

d-GMM



YieldPoint's **d-GMM(SPECTRE)** displacement sensor integrates magnetostrictive technology to produce a high precision digital instrument comprising a non-contact displacement sensor and digital temperature sensor. An on-board microcontroller applies temperature compensation and outputs a digital signal. Both the resolution (<0.01mm) and accuracy (0.25% linearity typical) are significantly better than for similarly priced technology.

The output signal includes the instrument's unique Sensor_ID, the Sensor_Type as well as the temperature and displacement data. A balanced differential RS485 output signal is widely recognized for reliability in harsh environments. The signal can be routinely transmitted over 500m of lead-wire.

The **d-GMM** is easy to install either (i) as a GMM by attaching to a 5/8" rock-bolt, or (ii) in a wide range of other crack-meter configurations. The device is fully retrievable. The electronics are hermetically sealed and the sensor can be submerged indefinitely.

Each instrument is individually calibrated to ensure that the resolution (<0.01mm) and accuracy (0.5% linearity typical) are an order of magnitude better than for similarly priced technology. The inherently digital form of the signals eliminates the necessity for expensive analog-to-digital conversion and results in low cost monitoring peripherals that output data in real world units (mm and degC).

Features:

- ▲ *On-board digital signal processing*
- ▲ *Digital (d-tech) 125mm (5 inch) stroke length*
- ▲ *High accuracy (0.5% FS) and resolution (0.01% FS)*
- ▲ *Individual calibration with coefficients stored in memory*
- ▲ *RS485 Output signal (9600,8,N,1) ASCII encoded*
- ▲ *Microcontroller provides output in real world units (mm and °C)*
- ▲ *Unique ID facilitates plug 'n play networking*
- ▲ *Digital temperature sensor for accurate compensation*
- ▲ *Magnetostrictive technology provides immunity to hostile environment*
- ▲ *Easy to interface with dataloggers (d-LOGGER), Ethernet and WiFi (DESTINY)*
- ▲ *Competitively priced*

Technology

Installation

The **d-GMM** is typically installed using a mechanical rock-bolt in a borehole as shown in the figure below. However different customers have found various ingenious ways to monitor deformation

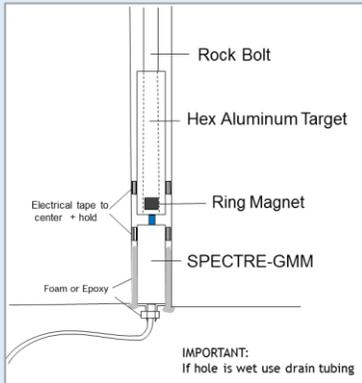


Fig 1: Installation configuration.

If installed in borehole the **d-GMM** target can be tightened with socket wrench (purchased separately). The GMM itself is usually secured using rock-bolt resin or expandable foam. In wet holes it is important to use a drain tube.

Shear Displacement

When deployed as a crack-meter, **SPECTRE** can measure a combination of shear and dilation. This creates opportunities for monitoring large displacements on cracks subjected to mixed mode deformations.

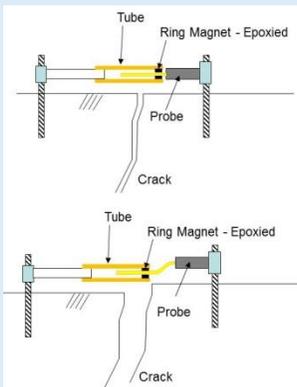


Fig 2: Effect of shear on d-GMM

Telemetry

Manual Readout

Readout can be made using YieldPoint's low cost manual readout box, which performs diagnostics on the lead-wires, recognizes the sensor type and ID and outputs the displacement and temperature data directly in mm and °C.

Automated Data Retrieval

BluPoint

Instruments can be wirelessly enabled using BluLink which provides a Bluetooth 5.0 connection which has a range of 100m LOS. BluLink can transmit data to BluGateways which are WiFi or LTE-M enabled. These devices can upload data to VantagePoint, YieldPoint's data aggregation and visualization tool.

BluLink also functions as a local data-logger storing 30,000 readings. Wireless download can be by any Bluetooth enabled Android device using the BluPoint app.



Fig. 3. BluLink and the BluPoint app.

