

Project 35 I SOLAR POWER



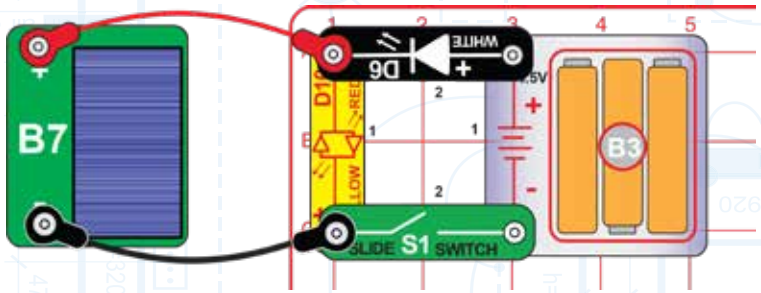
Electricity from solar cells is renewable, pollution free, and increasingly cost-competitive with other sources of electricity. Note however that the electricity produced by your solar cell is much less than the batteries can produce. Your solar cell can produce about 7V in bright sunlight, but this is greatly reduced when lots of current is flowing (like when the lamp is added to the circuit).

Build the circuit shown, and set the meter (M6) to the 5V scale. The solar cell (B7) is connected using the red & black jumper wires to allow you to easily adjust its position while viewing the meter.

Place the solar cell in direct sunlight or close to an incandescent light bulb. The meter shows the voltage produced by the solar cell. This solar cell can produce as much as 7V in bright sunlight, so the meter reading may be off the scale. Notice how the voltage increases when the solar cell is directly facing the light, or as you get closer to an incandescent bulb. Also compare the voltage produced using sunlight or incandescent light bulbs to using other types of light bulbs (LED, CFL, fluorescent).

Connect one of the LEDs (D6, D8, D9, or D10), the melody IC (U32), or the motor (M4) and fan across the points labeled A & B, "+" to A. See how well the solar cell can power each component the fan may need a push to get started). Also notice how the voltage drops when you add an LED/IC/motor to the circuit. You can try connecting the lamp (L4), but the solar cell will not be able to light it under any conditions (notice how the meter voltage drops to about 0V when you connect the lamp).

Project 36 I SOLAR TAKEOVER



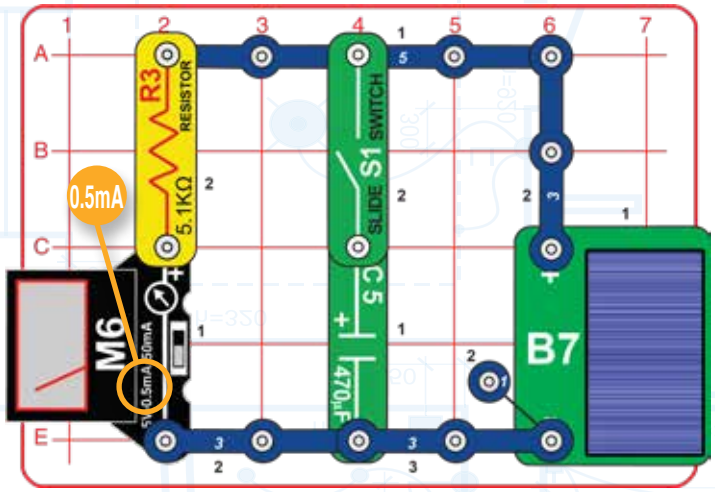
This circuit represents a solar powered light with battery backup. If the voltage produced by the solar cell is strong enough then it powers the red/yellow LED, otherwise the batteries power the red/yellow LED. The white LED isolates the battery holder from the solar cell, and indicates when the batteries are powering the red/yellow LED.

Build the circuit shown, connecting the solar cell (B7) with the red & black jumper wires. Turn on the slide switch (S1). The red/yellow LED (D10) should be red, and the white LED (D6) may be on. Cover the solar cell. The white LED will be on, indicating that the battery holder (B3) is powering the red/yellow LED.

Now place the solar cell in direct sunlight or close to an incandescent light bulb; if the light is bright enough then the white LED will be off, indicating that the solar cell is powering the red/yellow LED. If the white LED is dimmer than before but not off then the red/yellow LED is being partially powered by both the solar cell and the batteries. Note that light from LED, CFL, or fluorescent bulbs will not work with the solar cell.

Options: replace the red/yellow LED with the color LED (D8), place the fiber optic festive tree in its mounting base and on one of the LEDs, place an LED cover and slide on one of he LEDs, or mount the solar cell on the wall or roof of a 3D base grid structure.

Project 37 I SOLAR STAY ON



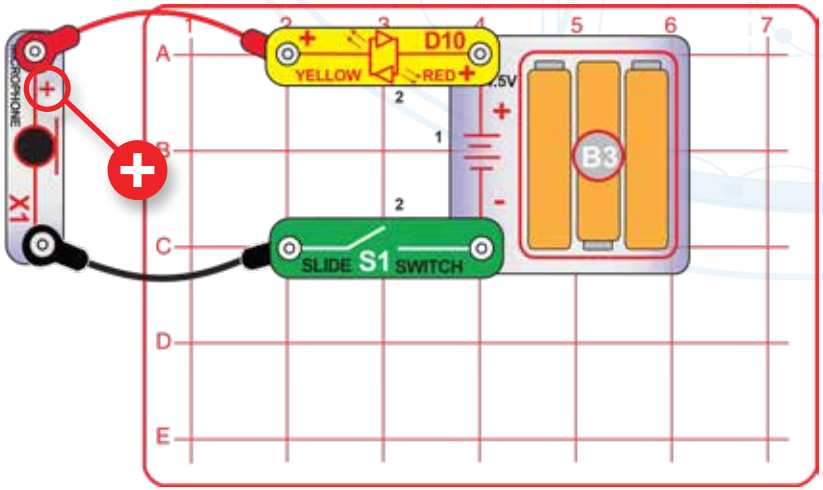
Build the circuit and set the meter (M6) to the 0.5mA scale. Leave the slide switch (S1) off for now. Place the solar cell (B7) in direct sunlight or close to an incandescent light bulb so the meter shows a current. Wave your hand over the solar cell to simulate clouds blocking the sunlight, and notice that the meter reading drops as you block the light.

Now turn on the slide switch to add the 470µF capacitor (C5) to the circuit. Wave your hand over the solar cell and notice that now the meter reading drops slowly if you block the light.

Replace the meter with the red/yellow LED (D10, "+" in either direction). The LED lights if there is enough sunlight on the solar cell. If the switch is on then the LED stays on for a while if you block the light to the solar cell.

Here the capacitor is acting as a rechargeable battery, to keep an LED or other device on even if clouds were to block light to the solar cell for a short time. If you used a larger rechargeable battery then the solar cell could charge it during the day and the battery could keep the light on all night. Rechargeable batteries are often used with solar cells in situations like this.

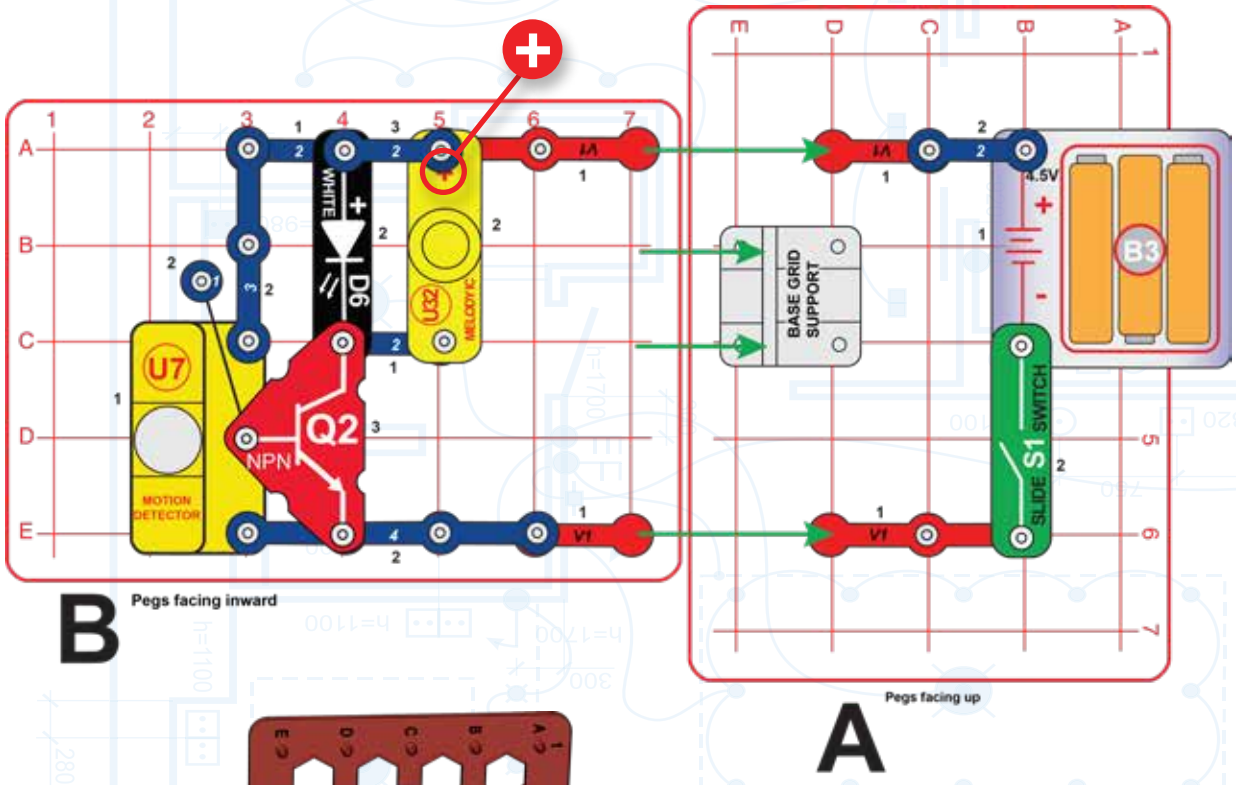
Project 38 I MEET THE MICROPHONE



Build the circuit shown and turn on the slide switch (S1). The red/yellow LED (D10) lights. Hold the microphone near your mouth and talk loudly or blow into it to change the LED brightness.

The microphone (X1) is actually a resistor that changes in value when changes in air pressure (sounds) apply pressure to its surface. When you talk or blow into the microphone its resistance changes, which then changes the current through the LED, which changes the LED's brightness.

Project 39 I MOTION DETECTOR



Assembly (adult supervision recommended):

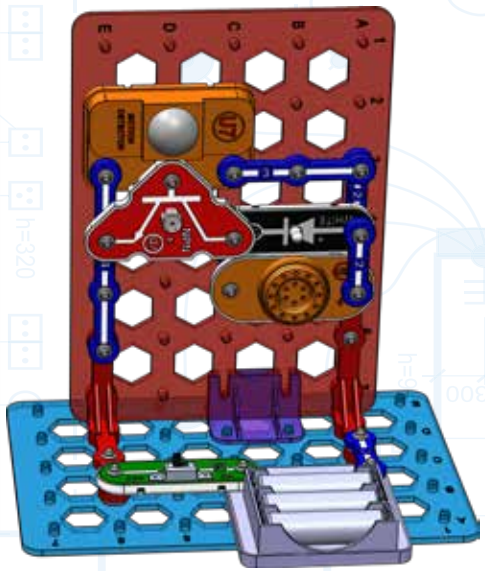
1. Place base grid support on base grid A.

2. Place parts on base grid B and install into base grid support on grids A. The pegs should be facing inward.

3. Place remaining parts on grid A.

Position the circuit so the motion detector (U7) looks out across a room and turn on the slide switch (S1). The white LED (D6) and melody IC (U32) are activated for a few seconds on start-up, and then whenever the circuit detects motion in the room.

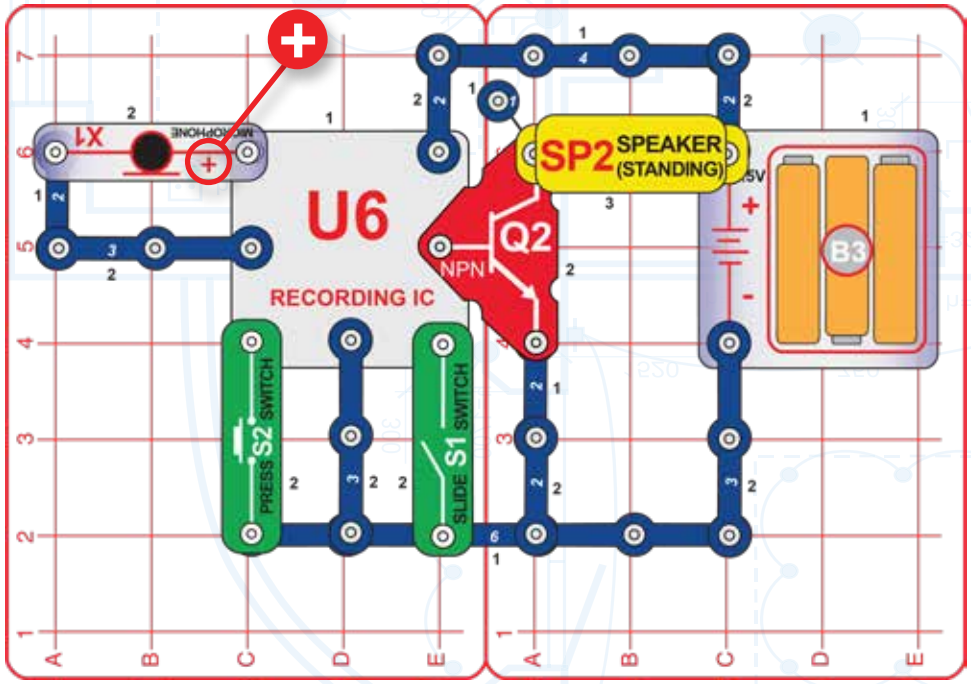
Variants: Replace the white LED or the melody IC with any of the other LEDs (D8, D9, or D10), the lamp (L4), or the motor (M4) and fan. The melody IC and motor cannot be used together, because they do not fit side by side.



All objects (including people and animals) produce infrared radiation due to the heat in them. Infrared radiation is similar to visible light but has a longer wavelength that our eyes cannot detect. The lens on top of the motion detector module filters and focuses the radiation, it is most sensitive to the radiation produced by our bodies.

Inside the motion detector module is an infrared detector with pyroelectric crystals, which create a tiny voltage when exposed to infrared radiation. A circuit amplifies and filters this voltage, but only responds to changes in the radiation level - so is only triggered by moving objects (motion). When motion is detected a timing circuit is used to control other Snap Circuits® devices for a few seconds, such as an alarm.

Project 40 | RECORD & PLAYBACK



Build the circuit shown. Turn on the slide switch (S1), you hear a beep signaling that you may begin recording. Talk into the microphone (X1) up to 5 seconds, and then turn off the slide switch (it also beeps after the 5 seconds expires).

