

User Manual

FarmDefender™ FD-120 — weed detection & spray

Version	v2.0
Revised	2026-08-14
Applies to	All FarmDefender weed-detection systems (Central Hub V2 / Capstan PinPoint III nozzle control)

FarmDefender™ Weed Detection — User Manual

Document version: 2.0 (2026-08-14) **System serial:** <SERIAL> (e.g. FD-120-26-0003)

Covers every FarmDefender weed system — from a 2-camera UTV rig to a 132' boom. Operation is identical on all of them; only the camera count changes. Where a number depends on your system, this manual says so. First time? If the system isn't mounted and wired yet, start with the Install Guide for your machine — there's a separate one per configuration. This manual assumes the system is mounted, wired, and has booted at least once. For just getting the screen open on your tablet, see Connecting to FarmDefender.

What this system does

FarmDefender is a **see-and-spray** system. Cameras watch the ground under the boom, each running a weed-detection model on its own on-board AI chip. When a camera sees a weed, it tells the Central Hub, which fires the matching nozzles through your **Capstan PinPoint III** nozzle controller — spraying the weed and skipping bare ground.

How many cameras you have depends on your system — 2 on an FD-22 UTV rig, 11 on a 120' boom. Everything in this manual works the same either way.

You drive; it sprays. There is nothing to operate from the cab once it's running.

Quick reference

Question	Answer
Do I run it from the cab?	Press Start Mission on the dashboard when you enter the field, then just drive — detection and spraying are autonomous.
Do I have to start anything?	Yes — the system only sprays during an active mission. One tap: Start Mission.
How do I know it's working?	The camera counter reads all cameras connected (e.g. 11/11 on a 120' boom, 2/2 on an FD-22), live speed + GPS, and MISSION ACTIVE on the Mission tab.
How do I spray more / less aggressively?	Detection Settings tab -> Spray More Often / Spray Less Often.
What if it stops mid-field?	Note the time, finish your pass, then check the dashboard.
Where does the data go?	Local storage first, then synced to FarmTech over Starlink for model improvement.

Question	Answer
Who do I call?	(406) 271-6400 or support@farmtech.us

Daily routine

Before you head to the field

1. **Visual check** — walk the boom. Cameras still aimed straight down? Cables intact? Nothing damaged from the last run?
2. **Lens check** — wipe each camera lens with a soft microfiber cloth if there's mud or dust on it. **Do not** use solvents or abrasive cloths; the lens is coated glass. A dirty lens is the #1 cause of missed or false sprays.
3. **Spray system** — bring up your sprayer as normal: tank filled, agitation on, boom pressure set, **Capstan PinPoint III powered on**. FarmDefender only fires the nozzles — your sprayer still supplies the chemical and pressure.
4. **Power on** — tractor ignition, then the cab cutoff switch on. The system boots automatically (about a minute).
5. **Connect to the dashboard:**
 - Phone/tablet -> **STARLINK** WiFi
 - FarmTech-supplied tablet -> tap the **FarmDefender** icon
 - Any other device -> browser -> **http://farmdefender.local:8080/**
 - Verify: **all cameras connected** (the counter reads your full count), live **speed + GPS**, and the nozzle

bar is live (not "Waiting for nozzles to connect...").

1. **Accept the operator agreement.** At every power-up the dashboard opens with the operator agreement. Read it, check the box, press **I Agree**. Missions and nozzle tests stay locked until you do; you won't see it again until the next power-up.

1. **Start a mission.** Pick your field under **FarmIQ Field Selection**, press **Start Mission**, and let the pre-flight camera check finish (a few seconds). The system only sprays during an active mission.

1. **Drive.** Set a steady ground speed (see "Ground speed" below) and spray.

During spraying

The system runs autonomously — detect and spray, camera by camera, as you go. Nothing required at the cab.

Most operators glance at the dashboard once at the start of a field (confirm all cameras connected, mission active) and don't touch it again. You can pull it up from your phone over Starlink WiFi any time. The **Spray Coverage** panel keeps a

live count of acres covered and chemical saved.

End of day

- **End the mission** — press **End Mission** on the dashboard. That saves the field's coverage map and stats and queues them for upload to your FarmIQ account.
- **Power down** — cab cutoff switch off (or shut off the tractor).
- **Today's data is on local storage** and survives power-off cleanly. No shutdown procedure.
- **Sync** — when the Starlink has sky view, the system uploads the day's captures to FarmTech for model improvement. Park where it can see sky for a while if you've been out of range.

