Case Study: Ballarat Health Services

Major Australian health care group starts upgrade of its reliable and efficient Opto 22 system—cites network segmenting capability and superior throughput of SNAP PAC Systems

Ballarat Health Services, in the Grampians Region of Victoria, Australia, is a major health care organization comprising two principal hospitals—the Queen Elizabeth Centre and the Ballarat Base Hospital. Ballarat Health Services' multi-block campus also encompasses convalescent homes, psychiatric services, six nursing home hostels, and rehabilitation centers. Through this broad collection of facilities, Ballarat Health Services is able to provide a comprehensive range of medical, surgical, geriatric, and mental health services to a population of more than 200,000 people in the region.

As the principal referral center for the Grampians Region, an area of more than 48,000 square kilometers, it's critical for Ballarat Health Services to keep facility, systems, and equipment running optimally. This responsibility falls squarely upon the shoulders of Ben Orchard and Nick Stephens, Plant Control Technicians for Ballarat Health Services and the 32-person Engineering Services team. The group's primary function is to select, procure, configure, install, and maintain the control hardware and software that keep the Ballarat Health Services facilities operating reliably and efficiently. For these purposes, Orchard has chosen Opto 22 automation and control products. Primarily, Orchard is using the company's *mistic*™ and SNAP Ethernet brand of I/O modules, brains, and controllers. Overall, Orchard has an install base of more than 17 controllers responsible for over 2700 I/O points scattered around the Ballarat campus.

"These controllers include numerous M4s and SNAP-LCM4s, which are forerunners to today's programmable automation controllers," says Orchard.

Orchard, however, is currently in the process of replacing this older hardware with Opto 22's latest and flagship product line—SNAP PAC Systems. In fact, Orchard has already upgraded four of his M4s to SNAP-PAC-S1 standalone programmable automation controllers. Orchard cites several important reasons for making the switch, including dual Ethernet ports that can be used for network segmenting, and much greater throughput. Indeed, for some of the processes at Ballarat, Orchard has seen the faster processing speed of the SNAP PAC result in dramatic improvement in throughput and process execution reduced from 7-8 seconds down to mere milliseconds.

HVAC

SNAP PAC controllers improve the overall performance of the heating, ventilation, and cooling system.

Critical to the operation of the Ballarat buildings and facilities is an effective heating, ventilation and cooling system. This includes chillers and air handlers and the blowers, filters, fans, and other components they're composed of. An Opto 22 system, including an M4 controller, connects to dampers—adjustable vents used for controlling airflow and draft—via SNAP I/O modules that reside on a remote I/O rack. Also on the rack is a SNAP-B3000 brain that receives the commands (via a serial connection) from the M4 and then relays these commands (via the modules) to set the dampers to open (allowing outside air in), closed (to allow the inside air to recirculate), or partially opened or closed. Orchard's ultimate plan for this particular application is to upgrade all of his M4s to SNAP PACs for overall better performance, including the aforementioned greater throughput.

"Fortunately for us, Opto's new SNAP PACs are not only more powerful but also provide a clear and easy migration path for us to be able to implement them. I can swap out our M4s for the SNAP PACs and have a better, faster system without having to even touch any of my remote I/O or sensors."

Before

After

M4s are replaced with SNAP PACs without having to touch any remote I/O or sensors.

Sophisticated Power Management

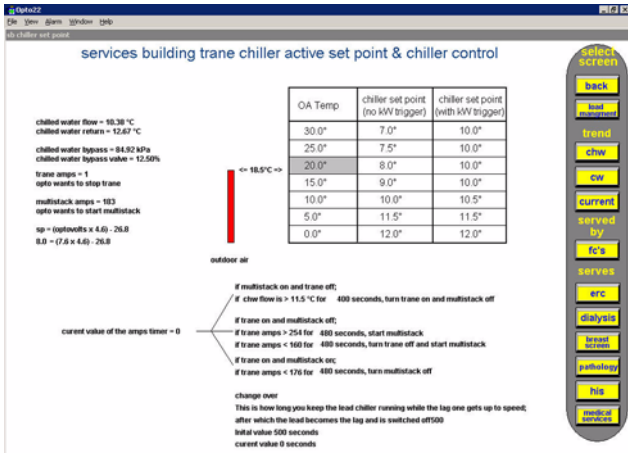
The Engineering Services team is also responsible for all of the generators that power the Ballarat Base Hospital. For maintenance purposes, each of these generators must run for approximately four hours at least once every two weeks. To accomplish this, each generator is connected to an Opto 22 system that starts and stops each generator when it's time for its weekly test.

