

# Proton Precession Magnetometer Data Acquisition

## Introduction

Proton Precession Magnetometers (PPMs) measure values of the total magnetic field in nanotesla (nT).

A video guide on the use of a PPM can be found on Blackboard Ultra [here](#).

Here is background reading on magnetics:

*[Eriksen and Milsom \(2011\). Field Geophysics. Chapter 3. John Wiley & Sons.](#)*

*[Kearey, Brooks, and Hill. 2013. 3<sup>rd</sup> ed. An introduction to exploration geophysics, Chapter 7.](#)*



*Geometrics G-856 Proton Magnetometer*

## Measuring Magnetics

PPMs are quite sensitive and must be treated with care. As the bottle of proton-rich liquid must be held on the end of a 2m long pole this can occasionally make the survey slightly awkward. It is generally good practice to unplug the sensor from the data logger whenever it is not in use, and especially if transporting it much more than a short distance.

The PPM is powered by an internal battery pack. If it is fully charged this should be sufficient for a full day of surveying, but make sure to carry a spare battery if necessary. Each time a reading is taken the data logger will present a figure of the battery voltage; preferably, this should not be less than 11V, and certainly no less than 10.5V (at which point the battery should be swapped out).

The PPM measures the magnitude of the **total field** and does not provide information on inclination, or declination. Provided the instrument has been correctly set up it will not have any internal, instrumental drift. However, diurnal variation of the earth's magnetic field must still be accounted for by taking regular base-station readings at a single location. Make sure to check the Kp index in case of magnetic storms, magnetometry data will be useless if gathered during such an event (<https://www.swpc.noaa.gov/>).

Magnetic surveys of this sort are most easily carried out by three people. One person carries the PPM sensor itself, on the end of the pole, the second carries the data-logger and takes the readings, the third person writes down the readings throughout the course of the survey. A fourth person can operate the Emlid GPS and take location measurements. It is important that anyone close to the sensor has a minimum of metallic material on them in order to decrease the likelihood of a local gradient affecting the sensor (zips and eyelets on clothing will most likely be fine, **phones will not be**).

In order to take a series of magnetic readings follow this process:

1. Place the pole on the selected sample location (station), keeping it as still and upright as possible, and align the bottle with North.
2. After giving the fluid in the bottle a short while to settle down, press "READ" on the data logger.
3. The first number shown is the battery voltage, it should be about 12V, if this is less than 10.5V then the battery needs replacing.
4. The second number is the reading for the magnetic field in nano-Tesla (nT)

5. Repeat the same reading a minimum of 3 times and record each one either in a notebook, or on the pro-forma recording sheet.
  - a. >3 readings allows for calculation of error for each station.
  - b. If there is more than a few nT difference between each reading, then make sure to take a fourth reading (or even a fifth)
  - c. If there is a significant variation between readings then look around for possible sources of variation in the field (e.g. power lines, metal fences, cars) – Note any observations down that might explain an erroneous result
6. Once the readings are complete then move to the next station location.
  - a. Make sure to consider the spacing between stations, the length of your profile, and the time available for the survey.
    - i. If the difference between station readings is increasing/decreasing by more than ~10nT, then consider reducing the station interval in order to adequately constrain the anomaly.
  - b. Following each reading the PPM will turn off in order to conserve battery
  - c. After all readings have been taken at the station, and the magnetometry team has moved on, the GPS logger can take the relevant point. Make sure to periodically check that the GPS and PPM stations are the same (so that no GPS points have been missed)
7. At the end of the survey (as a minimum) return to the base station and take another set of readings
  - a. To account for diurnal variation across the survey during data reduction.
8. After completion of the survey, the data must be digitised and shared amongst the rest of your group.
  - a. It's a good idea to photograph the data recording sheet following the end of the survey, in case it gets lost or damaged before it can be digitised.