MAGNETIC TEST EQUIPMENT

Stormtrooper Magnetometer

A handheld 3-axis magnetometer with calibrated distance sensing, built to characterise magnetorquers and magnets on the bench: map the field, fit the dipole moment, export the evidence.

3-axis MLX90393 | Sonar + field distance | BLE · Wi-Fi · OTA



Product overview

The Stormtrooper Magnetometer is the tool Minerva Dynamics uses to verify its own magnetorquers. Point it at a coil or magnet, press the button, and the gun logs the 3-axis field together with the calibrated distance from the sensor to the target. The mobile and desktop app builds a grid or 3D field map from these captures, suggests where to measure next, and identifies a magnetorquer's magnetic dipole moment with a full uncertainty budget. Distance comes from an ultrasonic sonar at longer range and from the measured magnetic field itself when the target is too close for sonar.

Key features

- **3-axis field measurement:** MLX90393 Hall sensor behind a 3 mm acrylic window, X/Y/Z, |B| and ΔB from a zeroed baseline.
- **Calibrated distance:** HC-SR04 sonar referenced to the magnetometer chip centre, with X/Y/Z components and a ruler-calibrated correction table.
- **Close range from the field:** a calibrated dipole model of the magnet turns the field into distance and sideways offset where sonar cannot see.
- **One-button capture:** 16 samples averaged per press, logged with distance, noise and location.
- **LED field ring:** 12 RGB LEDs show field strength at a glance.

Applications

- **Magnetorquer acceptance testing:** dipole moment identification from off / +I / −I field maps.
- **Permanent magnet characterisation** and dipole cross-checks.
- **Residual magnetic field surveys** of satellite parts and test setups.
- **ADCS lab work, training and education.**

Software

- Android app and browser app (served by the gun over Wi-Fi).
- Live readings, capture table, grid and 3D field maps, c-optimal next-point suggestions.
- Records with CSV / Excel export and optional Google Sheets and cloud sync; English and Turkish.

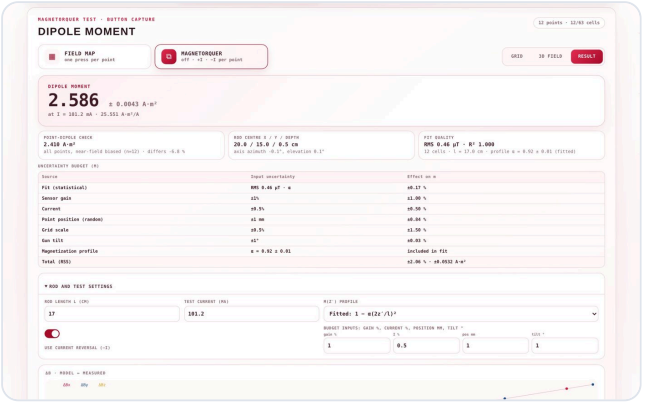
Specifications

MAGNETIC SENSING	
Sensor	Melexis MLX90393, 3-axis Hall-effect magnetometer
Measurement range (default setting)	X, Y: ±4.9 mT · Z: ±7.9 mT
Resolution (default setting)	X, Y: 0.150 µT/LSB · Z: 0.242 µT/LSB (16-bit)
Sampling	≈ 40 Hz internal; live stream to the app at 4 Hz; capture = 16-sample average
Outputs	Bx, By, Bz, |B|, ΔB from a zeroed baseline
DISTANCE SENSING	
Sonar	HC-SR04 ultrasonic, tilted 15° toward the sensor axis; distance and X/Y/Z referenced to the MLX90393 chip centre
Calibration	Ruler calibration from the app or PC; up to 16-point correction table; blind-zone rejection
Close range	Field-based magnet distance from a calibrated dipole model (typically a few cm, below the sonar's reliable range); sonar–field fusion
ELECTRONICS & CONNECTIVITY	
Processor	Espressif ESP32-S3
Wireless	Bluetooth LE; Wi-Fi 2.4 GHz access point with built-in web app
Firmware updates	Over the air (OTA)
User interface	16 mm capture button, 12-LED RGB field ring
POWER & MECHANICAL	
Battery	1 × 18650 Li-ion, battery level reported to the app
Charging	USB-C
Enclosure	PETG with TPU gaskets, acrylic sensor window, desk-stand foot
Size (L × W × H)	≈ 210 × 70 × 226 mm
Mass	≈ 420 g (design estimate)

Inside the app



Live field, distance and captures



Magnetorquer mode: field map and dipole-moment fit with uncertainty budget

Specifications refer to the default firmware configuration (0.9.7) and may change without notice. Field accuracy depends on calibration, magnetic environment and distance to ferrous parts.