Wireless solutions for surface and underground mining

Improve productivity and ensure safety in challenging environments
Comprehensive wireless solutions for mining applications

For more than 30 years, Eaton has provided complete wireless monitoring, control and networking solutions for the mining industry. Our products and solutions are used throughout the world in surface and underground mining for metal, mineral and coal processes.

Eaton’s proven solutions improve worker safety, mine security and equipment maintenance, helping to increase productivity and efficiency with lower costs. Eaton provides wire-free economics while delivering wire-like reliability for mining operations.

**Industrial wireless**

The Eaton ELPRO brand of products has helped companies in over 80 countries improve asset management and operations with reliable and secure wireless solutions that increase the effectiveness of monitoring and control.

Eaton is a mining industry leader providing wireless solutions that monitor and control remote machinery, collect critical process data from sensors, track physical and human assets and surveil operations and the environment.

Eaton provides a complete wireless solution for surface and underground mining operations. Industrial wireless mesh I/O radios, gateways, serial products, cellular routers, Ethernet modems and industrial-grade Ethernet switches meet the demands of rugged long-distance applications of the mining industry. The Eaton network management system lets you easily manage network complexities and the interoperation of diverse wireless and wired LAN equipment from a single location. The Eaton System Solutions group works with you to connect your diverse automation systems, instrumentation and controls, and to integrate your processes.

**Mobile machine control**

OMNEX Trusted Wireless™ mobile machine control transmitters, receivers and expansion modules provide safe, reliable control in harsh mining environments.

OMNEX is an industry pioneer and the leader in developing rugged radio remote controls for heavy machinery and field operations. OMNEX remote control products wirelessly control high-value hydraulic machinery in harsh environments with utmost reliability, precision and durability. Robust, easy to use and configurable, OMNEX products stand up under the most demanding industrial conditions.

### WIRELESS BENEFITS

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Long range</strong></td>
<td>Current frequencies allow for 12–37 miles (20-50 km) LoS (Line of Sight) between clients</td>
</tr>
<tr>
<td><strong>High speed</strong></td>
<td>Up to 50 Mbps bandwidth</td>
</tr>
<tr>
<td><strong>Secure</strong></td>
<td>Uses industry-standard encryption</td>
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<tr>
<td><strong>Rugged</strong></td>
<td>Impact-resistant housing</td>
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<tr>
<td><strong>Reliable</strong></td>
<td>Mesh technology provides high availability; never-fail Trusted Wireless</td>
</tr>
<tr>
<td><strong>Easy to relocate</strong></td>
<td>Fast roaming enables equipment mobility without data disruptions</td>
</tr>
<tr>
<td><strong>Low-powered</strong></td>
<td>Can be powered using small solar or battery installations</td>
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Surface and underground mining operations

Wireless networking infrastructure increases safety and productivity in environmentally challenging and mobile applications.

Applications for above-ground and below-ground mining operations:

**Surface**
- Remote control operation of excavators, load/haul/dump trucks, conveyors, bulldozers, mobile drills
- Surface extraction
- Ore treatment plants and quarries
- Security video monitoring
- Access control systems
- Power network monitoring
- PLC (Programmable Logic Controller) connections
- Fuel tank gauging, leakage detection
- Alarm monitoring of portable machinery
- Treatment plant monitoring
- Automated collection of mine slope wall data
- Emergency shower monitoring
- Water supply control systems

**Underground**
- Underground utility services
- Longwall mining
- Ventilation fan monitoring
- Conveyor monitoring and interlock
- Tunnel boring
- Detection of moving machinery
- Gas detection systems
- Remote control and alarm for emergency generators
- Compatible with leaky-feeder antenna systems

**ELPRO 915U-2 Wireless Mesh Networking I/O and Gateway**
The industry’s first 20-mile range self-seeking, self-healing mesh radio is ideal for monitoring multi-kilometer conveyor systems for operation and safety. The device provides alarm and status data from dragline excavators, level monitoring and pump control at tailing ponds and wastewater facilities and even safety-critical automated collection of mine slope wall data for storage and analysis.

