

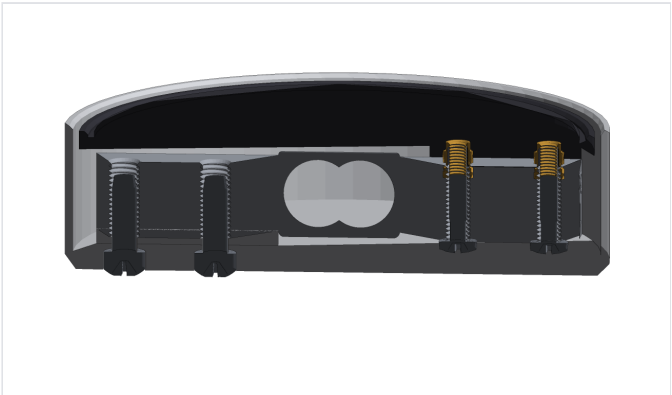
Presence Plate

Load cell desk plate · ESP32-C3 · ESPHome
Designed by Pawin Jirasuntornsiri

Size	Ø90 × 24 mm
Printed parts	2 — case, top plate
Electronics	ESP32-C3 SuperMini · HX711 · 4-wire bar load cell · 15 × WS2812B
Power	5 V 2 A, USB-C
Build time	90 min
Skills	Soldering, heat-set inserts, ESPHome flashing



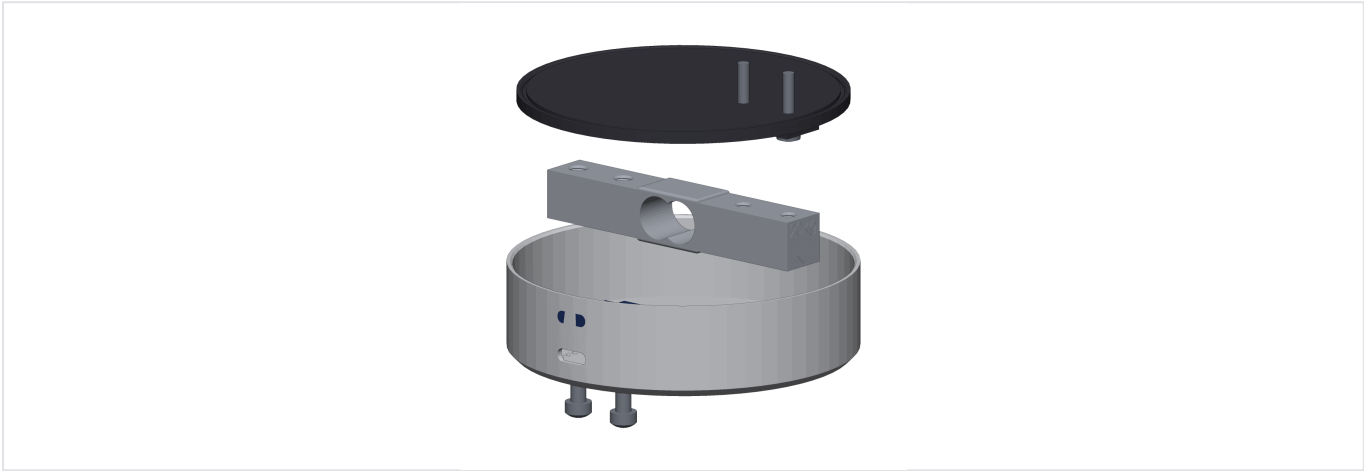
Assembled.



Section. Plate on the load cell free end (right), fixed end to the base (left).

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Assembly order. HX711 not shown — it mounts in the empty half of the case.

Parts

PRINTED

Part	Size	Print
Case	Ø90 × 24 mm	Open side up. No supports. White filament. 3 perimeters.
Top plate	Ø85 × 3 mm, 2 mm boss	Boss down, flat on the bed. Any colour.

PLA or PETG. Use PETG above 25 °C ambient.

