The Connected Mine, enabled by the

Rockwell Automation®
Mining Solution

Built on the PlantPAx® Distributed Control System
The State of the Mining Industry

A Challenging Environment

At Rockwell Automation, we understand the challenges the mining industry faces and are committed to helping forward-thinking companies streamline their operations and maximize productivity with smart investments.

A volatile commodities market has impacted profitability and sustainability in recent years. With an unpredictable forecast for a turnaround, the commodities market is having a transformative effect on business priorities. Doing more with less has become a mantra in every industry, but it has become amplified in the mining industry.

In addition, balancing improved operations with an uncompromising focus on safety is key. Mining companies are focusing their operational investments on areas that can help them maximize yield recoveries while still meeting regulatory requirements and maintaining safe or “zero harm” working environments.

A safe workforce isn’t the only concern. Increasing environmental regulations, in combination with limited energy and water resources, are changing the way companies consider investing. Mining is resource intensive, so sustainable use of the right resources can help reduce costs and accelerate innovation.

There’s no shortage of desire to make operations as efficient as possible, it’s just a question of how you drive productivity and maximize financial success.

What is your plan to accelerate operational excellence?

“If the mining and metals industry is going to streamline operations, while at the same time returning cash to investors, cutting back on CAPEX and, eventually, having to cultivate deeper and more difficult resources, it is going to have to develop new and innovative ways to do so.”

- The Economist Intelligence Unit, “In the Pits? Mining and Metals Firms and the Slowing of the Supercycle”
The Connected Mine

Uncovering the Future of Mining

Leaders across the industry are improving recovery and throughput, rationalizing their supply chains, improving operational efficiency and enabling remote and autonomous operations by harnessing data across their entire organization to create a connected mine, also known as a digital mine.

They’re using connected devices and smart machines to capture real-time process information and make better business decisions. Using this information, they’re gaining deeper business insights that allow for:

• Improved asset productivity
• Identification (and reduction) of variability across processes
• Creation of remote-operations centers
• Support for autonomous material transport
• Enhanced employee safety
• Improved mineral accounting
• Significant energy savings

In addition, mining companies can remotely monitor machine data enabling operators to access and manage equipment and production data across multiple applications. This is done from a single location, feeding machine and production data back in real time.

Until now, data has been trapped in assets throughout mining operations due to disparate automation technologies, legacy systems and the inability to create useful information out of what exists. With real-time reports, intuitive dashboards and robust business intelligence systems, companies can strengthen enterprise-wide accountability. Through this intelligence, businesses can make more informed strategic decisions and help make sure each mine is operating as efficiently and effectively as possible.

"No longer is information just a historical record of what has happened or what is happening now. Information used in conjunction with analytics can be a powerful tool to help mining companies predict performance and achieve the desired results."

- ARC Advisory Group, “Industrial Internet of Things Fulfilling the Vision of the Connected Mine”

ACCESSIBLE, ACTIONABLE, REAL-TIME DATA DRIVES:

• Production throughput
• Process quality
• Asset health
• Energy efficiency
• Mine safety
The Connected Mine

Smart Machines Producing Big Data for Analytics & Decision Making

Data to Information... Information to Intelligence

Remote Sensing of objects & environment

Abnormal Situation Management (ASM): We’re 4 hours into the shift, why is our total material moved off target?

Surveillance: camaras deployed for monitoring and maintenance

Vibration Detected, replace the bearing at the next scheduled shutdown

Power Monitoring: we’re trending 12% above forecast

The connected mine reaches farther than just underground – it’s a true pit-to-port solution that extends across your process.

A connected mine is transformative, but it does not need to be a complete overhaul of a company’s existing infrastructure.

Much of the data that is sought exists within a company’s system – it just lacks a means of being collected, analyzed and shared. Taking the necessary steps to modernize control systems and pull together historically disparate systems will create the foundation to mine this data.

