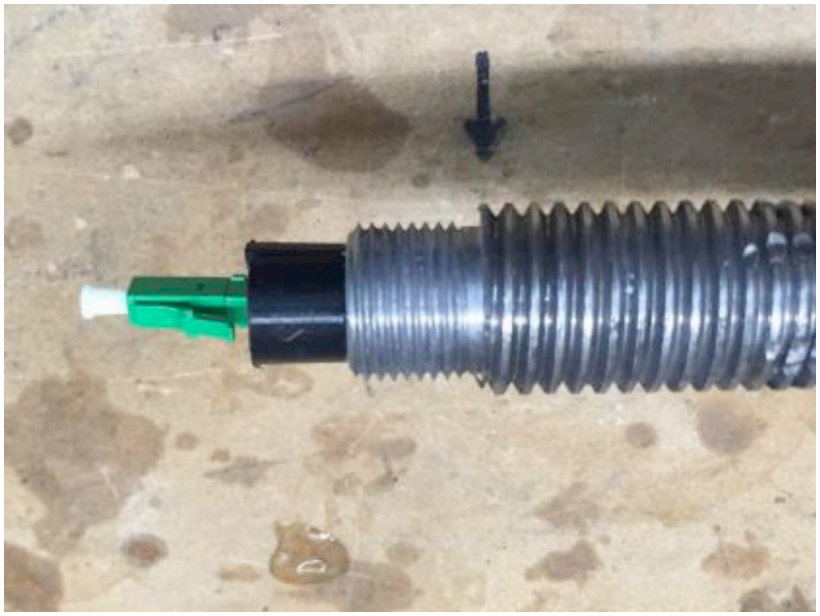
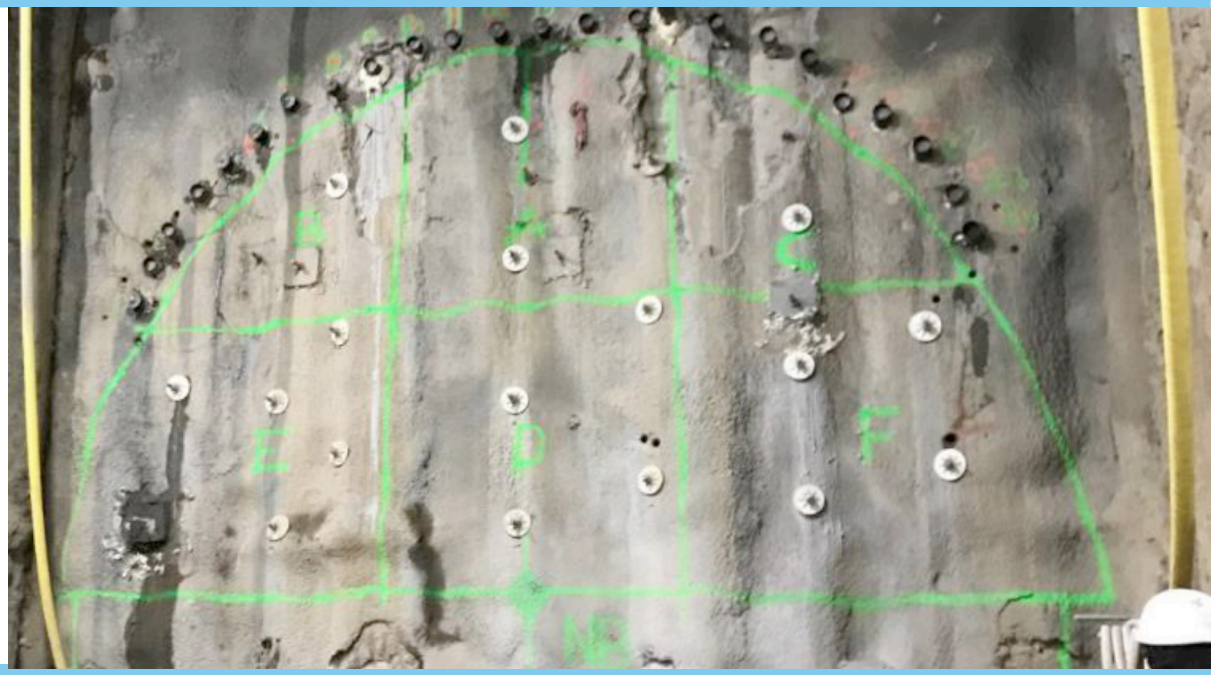
GEOSYSTEMS

FIBRE OPTIC INSTRUMENTED ROCK BOLTS





An IRB, or Instrumented Rock Bolt, is the perfect way to monitor the strain on a rock mass and on the surrounding ground control instrumentation. IRBs can be interspersed with standard rock bolts (e.g. 1-in-20 to 1-in-50 bolts as IRBs, depending on the area being monitored and design pattern of bolts) which can be surveyed with an optic fibre interrogator, either directly from the head of the bolt, or from dozens to hundreds of metres away when long optic fibre leads are specified for bolts installed in hazardous areas. This state of the art technology allows detection of both axial and shear failures, crucially enabling engineers to verify good or bad bolt pattern design. This empirical data can be fed into models for improved design and potentially massive cost savings in not over bolting.

