YieldPoint’s recognizes that in many mining situation fast deployment of an ungrouted borehole extensometer is preferable. The d-MPBX is a unique 1 to 6-Point Multiple Point Borehole eXtensometer (MPBX) based on a single rod design. The anchors are fitted with stainless steel torsion springs that secure the instrument in a 38-54mm borehole. The d-MPBX incorporates digital signal processing to result in dramatically improved accuracy compared to similar priced existing technology.

Design features of the d_MPBX involves a stiff hermetically sealed and potted central core that includes all of the electronics. The anchors are a simple aluminum tube to which are attached torsion springs that secure the anchor against the borehole wall.

The inherently digital nature of the signals eliminates the necessity for expensive analog-to-digital conversion and results in low cost readout unit that reads data directly in real world units (mm and °C). The sensor output is an ASCII (9600,8,N,1)digital signal which can be read by a low cost readout unit (d-Reader), dataloggers (d-Logger), and wirelessly networked (dMesh) for transmission to cloud based servers. The signals themselves are robust and can be transmitted over 500m of lead-wire. If broken the lead-wire can be twisted and taped together.

Features:

- Up to 6 spring loaded anchors do not require grouting
- 125, 150mm, 250mm stroke length
- High individual sensor accuracy (0.5%FS) and resolution (0.01mm)
- Output in real world units
- Unique instrument ID
- Calibration Coeffs. in Flash memory
- Smallest electronics head (25mm diameter 150mm length)
- On-board digital temperature compensation
- Suitable for mining methods that do not involved blast vibrations
- Easy to install and maintain—Arrives on site fully assembled.
- Length up to 6m
- Leadwire length up to 500m.
- 33-50mm borehole
- Fully waterproof
**Technology**

The *d-MPBX* design is based on a single rod design (see below) which includes 1 to 6 Eddy Current Displacement Sensors. The 6 displacement sensors are fully potted in a central plastic tube over which the anchors slide without contact and with minimal friction. The maximum recommended length of the *d-MPBX* is 6m.

![Diagram of d-MPBX design](image1)

**Fig 1**: The *d-Exto* and *d-MPBX* principal of operation.

Each displacement sensor is individually calibrated and the calibration coefficients written to microcontroller memory. The *d-MPBX* can easily detect and resolve sub-mm displacements with 10m resolution. Accuracy is enhanced by an on-board temperature sensor which provides compensation. The displacement sensors use non-contact sensing the design is inherently waterproof. The diameter of the instrument is only 25mm. This includes the electronics head that can be recessed into the borehole for protection.

**Readings**

IMPORTANT: The *d-MPBX* should only be deployed for mining situations where the anchors will not be dislodged by blasting activity.

The *d-MPBX* has been designed to be the simplest possible instrument to install in a 1.375 to 1.75mm borehole. No pre- or post-configuration is required. The anchors are spring loaded to ensure a positive fit to the borehole wall.

**Leadwires**

The leadwire comprises 2 twisted pairs: (i) power (5-24Vdc) and (ii) RS485 differential signal. 10m of additional leadwire is provided with each instrument at no additional cost.

**Installation precautions**

The *d-MPBX* is probably the easiest of all borehole extensometers to install. It is simply pushed into the borehole and the spring loaded anchors will hold against the rough borehole wall.

The head should be secured in place with either (i) the set of plastic wedges provided or (ii) polyurethane foam.

It is not possible to retrieve the instrument once it has been installed.

![Image of spring anchor](image2)

**Fig 2**: The spring anchor.
<table>
<thead>
<tr>
<th>Readings</th>
<th>Telemetry</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Manual Readout</strong></td>
<td><strong>BluPoint</strong></td>
</tr>
<tr>
<td><strong>Fig. 3. The d-Reader</strong></td>
<td>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.</td>
</tr>
<tr>
<td>Readout can be made using YieldPoint’s low cost manual readout box <em>(d-READER)</em>, which displays the Sensor ID the SensorType, and the Temperature and strain data in °C and με.</td>
<td>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.</td>
</tr>
<tr>
<td><strong>Data-logging</strong></td>
<td><strong>Fig. 4. BluLink and the BluPoint app.</strong></td>
</tr>
<tr>
<td>Data from d-MPBX can be collected using YieldPoint’s BlueLOGGER data-loggers <em>(BlueLOGGER)</em>. The Logger can store up to 30,000 reading from (i) 4 wired loggers and (ii) up to 24 Bluetooth 5 instruments. Two option exist for download (i) USB and (ii) Bluetooth using a tablet. The loggers require no configuration and are fully interchangeable with any other type of YieldPoint instrument <em>(d-Exto</em> borehole extensometers, <em>d-GMM</em>’s, <em>d-TILT</em>/<em>BluTilt</em> tiltmeters, <em>BluWire</em> interface etc.). Therefore clusters of instruments monitoring bolt load and ground movement can be easily implemented.</td>
<td></td>
</tr>
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</table>
The **d-MPBX** is designed to be a user-friendly ground movement monitoring solution that will enhance safety and improve excavation design. It can be routinely deployed within the production environment.

The device is most popular in soft rock mines e.g. Potash and salt mines.

- Monitoring ground movement in tunnels, drifts and roadways.
- Intersections monitoring
- Pillar monitoring
- Depillaring

## Application

<table>
<thead>
<tr>
<th>Specification</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core Technology: Temperature compensated LVIT displacement sensor. Temperature sensor</td>
<td></td>
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<tr>
<td>Output Signal: RS485 with transmission up to 500m over 2 x tp.</td>
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<tr>
<td>Displacement Range (F.S.): 0-150mm.</td>
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<tr>
<td>Strain Resolution: 0.01mm.</td>
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<tr>
<td>Strain Linearity: Typ. 0.1% F.S.</td>
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<tr>
<td>Total strain Accuracy - typically better than +/- 0.25%F.S.</td>
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<tr>
<td>Temp. range: Temp: -40 to 125°C</td>
<td></td>
</tr>
<tr>
<td>Temp Resolution: 0.1°C</td>
<td></td>
</tr>
<tr>
<td>Temp Accuracy: +/- 2°C Temp</td>
<td></td>
</tr>
<tr>
<td>Temp. coeff for Disp: Typ. +/- 0.02%FS / °C</td>
<td></td>
</tr>
</tbody>
</table>

**To Order Specify:**

- Number of anchors(1-6).
- Anchor locations.
- Leadwire length.
- Poly/armoured leadwire cover.

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