Configure Automatic Top-Off (ATO)

Reading time: ~15 minutes · Execution time: ~20 minutes · Audience: anyone who completed guide 05 and has at least one smart plug and one level sensor already configured

🟡 **Important Guide** — a feature that almost everyone will want to activate. Without it, the system works but is much less effective.

🗺️ **Your JoyReef Path:**

1. Shopping list
2. Controller assembly
3. Firmware + WiFi
4. Tank and sensor configuration
5. Tasmota smart plugs
6. **Automatic Top-Off (ATO) ← YOU ARE HERE**
7. Temperature
8. Water change
9. Advanced automations

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1. What you are about to do

ATO (Automatic Top-Off) is the first — and probably most useful — of the JoyReef automations. It serves to **replace the fresh water that evaporates** from your marine tank, maintaining constant salinity and level.

In a reef tank, fresh water evaporates continuously (leaving the salt behind). Without an ATO, you have to top off by hand, almost every day: forgetting for a week means crazy salinity, exposed heaters, and skimmers out of tune.

With the ATO configured, the portal keeps an eye on the water level through a **float switch** in the sump. When the level drops below the threshold, it turns on a **top-off pump** (connected to a Tasmota smart plug) for a few seconds, which pumps RODI water from a reservoir. When the level returns, it turns it off. **All automatic, 24/7.**

In this guide, you will configure:

- The **level sensors** (one mandatory minimum, one optional but highly recommended safety maximum)
- The **top-off pump** (= the smart plug you configured in guide 05)
- The **safety limits** (max time the pump can stay on, max per day, pause between cycles)
- **Advanced automations** (optional): pre-packaged routines to orchestrate start/stop/safety

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2. What you need

Before starting, you must have already configured:

- ✅ **A primary tank** on the portal (you set this up in guide 04)
- ✅ **At least one level sensor** connected to the controller and assigned to a "level function" (`ATO operating level`, `Sump - Minimum level`, etc.). See guide 04, sensors section
- ✅ **A Tasmota smart plug** configured, online, and assigned to the tank (see guide 05)
- ✅ **A top-off pump** already connected to the smart plug (the classic 5-10W AC pump that draws from the osmosis reservoir)
- ✅ **A RODI water reservoir** full, with the pump's intake submerged and the output positioned in the sump

> 💡 **Recommended (not mandatory): dual sensors.** ATO with only one level sensor (the "minimum") works, but has no **mechanical safety net**: if the minimum sensor gets stuck (hair, biofilm, crystallized salt), the pump starts and **never stops** until it hits the max daily limit or the dosing timeout. With a second "maximum" sensor positioned **1-2 cm above the minimum**, the system can stop the pump even if the main sensor fails.
>
> 💡 **Have more than one level sensor?** You can have ATO + water change + skimmer full + osmosis reservoir all monitored. In this guide, you configure **only the ATO**; other automations have dedicated guides (08 for water change, others coming soon).

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3. How Automatic Top-Off works

Before touching the configuration page, take two minutes to understand the logic: it will help you avoid setting random values or getting scared by the first "lockout" you see.

The basic principle

The system is a very simple loop that runs on the **physical controller** (not on the portal: this is important, **it works even if internet goes down**):

```
every N seconds:
    if the minimum sensor says "low water" for at least X seconds:
        turn on the pump
        wait for the sensor to say "water ok" again
        turn off the pump
        wait Y seconds before checking again (lockout)
```

The parameters (X, Y, and several others) are configured on the page. Let's look at them all, as each has a specific safety purpose.

The 3 levels of safety

ATO is the "riskiest" system of all automation: if it goes wrong, you empty your osmosis reservoir into the tank (= salinity shock → corals die). For this reason, there are **three overlapping safety filters**:

1. Limit per single dosing (`max_dose`) Maximum time the pump can stay on in a single cycle. If it exceeds this, the system goes into **"fault"** and stops until you unlock it manually. *Typical*: 60-180 seconds. *Purpose*: block the pump if the minimum sensor is stuck "low" and never returns to "ok."

2. Daily limit (`max_daily`) Total time the pump can work in 24 hours. If exceeded, fault. *Typical*: 600-1800 seconds (10-30 total minutes). *Purpose*: block the system if there is a **small continuous leak** (e.g., sump tap dripping): the pump would top off for hours without realizing it.