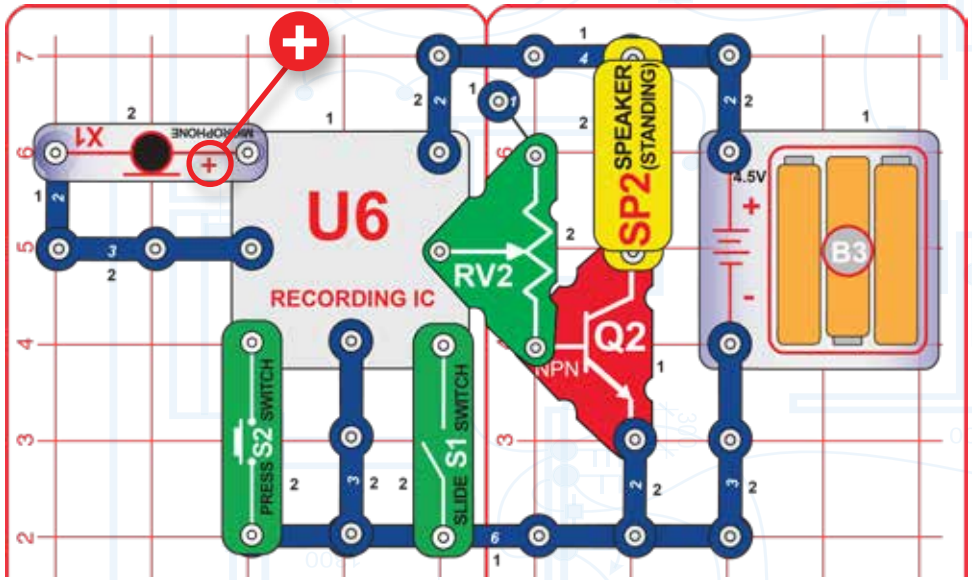
Press the press switch (S2) for playback. It plays the recording you made followed by one of three songs. If you press the press switch before the song is over, music will stop. You may press the press switch several times to play all three songs.

Part B "Wake Up Recording": Replace the press switch (S2) with the phototransistor (Q4, "+" on top). When the light on the phototransistor goes from dark to bright it plays the recording followed by one of three songs. When the sound is already playing you can stop it by again moving the circuit from dark to bright light. This project works best if you place it near a bright light and then cover and uncover the phototransistor to start or stop the sound. You can make a recording saying something like "wake up, it's morning".

Part C "Flooding Alarm": Record a flooding warning message. Connect one end of the red & black jumper wires across the press switch, and place the other ends in a cup or puddle of water (not distilled water). Your flood warning recording plays followed by a tune. You can silence the sound by removing the wires from the water and putting them back in (a second activation turns off the sound).

If you want to save energy, set your thermostat so your home is a little cooler in the winter and a little warmer in the summer. Every extra degree of heating or cooling reduces your energy cost significantly. You can use a programmed timer to automatically reduce heating or cooling when you know you will be away from home or asleep.

Project 41 | RECORD & PLAYBACK WITH VOLUME CONTROL



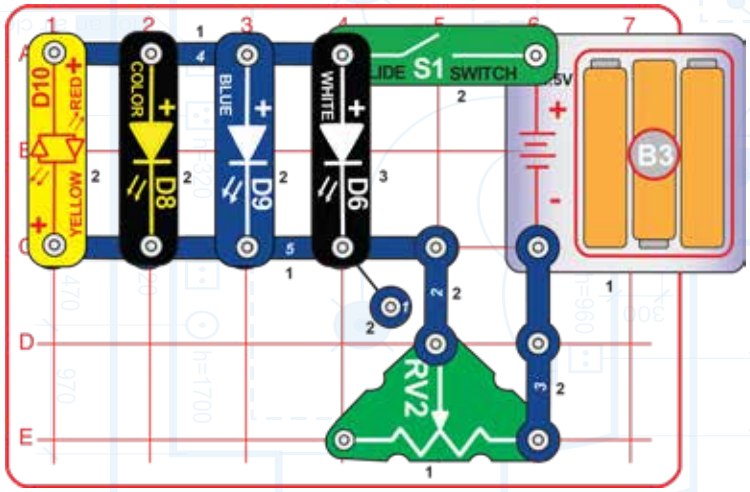
Modify the preceding circuit to include the adjustable resistor (RV2), as shown. The adjustable resistor is used as a volume control. Turn on the slide switch (S1), you hear a beep signaling that you may begin recording. Talk into the microphone (X1) up to 5 seconds, and then turn off the slide switch (it also beeps after the 5 seconds expires).

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

Move the lever on the adjustable resistor to change the playback volume.

The adjustable resistor reduces the control current to the NPN transistor (Q2), which controls the current through the speaker (SP2), lowering the sound volume.

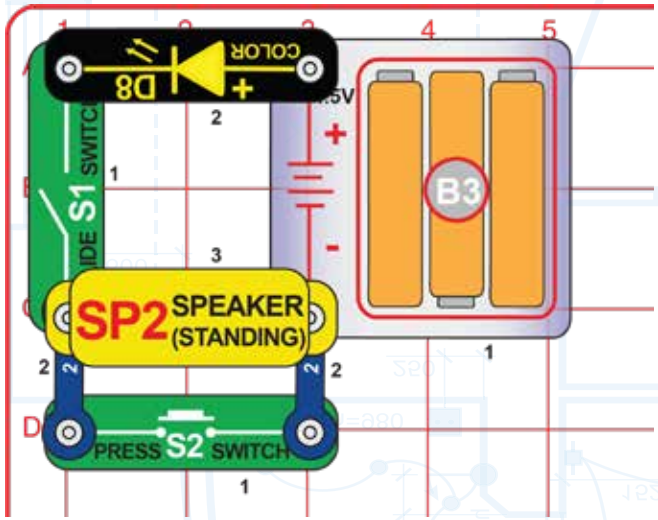
Project 42 | HIDING COLORS



Build the circuit shown and turn on the slide switch (S1). Move the lever on the adjustable resistor (RV2) to change the brightness of the LEDs (D6, D8, D9, & D10). Notice that some LEDs may not light at all settings of RV2.

The adjustable resistor (RV2) changes the voltage across the LEDs. LEDs turn on if the voltage exceeds a turn-on threshold (about 1.5V for red or yellow, about 2V for green, and about 3V for white or blue), brightness then increases as the voltage increases. At some RV2 settings a red or yellow LED has enough voltage to turn on but a blue or white LED does not. For the color LED (D8), red turns on easier than blue.

Project 43 | ABOUT THE SPEAKER



Build the circuit shown and turn on the slide switch (S1). The color LED (D8) lights and you hear strange sounds from the speaker (SP2). Push the press switch (S2) to stop the sound, and make the LED slightly brighter.

Replace the color LED with any of the other LEDs (D6, D9, & D10). Notice there is no sound now.

Replace the LED with the motor (M4) and fan. Notice there is sound from the speaker. Push S2 to stop the sound and make the fan speed up a little.

Replace the motor with the melody IC (U32). If you put your ear next to the speaker you can hear a little sound from it. Pushing S2 makes the sound from the melody IC a little louder.

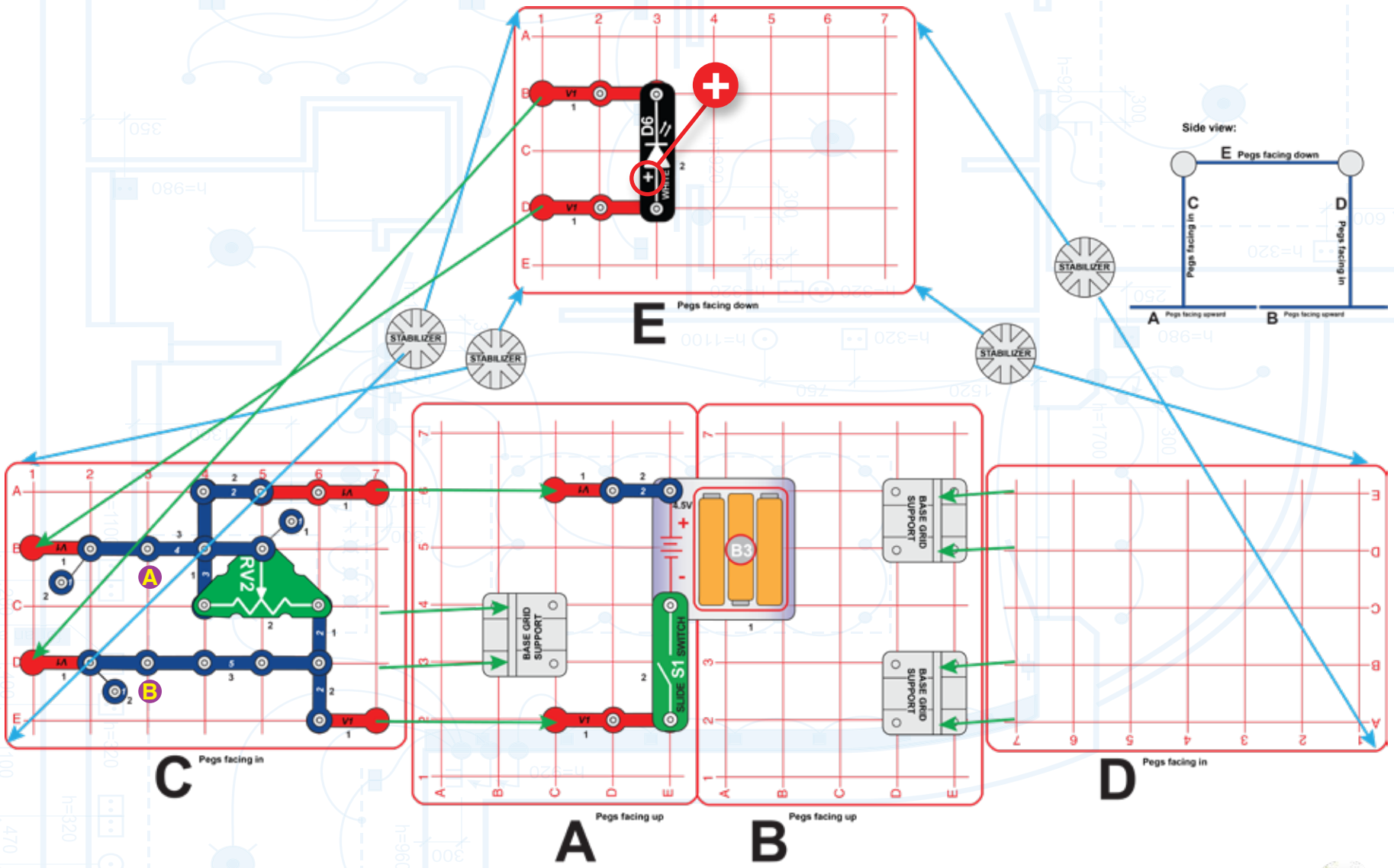
Inside the speaker is a coil of wire wrapped around a small magnet. A changing electric current in the coil makes a magnetic field, which makes the magnet vibrate. These vibrations create variations in air pressure, which your ears interpret as sound.

When the color LED changes colors, the current through it changes; these changes in current create the strange sounds you hear from the speaker. The other LEDs do not change color, so they do not change the current through the speaker and do not produce sound.

The motor uses magnetism to convert electrical energy into mechanical spinning motion. As the motor shaft spins around it connects/disconnects several sets of electrical contacts to give the best magnetic properties. As these contacts are switched, an electrical disturbance is created, which the speaker converts into sound. You could filter out the disturbance (and silence the sound) by adding the 470µF capacitor (C5, "+" toward B3) across the motor using the red & black jumper wires. The coil of wire in the speaker has some resistance (about 32 ohms), so pressing S2 bypasses the speaker's resistance and the fan speeds up a little.

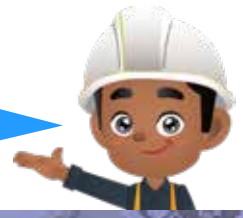
As the melody IC changes sounds the current through it changes, these changes in current create the sounds you hear from the speaker. Pressing S2 bypasses the speaker's resistance and makes the melody IC a little louder.

Project 44 | LIGHT DIMMER



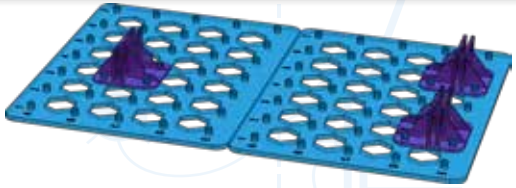
This circuit is like a light dimmer for a light in a room.

Most actual light dimmer switches in homes include a switch at the low end of the adjustment range, so the light can be turned off. Your RV2 part does not include such a switch, so a very small current will flow through the circuit when RV2 is set to its lowest setting and the LED appears to be off. Use the S1 slide switch to turn off the circuit completely.

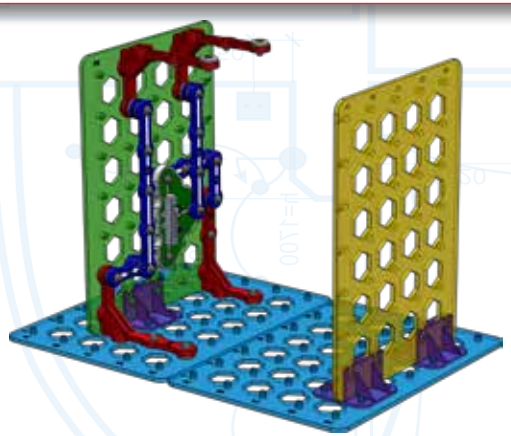


Assembly (adult supervision recommended):

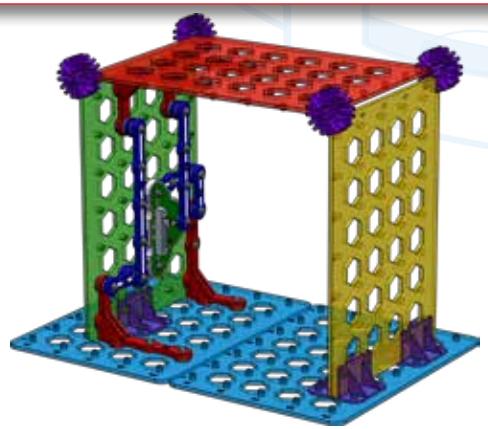
1. Place base grid supports on base grids A & B.



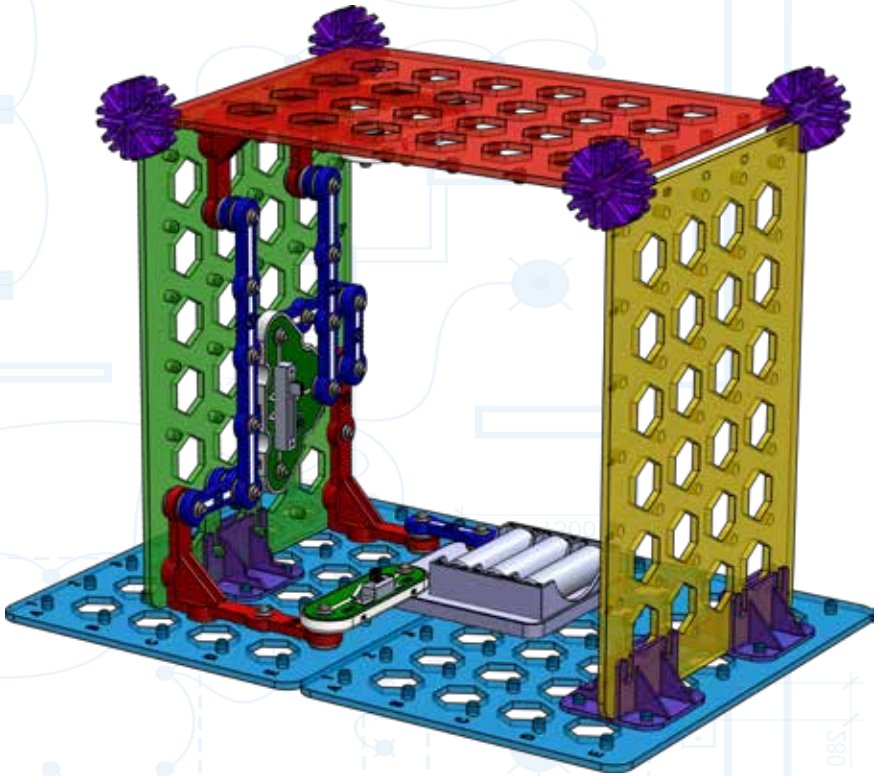
2. Place parts on base grids C, & D, and install into base grid supports on grids A & B. The pegs should be facing inward.