Once the data is extracted, it can help reduce safety risks and achieve a new level of operational intelligence to improve productivity and global competitiveness.
From Data to Information to Action

**Challenges**
- Operational Efficiency
- Yield
- Skilled Labor Shortage
- Network Availability
- Data Quality and Integration
- Data Availability Everywhere
- Regulatory Compliance / Reporting
- Security

**Our Solutions**
- Reference Architectures - Standard / Tested and Validated Solutions
- Connectivity and Data Aggregation - Remote Monitoring / Operations
- Mobility - Field Logistics Optimization
- Analytics - Production Optimization / Asset Performance Management / Enhanced Diagnostics / Predictive Maintenance / Model Predictive Control
- Personnel Tracking, Autonomous Vehicles and Machine and Electrical Safety to Drive Towards "Zero Harm" (provided through our PartnerNetwork® program)
- Physical and Cyber Security - Defense in Depth
- Regulatory Compliance / Reporting
- Security

**Benefits**
- Secure Access to Data at Every Level
- Contained Operational Cost
- Data Visibility
- Data Aggregation and Quality - Better Decision Making
- Workforce Optimization / Collaboration
- Improved Asset Utilization / Yield
- Improved Safety
Central to the concept of the connected mine is the relationship between IT and OT. The two roles need to share knowledge, skills and experience of each discipline to gain optimum benefit for the business as a whole.

This collaboration results in practical, scalable solutions with:

- Comprehensive security strategies that are robust and easy to use
- Open, standards-based networks that provide the safety and performance necessary for integrated control and information applications

Cisco and Rockwell Automation have collaborated to provide a common network and security environment on a single united network infrastructure for mining operations.

**Solutions at Leading Minerals Producer**

- Security DMZ configuration protects enterprise & production networks
- Minimized risks to devices more likely to be security targets
- Enabled future expansion
- Improved production efficiency
- Streamlined identification & resolution of production anomalies

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**Network & Security**

**Crushing & Grinding**

**Extraction Equipment**

**Enterprise-wide Business Systems**

**Site-wide Operations Systems**

**Mineral Processing**

- Process Automation System

**Electrical Controls**

- Electrical Distribution System

**Levels 0-3 Industrial Zone**

**Levels 0-3 IDMZ**

**Levels 4 & 5 Data Center Enterprise Zone**

**PlantPAx Distributed Control System**

**EtherCAT/IP**

**OEM**

**MPLS**

**FactoryTalk Direct**

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The Rockwell Automation Mining Solution
Unlock the Connected Mine with Rockwell Automation

Our operators have gained valuable information to help them understand why a certain batch took 20 hours to produce when it was supposed to take 16 hours. This improved visibility enables us to identify constraints in the refinery’s processes that we weren’t always aware of before.”

The PlantPAx solution was an ideal fit. We were able to put the full, robust system on top of our existing control base, which helped us create standard control modules needed for our processes.”

- Hermanus du Preez, control technology specialist, Anglo Platinum

The Rockwell Automation Mining Solution delivers a proven, comprehensive process control system designed specifically for the mining industry. Our network of global mining industry domain professionals integrates our best-in-class power, safety, information, discrete and continuous control on a single platform for simplified integration, installation, operation and maintenance.

Our systems take advantage of emerging technologies for collecting, aggregating, analyzing and visualizing data. While collecting and having access to data is important, doing so in a secure way is essential. Rockwell Automation employs a defense-in-depth (DiD) security approach to mitigate potential risks.

DiD is a recommended best security practice that uses multiple layers of protection through a combination of physical, electronic and procedural safeguards.

Using Rockwell Automation as the preferred global automation provider helps lower risk, reduce the total cost of ownership, simplify support and minimize training for operators. The Rockwell Automation Mining Solution is proven worldwide and is repeatable in any location globally. A standardized integrated automation system can be effective as mines experience a shortage of skilled workers who have traditionally operated machines manually.