3. Lockout between cycles (`lockout`) Minimum pause between one stop and the next start. Even if the sensor immediately says "I still have low water," the system waits. *Typical*: 30-120 seconds. *Purpose*: give the newly pumped water time to **stabilize** in the sump (waves from the return pump cause the float switch to oscillate).

What happens in case of a fault

If one of the limits is triggered, you will see on the portal (and on the controller) the status **"LOCKED FOR SAFETY"** with the reason for the fault:

- `MAX LEVEL reached` → the upper safety sensor triggered (= the minimum sensor didn't stop the pump, and the water rose too much)
- `DOSING TIMEOUT` → `max_dose` exceeded
- `DAILY LIMIT` → `max_daily` exceeded
- `SENSOR ABSENT` → the minimum sensor is not sending data to the controller

In all these cases, the pump **remains off** and you must click **"Unlock now"** after understanding why. **Do not unlock blindly**: if you unlock without resolving the cause, the fault will return within seconds, and in the meantime, you might have pumped more liters into the tank.

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4. Step 1 — Open the ATO page

From the JoyReef portal:

1. Open **portal.joy-reef.com** and log in
2. In the left menu, click on the **"ATO"** item (water pump icon 💧)
3. Or go directly to `portal.joy-reef.com/ato`

The **"ATO"** page opens with various boxes. If an **orange banner** appears at the top saying "Tank not selected" → go back to guide 04 and set a tank as primary, then return here.

If an **orange banner** appears saying "No level sensor assigned" → go back to guide 04 sensor section and assign at least one sensor to the role `ATO operating level` (or equivalent). ATO cannot function without it.

🖼️ **Image to insert here (Empty ATO page):** screenshot of the ATO page on first access, with the "ATO active" toggle off and empty fields.

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5. Step 2 — Configure level sensors

In the first card "**Levels**," you find 4 fields:

Minimum level sensor (mandatory)

The float switch that **detects when water has dropped enough** to start the top-off. Typically positioned in the sump, where the level drops first (because evaporation "discharges" the sump surface).

In the **"Minimum level sensor"** menu, select the level sensor you assigned as `ATO operating level` (or `Sump - Minimum level` if you chose that role). You'll recognize it by the controller name next to it (e.g., *"ATO operating level · Main Controller"*).

Minimum condition

Float switches can behave in two ways depending on the model:

- **"Low"** = the sensor signals "LOW" when water **drops** below the float (normally open, closes when it emerges from the water)
- **"High"** = the sensor signals "HIGH" when water **drops** (normally closed, opens when it emerges)

In practice: try manually raising and lowering the float with the tank full, see what changes in the "Sensors" section of the portal, and choose the condition that corresponds to "low water."

> 💡 **In doubt?** Leave it as "Low" and test: if the pump starts when it shouldn't (tank full), come back here and change it to "High."

Maximum level sensor (optional, but highly recommended)

