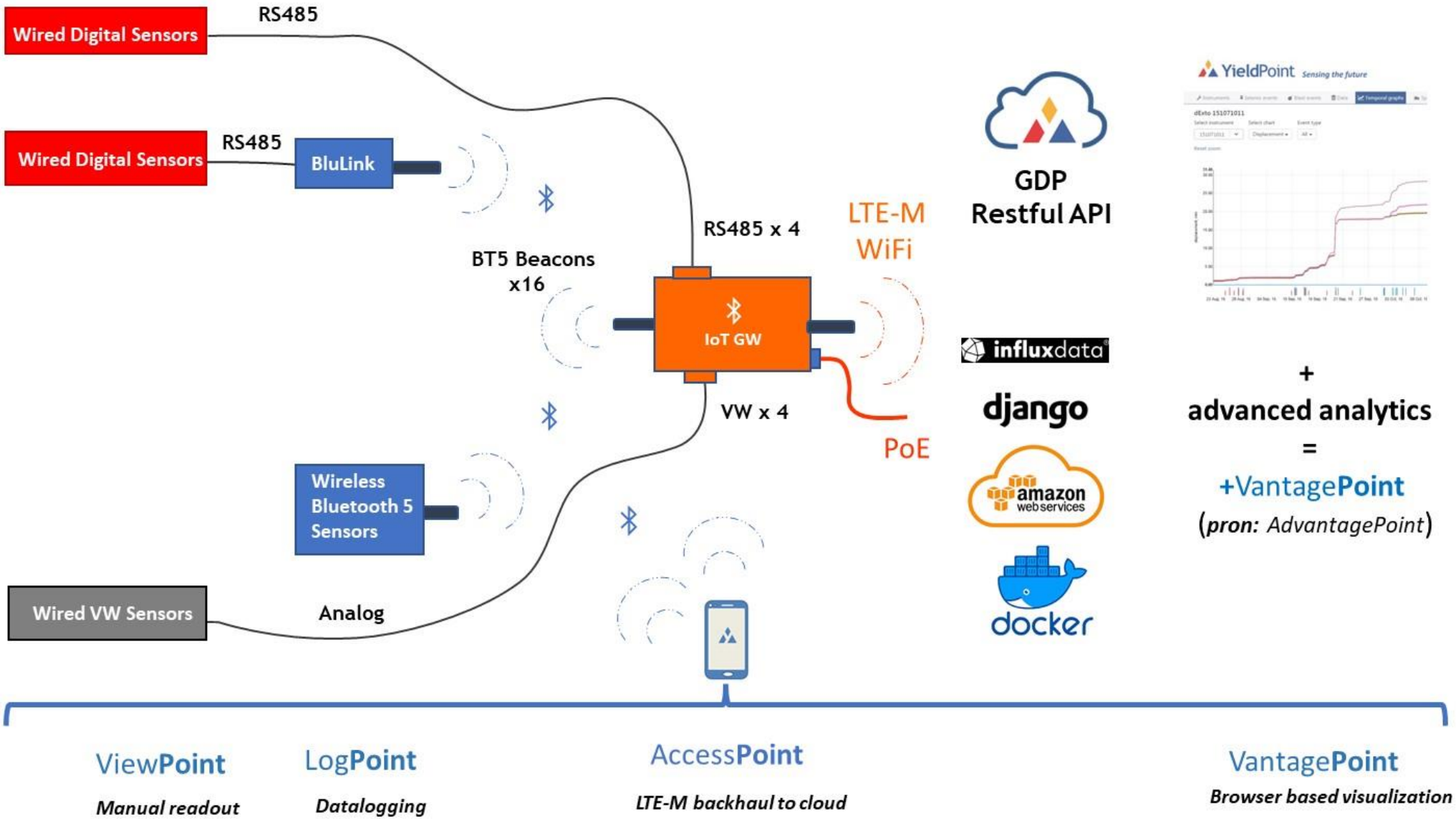
YieldPoint Catalog June 2022

sales@yieldpoint.com

Tel: +1-613-531-4722

YieldPoint *Sensing the future*



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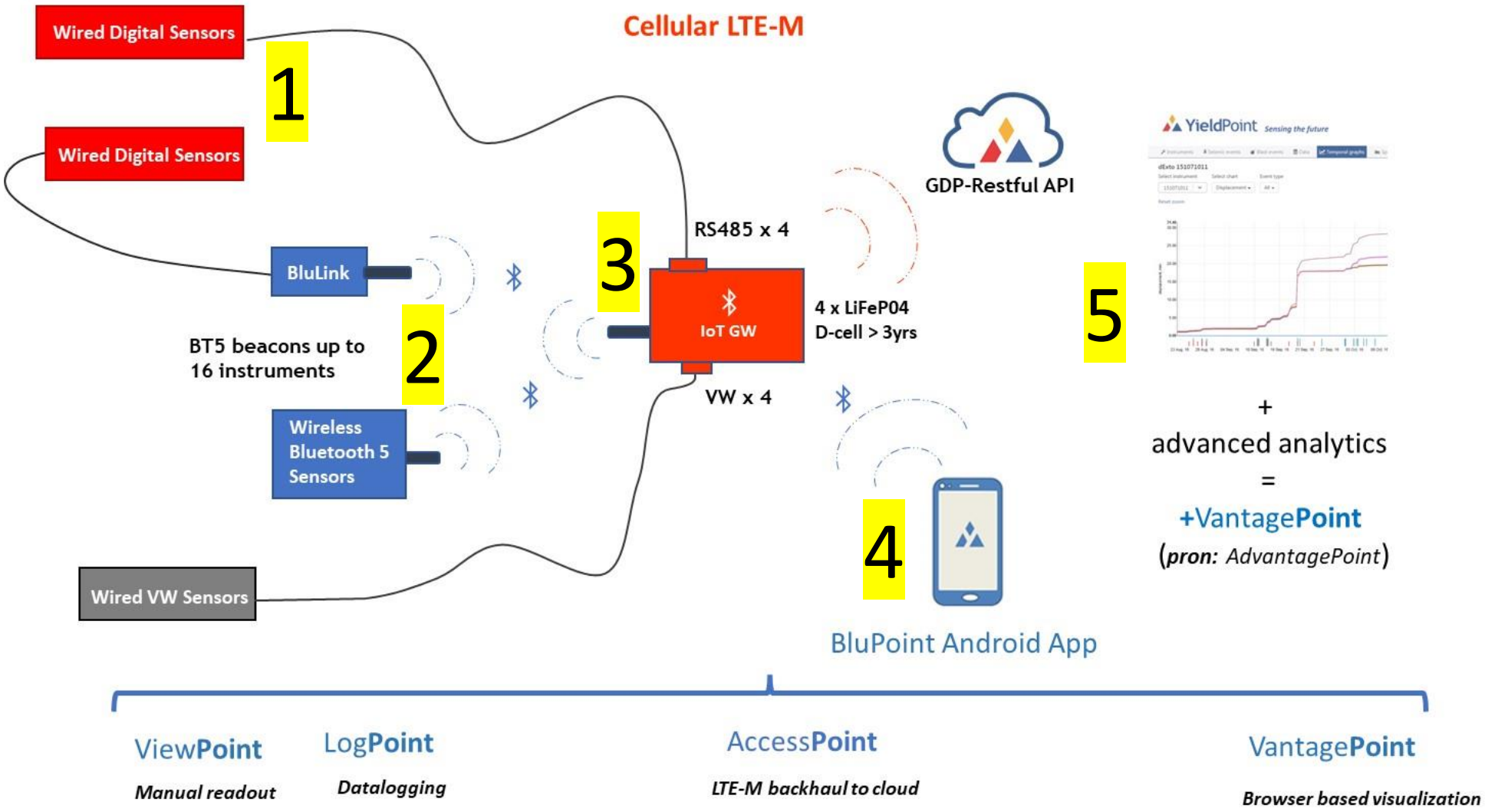
The YieldPoint Ecosystem



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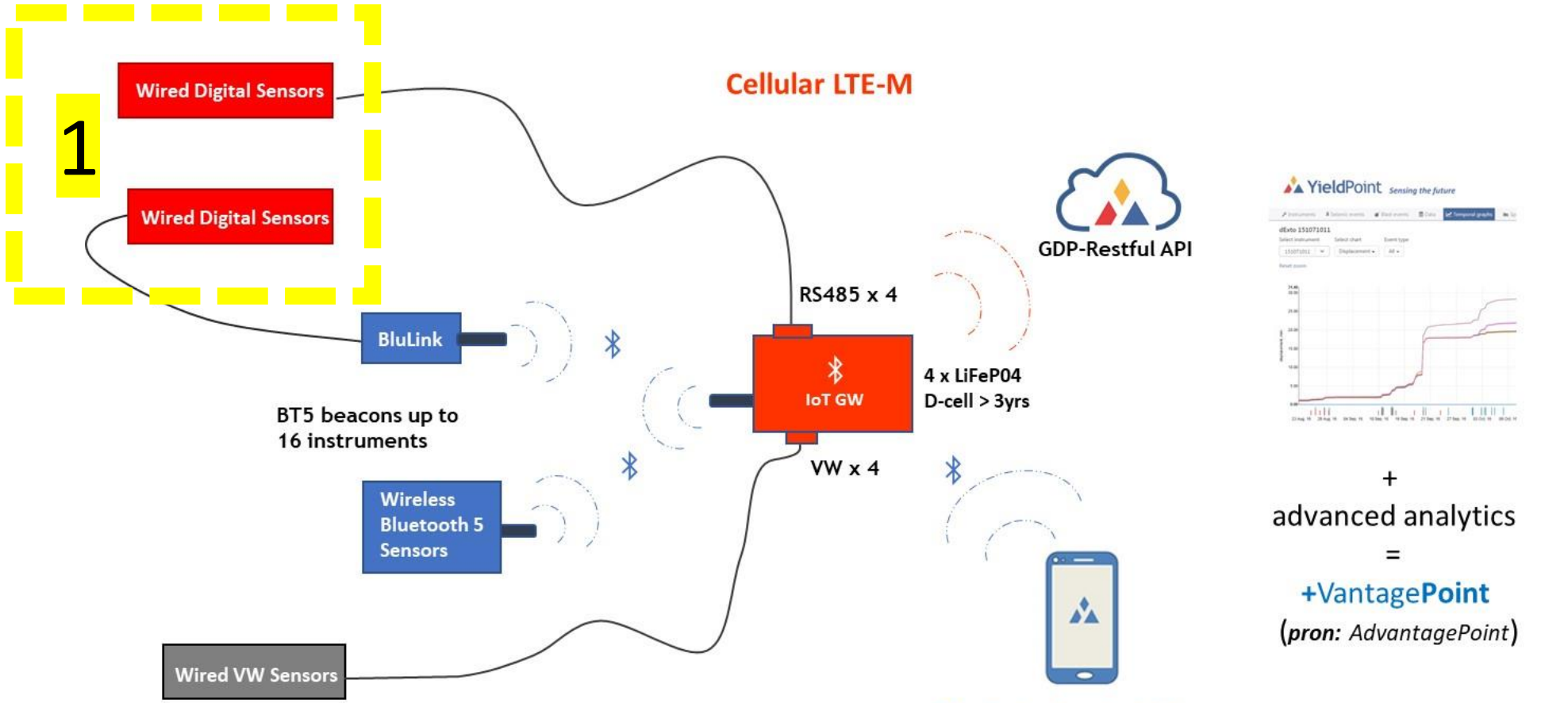
5 Product Categories

Category 1: The Digital Instruments



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(*pron:* *AdvantagePoint*)

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1 Digital Instruments

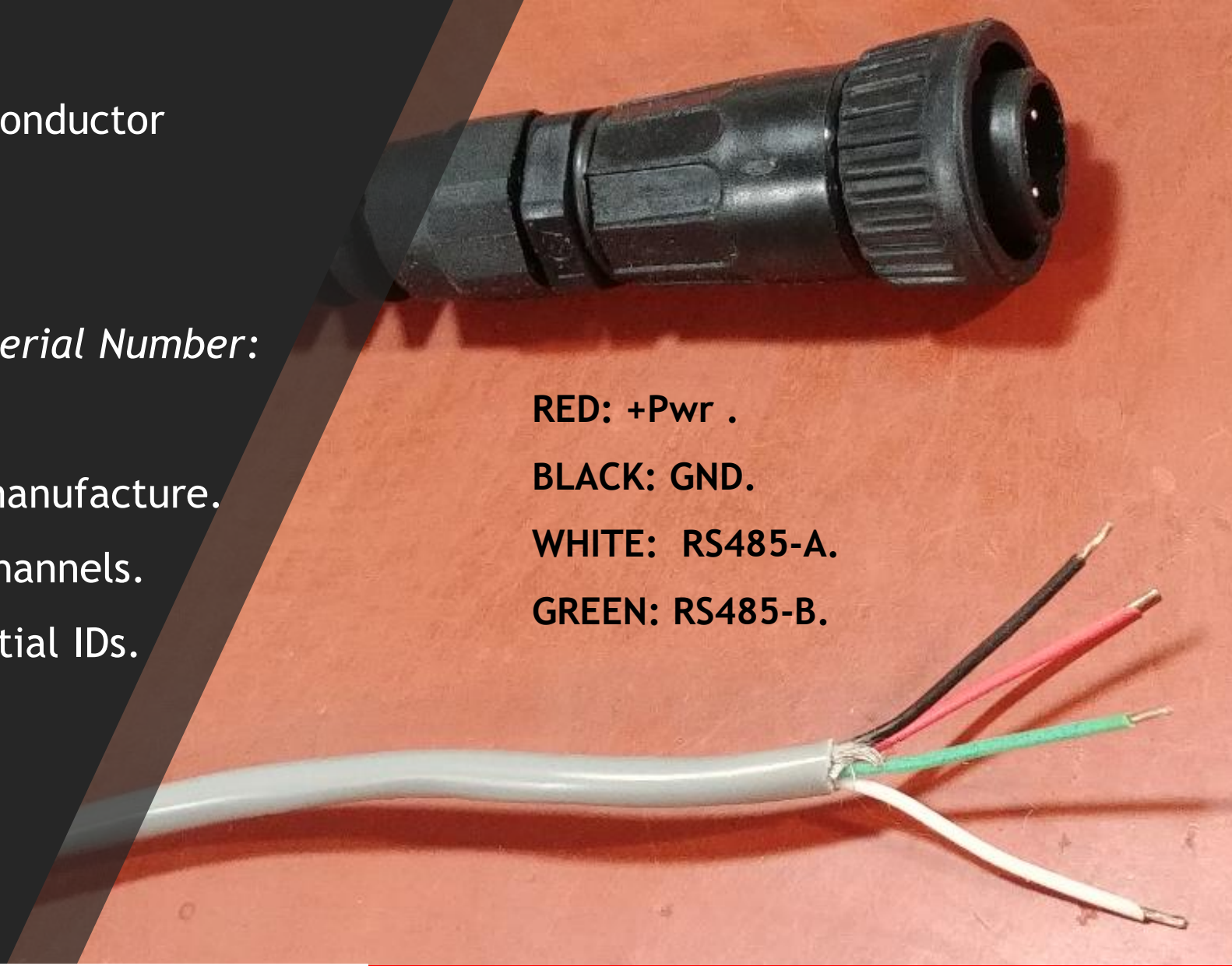
YieldPoint's digital technology is called d-Tech

- ***d*-Tech** is digital instrumentation platform developed by YieldPoint Inc. in Kingston, Ontario, Canada.
- A microcomputer is embedded in every instrument so creating truly SMART geotechnical and structural instruments.
- **Every YieldPoint instrument is DIGITAL and only YieldPoint instruments are truly SMART.**
- ***d*-Tech** is the modern approach to instrumentation. It enables clusters of instruments to be easily networked together using technologies such as 900MHz radio telemetry, BLE5 Bluetooth, WiFi and Ethernet.
- With simplicity comes lower cost especially with respect implementation and maintenance. The advantages permeate to all aspects of data monitoring and management.
- In wired systems the digital signals can be sent using RS485 long distances up to 800m. Damaged lead-wires can be twisted back together very easily and reliably.
- Signals are immune to the presence of water, as is the instrument itself.

All YieldPoint instruments have 4 conductor lead-wire:

Each instrument has a YP *Unique Serial Number*:

Digits 1 to 4 : year and month of manufacture.
Digits 5,6 : sensor type. 5 is # of channels.
Digit 7-9 : factory assigned sequential IDs.



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Universal RS485 wiring

- **Improved Accuracy**: Linearity, Temperature Compensation with built-in temperature sensor.
- **Improved Reliability**: non-contact technology, water immunity, low noise.
- Outputs directly in Real World Units.
- Output signals include Unique Sensor ID + SensorType.
- Many channels multiplexed on a single lead wire pair.
- **Simplified Low-cost Peripherals:** BLE5, WiFi, 4G-CAT-M1, 900MHz, dataloggers, Ethernet gateways (Category 3).
- **Safe and simple Data Transmission** and Management.
- Very limited need for configuration.
- Delivered calibrated and ready to use.

