EC / Salinity device: automatic measurement, setup and calibration

Reading time: ~10 minutes · Execution time: ~30 minutes (hardware excluded) + 5 minutes of calibration · Audience: anyone who wants their tank's salinity measured continuously on the portal, without a refractometer at hand

🔵 **Advanced guide** — not part of the 01-08 onboarding path. Tackle it only if you have already set up your tank and sensors (guide 04).

---

1. What you are about to do

In JoyReef, salinity is measured with a **dedicated device**: a small standalone board (type `ec`, name `ec-xxxxxx`) with its own ESP board, its own ADS1115 module and a **conductivity (EC) probe** designed for marine water. It's the twin of the pH device (guide 18): you flash it, connect it to WiFi, it appears on the portal as **"EC / Salinity probe"**, you assign it to a tank — and from that moment salinity is a live tank metric, with historical chart and dashboard widget.

How it works: the probe measures the water's **electrical conductivity** (EC, in mS/cm), which in marine water is directly related to salinity. The firmware compensates for temperature and converts the value to **ppt** (parts per thousand): the classic **35 ppt** of ocean water. Everything on board: the portal receives the value ready to use.

In this guide:

- You'll assemble the **EC device** (board + ADS1115 + probe board)
- You'll flash it and connect it to **WiFi**
- You'll complete the **configuration wizard** (basics + calibration)
- You'll use the **Salinity page** and the dashboard widget

⚠️ **The EC device and the pH device must never share a power supply.** The EC probe injects a small electrical signal into the tank: if the EC device and the pH device share power or ground (same powered USB hub, same multi-port power supply), the pH reading gets disturbed. **Use two separate USB power supplies**, each in its own outlet. This is why EC and pH are two separate devices and not a single board.

---

2. What you need (hardware)

- ✅ An **ESP8266 board**: a **Wemos D1 mini** (~€3-5) works perfectly. (Only the ESP8266 is supported at the moment.)
- ✅ An **ADS1115 module** — the ADC that reads the probe's analog signal. Connects with 2 wires (I2C).
- ✅ A **DFRobot Gravity DFR0300-H EC board with K=10 probe** — the seawater version (10-100 mS/cm range). **Not** the K=1 freshwater version: it would go out of range in a marine tank.
- ✅ A **12.88 mS/cm standard conductivity solution** for calibration (often included with the probe)
- ✅ RO water to rinse the probe
- ✅ A **dedicated USB power supply** (see warning above)

> 💡 **"Clean" build**: if you want to mount everything in a 3D-printed box with a perfboard (like the original JoyReef devices), the perfboard and wiring diagrams are in the project repo. To get started, though, the modules and a few dupont wires are enough.

---

3. Assembly

The chain is: **EC probe → DFR0300-H board → ADS1115 → ESP board**. The DFR0300-H board has its own 3-wire cable (Gravity connector): signal, power and ground.

EC board → ADS1115 / board

Gravity wire (DFR0300-H)	Goes to	Notes
Blue (signal)	`A0` of the ADS1115	0-3.2 V analog signal
Red (VCC)	`3V3` of the board	everything at 3.3 V
Black (GND)	`GND` of the board	