Ground speed

The system fires each nozzle band as that patch of ground passes under the boom, using GPS speed to time the shot. It works across normal spraying speeds, but:

- **Stay at a steady speed** through a pass — hard acceleration/deceleration is where timing errors show up.
- If you're seeing weeds sprayed slightly **behind** or **ahead** of target, note your speed and call us — the spray timing offset is a setting we can tune.
- Very high speed + very small weeds is the hardest case; if you're chasing tiny weeds, ease off the throttle.

Sensitivity

The **Spray More Often** / **Spray Less Often** buttons on the **Detection Settings** tab set how sure a camera must be before it sprays. Each tap is a small nudge, applied to every camera at once.

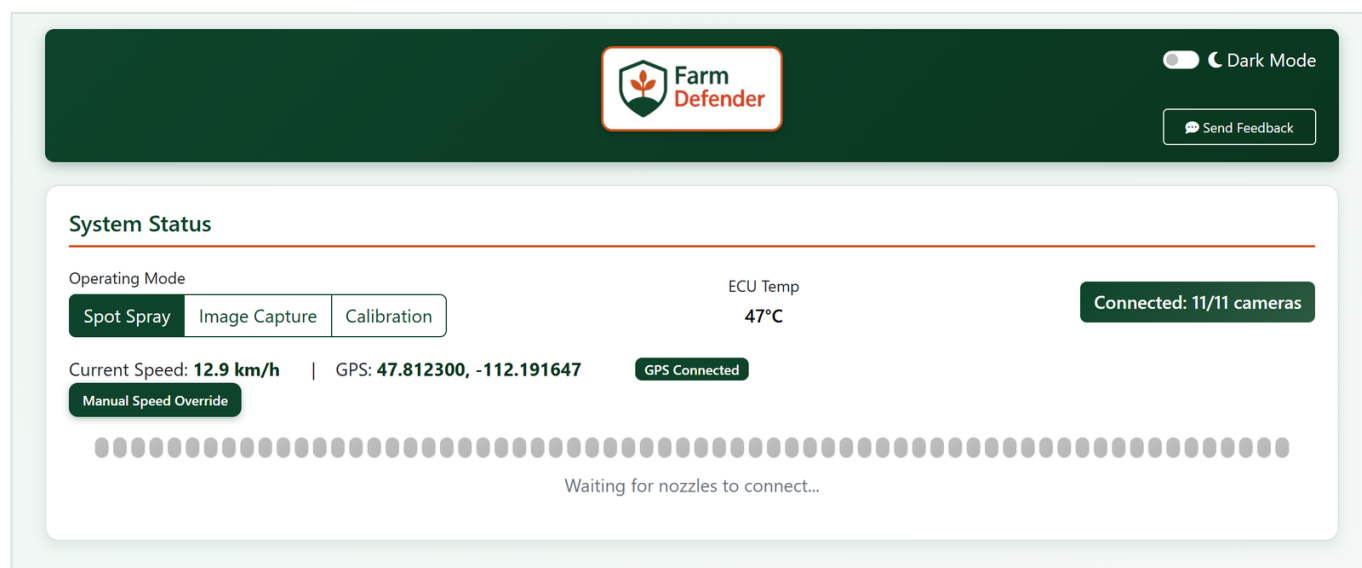
Button	Effect	Use when
Spray More Often	Catches smaller/fainter weeds, uses more chemical, more false sprays on residue/trash	Heavy weed pressure, small weeds, you'd rather not miss any
Spray Less Often	Sprays only clear, confident weeds, saves chemical	Light pressure, larger weeds, chemical savings is the priority

Watch a pass, tap, watch another. The setting takes effect immediately and carries across reboots.

The dashboard

Served from the Central Hub at <http://farmdefender.local:8080/> (on the STARLINK WiFi) or from the **FarmDefender** icon on a FarmTech-supplied tablet, or remotely through FarmTech support over Starlink. Everything below is on one page, split into tabs: **Mission**, **Spray Settings**, and **Detection Settings**. (Two more tabs — Setup and Camera Controls — are technician-only; see "Technician mode".)