Advantages of d-Tech

Category 1: The Digital Instruments

dExto-Hard Rock: Grouted borehole extensometer

Range: up to 250mm at 10µm resolution.

Length: up to 40m/140ft. Diameter 25mm/1”.

Head length: 40 to 50cm/16 to 20”.

Up to 6 anchor points.

Pre-calibrated, ready to install.

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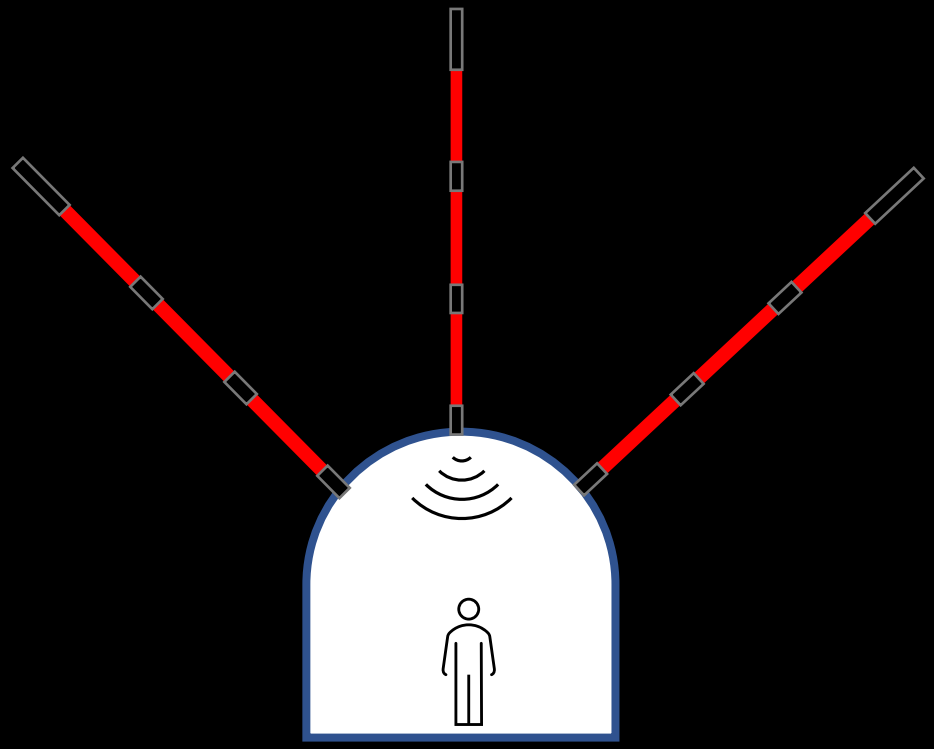
dEXTO-Hard Rock

Category 1: The Digital Instruments

dEXTO- Hard Rock borehole extenso-meters are used in galleries/ tunnels to monitor rock deformation. Their length is usually 150% of the average dimension of the excavation or 1.5x(H+W)/2.

To optimize the spatial resolution YP recommends using 6 anchor points if the dEXTOs are above 5m in length.



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dEXTO-Hard Rock

Category 1: The Digital Instruments

dExto-Civil: Civil extensometer for soft rock/soil

Range: up to 250mm at 10µm.

Length: up to 40m/140ft. Diameter 25mm/1” and 50mm/2” for the anchors.

Head length: 40 to 50cm/16 to 20”.

Up to 6 anchor points. Anchors must be manually adjusted for stiffness, upon installation.

Pre-calibrated, ready to install.

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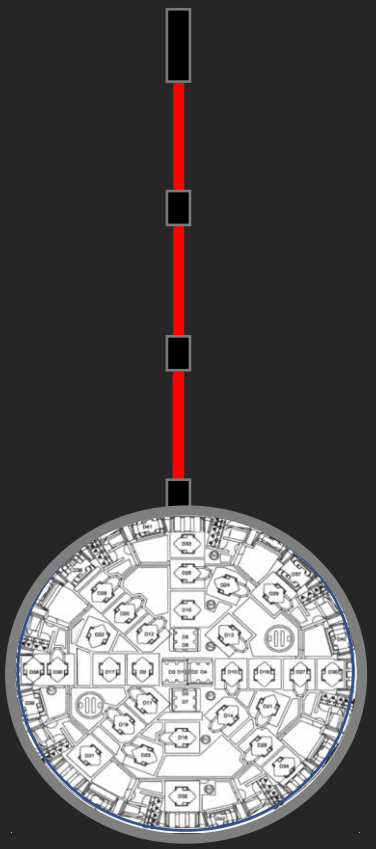
dEXTO-Civil

Category 1: The Digital Instruments



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dEXTO - Civil

Category 1: The Digital Instruments

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Length: up to 40m/140ft. Diameter 25mm/1” and 50mm/2” for the anchors.

Head length: 40 to 50cm/16 to 20”.

Up to 6 anchor points. Anchors must be manually adjusted for stiffness, upon installation.

Pre-calibrated, ready to install.

YieldPoint Sensing the future

dEXTO-Civil

Category 1: The Digital Instruments

dExto-Trench: Civil MPBX Extensometer for trenches in soil.

- Range: up to 250mm at 10µm resolution.
- Length: up to 30m/139ft.
- Up to 6 anchor points with 30cm/12” diameter acrylic plates for excellent force transfer.
- Up to 6 anchor points. Anchors must be manually adjusted for stiffness, upon installation.
- Pre-calibrated, ready to install after mounting of plates.

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dEXTO-Trench

Category 1: The Digital Instruments

dUMP Utility Monitoring Point

Range: 50 to 200mm at 10µm resolution.

Length: up to 20m/60ft.

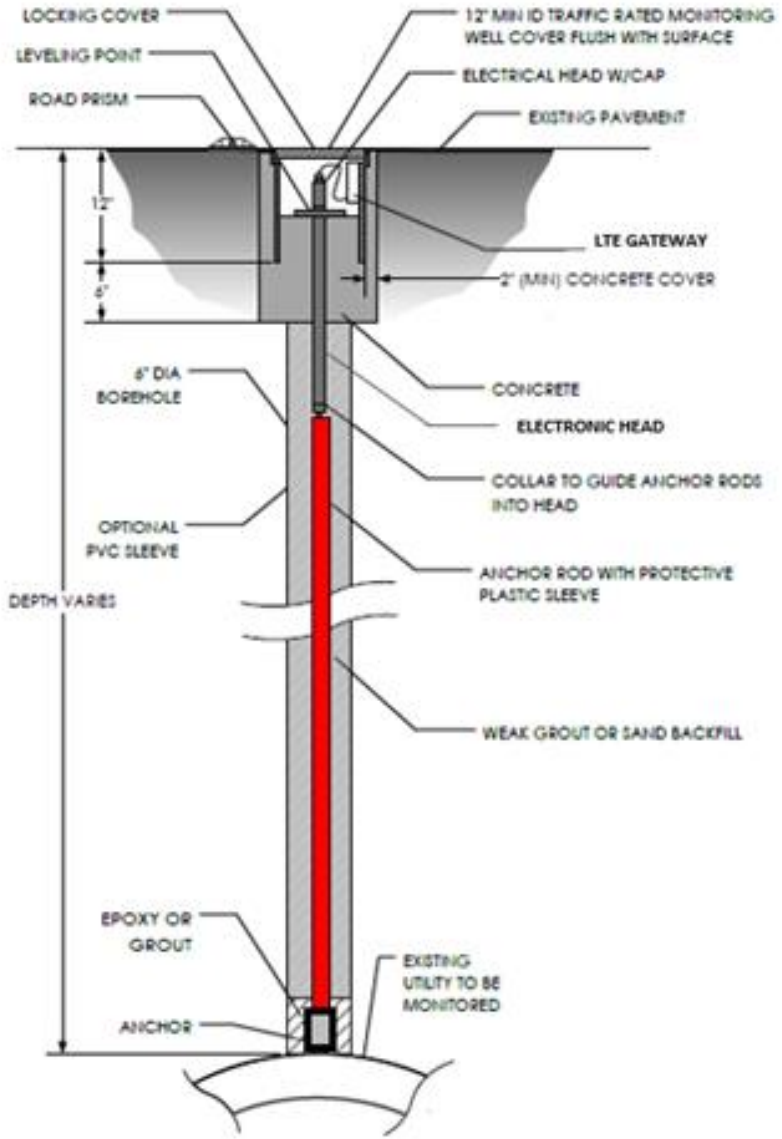
Diameter 25mm/1”.

Head length: 40 to 50cm/16 to 20”.

1 anchor point. Total length manually adjusted for

stiffness both at the Head and at the Anchor, upon installation.

Pre-calibrated, ready to install.



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dUMP

Category 1: The Digital Instruments

dExto-Mini: Extensometer for direct installation in cement, in a pile, etc.

Head diameter: 21mm/0.82”, anchors diameter 13mm/1/2”.

Up to 150mm/6” deformation with 10 to 20µm resolution.

Length up to 15m/50ft.

6 anchor points designed for a strong bond in cement and excellent transfer of forces. Precalibrated and ready to install.

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dEXTO-Mini

Category 1: The Digital Instruments

dCable: Digital instrumented cable anchor.

- Monitors its own performance by measuring percentage of cable capacity already used.
- Length up to 25m/80ft, head diameter 25mm/1”.
- Installs like any regular cable anchor in production flow. HAT and HAC.
- Must be grouted.
- Plain cable and Garford cable available.
- Can be twinned. Can integrate into tiebacks.

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dCABLE

Category 1: The Digital Instruments

dMPBX: Spring Anchor Extensometer for non-grouted boreholes.

- Dual spring system for positive installation experience and a more stable anchorage.
- Range: up to 200mm at 10µm resolution.
- Length: up to 15m/50ft, head diameter 25mm/1”, anchors 30mm/1.2”.
- Up to 6 anchor points. Ideal for coal, potash, salt mines. Pre-calibrated, ready to install.

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dMPBX – Soft Rock

Category 1: The Digital Instruments

dMicro: Crackmeter.

- Range: 10mm.
- Length 180mm/11”, diameter 7mm/0.25”.
- Resolution: 1µm.
- Mounts on 2 brackets bolted on either sides of a crack in the rock.
- Can be used multiple times at other locations.

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dmicro – Crackmeter

dGMM: Ground Movement Monitor.

- Mounts on a threaded bar grouted in a short borehole.
- Measure movement between the anchored depth of the threadbar and the wall.
- Range: 146mm.
- Resolution: 10µm.
- Can be used multiple times.

Category 1: The Digital Instruments

dSlough: Sloughmeter - Rock Fall Detector

- Up to 10 points and 150m long, 25mm/1” diameter, 1 LED per point, data logger compatible.
- 10 on/off LEDs in head.
- 10 prebuilt points will break when instrument is stretched more than 50mm/2” by rock deformation.
- Logger/Bluetooth/IoT compatible.

YieldPoint Sensing the future

dSlough

Category 1: The Digital Instruments

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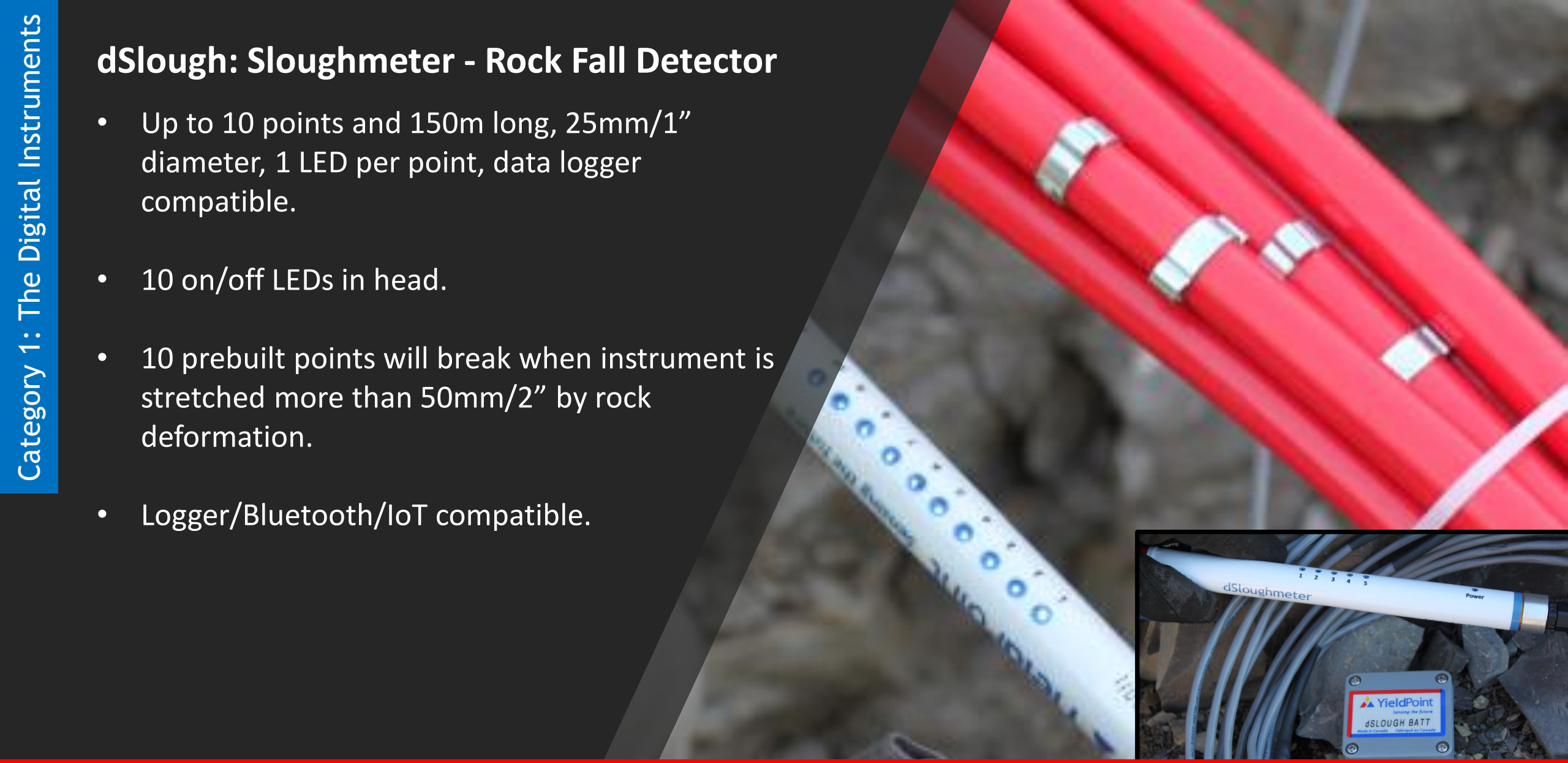

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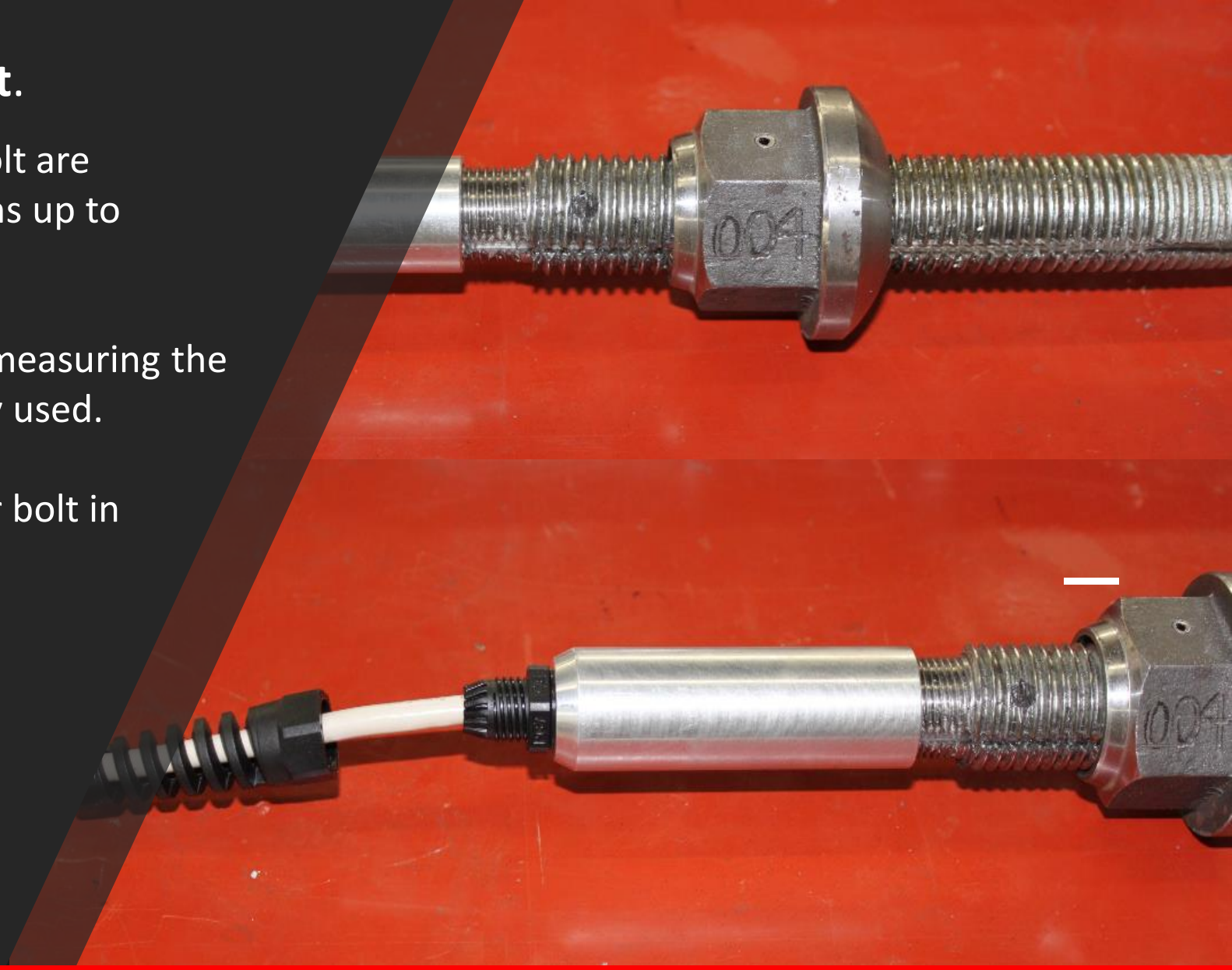
dSlough – Rock Fall Monitor

Category 1: The Digital Instruments

dRebar: Instrumented RockBolt.