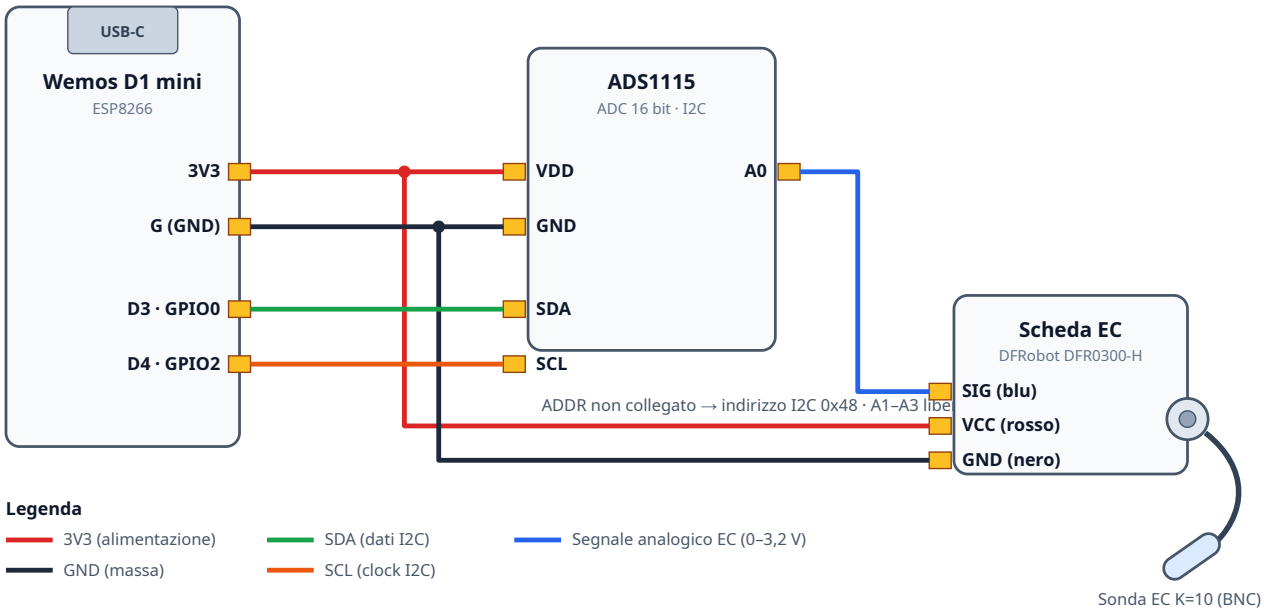
ADS1115 → ESP board (I2C, 2 wires)

ADS1115	ESP board	Notes
`VDD`	`3V3`	power
`GND`	`GND`	ground
`SDA`	board's SDA pin	I2C data
`SCL`	board's SCL pin	I2C clock

The I2C pins are the **same as the pH device**: `SDA = GPIO0` (D3), `SCL = GPIO2` (D4).

Device EC / salinità — cablaggio

ESP8266 (Wemos D1 mini) + ADS1115 + scheda EC DFRobot DFR0300-H (sonda K=10)



ESP8266: SDA = GPIO0 (D3), SCL = GPIO2 (D4) — stessa convenzione del device pH · 3V3 e GND si sdoppiano con giunzione a Y (pallino).
Alimenta questo device con un alimentatore USB separato da quello del device pH (mai lo stesso hub): evita interferenze EC ↔ pH in vasca.

> 💡 **The EC probe is sturdy** (it's a cylinder with two electrodes, no delicate membranes like pH), but the **board connector** isn't: secure the DFR0300-H board well in the box and leave some slack on the probe cable.

---

4. Firmware flash + WiFi

The EC device is flashed and connected to WiFi **exactly like the other JoyReef devices**:

1. **Firmware flash**: follow guide 16 choosing the **EC probe** firmware. (For later updates: OTA from the portal, guide 17.)
2. **WiFi connection**: on first boot the device creates the `joyreef-XXXXXX` configuration network (captive portal). Same procedure as the controller, described in guide 03b.

After a few seconds the device appears on the portal in **Config → Devices** with the type **"EC / Salinity probe"** and the name `ec-XXXXXX`.

---

5. Configuration wizard (basics + calibration)

Open the newly appeared device in **Config → Devices** and click **"Start configuration"**: a **2-step** wizard begins.

