01 / UNDERSTAND THE CONNECTIONS

01

How to use a breadboard

Make a connection. Change it. Explain why it works. A breadboard holds parts and joins selected holes, so you can experiment without soldering.

01 Read the hidden connection map.

02 Wire a button with jumpers.

03 Check the layout before power.

Meet your tools

NO CODE NEEDED



Solderless breadboard

Metal clips inside grip pins and connect groups of holes.

Three jumper-wire types

Male = pin; female = socket.



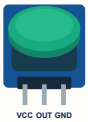
Male–male
Board holes ↔ board holes



Female–female
Header pins ↔ header pins



Male–female
Header pin ↔ breadboard



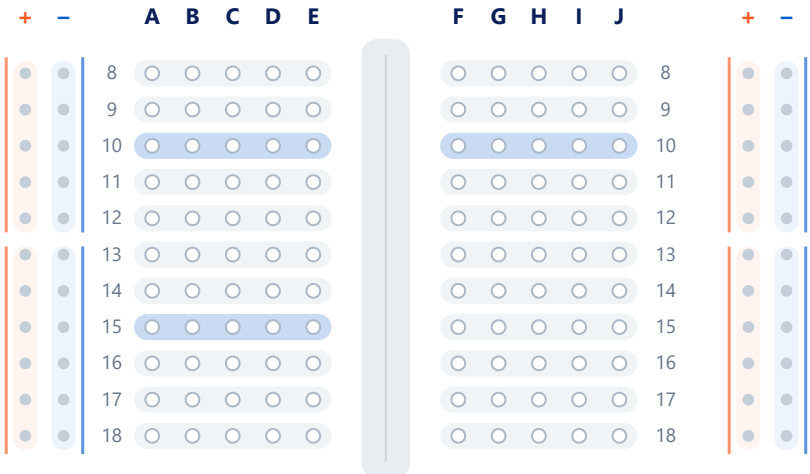
Push-button module

VCC → 3.3 V **OUT** → GPIO input
GND → GND

Front view: button above pins. Female sockets fit its header pins.

Look beneath the holes

TYPICAL LAYOUT



TEACHING VIEW · ROWS 8–18 · EXAMPLE SPLIT RAILS

Colored bands represent metal connections inside the board. This is a teaching diagram; the rail breaks and row count on your board may differ.

Five holes, one connection

On one side, A10–E10 are joined. A11–E11 are a different group. Neighboring rows are separate.

The gap separates the sides

E10 and F10 are not connected. F10–J10 form their own group, even though the row number matches.

Check the power rails. Markings supply no power; some rails are split. Check continuity with power off. To share 3.3 V across a split, bridge + → + and − → − with two male–male jumpers. Never bridge + to −.

02 / UNDERSTAND THE POWER RAILS

Check. Bridge. Share.

02

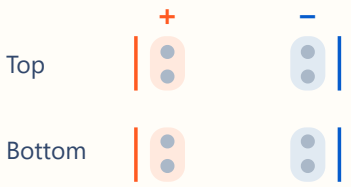
The long + and − rails distribute power. Some boards split these strips in the middle, so a supply connected at the top may not reach the bottom.

Disconnect USB, batteries, and other supplies before checking continuity.

Need both rail halves?

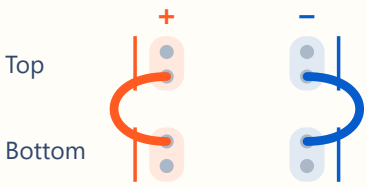
EXAMPLE SPLIT RAILS

Before bridging: separate sections



A split breaks the internal connection. Power at the top does not cross that break automatically.

After bridging: one shared supply



Use two male–male jumpers: **upper +** → **lower +** and **upper −** → **lower −**. Both halves can share 3.3 V and GND.

Check your actual board

POWER OFF FIRST

1 / Test the + rail

Use a multimeter in continuity mode. Touch one probe to an upper + hole and the other to a lower + hole.