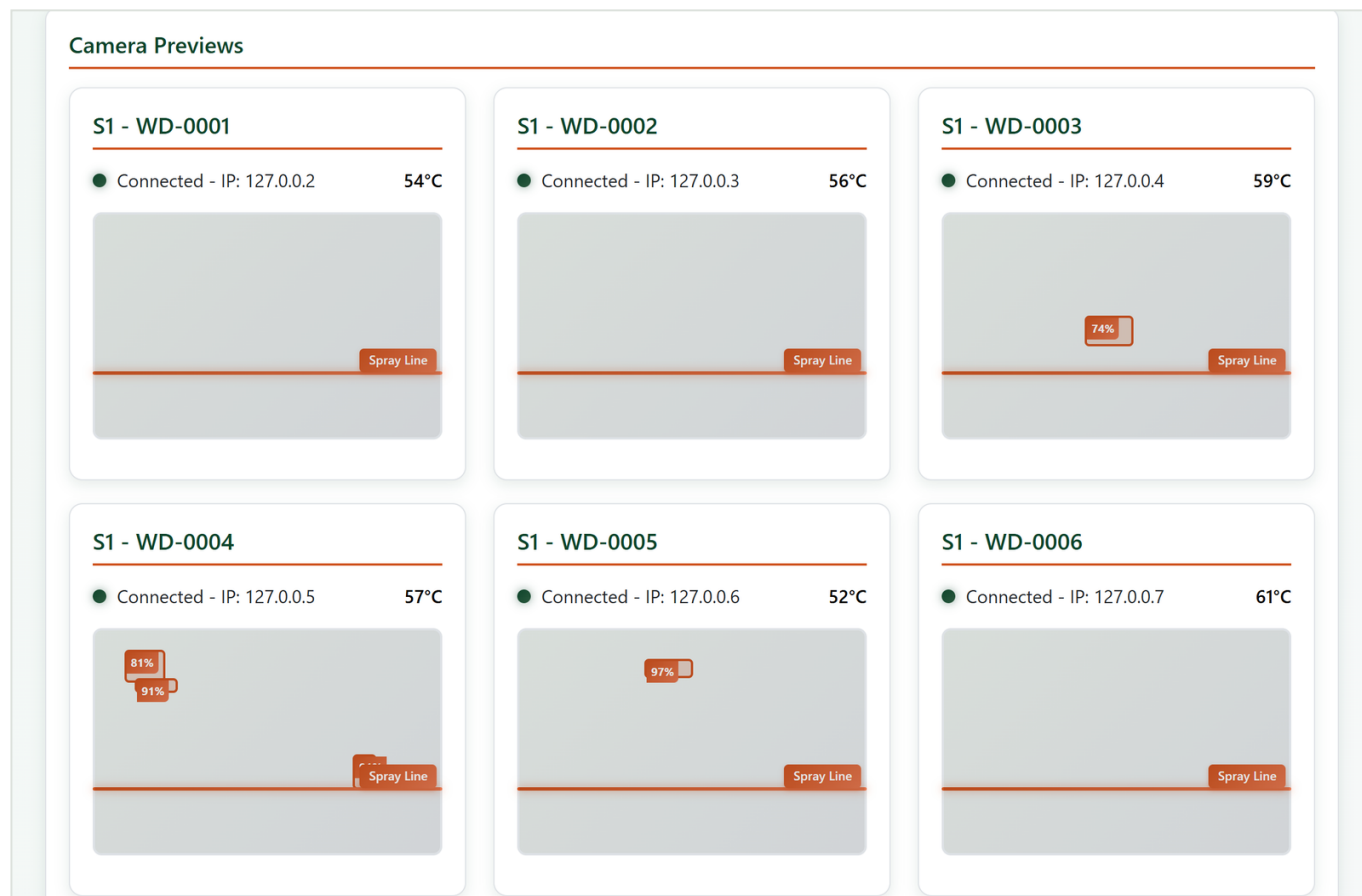
System status (top of every tab)



The System Status bar: operating mode, ECU temperature, camera count, speed, GPS, and the live nozzle bar.

