

MGM4000 Software Features

1. Unit Firmware (Embedded on Pico MCU)

- Dual Tri-axial Data Acquisition: 10 Hz synchronized sampling (top & bottom sensors), real-time total-field computation per sensor, gradient = Bottom – Top (signed, in nT).
- Tilt & Heading Correction: Module supplies pitch/roll; top sensor is also used as a digital compass; full 3D rotation matrix applied to magnetic vectors; output = tilt- & heading-corrected total fields and gradient.
- OLED Display HUD: shows top and bottom sensor total fields, gradient (signed, nT), bubble level overlay (pitch/roll status), connection status indicators.
- USB Output Stream: packets = (Timestamp, Top X,Y,Z, Top nT, Bot X,Y,Z, Bottom nT, Gradient, Pitch, Roll); 10 Hz stream to tablet over serial COM; plug-and-play detection by MGM Tablet App.

2. MGM Tablet App (Windows Tablet)

Device Management

- COM port auto-detect & persistence.
- Device label 'MGM4000' in dropdown.
- Connection health check.

Real-Time Data Display

- Gradient graph (scrolling plot).
- Numeric readouts (Top, Bottom, Gradient, Pitch, Roll).
- Bubble level visualization synced with unit.

GPS Integration

- Uses external chest harness-mounted antenna.
- Real-time GPS merged with unit data.
- Operator GPS position plotted with live gradient data.

Survey Recording & Logging

- Start/Stop recording buttons.
- Auto-save CSV logs: Lon, Lat, Gradient(nT), TopX, TopY, TopZ, Top(nT), BotX, BotY, BotZ, Bottom(nT), Pitch, Roll.
- Operator path recording of gps, gradient value with unique eraser function to eliminate erroneous or unwanted data.
- 3D visualization of gradient heat maps and operator path gradient values.
- Anomaly size measurement and triangulation measurements of anomaly position vs. known points.
- Anomaly depth estimation.
- Auto-export KMZ for Google Earth overlay.

Heatmap Generator

- Manual Grid input (3×3, 5×5, ratio, auto-center).
- GPS-driven auto-heatmap after recording.
- Real-time preview with crisp square grid cells.
- Scales to tablet window with hairline grid lines.

User Guidance & Filtering

- GPS drift eliminated via data point eraser.

3. Data Export & Compatibility

- CSV → Analysis in Excel, QGIS, ArcGIS, or MATLAB.
- KMZ → Direct Google Earth import (geo-referenced anomalies).
- Heatmap PNG/Overlay → For quick visualization.
- Open Formats → All exports human-readable for research transparency.