3. Mount grid E on top of grids C & D using 4 stabilizers, attaching the 2 vertical snap wires (V1) as you do it.



4. Place the remaining parts on grids A, B, & E.

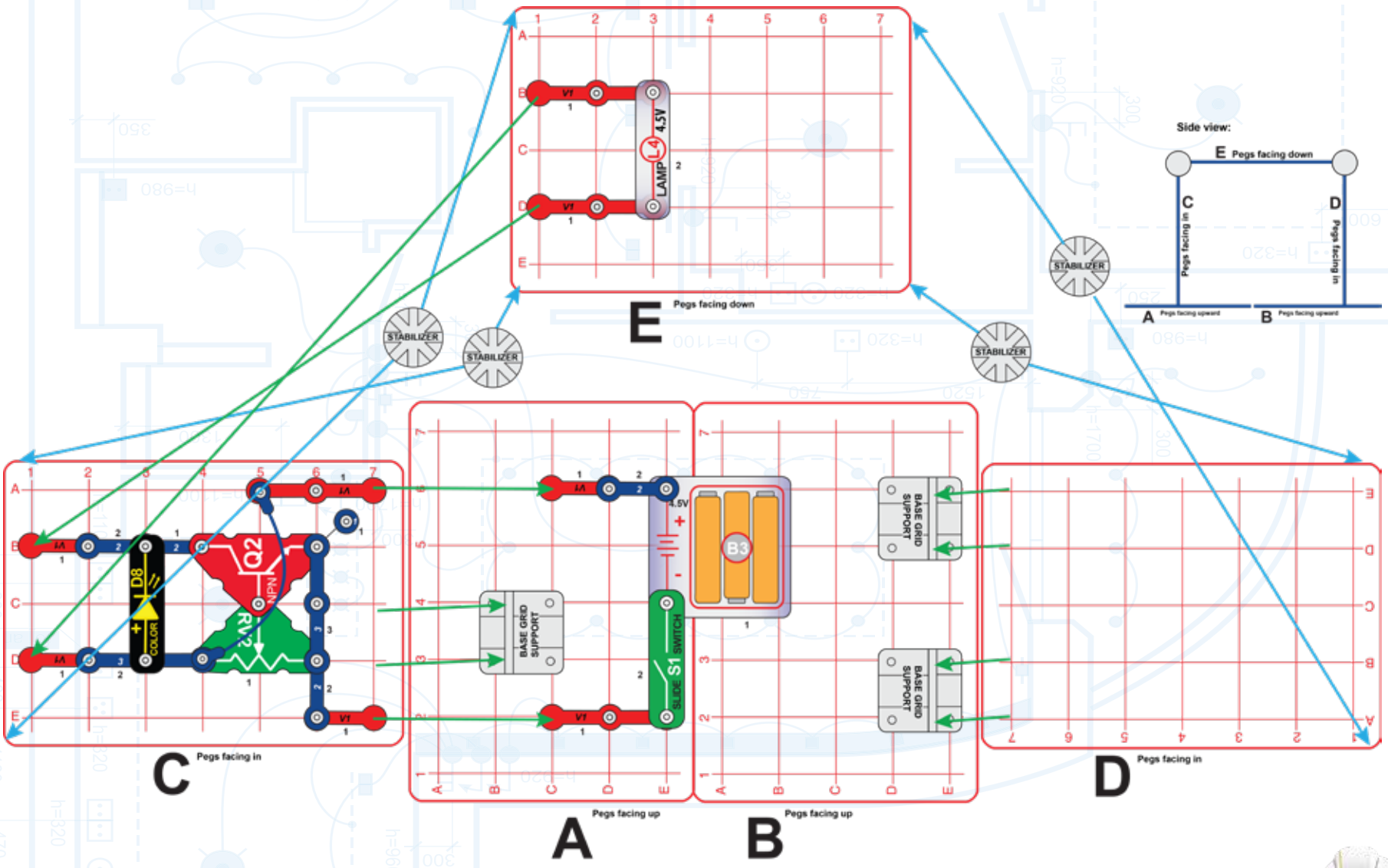


Turn on the slide switch (S1) and use the lever on the adjustable resistor (RV2) to set the brightness of the white LED (D6).

Replace the white LED with any of the other LEDs (D8, D9, or D10), the motor (M4) with fan, or the melody IC (U32). Move the lever on RV2 to vary the brightness, fan speed, or sound.

You can move the white LED (or other device) to be at points labeled A & B on grid C in the drawing ("+" to point A), making it a wall light instead of a ceiling light. You can place a light cover with a slide on the LED.

Project 45 | LIGHT DIMMER 2

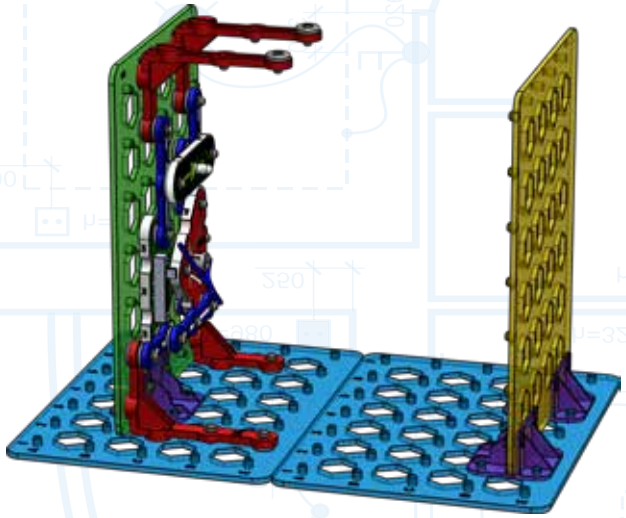


Like the preceding circuit, this circuit has a dimmer control for lights in a room. Like project 45, in this circuit the NPN transistor (Q2) uses a small control current through the adjustable resistor (RV2) to control a larger current through the lights and other devices. And unlike the preceding circuit, this circuit can have other lights or devices connected in parallel with the lamp, and all be controlled by RV2.

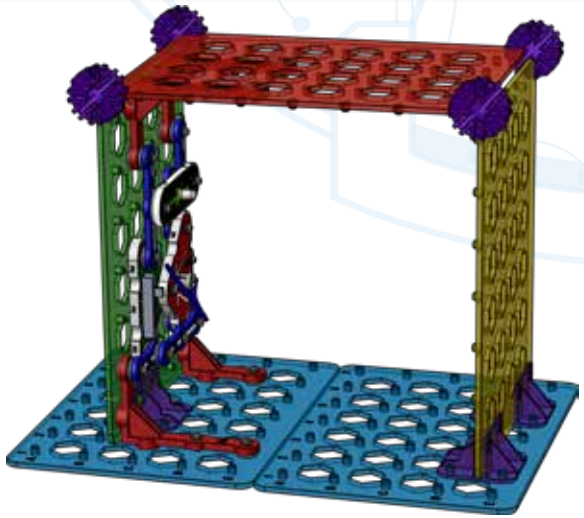
Assembly (adult supervision recommended):

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

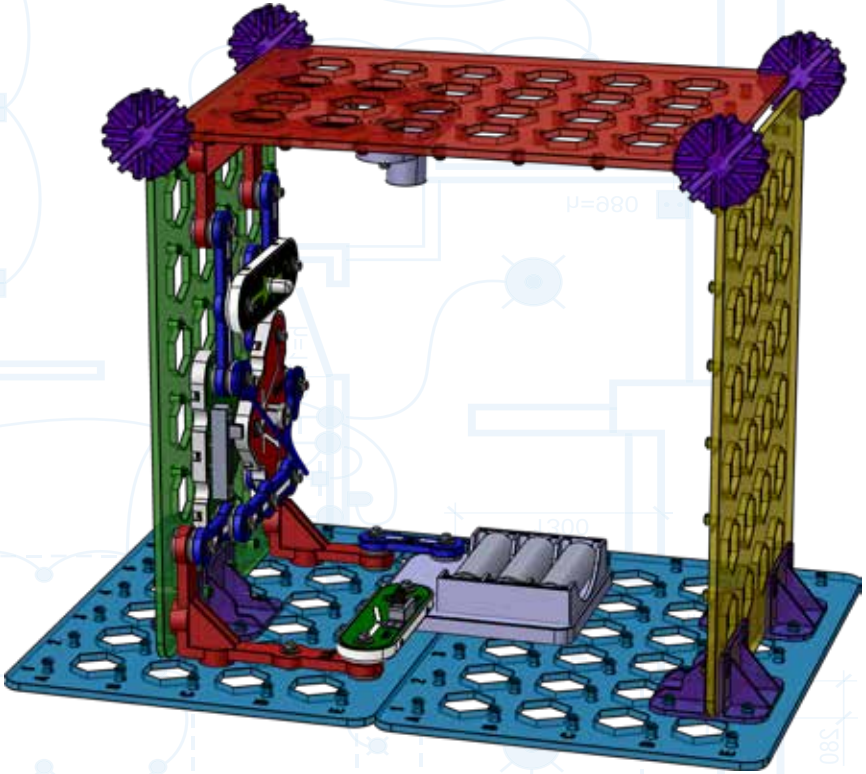
2. Place parts on base grids C, & D, and install into base grid supports on grids A & B. The pegs should be facing inward.



3. Mount grid E on top of grids C & D using 4 stabilizers, attaching the 2 vertical snap wires (V1) as you do it.



4. Place the remaining parts on grids A, B, & E.

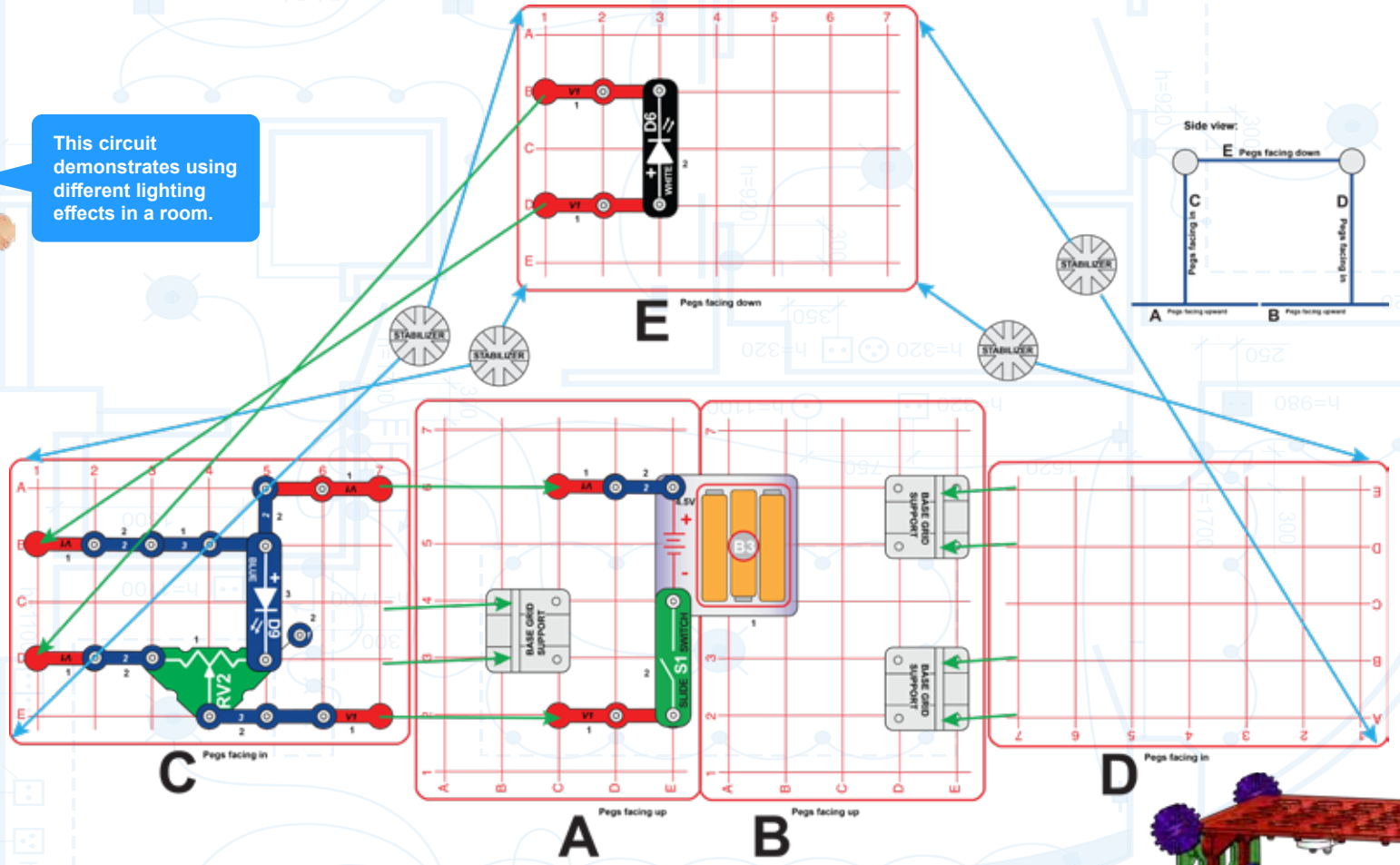


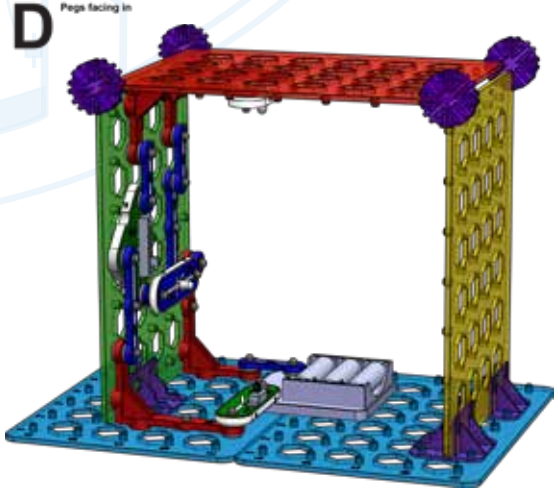
Turn on the slide switch (S1) and use the lever on the adjustable resistor (RV2) to set the brightness of the lamp (L4) and color LED (D8). You can place a light cover with a slide on the lights.

Replace the lamp or LED with any of the other LEDs (D8, D9, or D10), the motor (M4) with fan, or the melody IC (U32). Move the lever on RV2 to vary the brightness, fan speed, or sound.

Project 46 I LIGHT SHIFTER

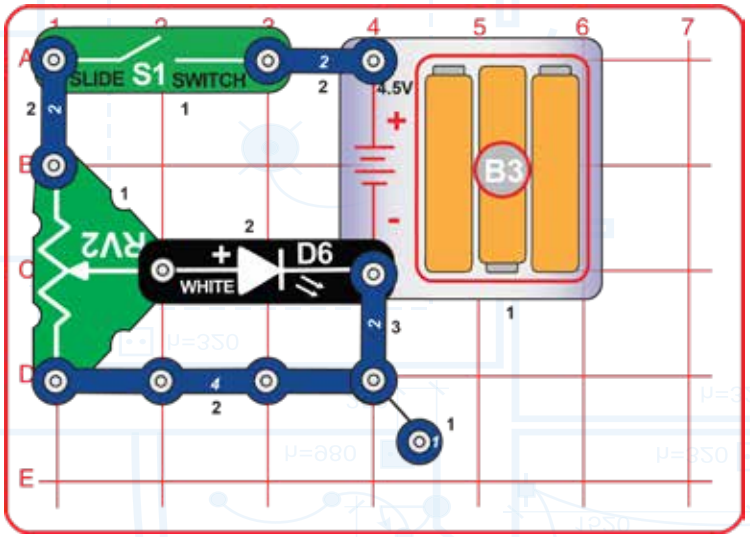
This circuit demonstrates using different lighting effects in a room.





