

## d-EXTO Mk II



YieldPoint draws on its 20 years of experience with designing superior instrumentation and now offers the new Point Multiple Rod Extensometer *d-EXTO Mk II*. YieldPoint has thousands of extensometers deployed around the world in most mining countries.

*d-EXTO Mk II* combines the traditional multi-rod design with optimized use of modern materials and digital signal processing to deliver dramatically improved accuracy and reliability compared to similarly priced existing technology. Instrument length goes up to 45 meters (145ft) with up to 6 anchor points with custom locations.

The maximum diameter of the instrument is only 25mm including the electronics head that can be recessed into the borehole (>50mm) for protection.



The distal anchor point is tapered to facilitate insertion into the borehole.

### Features:

- ▲ *1-6 anchor points.*
- ▲ *150-250mm (6-10 inch) stroke length with 0.01mm resolution.*
- ▲ *Output in real world units: mm.*
- ▲ *Robust design with filament wound fiber glass tube construction.*
- ▲ *Multiple Stainless Steel rods maintained straight in fiber glass tube for maximum accuracy.*
- ▲ *Materials chosen to minimize temperature sensitivity.*
- ▲ *High individual sensor linearity (>0.25%FS) with calibration sheet provided.*
- ▲ *Small electronics head (25mm diameter).*
- ▲ *Improved temperature compensation (factor 10).*
- ▲ *Improved survivability following blasts even if toe is damaged.*
- ▲ *Arrive on site fully assembled and ready to install.*
- ▲ *Sealed body: Use with high w:c ratio grouts.*

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# d-EXTO Mk II

## Technology

The *d-EXTO Mk II* design is based on a traditional multi-rod design (see below) which includes up to 6 LVIT (Linear Variable Inductive Transducer). The technology is described in the white paper included in A.1. The 6 custom stainless steel rods are housed individually in a custom filament wound fiberglass tube to maintain them perfectly straight and eliminate friction between rods. The individual rods are completely independent of one another and therefore if damaged by blasting the proximal sensors will continue to operate.

The inherently digital nature of the signals eliminates the necessity for expensive analog-to-digital conversion and results in low cost telemetry that reads data directly in real world units (*mm* and  $^{\circ}\text{C}$ ). The RS485 output signal (9600, 8, N,1) can be transmitted over 300m (1,000ft) of lead wire. The signals *d-EXTO*'s are compatible with the YieldPoint new **Blulink** product line using Bluetooth 5.0.

Each displacement sensor is individually calibrated and the calibration coefficients written to microcontroller memory. The *d-EXTO* can detect sub-mm displacements with  $10\mu\text{m}$  resolution. Accuracy is enhanced by 2 reference sensors that provide temperature compensation. Second order compensation can be applied based on the on-board temperature sensor. The non-contact sensing design is inherently submersible: it is especially suited for monitoring the displacement of backfill or working with very thin grouts.



YieldPoint MPBX extensometers are also available for use in soil (road settlement) or in trenches (slopes).

## Telemetry

### Bluetooth 5.0 communication

The *d-ExtO* can be plugged into YieldPoint's **BluLink (Bluetooth 5)** unit to allow reading with a smart phone or tablet using the SensorViewer App that is available from the Google Play store.

### Automated Data Retrieval



Clusters of up to 16 instruments can be monitored and networked via YieldPoint's **wired Ethernet Gateways** or a 900MHz low cost Zigbee wireless mesh solution. These solutions interface with TCP/IP or WiFi networks.

### Datalogging



Data from the *d-EXTO Mk II* can be collected using YieldPoint's **d<sup>1</sup>LOGGER** and **d<sup>4</sup>LOGGER**. The dataloggers require no configuration and are fully interchangeable with any other type of YieldPoint instrument (*d-CABLE* borehole extensometers, *d-GMM*, *d-TILT*, *d-PLUCKER* etc).

