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# Modernization of mill drive systems in minerals

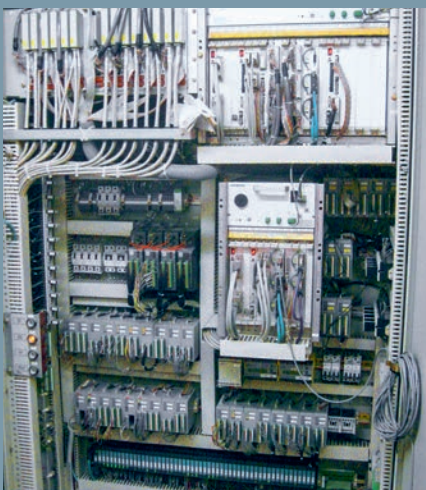
Answers for industry.

# Maintaining reliability and availability despite aging mill drive components

## The challenge:

Many Siemens Mill Drives have been in operation over decades. While motors easily achieve this lifetime, the situation with electronic controls can be different: Rapid advancements in electronics and computer technologies have allowed significant progress in the control technology of mill drive systems. Nearly all electronic systems used within the overall drive control – power distribution, power network protection, automation (PLC), visualization (HMI), closed-loop drive control for stator and excitation circuits, field sensors etc. – can be affected to some degree by this technological aging process.

For long-term operation of your mine, the only comprehensive solution to the challenges of aging devices is the stepwise modernization of the old control systems. Of course there is no single modernization concept or one-size-fits-all. Rather, for each individual customer and each specific installed system, the most suitable modernization solution has to be determined based on the customer's prioritized criteria. The modernization process should have as little impact as possible on the running mine production – the grinding mill is probably the most critical bottleneck in the mine production process, with each hour of downtime resulting in a potentially heavy financial loss for the operator. So it is evident that the technological considerations are only one part of crafting the right modernization concept.



SIMADYN drive control



COROS LS-B HMI



S5 PLC

**Customer: PT Freeport,  
Grasberg, Papua, Indonesia**

For this project Siemens was dedicated to identifying and implementing measures that from the point of view of the component cost may not always have been the cheapest compared to alternatives but which significantly reduced installation time, commissioning time, and associated risks during the cutover. All new components were premounted and pretested in the Siemens test facility in Erlangen, Germany, to ensure a smooth, trouble-free migration. In addition the major preparation work was done in advance of the main cutover during previously planned and regular maintenance shutdowns, and the cutover schedule and the manpower resources plan were optimized in a newly developed 3-shift working plan. Even Freeport's operation and maintenance personnel were trained on the new equipment beforehand, during the engineering phase. In this way, familiarity with the new technology was established up front, helping to secure the right levels of competence and confidence in Freeport's project team before executing any site works.

**Order:**

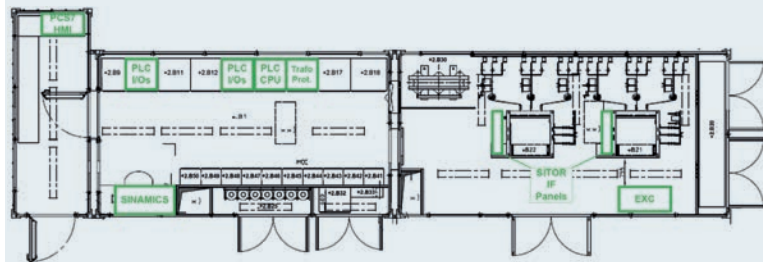
A modernization concept for a gearless mill drive that retains most of the existing electrical equipment

**Solution:**

- PLC system upgrade from SIMATIC S5 to SIMATIC S7
- Specially manufactured I/O adapters from S5 to S7 I/O boards that obviated the need for rewiring any I/O
- Upgrade of HMI from COROS LS-B to SIMATIC PCS7
- SINAMICS SL150 closed-loop control as a replacement for the old SIMADYN D
- New control cubicle in the existing E-House
- Newly developed closed-loop control interface board connected to the existing water-cooled power section
- Exchange of the old SIMOVERT D converter for excitation with a completely new SINAMICS DCM (6RA80) cubicle
- Reutilization of existing power cables, transformers, isolators, MCCs, and all auxiliary E-House equipment



New interface boards for the SINAMICS drive control fixed at existing power stack tower



E-House with the new equipment (in green)

**Customer: KGHM International Ltd.,  
Robinson Copper Mine, Nevada, USA**

The concept of a new E-House installed in parallel to the existing E-Room paved the way for minimal downtimes during the main cutover. The higher initial investment paid off handsomely during the installation and commissioning phase. The equipment inside the new E-House could be fully tested in advance in the manufacturing facility. In addition, all installation activities on-site were performed during normal operations without causing even an hour of production stoppage. A major number of testing procedures could be completed prior to the main cutover of the plant. During previously planned and regular maintenance shut-downs, the customer temporarily switched over the power cable connections between transformers and motors from the existing E-Room to the new E-House so that Siemens could complete portions of the necessary tests in advance and save more time during the main cutover. But our understanding of “minimal downtimes” didn’t stop there: The newly installed remote service feature now provides Siemens experts from around the world with immediate access to the automation and drive system and, in case of problems, the possibility of quickly resolving any unscheduled shutdowns.