The Opto 22 system reduces electrical load and regulates the water temperature of four main chillers.

Also, if the hospital's power load exceeds a specified threshold for an extended period of time, the Opto system automatically starts one of the generators in order to reduce the load the hospital places on the electrical grid.

"This usually only takes place during the summer months when our chillers are very heavily taxed," Orchard explains.

But this remote start-up and alternating of the generators is something of a "last resort" for Ballarat Health Services, as the organization has made concerted efforts towards power conservation. For example, the control system has been configured to regulate the cooling of the water for each of four main chillers. The Opto system monitors the outdoor air temperature, and as it increases, the system correspondingly decreases the chilled water set point. Conversely, when the power draw exceeds the predefined threshold, the chilled water set point is increased, thereby decreasing the strain on the chillers and thus lowering the overall power draw.



Air temperature and power are monitored to maintain chiller efficiency and low power usage.

"This will sometimes result in slightly increased room temperatures, but often it's enough to get us through the day without starting a generator," says Orchard. "Also, once a generator is started, the Opto system has been programmed to time how long it runs. If the generator isn't run for the required interval of four hours, then the Opto system knows to start that generator again when its biweekly test time rolls around. Plus, whenever there's a blackout, both generators are automatically started. The Opto system monitors the load placed on each generator and if it's determined that the overall load can be supported by one generator, then the other generator is powered down and put into a 'hot standby' mode."

Temperature Control

Similar automation strategies are used for the Ballarat hospitals' theaters (operating rooms.) In each of these theaters, the hospital staff has the ability to make changes to the system themselves. Nurses and doctors, for example, can use OptoTerminals—rugged operator interface terminals with touchscreens—that are mounted on the walls of the theaters to change the room temperature.

"Obviously, in the middle of a surgical procedure, medical personnel can't be distracted by having to fiddle around with switches, knobs or other controls to get the temperature right," Orchard explains. "They need to be able to walk over, touch the screen, set the temperature, and be done with it. The OptoTerminals provide an easy to understand and easy-to-use interface to the Opto control system, which accepts the temperature input setting and adjusts the HVAC system appropriately."

Wall-mounted OptoTerminal touchscreens allow doctors and nurses to adjust operating room temperature.

Additionally, the OptoTerminals are NEMA-4 certified (i.e., they are sealed and protected against splashing and hose-directed water.) This helps Ballarat Health Services meet its infection control standards regarding washing down and cleaning the theaters.

OptoTerminals provide an easy to-use-interface to the Opto 22 control system.

PID Control

Also within these theaters, positive pressure must be maintained at all times. Positive pressure refers to when the air pressure within a system, area, or enclosure is greater than the environment that surrounds it. Consequently, if there is any leak from the positively pressured system, it will be from the room into the surrounding environment. Likewise, positive pressure also ensures that there is no ingress of the environment into the closed system. Like most hospitals, Ballarat has positively pressured theaters so any airborne germs that might infect a patient being operated on are kept out.

To achieve and maintain the positive pressure in Ballarat's six theaters, an Opto 22 SNAP system connects to and gathers input data from strategically placed differential pressure sensors. These readings are processed by the SNAP system, which then sets outputs (i.e., sends commands) that make any needed adjustments to the HVAC system fans.

The specific hardware used to perform this PID control consists mainly of SNAP-M4 controllers, each controlling the air for three theaters and working with B3000 Ethernet brains (I/O processors) residing on 16-position racks. Orchard is very pleased the improvements these brain-based control loops offer.

"One very important factor is that all the PID loop parameters can be saved to flash RAM on the brain. This means that the PID loops can be up and running the instant power is applied to the rack."

PID-maintained positive air pressure keeps airborne germs out of the operating room.

Orchard uses Opto 22's SNAP-PID modules, which perform the individual PID loop calculations-one loop per module.