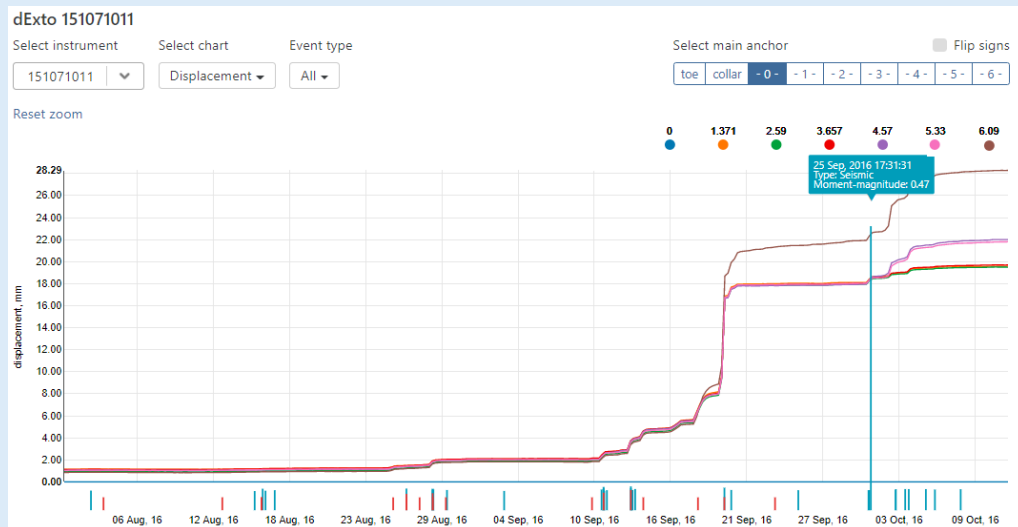
### Manual Readout

YieldPoint's low cost **d-READER** readout unit provides the temperature and displacement data directly in  $^{\circ}\text{C}$  and mm.

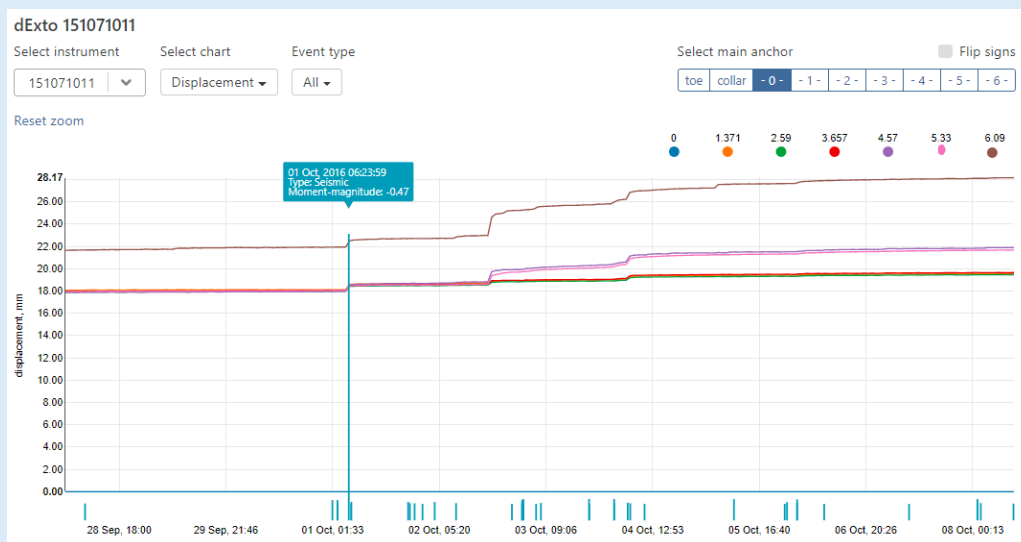
## Value Proposition: Data Analysis using the Geotechnical Data Platform

YieldPoint has developed a Geotechnical Data Platform, a powerful tool for aggregation, visualization and analysis of extensometer data. This web-based platform can accept data instantly pushed by YP Ethernet Gateway products such as d-MESH, 1 for 1, and wired Gateways or downloaded from d4LOGGER.

The data analysis can be integrated with blasting and seismic data-sets which enables engineers to develop an enhanced understanding of the mechanisms driving ground movements.