Solution for New Gold at Peak Gold Mine

- Integrated system optimizes sag mill control
- Increased annual leach circuit gold recovery +1,800 ounces
- 10% reduced cyanide consumption
- Improved annual throughput 2% = 18,000 tonnes
The Rockwell Automation Mining Solution

Why Rockwell Automation?

Reduce Risk

Rockwell Automation is the largest company in the world that is focused solely on automation. Our industry-proven, standardized process control system for the entire mine is designed by industry specialists specifically to mitigate your production challenges. We offer comprehensive, world-class service and support to help facilitate maximum uptime and a lower total cost of ownership. Our network of global mining industry domain professionals integrates our best-in-class power, safety, information, discrete and continuous control on one platform for simplified integration, installation, operation and maintenance. We also invest in developing information-enabled, cutting-edge solutions to help optimize operations and reduce risk.

Rockwell Automation provides the most comprehensive portfolio of integrated safety technologies and services. We help companies manage their production risks by assessing potential hazards during the design phase, and delivering safety solutions where needed. Whether on the machine, in the process, in the electrical system or across the IT network, our portfolio can meet your mining process challenges.

The condition monitoring system identifies at least 10 pending failures per year and at an average repair time of 10 hours per incident, the downtime saved is very significant to the business

- Scott Liddell, Senior Electrical Engineer, Newcastle Coal Infrastructure Group

Repeatability and Reliability

The Rockwell Automation Mining Solution is designed specifically for mining applications, by mining industry professionals. The standard, repeatable system controls the entire production infrastructure on a single platform – helping to simplify operations, maintenance and operator training.

The standardized, proven applications provided by the Rockwell Automation Mining Solution significantly ease the engineering process with error-free reconfiguration and safe replacement of a new mechanical component, which reduces engineering time.

This technology and approach helps enable consistency from plant to plant. All of this leads to a reduction in startup times. To speed implementation, our mining solution features:

- Pre-engineered content for control, monitoring and reporting, with built-in auditing, alarm and events
- Pre-defined, flexible and expandable engineering methodology for all site applications
The Rockwell Automation Mining Solution integrates information, control, power and safety on a scalable, reliable platform. Our systems also take advantage of emerging technologies for collecting, aggregating, analyzing and visualizing data.

By supporting industry standards, like IEC-61850, and protocols, we easily connect to third-party equipment for a consistent operator experience. This integration allows operators to make faster and better decisions for peak effectiveness in the supply chain.

The standardization, remote connectivity, ease of integration and global services of the Rockwell Automation Mining Solution provides a platform to ease the engineering process and amplify your operation and maintenance personnel.

This standardization is supplemented by making the right contextualized data available to the right people when they need it.

You are also assured a full range of services, designed to create value throughout your production lifecycle – whenever and however you need it.

From feasibility and conceptual studies to Front End Engineering, through upgrades and migrations, you can count on us for the expertise and technology to augment your workforce.

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Integrated control & information

Integrated discrete, process & power control improves efficiency

Streamlined implementation with modular control substations

Enabled optimal insight to process

Achieved flexibility & scalability

Met communication challenges with Wi-Fi & wired transmission

Impact Efficiency of Supply Chain

Address Workforce Challenges

OEM Coordination
The Rockwell Automation Mining Solution

Collaboration

Collaboration with third-parties is a key differentiator for Rockwell Automation. These third parties often include members of our PartnerNetwork™ program, an integrated team of system integrators, machine builders, distributors and best-in-class suppliers who work collaboratively to offer simplified project management and proven, complementary solutions.

This collaboration streamlines the supply chain, while simplifying integration, operations, maintenance and expansion.

"The need to keep up with increased power demand provided AGL Loy Yang with the opportunity to implement a drive solution incorporating the latest technology that would work effectively in the mine’s rugged environment."

- Robert Collins, electrical superintendent at AGL Loy Yang Mine
The Rockwell Automation Mining Solution

The Rockwell Automation Mining Solution is a purpose-built system leveraging the PlantPAx® Distributed Control System platform in demanding mining applications. The reliability and robust design (or nature) of the PlantPAx systems help operators make better and faster decisions.