ELECTRONICS

Part	Qty	Spec
ESP32-C3 SuperMini	1	The pocket is cut for this board
HX711 module	1	Green breakout. Not in the CAD.
Bar load cell	1	80 mm, 15 mm hole spacing, 4-wire full bridge . Count the wires in the listing photo. 3-wire pads are half bridges and will not work.
WS2812B strip, 60 LED/m	15 px	≈250 mm
470 Ω resistor	1	Series with DIN, at the strip end
1000 µF 16 V electrolytic	1	At the strip's 5 V/GND
10 µF electrolytic	1	At the HX711 pins
100 nF ceramic	1	At the HX711 pins
1N4007 diode	1	Spare. Fit only if pixel 1 misbehaves.
5 V 2 A supply	1	≥2 A on the label
USB-C cable	1	Data cable. Test it on a phone first.
Hookup wire	—	22 AWG strip power, 24–26 AWG elsewhere

HARDWARE

Part	Qty	Location
M3 heat-set insert, 3 mm long	2	Top plate
M3 × 16 screw	2	Load cell free end → plate
M4 × 16 socket cap screw	2	Base → load cell fixed end
Black electrical tape	—	Case wall
Superglue or VHB tape	—	ESP
Silicone feet	3	Underside

INSERT LENGTH — CHECK BEFORE ORDERING

Plate holes are **Ø3.5 × 3.0 mm deep**. Use **3 mm** inserts.

4 mm inserts bottom out 1 mm proud and stop the load cell seating flat. If you already have 4 mm, drill the holes to 4.5 mm with a 3.5 mm bit first. That leaves 0.5 mm under the visible top face, so control the depth.

The STEP file shows Insert M3 D5 L5mm. That is a library placeholder. D5 does not fit a Ø3.5 hole.

TOOLS

Soldering iron	Heat-set tip, or any conical tip
----------------	----------------------------------

Multimeter	Continuity and DC volts
Hex keys	2 mm, 2.5 mm
Flush cutters, wire strippers	
3.5 mm drill bit	Only if deepening the insert holes
Computer with ESPHome	<code>pip install esphome</code>

BEFORE YOU START

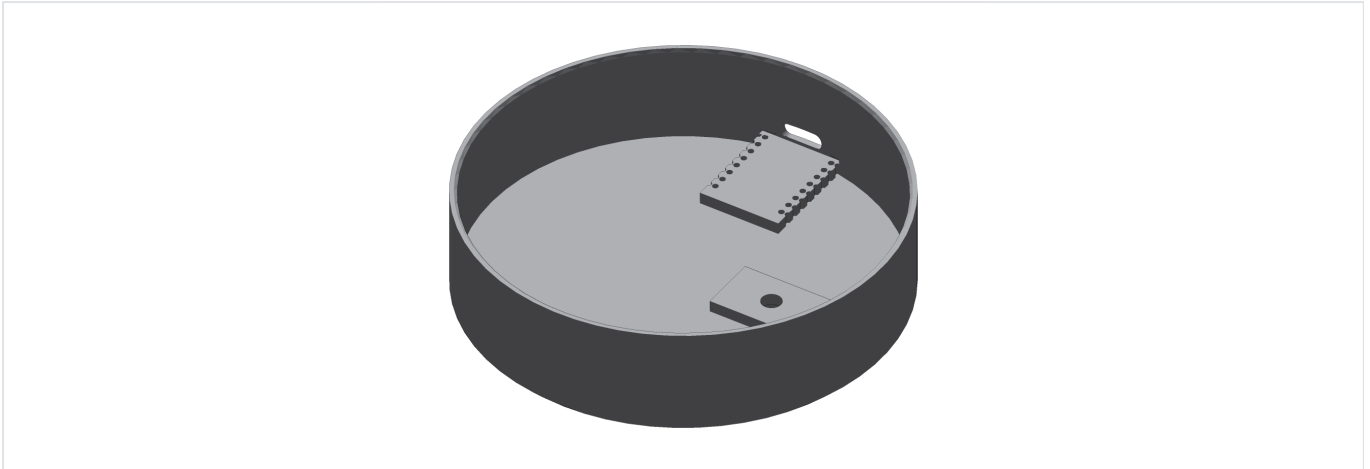
1. Meter the load cell. Red ↔ Black $\approx 1\text{ k}\Omega$. White ↔ Green $\approx 1\text{ k}\Omega$. Every wire to every other: finite, never open.
2. Plug the bare ESP into USB. Confirm it enumerates.
3. Drop the top plate into the case. It must clear the wall all round.