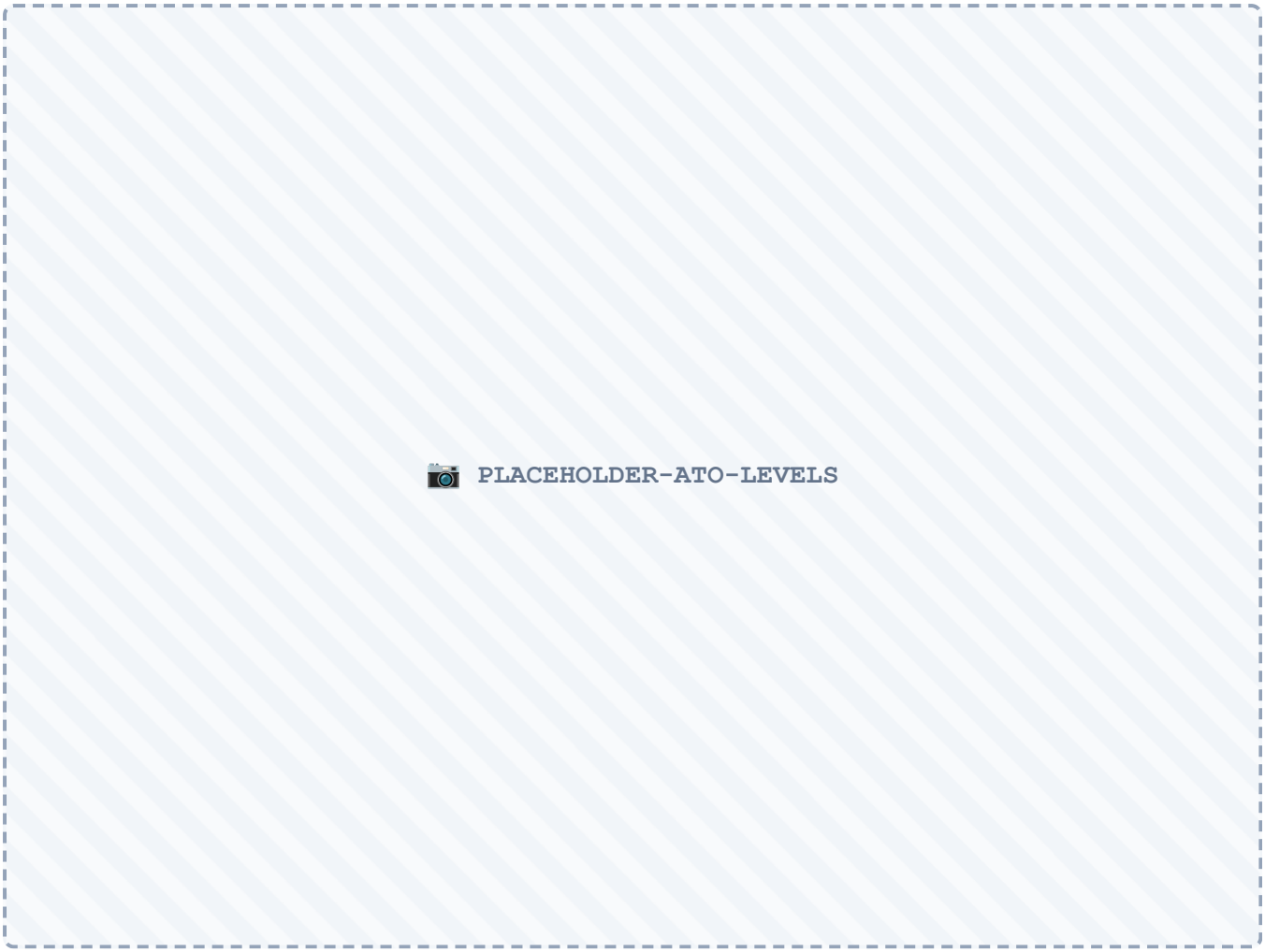
This is the **safety net**: a second float switch positioned **1-2 cm above** the minimum. Its only function is to say "STOP" if water reaches it — meaning the minimum didn't work and we are already beyond the operating level.

In the **"Maximum level sensor"** menu, select the sensor you assigned as `Sump - Maximum level` (or `ATO operating level` if you have a single dual float with two contacts).

If you don't have a second float switch, leave it as **"None"**: the ATO will still work, but you'll only be protected by the time/quantity limits (see section 7).

Maximum condition

Same logic as the minimum: choose the condition that corresponds to "water too high." *Typically "High"*: the sensor signals "HIGH" when the water lifts it.



🖼️ **Image to insert here (Filled Levels card):** screenshot of the "Levels" card with minimum sensor selected (e.g., "ATO operating level · Main Controller"), "Low" condition, maximum sensor selected, and "High" condition.

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6. Step 3 — Choose the top-off pump

In the second card "**Actuator**":

ATO Pump

In the **"ATO Pump"** menu, select the **smart plug** to which you connected the top-off pump. The menu shows all smart plugs assigned to your tank (= those you configured in guide 05).