- Rebar, threadbar and other rock bolt are instrumented in all sizes and lengths up to 6m/20ft.
- Monitors its own performance by measuring the percentage of bolt capacity already used.
- Designed to installs like any regular bolt in production flow.
- Resin or grout.



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dRebar Instrumented RockBolt

The lead wire connects to the grouted bolt and has a protective steel cap with an installation nut.

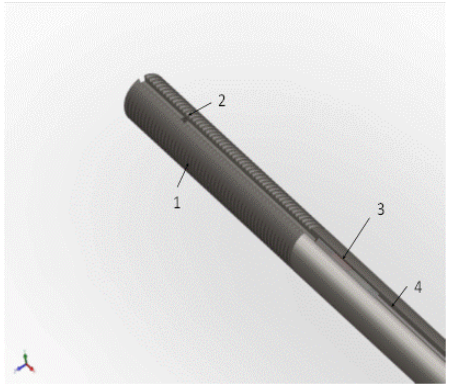
Once installed, the bolt can be fitted with a Bluetooth 5 data logger and protected from flyrock by various means such as this steel contraption.

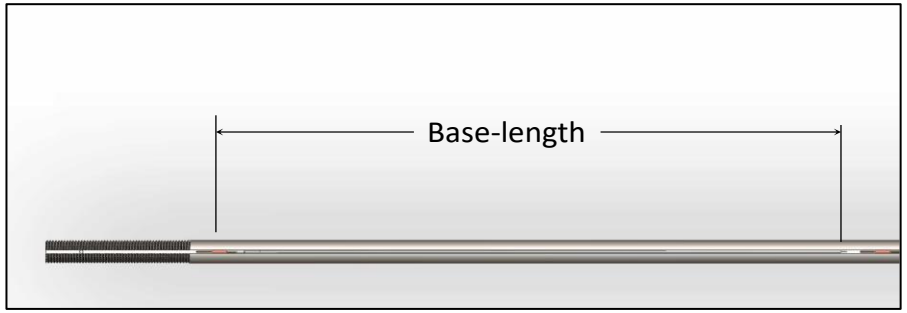
The dREBAR is based on a miniature long base length inductive strain gauge, small enough to be recessed into a 3.2mm groove in the bolt.

A miniature inductive displacement sensor comprising a precision coil and a high permeability core attached to stainless steel rod. The ends of the displacement sensor are secured to the bolt at a specified distance apart referred to as the base length. This base length may vary between 300mm and 2000mm so comprising a long base length strain gauge.

Upon loading, stretch of the bolt causes displacement of the precision coil relative to its high permeability core. The corresponding change in coil inductance causes a variation in the frequency of a resonant electrical circuit which is measured by the microcontroller in the instrument head. The accuracy of the displacement sensor is enhanced by an empirically derived temperature compensation algorithm that is applied by the microcontroller.

Every instrument is subjected to a multipoint calibration. The calibration coefficients are written into microcontroller memory, and a piecewise linear function is used to enhance linearity the output signal and applied strain. Every instrument is provided with a calibration report.

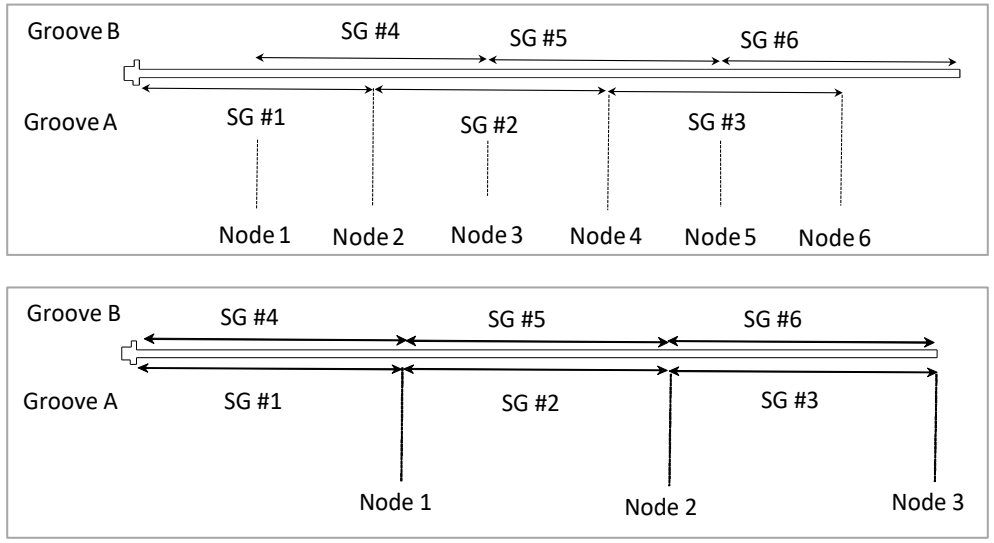




dRebar – Principle of Operation

d-REBAR technology can be applied to any rigid bolt or bar. Either a pair of strain gauges (for end anchored bolts spun in resin) or an array of loadmeters can be specified. For applications which require enhanced axial load resolution the strain gauge array should be staggered (Fig4 upper). If bending moments need to be more accurately resolved then a stacked configuration may be preferable (Fig 4. lower). A theoretical comparison of both is presented in a related technical note.

The specification of the strain gauge locations should be based on an understanding of the load distribution along a fully grouted rock bolt. The upper plot in Fig. 5 shows a typical load distribution. At the collar of the borehole the load depends on the stiffness (i.e. bearing conditions) of the faceplate. Along the length of the bolt the load increases in the bolt along the “pick-up” length and reaches a peak at the neutral point. The load decreases along the remainder of the bolt length, the “anchor length”, and is zero at the free end. In the case of a stiff bearing surface for the plate and a rapid decrease in the displacement magnitude around the excavation then the neutral point may actually occur at the faceplate (Fig 5, lower plot).



Category 1: The Digital Instruments

dSplitSet™: Digital instrumented friction bolt.

- SplitSet™ bolts are instrumented in all sizes and lengths.
- Deformation measured on several sections along bolt length.
- Helps evaluate bolt installation quality and ground support performance.

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dSplitSet

Category 1: The Digital Instruments

dTherm: Digital thermistor string.

- A string of temperature sensors embedded within one single flexible HDPE tube. The total diameter of the instrument is 25mm/1.0”.
- Up to 16 temperature points over 200m/650ft in length and the locations of the temperature points are entirely customized.
- dTherm will work with YieldPoint dReader, BluLink, d4BluLogger, BluGateway with WiFi, LTE and MiniSat, and 3rd party modules as well.
- The instrument is coiled over a 120cm/48” diameter and remains very straight once uncoiled. It is to be grouted in the borehole.

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dTherm - ThermoStrings

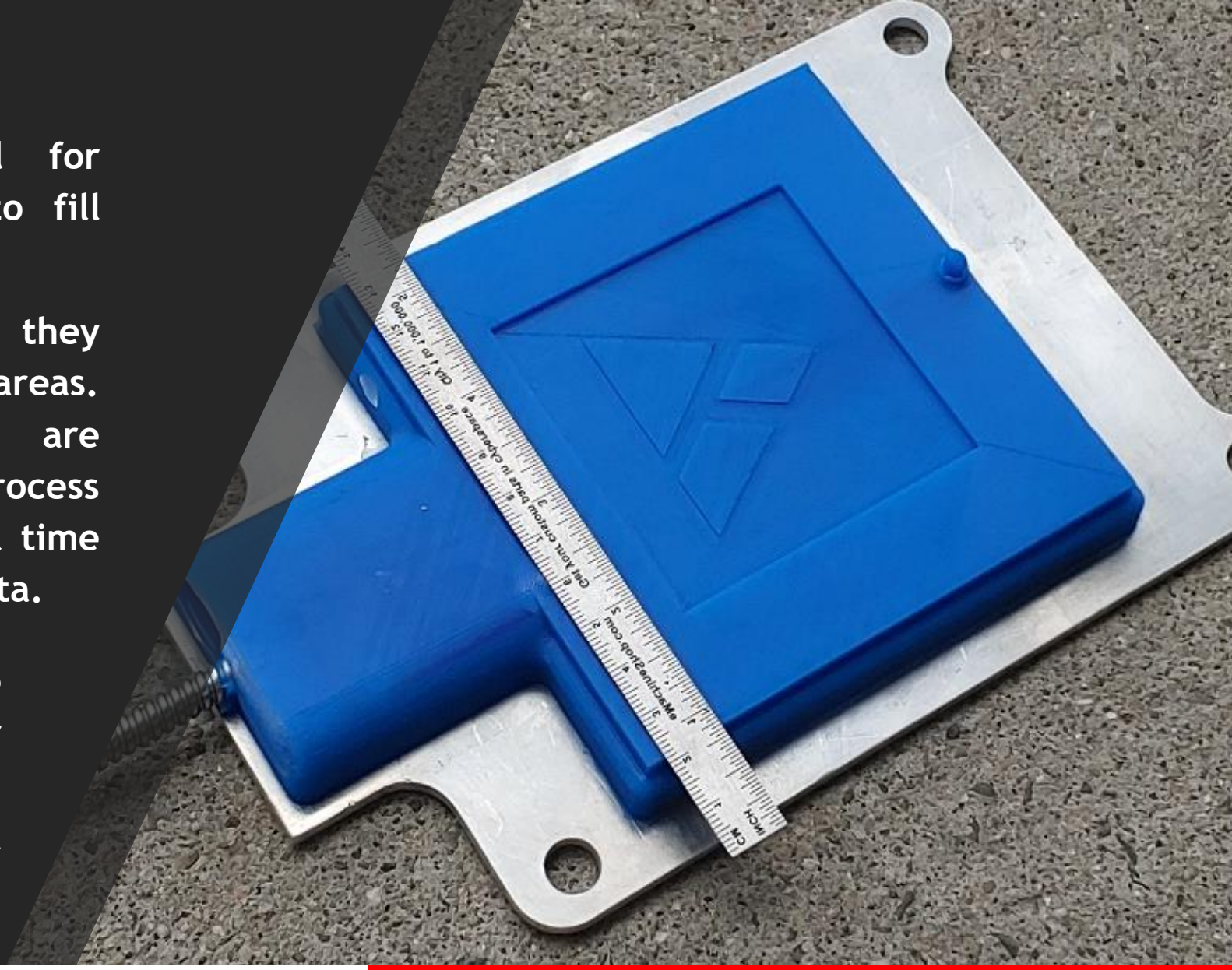
Category 1: The Digital Instruments

dPPC - Paste Pressure Cell

Innovative paste pressure cell for measure the pressure applied to fill barricade.

Workers safety is improved when they can be quickly removed from risk areas. Productivity and profitability are increased through better process efficiency made possible with real time remote access to paste pressure data.

YieldPoint offers a low-cost Paste Pressure Cell (PPC) especially for monitoring backfill Total Pressure to a resolution of 0.01kPa over a range of 3500kPa.



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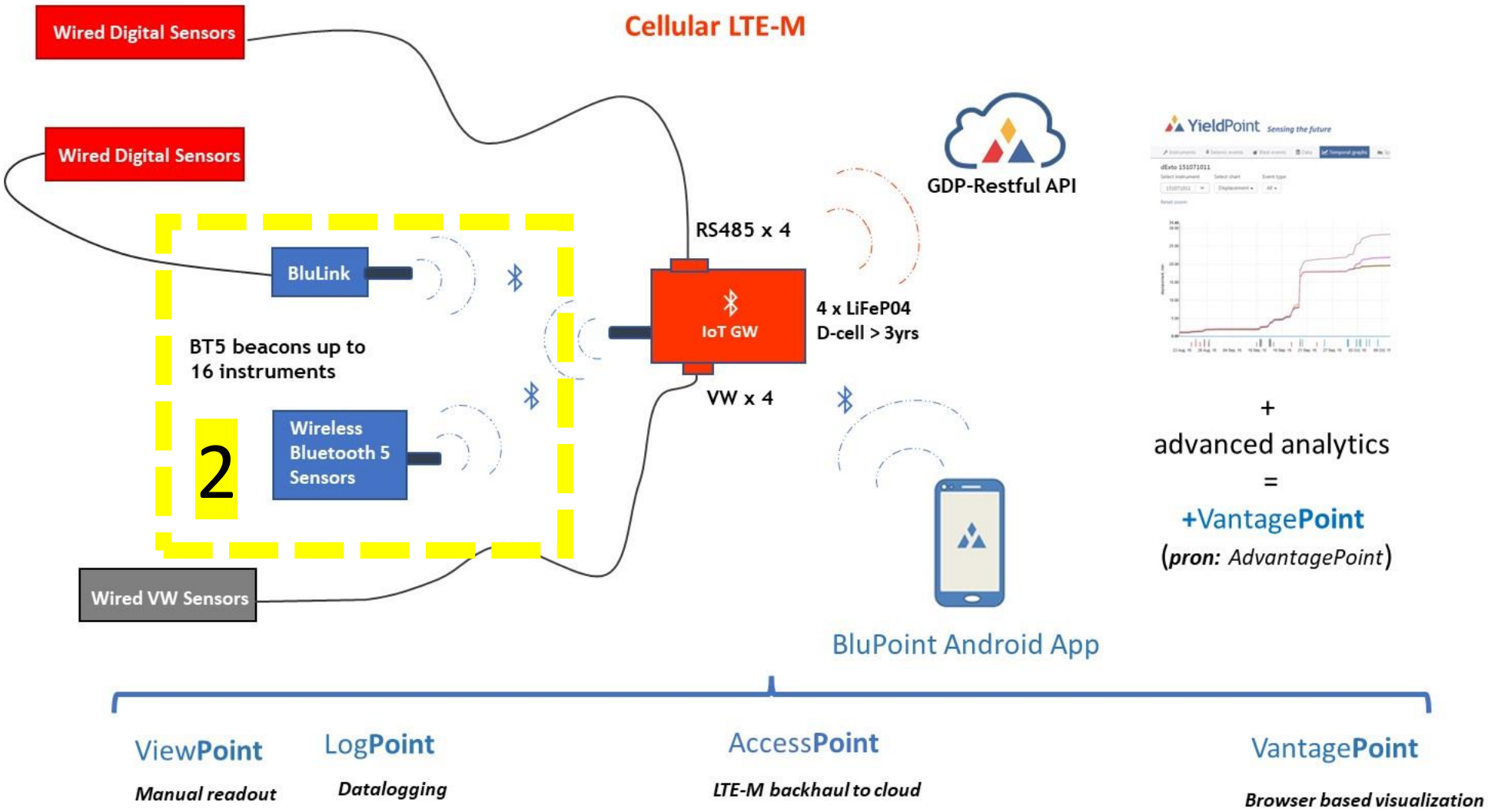
dPPC - Paste Pressure Cell

d-Tilt - 3D 360º tiltmeter

d-Tilt is a full 360 arcdeg triaxial tiltmeter for very precise measurement (0.001 arcdeg resolution) of changes in inclination. The instrument uses a very low noise MEMS accelerometer that enables a resolution of 0.001 arcdeg with a 24hr stability of +/-0.001 arcdeg.

Placement on structures does not require precise leveling. The d-Tilt can be attached to a beam or mounted directly to any structure. d-Tilt is also available in borehole model (shown) with a 38mm OD.

