BRAEMAC



EMBEDDED MONITORING AND CONTROL

FOR CRITICAL MINING ASSETS

EMERSON



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ABOUT BRAEMAC

Braemac is a global leader in the distribution of semiconductor components and electronic systems as well as value-added services. Empowering engineers and developers for over 40 years–Braemac features expert in-house engineers, extensive design-phase support, state-of-the-art distribution, value-add facilities, comprehensive supply chain solutions, and unparalleled customer service. Braemac offers solutions for diverse markets and applications, helping customers streamline development, reduce costs, accelerate time to market, and support long-term interoperability.

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FOREWARD

EMBRACING INTELLIGENT MINING OPERATIONS

Accelerated by digital transformation, global demand, market shifts, and increased regulatory standards, the mining industry is entering a pivotal new phase. Industry 4.0 is prompting organizations to move beyond traditional maintenance models to embrace future-ready strategies that promote operational efficiency, adaptability, and sustained growth.



Whether supplying lithium essential to electric vehicle (EV) production or rare earth elements to medical technologies, mining remains at the core of countless industries. With rising expectations around reliability and environmental responsibility, ensuring optimal performance of critical assets is crucial – not just a competitive advantage.

Mining companies must transition from reactive maintenance to predictive, insight-driven operations. Integrating advanced monitoring tools, embedded sensing technologies, and real-time control systems can significantly cut downtime, prolong equipment life, and increase productivity.

The shift to intelligent mining is already underway, and organizations must act now to position themselves at the forefront of innovation. By aligning with trusted partners like Braemac and investing in future-proof, scalable technologies, mining operations can unlock new levels of performance, safety, and long-term value.



BLOG

HOW TO MAINTAIN PEAK PERFORMANCE IN CRITICAL MINING ASSETS

Global mining operations are undergoing a fascinating transformation. Driven by digitalization, rising demands, market turbulence, and tighter regulations, mining organizations are rethinking their strategies to tap new levels of efficiency, innovation, and long-term growth.

From automotive to agriculture and healthcare, modern mining is a central piece of a wide range of industries. As the pressure to perform intensifies, organizations are recognizing that maintaining peak performance in critical mining assets is no longer optional – it's a strategic imperative.

To stay ahead, mining operations must move beyond traditional models and embrace smarter, data-driven approaches and cutting-edge technologies that enhance equipment reliability, minimize downtime, and maximize productivity.

Top 3 Ways to Maximize Mining Operation Uptime

Increasing productivity isn't just about keeping machines running, it's about designing smarter, more resilient operations that can adapt in real time to complex, high-risk environments. Modern mining operations must move beyond traditional maintenance models to embrace future-ready technologies for deeper insights, faster response, and greater control over physical assets.

Here are three proven strategies mining organizations are using to minimize unplanned downtime, extend equipment life, and drive operational excellence:

1. High-Speed Data Collection

Integrating high-speed data collection inititiatives is a crucial strategy that addresses the immense volume of data generated by modern mining operations. In scenarios involving safety incidents, quality deviations, or compliance checks, high-speed data collection enables sub-second logging and processing to provide operators with immediate actionable insights when they're most needed.

2. Custom Sensor Integration

Standard platforms often fall short of meeting the demanding and varied requirements of mining environments. From corrosive conditions to intense vibration, custom sensor integration empowers operators to monitor exactly what's needed. Specialized sensors help address niche challenges—such as tracking chemical reactions, particle flow, or detecting gas and air leaks—while maintaining seamless compatibility with centralized control systems.

3. Real-Time Control

Fast feedback loops enable measurement-based control strategies that respond instantly to emerging issues. Whether it's shutting down a machine before a bearing fails or adjusting process parameters on the fly, real-time control minimizes risk, reduces downtime, and ensures safer, more efficient operations. This proactive approach extends asset life and improves throughput, without compromising safety.

