



Electronics

Scouts BSA · STEM

Name

Started

Completed

Electronics is about the tiny parts that make gadgets work, from resistors to computer chips. You'll learn to read circuit diagrams, solder, and build a project of your own. It's a great start if you like taking things apart and figuring them out.

Requirements

Every official requirement, in plain language. Check the official wording when you sign off (scouting.org/merit-badges/electronics/). Tips and examples are ideas, not extra requirements.

- ☐ **1** Describe the safety steps to take when using, building, modifying, or repairing electronic devices

Tip: Make a short list of safety rules for your workspace, like eye protection, ventilation, and where to rest a hot soldering iron.

2 Schematic diagrams

Tips for this section: Start with a simple circuit that uses a resistor, a capacitor, and a transistor or chip, like an LED blinker. Draw it with standard symbols and explain what each part does.

Example for this section: Draw a simple LED blinker built around a 555 timer chip: a 9-volt battery, a few resistors, a capacitor, the chip, and an LED, each labeled with standard symbols. Explain that the capacitor charging and emptying sets the blink speed, and a resistor limits current so the LED doesn't burn out.

- ☐ **2a** Draw a simple schematic with correct symbols that includes resistors, capacitors, and transistors or integrated circuits, labeling every part

- ☐ **2b** Explain what each part in your schematic does

3 Soldering

Tips for this section: Practice on scrap boards first, with an adult nearby. Use a heat sink or clip to protect parts that don't like heat.

Example for this section: On a scrap board, solder five joints that look like shiny little volcanoes, not dull blobs. Then remove one part with a desoldering pump or braid, and clip a heat sink on an LED's leg while you solder it.

- ☐ **3a** Demonstrate proper soldering and desoldering

- ☐ **3b** Show how to keep electronic components from being damaged by heat

- ☐ **3c** Explain what a printed circuit board does and the precautions to take when soldering one

4 Control, digital, and analog electronics

Tips for this section: Practice converting a few numbers to binary each day. Then build a small logic project from a kit or a guide.

Example for this section: Convert 13 to binary: $8 + 4 + 1$, so 1101. Then build a simple logic project, like two switches wired so an LED lights only when both are on (an AND gate), and explain how that's how computers make decisions.

4a Discuss with your counselor

- ☐ **4a1** Discuss how electronics can be used to control something

- ☐ **4a2** Explain the basic ideas behind digital logic

- ☐ **4a3** Discuss how electronics can be used in three different analog applications

- ☐ **4b** Show how to convert three decimal numbers to binary and three binary numbers to decimal

4c Build a circuit project: Choose 1 of 3

- ☐ **4c1** Build a control device, find or draw its schematic, and explain to your counselor as best you can how the circuit works

- ☐ **4c2** Build a digital circuit, find or draw its schematic, and explain to your counselor as best you can how the circuit works

- ☐ **4c3** Build an analog circuit, find or draw its schematic, and explain to your counselor as best you can how the circuit works

5 Circuits, testing, and assembly

Tips for this section: Work several Ohm's law problems on paper, then check them with a multimeter on a real circuit.

Example for this section: Work a problem: a 9-volt battery and a 450-ohm resistor give $I = V / R = 0.02$ amps, or 20 milliamps. Then measure the real voltage and current with a multimeter and explain why they're a little different.

- ☐ **5a** Show how to use Ohm's law to solve a simple problem with current, voltage, and resistance

- ☐ **5b** Explain why test equipment is needed in electronics and how it's used; name three types and describe how each works

- ☐ **5c** Show your counselor how to read a resistor's color bands to find its resistance

- ☐ **5d** Explain how through-hole and surface-mount assembly differ and give three advantages of each

- ☐ **6** Name three careers that use electronics skills; for one of them, research its training, education, certification, experience, and costs, plus job outlook, starting pay, and advancement; discuss with your counselor what you learned and whether the career interests you

Tip: Talk with an electronics technician or engineer, or look up jobs in robotics, repair, and design.