

Remote Monitoring Solutions for Underground Mines

Costly and more dangerous compared to surface mining, underground mining offers multiple challenges. The appropriate monitoring solution is critical to ensure safety and productivity of the mine. Ackcio Beam, powered by Ackcio Mesh has been built to ensure reliability in tough and demanding environments such as underground mines.

01 MONITORING PORE WATER PRESSURE

Piezometers measuring the pore water pressure are monitored in real-time using Ackcio **BEAM-VW-S1** (1 channel) and **BEAM-VW-S8** (8 channels) Nodes.

02 ACKCIO GATEWAY

The Ackcio **BEAM-GW** receives sensor data from the Nodes within the network. Ackcio's Snape software that runs on the Ackcio Gateway is used to configure and manage the project. It also provides the option to push the data via FTP and/or API server hosting a software (selected) of client's choice.

03 STRUCTURAL HEALTH MONITORING

Ackcio **BEAM-TM** Nodes bundle Ackcio's long-range wireless mesh technology with Sigeo's trusted bi-axial self-compensated MEMS inclinometer, monitoring the horizontal and vertical movement of the surrounding buildings.

04 SLOPE STABILITY MONITORING

Ackcio **BEAM-TM** Nodes can be used to measure the slope stability around the mine site.

05 IN-DEPTH GROUND DISPLACEMENT

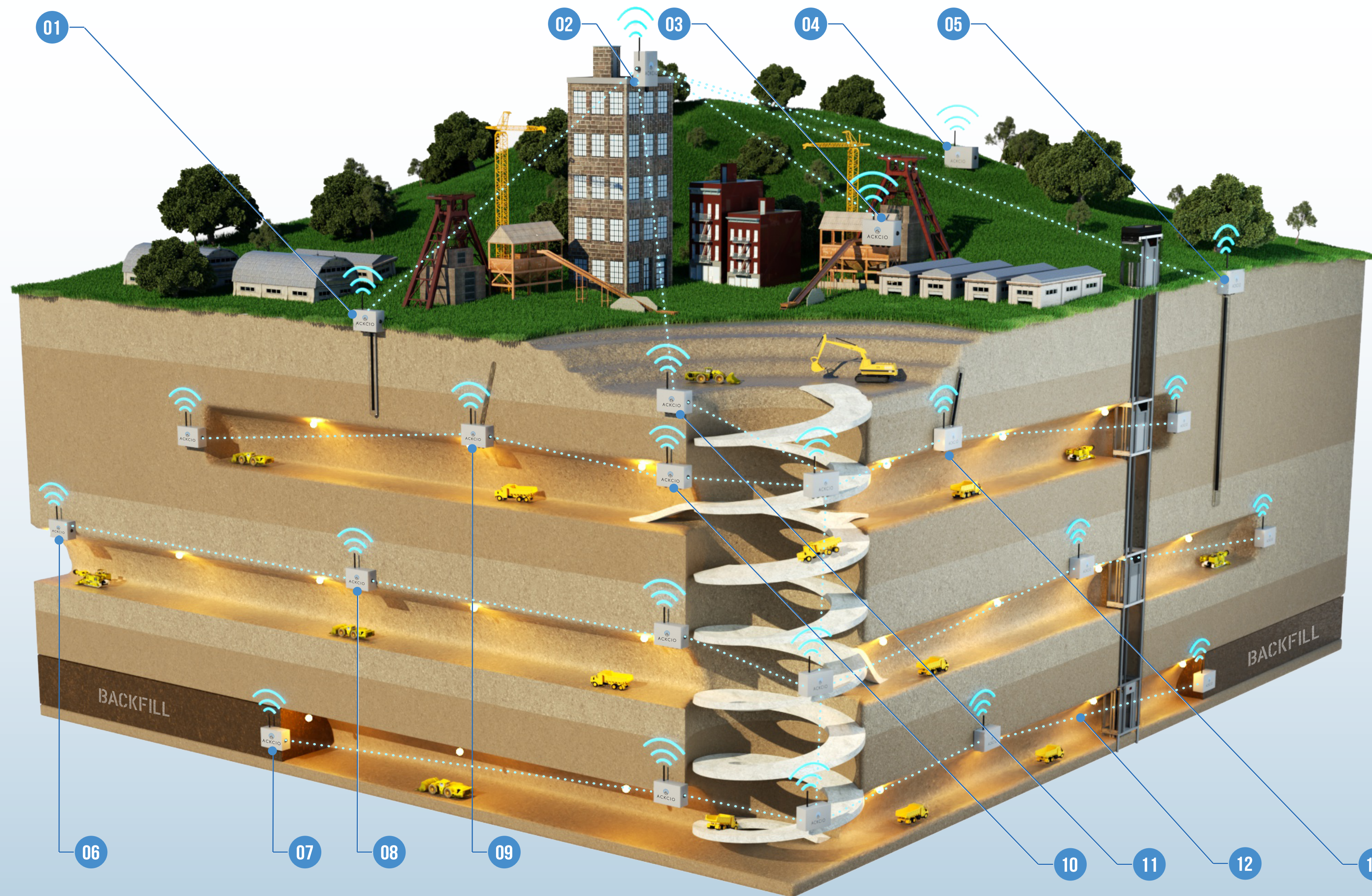
Settlement/lateral displacement is monitored by leading brands of digital in-place-inclinometers (IPI's)/MPBX/ extensometers/SAAs in real-time using Ackcio **BEAM-DG** Nodes.

06 MONITORING STRESS CHANGES

Ackcio **BEAM-VW-S8** (8 channels) Nodes automate the monitoring of a vibrating wire stress-meter in hard and soft rock applications.

07 BACKFILL MONITORING

Ackcio **BEAM-VW-S8** (8 channels) Nodes automate the monitoring of pressure cells measuring total earth pressure within the backfill.



08 INTEGRITY OF THE TUNNEL LINING

Ackcio **BEAM-VW-S1** (1 channel) and **BEAM-VW-S8** (8 channels) Nodes monitor strain gauges and load cells deployed throughout the tunnel shaft, along with convergence instruments, settlement cells, crack meters and other VW sensors.

09 SETTLEMENT DEFORMATION MONITORING

Ackcio **BEAM-AN-S4** (4 channels) Nodes automate the monitoring of a multi-point borehole extensometer (MPBX) that measures vertical deformation at various depths.

10 REPEATER NODES

If deployment challenges reduce the range of Ackcio Nodes, Ackcio **BEAM-RN** Nodes assist in extending the wireless range of other Ackcio Nodes within the network.

11 ACKCIO NODES

Each battery-operated Node acquires data from various sensors and transmits the sensor data wirelessly through the Ackcio Mesh network to the Ackcio Gateway.

12 ACKCIO MESH

Ackcio's patented long-range wireless **MESH** network connects the Ackcio Nodes to the Ackcio Gateway. The mesh network is self-healing, enhancing the transmission reliability. The ability to 'hop' up to 12 times significantly increases the reliability in complex, underground environments and offers the ability to go further and deeper underground. The system is highly flexible and scaleable.

13 SETTLEMENT DISPLACEMENT MONITORING

MPBX's and other digital instruments measure the displacement or deformation around the tunnels and shafts in real-time with Ackcio **BEAM-DG** Nodes.