BLOG CONTINUED

Enhancing Mining Operations in the Real World

Today, forward-thinking mining organizations are setting new industry standards by implementing high-impact strategies like high-speed data collection, customized sensors, and increased actionable insights to deploy advanced systems that optimize performance, reduce downtime, and improve safety in even the harshest environments.

Machine Health Monitoring Solutions

Slurry pumps, dewatering pumps, and ventilation fans are the lifelines of any mining operation. Resonate Systems' health monitoring solutions deliver real-time asset insights by continuously tracking vibration, temperature, and alignment to enable early fault detection and maximize uptime.

Designed for ruggedized deployments, these systems offer both wire and wireless installation, integrating seamlessly with SCADA and control systems to support predictive maintenance insights.

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Distributed Instrumentation in Titanium Production

Icon Technologies has developed a robust instrumentation system for the TiRO process, a next-gen titanium production method. Built on NI's CompactRIO Systems and LabVIEW software, the system integrates 12 distributed IO controllers and over 400 analog and digital points to enable high-speed, deterministic control and monitoring. Supporting both ongoing R&D and 24/7 commercial-scale production, this solution effectively meets strict operational standards.



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Velocity of Detonation (VOD) Monitoring for Blasting

Gamma Engineering's SpeedVOD system is a breakthrough in blast performance measurement. It uses cost-effective coaxial cable and TDR technology to capture the velocity of detonation across multiple boreholes. Combined with GPS time synchronization and an extensive data system, SpeedVOD enables superior quality control and operational efficiency.

CLICK HERE TO LEARN MORE

Acoustic Imaging for Leak Detection

The BATCAM 2.0 is an ultrasonic and acoustic sound camera designed for quick identification of air or gas leaks in mining environments. Featuring 112 precision



BLOG CONTINUED

microphones and powered through NI hardware, it delivers real-time visual feedback for conditions often undetectable by the human ear.

Compact, rugged, and accurate, this tool enables onsite personnel to respond immediately to leaks to reduce energy loss, improve safety, and ensure compliance.

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Enabling Innovation with Braemac Solutions

At Braemac, we specialize in embedded solutions and connected technologies that can help mining operations take critical asset performance to the next level. With a deep understanding of industrial challenges and a future-focused approach, our comprehensive portfolio delivers best-in-class solutions to fully immerse the mining sector in Industry 4.0.

Available through Braemac, NI's CompactRIO Systems allow developers to combine high-speed data collection, custom sensor integration, and real-time control within a single, ruggedized solution.

Purpose-built for industrial control and monitoring, CompactRIO synergizes high-performance processing capabilities, sensor-specific conditioned I/O, and a closely integrated software toolchain to support mission-critical applications. Ideal for applications and use cases requiring real-time data management and control, CompactRIO systems feature a controller with a processor running a Linux Real-Time OS and a chassis that contains a user-programmable FPGA. It supports industrial I/O modules from both NI and third-party vendors.

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How to Maintain Peak Performance in Critical Mining Assets

