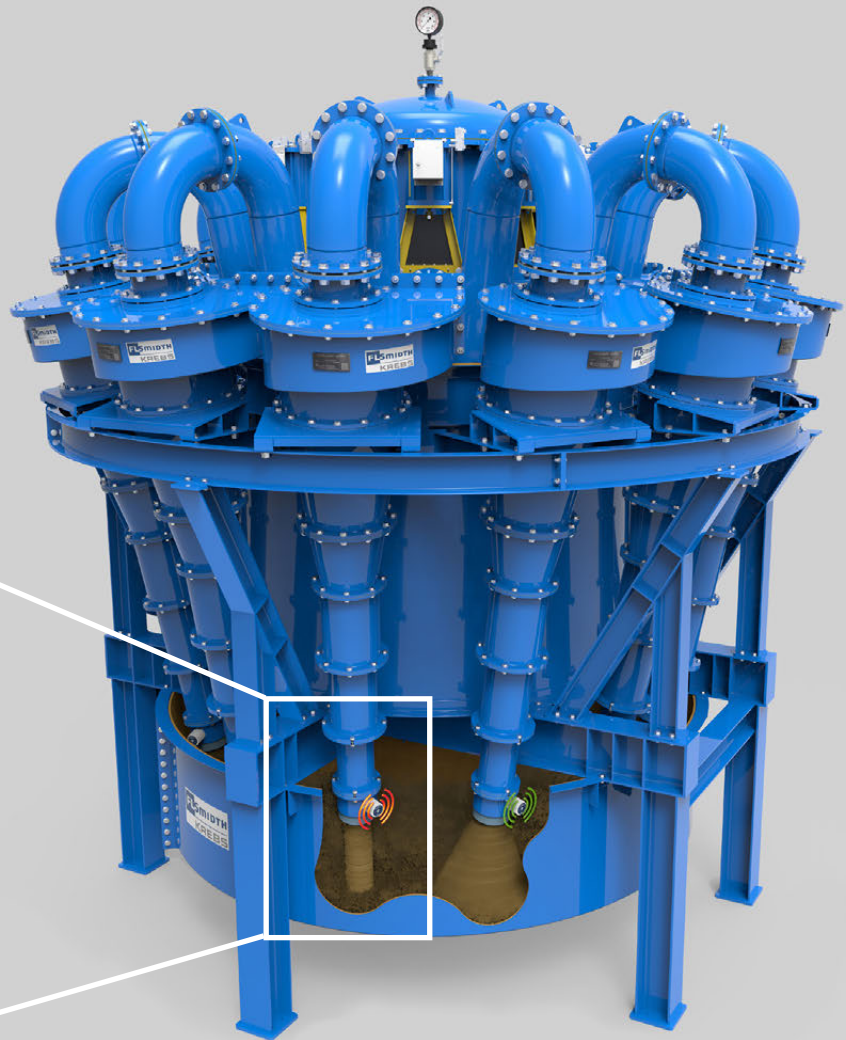
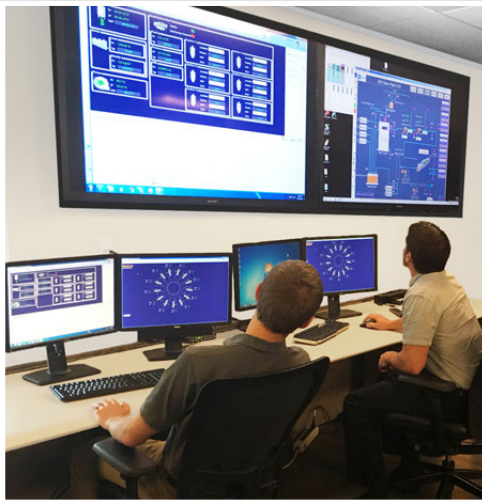


One Source

SmartCyclone™ Automation Solutions



SmartCyclone grinding circuit optimization system

FLSMIDTH
KREBS

Process Optimization using SmartCyclone™ Solutions

System Architecture:

FLSmidth's SmartCyclone™ is a monitoring and control solution for reducing cyclone-related process perturbations, improving cyclone overflow particle size distribution, predicting and controlling cyclone maintenance schedules, and optimizing closed-circuit grinding processes. The SmartCyclone closed circuit grinding optimization system, combines: FLSmidth Krebs patented SmartCyclone wear detection sensor technology, FLSmidth Krebs' patented roping sensor technology with patent-pending wireless controller system, and FLSmidth's ECS/ProcessExpert® process control software with new patent-pending Smart-Wear™ cyclone maintenance algorithm.