If the menu is empty or you don't see the right plug:

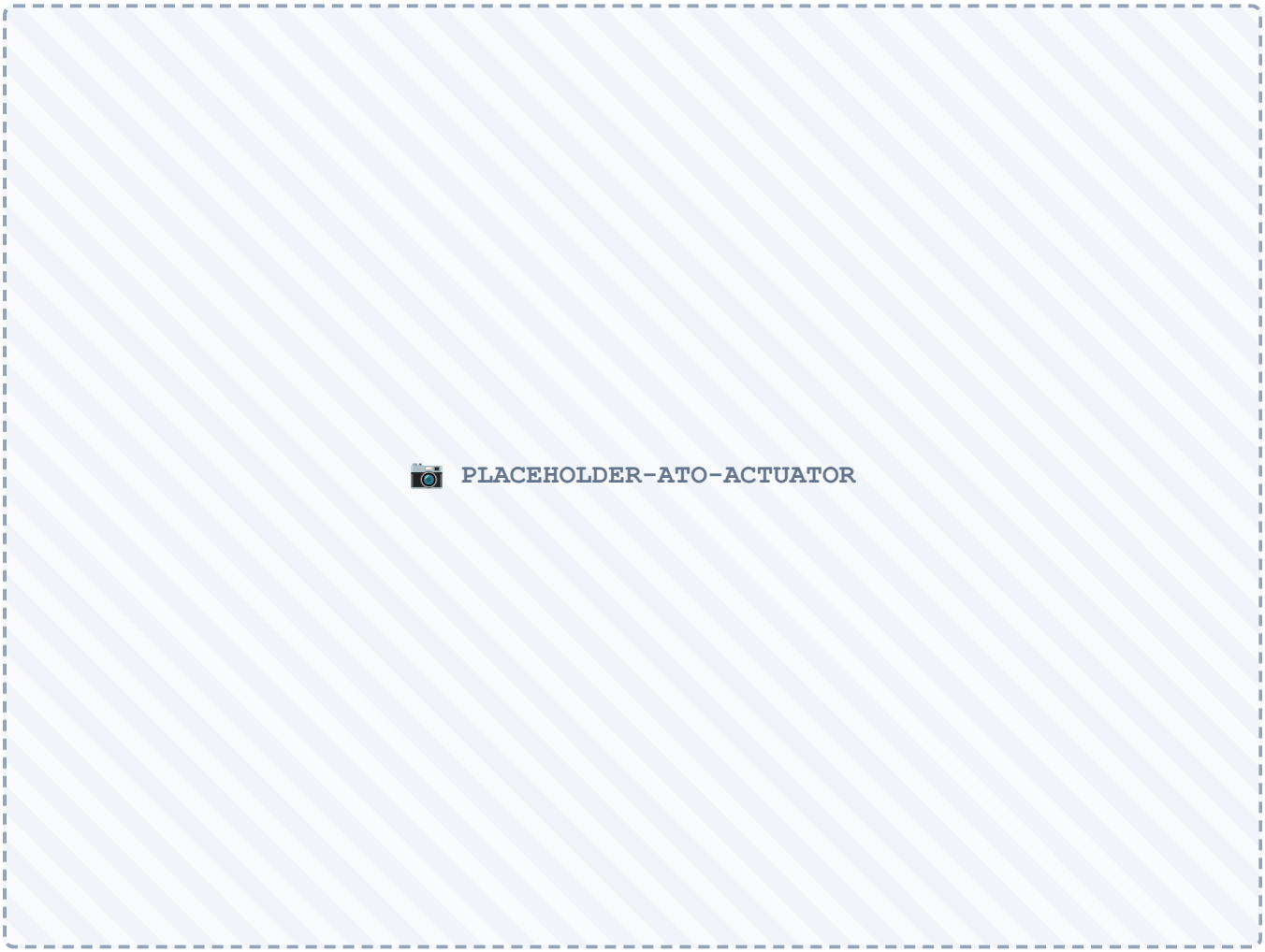
- The plug is not assigned to the **current tank** → go to *Config* → *Devices*, open the plug, check the "Tank" field
- The plug is offline or has never sent data → check the status indicator on the devices page

Start state / Stop state

These two menus tell the system **what the "on state"** of your pump is relative to the smart plug. In 99% of cases:

- **Start state**: `ON`
- **Stop state**: `OFF`

That is: to turn on the pump, we send `ON` to the plug; to turn it off, `OFF`. Leave the defaults unless you have a strange configuration (e.g., pump driven by an inverted relay).



> 🖼️ **Image to insert here (Filled Actuator card):** screenshot of the "Actuator" card with the "Top-off Pump" smart plug selected and default ON/OFF states.