Step 1 — Basics

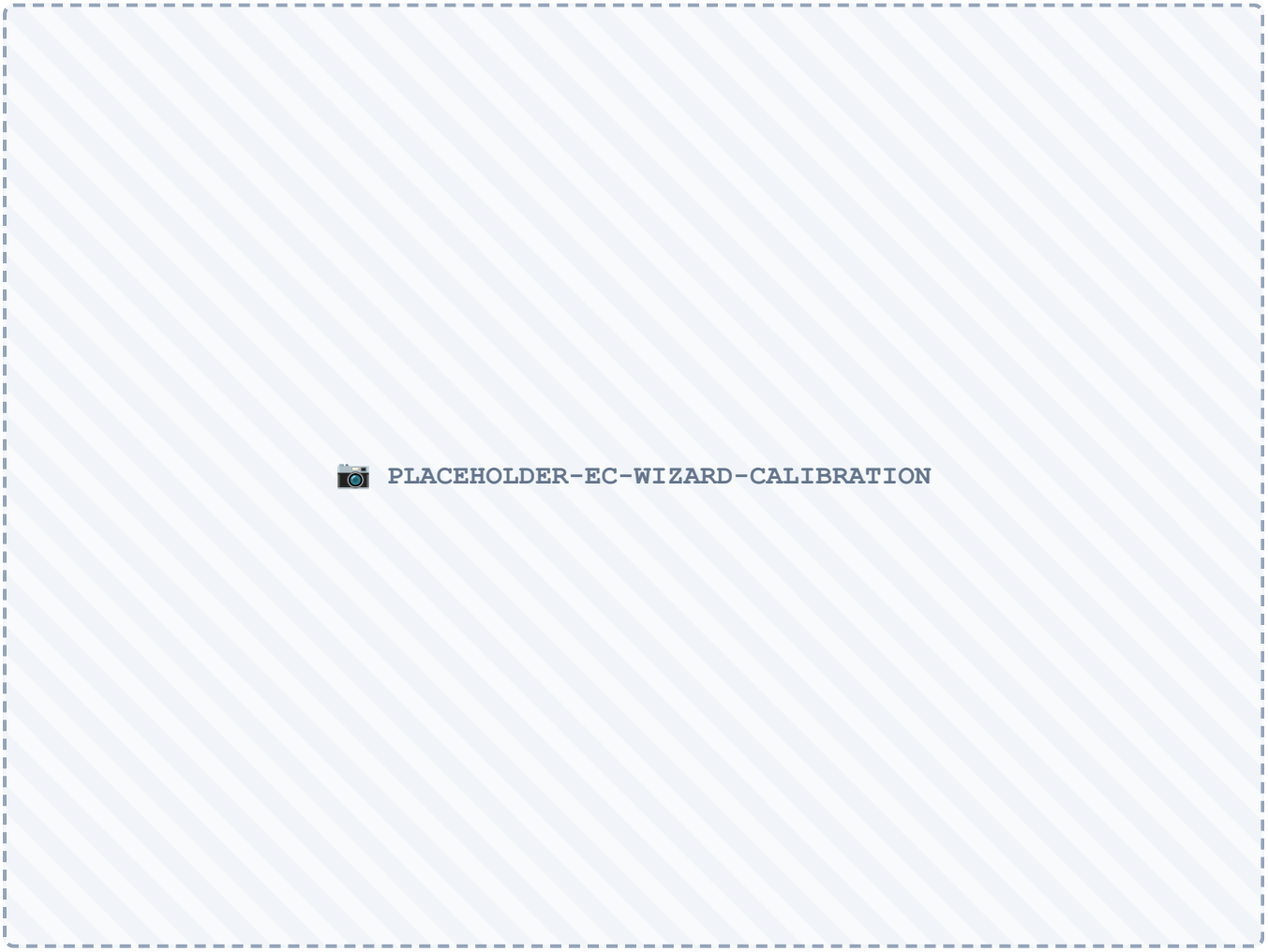
Give the device a meaningful **name** (e.g. "Tank salinity") and assign it to a **tank**. Assign it to the **same tank** as the controller measuring the temperature: it's needed for automatic compensation.