The ECS/ProcessExpert system is a modern, advanced process control solution used to stabilize and then optimize key minerals processes. It balances equipment loads, manages and corrects process disruptions, and optimizes wear on the plant's equipment – all by dramatically reducing/eliminating manual involvement from mill operators and to ensure optimum plant performance to achieve maximum efficiency and

higher profitability. The ECS/ProcessExpert solution also enables the development of a uniform operation strategy that outlines the best way to run the plant. Once this strategy has been established, the burden of training new operators is reduced.

The SmartCyclone system introduces electronic sensing and communications to Krebs' hydrocyclone separator product line and the encompassing process creating an "island of optimization" for mineral processing and specialty markets. With a SmartCyclone equipped process, the cyclone sensors can report the functional state of the cyclone by monitoring the conditions of the slurry flow for each cyclone individually.

The sensors can also report the wear status of the cyclone components, so that parts purchasing and maintenance operations can be planned earlier and with greater control. Finally, the sensors can report when a cyclone, or the SmartCyclone system itself, is malfunctioning such as when an individual cyclone experiences a condition called "roping", or a break-down in the classification.

Benefits:

Quick Perturbation Identification and Correction

- Less process down-time

Reduced Variation in Floatation Particle Size Distribution

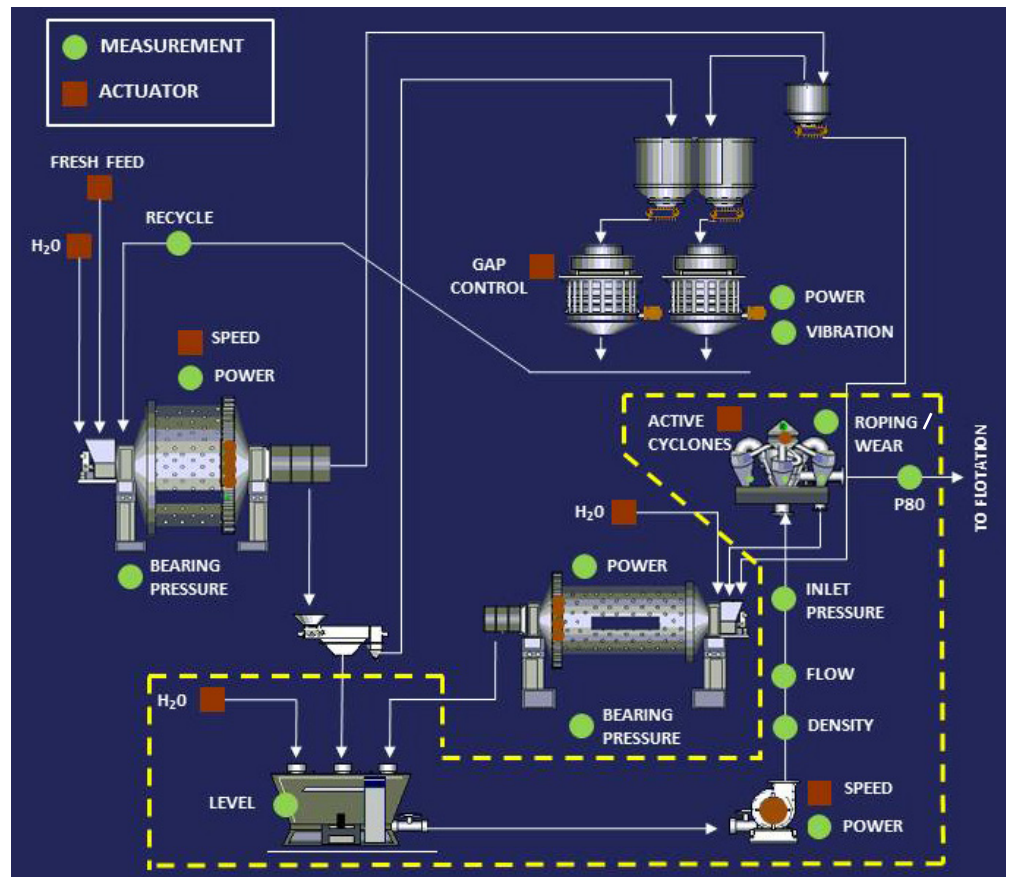
- Improved mineral recovery

Predictable Cyclone Maintenance Schedule

- Improved process stability
- Wear monitoring and management

Increased Production Capacity

