SUCCES STORY

OPTIMIZING TURBO TRAIN CONTROLS, ENERGY SAVINGS AND ECONOMIC VALUE WITH CCC INSIDE

Discover how CCC Inside for Honeywell Experion PKS helped a plant resolve load sharing issues, prevent devastating surge events, and advance the petrochemical site's digital transformation efforts.

One of the world's largest petrochemical manufacturers, our client has a long history of investing in technology and innovations that improve efficiency. In this case, it was seeking a solution to enhance the controls in one of its flagship facilities in the Middle East. The focus was optimizing turbomachinery performance to deliver sustainability and cost savings. CCC set out to equip the manufacturer's Middle East facility with CCC inside, a solution that reflects the client's penchant for innovation and desire to enhance environmental and economic value.

The Challenge

The facility's existing DCS system was obsolete and could not support end user's operational vision. The process air compressors shared the same discharge header but lacked load-sharing controls to prevent them from working against one another. Often, one would be loaded and the other unloaded — a condition that caused high power consumption and unnecessary recycling. Without a high-quality control system, the plant was left to solve the load-sharing issue by detuning or placing the machines in a "manual" mode. This resulted in overall inefficient process control. The plant was also experiencing frequent surge events stemming from issues with its receiver lines and unstable compressor loading.

Simplistic DCS or PLC process controls often lack the robust algorithms that operators require to truly optimize turbomachinery performance. The turbomachinery algorithms were poorly documented, and the logic was complex to understand and troubleshoot without specialized legacy engineering software. Local support was also limited for the turbomachinery applications. We developed CCC Inside to solve these key challenges.

In this client's case, we knew that delivering our best-in-class algorithms inside the Honeywell Experion PKS — the company's flagship DCS — would solve the compressor network and surge issues while enhancing energy, economic and overall performance. It would deliver that value while still allowing our client to maintain a flattened architecture. From project award through commissioning, our turbomachinery controls experts optimized every step — despite the customer's tight deadline for implementing CCC Inside for Honeywell Experion PKS.

Execution Phase

The project's demanding timeline required high levels of flexibility from our execution team, particularly when it came to knowledge building around the customer's legacy DCS and understanding its existing implementation and limitations. The lack of documentation and legacy engineering software required a diagnostic approach to determining detailed sequencing algorithms for these specific machines.

Another challenge was related to instrumentation. As typical with this type of machine, the instrumentation was located in a less-than-ideal position on the piping, which led to less- accurate mapping of the actual operating point position of the compressors.

Commissioning Phase

Our experts were tasked with commissioning six compressors during a brief plant shutdown window. We would also need to navigate the client's strict communications policy, which prohibited the use of phones or Internet onsite and thus eliminated remote support.

The Solution

At CCC, we understand the significant role that turbomachinery controls play in plant safety and efficiency. Through CCC Inside for Honeywell Experion PKS, we transitioned the plant to Honeywell's flagship DCS and implemented a world-class controls system inside it. This solution addressed the load-sharing challenge and protected the plant from potentially damaging surge events, all while maintaining the customer's preferred flattened architecture. With our solution, the client gained high-quality Antisurge Control algorithms including main control response, Recycle Trip and Safety On, allowing them to maintain the safest and most efficient operation.

The most efficient way to operate a network of compressors is to employ the widest possible operating envelope without recycling. To accomplish this, CCC Inside's control system ensures that all compressors reach their surge control lines and open their antisurge valves simultaneously, if necessary. The system also uses the Antisurge and Performance algorithms to achieve two key objectives: manipulate the recycle valves so that they protect the compressors from surging and manipulate the compressor suction throttle valve to maintain a common discharge header pressure within the required set point. In doing so, our system prevents the recycle valve from opening unless necessary, protects the facility against surge and curbs energy consumption and related emissions. The CCC Inside control solution allows smooth, bumpless and fully automatic loading and unloading of the individual compressors in the network, while keeping the air header pressure very stable.

During the execution and commissioning phases, our team leveraged world-class turbomachinery controls expertise to deliver a truly optimized solution.

Execution Phase

To meet the project's tight timeline, our execution team conducted a diagnostic survey of the existing system and discussed its limitations together with a panel of senior turbomachinery advisors, following CCC's proven execution process. The CCC engineering team executed critical optimization design decisions in cooperation with the end user, including:

- **Setting an accurate surge setpoint.** After the existing characterizer was recalculated into CCC's universal coordinates, it became obvious that the original setpoints were too conservative compressors. We calculated the accurate surge line, which allowed for wider operating envelope and a fully closed antisurge valve. Precise mapping of the surge limit line also allowed us to eliminate spurious surge events reported by the end user on other machines.
- **Improving placement of the discharge pressure transmitter.** The transmitter had been located downstream of the second stage aftercooler. By relocating it to the compressor second stage discharge, we helped our customer avoid cooler blockage and increase the accuracy of the discharge pressure measurement.

CCC and Honeywell DCS teams collaborated closely to integrate the design and deliver the best value for the end user in terms of autonomous operations and optimization. The project leveraged Honeywell LEAP™ methodology and decoupled hardware and software testing and commissioning work to maximize efficiency.

Commissioning Phase

After completing our in-depth execution process, we made numerous optimizations during commissioning to deliver the highest quality solution for our customer. These included:

- **Optimizing control execution**. In addition to CCC blocks, other logics — including auxiliaries, sequence, trips and communications blocks — were programmed into the same controllers. CCC and Honeywell's Engineering worked hand-in-hand to distribute the control module execution and phases in the C300 Control Execution Environment to deliver the best control quality and response time, all with a smaller footprint.
- **Enhancing controllability.** After witnessing slow IGV and BOV/ASV responses, we tuned the IGVs and recommended that the customer overhaul three BOVs. These actions allowed us to achieve optimal controllability.
- **Preventing surge caused by receiver line trips.** A group of air receiver lines was started and stopped frequently, causing sudden changes in the discharge pressure. When these lines restarted, they often tripped due to low discharge pressure — a dynamic that would occur whenever the compressors were unable to recover header pressure in time. The plant's N2 compressor receiver lines were experiencing the same issue. To ensure the discharge header pressure recovered in time, we optimized PI and RT tuning and derivative control implementation. This eliminated receiver line trips and, as a result, prevented the compressors from going into surge.

The Results

By equipping their plant with CCC Inside for Honeywell Experion PKS, our customer solved the Loadsharing problem that was causing significant energy loss and safety hazards. After implementing CCC Inside with properly tuned high-quality Antisurge Control, our customer did not experienced a single surge event.

The CCC Inside solution also eliminated the operators' previous anxiety about system behavior. Because the old system didn't protect from surge and caused uneven load distribution, they had to check the compressor operations frequently and often take manual action to stabilize them.

The user has gained a world-class solution that reduces repair costs, eliminates unnecessary process shutdowns, enhances startup and control availability, and provides improved visibility into the turbomachinery performance. By working with Honeywell and CCC, the user has full support coverage, and help and consultancy at any time. The result is measurable economic and environmental value that continues to position our client as a leader in petrochemical manufacturing innovation.

Does your operation value both flat architecture and best-in-class turbomachinery controls?

Discover how CCC Inside can bring advanced controls to your Honeywell Experion PKS