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7. Step 4 — Set safety limits

In the third card "**Limits**," you find 5 numerical fields. **All in seconds.**

Recommended values for a typical sump (~50 liter sump for a 200L net tank) with a standard AC top-off pump (5-10 W, ~80 L/h):

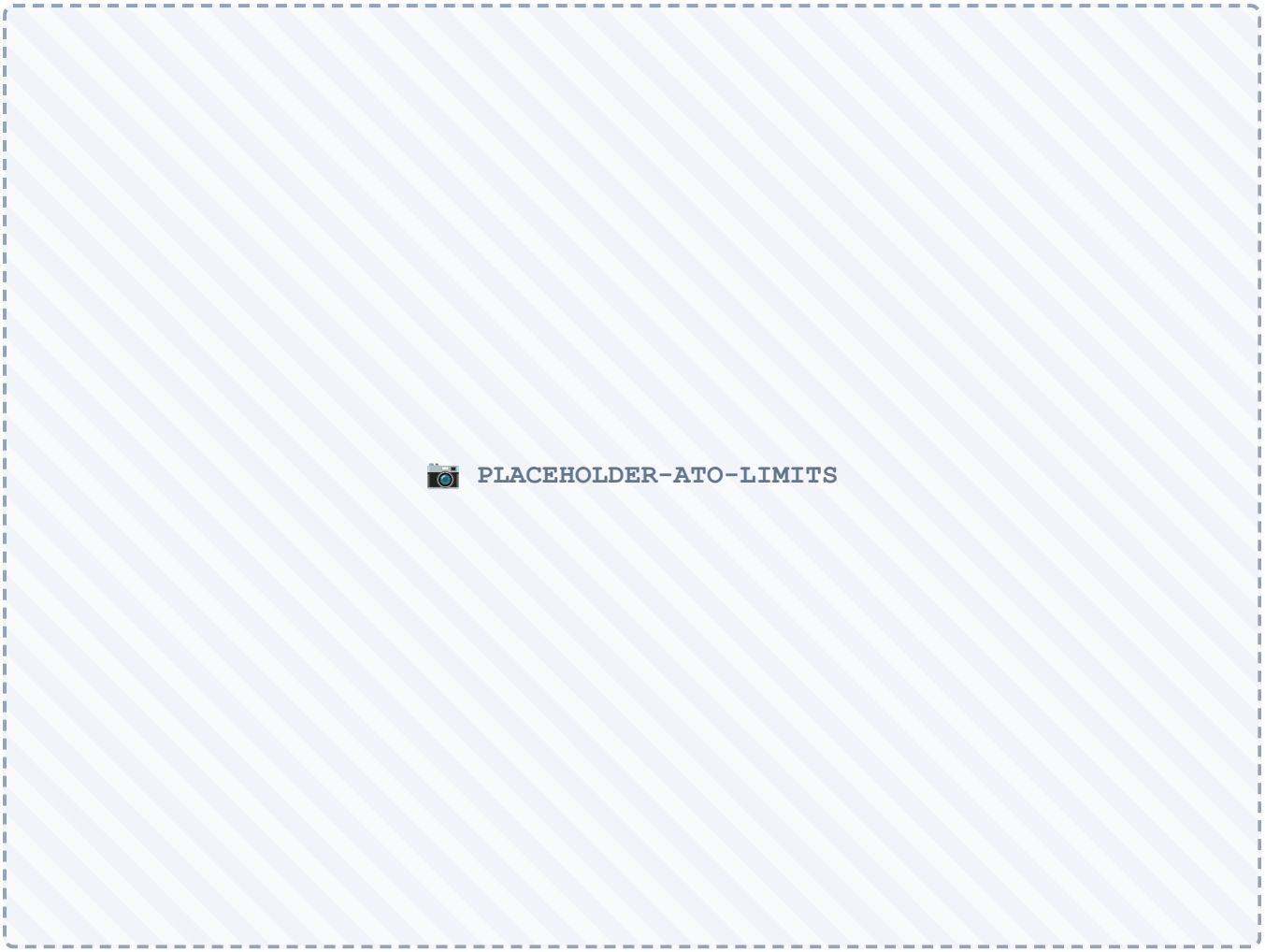
Field	Recommended Value	Purpose
Max dose duration	`120` (= 2 min)	The pump draws ~2.5L in 2 minutes, enough to top off 1-2 cm of evaporation in the sump. If the level doesn't return in 2 minutes, there's a problem
Max daily duration	`1200` (= 20 min)	Total 20 min/day = ~25L of RODI water per day, **well above** typical evaporation. If you exceed this, there's a leak
Lockout	`60` (= 1 min)	After each stop, wait 1 min before it can restart: newly pumped water stabilizes in the sump
Activation delay	`5`	The minimum sensor must say "low" for at least 5 consecutive seconds before starting the pump. Filters false positives from wave oscillations
Stop delay	`2`	The maximum sensor must say "high" for 2 consecutive seconds before stopping the pump (anti-oscillation)