**OMNEX TD3200 2-Way Remote Control with Color LCD Display**
A robust, next generation radio remote control designed for smooth operation and precise control of industrial machinery. The multi-function radio remote features state-of-the-art design, industry-leading ergonomics and integral two-way communications in a robust and lightweight portable control unit. The TD3200 includes a 3.5” transflective color LCD display that monitors status, displays diagnostic information and controls capability.
**Wireless improves productivity, reduces costs and increases safety**

**Water monitoring and control**
The monitoring and control of water resources in a mine often occurs over vast distances, making cabling impractical. Mine-water balancing, water meters and borehole/reservoir monitoring and control are typical wireless applications. ELPRO long-range 105U radio telemetry systems provide a reliable alternative to cabling.

**Ventilation fan monitoring**
The consequences of ventilation fan malfunction can be serious, especially in mines of great depth. Fans are often situated far from the control room, making constant monitoring via cabling difficult. An ELPRO radio link indicates when a fan has tripped. Data such as bearing temperatures and vibration readings is fed over a radio link to a SCADA, PLC or controller that handles alarm conditions.

**Security and surveillance**
Video surveillance of mines is important for detecting process and security problems before they result in costly operational shutdowns and delays. The ELPRO 245U-E wireless Ethernet modem range of products target high-throughput applications such as plant-based video surveillance. Military-grade encryption, WDS multi-hop repeating and serial-server functionality (RS-232/RS-485) are standard features of the 245U-E product family.

**Mobile machinery and stacker-reclaimer communication**
A reliable communications connection between the control room and a moving piece of equipment is essential. Problems can easily arise with cables and slip rings or communication cables to stackers or reclaimers. Installing an ELPRO wireless modem (Ethernet/RS-232/RS-485) between a PLC on the stacker or reclaimer and control room proves an ideal solution.

**Networking fire detection and access control panels**
During fire conditions wireless links are a safer option than cables prone to interruptions. ELPRO modems are used extensively to enable secure communications. To ensure information security, ELPRO radio modems come with encryption as a standard feature. Error checking over the air further enhances data integrity and reliability. All ELPRO modems have a license-free option and can be directly configured by a contractor or client to ensure fast installation with minimal delays.

**Mobile machine control of hydraulic machinery**
In mines, OMNEX remote control transmitters and receivers operate excavators, load/haul/dump trucks, conveyors and bulldozers. They are also used with mobile drills and inside very large tunnel boring machines to help erect segments (lining for the tunnel walls) during tunnel boring.
Solutions delivered

Solving simple and complex problems in surface and underground mining operations

Conveyor system monitoring iron ore plant
A mining company transports its ore via a 10.5 mile-long conveyor. ELPRO industrial wireless units were fitted to each section of the conveyor to measure roller bearing temperature. The units transmitted overheating-bearing alarms back down the conveyor to the mine as an early warning to enable planned maintenance of the conveyor. The battery-powered ELPRO wireless system acts as an independent backup for conveyor safety trip and sectional interlocking.

Excavator alarm data for surface coal mine
A moving dragline excavator in a surface coal mine uses ELPRO wireless units to transmit alarm status and operational data from the dragline boom to the operator’s cabin and a nearby maintenance depot. The wireless units replaced flexible cable connections that were unreliable, resulting in frequent machine outages.

Video monitoring at ore dump points
ELPRO wireless Ethernet units connect video cameras mounted at ore dump points to monitors in the cabins of large ore-carriers. The wireless video connection enables the carrier driver to monitor the area for potentially unsafe situations during the ore transfer process.

