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UPDATING CONTROLS IMPROVES UNIT START-UP

Kentucky Utility Company's E. W. Brown power plant, located in Burgin, Kentucky, recently upgraded the controls on its coal-fired Unit 2. According to Pat Grant, electrical and instrumentation supervisor, the plant had been experiencing problems with the servos and the mechanical portion of the control system. Because they were unable to coordinate the turbine controls and the boiler controls, the plant had trouble getting the steam turbine online.

Since the old equipment was outdated, replacement parts were difficult to locate. Further, there was difficulty in finding technicians with the knowledge and skills needed to perform troubleshooting and repairs. To resolve the problems, the plant decided to replace its outdated and faulty control system with new equipment that offered better reliability and performance.

The retrofit included new digital controls, two human/machine interface (HMI) stations and an operator control panel. In addition, the turbine's hydraulic control system and instrumentation were replaced by an electronic over-speed protection system.

AGING PLANT

Unit 2, built in 1963, is a tangentially coal-fired boiler with an electrostatic precipitator and low NO_x burners attached to a 175 MW Westinghouse steam turbine. Prior to the installation of a control system in 1994 the plant used an old mechanical-hydraulic system to open and close valves and to control the steam turbine's governor.

Over the years control system problems required that the unit be periodically taken off-line to make repairs to the controls. The governor control valves, for example, were always hunting for a set point, particularly at higher loads. Also, because the burner control system on the unit's boiler was newer, the burner controls responded to changes in operation faster than the older turbine controls.

Reheat stop valve conversion

After evaluating different options the plant awarded a contract to TurboCare Loveland Turbine Control Upgrade Facility to replace the controls. The contract specified the use of a Woodward MicroNet TMR controller and training of the plant's staff.

An important element in the selection process for the project was time. Although TurboCare Loveland recommended a 16-20 week time frame for project completion, the plant's schedule required that the project be completed in ten weeks, including everything from design through installation. Following the design, manufacture and assembly of the control system, a factory acceptance test was conducted.

Despite the compressed time frame the control system was shipped to the site on schedule. In addition, to ensure that the project would be completed on time the contractor prepared a turnkey installation package

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for the plant's personnel to follow. "We did the electrical and mechanical installation and had an engineer from Turbo-Care helping us through the entire process," says Grant.

Throttle valve conversion

FIVE-WEEK SHUTDOWN

The upgrade required a five-week shutdown in the fall of 2002. Although the plant kept the original steam valves, the old mechanical hydraulic controls were replaced with digital electric-hydraulic controls. New digital servo actuators for the throttle valves, the governor valves, the intercept valves and reheat stop valves were also installed.

The upgrade involved six major components:

- *HMI Engineering Stations*
- *Fault Tolerant MicroNet Controller*
- *New Cabinetry*
- *New Fluid Control System*
- *Critical Monitoring and Hydraulic Trip Panel*
- *Valve Actuation Kits*

The MicroNet programmable digital controller can be programmed to control any prime mover and its associated processes. Although the plant discussed using a distributed control system (DCS) the cost was prohibitive.

At the plant, the controller, power supplies, wiring termination points, termination modules and the power supplies for the remote devices are installed in a new cabinet. A two-line display panel is mounted on the outside of the panel.

A key feature of the MicroNet digital unit is a fault-tolerant architecture that allows for no single point of failure anywhere in the system. All modules and power supplies are replaceable without a shutdown. Over-speed protection uses a two-out-of-three system that independently monitors three magnetic pickups. It has a five-millisecond sample rate and a maximum total response time of 40 milliseconds. When over-speed occurs, the system records and displays the maximum speed.

A redundant high-pressure hydraulic power unit with dual input system power supplies, duplex filtration, a five-gallon accumulator and a 200-gallon storage tank, has replaced the old hydraulic system. The pump skid has its own instrumentation, control and panels.

FASTER RESPONSE

According to Grant, the electrical and instrumentation plant staff was trained on maintaining and troubleshooting the control system while the operators were trained on its use. The big difference from the operations' standpoint is the HMI engineering station: One screen gives a graphic overview of the entire system and another the images of the peripheral components and current operating data, Figure 1. The data includes lube oil pressure, thrust pressure (active and inactive), status of each valve, and key operating information on the turbine's speed and load. Operators are able to drill down to get details on other individual devices such as the governor valves, throttle valves, and the HPU located in the plant.

Besides having current operating data, the operators and engineers are able to see trends on all the information gathered throughout the system. A series of buttons on the overview screen can be used to bring up longer-term information on turbine speed, load, impulse pressure and valve positions. With the new system it is easier for the plant's staff to trend and troubleshoot a problem, says Grant.

Even though the plant has not been able to quantify specific monitory savings from the new control system, the operators now have better control of the turbine and the boiler. Because there is less lag time with the new turbine controls, the operators have better control when the unit's load is ramped up or down. PE

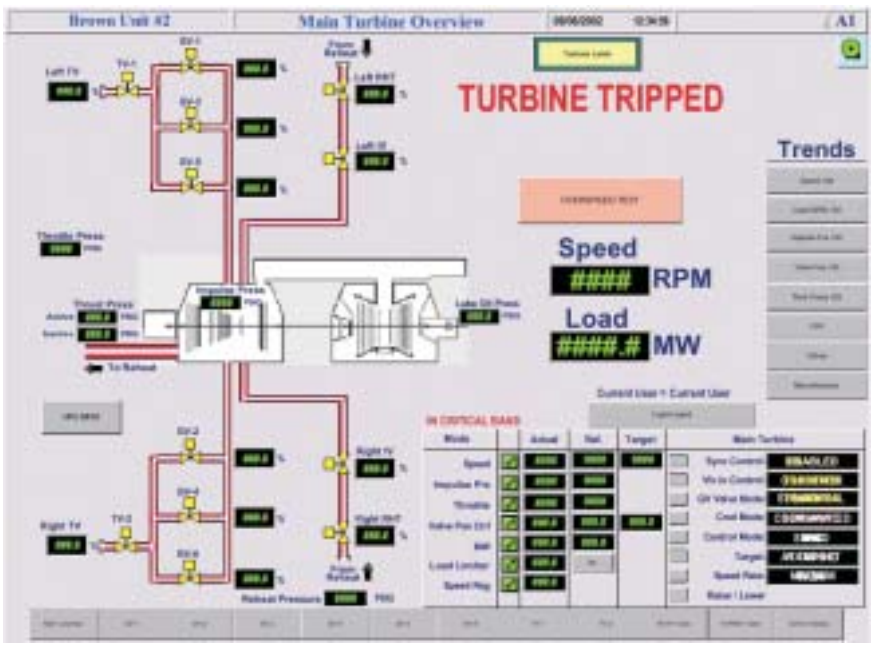

Figure 1: HMI screen: Main turbine overview

About the Author:
Joe Zwers is a writer from Los Angeles focusing on technology issues.