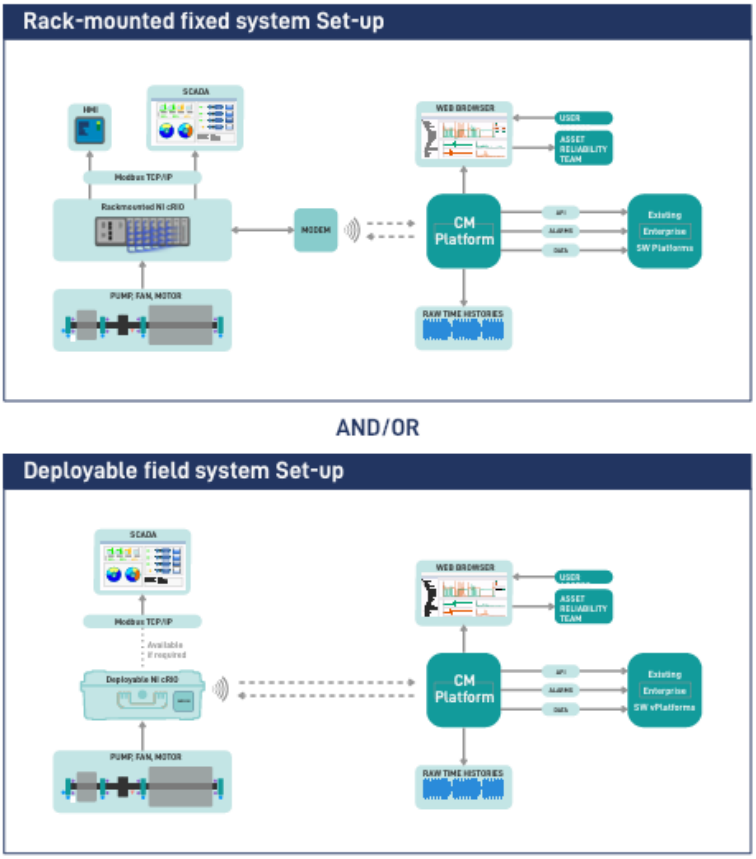
APPLICATION A

MACHINE HEALTH MONITORING FOR MINING PUMPS AND FANS

Resonate Systems, a system integration partner of Braemac, offers rugged machine health monitoring solutions. These solutions deliver continuous, real-time insights into critical equipment such as slurry pumps, dewatering pumps, and ventilation fans.

Purpose-built for flexibility, Resonate Systems' machine health monitoring solutions support both wired and wireless configurations to enable deployment in remote or hard-to-access locations. With seamless integration in existing SCADA and control systems, operators benefit from instant actionable insights for early detection of wear, misalignment, and potential failures.





APPLICATION B

DISTRIBUTED AND DETERMINISTIC INSTRUMENTATION SYSTEM FOR MATERIALS PROCESSING

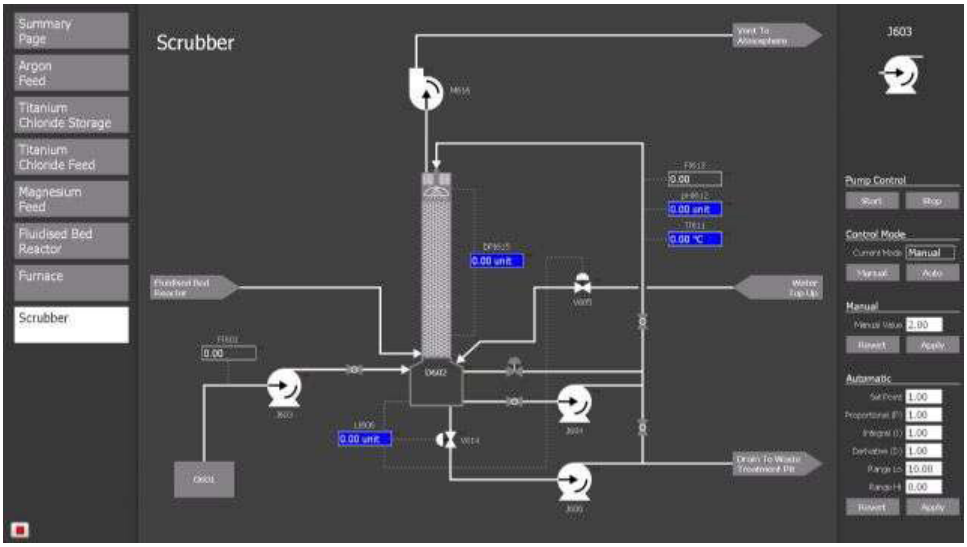
TiRO is a next-generation titanium production method originally developed by the CSIRO Division of Process Science, with Coogee Chemicals joining as a commercial partner in 2008. ICON Technologies has played a key role as the instrumentation system integrator for the first pilot-scale facility in Melbourne, designed for 24/7 around-the-clock operation.