- By adding a mechanism by which the plant operator can monitor roping, the process may be operated closer to the limits of the cyclone manifold design



Island of Optimization: Closed Circuit Grinding

Automation Package & New Wireless Technology

Wireless SmartCyclone System

The new Krebs wireless SmartCyclone sensor system eliminates the need for individual nodes and the interconnecting cables between the sensors and nodes and associated controllers. It utilizes a central wireless controller that can handle up to 16 sensors per unit; providing real-time wireless detection and communication of roping and /or wear data from the SmartCyclone sensors to the manifold controller(s) for forwarding to the control room workstation through an Ethernet cable.

The new wireless controller unit is a handheld device that can be removed from its docking/charging station to sync the individual sensors. Once it's removed, it goes into battery power mode and the user can walk to a desired sensor, activate it with a magnet; trigger and set the necessary operating parameters. Once this process is completed, the controller unit can be placed back onto its docking station within its' protective NEMA4X enclosure where it will then communicate live operating data to the control room.

The highlights of the New Wireless SmartCyclone system are the following:

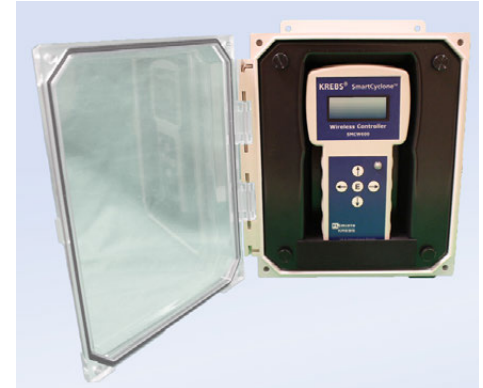
More compact system:

- Eliminate node boxes for each cyclone
- Utilizes (1) Central Controller for up to 16 cyclones

No Cables or Wires

- Controller contains wireless antenna, communicating with sensors
- No need to run cable trays, making it a more streamlined installation
- Cyclones can be taken out for maintenance without worrying about ripping the cables

SmartCyclone systems are offered in three different packages; Basic, Standard and Expert as shown below.



