Calibration card.

Everything needed to calibrate underground, on one folded sheet. Covers the new device — the one with the orange trigger.

When to calibrate

- **Every trip, before you start:** run a Mag Field Check (panel 4). It takes a few minutes and tells you whether a full calibration is needed.
- **Full calibration** when you survey in a new area, when readings look wrong, or when the field check keeps reporting a high amplitude.

Getting there

```
Menu
└ Enter Calibration
   ├ Enter Calibration
   │   ├ Part 1 (Ellipsoid)  56 readings
   │   └ Part 2 (Alignment)  24 readings
   ├ Mag Field Check
   └ View Last Cal
```

Part 1 and Part 2 are separate entries, so either can be re-run on its own. A full calibration is both, in order: 80 readings.

RECORDING KEYS · BOTH STAGES

Trigger	record a reading
Down (or Menu)	undo the last one
Hold Up + Down	save the result
Hold Down	discard and exit

Get away from metal first

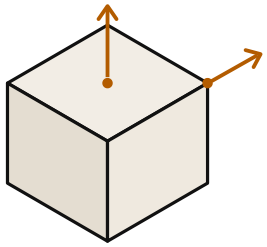
Calibrate in the same magnetic environment you will survey in, and well clear of bolts, helmet lights, SRT kit, ammo boxes and your phone. The device warns about anomalies, but it cannot undo a calibration taken next to a scaffold bar.

FOLD

Part 1 — Ellipsoid

Corrects sensor bias. Perfect sensors would trace a sphere as you turn the device through every orientation; a real one traces something closer to a rugby ball. This measures that shape.

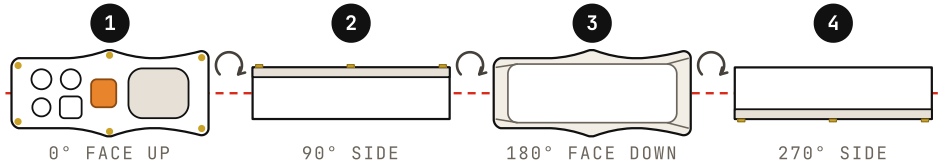
The set of orientations



Imagine a cube around you. Aim the laser at the centre of each of its **6 faces** and at each of its **8 corners** — **14 directions** in all.

At every one of those directions, take **4 readings**, rolling the device 90° about the laser axis between each.

14 × 4 = **56 readings**.



For each set of four readings in one direction, turn a quarter turn apart about the beam. You don't need to be 100% accurate about where the laser is pointing at this stage — the aim is just to get a wide distribution of directional readings.

Steady beats fast

The accelerometer needs the device still. Rest your arms on a non-magnetic surface between readings, or use a jig. Random orientations do work — the cube set just does better.

The result

The screen shows **Mag** and **Grav** — how uniformly each sensor's readings fit the ellipsoid. **Lower is better**, but don't worry too much about this number — you get a better idea of how well your calibration has gone in the alignment step, and this ellipsoid calibration will be used during Part 2.

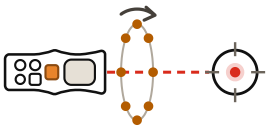
STAGE 2 · 24 READINGS

Part 2 — Alignment

Corrects the residual error between the sensors and the laser, which can never be mounted perfectly square to the beam. Keys are the same as Part 1 — see panel 1.

The procedure

1. Pick a target and put the laser on it. A small, distinct mark at a comfortable distance works best.
2. Take **8 readings** of that same target, barrel-rolling the device around the laser axis between each so the 8 are spread evenly around the full turn.
3. Move to a target in a **completely different direction** and repeat. Then a third. **3 targets × 8 = 24 readings.**



Take the shot, roll the device a little, take the next — **8 in all**, spread evenly around the full turn. Roughly 45° between each; covering the whole circle matters more than hitting the angles.

The laser stays on the **same spot** throughout. The device turns about the beam, it does not move around the target.

> **The steadiest hold I have found**
>
> Sit down with your head and back supported. Rest the back of the device against your nose, lock your arms to your sides, and roll from there. It removes nearly every degree of freedom between you and the device.

The result

The screen shows a single **Accuracy** figure in degrees. Save it if it is good; discard and re-run if it is not.

`< 0.25° EXCELLENT` — `< 0.5° ACCEPTABLE`

Above 0.5°, something went wrong — most often movement during the readings, or metal nearby. Re-run rather than survey on it.

FOLD

EVERY TRIP · 3+ PAIRS

Mag Field Check

Checks the calibration you already have, at the site you are about to survey. Another quick test is just to point the device at a target and take readings while barrel rolling it — if the calibration is bad, these readings will be significantly different.

1. Shoot a fixed target — the **foresight**.
2. Walk to the target, turn round, and shoot back at where you stood — the **backsight**.
3. Repeat for **3 or more pairs**, pointing in genuinely different directions each time.
4. Press **Up** to finish. The device reports a correction amplitude from the bearing error in each pair.

FIELD CHECK KEYS

`Trigger`	take a shot
`Up`	finish (after 2+ pairs)
`Hold Down`	exit

Reading it: low amplitude means the calibration is holding up. A consistently high one means hard-iron error the device cannot correct — run a full Part 1 + Part 2 before trusting the survey.

Checking what the device is running on

Menu → Enter Calibration → View Last Cal shows the stored **Mag** and **Grav** figures from Part 1 and the **Accuracy** from Part 2 — any time, without re-calibrating. Lower is better in all three. Worth a look before a trip rather than at the bottom of a pitch.

Warnings on a shot

`MagErr`	Field strength is not what the calibration expects — something ferrous is close.
`GravErr`	Gravity reading is off. Almost always movement during the shot.
`DipErr`	Dip angle disagrees with the calibration — local disturbance.

A flagged shot is shown but **not stored and not sent** — shoot it again.