

# ECS/ProcessExpert®

## Intelligent process control for the mining industry



# Achieve more with advanced process control

Global demand for commodities is flat and the number of high-grade deposits is falling. As mining companies increasingly turn to low-grade, complex mineral deposits, they are faced with higher costs and a more difficult process.

In effect, working harder for less gains. How do we change that balance and drive efficiencies in metals and minerals processing?

The answer is intelligent process control.

Intelligent control – advanced process control – combines a range of process control techniques to tackle all these issues and optimize mining operations. It's a guiding hand that leads your process to a state of optimal performance, giving you a more stable operation, greater productivity and improved quality.

## Key benefits

■  
Improved energy  
efficiency

■  
Quick ROI  
– under 1 year

■  
A more stable,  
more consistent  
operation

■  
Greater reliability: less  
wear, less downtime,  
less maintenance

■  
Optimized production,  
whatever the capacity

# Optimizing efficiency with the ECS/ProcessExpert System

What is missing in your mining process flow sheet? Do you lack insight into your process? Or maybe you have all the data you need, but no real means of putting it to use? Do you find yourself being reactive when you want to be proactive?

These are common concerns. It's what we hear from customers time and again. And it's why we developed the ECS/ProcessExpert system.

As suppliers of mineral processing equipment, we have an in-depth knowledge of both the technology and the science behind your system. We also understand your priorities.

So we designed a system that will:

- Stabilize the key processes.
- Manage and correct process disruptions.
- Minimize wear.
- Reduce operational and maintenance costs.
- Mill load target optimizer – automatically adjusts the mill load according to weight target and process conditions.

All for optimum plant performance.

## Flexible and customizable – advanced process control tailored to your needs

Every mining processing flowsheet is different. You design your plant according to your requirements. An advanced process control solution should be designed in the same way.

The ECS/ProcessExpert software includes a suite of customisable technologies that allows you to tailor functions to meet your unique requirements – and makes it possible for you to design your own solutions.

Each of the process control applications in the ECS/ProcessExpert software uses advanced techniques such as model predictive control and fuzzy logic rules. The system is designed for operation globally and is capable of handling a wide range of challenges, including adapting to plant upgrades and testing new process control strategies.



## How does it work?

- Measurement validation: All the parameters are validated before being used inside the system
- Performance and KPI's: The system identifies the process status and calculate the corresponding KPIs, which can be visualized by operators
- Actions: The controllers execute the corresponding actions to move the process to the desired targets

For a realistic test of the controller, the designer will often use the built-in PLC communication drivers of the ECS/ProcessExpert software to perform real-time testing with the current process values.

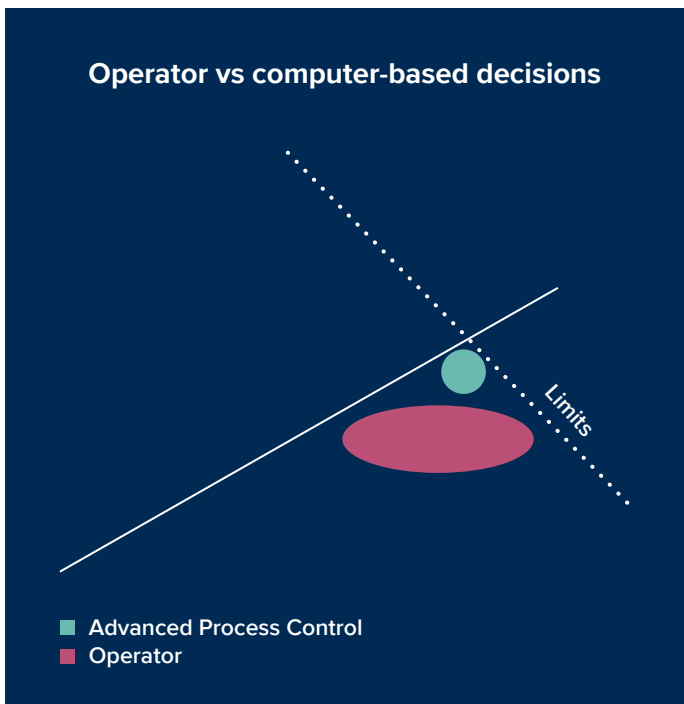
## Easy integration with existing control systems

The ECS/ProcessExpert solution has specific I/O drivers for communicating to the most recognized PLC brands.