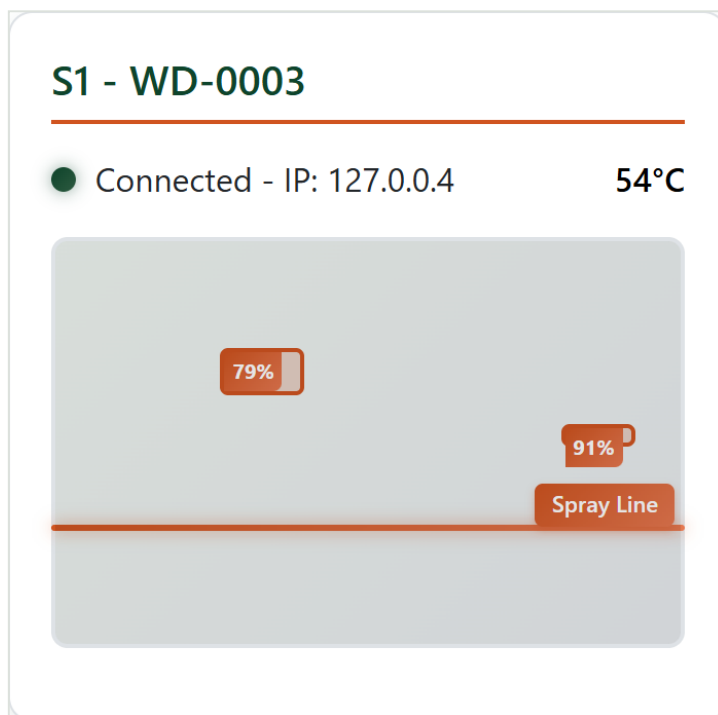
- **Operating Mode** — **Spot Spray** is the normal mode. **Image Capture** collects field imagery instead of spraying (see below). **Calibration** is used with FarmTech support during setup.
- **ECU Temp** — Central Hub temperature.
- **Connected: 11/11 cameras** — the counter shows your own camera count (11/11 on a 120' boom, 2/2 on an FD-22). Both numbers matching means every camera has checked in. Tap it for a per-camera list (serial, boom position, online status).
- **Current Speed + GPS** — live ground speed and position. Spray timing runs off this.
- **Nozzle bar** — one dot per nozzle; dots light as nozzles fire. "Waiting for nozzles to connect..." means the Capstan PinPoint III isn't powered or linked yet — power it on before you spray.

Camera previews (Mission tab)



Camera preview cards: one card per camera, left to right across the boom.

One card per camera, ordered left to right across the boom. Each card shows the camera's serial, its connection status and temperature, and a live view of what it's doing:



A single camera card: two weeds detected (79% and 91% confident), with the spray line shown.

- **Green dot + "Connected"** — camera is streaming and detecting.
- **Boxes with percentages** flash up as the camera sees weeds — each box is one weed and how confident the camera is. Boxes appearing as you drive is the quickest "it's working" check there is.
- **Spray line** — where in the camera's view the nozzles are timed to hit.

Operator agreement (every power-up)

The first thing the dashboard shows after a power-up is the **operator agreement** — the same acknowledgment you see on an autosteer terminal. You are in control of the sprayer and responsible for the chemical application; the agreement spells that out. Check **"I have read and understand"**, press **I Agree**, and the dashboard unlocks for the rest of the power cycle. Missions, calibration, and nozzle tests will not start until it's accepted. Each acceptance is recorded on the system. A printed copy is in your binder.

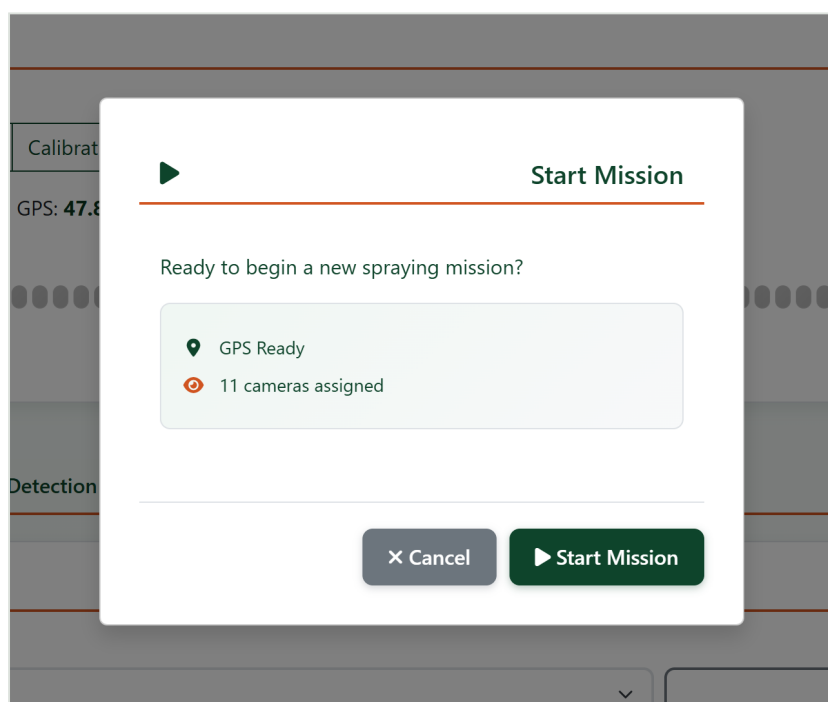
Missions

Spraying is organized into **missions** — one mission per field pass. The system detects and sprays **only while a mission is active**, and everything it does is recorded into a coverage map you get back in FarmIQ.