Use the preceding circuit but replace the lamp (L4) with the white LED (D6) and modify the parts on grid C as shown, as shown. Move the lever on the adjustable resistor (RV2) up and down to shift brightness between the white and blue LEDs (D6 & D9). You can replace either LED with the color or red/yellow LED (D8 & D10).

Project 47 | BRIGHTNESS/SPEED CONTROL

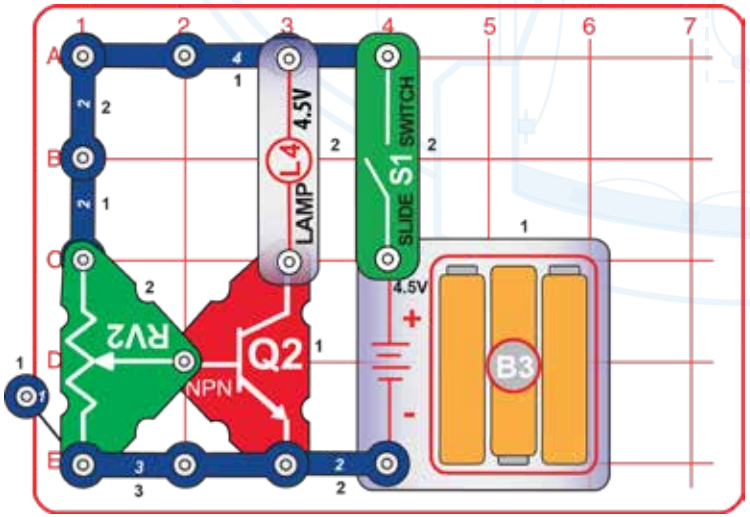


Build the circuit shown and turn on the slide switch (S1). Move the lever on the adjustable resistor (RV2) to change the white LED (D6) brightness.

Replace the white LED with any of the other LEDs (D8, D9, or D10), the motor (M4) with fan, or the melody IC (U32). Move the lever on RV2 to vary the brightness, fan speed, or sound. You can try the lamp (L4) but it will not light.

The adjustable resistor (RV2) varies from 200 ohms to 10k ohms in resistance, which reduces the electric current through the LEDs and other devices. RV2's minimum resistance of 200 ohms does not allow the motor to get to full speed, and does not allow the lamp to light at all.

Project 48 | BRIGHTNESS/SPEED CONTROL 2



Build the circuit shown and turn on the slide switch (S1). Move the lever on the adjustable resistor (RV2) to change the lamp (L4) brightness.

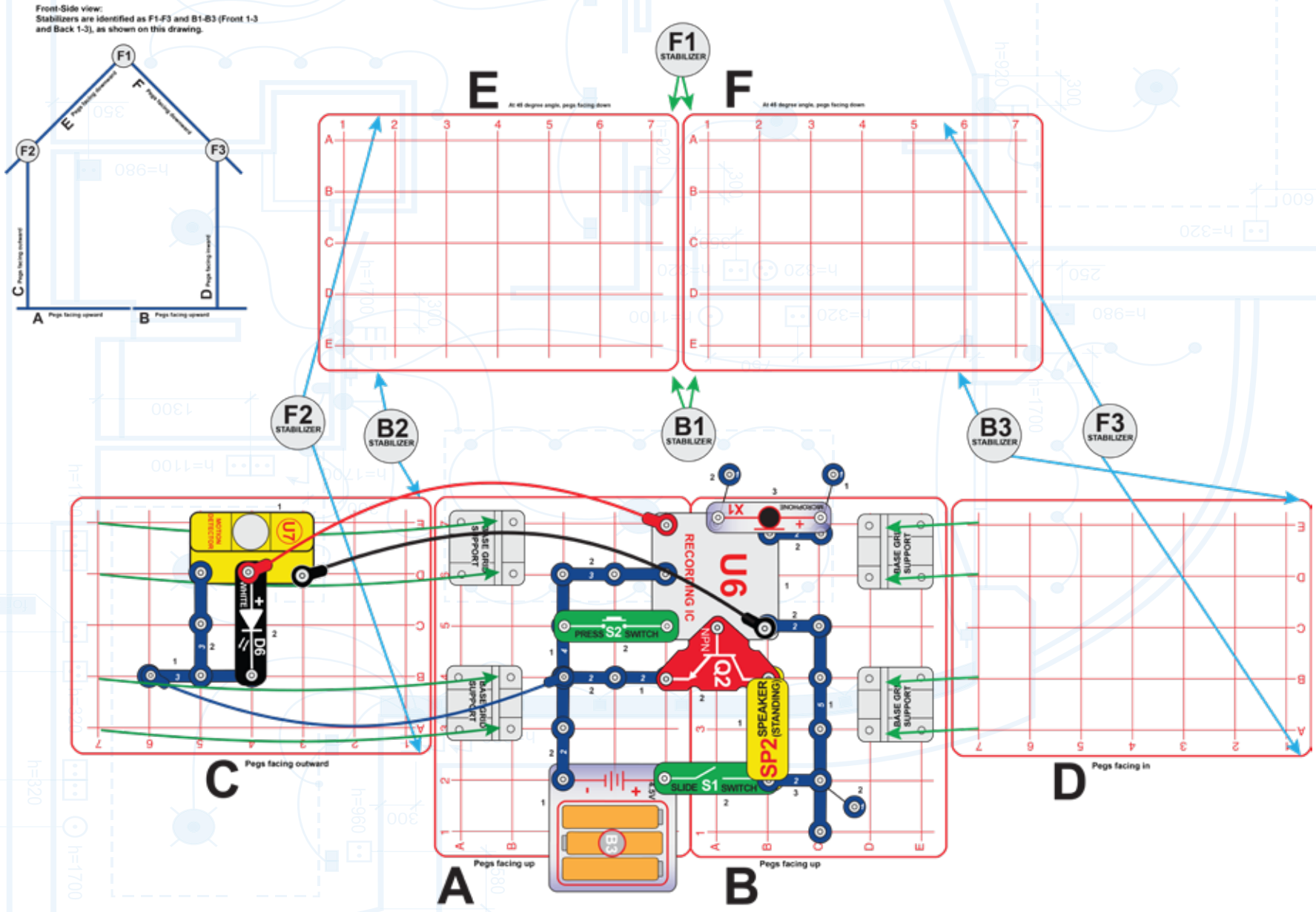
Replace the lamp with any of the LEDs (D6, D8, D9, or D10, "+" on top), or motor (M4) and fan, or melody IC (U32). Move the lever on RV2 to vary the brightness, fan speed, or sound, and compare to the preceding circuit.

In this circuit the NPN transistor (Q2) uses a small control current through the adjustable resistor (RV2) to control a larger current through the lights and other devices. Here the transistor has a much lower minimum resistance than RV2, allowing the lamp and other devices to get much brighter. Notice how devices that use less electric current (like LEDs) are on for most of RV2's range, while devices that use a lot of current (like the lamp) are off for most of RV2's range.

For the melody IC, the sound becomes distorted at low current (not quieter), because we are reducing the current to the melody-generation circuitry, not to its speaker directly.

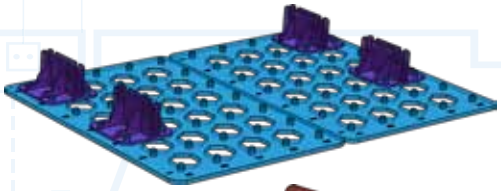
Another advantage this circuit has over the preceding circuit is that other lights or devices may be connected in parallel with the lamp, and all be controlled by RV2.

Project 49 I MOTION WARNING HOUSE

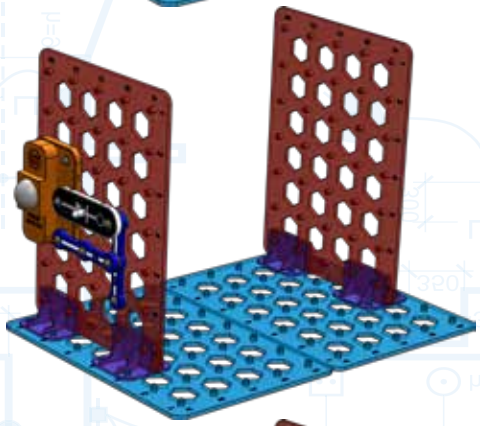


Assembly (adult supervision recommended):

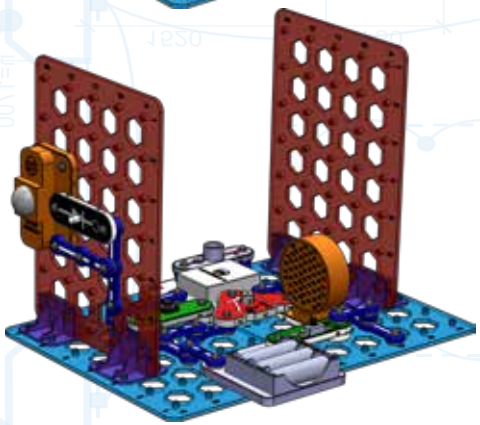
1. Place base grid supports on base grids A & B.



2. Place parts on base grids C & D except for the 3 jumper wires (red, black, & blue), and install into base grid supports on grids A & B. The pegs should be facing outward on grid C and inward on grid D.

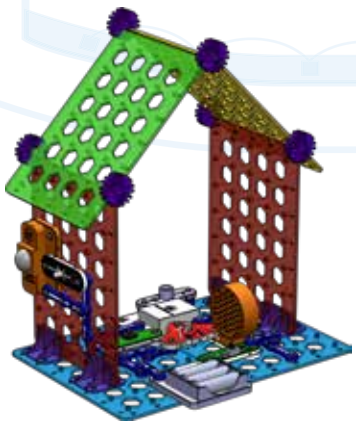


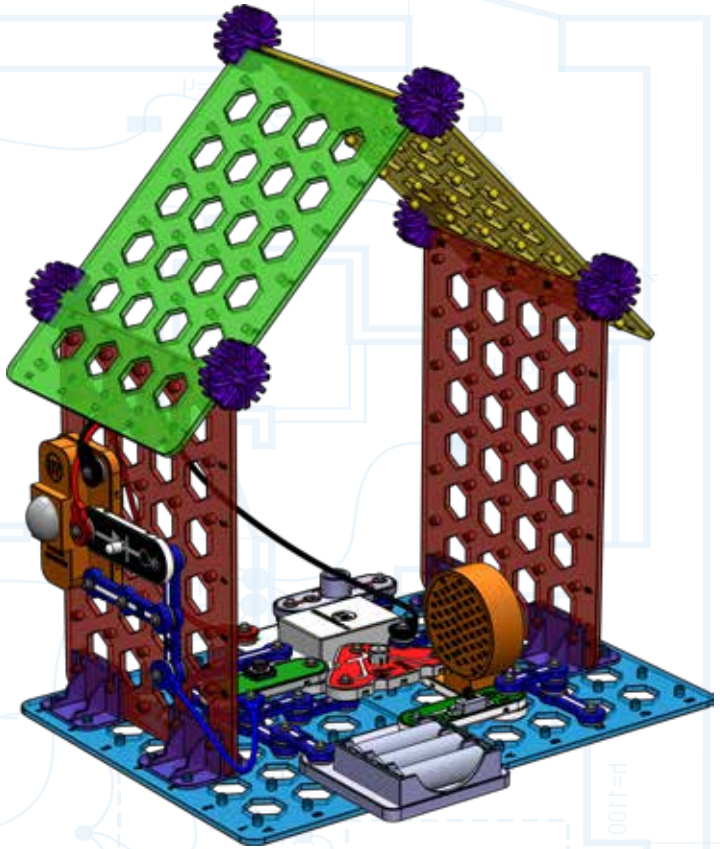
3. Place remaining parts on grids A & B.



4. Mount grids E & F 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.

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

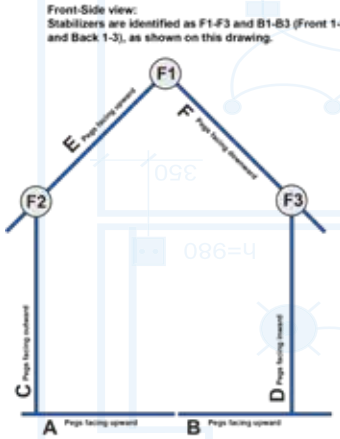


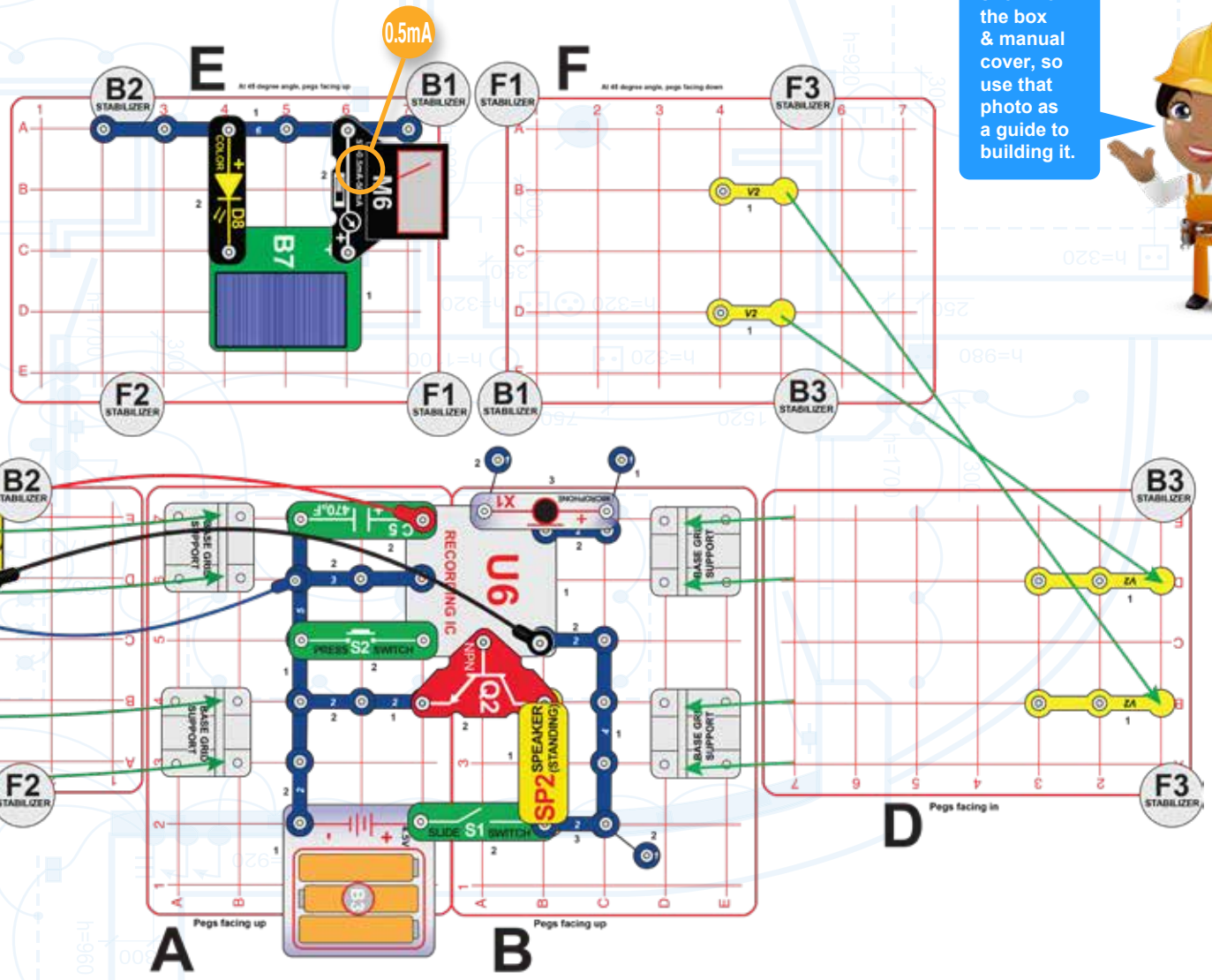


Position the circuit so the motion detector (U7) looks out across a room, but do not let it face anything moving (including you) just yet. Turn on the slide switch (S1), if there is any sound then wait for it to stop (and stay away from the motion detector). Push and hold down the press switch (S2) and talk into the microphone (X1) to record a message for up to 5 seconds, releasing the press switch when you are finished. You hear a beep when recording starts and another beep when recording finishes. Now the circuit is ready.