> 💡 **Automatic temperature compensation (ATC).** Conductivity depends heavily on temperature (~1.85% per °C). The EC device **receives the tank temperature automatically from the portal** and normalises the reading to 25 °C — you don't have to wire any temperature probe. If no temperature arrives for more than ~10 minutes, the device falls back to 25 °C until the data returns.

Step 2 — Calibration

The K=10 probe leaves the factory with a generic factor: for accurate readings it must be calibrated with the **12.88 mS/cm standard solution**. The wizard guides you:

1. **Rinse** the probe in RO water and pat it dry
2. **Immerse it** in the 12.88 mS/cm standard solution and wait **1-2 minutes** for it to stabilise
3. Enter the **solution conductivity** (12.88 is pre-filled) and the **solution temperature** (required field — measure the calibration liquid, **not** the tank: if the bottle is at room temperature, a 4-5 °C difference means an 8-9% error)
4. Press **"Calibrate now"**: the factor is saved on the device



🖼️ **Image to insert here (EC calibration wizard):** screenshot of wizard step 2 with the "Solution conductivity (mS/cm)" and "Solution temperature (°C)" fields and the "Calibrate now" button.

When the wizard finishes, the portal takes you straight to the **Salinity page**.

💡 **You can skip calibration** and do it later (it's also on the Salinity page): the device still measures with the default factor, but absolute accuracy is not guaranteed. The **"Restore factory calibration"** button undoes a bad calibration at any time.

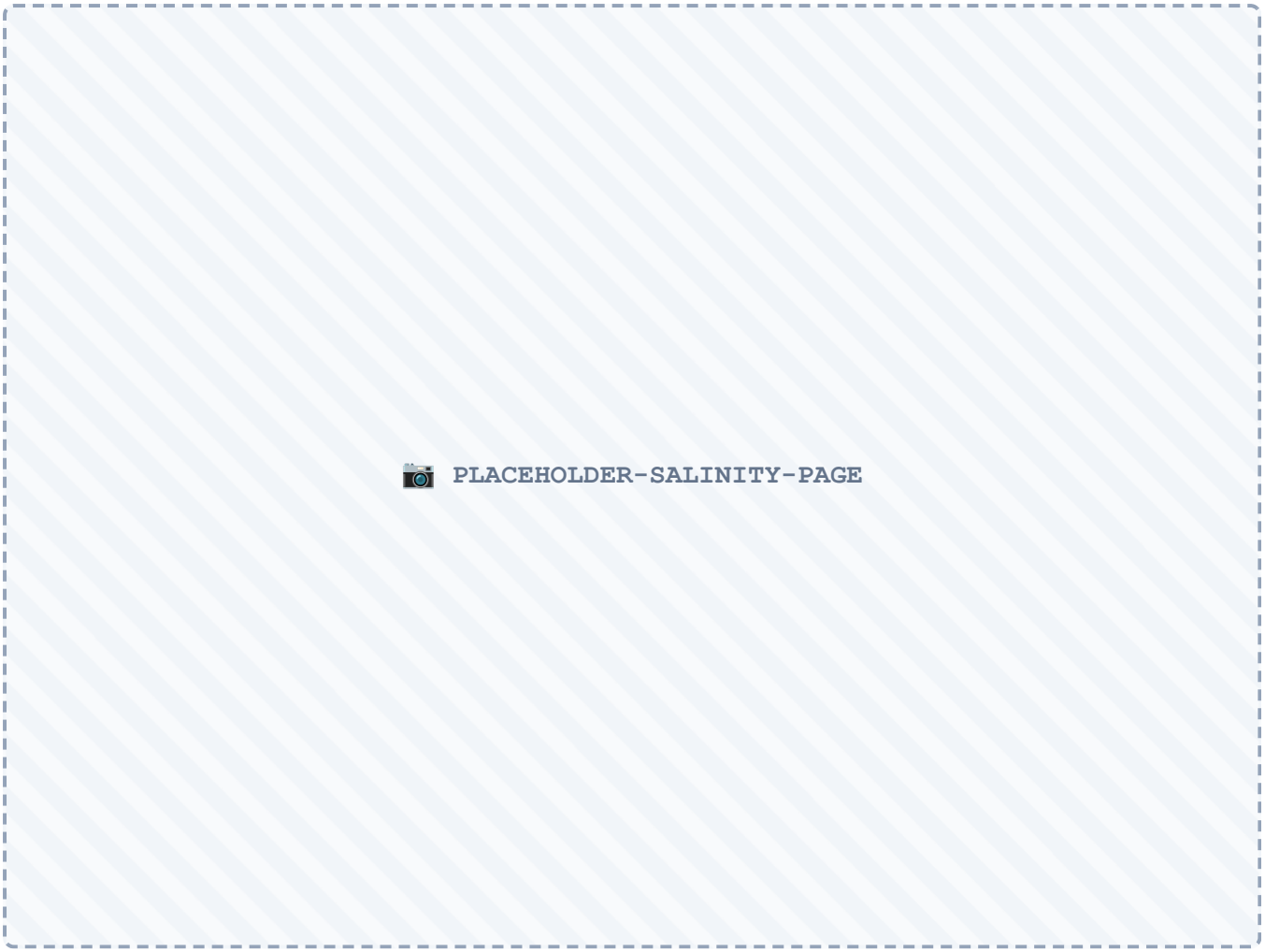
⚠️ **Recalibrate every 2-3 months**, or whenever the value doesn't match your refractometer: electrodes get dirty (films, limescale) and the factor drifts. Clean the probe with RO water before recalibrating.

