Incidence Perfect NG

User Manual (Beta)

Firmware: 2026.2.9

Build date: 2026-02-26

Revision: 0bd6830

Table of Contents

Incidence Perfect NG is a compact 2-axis inclinometer/incidence meter built around an ESP32-S3 + AMOLED touchscreen. It measures **roll** and **pitch** and provides guided workflows for **ZERO**, **MODE**, **ROTATE**, and **ALIGN**.

> Beta note: This manual describes the current firmware behavior. If something differs on your device, report the **firmware version shown on the splash screen**.

---

1) Getting Started

Power + Boot

- Connect the device over USB power.
- On boot you'll see the splash screen with the firmware version in the lower-right.
- After boot, the live readout screen appears (roll/pitch).

What You're Looking At

- **Top status line** shows:
  - orientation mode (`SCREEN UP` or `SCREEN VERTICAL`)
  - axis view (`BOTH`, `ROLL`, `PITCH`)
  - rotation (`ROT 0` or `ROT 180`)
  - live state (`LIVE` or `FROZEN`)
- **Readouts**:
  - `ROLL` (left) and `PITCH` (right) in degrees
  - colors shift for large angles (warning, then critical)
- **Bottom buttons**:
  - `ZERO`, `AXIS`, `MODE`, `ALIGN`, `ROTATE`

---

2) Touch Controls (Everyday Use)

ZERO

Use when the tool is resting in the reference position.

- Tap `ZERO`.
- A brief confirmation message appears.
- Values settle around `0.00`.

AXIS

Choose what you want to focus on:

- Tap `AXIS` to cycle: `BOTH -> ROLL -> PITCH -> BOTH`.

ROTATE (180 degrees)

Use when the device is physically hard to read and you want to flip the UI.

- Tap `ROTATE` to toggle `ROT 0` / `ROT 180`.
- Rotation persists after reboot.

Freeze / Unfreeze

Use freeze when you want to capture a reading without chasing tiny motion.

- Tap the **readout area** (the roll/pitch values) to toggle `LIVE` / `FROZEN`.
- When frozen, the displayed values hold steady.

---

3) BOOT Button (Physical Control)

The board has a physical **BOOT** button (`GPIO0`, active-low). It mirrors key actions so you can operate the device when the screen is hard to reach.

In normal measurement mode:

- **Short press**: toggle freeze (`LIVE <-> FROZEN`)
- **Long press (~1.2s)**: cycle `AXIS` (`BOTH -> ROLL -> PITCH`)
- **Very long press (~2.2s)**: enter/toggle `MODE` workflow (orientation change)

While holding BOOT, an on-screen hint shows what will happen on release and a progress indicator for the next threshold.

---

4) MODE (Orientation Change, Guided)

`MODE` changes how the device interprets orientation.

- `SCREEN UP`: standard “screen facing up” use case
- `SCREEN VERTICAL`: use case where the tool is used on a vertical surface

Touch Workflow

1. Tap MODE once to enter the guided workflow.
2. The UI shows which orientation to position the device into (target).
3. Tap CONFIRM, then **hold the device still**.
4. A countdown appears; when it reaches zero, the new mode auto-applies.
5. Tap CANCEL at any time to abort without changes.

BOOT in MODE Workflow

- Short press: CONFIRM
- Long press: CANCEL

---

5) ALIGN (Mechanical Alignment, 6 Steps)

Use ALIGN after mounting/enclosing the device to remove systematic bias.

This is a guided, 6-orientation capture procedure. The device will prompt you through the positions and ask you to capture each one.

Touch Workflow

1. Tap ALIGN.
2. Follow the on-screen instruction (example: `Place tool: SCREEN UP`).
3. Tap CAPTURE to record that step.
4. Repeat until all steps are captured.
5. Tap CANCEL to abort safely at any time.

BOOT in ALIGN Workflow

If the screen is hard to access (for example screen-down steps):

- BOOT short press = CAPTURE

---

6) Serial Control (Optional)

If connected to a PC, you can control the same workflows via serial (115200).

Core commands:

- z: ZERO now

- `a`: AXIS cycle (`BOTH -> ROLL -> PITCH`)
- `r`: ROTATE 180 toggle
- `C`: start ALIGN workflow
- `c`: confirm/capture (context-sensitive)
- `m`: start MODE workflow to the opposite orientation
- `u`: start MODE workflow targeting `SCREEN UP`
- `v`: start MODE workflow targeting `SCREEN VERTICAL`
- `x`: cancel pending MODE workflow

Serial and touch workflows are designed to stay synchronized.

---

7) Troubleshooting

Touch Feels Hard To Trigger

- Use BOOT alternatives for critical actions.
- Try deliberate taps (not swipes) centered on the button.

Serial Monitor Doesn’t Resume After Reset

- Some setups require closing/reopening the serial monitor after reset.
- Always report the firmware version shown on splash if you see inconsistent serial behavior.

MODE Doesn’t Apply

- Ensure you press `CONFIRM`, then keep the device still until the countdown finishes.
- If you move, the countdown may reset (by design).

---

8) Beta Tester Checklist + Feedback

If you’re testing externally, use:

- `../release/beta-checklist.md`
- `../release/tester-handoff-note.md`

When reporting an issue, include:

1. Firmware version (from splash)
2. Exact steps to reproduce
3. Expected vs actual result

4. Photos/video if UI-related

Appendix A: Hardware Notes

For reference bring-up settings (Arduino IDE), see:

- `../hardware/board-settings.md`
- `../hardware/board-settings-arduino-ide.jpg`

Authorship

This firmware and UI were developed by **Per Takman**, with assistance from **OpenAI Codex (Codex CLI)**.

License And Warranty

- The project source code is released under the MIT License.
- The software is provided “AS IS”, without warranty of any kind.
- Third-party manuals, schematics, and library dependencies remain under their respective original licenses/terms.