Truck loading processing at taconite pellet plant
A taconite pellet manufacturing plant needed a reliable, easily maintained radio control system to ensure the product was safely and efficiently loaded for transport. An OMNEX Trusted Wireless™ FHSS remote control in conjunction with a PLC added functionality, prevented multiple-transmitter interference and operated a set of video monitors that increased visibility. The solution transformed the plant loading process, creating a safer, more reliable control system. In combination with supplemental control equipment, the OMNEX remote control ensured reliable, precise control in a coarse, hazardous environment. The solution enhanced worker safety, maximized productivity and made upkeep a breeze.

“Our ELPRO wireless telemetry system provides communications with hard-to-reach irrigation stations in our sulphide leaching process. Pump control commands and critical process variables such as flow, pressure and temperature are seamlessly transmitted to the PLC for proper operation.”

Jose Miranda Romero, Chief of Control and Communication Process Xstrata Lomas Bayas Mining Company, Antofagasta, Chile
# Wireless product portfolio

## Information: Monitor and optimize

- **Control System**
- **Data Acquisition System**
- **Network Management System (NMS)**

## Controller: Integrate and extend

<table>
<thead>
<tr>
<th>Gateway</th>
<th>Mesh 869/900 MHz</th>
<th>Modem 2.4/5.8 GHz</th>
<th>Modem 360–512/869/900 MHz</th>
<th>Managed Switches</th>
<th>Unmanaged Switch</th>
<th>Modem Quad Band</th>
<th>Cellular</th>
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<tbody>
<tr>
<td>Gateway</td>
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## Machine: More throughput and uptime

<table>
<thead>
<tr>
<th>Mesh 869/900 MHz</th>
<th>Modem 2.4 GHz/900 MHz</th>
<th>Modem 869/900 MHz</th>
<th>Modem 150/220/400 MHz</th>
<th>Modem 2.4/5.8 GHz</th>
<th>Modem 360-512/869/900 MHz</th>
<th>Modem Quad band</th>
<th>Cellular</th>
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<tbody>
<tr>
<td>Mesh</td>
<td>Serial products</td>
<td>Mesh</td>
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## Sensor: Smarter diagnostics

<table>
<thead>
<tr>
<th>One Way 869/900 MHz</th>
<th>Mesh 869/900 MHz</th>
<th>Multi 150/220/400/869/900 MHz</th>
<th>Gateway 900 MHz</th>
<th>Expansion</th>
<th>Gateway 2.4 GHz</th>
<th>Data Concentrator 2.4/5.8 GHz</th>
<th>WirelessHART™ products</th>
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<tr>
<td>I/O products</td>
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## Mobile: Control and enhance safety

<table>
<thead>
<tr>
<th>Two Way 2.4 GHz/900 MHz</th>
<th>Handheld Proportional 2.4 GHz/900 MHz</th>
<th>Belly Pack 2.4 GHz/900 MHz</th>
<th>Handheld Digital 2.4 GHz/900 MHz</th>
<th>CAN Controller 2.4 GHz</th>
<th>Logic Controller 900 MHz</th>
<th>CANbus 2.4 GHz/900 MHz</th>
<th>Expansion modules</th>
</tr>
</thead>
</table>
Achieving increased safety and productivity with automated slope monitoring

Mining is a challenging endeavor. Movement of open cast mine walls poses a major safety issue, putting personnel and expensive equipment at risk. Manual data collection is error-prone and dangerous. Changes to a mine often require relocation of equipment. Instrumentation is always an issue due to physical changes in the mine environment. Cabling can be prohibitive and often is not an option.

What’s needed? A low-powered remote solution that allows a higher slope angle, increasing mining efficiency.

Slope monitoring solution
An Eaton slope monitoring solution uses automated survey equipment to measures angle and distance to target prisms placed on mine walls. A wireless network provides the means for automated collection of slope wall data for storage and analysis.

A seamless, integrated solution
• Seamless integration of instrument and alarm data with existing control networks
• Wireless network provides reliable way to integrate key measurement instruments
• Database of mine wall data provides long-term trending information
• Analysis enables near real-time notification of mine wall issues, both at the office and in the pit
• Compatible with other measurement technologies such as weather instruments