---

6. The Salinity page

You'll find it under **Monitoring** → **Salinity** (URL `portal.joy-reef.com/sensors/salinity`), or via the **"Details →"** link on the dashboard widget. It shows:

- The **current salinity** in ppt, with **Live/Offline** badge and status (OK / Warning / Alarm)
- The **graduated scale** 28-42 ppt with the **34-36 ppt target zone** highlighted and the needle in real time
- The **EC Calibration** section (the same as the wizard, for periodic recalibrations)
- If you have multiple EC devices on the same tank, the **per-device table** with each one's value and status



🖼️ **Image to insert here (Salinity page):** screenshot of the Monitoring → Salinity page with the current value in ppt, Live badge, 28-42 scale with the 34-36 target zone highlighted and the EC Calibration section.

On the **dashboard**, salinity has its own widget: current value, last-24-hours chart and 24h average.

💡 **The journal benefits too**: when you create a journal entry, the salinity field comes **pre-filled** with the EC device's reading ("Automatic detection") — no more manual transcriptions from the refractometer.

---

7. If something goes wrong

Symptom	Probable cause	What to do
Salinity missing / "No EC device assigned"	Device not assigned to the tank	Config → Devices → open the device → Tank field
EC device offline	WiFi/MQTT down	Check power and WiFi (repeat the captive portal of guide 03b if you changed network)
ADS1115 not detected	Wrong I2C pins or wiring	Verify `SDA` / `SCL` (GPIO0/GPIO2) and VDD/GND
Obviously wrong readings (e.g. 20 or 50 ppt with a healthy tank)	Missing/bad calibration	Recalibrate (sec. 5) measuring the **solution temperature**; in extreme cases "Restore factory calibration" and recalibrate
"Jumpy" readings	Air bubbles on the electrodes or probe near pumps	Gently shake the probe to free the bubbles; move it to an area with moderate flow
The value doesn't match the refractometer	Probe drift or uncalibrated refractometer	Calibrate the refractometer with its solution, then recalibrate the EC device
Salinity "frozen" while temperature changes	No temperature arriving → ATC on 25 °C fallback	Assign the EC device to the **same tank** as the controller with the temperature probe
pH went crazy since the EC device arrived	Shared EC/pH power supply	Two **separate** USB power supplies, never the same powered hub (sec. 1)