In addition, the ECS/ProcessExpert software supports industry standard OPC UA protocol, enabling integration with most existing control systems.

## Control system features

To give you the best overall perspective on your operations, the ECS/ProcessExpert software has built-in control system features such as long-term historian with trending, alarm and event management as well as a sophisticated HMI for graphical process representation.



## Custom design

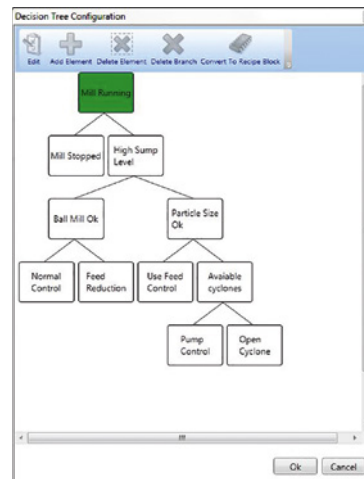
- Process customized "abnormal situation management"
- Process customized operation objective
- Priority management of the objectives

## The technologies

- MPC (Model Predictive Control): A multi-input, multi-output controller that handles process dynamics and interactions. MPC performs optimization calculations to drive the measurements to predefined targets or ensure they remain within a set band limit
- Symbolic AI technologies: Focused on high-level "symbolic" (human-readable) representation of problems, logic and search.
  - Expert systems
  - Fuzzy logic, delivers rule-based, intelligent fuzzy control
  - Inference rules
- Non-symbolic AI technologies: Involves providing raw data to the machine and leaving it to recognize patterns:
  - Machine Learning
  - Deep Learning
- Kalman filter: A soft sensor that generates readings where signals are unavailable or unreliable

## The tools

- Process input: For input reading, validation, signal treatment and normalization
- Process output: For process control and trending
- Control objectives: For managing specific process conditions (for example, mill weight)
- Priority management: For prioritizing the handling of abnormal process conditions
- Programming: Enables an open development environment



Decision Tree

# Achieving long-term stability in grinding circuits

If your grinding circuit operation is unstable, the productivity, quality and efficiency of your entire process is at risk.

Stabilizing the process enables you to reduce energy consumption and increase throughput. But how do you achieve long-term stability?

The ECS/ProcessExpert system analyses a wide range of signals and makes automatic adjustments to manage both your equipment and your process performance, resulting in improved grinding efficiency.

## Parameters controlled

- Feed rate
- Mill water addition
- Mill speed
- Pump speeds

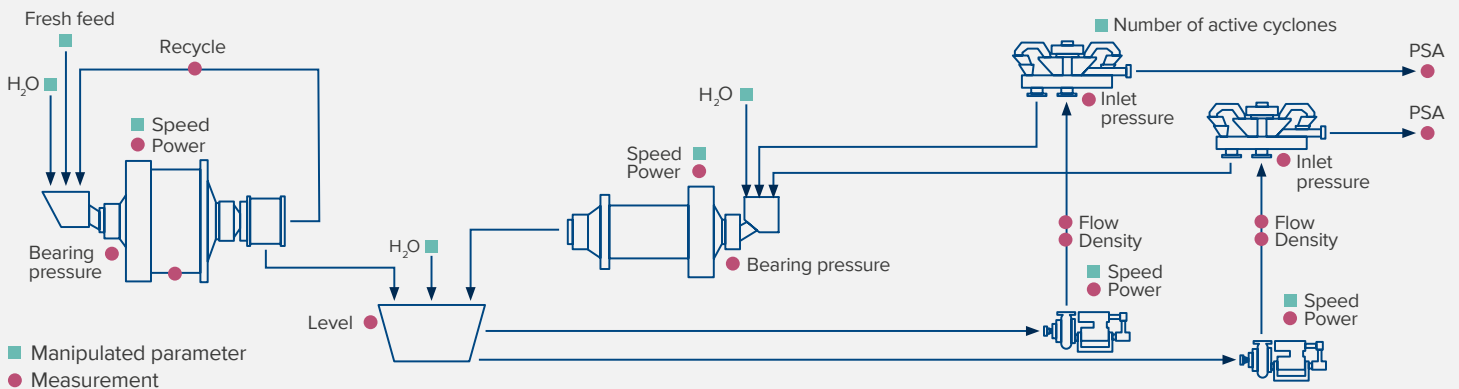
## Parameters monitored

- Mill power consumption
- Load impacts
- Mill mass
- Sump levels
- Circuit flows
- Pump power
- Stream density
- Hydro-cyclone pressure
- Product quality