Wireless Hand Held Controller in Docking Station



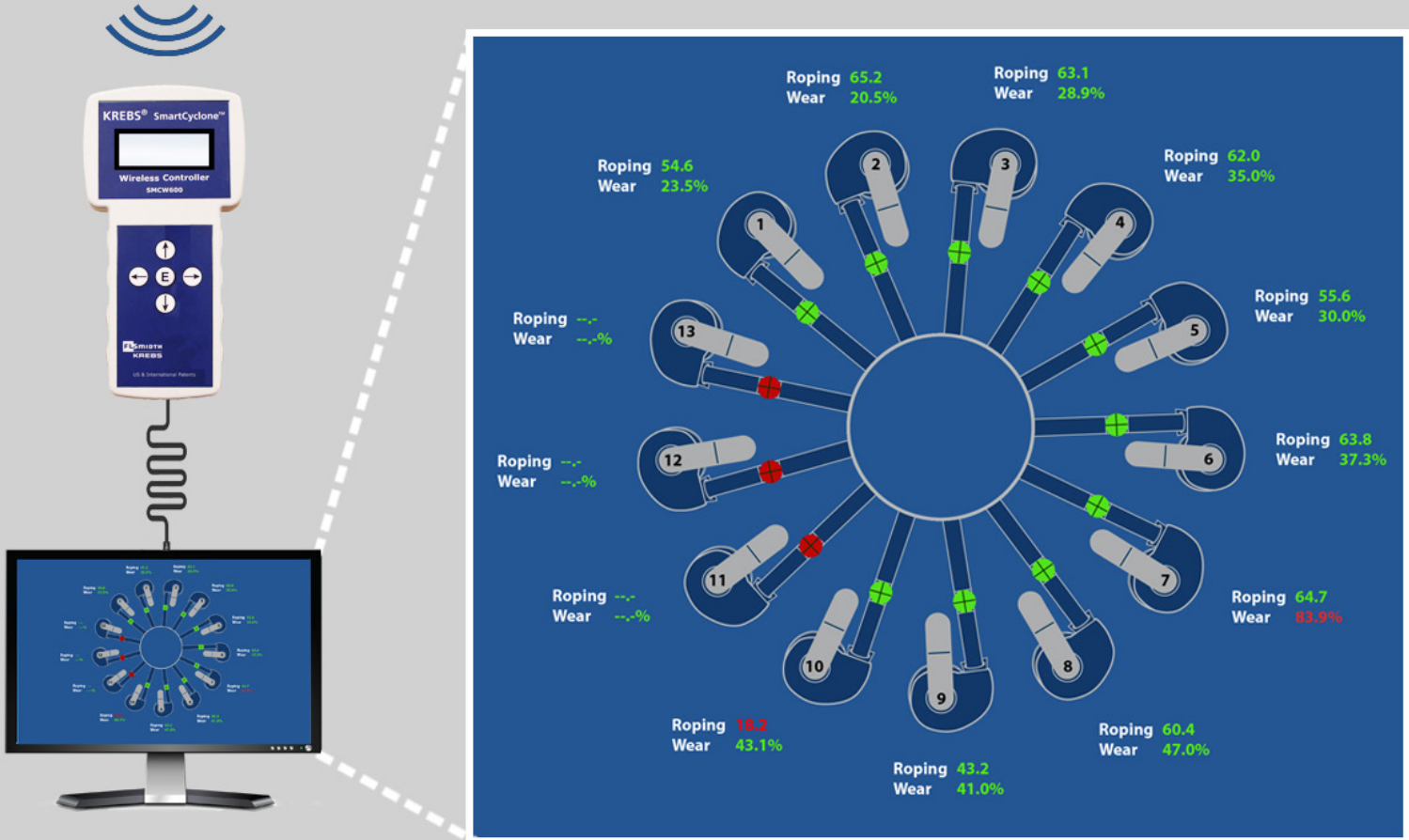
Syncing Wireless Roping Sensor to Wireless Hand Held Controller

| | Sensor Input | Control Action |
|----------------------------------|--------------------------------------|--|
| Basic Package Includes | Roping Detection * | Alarm Only |
| | Wear Detection * | |
| | Cyclone On/Off via Valve Position | Display Only |
| Standard Package Includes | Complete Basic Package, Plus | Turn Off/On Cyclones (to address roping events and manage wear) |
| | Cyclone Flow Timer | |
| Expert Package Includes | Complete Standard Package, Plus | Turn Off/On Cyclones (as above) |
| | Particle Size Distribution / Density | Inc./Dec. water addition, pump speed and/or number of operating cyclones |
| | VFD Amps | Optimize pump speed |
| | Sump Level | Optimize pump speed and water addition |
| | Feed Pressure | Optimize pump speed and/or turn off/on cyclones |

*Directly supplied by FLSmith

SmartCyclone™ Automation Solutions

www.flsmidthkrebs.com



Configurable Graphical User Interface

This interface shows 13 total cyclones with 10 operating. One cyclone is indicating roping and another cyclone is showing wear value of 83.9%, and has exceeded the designated wear limits. The operator can enter the customized set point fields on the user interface screens and also monitor the real time trending of critical process parameters.

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