Project complexity at electrical power plant in Bahrain addressed with flexibility and scalability of PlantPAx DCS

System Integrator, SEID, deploys single, integrated control platform to integrate different signals and protocols for interconnection to higher-level DCS

Challenge

Interconnection of diverse systems and management of diverse communication protocols

Solutions

A PlantPAx solution from Rockwell Automation was installed, which included:

- PlantPAx Control System in redundant solution both for I/O and control system.
- HART Protocol enabled on the EtherNet I/P I/O
- Rockwell Automation library of Process Objects
- Field network handling, including MODBUS TCP/IP interface in redundant configuration, Fieldbus Foundation interfaces & PROFIBUS
- EWS & OWS

Results

- Availability of accurate information relative to diagnostics on equipment and parameter faults.
- Intelligent management of equipment through Fieldbus Foundation
- Reinforcement of collaborations and possible future opportunities

The primary requirements were for a control solution that would deliver high reactivity, integration and reliability

Background

A new electrical power plant in Bahrain needed an integrated control system for automating four three-phase centrifugal gas compressors.

With a growing population and rapidly expanding industrial footprint, Bahrain is seeing rapid expansion of its electrical infrastructure, with the commissioning of new plants and modernisation of existing facilities. According to the Oxford Business Group: "Bahrain has an available electricity capacity of nearly 3,921 MW, with peak demand hitting 3,418 MW in summer 2016. At the same time, top estimates have peak demand reaching around 4,500 MW in 2020 […] this will require significant new power supplies coming on-line in the near future, as well as upgrades to the distribution network."

Centrifugal compressors are vital assets in gas-based applications, delivering proven reliability. However, while requiring less maintenance than other compressor formats, their performance characteristics are more easily affected by changes in gas conditions, so tight control must be maintained, to help ensure optimum operation.

The primary requirements in this project were for a control solution that would deliver high reactivity, integration and reliability. It also needed to manage a diverse range of communication protocols and provide interconnection with a higher-level DCS.

For this task, the power plant selected SEID srl, an Italian Control System Integrator that specialises in the supply of control systems and electrical equipment for production lines or complex processes.

Founded in the 1980s, SEID serves customers all over the world from its headquarters in Bergamo. Originally specialising in industrial electrical engineering and installation, SEID evolved – gaining experience in the design, engineering, production and supply of services in the field of industrial automation processes. This evolution means that the company now operates at a global level, collaborating in the realisation of large-scale international projects.

Its focus on process control and its recognised ability to provide added value, were the basis for the company being selected to supply the integrated control system for this new power plant in Bahrain, with the interoperability, flexibility and scalability of the PlantPAx® distributed control system from Rockwell Automation, being the obvious candidate for the control architecture.

Challenge

The four three-phase centrifugal gas compressors, with a 30 Kg/s capacity, feed three gas turbines, which, combined with three cycle steam turbines, supply total power of 1.8 GW. Each compressor is powered by a 6.5 MW at 11,500 V electric motor.

In addition to the physical dimensions – which were already a challenge – there were other elements that represented critical aspects in the development the project. A single control platform was required that would have to interoperate with different types of signals and communication protocols, while also interconnecting with a higher-level distributed control system (DCS) through Modbus TCP/IP, using redundant communication on ETH/FO and towards the MCC-LV/MV through PROFIBUS.

Solution

Thanks to the high performance it offers, SEID chose the PlantPAx distributed control system from Rockwell Automation. This delivers robust communication with the rest of the system and has minimum impact on system performance, which has to be high and aligned with the control logic of the compressors.

The four compressors are automated using high-level process controllers, in redundant configuration. These are used to acquire diverse types of signals and manage different communication protocols coming from the compressors, which are fitted with traditional instrumentation (4-20 mA), as well as intelligent instrumentation using HART and Fieldbus Foundation protocols. This system gives the operator a raft of information relative to diagnostics on the field instrumentation, devices, actuators and motors, which helps with implementation of scheduled and extraordinary maintenance.

A single control platform was required that would have to interoperate with different types of signals and communication protocols

The system also interconnects with the higher-level DCS through a redundant Modbus TCP/IP connection on an ETH/FO network, towards the plant's Motor Control Center, low and medium voltage, through redundant PROFIBUS links. These two protocols deliver intensive and continuous exchange of information in real time, allowing high intervention reactivity in case of faults in the pre-set values, helping to deliver higher availability and greater safety.

The performance features of the PlantPAx DCS and solid integration of the programming software, the I/O modules and the various communication protocols, allowed the development of complex software routines, without having any effect on the cycle times. Load control algorithms, controller performance, load sharing and anti-surge controller functions were implemented to help ensure the best control and performance of the centrifugal compressors. To deliver immediate availability of information about the condition of the machines, HMIs permit operators to react intuitively and rapidly in case of emergencies.

Results

The PlantPAx system is built according to a standard and its multi-disciplinary architecture helps to deliver the fundamental requirements of the project – high reactivity, better integration and enhanced reliability.

"The choice of Rockwell Automation was a winner because it allowed us to successfully face all the challenges of the project while staying on schedule."

The availability of different types of data from a single control system provides the customer with real-time information, which, in turn, improves diagnostics, efficiency and maintenance, not only of the four compressors but throughout the entire power plant.

The use of Fieldbus Foundation technology with the PlantPAx distributed control system, also delivers easier management of multiple interfaces in the development and configuration phases of the software, using tools that are totally integrated into the system. The system provides constant accurate information in real time about diagnostics and any faults, offering the possibility for operators to intervene rapidly, reducing downtime and improving the overall efficiency.

The compressors are automated using high-level process controllers, in redundant configuration

The consolidated collaboration between the Rockwell Automation team and SEID was further reinforced by the success of this project and has cleared the path for future opportunities.

"The project was particularly complex, and certainly the biggest problem was the dimensions of the machines," affirmed Roberto Bennice, Sales Director at SEID. "I could say that the biggest challenge was represented by the adjectives 'diverse' and 'single. We had to interconnect diverse systems on diverse machines with diverse devices using diverse communication protocols, all with a single control solution that would satisfy the objectives of high reactivity, complete integration and higher reliability. The choice of Rockwell Automation was a winner because it allowed us to successfully face all the challenges of the project while staying on schedule."

Additional Information

www.rockwellautomation.com

The results mentioned above are specific to SEID's and its customer's use of Rockwell Automation products and services in conjunction with other products. Specific results may vary for other customers.

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