How to calibrate for your specific tank

If your tank is much smaller/larger, or the pump much more/less powerful, recalibrate:

- **`max_dose`** = "how many seconds of pump are needed to recover 1 cm of level in the sump"? Measure once by hand, then double it. For powerful pumps (> 200 L/h), `30-60` seconds might be enough.
- **`max_daily`** = "how much water evaporates in 24h at MAXIMUM"? Measure for 2-3 days noting the sump level before and after. Set triple the measured evaporation.
- **`lockout`** = "how much time does water need to stabilize?" If the return pump is large and makes strong waves, increase to `120-180`.

> ⚠️ **DO NOT set `max_dose = 0` or `max_daily = 0`**: zero means "no limit," and you remove your protections. Even if you are sure of your configuration, **always leave sensible values**: they will save your aquarium the day a sensor fails.



🖼️ **Image to insert here (Filled Limits card):** screenshot of the "Limits" card with recommended values (120, 1200, 60, 5, 2).

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8. Step 5 — Activate ATO and save

You have filled out all three cards. Now:

Step 1: activate the toggle

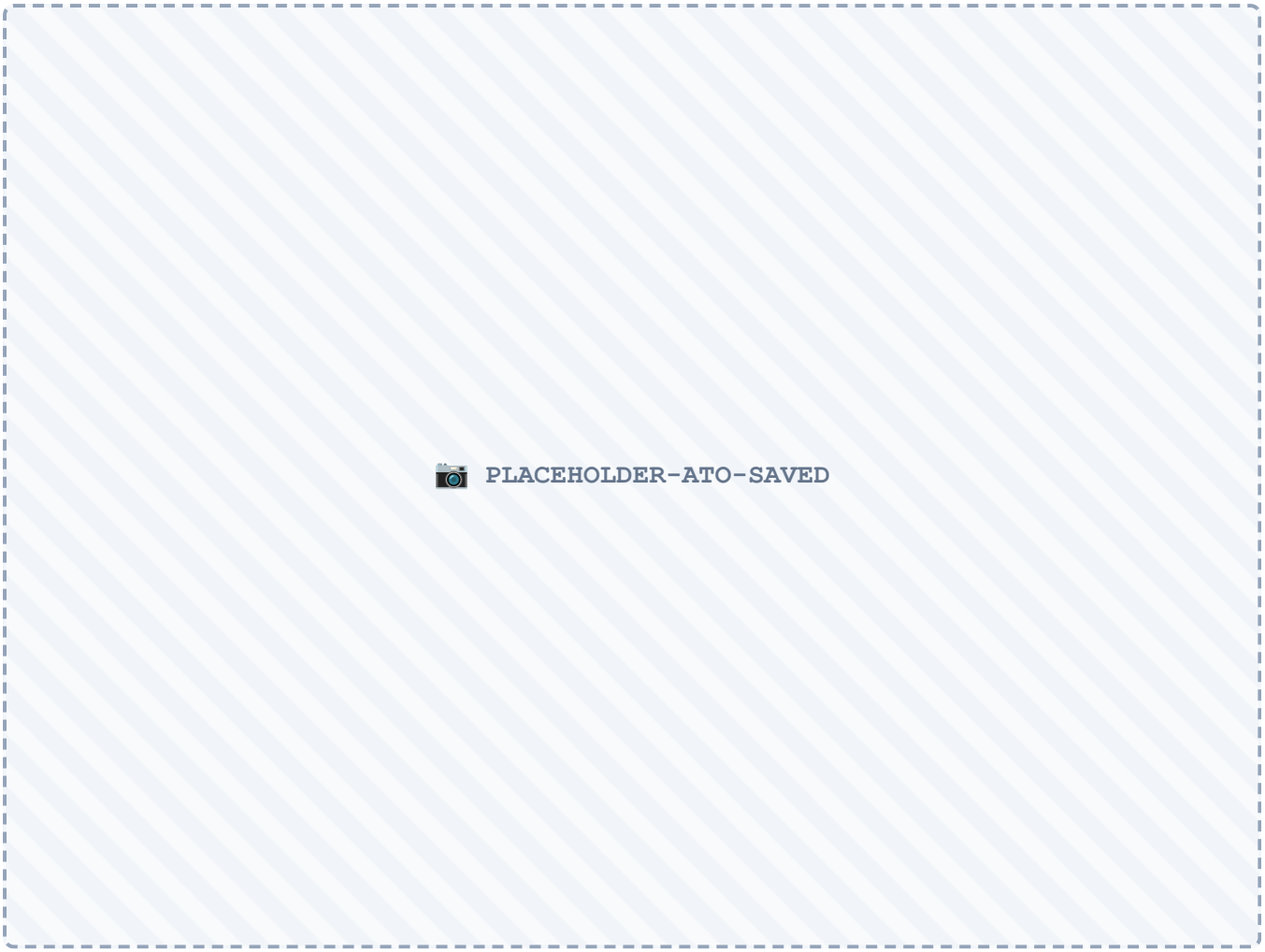
In the top right of the "Configuration" section, you'll find the **"ATO active"** toggle. Click it to activate (it becomes **green**).