2 / Test the − rail

Repeat on the upper and lower − sections. Check each rail separately; do not assume they match.

3 / Bridge only if needed

If the sections are not connected and you need both, add same-polarity bridges. Connected rails need no bridge.

Painted stripes are helpful labels. A continuity check confirms the electrical connection.

Keep the rails separate

Red (+) and blue (−) identify different rails. They are not connected to each other. The rails on the opposite side of the board are also separate.

One source is enough: correctly bridged halves share the same 3.3 V supply. You do not need a second supply just because the rail is split.

> **Never bridge + to −.** That would short the supply. Bridge + to + and − to − only.

Can you explain it?

1. A split rail is powered at the top. Is the bottom automatically connected?
2. Which jumper type connects holes across the split?
3. Do bridged halves need separate supplies?

Answers: 1. No—the split separates them.
2. Male–male, one for each polarity.
3. No—they can share one source.

A jumper is needed only when the sections are separate and you want to use both. Check first, then wire.

03 / PUT THE CONNECTION MAP TO WORK

Build. Trace. Change.

03

Use the printed letters and numbers to find each hole. Insert one pin per hole, gently and firmly. These are connections to trace, not a powered circuit.

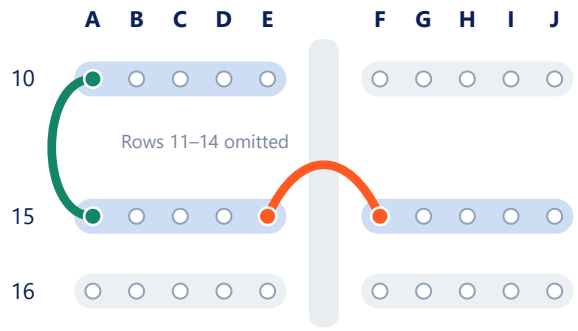
- **Keep USB, batteries, and all other power disconnected.**

1 Join two groups on the left

Use male–male jumpers. Place a green wire from **`a10 → a15`**. E10 and E15 now share a connection. The right side is still separate. Pull the plastic head when removing a wire.

2 Bridge the center gap

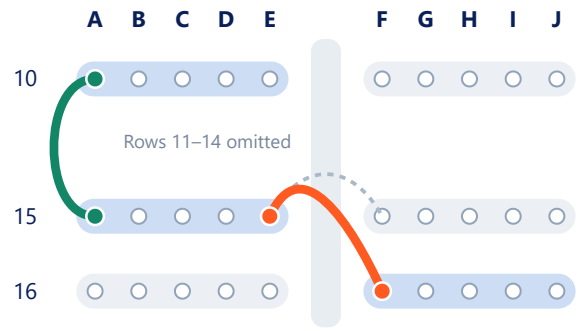
Add an orange jumper from **`e15 → f15`**. Keep the green jumper in place.



Trace it: E10 now connects to J15.
`e10 → a10 → a15 → e15 → f15 → j15`

3 Move just one endpoint

Leave E15 fixed. Move the orange end from **`f15 → f16`**. The dashed line shows its old position.



What changed? E10 now connects to J16.
J15 is separate again. One row matters.

The shaded groups show predicted connectivity, not flowing current or a meter reading. The center gap stays isolated wherever no wire bridges it.

Before any later power-up

- [ ] Disconnect power before moving a wire.
- [ ] Read every coordinate; check for loose pins, bent pins, or unintended shared groups.
- [ ] Rule out unintended power-to-ground links. Check any rail sections you plan to use.
- [ ] Confirm voltage and pin labels. This button: VCC → 3.3 V; OUT → GPIO input; GND → GND. Each pin needs a separate connected group.

Can you explain it?

1. On an empty board, are A10 and E10 connected?
2. On an empty board, are E10 and F10 connected?
3. Do red and blue rail markings supply power?

