

User-friendliness and energy efficiency in building automation

## Complex climate control handled by easy-to-operate PC-based solution in luxury residential high-rise in Florida

Traditionally, building automation has been similar in accessibility to industrial automation by requiring highly skilled programmers and engineers. To alleviate this, the American company Fulcrum Automation and Control Technologies developed FACTWARE, a software solution for intelligent building monitoring and control based on Beckhoff control components. FACTWARE is not only simple and intuitive to operate, it also reduces costs through efficient use of resources.



Based in Beachwood, Ohio, Fulcrum has decades of experience in industrial automation and control, telecommunications, energy, environmental management, risk management and IT. When Fulcrum implemented FACTWARE in a luxury residential high-rise called Toscana North, located in Highland Beach, Florida, they were able to realize the full potential of the building automation software in terms of operator efficiency and energy savings.

Fulcrum was commissioned to automate the control system for the cooling tower of the 17-story condominium, which features two recirculating pumps, two tower cooling fans and three chemical injection pumps. The building management at Toscana North required a monitoring station with visual interface and audio alarming capability to be installed in the lobby's reception area. They also sought the ability to send text message alarms to maintenance crews on cell phones in real-time, 24/7. In addition to the alarming system, Fulcrum determined there were improvements that could be made to dramatically enhance the energy- and cost-efficiency of the building.

The Toscana North cooling tower is located on the building's roof and the control room for it is near the top floor. Fulcrum placed a Remote Terminal Unit (RTU) controller near the cooling tower's fan motors and pumps. The RTU interfaces with four variable speed drives that together power the pumps and fans.

"Fulcrum technology requires Windows CE and Beckhoff offers an ideal range of Windows CE-enabled controllers with a wide selection of processors," said Marc Gervais, General Manager, Fulcrum Automation. "This scalability helps us accommodate our customers' needs to match the perfect controller to each unique application."

As the controls centerpiece, the FACTWARE solution incorporates a networked CX9010 Embedded PC with 533 MHz Intel® IXP420 processor with XScale® technology, Windows CE, Ethernet, DVI and USB ports as well as TwinCAT PLC software, all from Beckhoff. The system is also equipped with various digital and analog Bus Terminals.

### Reduced energy consumption – extended service life

Toscana's cooling towers were installed in 2001 when power cost 5 cents a kilowatt-hour as opposed to 11 cents today, resulting in a significant increase in the running costs for Toscana North. As is often the case with large construction projects, the tower's control systems were basic and not designed to optimize energy use. Further costs arose through the risk of fan failures. The fan controls were based on temperature setpoints with fan 1 acting as a primary fan at all times while fan 2 operated as supplemental cooling and backup to fan 1, resulting in premature wear of fan 1. As a complicating factor, maintenance personnel had to reach the top floor daily to determine the status of the cooling tower and often became aware of situations "after the fact" instead of foreseeing potential problems before they developed.

Fulcrum eliminated these inefficiencies by automating the fan system with 12-hour lead/lag type cycling between main and auxiliary functions while maintaining the building's original temperature setpoint tuning. "These fans and pumps are very expensive pieces of equipment" Gervais said. "Alternating lead and lag saves considerable wear and tear and will drastically extend the life of the equipment."



Considering the typical ROI system savings on a single pump running at 60 Hz, the yearly ROI achieved at Toscana North is significant.

The two pumps are also cycled between main and auxiliary functions on a 12-hour basis. "Previously, the lead pump ran at full speed at 60 Hz. At this level, the system drew far too much power," Gervais said. "The amount of power drawn is not proportional to the speed of the motors, it increases exponentially. The ideal spot is around 32 Hz or a bit higher depending on individual drives." The FACTWARE user is able to log their information and intelligently modulate power to meet system requirements at all times. The VSDs ramp up the pumps in such a way that there are no power spikes, preventing wear and tear on the motors. In addition to protecting the equipment investment, modulating the speed of the pumps provides Toscana North direct savings on energy consumption, leading to a reduction of approximately 30 percent in overall use.

If energy consumption is reduced by even 10–20 percent for every cooling tower, the potential savings for the market are enormous.

The lobby's reception area at Toscana North has a monitoring station with visual interface and audio alarming capability. Communication is facilitated via a Beckhoff BK9100 Ethernet TCP/IP Bus Coupler installed at the concierge desk.



Frank Daire, Building Manager, Toscana North (left), and Marc Gervais, General Manager, Fulcrum Automation (right)

Finally, the system continually monitors and controls the chemical injection pumps and notifies the chemical vendor when chemicals are out of the specified range, avoiding unnecessary "check up" visits.

**FACTWARE enhances operator efficiency and reduces costs**

Configured with contact names, e-mail addresses and cell phone numbers, the system immediately notifies the Toscana North staff of alarm conditions and receives scheduled operational logs.

The energy savings combined with time savings for maintenance crews result in a considerable cost reduction and ROI for the operators of Toscana North. "The combination of the user interface with Beckhoff's PC-based technology is a game-changer for monitoring small-scale HVAC applications and stand-alone pumping stations," Gervais said. "There are roughly half a million cooling towers like the one at Toscana North in the United States. If energy consumption is reduced by even 10 – 20 percent for each cooling tower, the potential savings for this market are enormous."

"Beckhoff offers a flexible control platform that can be easily integrated into legacy systems," Gervais said. "This permits painless retrofitting and vast improvements for applications that were quite difficult to modernize in the past."