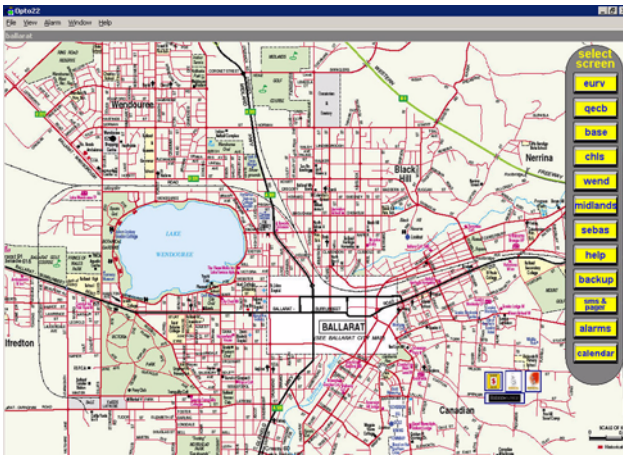
Despite the fact that there are 16 modules per rack, there is no system degradation. This is due to the fact that the Opto system has a distributed architecture where the controller communicates with multiple remote I/O brains (the SNAP-B3000-ENETs) that handle the PID and relieve the controller of this taxing, processing-intensive burden. The application has worked well for Orchard for some time but despite this, he and his team have already begun to replace the M4s with SNAP-PAC-S1s for the substantial performance and consolidation features they provide.

"The SNAP PAC System offers newer, faster, and cheaper processors like the SNAP-PAC-EB2 that can perform up to 96 loops of PID control. This makes those single loop PID modules unnecessary. In their place, I can use Opto's new higher density 32-channel I/O modules. This gives me a faster system with fewer components that's going to give us more flexibility and cost us a lot less money than the ones we've used in the past."

A History With Opto 22

Migrating to Opto 22's latest and greatest technologies is nothing new for Orchard. He has been integrating Opto 22 products for fifteen years and has experience with a number of the company's legacy control systems, including Optomux, *mistic*, FactoryFloor and SNAP Ethernet (first introduced in 1982, 1991, 1996, and 1999, respectively.) Throughout, Orchard has always been impressed with the Opto product line's flexibility and ease of use.

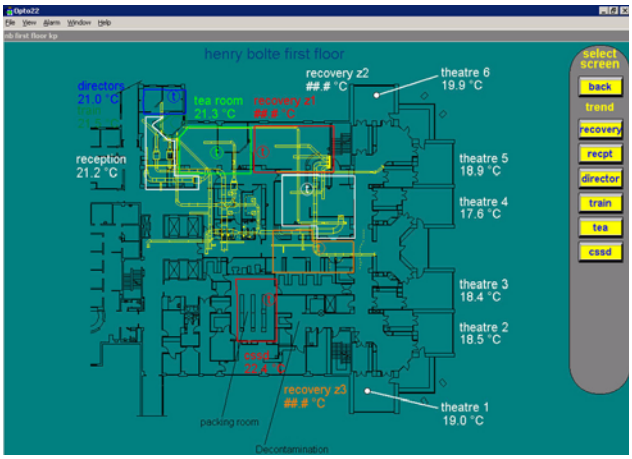
Orchard demonstrates this ease of use each and every workday when he checks on the multitude of Ballarat Health Services systems. Orchard used Opto 22's OptoDisplay HMI (human-machine interface) development software to design an interactive map of the entire Ballarat Health Services campus. Clicking on any one of the campus buildings brings up its floor plan and further clicking drills down to graphical representations of the building's individual rooms, and the specific systems and equipment therein.



Plant Control Technician Ben Orchard used Opto 22's OptoDisplay HMI software to design an interactive map of the entire Ballarat Health Services campus.

Significantly, since OptoDisplay was first introduced in 1996, Opto 22 has released several new versions of OptoDisplay along with two all-new and improved iterations of HMI development software—ioDisplay and PAC Display. Despite this, because of the company's commitment to providing clear migration paths to its latest technologies, Orchard has always been able to seamlessly transfer his existing HMI projects to the newer platforms—something that's

proved critical for Orchard, who currently has designed and is using more than 1000 HMI screens.



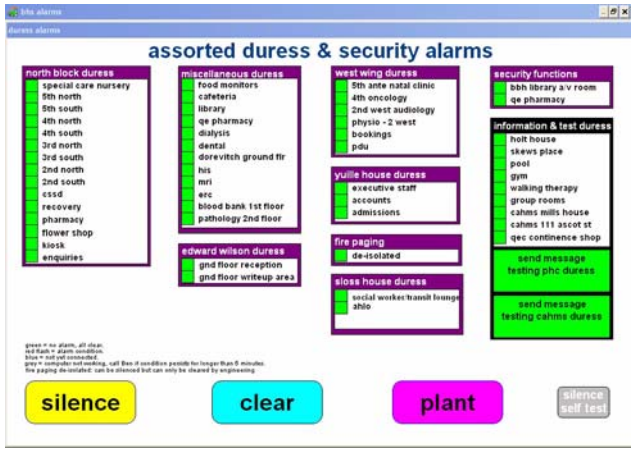
Clicking on a campus building brings up its floor plan.

