Potassium

Optically Pumped K-Mag / Grad (GSMP-40 v7.0)

The upgraded v7.0 system is the highest sensitivity and absolute accuracy magnetometer / gradiometer available. It is designed for mobile applications with the most demanding survey specifications.

New technology upgrades provide even more value:

Data export in standard XYZ (i.e. line-oriented) format for easy use in standard software programs

Programmable export for full output control

GPS elevation values for input into geophysical modeling routines

<1.5m standard GPS for high resolution surveying; higher resolutions also available

Enhanced GPS positioning resolution

Multi-sensor capability for advanced surveys to resolve target geometry

Picket marketing / annotation for capturing related surveying information on-the-go

And all of these technologies come complete with the most attractive savings and warranty in the business!

Optically Pumped Potassium (GSMP-40) ground system with electronics, light weight sensors and cable. Sensors can also be aligned vertically.

GEM is unique as the only commercial supplier of Potassium systems -- the highest sensitivity and absolute accuracy optically pumped magnetometers available. The new GSMP-40 system extends these characteristics to the next generation of even higher performance instruments.

Major benefits of the GSMP-40 include:

• Acquisition of very high resolution and accuracy data. Potassium systems are substantially more sensitive than other optically pumped magnetometers / gradiometers.

• Location of very weakly magnetic objects or small-size anomalies. This is a key requirement in applications, such as UXO / EOD and archeology, where success depends on the ability to map and characterize the smallest contrasts in magnetic physical properties.

•High quality results in areas with high gradients. GEM's new small diameter (40mm) sensors optimize magnetic measurements for sensitivity and gradient tolerance.

• Proven reliability and predictability of results. The natural physics of Potassium narrow line spectra minimizes heading and orientation errors to negligible levels.

•Minimization of maintenance costs. Once a system is purchased, there is no need to return it for periodic optical alignment. This significantly reduces servicing and shipping costs over the lifetime of an instrument.

•Enhanced survey efficiency. The GSMP-40 minimizes operating requirements, such as warm up and lock times, that slow surveys down.

•Fast response to changing magnetic fields -- for moving and stationary work.

A Different Approach to Optically Pumped Technology

While some of the principles of GEM's unique optically pumped Potassium magnetometer are similar to other optically pumped systems, the Potassium approach differs significantly in terms of the underlying physics.

The main difference is that Potassium is characterized by widely-spaced, non-overlapping spectral lines. Spectral lines provide the basis for measurement in all optically pumped systems.

From an instrumentation perspective, narrow, non-overlapping spectra provide a number of benefits:

•Enable the electronics to easily lock on a pre-defined spectral line. This, in turn, translates into very high sensitivity and maximum bandwidth (i.e. the “size” of geophysical features that can be resolved with the system).

•Minimal heading errors. These errors occur due to variations in alignment of the sensor head in the magnetic field. With Potassium errors are less than 0.1 nT. With other optically pumped systems, the heading error is 1 to 2 nT and can completely overwhelm the real magnetic response.

Reductions in heading errors also translate into improved gradient measurements. As indicated, the GSMP-40 does not introduce orientation “noise” into measurements. The result is that the gradient measurements are very high quality -- both in dynamic and static environments.

Advancing the Field of Potassium Magnetometry

GEM’s R&D programmes continue to advance the frontiers of magnetometry.

For example, recent developments with small sensor designs have increased gradient tolerance by five times while maintaining the industry standard in sensitivity and absolute accuracy.

With GEM, our work in delivering the most advanced and reliable products continues every day -- Our World is Magnetic!.

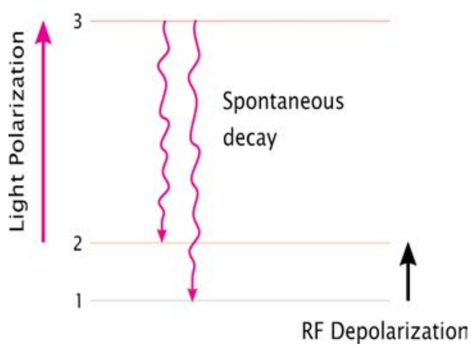
Theory of Operation

A typical alkali vapour magnetometer consists of a glass cell containing an evaporated alkali metal (i.e. alkali atoms).

According to quantum theory, there is a set distribution of valence electrons within every population of alkali atoms. These electrons reside in two energy levels as represented by the numbers 1 and 2 in the figure below.

Light of a specific wavelength is applied to the vapour cell to excite electrons from level 2 to 3 only. This process (called ***polarization***) reduces the number of atoms with electrons at level 2. The result is that the cell stops absorbing light and turns from opaque to transparent.

Electrons at level 3 are not stable and spontaneously decay back to levels 1 and 2. Eventually, level 1 becomes fully populated and level 2 is fully depopulated.



At this point, RF ***de-polarization*** comes into play. Here, we apply RF power of a wavelength that corresponds to the energy difference between levels 1 and 2 to move electrons from level 1 back to level 2.

The significance of de-polarization is that the **energy difference between levels 1 and 2 (i.e. the frequency of the RF depolarizing field) is directly proportional to the magnetic field.**

The system detects the fluctation of light intensity (i.e. modulation) as the cell becomes opaque and transparent, and measures the corresponding frequency. The frequency value is then converted to magnetic field units.

GSMP-40 Specifications

Performance

Sensitivity: 0.0025 nT RMS @ 1 Hz
Resolution: 0.0001 nT
Absolute Accuracy: +/- 0.1 nT
Dynamic Range: 20,000 to 100,000 nT*
Gradient Tolerance: 13,000 nT/m
Sampling Rate: 1, 5, 10, 20 Hz

* High Field (300,000 nT) Option Available.

Orientation

Sensor Angle: Optimum angle 30° between sensor head axis & field vector.

Orientation: 10° to 80° & 100° to 170°

Heading Error: +/- 0.05 nT between 10° to 80° and 360° full rotation about axis.

Environmental

Operating Temperature: -20°C to +55°C **
Storage Temperature: -70°C to +55°C
Humidity: 0 to 100%, splashproof

** Optional to -40°C

Dimensions & Weights***

Sensor: 141mm x 64mm (external dia.) and 1.5 kg

Electronics Box: 310mm x 75mm x 90mm and 1.6 kg

*** Optional console availabe

Power

Power Supply: 22 to 32 V DC

Power Requirements: Approx. 50 W at start up, dropping to 12 W after warm-up

Power Consumption: 12 W typical at 20°C

Warm-up Time: <10 minutes @ -40°C

Outputs

Cycled Total Field readings with position & time as digital readout or graph form on the console or as ASCII format via an RS-232 COM port. Pre-amplifier outputs are continuous signals at the Potassium Larmor frequency which are proportional to the magnetic field (7 Hz/nT).

Standard Components

GSMP-40 console, electronics box, GEMLinkW software, batteries, harness, charger, sensor with cable, 24V battery belt, RS-232 cable, pole assembly, instruction manual and shipping case.

GEM SYSTEMS ADVANCED MAGNETOMETERS

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