The screenshot shows the 'Mission' tab in the FarmDefender application. At the top, there are three tabs: 'Mission' (selected), 'MISSION ACTIVE', 'Spray Settings', and 'Detection Settings'. Below the tabs, the 'FarmIQ™ Field Selection' section is visible. It includes a dropdown menu for 'Active Field (for the next mission)' with 'West Quarter (W02)' selected, a 'Refresh Fields' button, and a 'Connected' status indicator. Below this, it shows 'Active field: null', 'Recent uploads', and 'No missions yet.' There are three buttons: 'Start Mission' (green), 'Pause Mission' (orange), and 'End Mission' (red). To the right, it says 'Mission active - 800 spray events recorded' and 'GPS: Available (47.812300, -112.178195)'. Below this, the 'Spray Coverage — This Mission' section shows a large '98.1%' chemical saved vs broadcast spraying. It also displays 'Total area spot sprayed: 0.07 ac' and 'Total area traversed during mission: 3.65 ac'. A progress bar indicates '1.9% of the traversed area needed spray'.

The Mission tab during spraying: field selected, MISSION ACTIVE, and the live Spray Coverage panel.

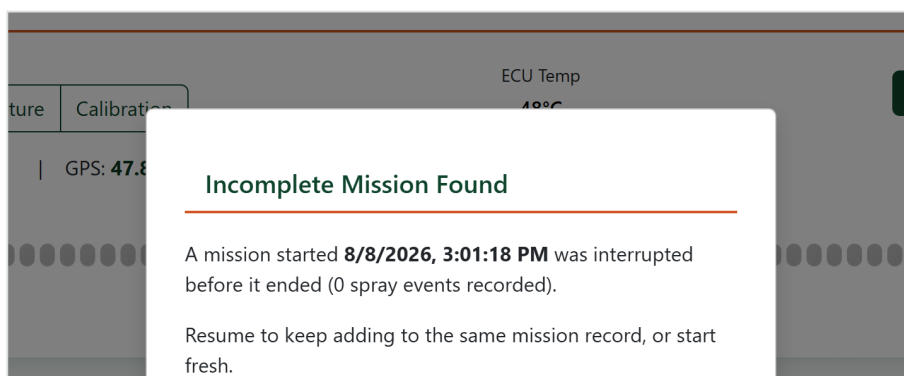
1. **Pick your field** under FarmIQ Field Selection (connect your FarmIQ account once; fields load from there).
2. **Start Mission** — a pre-flight check runs first: every camera must prove it's producing frames right now. All green -> **Start Mission**. A camera failing the check gets its nozzle span blanket-sprayed as a failsafe if you press **Start Anyway** — fix the camera if you can.



The pre-flight check before a mission starts: GPS ready, every camera verified.

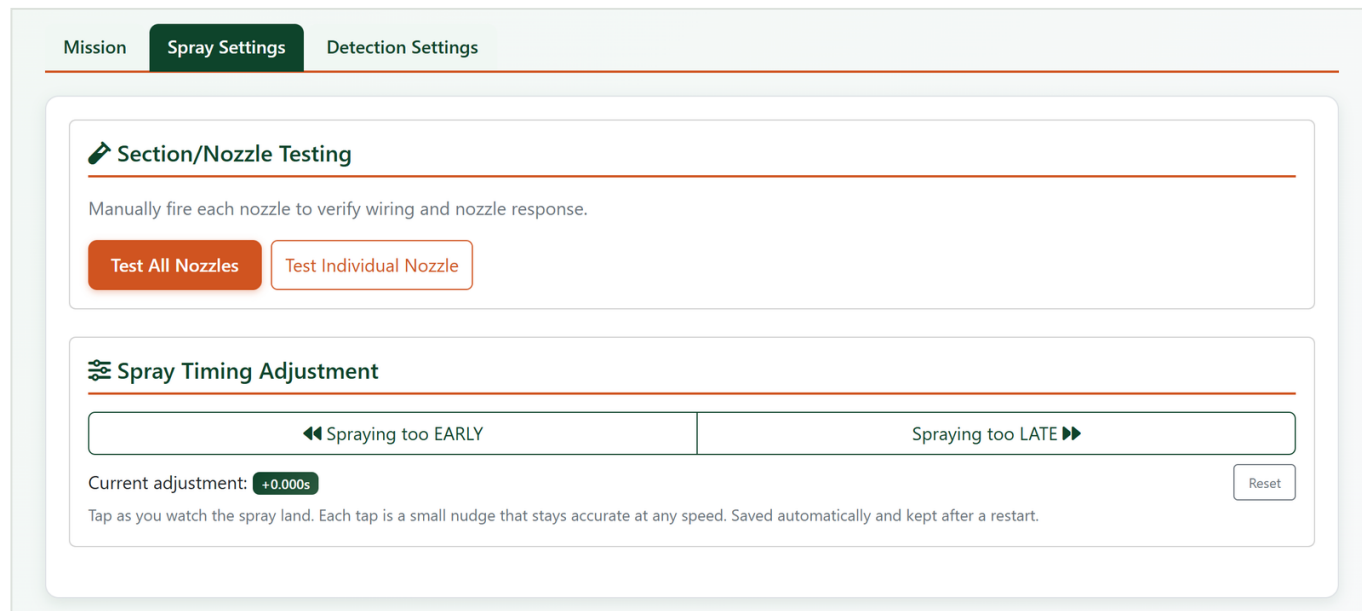
1. **Drive.** The **Spray Coverage** panel tracks chemical saved vs broadcast, acres spot-sprayed, and acres traversed, live.
2. **Pause Mission** stops all spraying and recording until you resume (road crossings, refills).
3. **End Mission** when the field is done — that closes the record, generates the spray map, and queues the upload to FarmIQ.