Category 2: Bluetooth 5 Instruments



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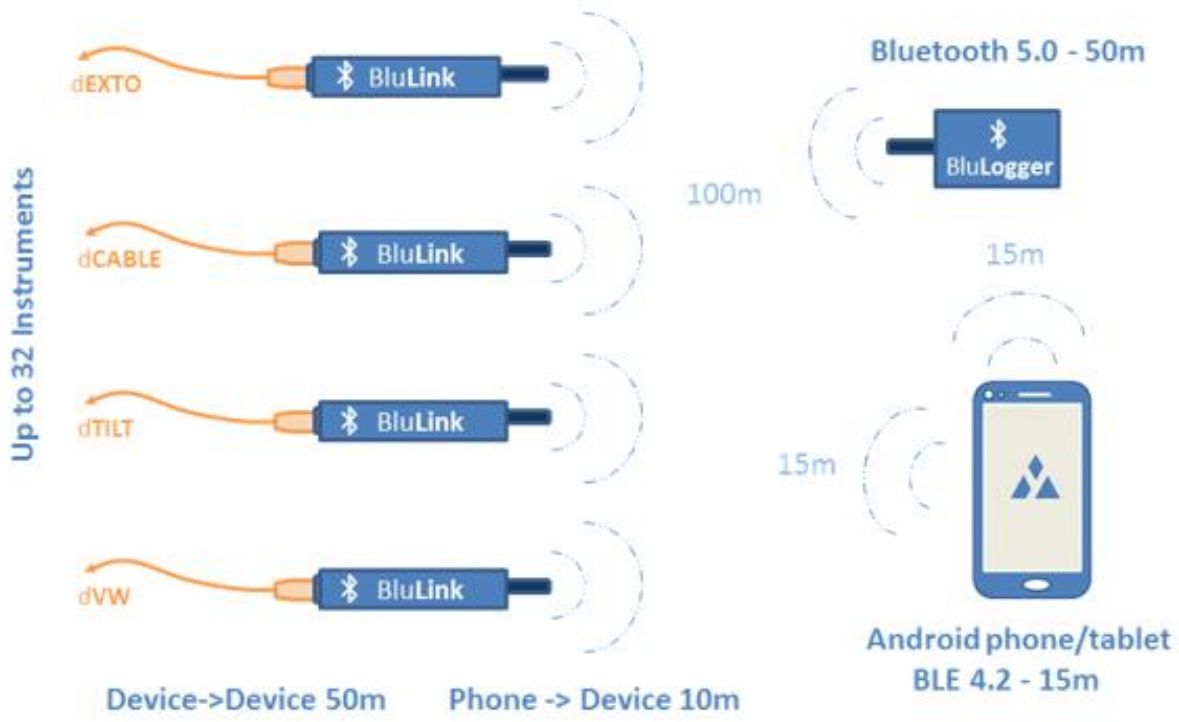
2: Bluetooth 5 products

Category 2: Bluetooth 5 Instruments



BluLink loggers turn any YieldPoint instrument into a data logger with Bluetooth BLE5 capability. 30,000 readings saved, 50 to 200m transmission range, adjustable frequency. BluPoint Android application. Sends data to BluGateway for networking.

The BluLink-S is fully encapsulated and will operate indefinitely underwater.

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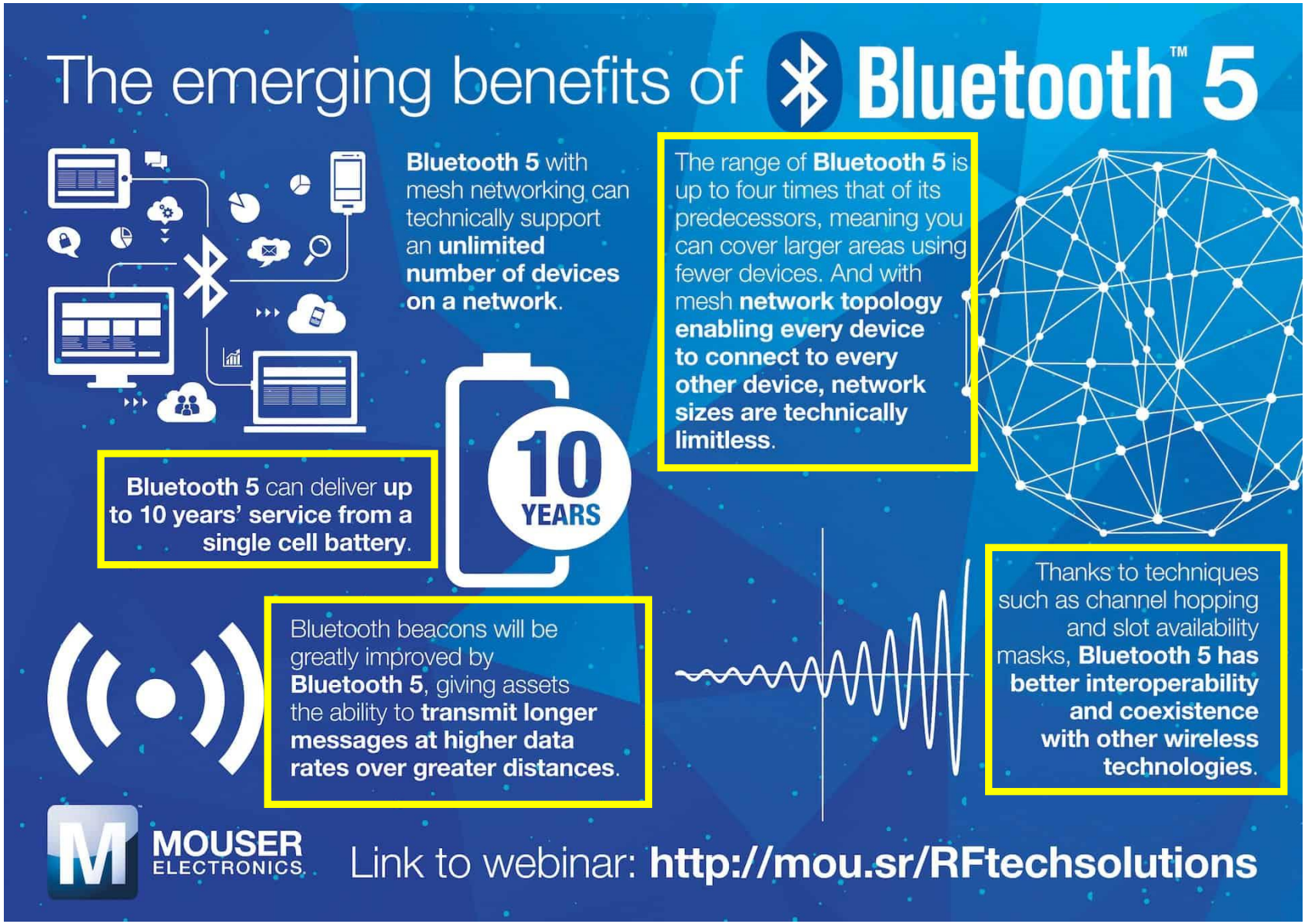
BluLink-S

Category 2: Bluetooth 5 Instruments



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BlueTooth 5

Category 2: Bluetooth 5 Instruments

BluLink-R: BT5 Logger and Transmitter

Works with any YieldPoint digital instruments.

Confirms instrument connection by flashing LED.

Stores 30,000 data strings at user intervals.

Beacons new data string via Bluetooth 5.

Data strings are date & time stamped events.

Communicate with 4G LTE-Cat M1.

IP67 enclosure, external BLE5 antenna included, replaceable **lithium D-cell batteries** good for 3 years. Batteries not included.

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BluLink-R

Category 2: Bluetooth 5 Instruments

BluEXTO: BT5 Borehole extensomter

Paradigm shift for Engineers designing large underground excavations, BluExto is the first genuinely wireless displacement monitoring solution. Integrates installation, measurement, signal processing, logging and telemetry complete with an 8-year battery capacity. The borehole extensometer has up to 6 anchor points each with measurement resolution of 10 microns over ranges up to 250mm. BluExto is a derivative of YieldPoint's dExto MkII design.

Integrated into BluEXTO head is a logger that can store 30,000 measurement, battery capacity for 8 years and a Bluetooth 5 radio modem which will beacon readings every 5 seconds with a range up to 100m.

Category 2: Bluetooth 5 Instruments

BluTilt: 360° Triaxial Tiltmeter.

- Data logger 30,000 readings capacity.
- IP68 metal enclosure 140x90x60mm (5.5/3.5/2.5”). Optional.
- High resolution at 1/1000th degree on all 3 axes.
- Range 360 degrees on all 3 axes.
- Mounts on any kind of structure.
- Can be installed on any angles thanks to triaxial 360 degrees range.
- Bluetooth BLE5 Communications.

YieldPoint Sensing the future

BluTilt

Category 2: Bluetooth 5 Instruments

: HID cell interface

BluCSIRO is a single channel Bluetooth and logging enabled interface for CSIRO HID cell, made by ESS in Australia.

The device interrogates the stress cell and returns a single output string with the respective values for the 12 strain gauges.

Could also become available as a 4G LTE-M gateway in the future.

GEOSYSTEMS

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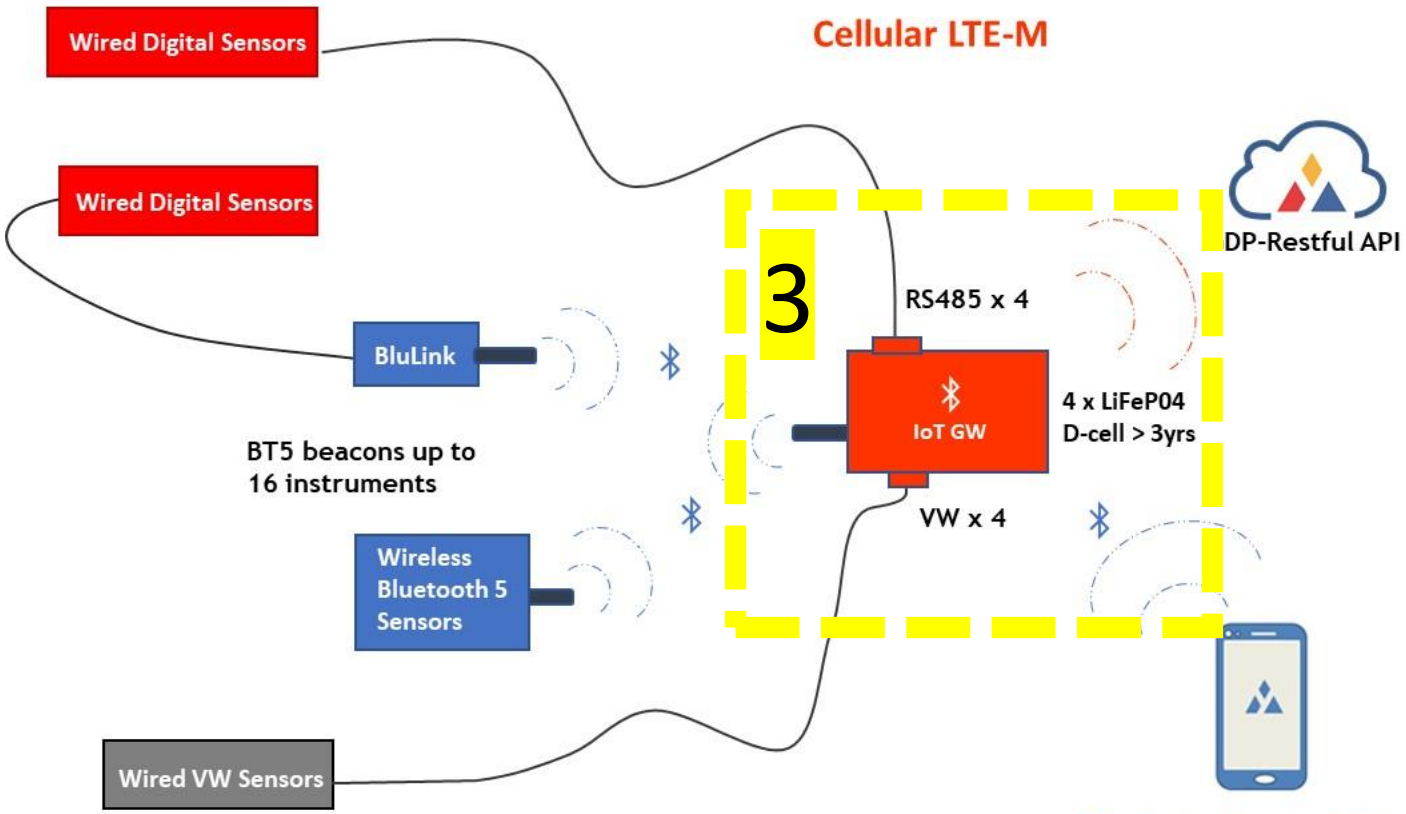
BluCSIRO



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ViewPoint
Manual readout

LogPoint
Datalogging

AccessPoint
LTE-M backhaul to cloud

VantagePoint
Browser based visualization

Types of YP Gateway

YieldPoint's Gateways can aggregate readings From a population of geotechnical instruments emitting three types of signal:

(i) RS485 digital signal (Category 1),
(ii) BlueTooth 5 beacons (Category 2),
(iii) VW instruments.

Backhaul to the cloud can be either:

a) LTE-M
b) WiFi/Ethernet
c) miniSat (SWARM)

All configuration is from YP's Bluetooth App for Android called BluPoint (Category 4).

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Gateway Types

Cellular Backhaul

Wikipedia says:

LTE-M (LTE-MTC [Machine Type Communication]), is a type of low power wide area network (LPWAN) radio technology standard developed by 3GPP to enable a wide range of cellular devices and services (specifically, for machine-to-machine and Internet of Things applications).[1][2]

LTE-M technology is designed for use by IoT devices that want to connect to a 4G network without a gateway and while using batteries. These low-powered devices are expected to make up the bulk of devices that operate within the Internet of Things over the next few years. They are likely to make up the majority of the predicted 38 billion connected devices estimated to be in operation by the year 2025. LTE-M products are exciting a lot of manufacturers because they are very cheap to build.

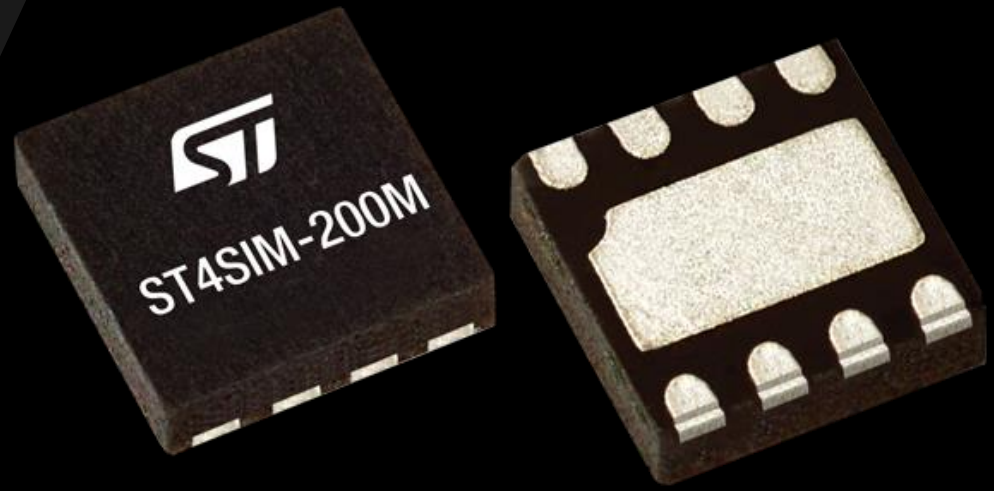
IMPORTANT: (i) LTE-M is different from regular LTE cellular
(ii) LTE is an integral component of 5G

https://www.5gamericas.org/wp-content/uploads/2019/07/LTE_Progress_Leading_to_the_5G_Massive_Internet_of_Things_Final_12.5.pdf

eSIM chips?