Walk in front of the motion detector to activate your recording followed by a tune, or to stop the sound. If the motion detector is activated while the recording/tune is already playing then the sound will stop. If the motion detector is activated twice quickly then there may only be a brief sound, but if it's only activated once then it will play the full recording and tune.

Project 50 I MOTION WARNING HOUSE 2





This is the circuit shown on the box & manual cover, so use that photo as a guide to building it.

In the preceding circuit the sound is easily turned on and off. This circuit is similar but adds the 5.1kΩ resistor (R3) and 470µF capacitor (C5) to create a filter between the motion detector (U7) and the recording IC (U6) so that the sound is not turned on and off so easily. This circuit also has one of the roof grids flipped so the pegs are up, and mounts a solar cell circuit on it. You can compare the two circuits.

Assembly (adult supervision recommended):

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

2. Place parts on base grids C & D except for the 3 jumper wires (red, black, & blue), and install into base grid supports on grids A & B. The pegs should be facing outward on grid C and inward on grid D.

3. Place remaining parts on grids A & B.

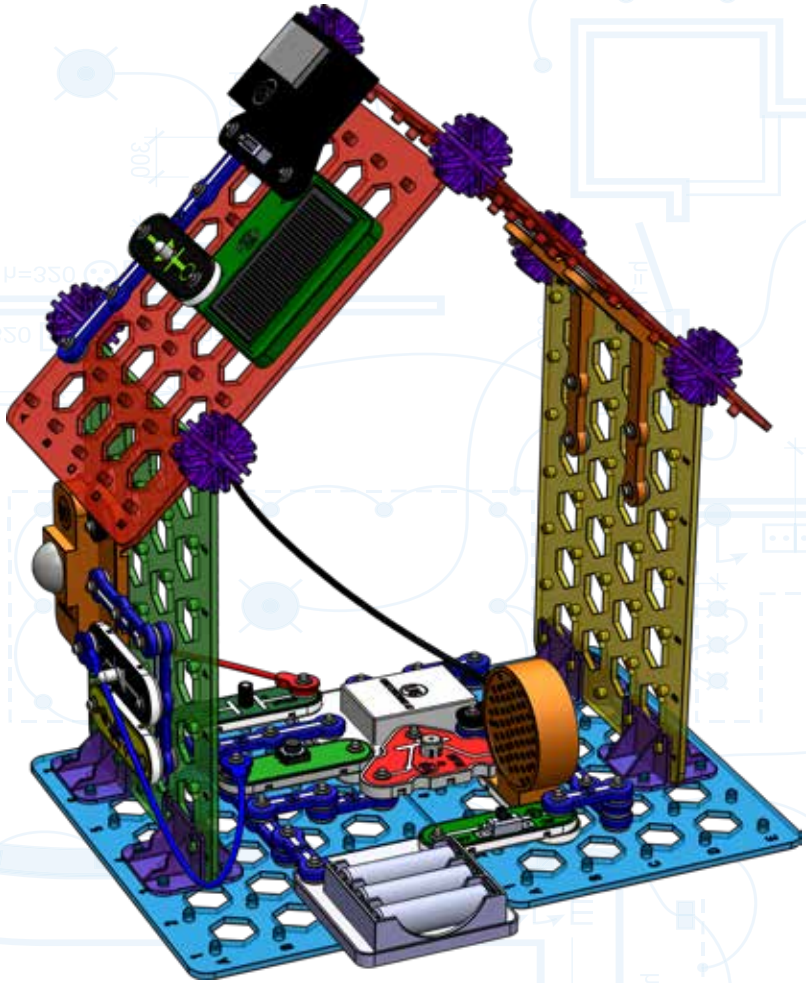
4. Place parts on grid E and mount grids E & F at 45 degree angles, with pegs oriented down on top of grids C & D using 6 stabilizers, attaching the two 45 degree vertical snap wires (V2) between grids D & F as you do it, adjust the positions of the stabilizers as needed.

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

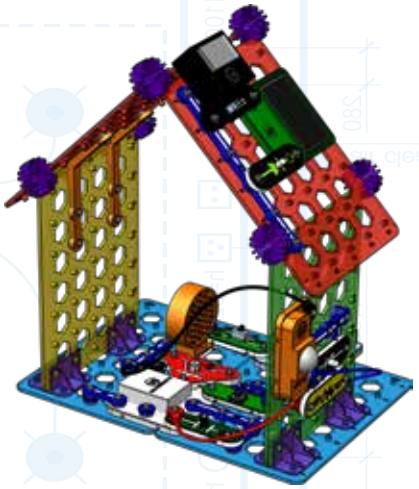
Set the meter (M6) to the 0.5mA scale. Position the circuit so the motion detector (U7) looks out across a room, but do not let it face anything moving (including you) just yet. Turn on the slide switch (S1), if there is any sound then wait for it to stop (and stay away from the motion detector). Push and hold down the press switch (S2) and talk into the microphone (X1) to record a message for up to 5 seconds, releasing the press switch when you are finished. You hear a beep when recording starts and another beep when recording finishes. Now the circuit is ready.

Walk in front of the motion detector to activate your recording followed by a tune, or to stop the sound. If the motion detector is activated repeatedly in a short time then the white LED (D6) may flicker but the sound may not start or stop, if this happens then just wait a little longer for the sound circuit to reset itself.

Light on the solar cell (B7) produces electricity for the meter and color LED (D8). Sunlight or incandescent light bulbs work best. Light from LED or fluorescent bulbs does not work well with solar cells.



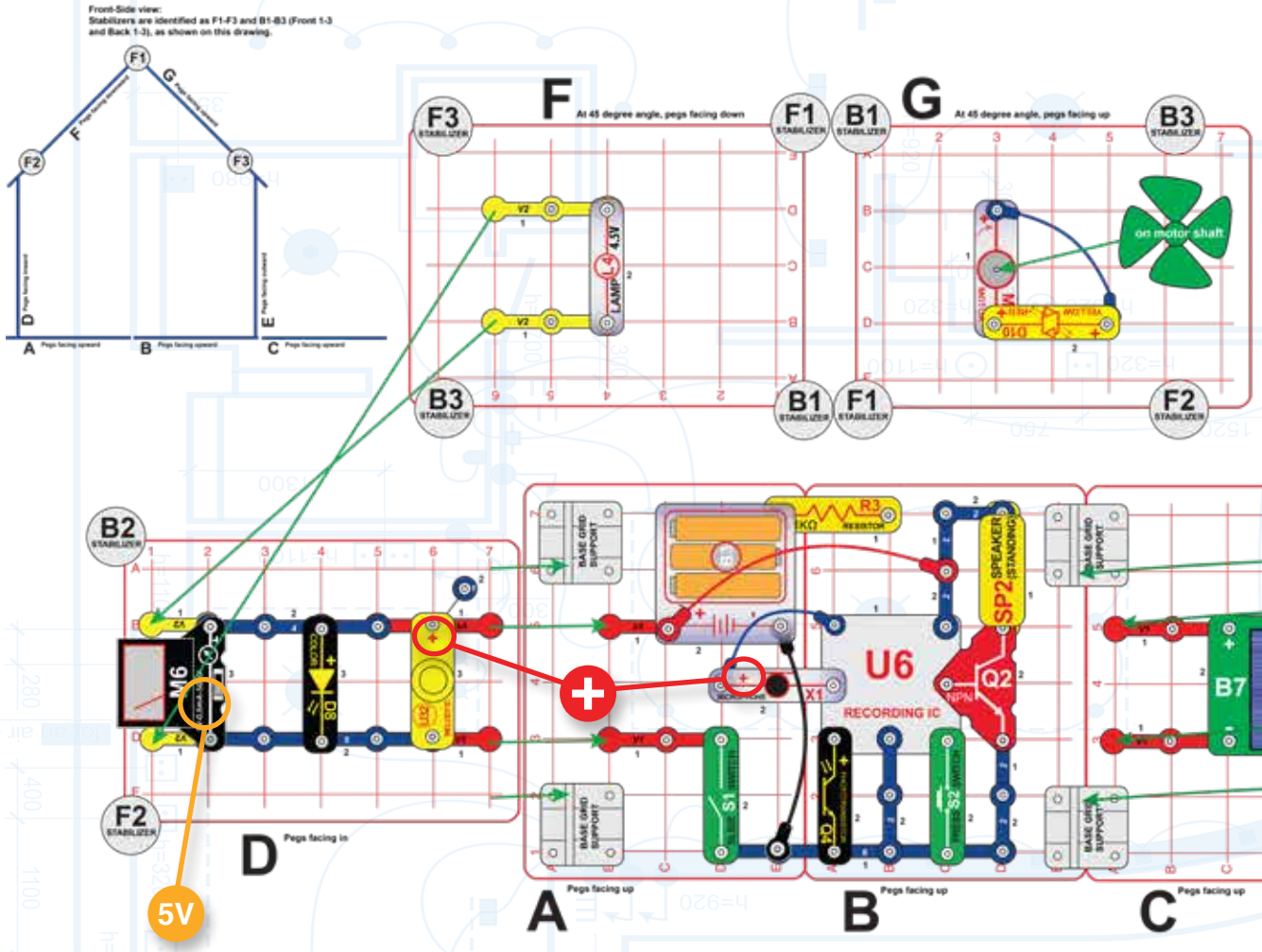
Side View A



Side View B

Project 51 | HOUSE OF FEATURES

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.



This circuit represents features you might find in a home:

- The lamp represents a room light.
- The color LED represents a TV or computer.
- The melody IC represents sound from a TV or radio.
- The meter represents a device monitoring the system power.
- The slide switch represents a local or master switch controlling some of the above devices. It might be on a wall or table.
- The recording IC (U6) might represent a wake-up or other light controlled sound device.
- The motion detector represents a motion sensor watching the outside of the home, and is powered by sunlight. The 470µF capacitor keeps the motion detector on when something briefly blocks light to the solar cell; it represents a rechargeable battery.
- The motor & fan represent a windmill, powering a light.

Assembly (adult supervision recommended):

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

2. Place parts on base grids D & E, and install into base grid supports on grids A, B, & C. The pegs should be facing inward on grid D and outward on grid E.

3. Place remaining parts on grids A, B, & C except for the red jumper wire.

4. Place parts on grids F & G, and mount grids D & E at 45 degree angles and with pegs oriented down for grid F and up for grid G, on top of grids D & E using 6 stabilizers, attaching the two 45 degree vertical snap wires (V2) between grids D & F as you do it. Adjust the positions of the stabilizers as needed.

5. Set the meter (M6) to the 5V scale. Position the circuit so the motion detector (U7) looks out across a room. If desired, place the light cover and a slide on any of the LEDs (D8 & D9) or the lamp (L4). Turn off the slide switch (S1). Lastly, connect the red jumper wire. Note that the 5.1kΩ resistor (R3) is not electrically connected, it is used only as a support for the battery holder (B3).

If there is any sound then wait for it to stop. Push and hold down the press switch (S2) and talk into the microphone (X1) to record a message for up to 5 seconds, releasing the press switch when you are finished. You hear a beep when recording starts and another beep when recording finishes. Now the circuit is ready. *Do not leave the circuit for two minutes because the lamp will be hot.*

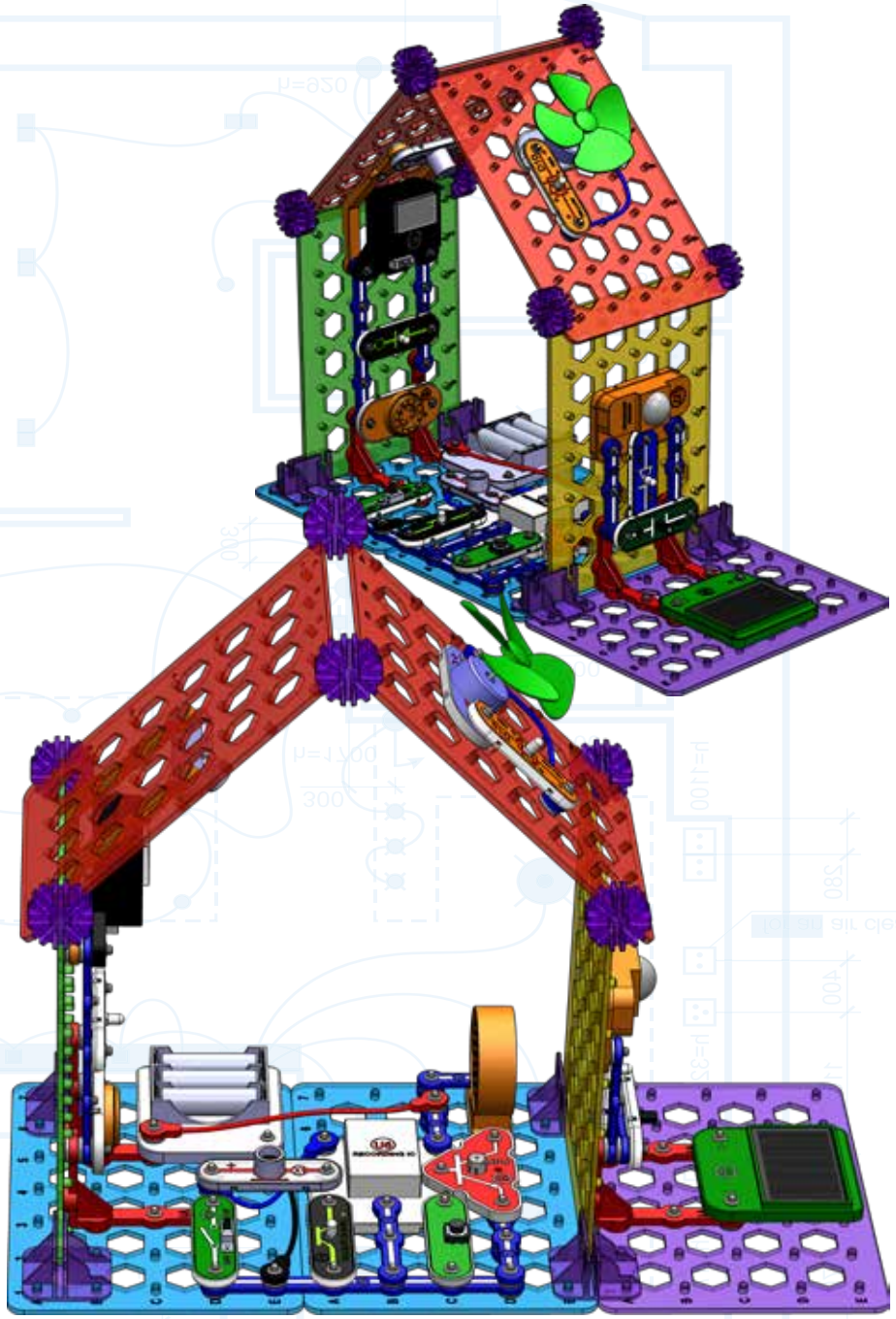
Features:

1. When the light on the phototransistor goes from dark to bright it plays the recording followed by one of three songs. When the sound is already playing you can stop it by again moving the circuit from dark to bright light. This project works best if you place it near a bright light and then cover and uncover the phototransistor to start or stop the sound. You can make a recording saying something like “wake up, it’s morning”.

