Suspended dIdD

Delta Inclination / Delta Declination
Potassium Observatory System

NEW!

GEM SYSTEMS
ADVANCED MAGNETOMETERS

Our World is **Magnetic.**

The Suspended dIdD system is designed for specialized stationary applications that require the most demanding survey specifications.

Key benefits include:

- Integrated system that replaces combined fluxgate / total field installations
- Long term stability for accuracy and reliability of measurements
- Unsurpassed immunity to temperature changes and aging of materials
- High sensitivity, high speed vector measurements using Potassium technology
- Optimized signal to noise ratio through advanced Potassium design
- Rapid data output using custom Windows-based display software
- Efficient remote control operation / interrogation using RS-232 and USB
- Flexibility to enable real-time transmission via RS-232 and modem to satellite and phone links
- Internet-based upgrades (from the office or field)

dIdD integrated 3 component coil system with enclosed Potassium sensor designed for long-term observatory monitoring applications

Suspended dIdD for Observatories

In the past, magnetic observatories relied on a combination of Potassium, fluxgate and theodolite instruments for obtaining total field and variability measurements. GEM then introduced the dIdD (delta Inclination / delta Declination) vector system for high precision results.

Now, the dIdD has been enhanced significantly with the development of the Suspended dIdD system.

The Suspended dIdD comprises a revolutionary small diameter of spherical Potassium cell (35 mm) with a bidirectional set of bias coils. Data can be sent directly to a computer or to GEM's Console (optionally).

Simplifying Magnetic Measurements

The Suspended dIdD simplifies the set-up of magnetic observatory installations by eliminating the need for fluxgate magnetometers and thermally insulating structures. In addition, the new system minimizes ongoing system calibrations, which, in turn, frees personnel to concentrate on more essential tasks (interpreting and understanding data).

These important new benefits are achieved through system design:

* Temperature coefficients that reduce drift to less than 0.1 nT / °C (compared with 0.5 nT / °C for high-end fluxgate magnetometers);

* Physical suspension of the Potassium sensor (shown experimentally to contribute to reduced drift);

* Long term drifts that are less than 2 nT / year - matching or exceeding the best component measurement at any observatory;

Ultimately, the system also exceeds specifications set by Intermagnet - the global network of observatories monitoring the Earth's magnetic field (www.intermagnet.org).

GEM's Suspended dIdD is implemented in the world's newest magnetic observatory as the sole instrument for continuous, stable measurement. The system will be calibrated by theodolite on a reduced basis (i.e. in comparison with older technology installations).

Suspension System

The new Suspended dIdD magnetometer uses a set of two beryllium / bronze springs for suspension. These springs are oriented perpendicular to each other for stability.

Even if the base or suspending part is tilted, the two springs ensure that the coil remains in the same position.

The benefit is that the axis between the coils and the planes of measured magnetic fields does not change - ensuring precision measurement.

Sensor and Coils

A key engineering design consideration was development of Potassium sensors that were optimally shaped to better interact with the magnetic fields surounding the coil. Below is an image of the revolutionary spherical sensor that was implemented in the Suspended dIdD.

The external casing is impact resistant plastic. An upper support plate ensures that there is no movement of the sensor. The smaller sized sensor has advantages in terms of robustness (i.e. it is more durable than previous generations of larger, cylindrical sensors).

It is also easier to suspend and can be transported more readily using an immobilizing mechanism.

Suspended dIdD Measurement

The dIdD is a vector magnetometer for continuous monitoring of the inclination, declination and total intensity of the Earth's magnetic field. This combination differentiates it from fluxgate instruments (i.e. that only provide inclination and declination).

GEM's dIdD employs a mutually orthogonal coil system that measures one unbiased and four biased values of the total magnetic field. The coils are oriented to be perpendicular to the Earth's magnetic field vector, F (i.e. one coil is in the horizontal plane and one coil is in the vertical geomagnetic meridian plane).

Equal and opposite deflection currents are introduced sequentially in the Inclination (I) coil (i.e. oriented perpendicular to F). The resultant deflected values of F in the geomagnetic meridian plane are called the Ip and Im values. The Potassium magnetometer records these values as well as the undeflected value.

Then, equal and opposite currents are sequentially introduced into the Declination coil (D) which is also perpendicular to F. The resultant deflected values of F in the geomagnetic East - West direction are called the Dp and Dm values. The Potassium magnetometer records these values as well as the undeflected value.

A simple algorithm determines the subsequent instantaneous angular changes of the direction of the Earth's vector, F. These angular changes are dI and dD.

Adding dI and dD to baseline values of Inclination and Declination gives instantaneous Inclination and Declination values for F. (Baseline values are determined from absolute measurement.)

Data Acquisition & Display Software

GEM's custom data acquisition and display software is a Windows interactive interface. The software saves the calculated values to a disk file and displays the values in text and graph modes for easy monitoring of system functions.

The dIdD analog display charts the incoming data versus time. Separate charts show Total Field, East, North and Vertical components. Inclination and Declination charts are shown in graphical windows displayed below these values.

Specifications

Performance
Sensitivity: 0.005 nT/Hz @ 0.2 sec
Resolution: 0.0001 nT
Absolute Accuracy: 0.2 nT
Range: 15,000 to 120,000 nT
Gradient Tolerance: 30,000 nT/m
Operating Temperature: -20C to +55C
Power Consumption: 24V, 50W start-up dropping to 12W after warm-up

Rate of Reading
0.2 sec per interval, 1.0 sec full cycle
5 measurements acquired during each full cycle

At 2.5 Sec Cycle
dI uncertainty less than / equal to 1 arcsec rms
dD uncertainty less than / equal to 2 arcsec rms
for I_O less than / equal to 45°
dD less than / equal to 4 arcsec for I_O less than / equal to 70°

Range of measurement
I_O less than or equal to + / - 90°
D_O less than or equal to +/ -180°

Operating Modes
Automatic: X, Y, Z, dI and dD
Remote Control: optional using RS-232 interface

Dimensions
Electronics Box: 310 x 75 x 90mm
Sensor: 110 mm diameter
Console (optional): 223 x 69 x 240mm

Weights
Electronics Box: 1 kg
Sensor and Coil: 3.5 kg
Console (optional): 1 kg

Standard Components
Electronics box, dIdD sensor with 5m cable, dIdD software, RS-232 cable, instruction manual, console (optional), GPS for precise time values (optional).

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