TiRO is an advanced continuous feed process that uses a fluidized bed reactor with a vacuum sublimation chamber to generate titanium powder in an Argon-controlled environment. ICON's instrumentation setup 12 distributed IO Chasses/Controllers, over 400 analog, digital, and motion IO points, and a mix of conventional PID and custom control logic.

The instrumentation system was purpose-built to achieve several objectives:

- Enable ongoing research and development for TiRO
- Support full commercial-scale testing of advanced manufacturing equipment and techniques (faster control speeds than typical PLCs)
- Operate as a continuous production line capable of delivering high-quality, controlled titanium powder batches suitable for testing and distribution

Based on NI's CompactRIO Systems and LabVIEW software, the solution offers robust, real-time performance. It delivers the flexibility required by research teams for advanced data acquisition and processing, while also meeting the reliability standards of industrial process engineers running 24/7 operations.



APPLICATION C

DETONATION MEASUREMENT SYSTEM

Gamma Engineering's SpeedVOD system is an advanced detonation measurement tool designed specifically for modern blasting applications. Using standard, cost-effective coaxial cables inserted into boreholes, the system precisely captures and logs the velocity of detonation (VOD) for explosive charges.
The SpeedVOD system leverages sophisticated Time Domain Reflectometry (TDR) technology to deliver high-resolution, reliable data that helps optimize blast performance. Its practical design allows for streamlined setup and cost-effective operation.



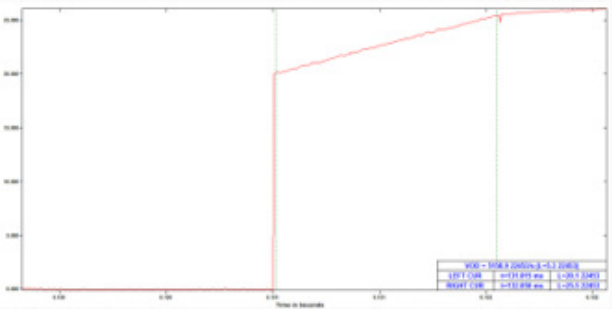
Key Features:

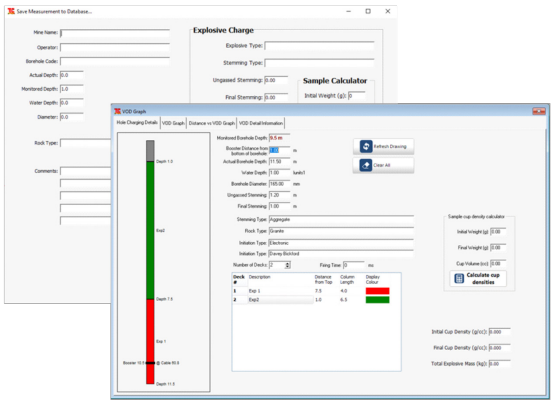
- **Standard, Low-Cost Coaxial Cable:** Utilizes easily sourced coaxial cable to reduce material costs and simplify deployment.
- **Multi-Hole VOD Measurements:** Collects synchronized data across multiple blast holes for comprehensive analysis.
- **Run-Up and Steady-State VOD:** Delivers a full picture of detonation behavior across the entire blast event.
- **GPS time Synchronisation:** Ensuring accurate timestamp and location data.
- **Extended Cable Range:** Operates effectively with cable lengths up to 500 meters, supporting both deep and multi-hole scenarios.

SpeedVOD Software

The software ecosystem behind SpeedVOD adds robust data processing and visualization tools for blast engineers. With a dedicated database for storing borehole and explosive profiles, the system supports high-level analysis, intuitive graphing, and seamless data export. Together, the hardware and software provide a complete solution for blast quality assurance and performance optimization.

- **VOD vs. Time and Distance Graphs:** Visualizes detonation performance for easy interpretation.
- **Advanced Filtering:** Refines data for precise analysis.
- **Flexible Data Export:** Saves files in various formats for sharing and reporting.
- **Detailed Reporting:** Generates comprehensive reports for documentation and review.