If power was lost mid-mission (tractor off before End Mission), the dashboard offers to pick the mission back up:



Interrupted mission? Resume to keep adding to the same field record, or start fresh.

Spray Settings tab

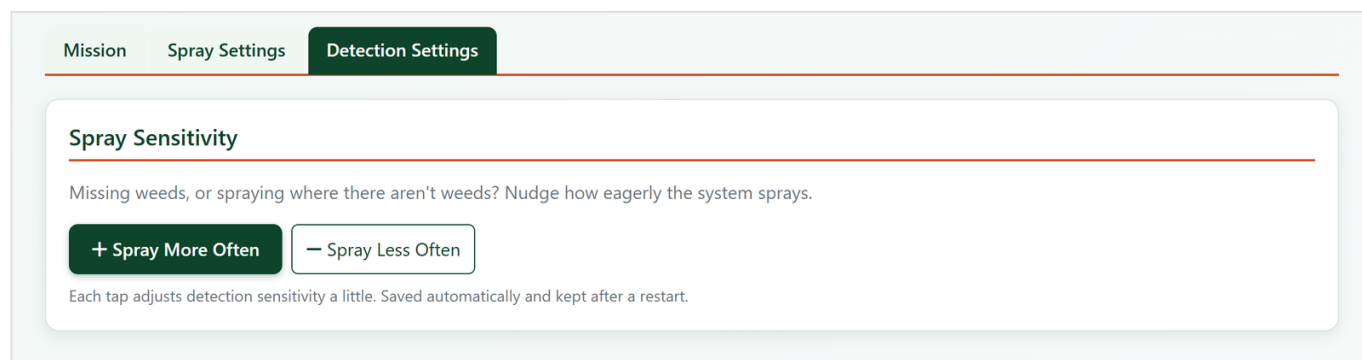


Spray Settings: nozzle testing and the spray timing nudge.

- **Section/Nozzle Testing** — fire all nozzles (or a single one) from the cab to verify plumbing and wiring before you head out. Tank on, boom pressure up first.
- **Spray Timing Adjustment** — if spray is landing behind or ahead of the weeds, tap **Spraying too EARLY** / **Spraying too LATE** as you watch it land. Each tap is a small nudge that stays accurate at any speed. Saved

automatically.

Detection Settings tab



Mission Spray Settings **Detection Settings**

Spray Sensitivity

Missing weeds, or spraying where there aren't weeds? Nudge how eagerly the system sprays.

+ Spray More Often **- Spray Less Often**

Each tap adjusts detection sensitivity a little. Saved automatically and kept after a restart.

Detection Settings: nudge how eagerly the system sprays.

Spray More Often / Spray Less Often — the sensitivity control described under "Sensitivity" above.

