



ADVANCED MAGNETOMETERS

GSMP-30 Potassium Magnetometer

The new standard in high sensitivity aeromagnetics

Description

The GEM Systems GSMP-30 is a high sensitivity potassium magnetometer sensor, providing unmatched sensitivity, in addition to near zero heading error and low maintenance costs. The GSMP-30 operates on principles similar to other alkali vapour magnetometers but benefits from the unique nuclear properties of Potassium and its spectrum characteristics.

The GSMP-30 is comprised of:

- sensor head
- RF drive electronics / signal processor module
- cable (1-10 m) to separate the sensor head from the electronics box

Features

Some of the important benefits of the GSMP-30 optically pumped magnetometer include:

- highest sensitivity
- best absolute accuracy
- negligible orientation errors
- fast start-up and recovery for the GSMP-30 to re-establish oscillator lock after an orientation change from a dead zone into the active zone
- fast tracking - the GSMP-30 measures precise Larmor frequency changes in response to field changes of several thousand nT within a sample period.
- low susceptibility to Electromagnetic Fields - special GSMP-30 design considerations were taken to shield GSMP-30 components from stray EM interference.



GSMP-30 High Sensitivity Potassium Sensor

GSMP-30 Advantages

- GSMP-30 has the highest absolute accuracy (varying by no more than ± 0.1 nT between any GSMP-30 sensors) making the GSMP-30 the best choice for gradiometer installations.
- GSMP-30 does not require regular alignments and new lamps can be replaced in the field for a modest price. Maintenance costs are estimated to be 10 times lower than popular substitutes.
- GSMP-30 is not subject to phonics (low frequency vibration in the audio range) because the RF field does not have to be critically aligned with the light source.
- GSMP-30 faster sampling with higher resolution than popular substitutes.

Airborne Applications

The long term stability, high sensitivity and fast response to the changing magnetic field make the GSMP-30 ideal for a wide variety of applications, such as:

- Airborne magnetic and magnetic gradient surveying - **for mineral and petroleum exploitation, regional mapping and environmental applications.**
- Base station magnetic monitoring - **for observing and correcting diurnal magnetic activity and disturbances, particularly on high-sensitivity airborne surveys.**



GSMP-30 High Sensitivity Potassium Magnetometer Sensor with AirNAV Data Acquisition and Navigation System

Benefits of the nuclear properties of Potassium - Gradiometer Applications

- **absolute accuracy** - the GSMP-30's unmatched absolute accuracy (a variance of only ± 0.1 nT between any GSMP-30 sensors) makes this sensor the best choice for all gradiometer installations. Some optically pumped magnetometers have broad spectral lines that limit the absolute accuracy of these systems.
- **sensitivity** - the inherent potential sensitivity resulting from the spectrum characteristics of potassium and the high natural frequency of 7 Hz/nT.
- **insensitivity to orientation** - virtually zero heading error resulting from the nuclear properties of potassium

GSMC-01 Magnetometer Signal Processor /Counter Modules

Installed in the AirNAV Data Acquisition and Navigation System, the GSMC-01 Magnetometer Signal Processor Module is a high performance magnetometer counter that provides user programmable sampling up to 20 Hz.

The unit features automatic time synchronisation to a GPS 1PPS signal, and RS-232 GPS string, to within one microsecond. This allows very accurate timing of magnetometer sampling. In addition to the GSMP-30 sensor, the GSMC-01 magnetometer counter can process continuous Larmor signals from all optically pumped magnetometers.

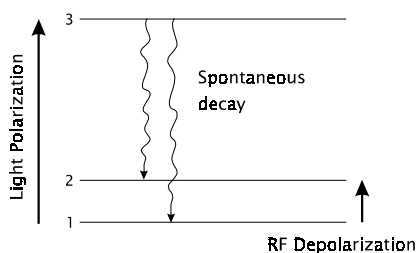
Compatibility with Existing High Resolution Magnetometer Installations

The GSMP-30 is designed to adapt seamlessly into existing airborne, portable and base station installations and offers compatibility with the major manufacturers of active compensation units having Larmor signal input.

Theory of Operation

A typical alkali vapour magnetometer consists of a glass cell containing the evaporated alkali metal, which is exposed to light of a specific wavelength. According to quantum theory, in every population of alkali atoms, there is a set distribution of valence electrons between two energy levels, represented by 1 and 2 in the figure below.

A wavelength of light is applied to the cell to excite electrons only from level 2 to level 3. This is called *polarization*. As the number of atoms with electrons at level 2 decreases, the cell will stop absorbing light, and will turn from opaque to transparent. Electrons at energy level 3 are



not stable, and will spontaneously decay back to levels 1 and 2. Eventually, level 1 will become fully populated, and level 2 will become depopulated, and the cell will be completely transparent.

That's where RF *depolarization* comes into play. RF power of a wavelength that corresponds to the energy difference between levels 1 and 2 is applied to the cell to move electrons from level 1 back to level 2. The significance of this act is that **the energy difference between levels 1 and 2 (the frequency of the RF depolarizing field) is proportional to the magnetic field.**

Specifications of the GSMP-30

- Sensitivity:** 0.001 nT/ $\sqrt{\text{Hz}}$
- Absolute accuracy:** ± 0.1 nT
- Dynamic Range:** 10,000 to 125,000 nT
- Sensor Angle:** Optimum angle 30° between the sensor head axis and the magnetic field vector.
- Orientation Range:** 10° to 80° and 100° to 170°
- Heading Error:** less than 0.1 nT combined for sensor *spins* on all orientations from 10° to 80°
- Environmental:**
Storage Temperature: -70°C to 55°C.
Operating Temperature: -40°C to 55°C.
Humidity: 0 to 100%, splashproof.
- Weight of Sensor Head:** Less than 1.3 kg. (2.9 lbs).
- Size of Sensor Head:** Diameter: 89 mm (3.5").
Length: 152 mm (6.0").
- Drive Electronics:** 30.6cm X 8.5cm X 7.5cm, 1.6 kg
- Power Supply:** 18 to 35 V DC.
- Power Requirements:** Approx. 25 W at start up dropping to approx. 8 W after warm up.
- Power Consumption:** 8 Watts typical at 20°C.
- Warm-up Time:** Less than 15 min. @ -40°C.
- Outputs:** Cycled measurements of the Total Magnetic Field supported by position and time as digital read out or graph form on the console or as ASCII format through an RS232 com port. Electronics box output consists of continuous signals at the Larmor frequency for potassium which is proportional to the magnetic field (7 Hz / nT).
- Cable between Sensor/Drive:** 4 metres standard, optional (1.0 m-10m)
- Cable between Drive Electronics/Signal Processor:** (1.0 m-100m)

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