Step 2: save

At the top of the page, next to the "Automatic ATO" title, is the **"Save settings"** button. Click it.

A green confirmation banner appears below: **"ATO settings saved and sent to controllers."**

In **a few seconds**, the controller receives the new configuration and starts monitoring the sensor. From this moment, the system is **operational 24/7**.



🖼️ **Image to insert here (ATO saved):** screenshot of the ATO page immediately after saving, with the green "Active" toggle at the top, the real-time monitor visible, and the green confirmation banner.

Step 3: verify the real-time monitor

Immediately after saving, a new section **"Real-time status"** appears with 4-5 boxes:

- **ATO Smart Plug** — current state (OFF in standby, ACTIVE during dosing)
- **System Safety** — OPERATIONAL or ANOMALY DETECTED
- **Today used** — total dosing seconds since midnight
- **Last update** — when the controller sent the last update

If you see a large **green dot** next to "DOSING IN PROGRESS" or **blue** next to "WAITING (Standby)," the system is working. ✅

If you see a **red dot** with "FAULT: ..." on first start, go to the "If something goes wrong" section further down.

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9. Step 6 (optional) — Create advanced automations

Under the "Operational notes" card, you'll find an **"Advanced automations"** section with a **"Create automations"** button.

What it does: generates a series of ready-to-use routines (visible in the *Automations* page) that handle:

- Notifying via email if the ATO goes into fault
- Logging every dosing as an event (visible in the timeline)
- Turning off the skimmer for a few minutes after each top-off (useful if new water makes the skimmer "over-boil")

Do you have to do it? No, it's optional. The ATO pump works perfectly without them. Create the automations only if you want the extra behaviors above.

For now, you can **skip this step** and create them in the future when you are more familiar. You will always find them here.

> 💡 **The created automations are editable.** Once you click "Create automations," you can find the routines on the *Automations* page and adapt them as you like (change email recipients, thresholds, etc.). They are not "carved in stone."

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10. Verify that it really works

Settings are saved, the monitor says "Operational." But does it **really** work? Let's do an active test.