Assembly

1 Tape the wall

5 min

- Line the inside of the case wall with black electrical tape, floor to rim.
- One continuous band. Overlap the ends 10 mm.
- Press flat. No bubbles where the strip will sit.



Case, open side up. ESP pocket at the back, load cell pad at the front.

2 Fit the LED ring

10 min

1. Cut the strip to **15 pixels**, on a pad line.
2. Solder the three wires to the DIN end before fitting.
3. Fit the 470 Ω resistor in the data wire, at the strip end.
4. Stick the strip around the inside of the wall, over the tape, LEDs facing out.
5. Start and finish next to the ESP pocket.

CHECK

DIN is the end the printed arrows point **away from**. Wrong end and the strip stays dark.

Keep the strip upright against the wall. Do not curl it flat — that cracks the traces.

3 Set the inserts

10 min

Two holes in the boss on the plate underside. $\varnothing 3.5$ mm, 3.0 mm deep, 15 mm apart.

1. Set the iron to 220 °C for PLA, 240 °C for PETG.
2. Sit the insert on the hole.
3. Put the iron in it. Let its own weight take it down. **Do not push.**
4. Stop when the flange is flush with the boss face.
5. Check flush with a straight edge across the boss while still warm.

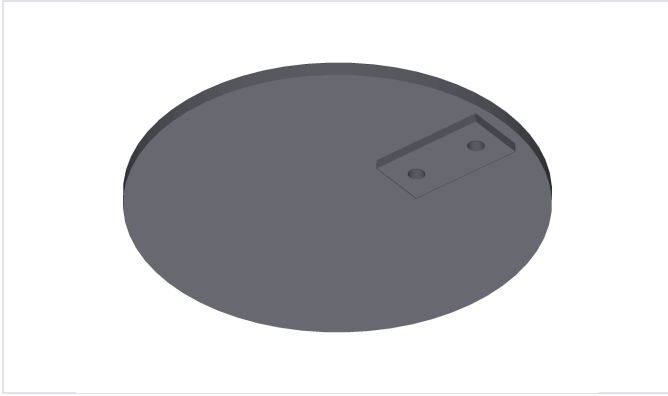
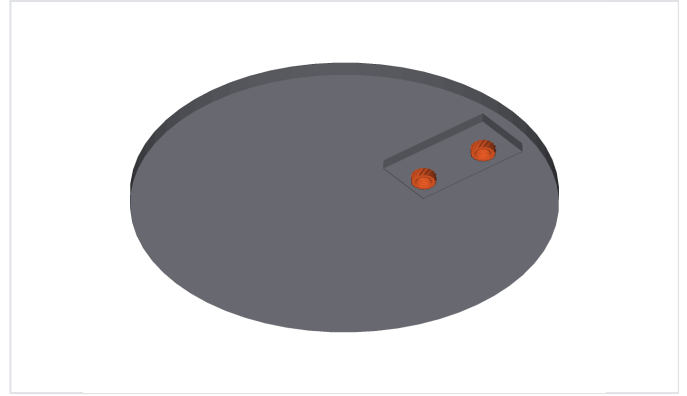


Plate underside, before.



Inserts flush with the boss face.

4 Bolt the load cell to the plate

5 min

Two M3 × 16 screws, up through the load cell into the inserts.