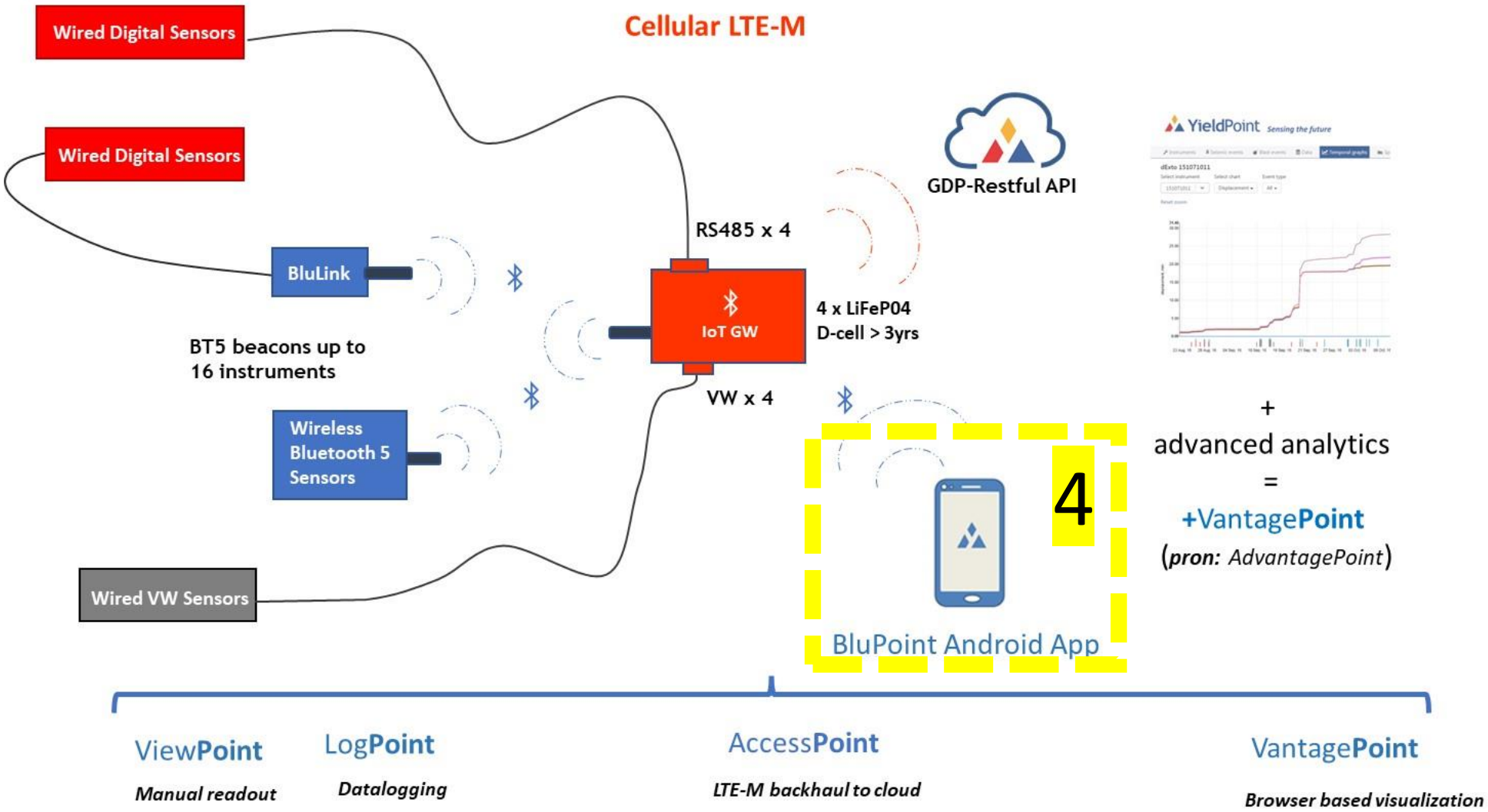
The eSIM (embedded SIM) is a small chip soldered directly to the IoT Gateway board.

The “e” in eSIM does not refer to “electronic” as is so often the case (for example, eMachines, eCommerce, and e-mail). Instead, it refers to “embedded” — a SIM that is directly attached to a board and is not removable. The official name for this form factor is MFF2.



SIM Cards?

The SIM card has been around since the early 1990s. It is a small, removable piece of silicon and copper encased in plastic. Each manufactured SIM has a globally unique serial number called an ICCID (Integrated Circuit Card ID), along with an IMSI and IMEI, to identify it on the network.



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4: Android BluPoint App

Category 3: Loggers and Gateways

The BluPoint App

Swipe from the left to activate the BluPoint Activities:

The BluPoint App is the software interface between Android devices and BluPoint hardware. Swiping from the left reveals a number of Activities that comprise the App.

ViewPoint: Connect to an instrument (10m range) to view/save the latest data

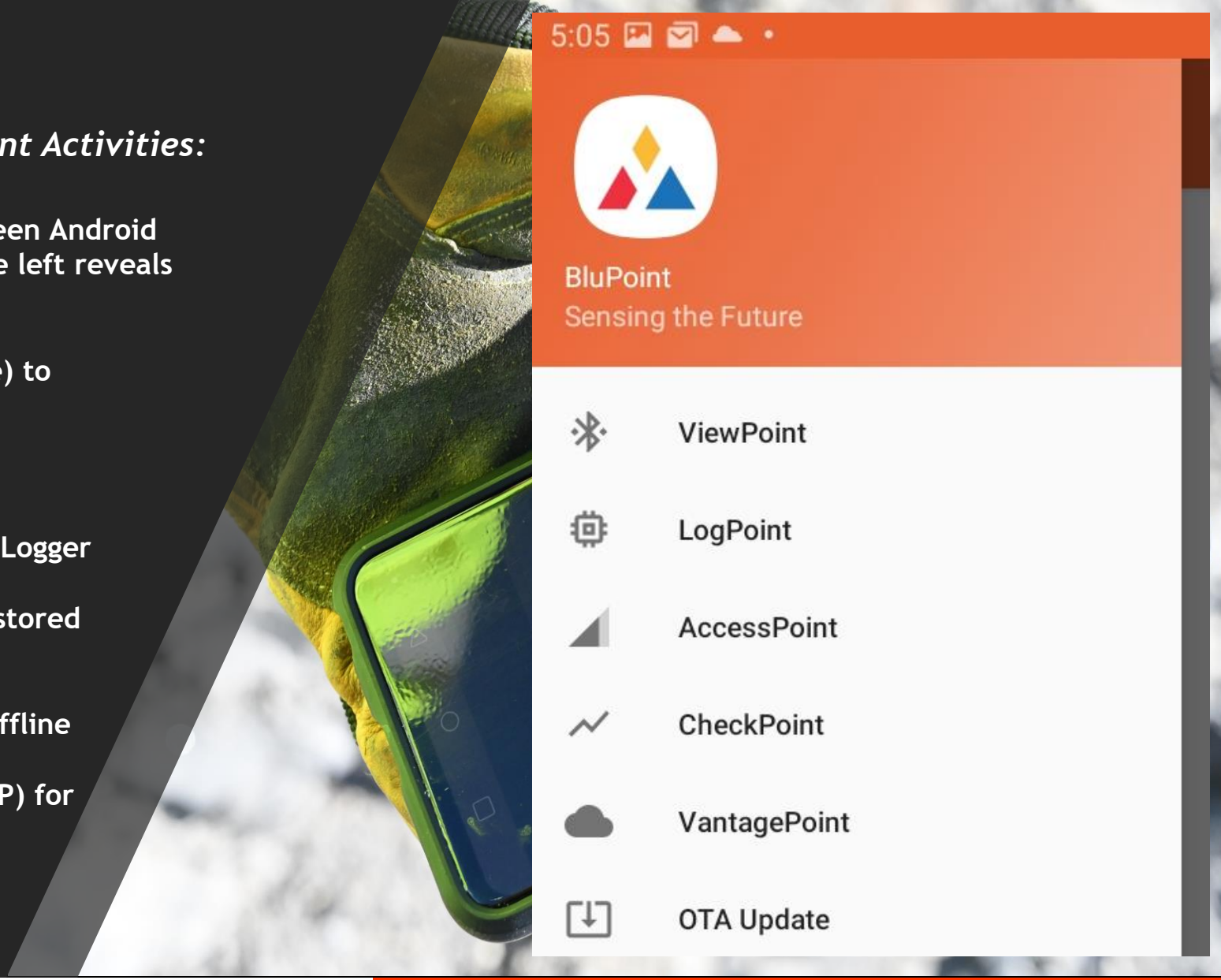
LogPoint: Connect to a BluLogger. Extract data onto Andoid device. Scan the instruments in range(50m) of the BluLogger

AccessPoint: Log onto a BluGateway. Download stored data.

CheckPoint: Android App to display data when offline

VantagePoint: A Geotechnical Data Platform (GDP) for visualization and analysis of data

OTA Update: Update Blulink and BluGateway Firmware



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5 BluPoint Activities

Category 3: Loggers and Gateways

The BluPoint App

The BluPoint App is used to perform the following tasks:

(i) Configuration reading intervals, clock
(ii) Downloading and erasing readings
(iii) Configuration of backhaul target for Gateways.
(iv) Managing historical readings
(v) Health monitoring.

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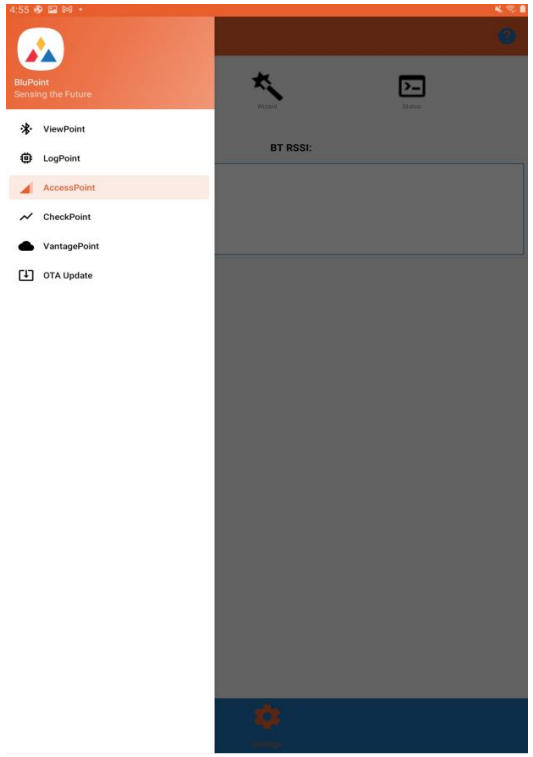
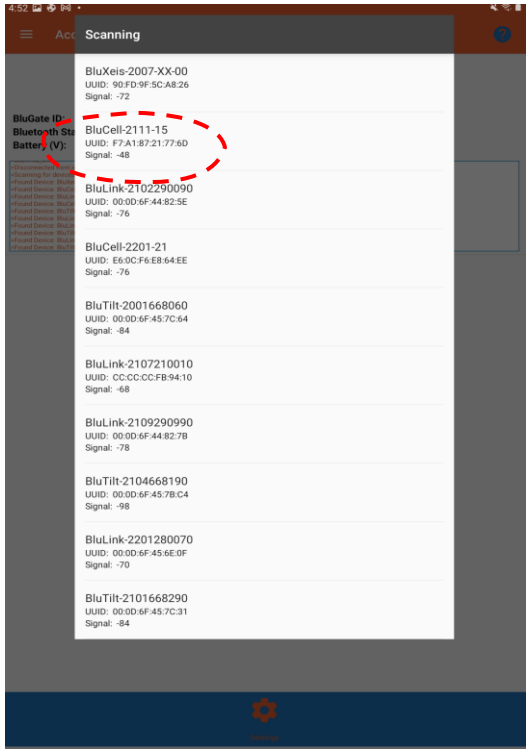
VantagePoint

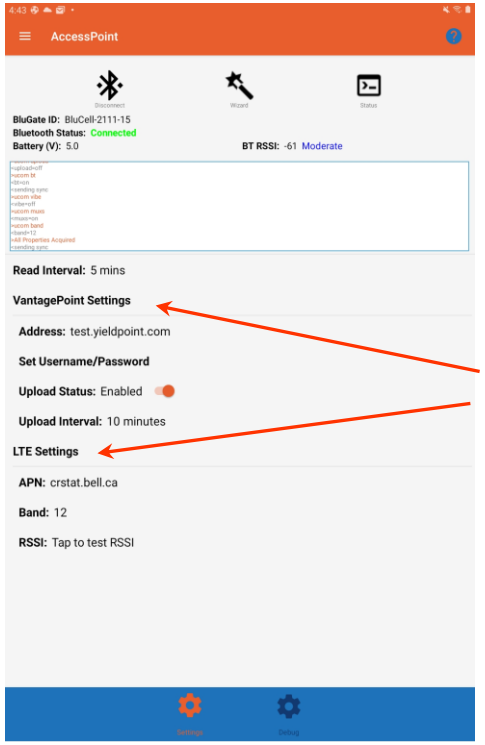
Category 3: Loggers and Gateways



1. Open BluPoint and drag from the left to show Vantagepoint



2. Tap connect and select the BluCell ID



Tap to expand

3. VantagePoint will connect to the Gateway and retrieve parameters

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AccessPoint for managing gateways settings

Signal strength or RSSI

RSSI (Received Signal Strength Indicator): Radios can communicate down to an RSSI of -92.

Range: -40 to -60 Good
-60 to -80 Moderate
<-80 Poor

IMPORTANT: Whatever the orientation of the device, the antenna should be VERTICAL

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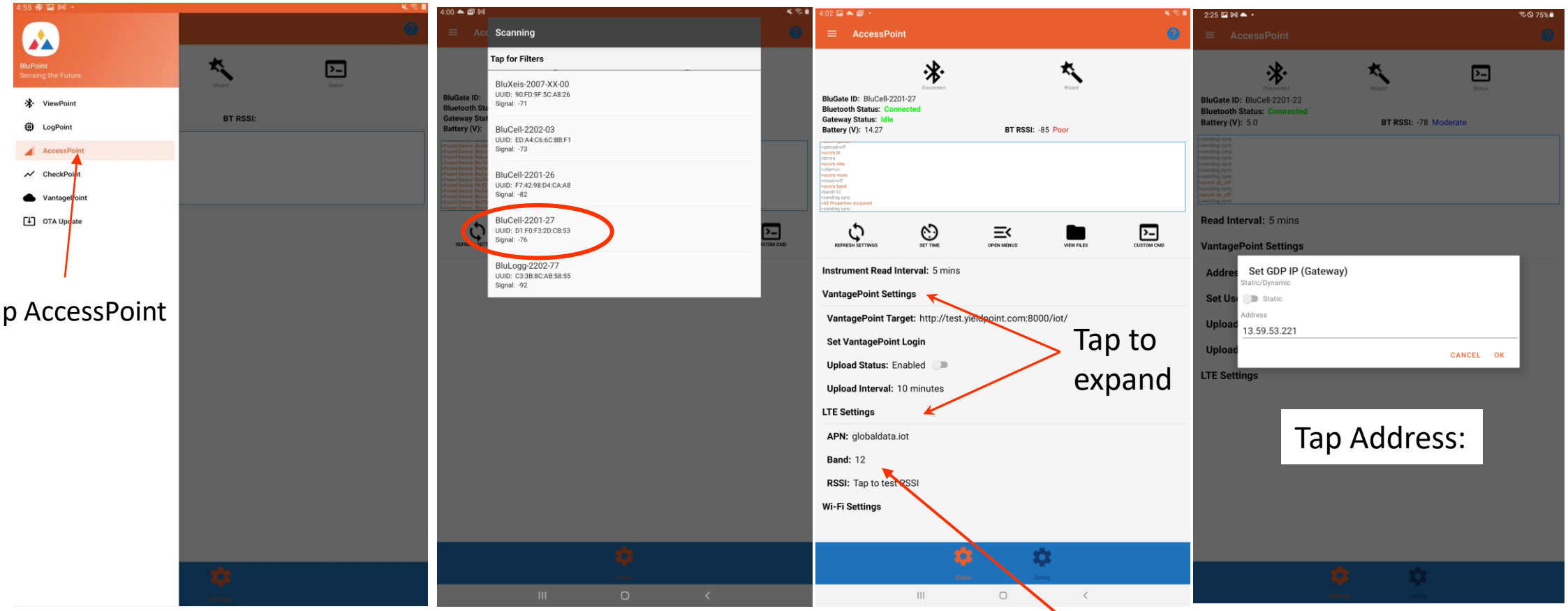
RSSI