Image Capture mode

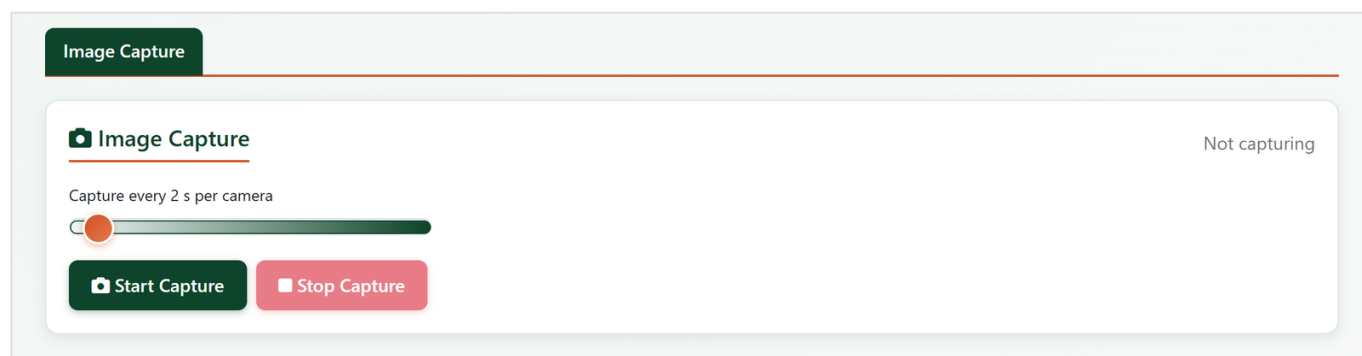


Image Capture

Image Capture

Not capturing

Capture every 2 s per camera

Start Capture **Stop Capture**

Image Capture mode: collect field imagery instead of spraying.

Switch **Operating Mode** to **Image Capture** and an Image Capture tab appears: set the interval, press **Start Capture**, and drive — every camera saves frames of your field instead of spraying. We use these captures (synced over Starlink) to retrain the weed model on your ground. Switch back to **Spot Spray** when done; spraying is disabled while capturing.

Checking a single camera

Tap the camera counter for the full list — serial, boom position (numbered left to right across the boom), and online status per camera. This is the fastest way to name a problem camera when you call us.

Connected Cameras	
Serial: WD-0001	● Online
Position: 1	
Serial: WD-0002	● Online
Position: 2	
Serial: WD-0003	● Online
Position: 3	
Serial: WD-0004	● Online
Position: 4	
Serial: WD-0005	● Online
Position: 5	
Serial: WD-0006	● Online
Position: 6	
Serial: WD-0007	● Online
Position: 7	
Serial: WD-0008	● Online
Position: 8	
Serial: WD-0009	● Online
Position: 9	
Serial: WD-0010	● Online
Position: 10	
Serial: WD-0011	● Online
Position: 11	

The Connected Cameras list: every camera's serial, boom position, and status.

Technician mode

Tapping the FarmDefender logo and entering a PIN unlocks two more tabs — **Setup** (boom geometry, camera placement) and **Camera Controls** (exposure and imaging calibration). These are used by FarmTech during install and remote support; day-to-day operation never needs them.

Maintenance

Daily (during spray season)

- **Wipe camera lenses** if dusty/muddy. A clean lens is the difference between spraying the weed and spraying nothing — or spraying everything.

Weekly

- **Visual inspection** of every cable run along the boom: chafing where cable touches the bar, loose/broken zip-ties, pigtails near connectors that may have over-flexed.
- **Check the Central Hub and Camera Hub boxes** — lids/glands sealed, no water inside.

After every fold/unfold cycle

- **Inspect the wing-uplink cables** where they cross the fold hinge. They should curve, never pinch or kink.

End of season

- **Power off** fully (cab cutoff off / disconnect).
- **Inspect every connector** for corrosion; apply dielectric grease to anything that's been wet.
- **Cover or store the cameras** — they're sealed, but covering reduces sun fade and bird mess in storage.

Pre-season (next year)

- Uncover, reconnect, power up.
 - **Run a parked test** (engine on, cab cutoff on, open the dashboard, confirm every camera connected + GPS).
 - Check the dashboard for a **model update** — we retrain on your fields and push improved models over Starlink.
-

Troubleshooting

"A camera shows Offline" (or the counter is one short — e.g. "Connected: 10/11 cameras")

1. Tap the camera counter — the Connected Cameras list names the missing camera by serial and boom position (numbered left to right across the boom).
2. Walk to it. Check the cable from the camera back to its Camera Hub.
3. Unplug + replug both ends of that cable — listen for the wedgelock click.
4. Wait 30 seconds. Card shows Connected = solved.
5. Still offline? Swap that cable with a known-good one. If the fault follows the cable, the cable's bad. If it stays at the position, the detector's bad. Either way — call us.

"All cameras offline, no GPS, dashboard unreachable"

System isn't booting or lost power.