Answers: 1. Yes—same five-hole group.
2. No—the gap separates them.
3. No—a suitable source supplies power.

Success: Trace both layouts aloud and explain why J15 becomes separate after the move. Finish with the practice unpowered.

Your 15-minute foundation route Introduction 2 min · Connection rules 4 min · Practice 6 min · Checklist + review 3 min

04 / APPLY IT TO A BUTTON

Wire the button.

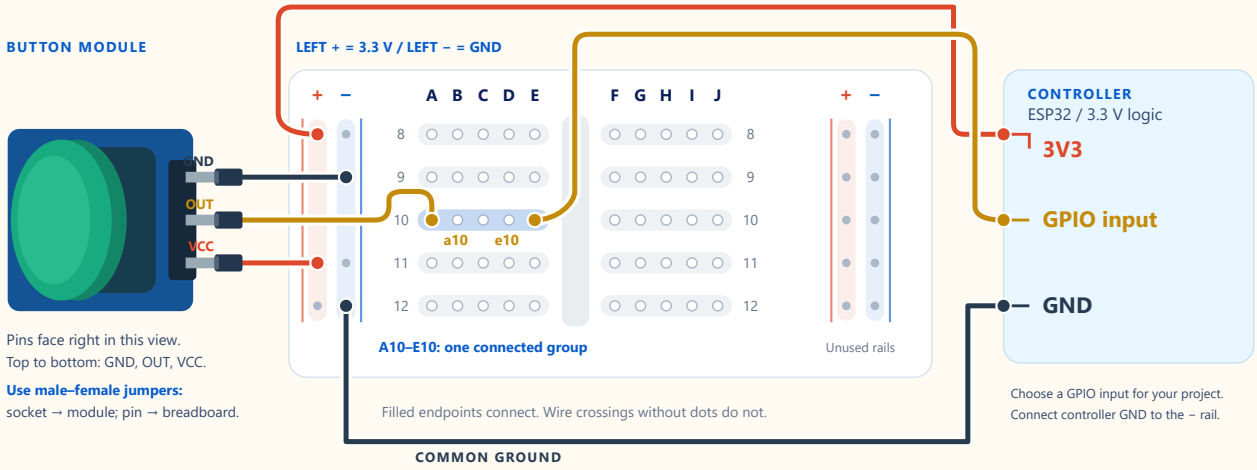
04

Remove the previous practice jumpers. Use three male–female leads on the button: sockets on its pins, male ends in the breadboard. Match controller leads to its connectors.

- **Keep USB, batteries, and all other power disconnected while wiring.**

One complete connection

3.3 V · SHARED GROUND



Use one checked, continuous segment of the left + and − rails. Filled endpoints connect; crossings without dots do not.

1 / Set up the rails

Controller **3V3** → **+**.
Controller **GND** → **−**.
All parts share this ground.

2 / Connect button power

Button **VCC** → **+ (3.3 V)**.
Button **GND** → **−**.
Pull connector heads, not wires.

3 / Connect the signal

Button **OUT** → **A10**.
E10 → **GPIO input**.
A10 and E10 share one strip.

Before power-up

- [ ] Supply disconnected while you inspect or rewire.
- [ ] VCC uses 3.3 V; the button and controller share GND.
- [ ] OUT and the GPIO jumper use the same five-hole group. Check printed coordinates and firm pins.
- [ ] No unintended + to − connection. Finish this practice with power disconnected.

Quick check: OUT goes to a GPIO **input**.
VCC uses **3.3 V**. The button and controller share **GND**.

Trace the button connections

Power: controller 3V3 → + rail → button VCC.

Ground: controller GND → − rail → button GND.

Signal: button OUT → A10 → E10 → GPIO input.

A10 and E10 share one internal strip. A11 is a separate group. Trace every endpoint in the completed layout before applying power.

Practice sequence Understand the map → complete the jumper exercise → remove those wires → build and inspect the button layout.