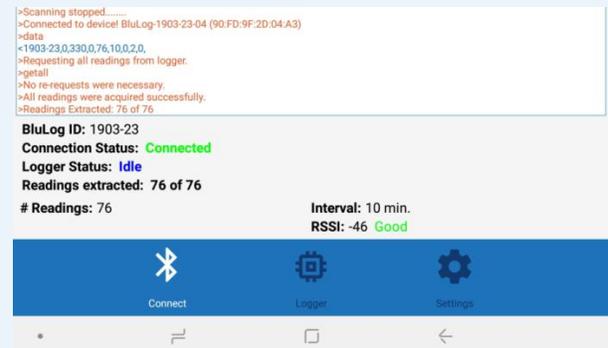


Fig. 4. The BluLogger app

Telemetry

900MHz 1for1 Telemetry

For longer range deployments the d-Rebar operate with YieldPoint's 900MHz 1for1 mesh radio telemetry system. Individual radios have a LOS range of 300m.



Fig 5: An installed 1 for radio



Fig 6: The 1for1 Gateway

Case Study 1

Case Study 1: Monitoring in a salt mine

YieldPoint's d-GMM is widely used to monitor movements in salt and potash mines. The hermetically sealed design resists the harsh environment. The d-GMM can be configured as either (i) a closure station, or (ii) a roof monitoring station. Alternatively the d-GMM can be used to monitor any structure that may be moving and potentially unstable. Increasingly YieldPoint is providing salt and potash mines with 900MHz d-Mesh telemetry which transmits particularly well in room and pillar mines.



Fig 7: d-GMM monitoring a structure in a potash Mine.

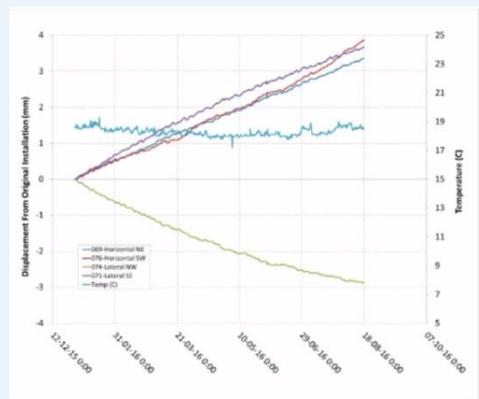


Fig 8: Displacement measured by d-GMM in mm. The data is collected using d4loggers.

Case Study 2

Monitoring a dam buttress



Fig 9: A d-GMM monitoring a crack in a dam buttress.

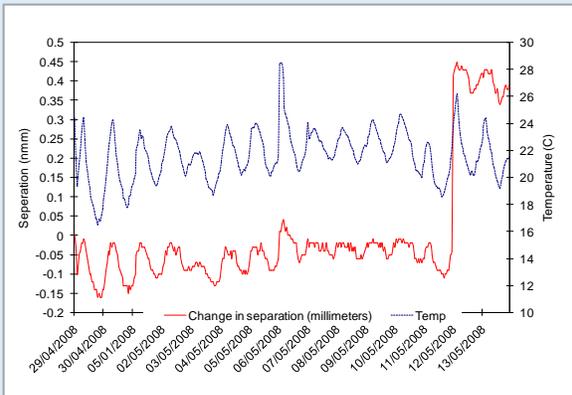
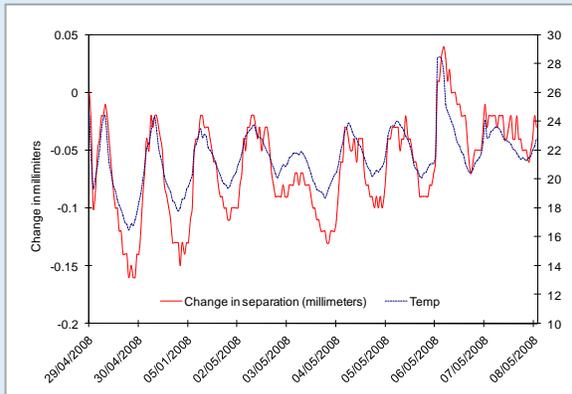


Fig 10: Monitoring cracks on an exterior basement wall. RHS scale is temperature

Telemetry

Specifications

- ▲ **Borehole size:** 30mm+
- ▲ **Range (F.S.):** 250mm, 125mm, 100mm or 50mm. Temp: -40 to 125°C
- ▲ **Core Technology** 126mm magnetostrictive + temperature sensor
- ▲ **Output Signal:** RS485(9600,8,N,1) ASCII encoded string with Sensor_ID, Temp, and Displacement values.
- ▲ **Displ. Resolution:** 0.01mm with hand held readout
- ▲ **Displ, Hysteresis:** 0.025mm
- ▲ **Displ Repeatability:** 0.025mm
- ▲ **Displ.Linearity:** typically 0.01mm
- ▲ **Temp. Range:** -40 - 125°C
- ▲ **Temp Accuracy:** +/- 2°C
- ▲ **Temp Resolution:** 0.1°C