AccessPoint is an Activity within the BluPoint App to manage gateway setup

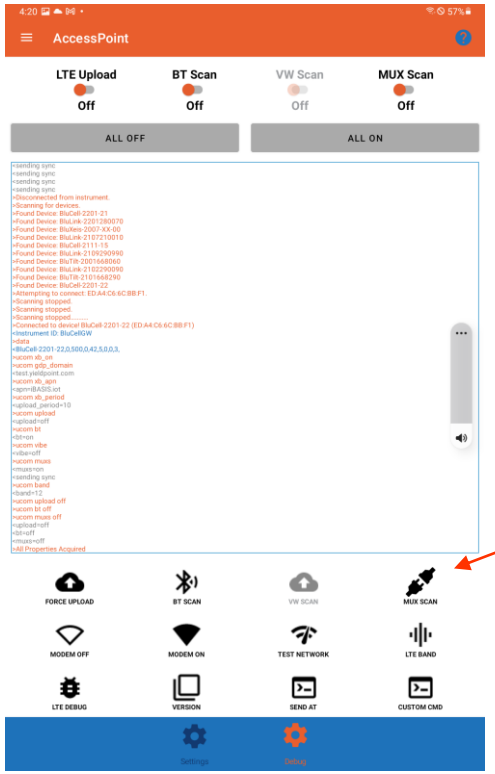


YieldPoint *Sensing the future*

AccessPoint

MUX 4 x RS485 instruments

Tap “ALL OFF” to suspend all auto tasks



Find instruments plugged into the 4 x YP RS485 instrument ports

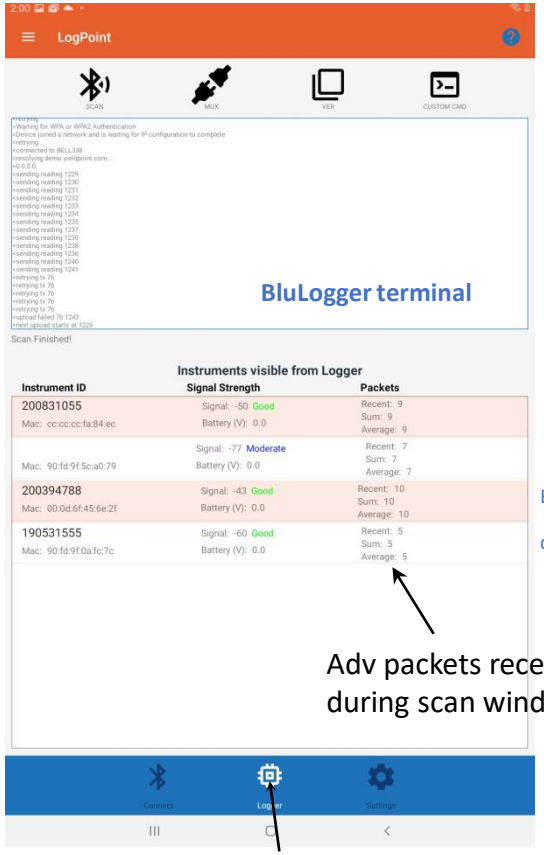
```
>ucom mux
<Reading MUX ports
<:YP,210721001,d1EXTO,21,+ 18.1,C, 52.01,mm,
<Port 2: No Ins found
<Port 3: No Ins found
<Port 4: No Ins found
<mem write 18378
<Muxing done
```

d1Exto on Port 1

Port 1 Written to memory

YieldPoint *Sensing the future*

Rs485 Mux



d2EXTO + BluLink

BluWire

dExto + BluLink

Adv packets received during scan window

The Logger Button

Custom commands:

SCAN BluLogger will scan all instruments within a 100m radius of the BluLogger.
Important: The BluLogger (BT 5) will detect instruments that the Android device (BLE 4.2) will not.

SYNC Sync the time/date on the BluLogger with this Android device

VER Returns the BluLogger Firmware Version

CUSTOM Send a custom BluLogger Command.

YieldPoint *Sensing the future*

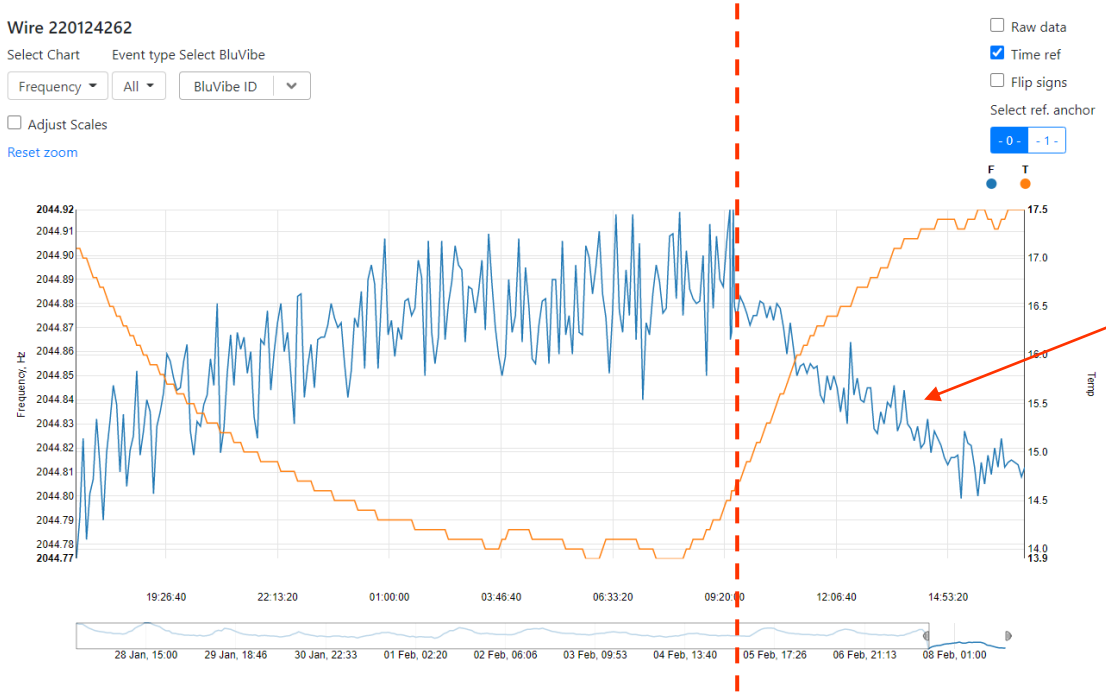
Scan BT5 beacons

VW Range setup

Freq Ch# Start(Hz) Span(Hz)

freq 2 1000 4000

freq 2 1800 500



Chirp is from 1800hz to 2300Hz

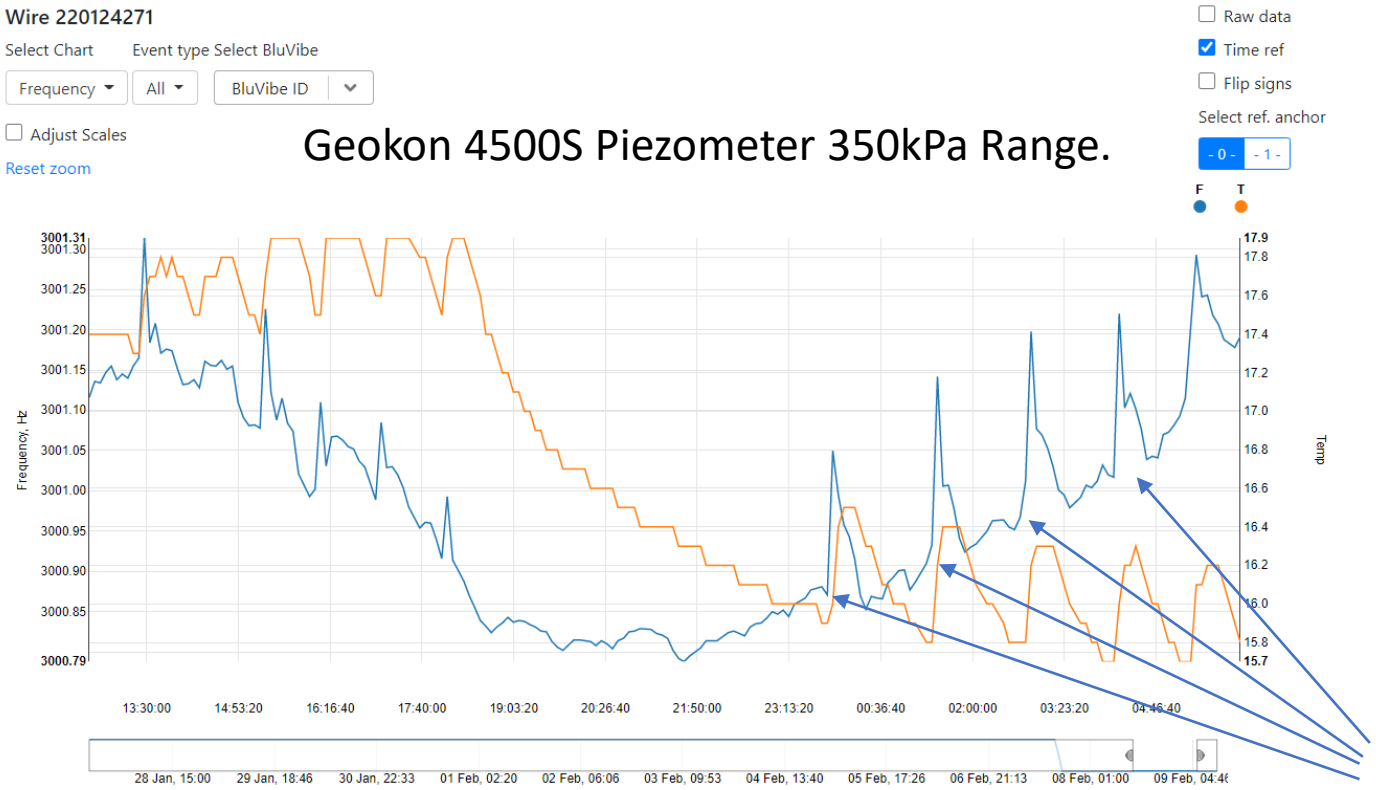
Reduced noise due to lower frequency range for excitation chirp

Output from Roctest PWL -70kPa vented piezometer

YieldPoint *Sensing the future*

4 x VW ports

VW Range setup

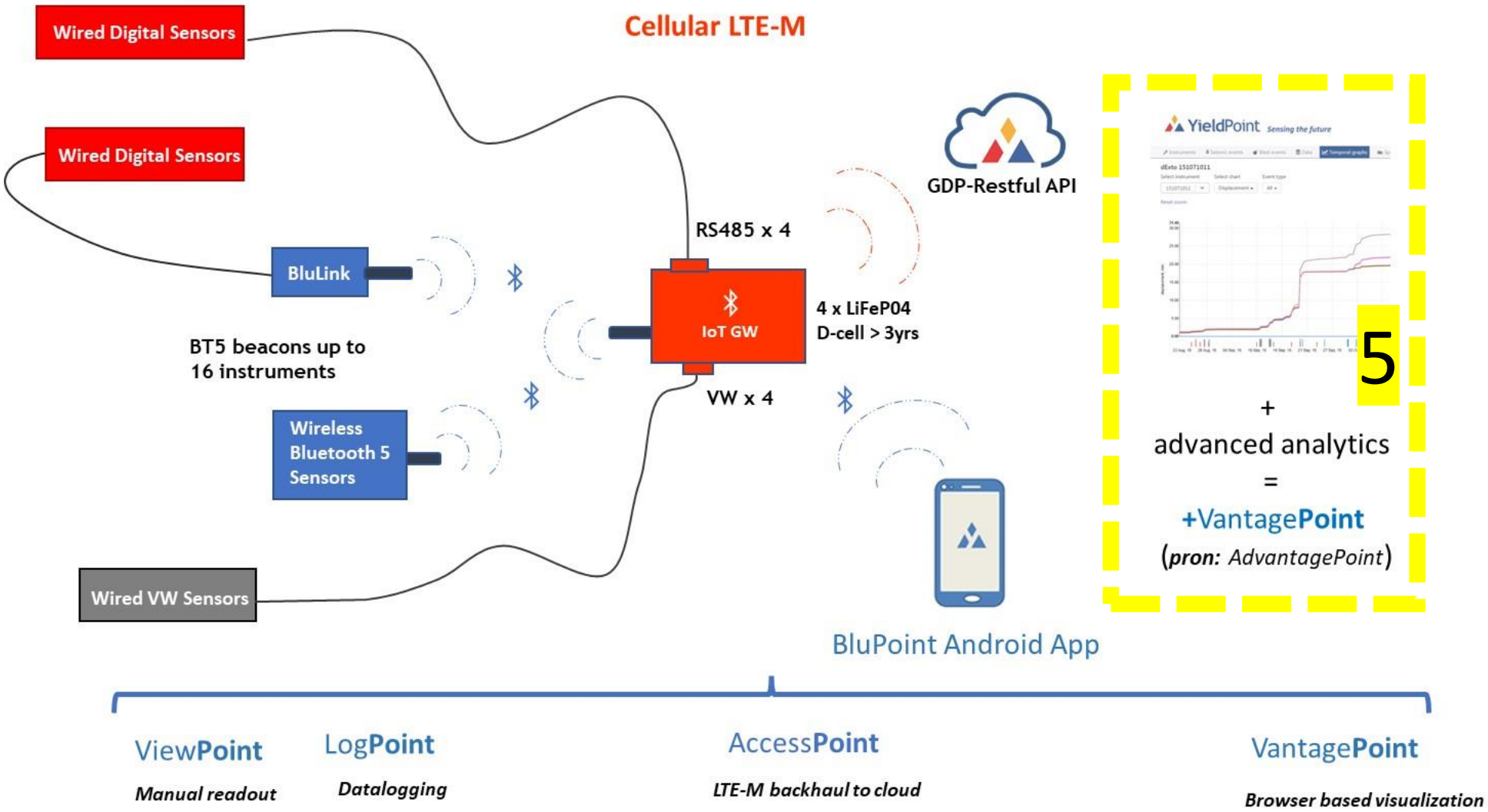


Geokon 4500S Piezometer 350kPa Range.

ΔP due to Indoor Heating system cycles

YieldPoint *Sensing the future*

4 x VW Ports



YieldPoint *Sensing the future*

4: Android BluPoint App

Instruments

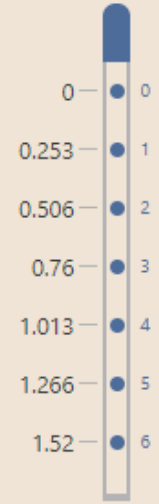
Quick search: 160371010 [Search] Rows: 20

Instrument ID	Type	Level	Project	Location	+ New
160371010	dExto	5	C	C	

Instrument ID: 160371010
Instrument type: dExto
Channels: 7
Zero timestamp:
Project: C
Location: C
Coordinates: east:, north:, depth:
Level: 5
Borehole:
Install date:
Installed by:
Purpose:
Notes:

Head at: toe

Anchors:



YieldPoint *Sensing the future*

Instrument Configuration

dExto 160371010

Select instrument: 160371010 | Rows: 20

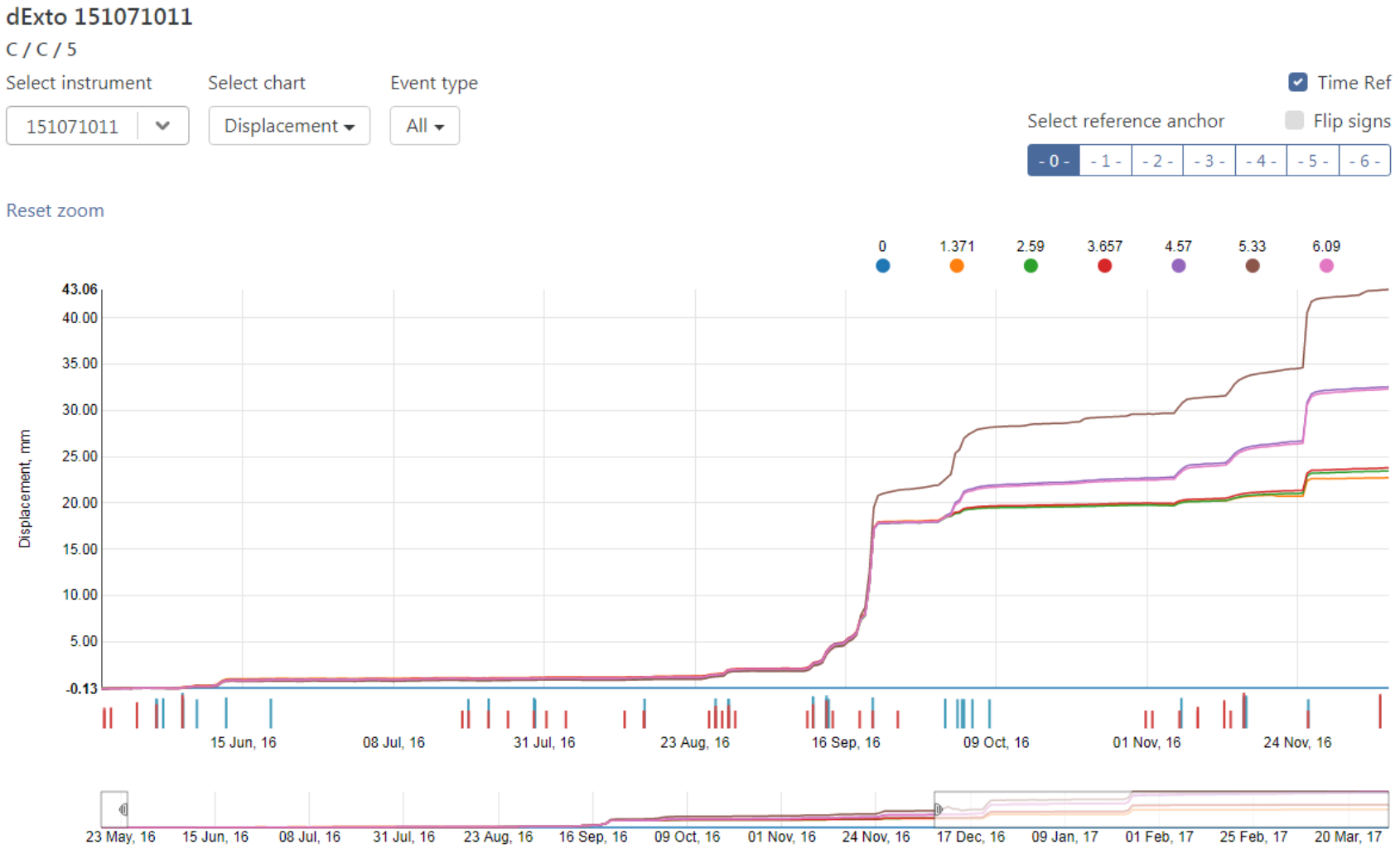
1 2 3 4 ... »

