GEM Systems
ADVANCED MAGNETOMETERS

Airborne Systems

Potassium "SuperSenser™" Magnetometer / Gradiometer

The new optically pumped Potassium "SuperSenser" is the most advanced airborne sensor on the market today.

It offers a number of benefits for fixed wing and towed survey configurations, including:

- **Highest sensitivity (i.e. highest signal-to-noise) for enhanced resolution of geological and cultural features in a variety of applications.**
- **Highest absolute accuracy (varying by no more than +/- 0.1 nT between sensors)**
- **Negligible orientation (heading) errors**
- **Faster sampling**
- **Insensitivity to microphonics**
- **Lowest maintenance (no re-alignments)**

As well, GEM offers advanced base station capabilities, such as:

- **Potassium & Overhauser**
- **3 modes for flexible base station scheduling**
- **GPS option for precise time synchronization with onboard GPS**

Optically pumped Potassium SuperSenser (GSMP-30A) sensor and cable. Can also be configured with additional sensors for gradiometer readings.

The worldwide application of airborne magnetic and gradiometric data is growing -- driven by the increasing demand for high-resolution, low cost data to:

- Map targets, geology and geologic structure in mineral exploration
- Perform frontier evaluation and augment seismic data in hydrocarbon exploration
- Detect Unexploded Ordnance (UXO)
- Map pipelines and other cultural objects in environmental and engineering investigations

To address industry requirements, GEM recently introduced "SuperSenser" -- the highest resolution magnetometer / gradiometer airborne system available.

The SuperSenser (GSMP-30A) is based on a unique optically pumped Potassium sensor - a technology that offers an order-of magnitude increase in resolution over other systems. It also provides:

- Reduced "heading" errors
- Highest absolute accuracy
- Decreased maintenance costs

These advantages -- plus GEM's reputation as a proven supplier of advanced technologies -- make the GSMP-30A a key solution to consider for your next airborne installation.

Key Components

The SuperSenser technology comprises:

- Sensor head
- Radio Frequency (RF) pre-amplifier and drive electronics module
- Cable (1 to 10m - standard 4m) to separate sensor and electronics for noise elimination
- Optional signal processor / console and cable

The sensor deploys as a single unit, or in combination with other sensors for magnetic gradient measurements.

In the example below, the sensor is deployed in a multi-sensor configuration for gradient and total field magnetic measurements. Here, four Potassium

units can be installed in a special “bird” with two fins at the tips of an imaginary tetrahedron to allow for measurement of Total Magnetic Field and the gradients in three directions:

- Vertical gradient
- Horizontal gradient (along-the-track)
- Horizontal gradient (across-the-track)

Horizontal gradient measurements are increasingly popular for providing details about the lateral extent of subsurface anomalies located between survey lines. Vertical gradients can assist significantly in identifying geologic / structural contacts and near-surface targets (such as UXO).

In the example below, we show the system deployed in a fixed wing “stinger” implementation for acquisition of high resolution Total Magnetic Field data.

Implementing Your Solution

The GSMP-30A system can be interfaced either to GEM’s signal processing console which provides 32 MBytes of memory for data acquisition, or to other recorders and data acquisition systems.

GEM’s technicians are here to provide set-up and interfacing help, such as:

- Installation assistance for “fixed-wing” or “stinger” configurations
- Custom “bird” design and development for “towed” configurations
- Conversion of output voltages into corresponding frequency and magnetic field values
- Electronics interfacing to on-board recording and navigation systems

Airborne Base Station Configurations

Another area of application for GEM’s advanced magnetometers is in airborne base station monitoring. Our customers have the choice of working with GSMP-30A or Overhauser (GSM-19) units.

The GSMP-30A implementation offers advantages for surveys where very high resolution durnal corrections are needed. GSM-19 implementations deliver good resolution and economical pricing.

Both implementations share a number of advanced features (introduced in GEM’s v6.0 firmware release), including:

- Precise time synchronization of field and base station units using a built-in GPS option. This capability is particularly important for working in noisy magnetic conditions and provides the highest accuracy possible.
- Flexible scheduling (up to 30 on / off periods). Simply define a series of intervals and the base station will turn itself on as you need. This mode provides the greatest flexibility for longer surveys where leaving your base station on increases efficiency. Immediate start and daily modes are also provided.

Benefitting from the Natural Properties of Potassium Optical Pumping

With more than a decade of experience with Potassium technologies, we feel confident that your next survey will benefit in many ways, including acquisition of:

- Highest sensitivity data (reflecting Potassium spectrum characteristics and high natural frequency of 7 Hz/nT)
- Highest absolute accuracy (a variation of only +/- 0.1 nT between sensors makes the GSMP-30A an ideal choice for gradiometer installations)
- Data with minimal heading errors (reflecting the insensitivity of Potassium to aircraft / bird orientation)
- Data that is not affected by phonics (low frequency vibration in the audio range)

As well, maintenance costs are minimal in comparison with other systems as key components can be replaced in the field.

SuperSenser Specifications

Performance

Sensitivity:	0.001 nT @ 20 readings / sec
Resolution:	0.0001 nT
Absolute Accuracy:	+/- 0.1 nT
Dynamic Range:	10,000 to 120,000 nT
Gradient Tolerance:	Over 5,000 nT/m
Sampling Rate:	up to 20 readings / sec

Orientation

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

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

Heading Error: < 0.1 nT between 10° to 80° and 360° full rotation about axis.

Environmental

Operating Temperature:	-40°C to +55°C
Storage Temperature:	-70°C to +55°C
Humidity:	0 to 100%, splashproof

Dimensions & Weights

Sensor:	89mm dia. x 152mm length, and < 1.3 kg
Pre-amplifier:	30.6cm x 8.5cm x 7.5cm and 1.6 kg

Power

Power Supply:	18 to 35 V DC

Power Requirements: Approx. 25 W at start up, dropping to 8 W after warm-up

Power Consumption:	8 W typical at 20°C
Warm-up Time:	<15 minutes @ -40°C

Outputs

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

Components

Sensor, pre-amplifier box, 4m sensor / pre-amplifier cable, manual & ship case.

Optional pre-amplifier to signal processor cable (1.0 to 100.0m)

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