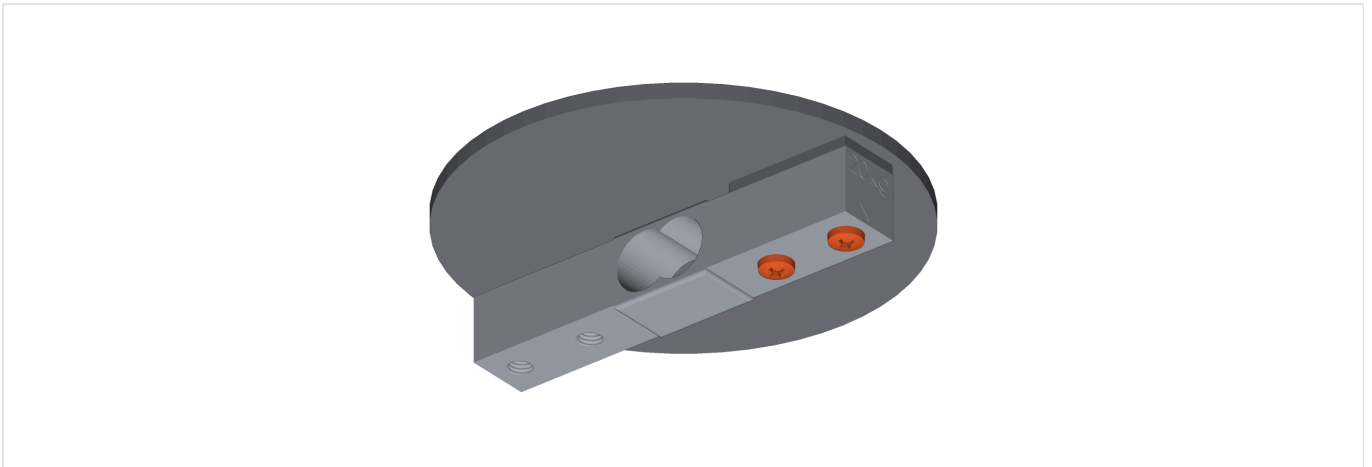
THE END YOU BOLT HERE MUST BE THE FREE END

Marked cells: the arrow points to the free end.

Unmarked: hold one end, press the other. The end that deflects is the free end.

Backwards and the plate reads almost nothing.

- Tighten firm. Do not overtighten — brass in plastic.
- If the cell's holes are M4 or M5, add an M3 washer under each screw head.

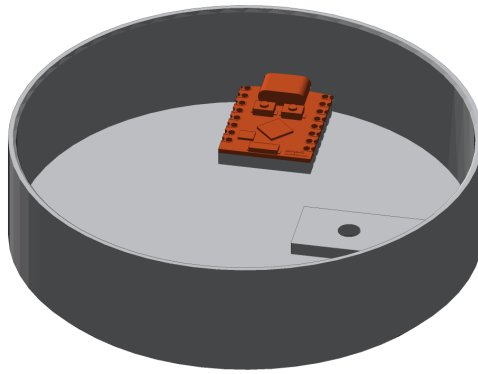


Free end bolted to the plate boss.

5 Fit the ESP

5 min

1. Dry fit the SuperMini in the pocket. Check the USB-C port lines up with the wall slot.
2. Superglue at each corner, or a square of VHB.
3. Let it set before soldering to it.



SuperMini seated, USB-C at the wall slot.

6 Wiring

30 min

Full diagram on page 9.

From		To
LOAD CELL → HX711		
■ RED	→	E+
■ BLACK	→	E−
□ WHITE	→	A−
■ GREEN	→	A+
B+ and B− stay unconnected.		
HX711 → ESP32-C3		
VCC	→	3V3
DT	→	GPIO4
SCK	→	GPIO5
GND	→	Star ground
LED RING		
ESP GPIO6 → 470 Ω	→	Strip DIN
ESP 5V	→	Strip 5V
Strip GND	→	Star ground
CAPACITORS		
1000 μF	→	Across strip 5V / GND, at the strip
10 μF + 100 nF	→	Across HX711 VCC / GND, at the pins