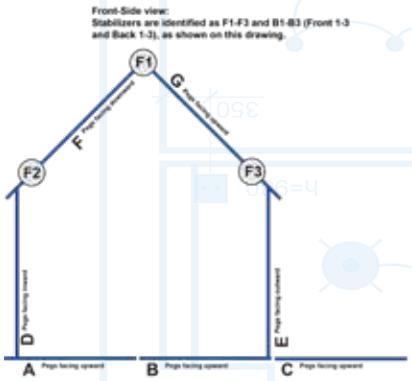
2. Turn on the slide switch (S1). The lamp and color LED light, the melody IC (U32) plays tunes, and the meter measures the battery voltage.

3. Place the solar cell (B7) in sunlight or near an incandescent light bulb (not a LED, CFL, or fluorescent bulb). If light is strong enough then the solar cell will power the motion detector (U7). Walk in front of the motion detector to activate the blue LED.

4. Blow on the fan. If you blow hard enough then the red/yellow LED (D10) lights.



Project 52 | DOORBELL RECORDING 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.

This circuit represents features you might find in a home:

- The lamp represents a room light.
- The color LED represents a TV or computer.
- The slide switch represents a local or master switch controlling some of the above devices. It might be on a wall or table.
- The recording IC (U6) represents a doorbell recording, and a flooding alarm in Part B.
- The solar cell and white LED represent outdoor lighting powered by solar, with a rechargeable battery that could keep the light on through the night.
- The motor & fan represent a windmill, powering a light.

Assembly (adult supervision recommended):

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

2. Place parts on base grids D & E, and install into base grid supports on grids A, B, & C. The pegs should be facing inward on grid D and outward on grid E.

3. Place remaining parts on grids A, B, & C; one end of the red & black jumper wires should be unconnected for now.

4. Place parts on grids F & G, and mount grids D & E at 45 degree angles and with pegs oriented down for grid F and up for grid G, on top of grids D & E using 6 stabilizers, attaching the two 45 degree vertical snap wires (V2) between grids D & F as you do it. Adjust the positions of the stabilizers as needed.

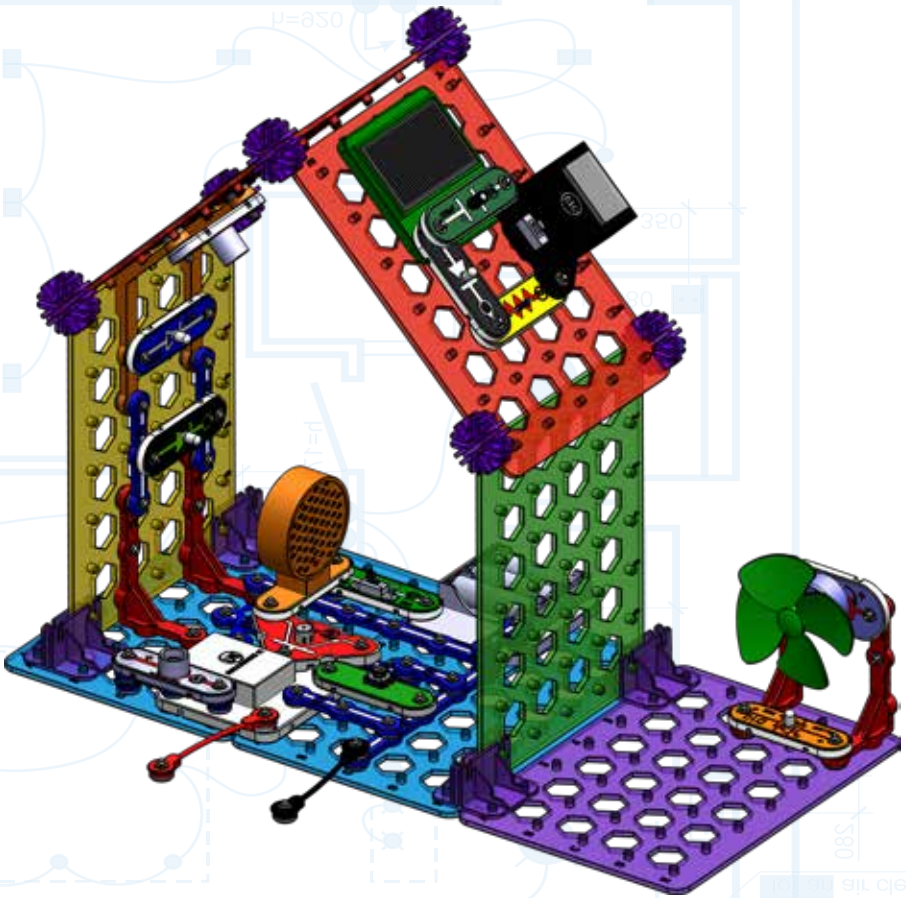
Set the meter (M6) to the 0.5mA scale. If desired, place the light cover and a slide on any of the LEDs (D8 & D9) or the lamp (L4).Turn on the slide switch (S1). Push and hold down the press switch (S2) and talk into the microphone (X1) to record a doorbell greeting message for up to 5 seconds, releasing the press switch when you are finished. You hear a beep when recording starts and another beep when recording finishes. Now move the press switch (S2) to point labeled A & B on grid E, and connect the red & black jumper wires to it (red to A and black to B). *Do not leave the circuit for two minutes because the lamp will be hot.*

Features:

1. The color and blue LEDs and lamp are on. Push the press switch (the "doorbell") to hear your recording followed by a tune. You can silence the sound by pressing the doorbell again. Turn off the slide switch to disable these.

2. Place the solar cell (B7) in sunlight or near an incandescent light bulb (not a LED, CFL, or fluorescent bulb). If light is strong enough then the solar cell will light the white LED (D6) and the meter will measure current.

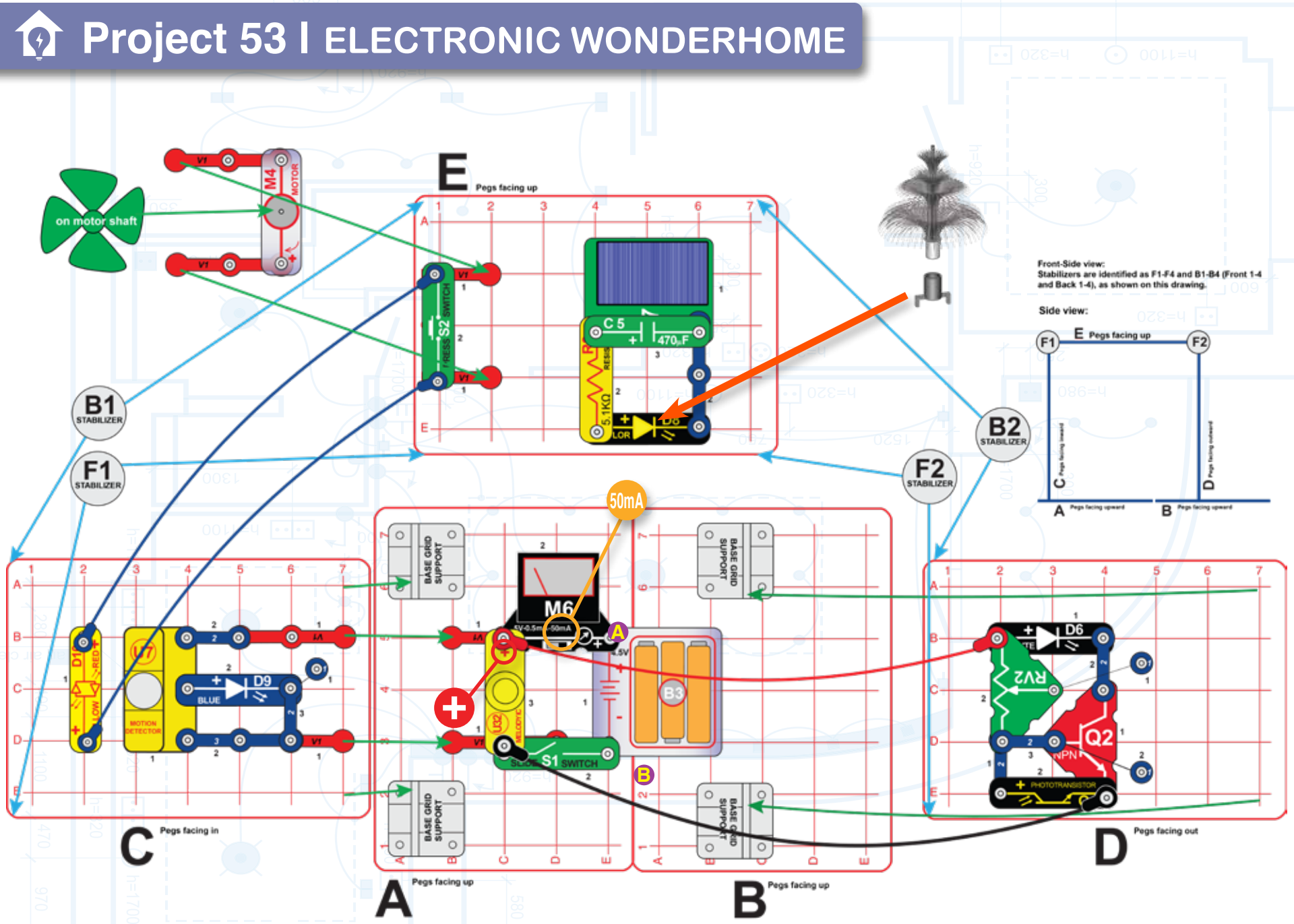
3. Blow on the fan. If you blow hard enough then the red/yellow LED (D10) lights.



Part B: Use the original circuit (do not connect the press switch across points labeled A & B). Place the loose ends of the red & black jumper wires on the table so they do not touch anything. Turn on the slide switch. Push and hold down the press switch (S2) and talk into the microphone (X1) to record a flooding warning message for up to 5 seconds, releasing the press switch when you are finished. You hear a beep when recording starts and another beep when recording finishes.

Place the loose ends of the red & black jumper wires into a cup or puddle of water (not distilled water). Your flood warning recording plays followed by a tune. You can silence the sound by removing the wires from the water and putting them back in (a second activation turns off the sound).

Project 53 I ELECTRONIC WONDERHOME



Assembly (adult supervision recommended):

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

2. Place parts on base grids C & D except the jumper wires, 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 remaining parts on grids A & B, except for the jumper wires.

4. Place parts on grid E, and mount on top of grids on grids C & D using 4 stabilizers. The pegs on grid E should face upward. Adjust the positions of the stabilizers as needed.

5. Connect the jumper wires (2 blue, 1 black, and 1 red).

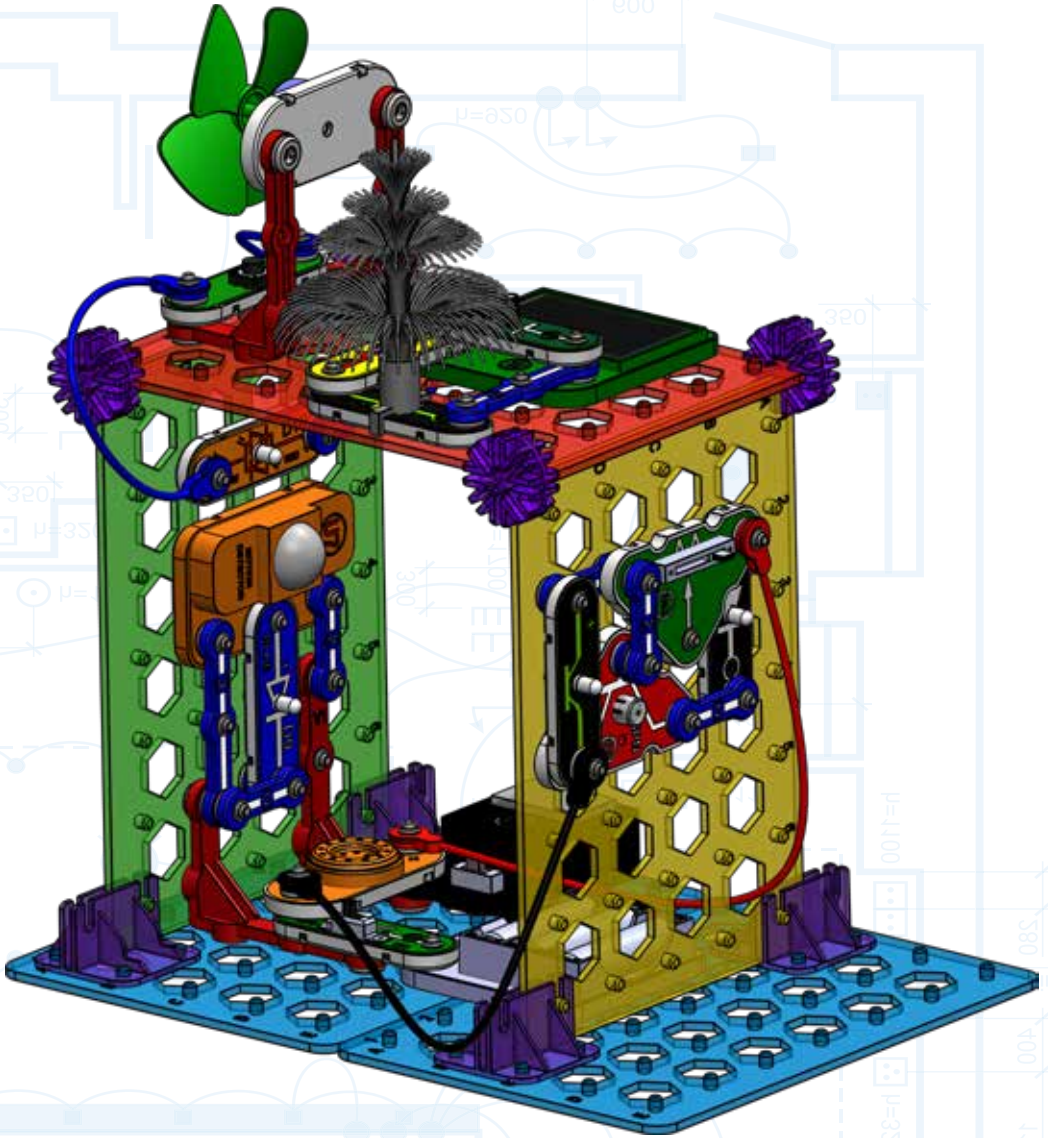
Set the meter (M6) to the 50mA scale and turn on the slide switch (S1). The melody IC (U32) plays tunes. The meter measures the current. The motion detector (U7) monitors the home for motion, move your hand near its dome and it activates the blue LED (D9). The phototransistor (Q4) monitors the room light and turns on the white LED(D6) if the lighting is low, it there is bright light on Q4 then the white LED is off.