1. Tractor ignition on? Cab cutoff switch on?
2. Check the main fuse on the 12 V side — replace a blown fuse with the same rating.
3. Check both converter input plugs are seated in the battery box.
4. Still no boot — call us.

"GPS won't lock"

1. Antenna needs clear sky — it won't lock in a shed.
2. Check the SMA connector at the Central Hub is finger-tight (don't crank it).
3. Inspect the antenna cable along its run.
4. Outdoors with sky view for >5 min and still no lock — call us.

"Cameras see weeds but nothing sprays"

1. **Mission started?** The system only sprays during an active mission — the Mission tab must show **MISSION ACTIVE**. This is the #1 cause.
2. **Capstan PinPoint III powered on and enabled?** If the dashboard says "Waiting for nozzles to connect...", the Central Hub isn't linked to the nozzle controller — FarmDefender sends it the fire commands; if it isn't on and active, nozzles won't open. (If the controller is newly installed and has never sprayed, it may still need its one-time commissioning/enable by your dealer or Capstan — call us and we'll confirm the link.)
3. **Boom/section master on?** Tank valve open, pressure up?
4. **Sensitivity** not set too low? Tap **Spray More Often** and watch a pass.

"Sprays too much" or "sprays bare ground"

1. **Clean the lenses** — dust/residue reads as weeds.
2. Tap **Spray Less Often** on the Detection Settings tab.
3. If it's spraying crop or trash consistently, note the field/conditions and call us — that's a model-tuning item and good training feedback.

"Starlink offline"

1. Antenna has clear sky, not blocked by a building/tree?
2. Starlink router has power (its own LED)?
3. Check the cable from the converter to the Starlink router.
4. If FarmDefender otherwise looks fine, it's usually a Starlink-side network issue — use the Starlink app's troubleshooting. FarmDefender keeps detecting and spraying with or without Starlink; you just won't get data sync or remote support until it's back.

Support

Phone: (406) 271-6400 **Email:** support@farmtech.us

Remote support

With your OK, we can remote into the Central Hub over Starlink and diagnose without you doing anything. Just call and say "you can remote in."

Reporting an issue

Please include:

- **System serial** (FD-<MODEL>-<YY>-<####> from the build record card)
- **What happened** + when (date + time)
- **What's red on the dashboard** (if anything)
- **What you've tried**

A screenshot of the dashboard is worth a thousand words.

Warranty

- **1 year** on FarmTech-supplied hardware (detectors, Central Hub, Camera Hubs, cables, mounts) from ship date.
- **Year-1 Starlink service** included; service transfers to your account afterward.
- **AI model retrained on your fields** at the end of season 1 — included.

Damage from impact, chemical ingress beyond the enclosure rating, or modifications voids warranty. Wear items (zip-ties, split-loom, cleaning cloths) are not warrantied. FarmDefender controls nozzle timing only — your sprayer, plumbing, pump, and chemical handling are not part of this system or its warranty.

Appendix A: Hardware reference

For the curious or for deep diagnostics:

- **Weed Detectors (x11):** sealed AI camera units — a 5 MP global-shutter camera paired with an on-board AI accelerator, PoE-powered (802.3af/at). Each runs the green-on-brown weed model on-device and covers ~10 ft of boom (~3 m field of view) from ~1.5 m height.
- **Central Hub V2 (FD-CH-V2):** FarmTech edge computer. Reads ISOBUS NMEA 2000 GPS, runs the dashboard, and sends nozzle-fire commands to the Capstan PinPoint III over CAN.
- **Nozzle control:** Capstan PinPoint III (PWM nozzle valves) — FarmDefender

drives it; the sprayer supplies pressure and chemical.

- **Camera Hubs (x4):** industrial 5-port PoE switches (2 per wing) feeding the detectors.
- **GPS:** ISOBUS NMEA 2000 from the machine's receiver, plus FarmDefender antenna.
- **Connectivity:** Starlink Mini (Year 1 included).
- **Power:** everything-on-48 V — 2x industrial 480 W 12 V->48 V converters, fused on the 12 V side, cab cutoff switch.

For the full BOM, schematics, and cable schedule, contact FarmTech.

Appendix B: Compliance

- **FCC:** the Central Hub and detector units contain FCC ID **2ABCB-RPI5**. IC: **20953-RPI5**.
 - **IP rating:** detector and hub enclosures sealed for boom-mount field use.
 - **Operating temperature:** -20°C to +60°C (-4°F to +140°F). Outside this range, operation isn't guaranteed.
 - **Storage temperature:** -40°C to +80°C.
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