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APPLICATIONS

- Suitable for rock mines, storage caverns, road and rail tunnels and coal mines
- Inherently safe and IS certifiable optical rock bolts
- Measurement of strain profile rather than localized strains
- Measurement of shear and axial longitudinal strain
- Spatial resolution from 5cm down to 1mm
- Operational accuracy better than +/-10 microstrains
- Instrumented optical bolt cost minimized
- Suitable to a variety of rock bolts : rebar, threadbar, NMX, CT, AT & AX grade bolts
- Clusters of bolts that can be monitored simultaneously

FIBRE OPTIC IRB

Rock bolts are subjected to a combination of axial and shear loading. Over the life cycle of the excavation, rock movements may transition from distributed to discrete as cracks and shear zones localise.

Accurately monitoring the strain profile of fully grouted rock bolts reveals much about rock mass behaviour around an excavation and about the rock bolts. Optical Strain Sensing represent the perfect solution for strain monitoring for most bolt types.

An optical fibre is embedded along 3 grooves machined along the length of the rock bolt. The delta 120° arrangement allows excellent resolution on axial strain and shear vector.

An optical connector is mounted at the end of the bolt. This connector is protected by a metal cap during both shipping and installation.

The optical bolt is installed with standard methods. The cap is removed for connection to the optical cable coming from the optical analyser. A new cap is mounted to permanently protect the optical connector and cable if shot-crete is not used.

The optical analyser can be located several hundreds of meters away from the bolts in a safe zone meaning this solution can be adopted in hazardous and explosive environments such as coal mines.

SENSOR SPECIFICATIONS

Standard sensor lengths	Available from 1m to 100 m
Sensor diameter	155 µm
Operating temperature range	-40 to 300 °C
Fibre type	Polyimide coated low bend loss fibre
Connector	LC/APC

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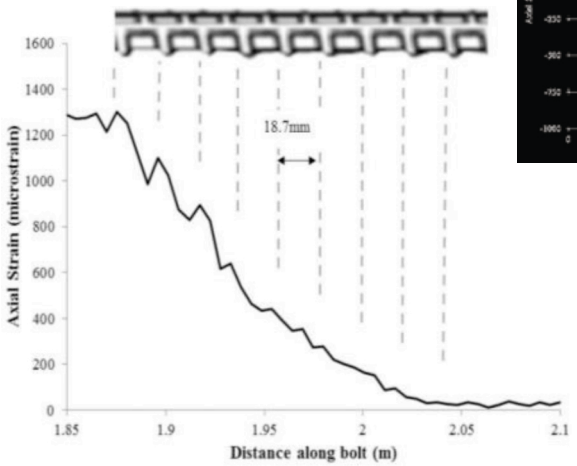
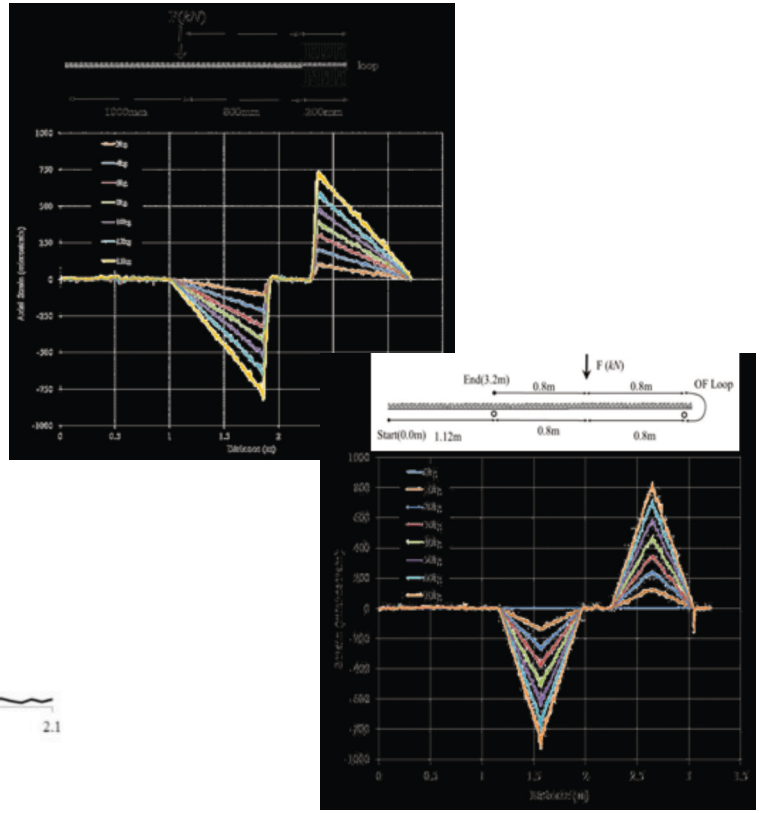
FIBRE OPTIC READER SPECIFICATIONS

Number of channels per system		Up to 8 channels
Max sensor length (per channel)	Regular mode	20 m
	Extended range	100 m
Max gage pitch	Up to 30 m sensors	0.65 mm (1,538 gauges per meter)
	100 m sensors	2.6 mm (384 gauges per meter)
Strain measurement range		+/- 15,000 ue
Max non sensing cable length (connects instrument to sensor)		Up to 200 m per channel
Data interface		Ethernet





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