If the solar cell is in sunlight or near an incandescent light bulb (not a LED, CFL, or fluorescent bulb) then it will charge the 470µF capacitor (C5) and light the color LED (D8) and fiber optic festive tree. Once C5 is charged, the LED will stay on if light to the solar cell is blocked for a short time.

The motor (M4) and fan are a windmill, powering the red/yellow LED (D10). If you blow hard enough on the fan then the LED lights.

If desired, place the lamp (L4) between the points labeled A & B (directly across the battery holder). There is no on/off switch for it, so remove it to turn it off.

The press switch (S2) is used only to stabilize the vertical snap wires that hold the motor, so do not press it. The adjustable resistor (RV2) is used as a fixed resistor, so moving its lever has no effect.



This circuit represents features you might find in a home:

- **The motion detector and blue LED represent a security system; which might include a siren.**
- **The melody IC represents music from a stereo or radio.**
- **The meter represents a device monitoring the system power.**
- **The phototransistor and white LED represent outdoor lighting that comes on at dusk or nighttime.**
- **The motor & fan represent a wind generator, powering a room light.**
- **The solar cell and color LED represent outdoor lighting powered by solar, with a rechargeable battery that could keep the light on through the night.**
- **The lamp (if added) represents a room light.**

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.

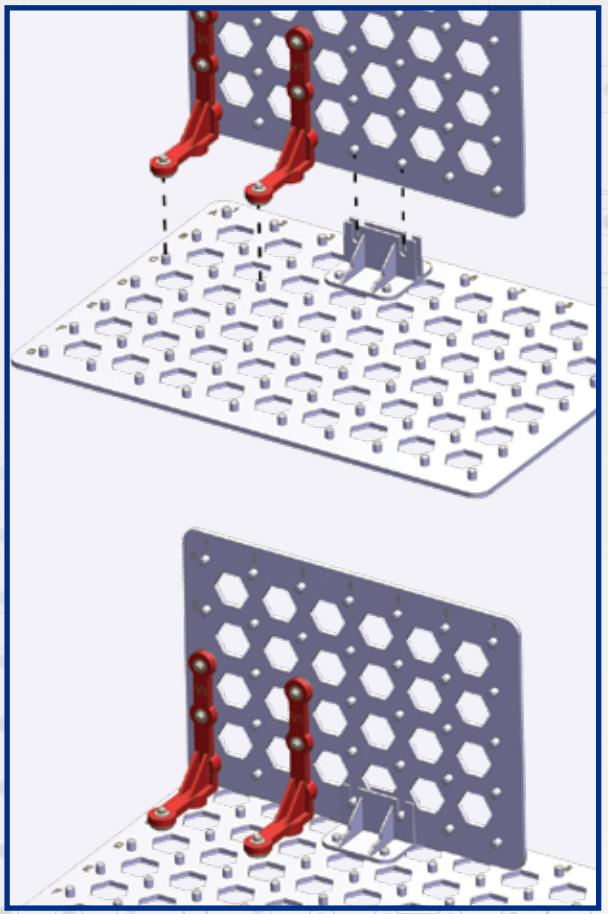
You need a power source to build each circuit. This is labeled (B3) and requires three (3) 1.5V "AA" batteries (not included).

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.

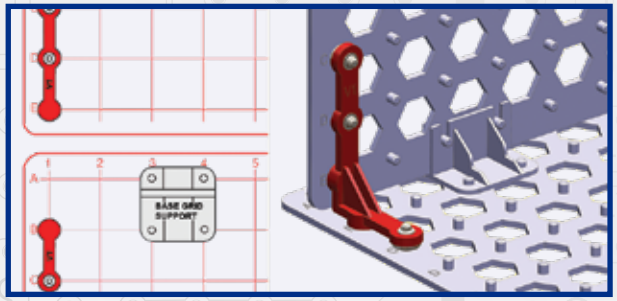
When assembling the 3D circuits, the order in which parts are installed is important. In particular, the vertical snap wires (V1) need to be snapped onto the mini base grid first and then the mini base grid is slid into the base grid support as shown below.



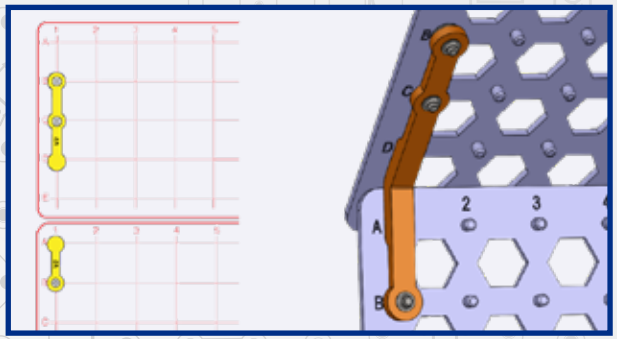
HOW TO USE YOUR SNAP CIRCUITS®

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.

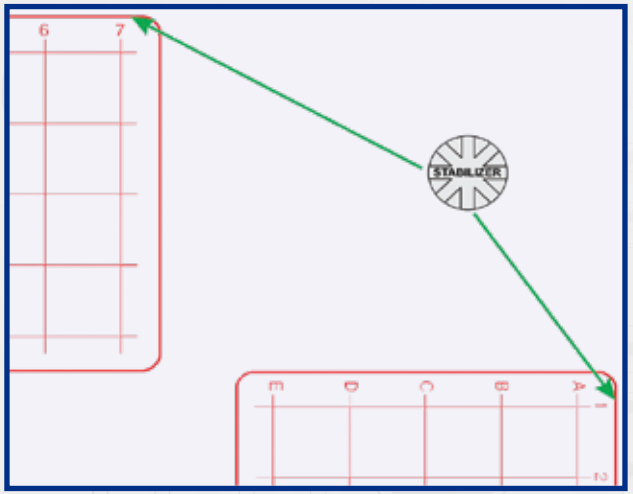


The 45 degree vertical snap wire (V2) is similar to V1 but mounts at a 45 degree angle.

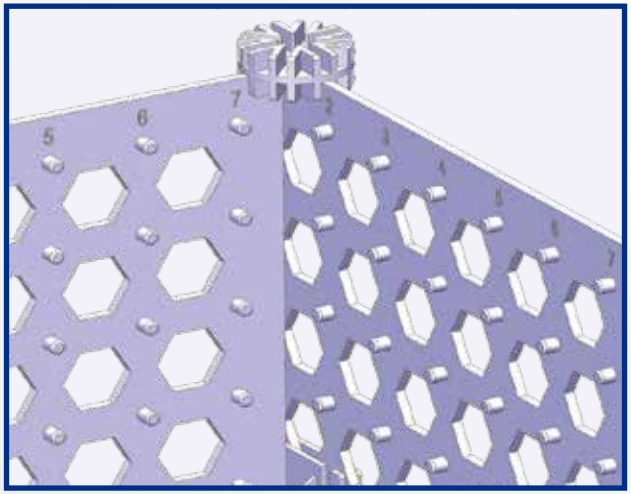


When inserting the base grid into the base grid support, it is a good idea to insert an area on the base grid that doesn't have raised letters or numbers. The raised text can interfere with the insertion or cause a tight fit between the base grid and base grid support.

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.

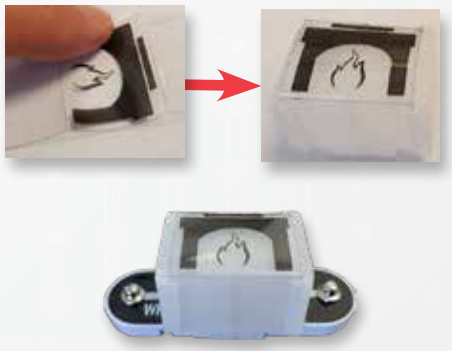


To attach the stabilizer to the base grid, simply align the desired grooves in the stabilizer with the edges of the base grids and press down. The figure below shows how the stabilizer symbol is presented in the manual and the 3D rendering of the stabilizer mounted to two base grids.

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

HOW TO USE YOUR SNAP CIRCUITS®

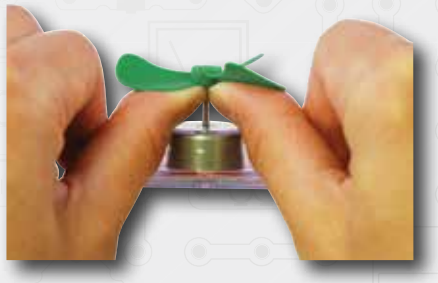
The light covers and slides may be placed on the LEDs (D6, D8, D9, & D10) or lamp (L4) as decoration. Fold the slides as indicated and slide them into the slots on the cover, as shown.



The fiber optic festive tree can be mounted on the LEDs (D6, D8, D9, & D10) 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.



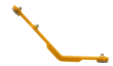
Note: while building the projects, be careful not to accidentally make a direct connection across the battery holder (a "short circuit"), as this may damage and/or quickly drain the batteries.

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)

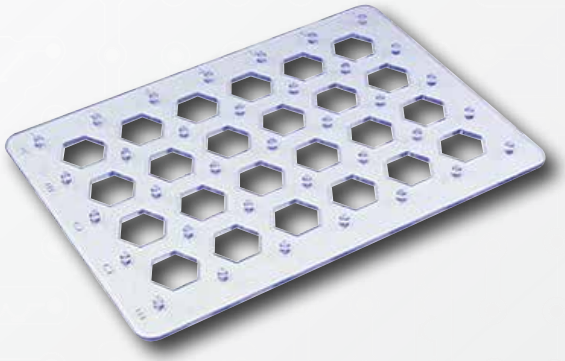
Important: If any parts are missing or damaged, **DO NOT RETURN TO RETAILER**. Call toll-free (800) 533-2441 or e-mail us at: help@elenco.com. Customer Service: 150 Carpenter Ave., Wheeling, IL 60090 U.S.A. ● You may order additional / replacement parts at www.elenco.com/replacement-parts

Qty.	ID	Name	Symbol	Part #	Qty.	ID	Name	Symbol	Part #	Qty.	ID	Name	Symbol	Part #
❒ 3	1	1- Snap Wire		6SC01	❒ 1	D6	White LED		6SCD6	❒ 1	Q2	NPN Transistor		6SCQ2
❒ 6	2	2- Snap Wire		6SC02	❒ 1	D8	Color LED		6SCD8	❒ 1	Q4	Phototransistor		6SCQ4
❒ 3	3	3- Snap Wire		6SC03	❒ 1	D9	Blue LED		6SCD9	❒ 1	R3	5.1kΩ Resistor		6SCR3
❒ 1	4	4- Snap Wire		6SC04	❒ 2	D10	Red/Yellow Bicolor LED		6SCD10	❒ 1	RV2	10kΩ Adjustable Resistor		6SCRV2
❒ 1	5	5- Snap Wire		6SC05	❒ 1		Mounting Base		6SCFMB	❒ 1	S1	Slide Switch		6SCS1
❒ 1	6	6- Snap Wire		6SC06	❒ 1		Fiber Optic Festive Tree		6SCFT2	❒ 1	S2	Press Switch		6SCS2
❒ 1	B3	Battery Holder - uses three 1.5V type "AA" (Not Included)		6SCB3	❒ 1		Jumper Wire, Black		6SCJ1	❒ 1	SP2	Speaker		6SCSP2
❒ 1	B7	Solar Cell		6SCB7	❒ 1		Jumper Wire, Red		6SCJ2	❒ 10		Stabilizer Purple Tint		6SCSTABPR
❒ 2		Base Grid Mini (7.7" x 5.5") Red Tint		6SCBGMRD	❒ 1		Jumper Wire, Blue		6SCJ4	❒ 1	U6	Recording IC		6SCU6
❒ 1		Base Grid Mini (7.7" x 5.5") Yellow Tint		6SCBGMYL	❒ 1	L4	Lamp, 4.5V		6SCL4	❒ 1	U7	Motion Detector		6SCU7
❒ 1		Base Grid Mini (7.7" x 5.5") Green Tint		6SCBGMGR	❒ 2		Light Cover		6SCLCOV	❒ 1	U32	Melody IC		6SCU32
❒ 2		Base Grid Mini (7.7" x 5.5") Blue Tint		6SCBGMBL	❒ 1		Light Cover Slides Set of 3		6SCLCOVSL	❒ 4	V1	Vertical Snap Wire 90 Degrees		6SCV1
❒ 1		Base Grid Mini (7.7" x 5.5") Purple Tint		6SCBGMPL	❒ 1	M4	Motor		6SCM4	❒ 2	V2	Vertical Snap Wire, 45 Degrees		6SCV2
❒ 4		Base Grid Support Purple Tint		6SCBGSUPPR	❒ 1		Green Fan		6SCM4B	❒ 1	X1	Microphone		6SCX1
❒ 1	C5	470µF Capacitor		6SCC5	❒ 1	M6	Meter		6SCM6					

ABOUT YOUR SNAP CIRCUITS® PARTS

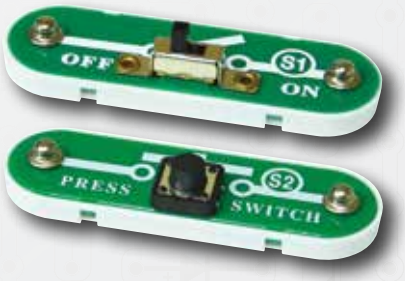
BASE GRID

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

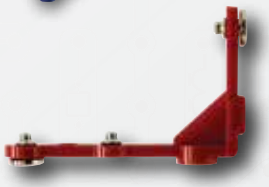
The **slide & press switches (S1 & S2)** connect (pressed or "ON") or disconnect (not pressed or "OFF") the wires in a circuit. When ON they have no effect on circuit performance. Switches turn on electricity just like a faucet turns on water from a pipe.



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 & V2)** 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)

The **adjustable resistor (RV2)** is a 10,000Ω resistor but with a center tap that can be adjusted between 200Ω and 10,000Ω.

Adjustable Resistor (RV2)

ABOUT YOUR SNAP CIRCUITS® PARTS

LEDs

The **white, color, blue, and red/yellow LEDs (D6, D8, D9, & D10)** 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 (about 1.5V for red or yellow, about 2V for green, and about 3V for white or blue), brightness then increases.

The color LED contains red, green, and blue LEDs, with a micro-circuit controlling then. The red/yellow bicolor LED contains red and yellow LEDs connected in opposite directions.

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 (except for bicolor LED D10).

LEDs (D6, D8, D9, & D10)

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)

SPEAKER

The **speaker (SP2)** converts electricity into sound by making mechanical vibrations. These vibrations create variations in air pressure, which travel across the room. You "hear" sound when your ears feel these air pressure variations.

Speaker (SP2)

MICROPHONE

The **microphone (X1)** is actually a resistor that changes in value when changes in air pressure (sounds) apply pressure to its surface.