Orchard and the Engineering Services staff use the HMI screens to get real-time views of how all the Ballarat HVAC and other systems are functioning and also to view and acknowledge alarms that are triggered whenever any of Orchard's predefined operating parameters are not being met.

"The symbols I used to build all of these screens are from Opto 22's very extensive library of runtime graphics. We have both two- and three-dimensional representations of our chillers, gas-fired boilers, pumps, and compressors, which allowed me to design interfaces that look as much like the actual systems and equipment as possible. Even someone who knows nothing about our facilities can look at these screens and understand what's going on."

Duress Monitoring & Alarming

Many Ballarat nurses and other personnel carry with them at all times a personal black alert button, a small pen-sized device that, despite its unobtrusive look, functions as a crisis alert button that triggers security and other emergency response. Once pressed, the button sends wireless signals over a specific frequency. A local receiver checks for a valid code within this signal and (if validated) closes a relay that triggers a digital input through a connection to a digital module on a SNAP I/O rack. A SNAP-B3000 brain then relays the signal to the controller (once again, either an M4 or SNAP-PAC-S1) which then activates an audio alarm and flashes a graphic on the HMI screen of the PC at the main reception desk.



As part of a duress monitoring system, an HMI screen helps ensure the safety of patients and staff.

"We refer to this personal emergency response system as 'wireless duress monitoring' and it's critical to ensure the safety of both patients and staff if someone suffers a seizure, psychotic episode, or is otherwise in danger of injuring themselves or someone else," says Orchard.

Refrigeration Monitoring, Alarming, & Regulatory Compliance

Beyond optimizing system performance and providing remote monitoring and alarming capabilities, the Opto 22 systems also help Ballarat Health Services address some of its many regulatory compliance issues. Specifically, PAC Display "SuperTrends" provide a graphical data record of the temperatures of the many refrigerators that are used to store hospital food and drugs. These supertrends essentially track and create a graphical log file for up to 16 different parameters (temperatures, in this case) over any specified period of time, thus providing an easily understood visual record. With this trending feature, an accurate record is created and, as the law dictates, these records are made available to Australian government regulatory agencies for review or audit. Orchard archives six months of SuperTrends for the refrigerators that store drugs and three month's worth for the refrigerators that keep food.

Yet another interesting application of Opto 22 products at Ballarat Health Services is at the Queen Elizabeth Center, where an Opto 22 control system manages the heating process of the hydrotherapy pool. At the bottom of the pool is a layer of tile; underneath this, a layer of grout, then concrete, and finally the ground. To avoid cracking in any of the top two layers, the pool has to be heated extremely slowly. This

required the development of a special heating control strategy. Orchard used the ioControl programming software to create a strategy that heats the pool gradually, at a mere .1 degree per hour. Orchard says that strategies like this are very easy to design using either the scripting or flowcharting tools included with ioControl.

Looking Ahead

Orchard recently visited the Opto 22 corporate headquarters and manufacturing facilities in Temecula, CA, USA. The timing of his visit was very fortuitous, as the company had recently held its OptoSummit and SNAP PAC System Launch, which educated attendees on the SNAP PAC System hardware and software. Orchard was able to chat extensively with Opto 22 system and design engineers. These discussions confirmed what Orchard already knew—the addition of SNAP PAC System components to the already superb systems installed at Ballarat Health Services will make a good situation there even better.

Orchard's visit also allowed him to meet face to face with the Opto 22 Product Support Specialists he chats with on a weekly basis. "It's why we chose Opto to work with in the first place and why we keep coming back," Orchard concludes. "The support is always there and the products are rock solid."

About Opto 22

Opto 22 develops and manufactures hardware and software for applications involving industrial automation and control, remote monitoring, and data acquisition. Opto 22 products use standard, commercially available networking and computer technologies, and have an established reputation worldwide for simplicity, innovation, quality, and reliability. Opto 22 products are used by automation end-users, OEMs, and information technology and operations personnel. The company was founded in 1974 and is privately held in Temecula, California, USA. Opto 22 products are available through a worldwide network of distributors and system integrators. For more information, contact Opto 22 headquarters at 951-695-3000 or visit www.opto22.com.

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