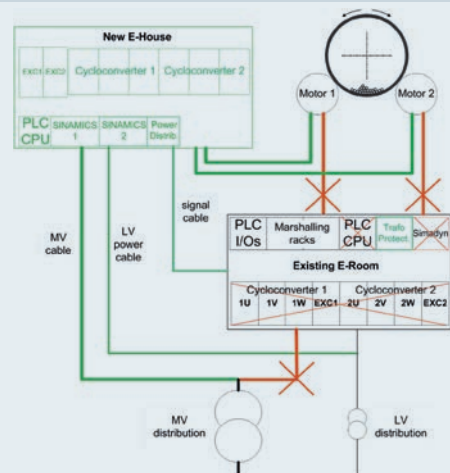
Installation of new container (E-House) outside of the grinding building

**Order:**

Modernization of a twin pinion AC synchronous drive system using a parallel setup approach to minimize downtime during cutover

**Solution:**

- Replacement of the complete converter system with the new SINAMICS SL150 cycloconverter in air-cooled version – with the SINAMICS SL150 preassembled in a container module (E-House) together with the new SINAMICS DCM for the excitation circuit and a new air-cooling and circulating system
- Installation of new PLC CPU in a new E-House as well as the connection of the existing I/O modules in the existing E-Room
- Building of a new E-House on a platform attached to the outside wall of the grinding building along with an opening through the wall to allow direct access from the mill platform
- Reutilization of existing I/O marshaling racks, motors including auxiliaries, and transformers



Schematic drawing of the new E-House and cables (in green) in parallel to the existing system removed after final cutover (in red)

## Our solution:

A custom-tailored modernization solution includes much more than simply some new electrical components. It is also important to analyze how many days of shutdown, intermittently and in total, can be foreseen for the modernization work. Or in other words: The production time loss has to be kept as low as possible. The perfect solution for your individual modernization scenario will be the optimum determination considering the investment costs of the new equipment, expected performance increase,

minimum duration of the cutover (equaling reduced loss of production), and evaluation of all associated risks.

With decades of experience in drives, mining, and automation, Siemens is able to offer you a tailored modernization concept based on a highly standardized field-proven modular approach.

## Good reasons for mill drive modernization:

Siemens has been successfully implementing modernizations of selected equipment at installed systems for many years. However, the introduction of the SINAMICS SL150 drive control system for cycloconverters triggered an extensive engineering development with the specific aim of evaluating the complete electrical components of the older systems, defining adequate substitute solutions, and developing alternative modernization concepts.

The result of this development is a variety of innovative approaches, based on standard modules, to modernize the existing mill drive to a state-of-the-art system to prepare it for many further years of continuous and reliable operation.

Our experience clearly shows how worthwhile it is to spend sufficient time and resources at the very beginning to evaluate all possible alternatives and find the best possible technical solution for each application to fit the customer's requirements.

Meanwhile, in the last few years we have modernized more than 10 systems to the latest automation and drive technology, giving Siemens plenty of experience in the field and the capability to further develop and improve our modernization concepts.

Considering the importance of the cutover work and the potential cost of the related production loss, it becomes clear that the implementation of the work during the cutover is just as important as the right technical concept itself. Excellent and meticulous planning and preparation, a highly motivated can-do project team, and a trusting and cooperative relationship with our customer are indispensable factors for a successful modernization project.

The broad range of Siemens modernization solutions is tailor-made to cover the replacement of ageing equipment from a single component level right up to partial and complete systems. Furthermore our customers can benefit from adding new and enhanced features not previously implemented on the running system as well as increasing the overall performance or even the capacity of their mill drive system.

## Your benefits:

- Directly benefit from the latest developments in automation and drive technology.
- Enhance the longevity of your mill drive while keeping the levels of high productivity, reliability, and availability you are used to.
- Increase your plant availability through improved troubleshooting and diagnostic possibilities as well as personnel training.
- Minimize impact, cost, and risk of the modernization work on operations through optimized and standardized packages in combination with other routine work at the mill.
- Improve the overall serviceability.

More information:  
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