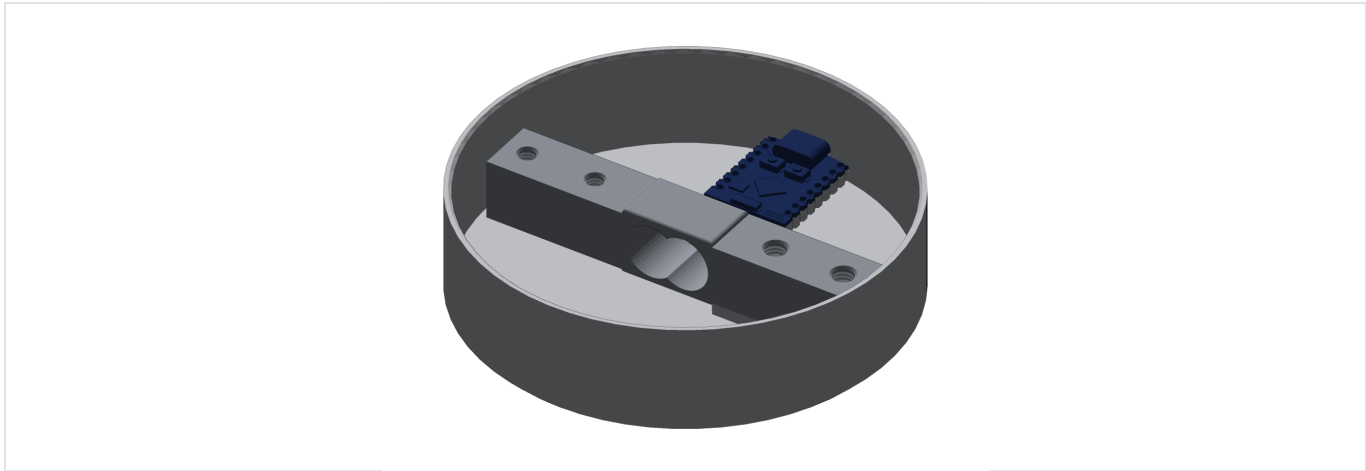
THREE THAT WILL COST YOU THE EVENING

- **HX711 VCC to 3V3, never 5 V.** At 5 V its DOUT drives 5 V into a 3.3 V GPIO.
- **Star ground.** Every GND wire ends at one physical joint. No daisy chaining.
- **10 μF and 100 nF at the HX711's own pins.** Not on the perfboard.

PLACEMENT

- HX711 in the empty half of the case, 30–50 mm from the load cell.
- Service loop in the cell's four wires. Anchor them on the **fixed end** side only.

- Keep the cell wires clear of the strip's power and data. Cross at 90°.
- Nothing may touch the top plate or the free end of the cell.



Load cell and ESP fitted. HX711 goes in the empty half.

7

Flash and test

20 min

STOP — DO NOT FIT THE BASE SCREWS YET

Test with the case open. Everything is reachable now and will not be afterwards.

Put secrets.yaml beside the config:

```
wifi_ssid: "your-network"
wifi_password: "your-password"
```

Then:

```
esphome run presence-plate.yaml
```

CHECK IN ORDER

1. **Boots and joins WiFi.** Ring runs a slow blue orbit, then one green flash.
2. **Colours correct.** Green flash comes out red → set rgb_order: RGB, reflash.
3. **Pixel 1 correct.** First pixel wrong or flickering, rest fine → fit one 1N4007 in series with the strip's +5 V. Silicon, not Schottky.
4. **Cell responds.** Watch Load_cell_raw. Press the plate: the number must move by thousands and return.
5. **Ring goes red, slow orbit.** Normal. Means not yet calibrated.

FAULTS

Symptom	Cause
Raw reads NaN	DT/SCK swapped, or HX711 unpowered
Raw steady, never changes	Cell not in the load path, or fixed end bolted to the plate
Raw noisy by thousands at rest	100 nF not at the HX711 pins; cell wires near the strip
Board resets when the ring lights	1000 µF missing or too far from the strip
Strip dark	DIN at the wrong end
WiFi drops, "Auth Expired"	power_save_mode: none and output_power: 15dB missing from the config



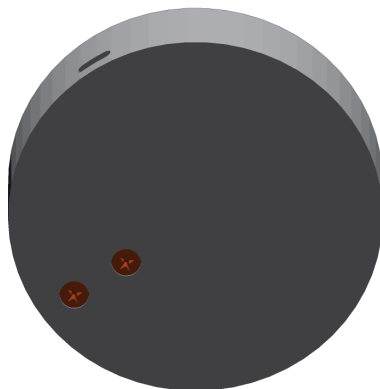
Fit the base screws

5 min

1. Two M4 × 16 socket cap screws, up through the counterbores in the underside, into the load cell's fixed end.
2. Tighten fully. This joint must not move.
3. Fit three silicone feet, evenly spaced.