## Benefits

- Up to 6% increase in production
- Up to 6% reduction in grinding specific power consumption
- Up to 30% reduction in quality and process variability
- The ECS/ProcessExpert solution also enables you to develop a uniform operation strategy that outlines the best way to run the plant. Once this strategy has been established, training new operators becomes much easier.

## An example of circuit measurements & actuators



# Coping with variability in your process

In any processing plant, change is inevitable. Variations in the deposits themselves, in equipment conditions and even in the local environment, could all impact process stability and performance. Ultimately, this can reduce the efficiency of mineral and metal liberation – and cut into your profits.

The problem is that conventional control systems with PID loops just can't cope with this kind of variability. PID's can't coordinate action across your process – so they can't react to changes as they happen. What you need is a system that can measure all the inputs, model all the outputs and adjust your process parameters accordingly, in a preventive way.

The ECS/ProcessExpert system does just that. Through constant monitoring of operational and process conditions, the ECS/ProcessExpert can make whichever automatic adjustments are necessary to stabilize the process flow, balance the circuit load and protect equipment, all while ensuring your product quality is protected. The system uses the best control technology for each particular task. For example, an advanced Multi Input Multi-Output Model-based Predictive Controller (MPC) it has proven to be successful to achieve the best possible grinding efficiency.

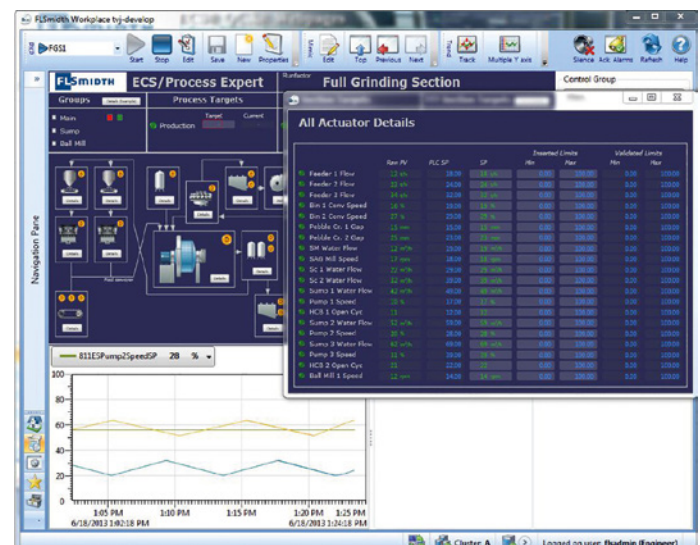
The result is stable operation, reduced energy consumption and increased production. With less wear, maintenance and downtime are also reduced, giving you greater profitability.

## Stabilization of upset conditions

The upset control mode is designed to handle unexpected and sudden disturbances to the circuit. This upset control mode will bring the process back to normal operation as soon as the process disturbances disappear.

In the event of any disturbance the application will ensure rapid and bigger action on process actuators such as feed and speed of the mill to achieve optimum recovery, and the system monitors the mill until normal conditions are restored. If a process measurement is declared invalid (for example due to hardware failure), the controller will automatically replace the measurements with secondary signals or estimated values to continue operation.

This temporary measurement replacement can also be selected manually by the operator if a device is temporarily taken out for maintenance.



# Successful implementation depends on comprehensive support

We deliver solutions, not products. When you select the ECS/ ProcessExpert system, we are committed to supporting you from the very outset, right through implementation and beyond.

The moment we begin an advanced process control project, a dedicated project manager is assigned to coordinate all activities over the lifetime of the project. As your main contact, the project manager is involved in the implementation process right from the start, providing you with a clear and detailed project plan that contains all the phases, key deadlines, project meetings and more.

Your project manager will then use our 8-step implementation model to ensure that you receive the professional support you need to get the most from your system.



