Wireless Monitoring System

Long-range radio data acquisition systems (LS Series) constitute a new tool in the geotechnical and structural monitoring world. The LS systems help users:

- Better manage their structure or project by providing data from the instruments of their choice;
- Improve the protection of large structure by connecting large arrays of instruments;
- Lower costs by connecting instruments over long distances without the need for cabling.

Why use the LS Series?

Engineers and project owners can obtain long-term, reliable and more comprehensive coverage of the structures or areas they wish to monitor at a lower cost. While the DL Series can connect a large number of instruments in a small area more efficiently, difficulties quickly arise when projects contain large areas or structures. 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. Deploying the LS Series and taking advantage of its kilometre-range radio reduces costs for a wide range of projects.

How do they work?

GKM Consultants’ long-range systems integrate a new high-range, low-power radio with state-of-the-art geotechnical sensors. The system is built around a nodes-gateway structure. Instruments are directly wired connected to nodes, which acquire and transfer data over long distances to a gateway where all data is centralized and accessible.

Example applications

- **Mine tailings**
  Mine tailings often require a large number of instruments spread out over a large area. A common situation is to have wells instrumented with piezometers along a several-kilometre-long dike. Using the LS Series makes it possible to cover distances up to 15 km (with a free line of sight) to transmit measurements to a base station.

- **Structural health**
  Structures such as bridges, railways and highways often span long distances. With the LS Series, a wide range of instruments, including tiltmeters and settlement systems, can all be linked to a central station (the gateway).

- **Urban tunneling**
  Large tunnels in urban environments can pose challenges with regard to the protection of surrounding buildings. To monitor their effects, a large number of instruments, such as tiltmeters, are attached to buildings and structures. Running cables up and down buildings and across streets back to a central logger is expensive and sometimes simply not possible. Implementation of an LS Series system can cover a large number of buildings in a 600 square kilometre area for a fraction of the cost of standard instrumentation.
Technical Features

**Gateway**

The gateway receives data and coordinates the nodes in its network. Up to 100 nodes can be connected to a single gateway. Its large on-board memory can store years of readings.

It hosts a cellular modem, ensuring permanent connectivity. The gateway regularly uploads its data to GKM Consultants’ servers for analysis and visualization on our remote data management system (RDMS).

**Nodes**

Nodes contain an on-board circuit that performs measurement on many types of instruments. They hold several years’ worth of data.

They can be connected locally and configured using a USB cable and an Android application. During deployment, this application provides immediate information on radio signal strength back to the gateway, eliminating all the risk of installing a radio-enabled system with a signal that is too weak.

**Options**

**Local data logger**

Nodes can be used as a local data logger system without the use of a gateway to remotely retrieve data. This cost-effective option is convenient for localized monitoring where real-time is not required.

**Gateway Connections**

In most applications, the data is uploaded by the gateway through its on-board cellular modem.

Other connection options, such as a direct local connection or connection through a company network, are available for the gateway.

**Gateway Power**

The gateway is powered by a solar panel and battery or 120-220 V AC.
Battery life
Up to 10 years

Data storage
Each node can store up to 200,000 readings. The gateway has 8 Gb of on-board memory.

Radio range
Up to 15 km

Temperature range
-40 to 50 °C

Environmental protection rating
IP67

Compatible instruments
Vibrating wire instruments (1- and 5-channel options)
Analog instruments (4 channels)
- Thermistors
- RTDs
- Bridge Strain gages
- Thermocouples
- Potentiometers
- ±10 V
- 4-20 mA

Vibrating wire Node
Excitation voltage: ±5 V
Measurement range: 300 to 7000 Hz
Resolution (-40 to 85 °C): 0.12 Hz
Accuracy (-40 to 85 °C): 0.018% FS

Thermistor
Measurement range: 0 Ω to 4 MΩ
Resolution: 1 Ω
Accuracy (20 °C): 0.05 °C

Barometer
Pressure range: 300 to 1100 hPa

Tiltmeter Node
Type: MEMS (Micro-Electro-Mechanical System)
Inclinometer Range: ±15°
Accuracy (±5°): 0.004°
Accuracy (±15°): 0.025°
Resolution: 0.001°
Repeatability: 0.005°
Axes: Biaxial
Temperature sensor resolution: 0.1 °C
Temperature sensor accuracy: ±0.5 °C

Analog 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: 4-20 mA
Accuracy (0 to 50 °C): 0.05% FS

Potentiometer
Accuracy (0 to 50 °C): ±0.02% FS

Full wheatstone bridge
Accuracy (0 to -50 °C): ±0.1% FS

Thermistor
Accuracy (0 to 50 °C): ±0.2 °C

PT 100
Accuracy (20 °C): ±0.8 °C

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