Export data | Import data

Date	0	0.253	0.506	0.76	1.013	1.266	1.52	Temperature	+ New
2016-05-19 10:00:44	0.00	20.63	20.95	21.07	20.87	20.57	20.56	34.9	
2016-05-19 11:00:43	0.00	20.64	20.94	21.05	20.86	20.57	20.54	35	
2016-05-19 12:00:43	0.00	20.64	20.95	21.07	20.87	20.57	20.55	35	
2016-05-19 13:00:43	0.00	20.64	20.94	21.05	20.86	20.56	20.54	35	
2016-05-19 14:00:43	0.00	20.63	20.94	21.06	20.87	20.56	20.54	35	
2016-05-19 15:00:43	0.00	20.63	20.94	21.05	20.86	20.57	20.54	35	
2016-05-19 16:00:43	0.00	20.62	20.93	21.07	20.87	20.57	20.55	35	
2016-05-19 17:00:42	0.00	20.63	20.94	21.05	20.85	20.56	20.54	35	

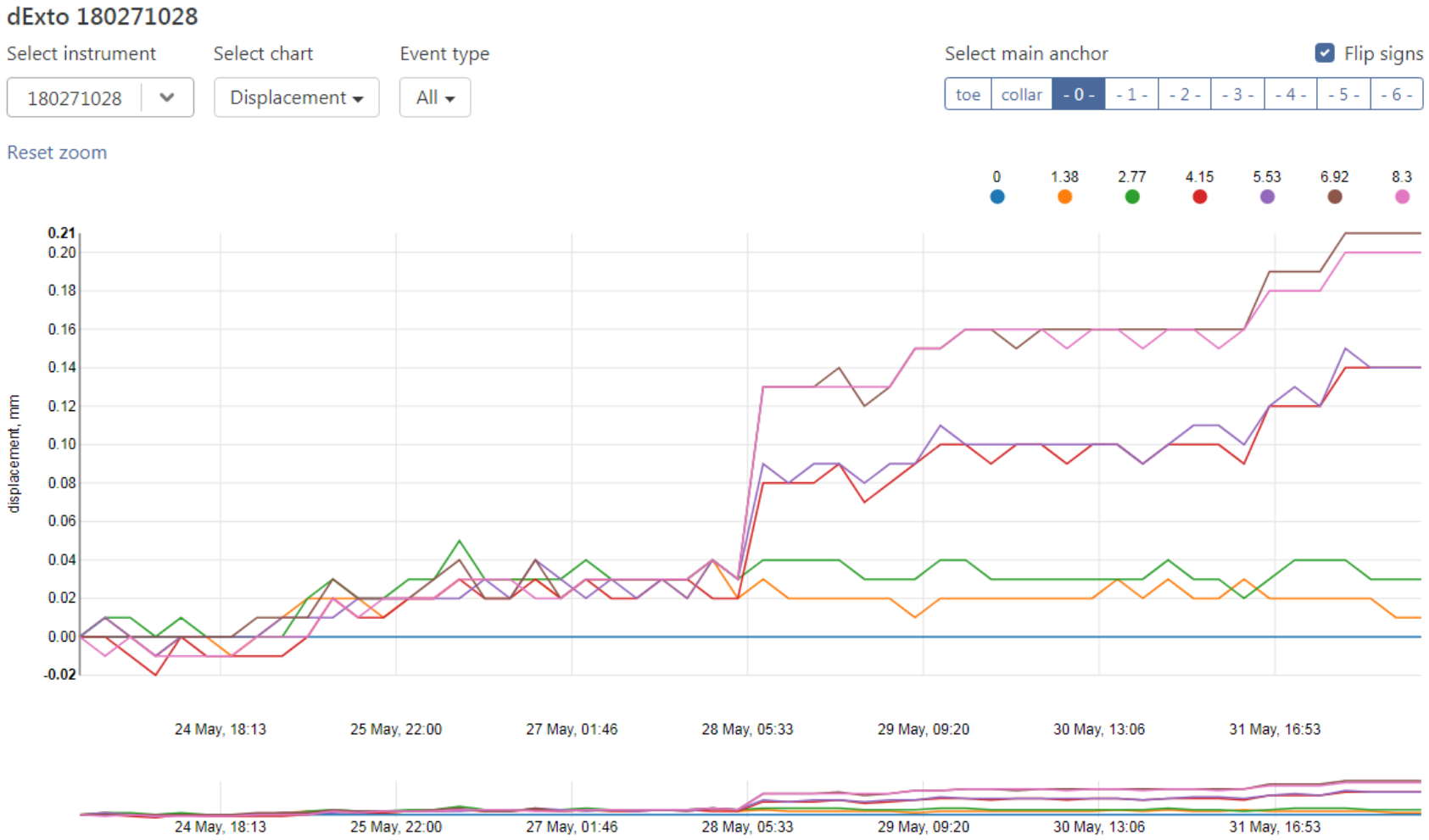
YieldPoint *Sensing the future*

The time-series dataset



YieldPoint *Sensing the future*

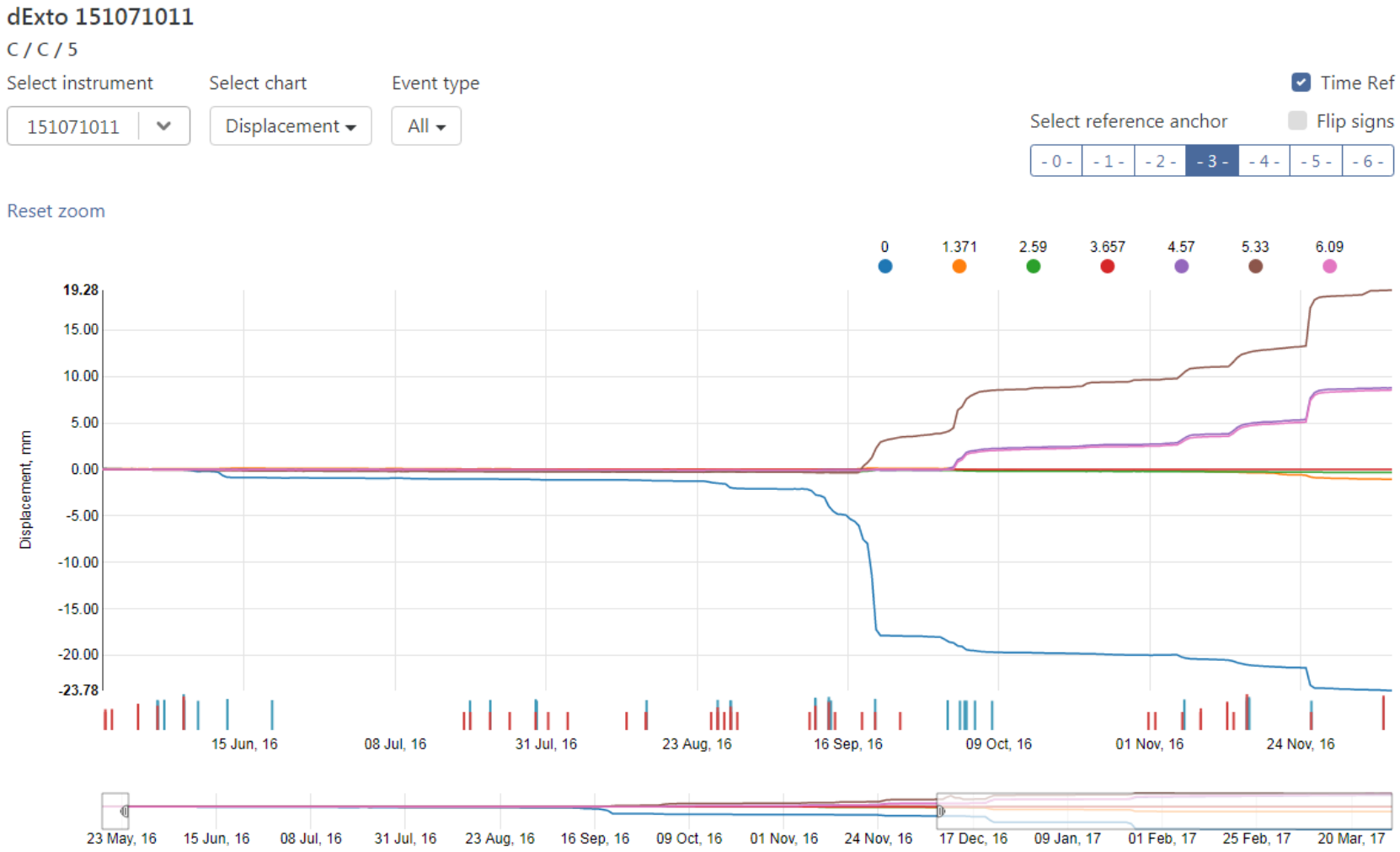
VantagePoint: Temporal plot



YieldPoint *Sensing the future*

VantagePoint: Temporal plot - Hi Res

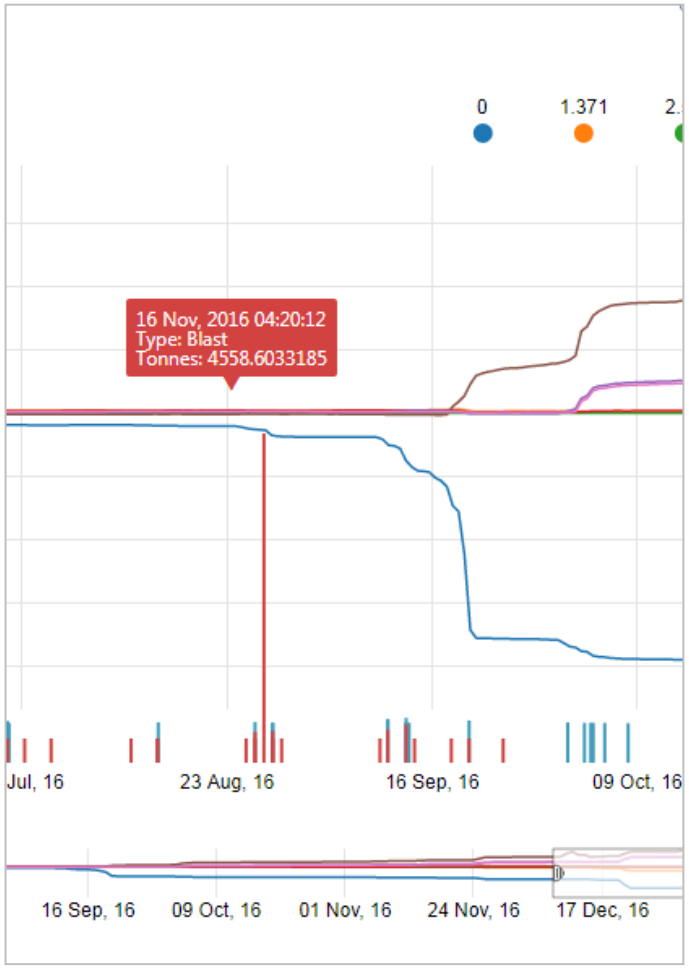
Reference to center of pillar



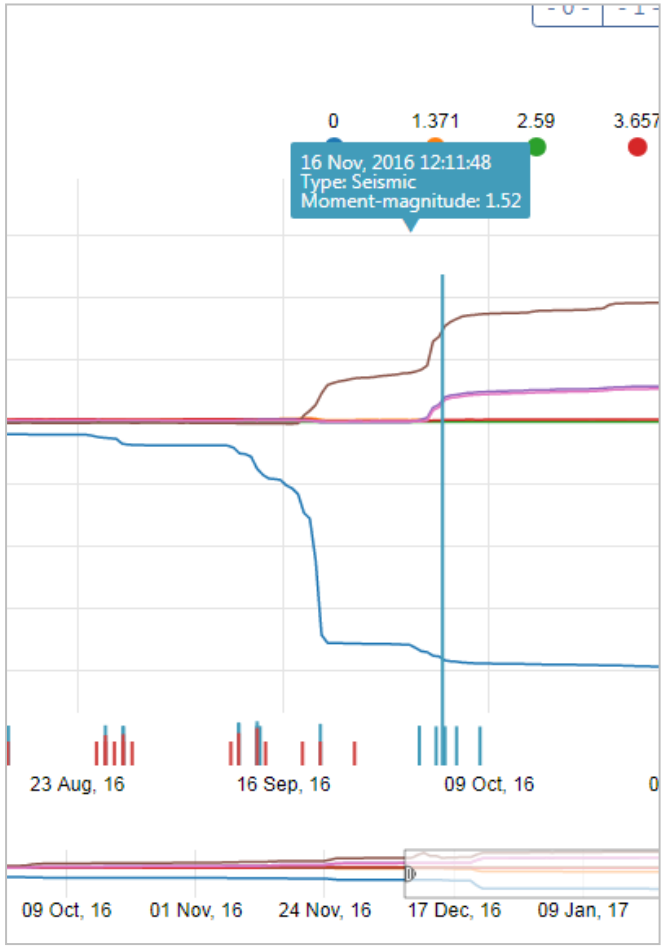
YieldPoint *Sensing the future*

VantagePoint: Reference Anchor

Blasting event



Seismic event



YieldPoint *Sensing the future*

VantagePoint: Events

Category 5: The Cloud - VantagePoint

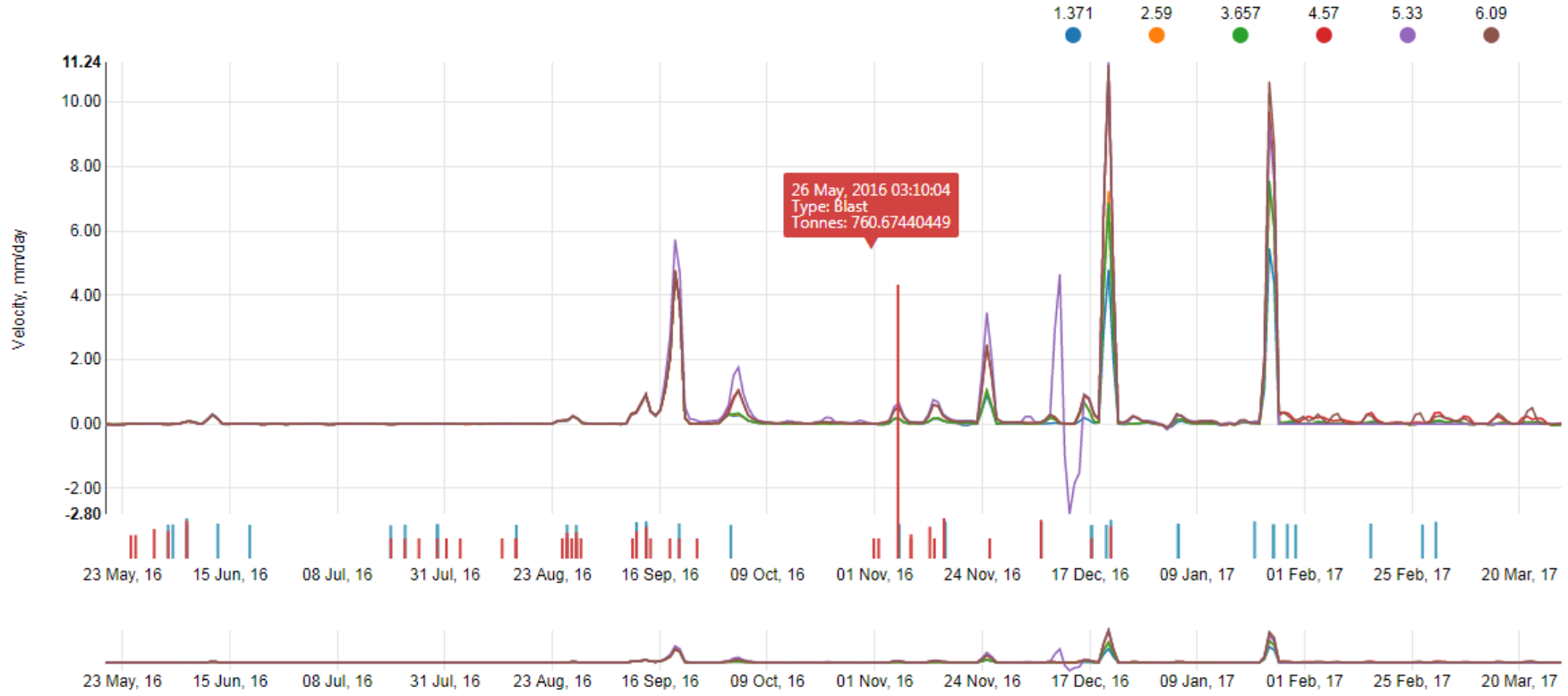