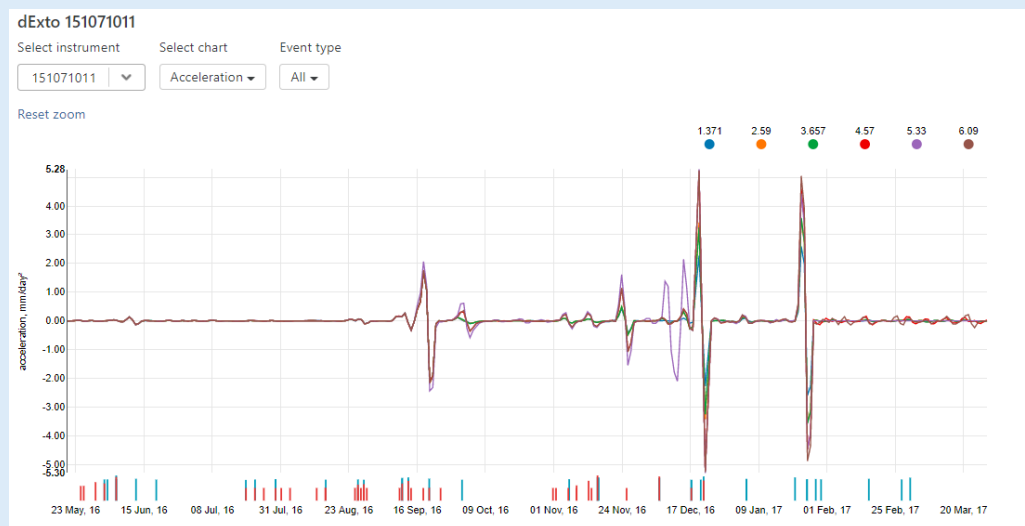
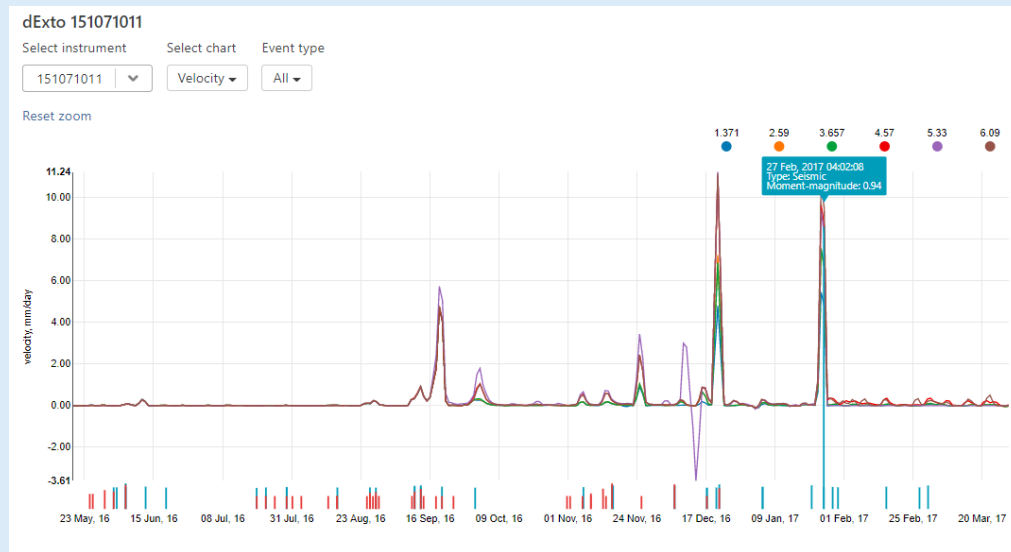


This software features a very powerful zooming capability that allows engineers to analyze the effect of individual blasts or seismic events. By establishing relationships between the magnitude and distance (concept of scaled distance) of events and the corresponding “micro-damage” to the walls of excavations, powerful predictive models can be developed.



## Data Analysis using the Geotechnical Data Platform

In addition to displacement, Velocities and Accelerations can be graphed. Blasts and Seismic Events can be correlated to spikes in Displacement Velocity. The height of the spike can be related to the “scaled magnitude” of the event.



Time series analytics can potentially be used to create forward looking predictions based on future planned blasting events. YieldPoint will work with customers to provide the GDP on a cloud platform or locally on a mine-site server

## Core Sensor Technology

- ▲ **Core Technology:** Up to 6 temperature compensated LVIT(Linear variable Inductance Transducers) Sensors: 0-250mm range. 1-wire Digital Temperature sensor.
- ▲ **Digital noise:** +/-0.02%FS
- ▲ **Resolution:** Fully 0.01mm with option to over-sample for micron scale resolution.
- ▲ **Linearity:** 0.25%FS typical better than 0.15% based on >10 point digital linearization.
- ▲ **Displacement Temp. Sensitivity:** Typically 0.02%FS. Effect can be reduced by recessing instrument head into borehole.
- ▲ **Repeatability:** Better than 0.25%.
- ▲ **Overall Accuracy:** The lesser of 0.35%FS or 0.5mm.
- ▲ **Temp. range:** Temp: -40 to 125°C.
- ▲ **Temp resolution:** 0.1°C.

## Overall Instrument Performance

- ▲ **Key Feature:** Fully integrated and preassembled borehole extensometer.
- ▲ **Anchors:** 1 to 6, custom locations.
- ▲ **Dimensions:** Up to 45m (145ft). Straightens immediately once uncoiled.
- ▲ **Instrument Specifications (Typical):**
  - Thermal stability: Typ 0.02% FS/C
- ▲ **Temperature range:** -40 to 125°C
- ▲ **Output Signal:** RS485 with transmission up to 500m over 2 x tp.
- ▲ **Output Signal:** An RS485 synchronous serial signal: 9600,8,N,1. ASCII encoded. Values and units transmitted.