Enabling the connected mine
Challenges in mining

Mines face specific and intense challenges. Harsh operation environments and complex processes aren’t made easier with disparate systems and lack of real-time information.

At the same time, aging equipment and workforce dynamics affect productivity negatively.

- Operator productivity
- Workforce skills gap
- Lack of standardization
- Excess time and energy configuring control systems
- Maintenance efficiency
PUTTING A PRICE ON RISK

PROJECT RISKS
It may not be the bulk of project spend, but control system design can have a disproportionate impact on project outcome – accounting for as much as 80% of risk late in a project. Control system failure and/or integration issues with process OEMs during setup can grind a project to a halt, and necessitate additional expenditures on engineering hours.

OPERATIONAL AND MAINTENANCE RISKS
Ongoing system performance is at risk if the control system is not properly designed and implemented. It’s possible that the mine won’t hit production targets or meet quality standards.

Similarly, additional maintenance costs will be incurred down the road if the control system is difficult to learn and maintain. Mines may be faced with lengthy unplanned downtime events as they search for the root cause of issues, and attempt to supply technicians with the information needed to fix the problem.

In the big picture of a project, control system cost typically comprises only 1-2% of overall costs. However, properly designing and implementing the right control system can make or break your entire project.

Source: Frost & Sullivan Study
What is the Rockwell Automation mining solution?

The Rockwell Automation mining solution is an integrated solution built on standard PlantPAx® architecture. It includes pre-engineered content for better control, monitoring and reporting:

- Controller and visualization
- Alarm management
- Accountability
- Sequences
- Standard reports
- Sandbox

It also includes mining-specific functions built in to address items like conveyor material control, flotation, compressors and safety devices.

The Rockwell Automation mining solution is delivered by Rockwell Automation Global Solutions, meaning the solution is plant-wide and scalable, with secure and information-enabled control, power and safety.

**Project management** delivered by Rockwell Automation

**Mining-specific functions**: Conveyor material control, flotation, compressor, safety devices

**Enhanced process control features**: Electrical breaker, events management, sequences for control and monitoring, reporting, sandbox environment

**Built on the PlantPAx® distributed control system**
Enhanced process control features

SEQUENCES FOR CONTROL AND MONITORING
Program a dedicated control module to automate tasks or procedures, like plant startup, right from within the controller. The module can take ownership of targets like motors, valves, sequences and groups and actively monitor and control each target.

Each sequence contains numerous programmable steps, where each step has command and transition logic associated with it. The faceplate automatically renders the flowchart to allow the visualization of the sequence.

EVENTS MANAGEMENT
The events management feature keeps a time-stamped log of all events and audits, and records accountability so you can see if a command was operator-generated or controller-based.

SANDBOX ENVIRONMENT FOR FACTORY ACCEPTANCE TESTING (FAT)
See your plant come to life in the sandbox environment. Test simulation of raw inputs and outputs to replicate plant response and validate the control of operations in a safe environment.

The sandbox environment can also be used as a tool for operator training and can include evaluation criteria, like how quickly an issue was resolved, and user navigation efficiency to resolve an issue.

INTEGRATED REPORTS
The customizable web environment provides standard and custom reports that give you clear context around your data for better decision-making.

You can run production reports for different control modules found in the plant; alarms occurred across the plant; operations events (including set points changes) and the sequence of events report.
THE ROCKWELL AUTOMATION MINING SOLUTION

**Mining-specific functions**

**FLOATATION LEVEL CONTROL**

Level control in flotation cells is a complex task. Since the cells are connected, any disturbances in one area will propagate through the circuit. Our stability control solution sees the system as a whole and provides the proper level management across the full series of flotation cells, reducing disturbances.

**CONVEYOR MATERIAL CONTROL**

**Tracking:** Utilize the speed, belt length, feed points and reference weightometers to accurately model the loading and position of product on a conveyor system. This enables the control system to track the distribution of product along conveyors, optimize the loading process and avoid overload.

**Gap control:** Our control solution has the ability to manage loading gaps across the system. Some transfer operations can only be executed if there is proper clearance. For example, a chute cannot be switched (to load materials to different systems) under load. In this case, our solution can safely and automatically switch a chute without tripping the belt when the clearance (gap) is present.

**Multiple product management:** Handle multiple products on the same conveyor by creating a controlled gap between the products to increase belt throughput and operating efficiency.

**DEVICE CHECKING**

Visualize all safety components on equipment and determine their combined status with the device-checking application. A report is generated to confirm equipment status and verify safety checks have been taking place on schedule.

**COMPRESSOR ANTI-SURGE CONTROL**

Instability results in mechanical fatigue and under a surge condition can result in catastrophic equipment failure. Often this control is part of multiple OEM packages.

Our advanced solution analyzes the pressure, flow and air properties to control the compressor safely within optimal operating thresholds. This control is visualized on the HMI as a compressor map to provide transparency of your equipment’s operation. Our anti-surge control is built into a ControlLogix and hence our compressor solution is a complete integrated solution in a single controller where complete control is integrated off a single platform.

**COMPRESSOR MANAGEMENT**

Compressed air networks serve various areas of the mine, and each area has specific requirements and operating schedules. If not properly managed, the entire air network can become imbalanced, either wasting energy and operating at too high of a level, or impacting production and operating at too low of a level. Our optimization algorithms are designed to manage multiple compressors in a distributed system according to pressure requirements and schedule.

Challenges you face
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Process control for mining
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Project management capabilities

Reducing risk and creating value throughout your production lifecycle

Feasibility and conceptual studies
- Feasibility studies
- Conceptual design
- Consulting services
- Workforce readiness

Front end engineering and design
- Information, control, power, safety
- Process optimization
- Instrumentation
- Electrical
- Packaged equipment

Design and engineering
- Design and implementation
- Construction, fabrication
- Testing (FAT)
- Training
- Network and security

Installation and commissioning
- Installation management
- Start up / commissioning
- Training
- Documentation
- Parts management

Operation and maintenance
- Remote system monitoring
- Service agreements
- On-site engineering
- Asset management
- Reliability

Upgrades and migrations
- System audits
- Obsolescence risk mitigation
- Hardware / software upgrades
- DCS / control and safety system migration

Lower engineering costs
Maximize project quality
Optimize delivery time
Minimize business risk

Project management methodology:
Repeatable, predictable, auditable, automated

PMI® project methodology
Industry libraries
Standard project templates
Global project oversight

PROJECT MANAGEMENT
MINING-SPECIFIC FUNCTIONS
ENHANCED PROCESS CONTROL FEATURES
PLANTPAx®
Successfully implemented all **across the globe**

- **32** application centers
- **6200+** delivered projects each year
- **23** system integration centers
- **17,000+ m²** system integration floor space
- **150 to 800** hardware deliverables each month
- **16** remanufacturing & repair centers
ROCKWELL AUTOMATION MINING SOLUTION

STANDARDIZE A SOLUTION
- The right approach and methodology to implement a solution predictably and consistently anywhere in the world
- A proven solution, developed specifically for mining customers
- Easier to maintain with controller centricity

REDUCE TIME TO MARKET
- Sandbox Software Factory Acceptance Testing
- Rapid development using CASE tools to deliver error free code, so late changes can be made with minimal impact on schedule
- Proven implementation methodology

ENABLE THE CONNECTED MINE
- Complete transparency of operations
- Get the right information to the right person at the right time
- Achieve one version of the truth
Enabling the connected mine

Enterprise and business applications

Third party applications & systems

IoT platform / Analytics and visualization

Remote monitoring

Supply chain simulation

Process optimization

Asset performance

IoT gateways

Integrated process control and power

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