APPLICATION D

SOUND CAMERA FOR REAL-TIME DETECTION OF AIR/GAS LEAKAGE AND QUICK ONSITE RESPONSE

SM Instruments' BATCAM 2.0 is the world's smallest and lightest ultrasonic/acoustic camera developed to detect gas leaks and electric arcs by measuring signals in the ultrasonic band. Equipped with 112 precision microphones, the BATCAM 2.0 delivers enhanced sensitivity and can detect ultrasonic signals up to 48 kHz—including subtle noises such as buzzes, squeaks, and rattles—making it ideal for both industrial diagnostics and environmental monitoring.

Key Hardware Features:

- 112 Ch High Performance MEMS Microphone
- Captures and analyzes ultrasonic signals up to 48 kHz for precise detection
- Audio and HDMI Output
- 5-inch Touch Screen
- 4-Hour Battery Life
- Integrated Distance Sensor
- Two Adjustable



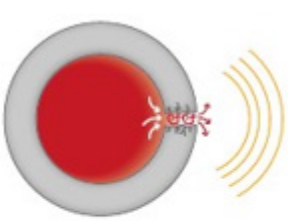
Key Software Features:

- Real-Time Acoustic Visualization and Display
- Band Pass Filtering
- Leakage Estimation Index Display
- Image Averaging Function
- Video and Image Capture
- Accuracy Improvement over Distance
- Sensor Self-Diagnosis Function



APPLICATION D

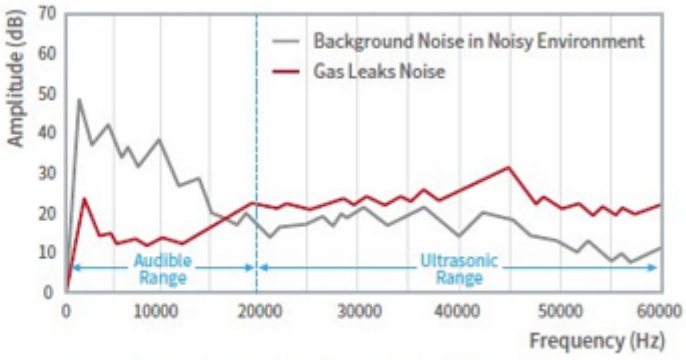
PRINCIPLES OF ULTRASOUND MEASUREMENT



[When a Gas Leak Occurs]

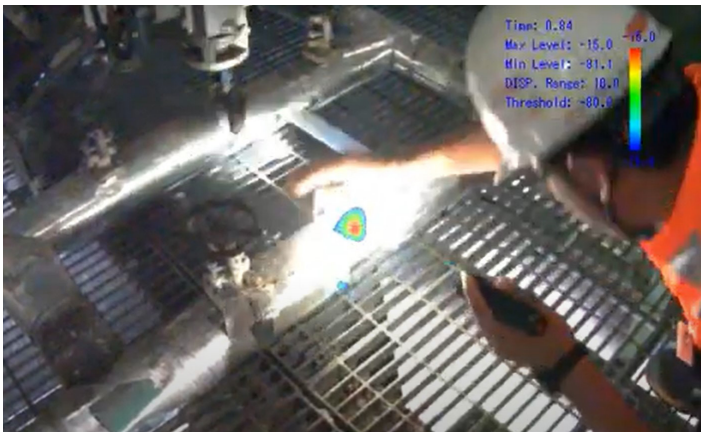


[When an Electric Discharge Occurs]



Measurement Range of BATCAM 2.0

Field Demonstration Videos



GAS LEAK DETECTION AT A THERMAL POWER PLANT



AIR LEAK DETECTION



ELECTRIC ARC DETECTION FROM TELEGRAPH POLES

TECHNOLOGY

NI EMBEDDED MONITORING AND CONTROL TECHNOLOGY

High-Performance Embedded Monitoring and Control for the Harshest Environments

CompactRIO systems deliver powerful processing capabilities, sensor-specific conditioned I/O, and a closely integrated software toolchain that make them ideal for monitoring, and control applications.



