

ACKCIO Series

Wireless Mesh Monitoring System

Mesh radio geotechnical monitoring systems are a powerful tool for underground mines and structures. They help engineers and managers:

- Better manage their project by providing data they need from the right instruments;
- Improve safety by automatically collecting data from a large number of instruments;
- Lower costs by connecting instruments over very long distances with minimal disruptions.



Why use ACKCIO?

Engineers and mine operators can obtain long-term, reliable and more comprehensive coverage of the tunnels, galleries or areas they wish to monitor. The cost of running instrument cables in large-scale instrumentation projects is often prohibitive and becomes a deterrent to the installation of robust and thorough monitoring systems. Other radio solutions require line of sight and do not offer the option for data to be relayed wirelessly. With a fully integrated mesh product data can be relayed around bends, twists and turns and even be re-routed automatically should communications be impeded between two nodes. The system's long-lasting battery life makes it an ideal solution for hard-to access tunnels.

How do they work?

ACKCIO's mesh system integrates a low-power and long-range radio with state-of-the-art geotechnical sensors. Instruments are directly wired to the node. The nodes perform acquisition and transfer data over radio to a gateway where all data is centralized.

Example Applications

❑ Barricades and backfilling

With dataloggers connected in a mesh network, it is safer and easier to monitor the level of backfill by doing it remotely in real-time.

❑ Convergence monitoring

Tunnels need to be closely monitored for clearance for safety purposes. Using a combination of rock bolts, inclinometers and extensometers provides the information required for safe operations. With the ACKCIO products, data can be relayed directly to the station or the offices for real-time monitoring and modeling, triggering alarms as needed.

❑ Ground stability

Underground mines in the arctic use thermistor strings to monitor the temperature of permafrost in the vicinity of the mine. These instruments are often located out of the way and manually collecting their measurements requires precious time from field staff. By strategically locating relay nodes, data can be entirely collected remotely and be used in tracking and modeling of the mine behavior.

Technical Features

❑ Gateway

The gateway receives data from and coordinates the nodes in its network. Its large on-board memory can store years of readings.

The gateway has several connectivity options including Wi-Fi, Ethernet and cellular.

❑ Nodes

Nodes contain an on-board circuit that performs measurement on many types of instruments.

They can be connected locally and configured using a USB cable and an Android application. During deployment, this application provides instant feedback on radio signal strength back to the gateway, removing all the guesswork often associated with radio-enabled systems.

Options

❑ Nodes

Options include vibrating wire, digital, tiltmeter and analogue nodes, covering all use cases for monitoring.

❑ Wide compatibility

Instruments from leading manufacturers are supported natively, such as multi-point borehole extensometers, rock bolts, tiltmeters and more. The analogue node opens the system to any instrument with generic 0-5 V, bridge completion or 4-20 mA output.

❑ Flexibility

With a self-healing mesh network, relay nodes and a large number of hops, the ACKCIO networks can be adapted for any mine.

Technical Information

❑ Battery life

Up to 5 years. Varies depending on sampling rate, number of hops and instrument types.

❑ Data storage

Each node can store years' worth of data. The gateway has 16 Gb onboard memory.

❑ Radio range

Up to 10 km (surface) or 1 km (underground) per hop with line of sight. Up to 8 hops. Up to 50 nodes per gateway.

❑ Temperature range

-40 °C to 80 °C

❑ Compatible instruments

Vibrating wire instruments (1 and 8 channel options)

Analogue instruments (1 sensor with 2 outputs or 4 sensors with 2 outputs)

- Thermistors
- RTDs
- Bridge Strain gages
- Thermocouples
- Potentiometers
- ± 10 V
- 0-20 mA

Digital instruments

- Campbell Scientific
- YieldPoint
- SAA
- Geokon
- Geosense
- Sisgeo

❑ Vibrating wire Node

Measurement range: 450 to 6000 Hz
 Resolution (-40 to +85°C): 0.01 Hz
 Accuracy (-40 to +85°C): 0.04 % FS

Thermistor

Resolution: 0.1°C
 Accuracy (20°C): 0.05°C

Barometer

Pressure Range: 300 to 1100 hPa
 Resolution: 0.18Pa
 Accuracy: 1.7 hPa

❑ Tiltmeter Node

Type: MEMS (Micro-Electro-Mechanical System)
 Inclinometer Range: ± 15°
 Accuracy (± 15°): 0.01°
 Axes: biaxial

❑ Analogue Node

Power supply:
 5 V DC / 12 V DC / 24 V DC up to 60 mA selectable for each channel

Voltage

Measuring ranges [V DC]: ±10; ±1.25
 Accuracy (-40 to +85°C): ± 0.05 % FS

Current loop (2-3 wires)

Measuring range: 0-20 mA
 Accuracy (0 to +50°C): 0.05 % FS

Full wheatstone bridge

Accuracy (0 to -50°C): ± 0.25 % FS

Thermistor

Accuracy (-20 to -50°C): 0.2 °C

The exact technical specifications will be set by the requirements of your project.

GKM Consultants will help you select the right instruments to tailor your system to your needs.