YieldPoint’s d-micro technology is a high precision digital strain-gauge that can monitor either discrete displacements (i.e. crack dilation) or distributed strains (i.e. stretch of a steel reinforcing element) to μm resolution.

The sensor is extremely thin (<7mm OD) and can easily be recessed down boreholes, attached to cables and bolts or embedded in shotcrete pillars. The d-micro is easy to install by attaching to the #8-32 threaded rods at both ends of the sensor.

The RS485 output signal is an ASCII encoded message that includes the unique Sensor_ID, the Sensor_Type as well as the temperature and displacement values. This eliminates the necessity for expensive analog-to-digital conversion so that the low-cost readout unit outputs data in real world units (μm and °C). Readings can also be made using the USB port of a PC or web-book computer (SensorViewer). A Real-time Plug ‘n Play network of d-micro sensors (or any other YieldPoint Instrument) can be built in minutes using DESTINY/IP. Long term, low power, data logging is possible using the low cost d-LOGGER solution.

These features make solutions based on d-micro instruments significantly more cost effective than those of competing products in the same marketplace.

Features:

- 10mm (0.4inch) stroke length
- High accuracy (0.25% FS) & resolution (0.01% FS)
- ASCII encoded RS485 Output signal
- Microcontroller provides output in real world units (μm and °C)
- Microcontroller stores Sensor_ID & Calibration Coeffs.
- Digital temperature sensor for accurate compensation
- Immunity to hostile environment
- High survivability to shock and vibration
- Easy to install and maintain and re-zero
- Low cost readout unit
- Plug ‘n Play d-LOGGER
- Easy to interface with Ethernet and WiFi networks running TCP/IP
- Competitively priced
The d-micro strain gauge is capable of 1µm resolution over a range of 10mm. The gauge is attached to the structure using the #8-32 threaded rod at either end. The length of the sensor is 250mm and the diameter of the body is 7mm.

**Signal Conditioning**

An on-board microcontroller provides temperature compensation, applies a 10-point calibration algorithm, and outputs an ASCII encoded RS485 (9600,8,N,1) signal.

**Output Signal**

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 1000ft of lead-wire.

Manual Readout

Readout can be made using YieldPoint’s low cost manual reader (d-Reader), with a backlit LCD. The Unit displays the Sensor_Type and Sensor_ID and outputs the displacement and temperature data directly in mm and °C.

**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.

![The relation between displacement and microcontroller output for d-micro (@ 20.3°C)](image-url)
## 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.

### Applications

- Monitoring crack opening in buildings and structures.
- Monitoring crack opening in underground excavations.
- Monitoring concrete fracturing.
- Monitoring the loading of structural elements such as posts and pillars.
- Monitoring the loading of concrete columns or pillars.
- Determining load in steel reinforcing elements.

### Case Study

Measuring deformation across pre-existing fracture in a concrete access tunnel of a dam.

Measured displacements (red) for a d-micro on an external concrete wall exposed to diurnal temperature cycles (Blue). Recorded with d-LOGGER data-logger.

### Figures

**Fig 2:** An installed 1 for radio

**Fig 3:** The 1for1 Gateway

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YieldPoint

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<table>
<thead>
<tr>
<th>Applications</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Range (F.S.)</strong> - 10mm, Temp: -40 to 125°C</td>
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</tr>
<tr>
<td><strong>Core Technology</strong> - Eddy current transducer (oscillation Frequency 5 - 10,100Hz interfaced with microcontroller) Digital temperature sensor</td>
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</tr>
<tr>
<td><strong>Output Signal</strong> - RS485 (9600,8,N,1) ASCII encoded signal comprising: Unique Instrument _ID, Sensor_Type, Temp and Displacement data</td>
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<tr>
<td><strong>Displ. Resolution</strong> - 1μm with hand held readout.</td>
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<td><strong>Displ. Linearity</strong> - typically 0.5% F.S</td>
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<td><strong>Displ. Accuracy</strong> - better than +/- 100μm absolute or 50μm relative.</td>
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<tr>
<td><strong>Temp. Accuracy</strong> +/- 2°C -Digitally trimmed at 0°C and 25°C</td>
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</tr>
<tr>
<td><strong>Temp Resolution</strong> 0.1°C</td>
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</tr>
<tr>
<td><strong>Temp coeff for displacement sensor:</strong></td>
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</tr>
<tr>
<td>&lt;0.02%FS/°C (0-50°C)</td>
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