# FLSmidth's 8 step implementation process

- 1 Project planning**  
An FLSmidth project manager prepares a comprehensive, start-to-finish strategy.
- 2 Client process interviews**  
FLSmidth technicians visit the site to determine the plant's control needs.
- 3 Application design and process strategy review**  
We design the right solution based on the site visit and interviews.
- 4 Primary system commissioning**  
Commissioning is completed and the system is implemented and monitored onsite.
- 5 Operator and super-user training**  
FLSmidth representatives train operators in the new system.
- 6 Remote monitoring and fine-tuning**  
As the final part of the commissioning phase, we makes small adjustments to the system either remotely or onsite.
- 7 Follow-up visit**  
After commissioning is complete, we visit the site and transition to the service phase of the agreement.
- 8 Establishing long-term support**  
We continue to monitor the system and analyze KPI data, helping to support the system and ensure that the plant runs as efficiently as possible.



# Long-term and continuous support

Optimising a manufacturing process is not a one-time activity. It requires regular focus to maintain reliability and adapt to changing conditions. A continuous improvement approach can result in improving results over the long term.

We provide long-term support to help ensure efficient operations throughout the lifetime of the plant. Services can be purchased as-needed or through a PlantLine™ service agreement. The service agreement has the advantage of fixed price and proactive service.

## Remote services

Providing support remotely is faster and more cost effective than waiting for an FLSmith engineer to travel to your site. Remote services are provided using the secure Go2FLS system.

- 24-hour Global Support: Telephone, email and chat support for critical issues anytime
- Remote troubleshooting. Fast response and support to troubleshoot problems and fix critical issues that can prevent your system from operating

- Remote engineering. Changes to the programming or configuration
- Performance monitoring and remote optimisation. The Process-Expert Insights application monitors the performance of the system. Our engineers can monitor this proactively and inform you of any deterioration in performance. A solution can to the problem can be discussed, agreed and then implemented remotely. This keeps you process running with optimal efficiency
- Remote software maintenance – Updates to the software can be installed remotely. Software updates help to keep the system secure and provide new features.



# We have you covered

## Onsite services

Remote service is cost effective and fast, but is no replacement for having an engineer at your site.

- Preventative maintenance service – Service contracts typically include a scheduled site visit for preventative maintenance to perform tasks such as software updates, system backups, system performance checks, network checks.

## Training courses

- To keep operators and engineers on top of processes and new technologies and knowledge, FLSmidth provides training courses for all plant staff. Courses are divided into introduction, user, specialist and expert levels – and special courses tailored to the unique requirements of engineering companies and technical centres can also be arranged

## Software license agreements and upgrades

- Service agreements can optionally include software license agreements, so you can update the software anytime at no additional cost. Keeping software regularly updated is an essential part of any cyber-security plan
- If your system is becoming obsolete we can include an upgrade plan in a service agreement






## Learn more about FLSmidths digital solutions

 [www.flsmidth.com/en-gb/solutions/digitalization](http://www.flsmidth.com/en-gb/solutions/digitalization)



## Attain the full benefit from your process control systems by attending a training course

 [www.flsmidth.com/en-gb/services/training/  
process-control](http://www.flsmidth.com/en-gb/services/training/process-control)



## Subscribe to FLSmidth Highlights

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# Bringing better solutions to light

in the cement and mining industries

The future is full of possibilities and you are leading the way. But it's never a straight journey and it's easy to lose sight of true potential. With an ally by your side, who shares your ambitions and who sees the world from different angles, we can find the right way together.

For more than 135 years, we have challenged conventions and explored opportunities. Across more than 50 countries, we are 12,000 employees who combine our unique process-knowledge on projects, products and services to drive success. We develop the most advanced technology in our industries and offer market-leading product and service ranges.

Rooted in a culture of honesty, trust and transparency, we activate our knowledge and experience to navigate your complexity and bring better solutions to light. So no matter where in the world you are, we are here to help you discover new ground and achieve sustainable productivity enhancement.

We are the market-leading supplier of engineering, equipment and service solutions to customers in the global mining and cement industries.

**We discover potential.**

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**FLSmidth A/S**  
Vigerslev Allé 77  
2500 Valby  
Denmark

Tel. +45 36 18 10 00  
Fax +45 36 30 18 20  
[info@flsmidth.com](mailto:info@flsmidth.com)

[www.flsmidth.com](http://www.flsmidth.com)