To help meet key market challenges, the PlantPAx DCS is built to leverage modern approaches such as:
- Site-wide control and optimization
- Scalable and modular architectures
- Open, information-enabled, and secure architectures
- Flexibility of support of the system

In addition to this core functionality, the Rockwell Automation Mining Solution enhances the user experience with customizable features such as:
- Modules developed for advanced process mining applications
- Device integration simplified with FDT technology which also permits status monitoring of field instrumentation
- Standards-based alarming and intuitive navigations help facilitate effective adoption with less opportunity for error
- Uptime can be improved through diagnostics that encompass field level instruments, rotating assets, controller loading, and network performance to accurately direct improvement and maintenance tasks that lead to a healthy system.

Built On The PlantPAx® Distributed Control System Platform

Solutions at an Australian Mining Operation

- Drives automated reporting & dashboards
- Connects to multiple data sources
- Enables supply chain transparency
- Supports the Connected Enterprise strategy
The use of standardized control modules and pre-engineered solutions for key mining applications provides a robust system to meet your performance needs. The Rockwell Automation Mining Solution is based on decades of mining domain expertise and applications across the industry, which is designed to reduce start-up time and life cycle cost.

- **Standard and Scalable**: Consistency of engineering and execution methodology helps to deliver standard and repeatable solutions
- **Less Risk**: Standardized systems that encapsulate domain expertise and execution methodology to significantly reduce project risks
- **Improved Visibility**: A unified data model enables Premier Integration of Rockwell Automation and third-party data sources. This provides the right information for better and faster decision making
- **Easier Maintenance**: Adding new devices is quick and easy with the device-oriented modular engineering approach
- **Improved Diagnostics and Reporting**: Remove detective work from fault finding with many options to visualize information including FDT / DTM technology and a set of predefined templates:
  - Built-in support for standard device types (Control Modules (CM): Analogs, Motors, etc.)
  - Controller initiated data logging (Alarms, Events, Audit Trails, Production data)
  - New devices automatically inherit Report, Audit, Event and Alarms
  - Compliant with ISA 18.2 Alarm System Management
  - Alarming is controlled and managed in the controller
  - Unlimited configured alarms per controller
- **Model Predictive Control (MPC)**: MPC solutions continuously assess current and predicted operational data, compare it to desired results, and compute new control targets to help you reduce in-process variability, operate within equipment constraints and improve performance.
The Rockwell Automation Mining Solution fully integrates our Intelligent Motor Control and PlantPAx® DCS. This integration offers a production and reporting control system designed specifically for mining operations. We provide:

- Predictable outcome and performance
- Domain expertise that includes compressors, conveyors, flotation, ventilation, and milling
- Simplified configuration for pre-engineered content for control, monitoring, and reporting
- Cost-effectiveness with shorter engineering times, lower risk contingency required

In every area of the mining process there are several motor-driven applications that can benefit from the speed and/or torque control offered by our variable-frequency drives.

Our Allen-Bradley® CENTERLINE® low and medium voltage motor control centers (MCCs) offer optimal safety, performance, and reliability to meet your global needs. Benefit from sharing the same architecture, components, programming language, and networking with the entire portfolio of CENTERLINE MCCs. Receive unparalleled support from a single-source provider to meet all of your motor control needs.

Through the Rockwell Automation Mining solution, with Intelligent Motor Control and PlantPAx DCS integration, you can experience:

- Higher uptime
- Unrivaled energy efficiency (less CO₂ emissions)
- Extended machinery lifetime
- Lower investment, installation, operational and maintenance costs
- Improved safety and reliability
- A robust technology

Solution for BESTECH at Vale Mine

- Optimized underground VOD system
- Reduced wear & tear on MV & LV motors
- Enabled simpler installation
- Achieved 30% energy savings
- Decreased annual greenhouse gas emissions by 540 tons