Microphone (X1)

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)

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)

ABOUT YOUR SNAP CIRCUITS® PARTS

IC MODULES

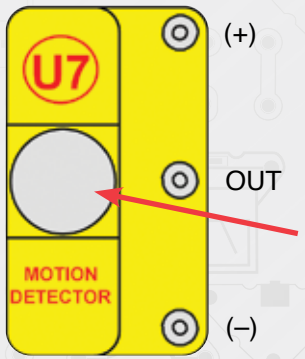
The **melody IC (U32)** contains a specialized sound-generation integrated circuit (IC), a small speaker, and a few supporting components. The IC has a recording of the melody, which it makes into an electrical signal for the speaker. The speaker converts the signal into mechanical vibrations. The vibrations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

Some types of electronic components can be super-miniaturized, allowing many thousands of parts to fit into an area smaller that your fingernail. These "integrated circuits" (ICs) are used in everything from simple electronic toys to the most advanced computers. The **recording IC module (U6)** is actually a module containing specialized memory and sound-generation ICs, and other supporting components (resistors, capacitors, and transistors) that are always needed with them. This was done to simplify the connections you need to make to use them. The description for this module is given here for those interested, see the projects for connection examples:

U6 Connections:
(+) - power from batteries
(–) - power return to batteries
Rec - record
Play - play
Out - output connection
Mic + - microphone input
Mic – - microphone input

See Project 40 for example of proper connections.

The **motion detector (U7)** contains an infrared detector, amplifier-filter circuit, and timing circuit. A schematic for it is available at www.elenco.com/faq.



U7 Connections:
(+) - regulated power from batteries
(–) - power return to batteries
OUT - output connection
Lens

All objects (including people and animals) produce infrared radiation due to the heat in them. Infrared radiation is similar to visible light but has a longer wavelength that our eyes cannot detect. The lens on top of the motion detector module filters and focuses the radiation, it is most sensitive to the radiation produced by our bodies.

Inside the motion detector module is an infrared detector with pyroelectric crystals, which create a tiny voltage when exposed to infrared radiation. A circuit amplifies and filters this voltage, but only responds to changes in the radiation level - so is only triggered by moving objects (motion). When motion is detected a timing circuit is used to control other snap circuits devices for a few seconds, such as an alarm.

SOLAR CELL

The **solar cell (B7)** contains positively and negatively charged silicon crystals, arranged in layers that cancel each other out. When sunlight shines on it, charged particles in the light unbalance the silicon layers and produce an electrical voltage of up to 7V. The maximum current depends on the type of light and its brightness, but will be much less than a battery can produce. Bright sunlight works best, but incandescent light bulbs also work.

Solar Cell (B7)

ABOUT YOUR SNAP CIRCUITS® PARTS

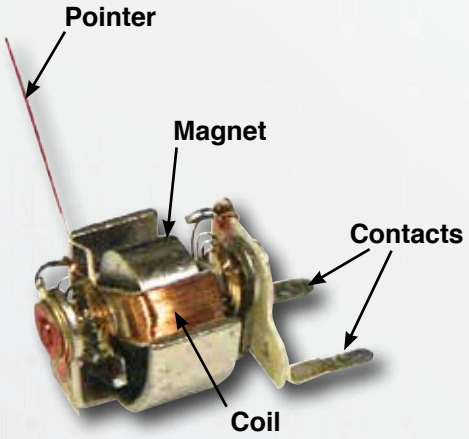
METER

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 movable 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).

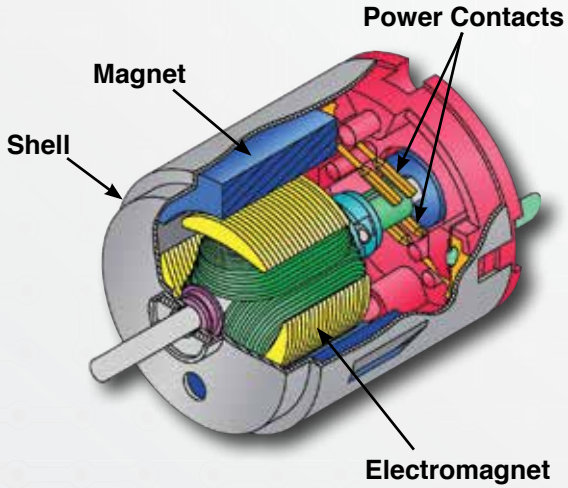
MOTOR

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, 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.

ALWAYS connect the ICs using the configurations given in the projects.

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

NEVER leave a circuit unattended when it is turned on.

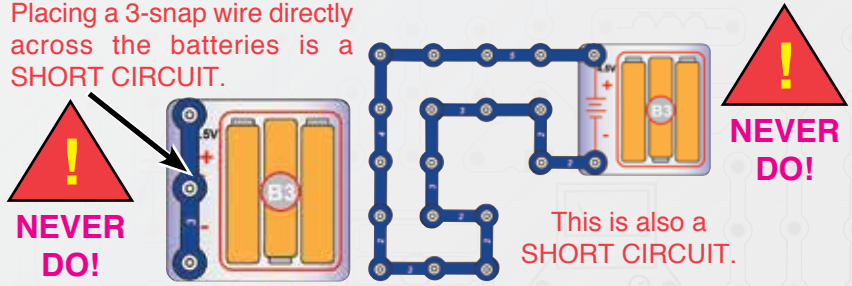
For all of the projects given in this book, the parts may be arranged in different ways without changing the circuit. For example, the order of parts connected in series or in parallel does not matter — what matters is how combinations of these sub-circuits are arranged together.

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.

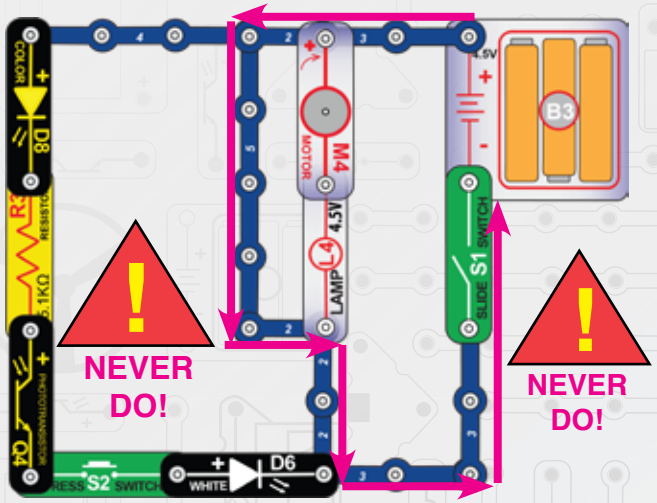
Warning to Snap Circuits® owners: Do not connect additional voltage sources from other sets, or you may damage your parts. Contact ELENCO® if you have questions or need guidance.

Examples of SHORT CIRCUITS - NEVER DO THESE!!!

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



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.

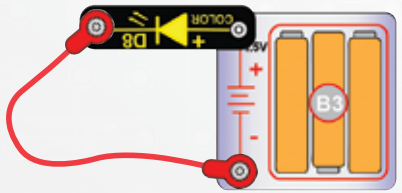
d. Try replacing the batteries.

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.

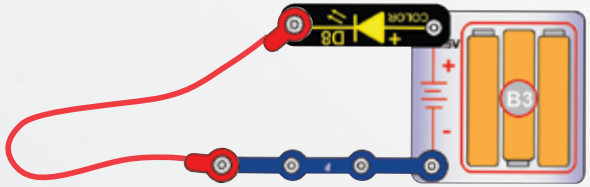
If you suspect you have damaged parts, you can follow this procedure to systematically determine which ones need replacing:

1. **White LED (D6), color LED (D8), blue LED (D9), red/yellow LED (D10), 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, blue LED, and color LED directly across the battery holder (LED + to battery +), the LED should light. Place the red/yellow LED directly across the battery holder, in both directions, it should light red in one direction and yellow in the other. 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.

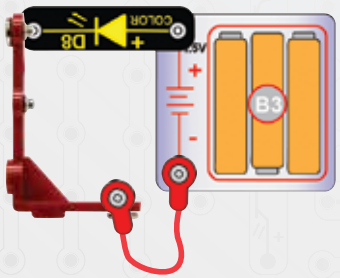
2. **Jumper wires:** Use this mini-circuit to test each jumper wire, the LED should light.



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, 90 degrees) and angled snap wires (V2, 45 degrees):** Use this mini-circuit to test each of the vertical and angled snap wires, one at a time. The LED should light.



TROUBLESHOOTING (ADULT SUPERVISION RECOMMENDED)

5. **Slide switch (S1, press switch (S2), and speaker (SP2):** 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. Replace the press switch with the speaker; the LED should light or the speaker is broken.

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

10. **Solar cell (B7)**: Build project 35 and place the solar cell in sunlight or near a bright light source (incandescent light bulbs are best); the meter pointer should move.

11. **Microphone (X1)**: Build project 38. Holding the microphone near your mouth and talk loudly or blowing into it should change the LED brightness.

12. **Adjustable resistor (RV2)**: Build project 47. Moving the lever on RV2 should change the LED brightness.

13. **Recording IC (U6):** Build project 40. You should be able to make a recording of 5 seconds, then listen to the three prerecorded songs.

14. **Motion Detector (U7):** Build project 39. The LED (D6) and melody IC (U32) should activate for a few seconds on power-up and then whenever the circuit detects motion.

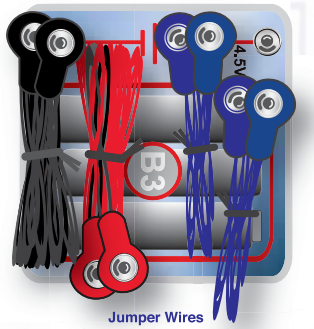
Notes

Running a ceiling fan will allow you to raise the air conditioner setting in the room about 4°F with no reduction in comfort.

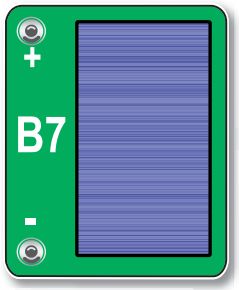
Notes

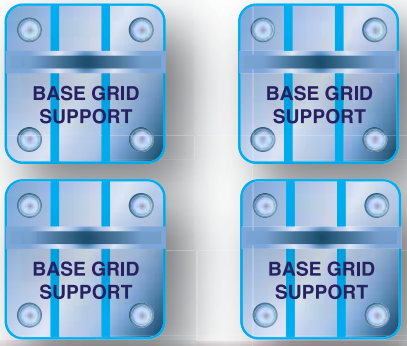
Opening the oven door to check on food that is baking will let heat escape, making the oven work harder. It is better to use the oven light.

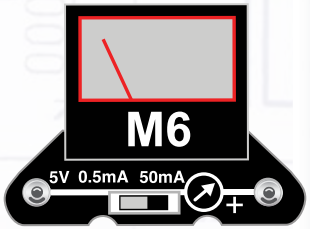
MyHSCP20 Parts Layout

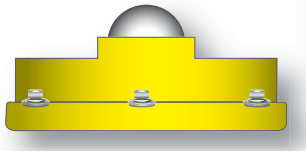


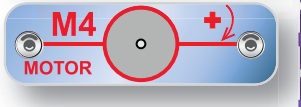
Jumper Wires
(2 blue, 1 red, 1 black)
underneath.

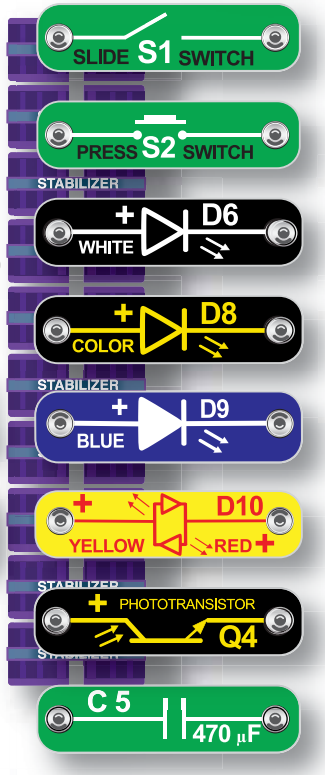


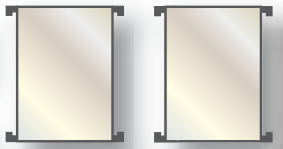






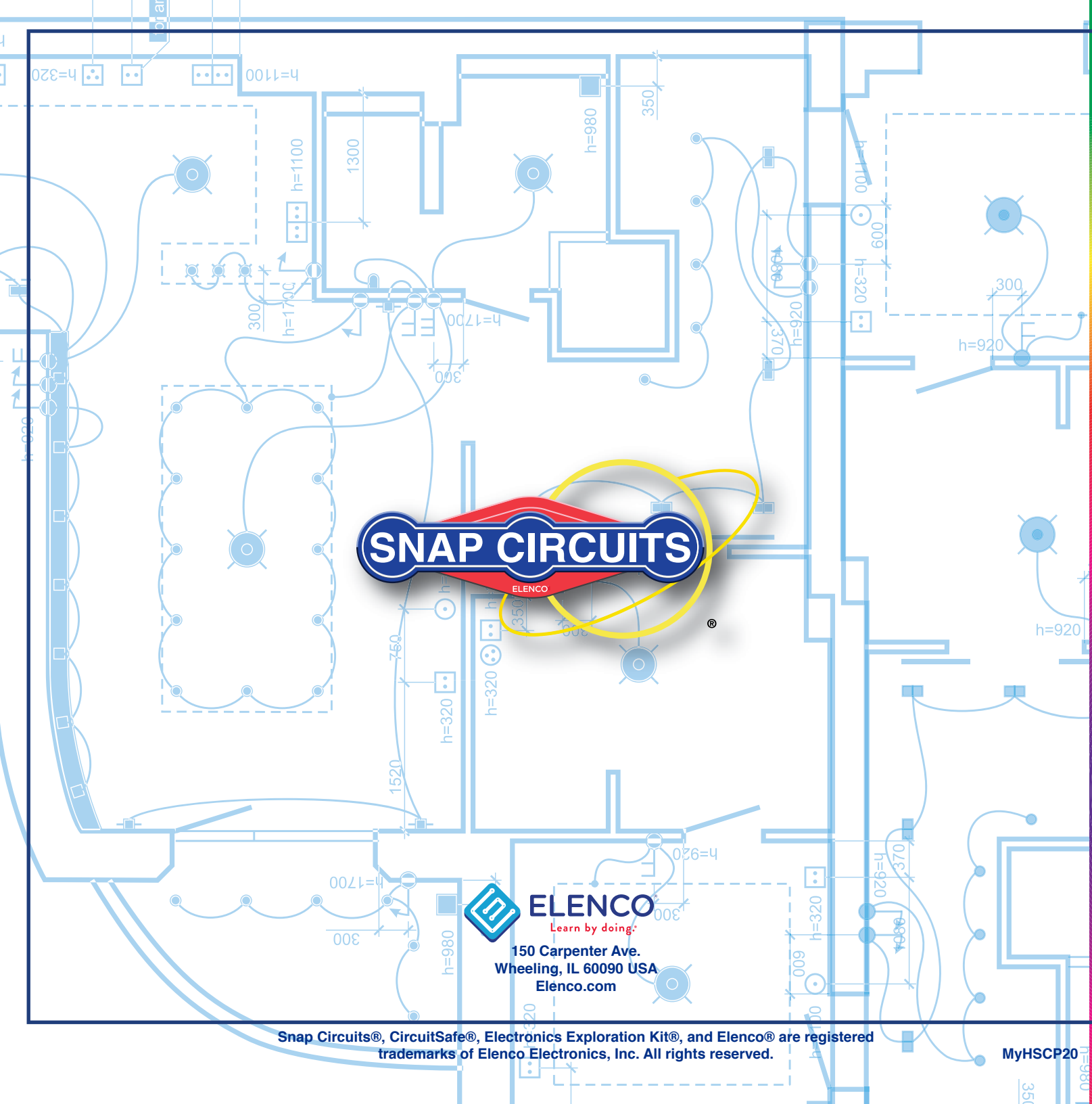






1 Base Grid (7.7" x 5.5") overlays some parts, and 6 others are below.

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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