CHECK THE PLATE FLOATS

- Gap ≈1 mm, even all the way round.
- Press the rim at three points. It must return each time.
- Any contact with the wall and the cell reads nothing. Sand the plate edge. Do not loosen anything.



Underside. M4 heads recess into the counterbores.

9 Calibrate

1 min

Start it one of two ways:

- Press **Calibrate** in Home Assistant, or
- Knock · · – – · on the plate — short, long, long, short. Tap slowly: 0.5 s, 1 s, 1 s, 0.5 s. The ring fills red. Tap once more to confirm.

Ring	Do this
 Amber, filling	Clear the plate. 4 seconds.
 Blue, breathing	Put the object on
 Green pixels	Sample captured. 5 pixels each, 3 samples.
 Amber, breathing	Take the object off
 Green flash, then orbit	Done. ~15 s total.
 Red flash	Timed out. Nothing changed. Repeat.

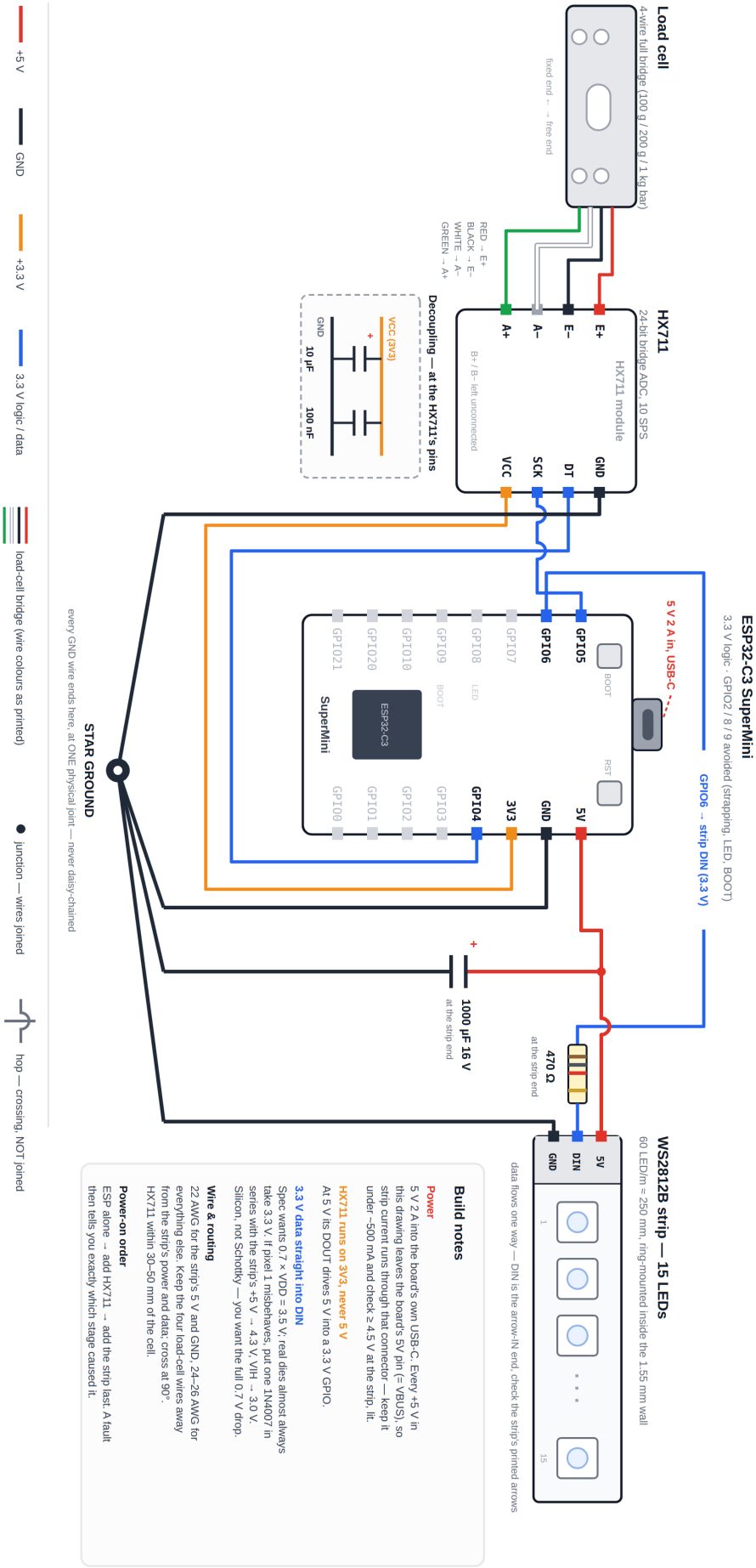
Blue = put it on. Amber = take it off. The Tare button is not needed.