Test 1: manual sensor simulation

1. **Temporarily remove the minimum float switch** from its bracket in the sump (carefully, without turning anything off)
2. **Hold it up** (= dry sensor = "low" state = ATO trigger)
3. Wait **5-10 seconds** (the "activation delay" + controller cycle time)
4. **You should hear the pump start**, and in the portal monitor see "DOSING IN PROGRESS" + green dot
5. **Lower the float switch** back to the operating position
6. The pump **stops** after 1-2 seconds (the "stop delay")
7. In the monitor you see "WAITING (Standby)" and total seconds in the "Today used" box

If this test works, **the ATO is operational**. ✅

Test 2 (if you have the maximum sensor): failsafe test

1. **Remove the minimum float switch** and hold it up (the pump starts)
2. **Immediately after, also remove the maximum one** and hold it up (= simulates "water too high")

3. The pump **stops immediately**, and the system goes into **"FAULT: MAX LEVEL"**
4. In the monitor, the orange banner "Top-off is locked for safety" appears with the **"Unlock now"** button
5. **Lower both float switches** back to operating positions
6. Click **"Unlock now"**
7. The system returns to "WAITING." ✅

You have just verified that the safety net really works. **It's worth ten minutes of your time.**

> ⚠️ **After the test, recheck that the float switches are in the correct operating position** and that the system sees the water. If you have doubts, follow the sensor in real-time from the *Sensors* page for a few minutes.

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11. If something goes wrong

The pump starts immediately and doesn't stop (with full sensor)

The **minimum condition is inverted**: the system thinks "high" is "low" or vice versa.

Go back to the ATO page "Levels" section and **change "Minimum condition"** (if it was "Low," set it to "High" and vice versa). Save. Try again.

It never starts, even when moving the float switch

Possible causes, in order of probability:

1. **ATO is not active** → check the "ATO active" toggle above the configuration (must be green)
2. **The sensor is not sending data to the controller** → go to *Sensors*, see if the float switch value changes when you move it by hand. If it doesn't, it's a wiring problem (see guide 04)
3. **You are looking at the wrong sensor** → check in the "Levels" card which sensor you selected as minimum
4. **The controller is offline** → look at the status dot in the "Real-time status" section. If red → controller offline, go to *Devices*

"FAULT: DOSING TIMEOUT" on first activation

`max_dose` set too low, or the pump can't recover the level in that time.

Diagnosis:

- **Is the pump tap open?** Sometimes tubes are clogged or kinked
- **Is the osmosis reservoir empty?** The pump is running dry, not moving water
- **`max_dose` too low?** For a large tank with a weak pump, 60-120 seconds might not be enough. Unlock, increase to 180-300, and try again

"FAULT: MAX LEVEL" immediately

The upper safety sensor sees "high water" from the start. Possible causes:

- **Wrong positioning** of the maximum sensor: it must be 1-2 cm ABOVE the minimum, not below
- **Maximum condition inverted**: same reasoning as the minimum, try changing it
- **Sensor faulty/fouled**: check by hand

"FAULT: SENSOR ABSENT"

The controller doesn't receive data from the minimum sensor for more than a few minutes.

- Check the float switch cable (terminals firmly secured)
- Reboot the controller (unplug for 10 sec, replug)
- Verify in the *Sensors* page that the value arrives in real-time

"FAULT: DAILY LIMIT"

In 24 hours, the pump has worked more than allowed. Almost always means a **leak** or **minimum sensor stuck "low"**.

- **Check the sump for excess new water** compared to normal (= minimum sensor oscillating randomly)
- **Search for leaks** in the system (sump pipes, fittings, skimmer)
- **Do not unlock blindly**: if you have a leak, unlocking will top off more water

Real-time monitor says "Controller offline"

Go to guide 04, controller troubleshooting. ATO cannot function if the controller doesn't talk to the portal (worse: it will continue to run locally on the controller, but you won't see states and won't be able to unlock faults).

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12. Next step

Do you have the ATO operational and tested? Perfect. Your tank now **tops itself off**.

The next natural automations to tackle are:

➡️ **Guide 07 — Temperature control** (heater + fan, hysteresis, alerts)

➡️ **Guide 08 — Automatic water change** (drain pump + fill pump, weekly scheduling)

Both follow the same conceptual logic as the ATO: **sensor** → **threshold** → **actuator** → **safety**. Once you understand ATO, the others are faster.

> 💡 **Let the ATO run for a few days before moving on to something else.** Verify in the event timeline (*Events* menu) that it starts every 6-12 hours with short doses (30-60 sec). If you see continuous doses or strange cycles, return to the configuration and recalibrate before adding other automations.