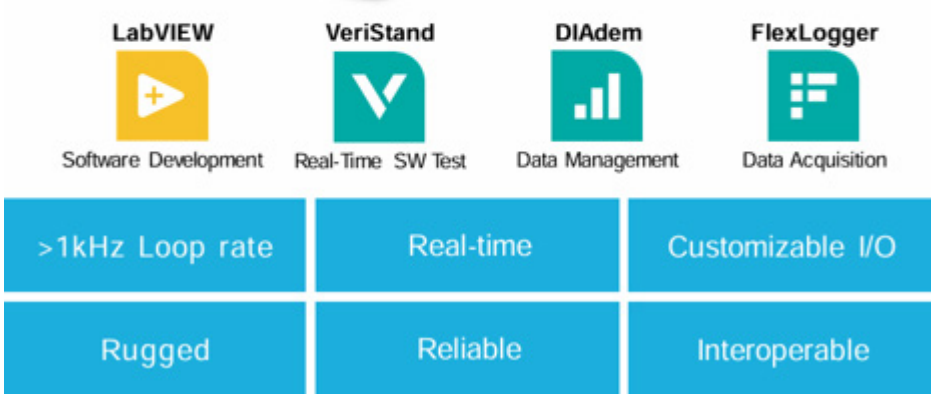
The CompactRIO platform offers key capabilities for reliable embedded control and monitoring:

- Faster control speeds than typical PLCs.
- Rugged hardware with conformal coating withstands oilfield conditions for temperature (-40 to 70 °C), shock (50 g), vibration (5 g), and moisture.
- LabVIEW graphical programming accelerates real-time and FPGA software development.
- NI's partner ecosystem extends the platform to add specialized and custom I/O, as well as protocol communication.









TECHNOLOGY

NI EMBEDDED MONITORING AND CONTROL TECHNOLOGY

Monitoring the Main Gearbox of a Bucket-Wheel Excavator Using CompactRIO



"We chose CompactRIO because of its resistance to shock and vibration, and its ability to operate in a wide temperature range. In addition, the system ensures failure-free operation with custom diagnostics tasks."

- Paweł Pawlik, AGH University of Science and Technology, Faculty of Mechanical Engineering, Department of Mechanics and Vibroacoustics

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Oil Well Fracture Pump Monitoring and Analysis Using LabVIEW and NI RIO Technology



"LabVIEW has made the software development side much quicker. What most C programmers take two years to do, we can accomplish in a couple of months. We can use that time savings to get to market quicker and capitalize on our competitors' lag time."

– Robert Stewart, CEO Lime Instruments, LLC

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DRIVING THE FUTURE OF SMARTER MINING OPERATIONS

From embedded monitoring and control to advanced sensing, Braemac is a one-stop resource bridging test and measurement with the industry's latest technologies. With support from expert teams leveraging a history of hands-on experience across a wide range of noise, vibration, and harshness (NVH) applications, developers can confidently scale deployments to meet real-world challenges. With Braemac as a trusted partner, you can confidently enable your mining organization to operate more intelligently, efficiently, and safely.

Our robust network of committed local system integration partner includes Resonate Systems, Gamma Engineering, ICON Technologies, Elevate Controls, and many more.

With support from expert teams leveraging a history of hands-on experience across a wide range of noise, vibration, and harshness (NVH) applications, developers can confidently scale deployments to meet real-world challenges.

By combining world-class technologies with Braemac expertise, we deliver the innovation, extended asset life, and competitive edge needed to stay ahead in your mining operation. From accelerating digital transformation to enabling smarter decision-making at the edge, our integrated solutions are purpose-built to meet the demands of today's toughest industrial environments.



QUESTIONS?

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