Presence Plate — wiring

ESP32-C3 SuperMini · HX711 · 4-wire load cell · 15 × WS2812B · powered through the board's own USB-C · no level shifter

Designed by Pawin Jirasuntonmsiri

rev A



Reference

DIMENSIONS

Overall	Ø90.0 × 24.0 mm
Case bore	Ø86.9 mm
Case wall	1.55 mm
Case floor	3.0 mm
Top plate	Ø85.0 × 3.0 mm, boss +2.0 mm
Plate to bore, radial gap	1.0 mm
Plate below the rim	0.88 mm
Plate insert holes	2 × Ø3.5, 3.0 mm deep, at 20 and 35 mm from centre
Base screw holes	2 × Ø4.3 through, Ø7.0 × 3.0 mm counterbore
Hole spacing, both ends	15.0 mm
Load cell pad, proud of floor	2.5 mm
ESP pocket	17.8 × 24.0 mm, 2 × 8 holes at 2.54 mm
Load cell envelope	80.1 × 12.7 × 14.3 mm

TUNING

Symptom	Change
Placements missed	step_window_ms → 800–1000. Watch Change per window while placing; the spike must exceed learned weight × 0.75.
False events	step_fraction → 0.9
Double triggers	Raise event_lockout_ms
Calibration reads low	Raise cal_settle. Minimum 800 ms.
Tap rhythm never matches	Tap slower. Or do the 80 SPS mod: cut the trace tying HX711 pin 15 to GND, tie pin 15 to DVDD, set cell_poll: 15ms, halve the four tap windows.
Weight wildly wrong	cell_rating_g is wrong. Check Counts per gram against the table in the config.

HOME ASSISTANT ENTITIES

binary_sensor.<name>_<object>_on_plate	occupancy
light.<name>_<object>_ring	ring, with effects
sensor.<name>_plate_weight	grams
sensor.<name>_change_per_window	diagnostic
sensor.<name>_learned_<object>_weight	diagnostic
sensor.<name>_counts_per_gram	diagnostic
sensor.<name>_load_cell_raw	diagnostic
button.<name>_calibrate	

ERRATA — REV A SOURCE FILES

File	Fix
Both YAML	baseline_rate_g appears in the tuning notes but is not a substitution and nothing reads it.

Both YAML	Entity list names sensor...._baseline_deviation. Correct name is sensor...._change_per_window.
PLate.step	Inserts modelled D5 × L5. Holes are Ø3.5 × 3.0. Use 3 mm inserts.
PLate.step	Load cell embossed 20 kg, base fasteners modelled 8-32 UNC. Both placeholders. Build with M4.

Presence Plate · build instructions rev A · designed by Pawin Jirasuntornsiri · dimensions from PLate.step · firmware MIT · hardware CC BY-SA 4.0