dExto 151071011

C / C / 5

Select instrument | Select chart | Event type

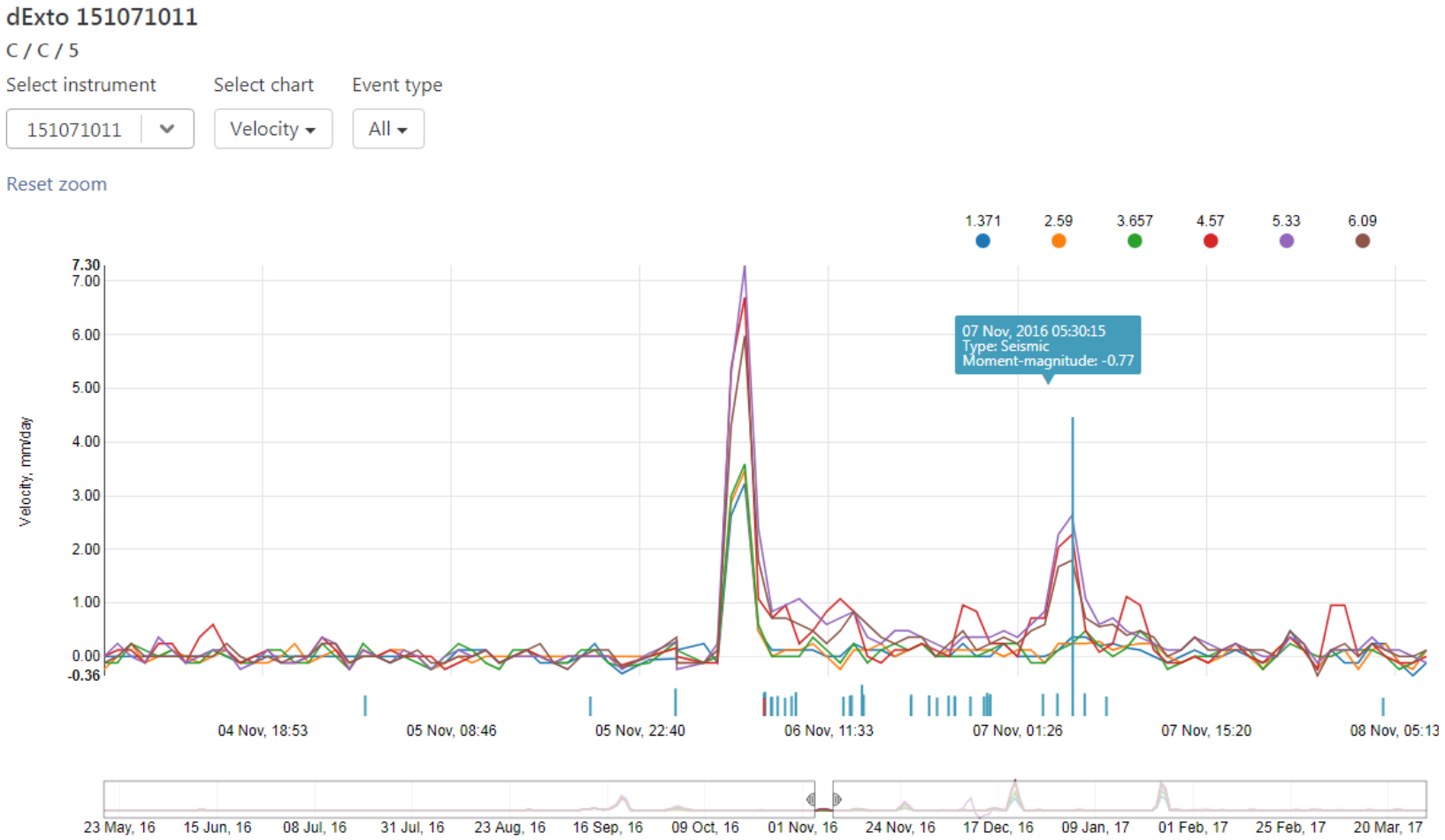
151071011 | Velocity | All

Reset zoom



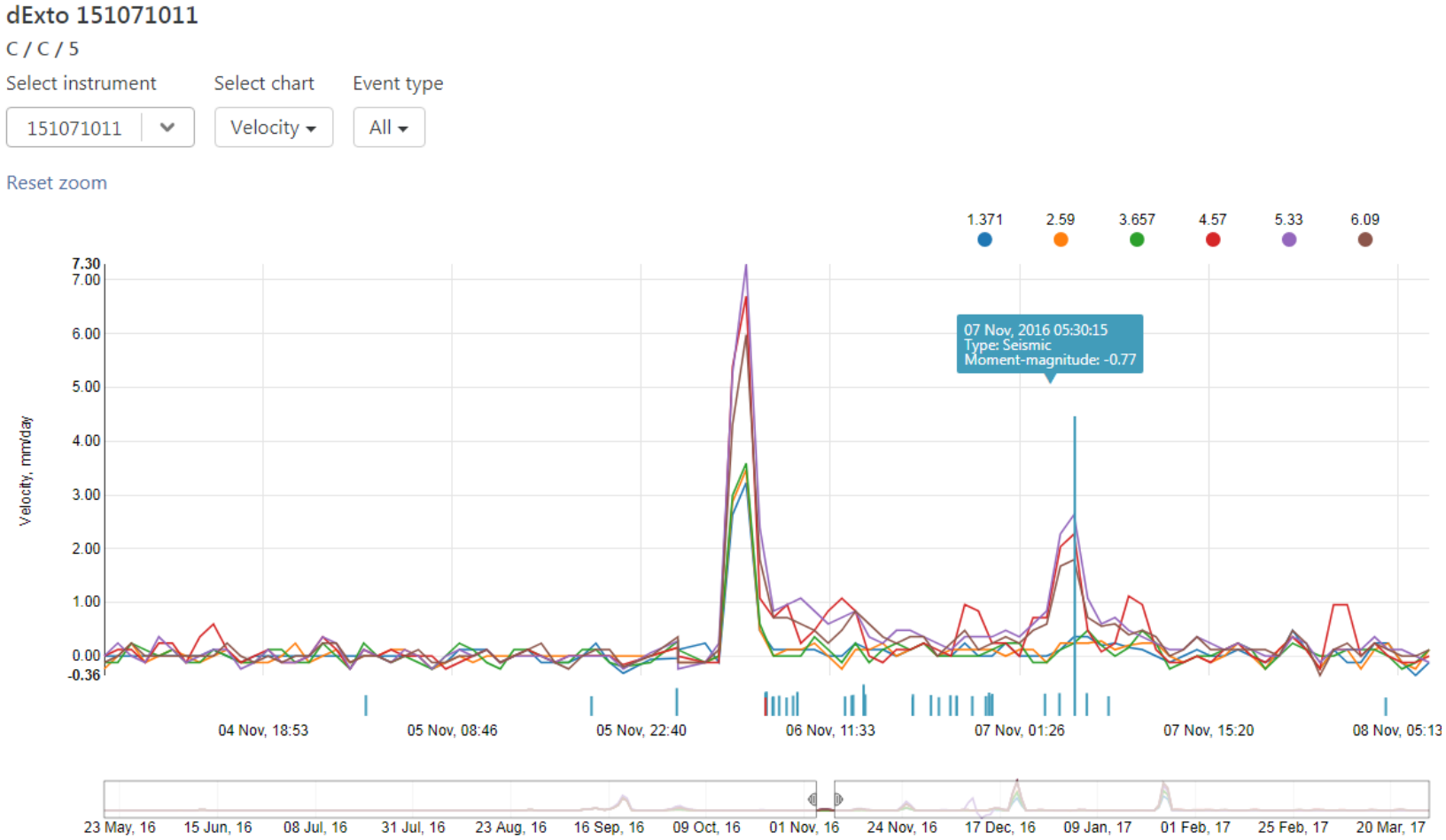
YieldPoint *Sensing the future*

VantagePoint: Velocity



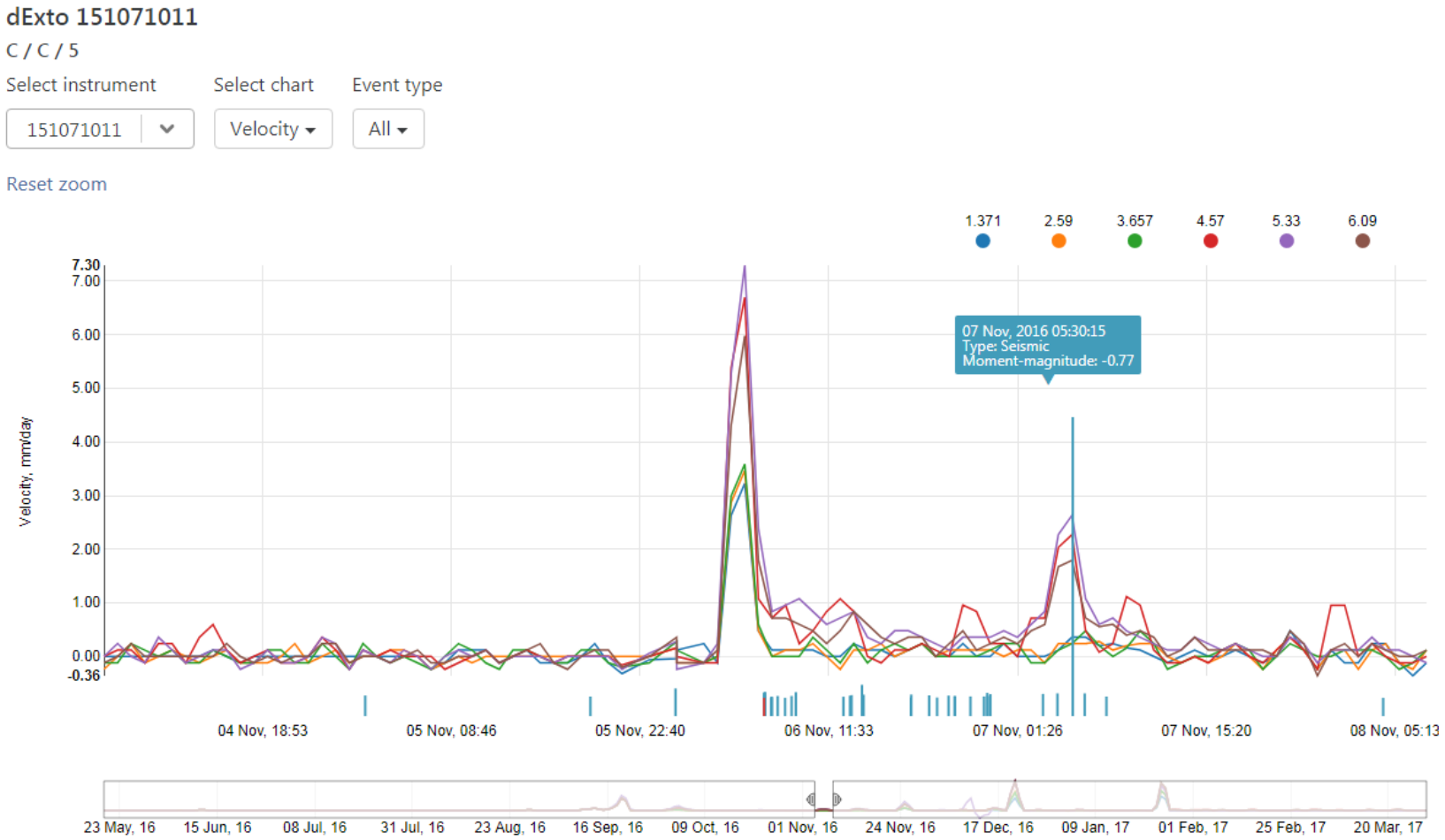
YieldPoint *Sensing the future*

VantagePoint: Zoom in on events



YieldPoint *Sensing the future*

VantagePoint: Zoom in on events



YieldPoint *Sensing the future*

VantagePoint: Zoom in on events

1for1 Radio

1for1 Ethernet Gateway

Ethernet gateways are used to push data to the VantagePoint either via our 1 for 1 borehole radios or directly with lead wires.

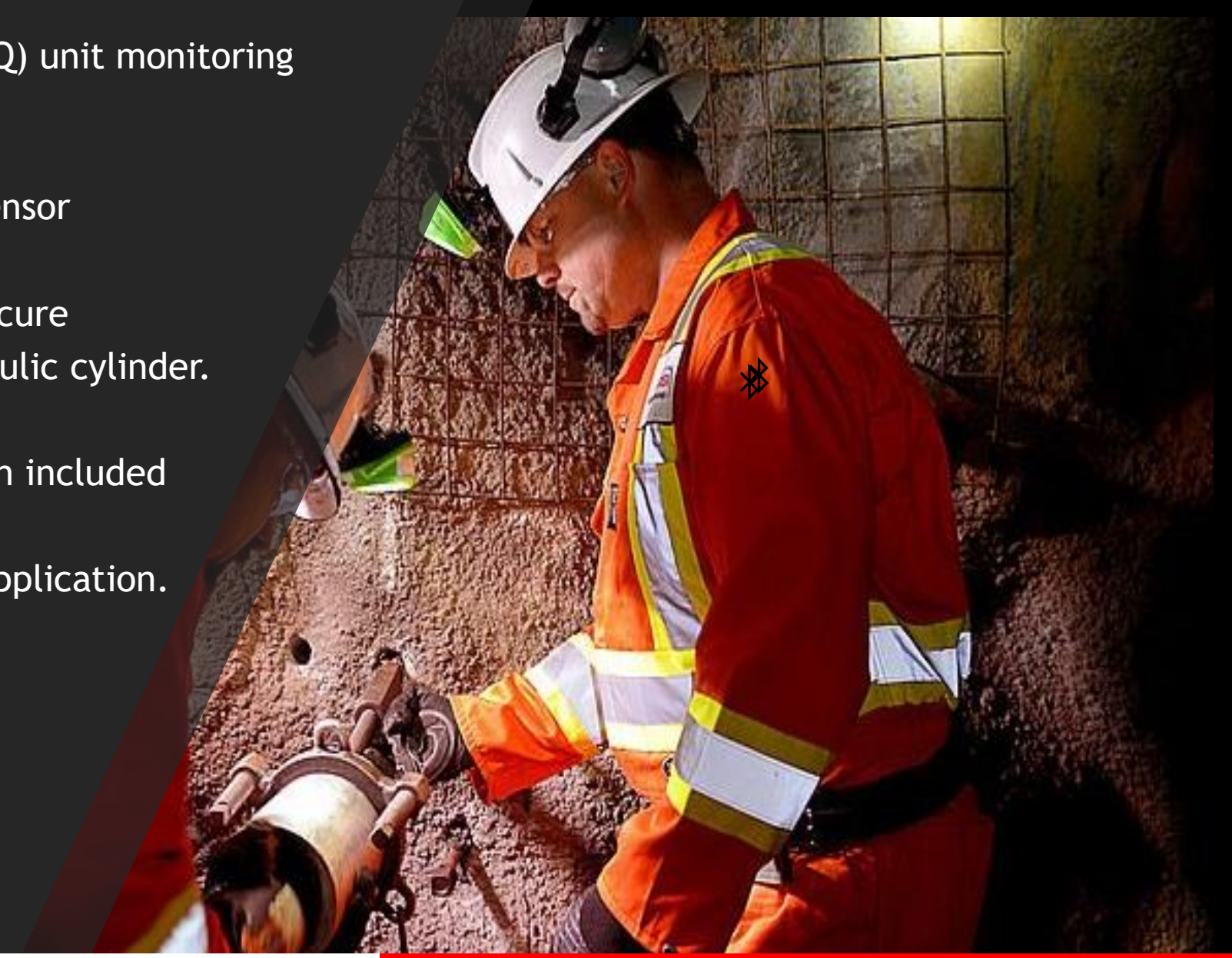
YieldPoint Sensing the future

1for1 900MHz mesh radios

Category 5: Micellaneous Products

Bluetooth BLE5 Data Acquisition (DAQ) unit monitoring at 1 reading/sec.

- Magnetostrictive displacement sensor
- 10,000 psi pressure transducer
- Custom engineered fixtures to secure displacement sensor to the hydraulic cylinder.
- Optional load cells.
- Easy-to-use software operating on included Android tablet.
- Rugged design for underground application.
- Hardened carrying case.



YieldPoint *Sensing the future*

PullTest