

## Case Study: Callaway Golf

### *Callaway drives better after a year with SNAP Ethernet I/O*

Compared to most manufacturing plants, Callaway Golf Ball Company of Carlsbad, California is operating way above par—but in this case, that’s a good thing. By employing SNAP Ethernet I/O technology from Temecula, California-based Opto 22, Callaway has increased its yield of golf balls from 33 to 99 percent, chipped its way free of the high cost of proprietary control hardware, and can now adapt more quickly to the changing needs of its factory floor.

Callaway began using Ethernet-based I/O to help automate its new 225,000 square-foot manufacturing facility, which was built to produce Callaway’s revolutionary new golf ball, the Rule 35. Initially, the most visible and immediate benefits of this implementation were in the “short game”—that is, the technology increased the speed at which Callaway could connect new equipment while also enhancing the company’s ability to acquire data from real-time testing. Over the past year, however, Callaway has also been using Ethernet I/O technology to improve its “long game”—specifically, plant management.

“Making golf balls is a very complex process that must be monitored very closely,” says John Irwin, manufacturing data manager at Callaway. “It’s a very high-speed process, involving thousands of balls in constant motion, all over the plant.”

Golf balls are made in several stages and temperature regulation is critical to each. For example, in a finishing operation where golf balls are being painted, the balls go through an oven at a rapid rate. The process has three different lines and each line has several ovens. At any point in time, there may be thousands of balls in the ovens. “But they don’t just sit there and cook,” says Irwin. “They are constantly moving. Balls move continuously from left to right and right to left. Without proper temperatures in every zone of the oven, the balls on the right side might be cured properly but the balls on the left might not. We monitor those temperatures continuously, taking readings at least once per second.”

Soon after operations at the new manufacturing facility began, Callaway engineers discovered that these ovens and other installed production equipment did not have enough sensors, so Irwin and his team of engineers began outfitting this equipment with SNAP Ethernet I/O systems from Opto 22.

The SNAP Ethernet I/O system consists of a processor (or “brain”) and input and output modules connected to real-world equipment such as thermocouples or pressure and conductivity sensors. The system is connected to an Ethernet network and each sensor can then be accessed through the SNAP Ethernet I/O

system’s brain. The brain processes the data and sends it via the Ethernet TCP/IP connection to a host device—in this case, the Wonderware InTouch PC-based SCADA system and the Allen-Bradley PLCs that control the actual manufacturing processes.

Irwin says installation of the new hardware was simple. “I can buy a system from Opto 22, install it, establish an Ethernet connection, assign an IP address, and have it up and running in no time. The Opto 22 system lets me get as many as 60 I/O points configured in 15 minutes.”

Fortunately for Callaway, the SNAP Ethernet brain and I/O modules are built for use in industrial applications, so they are designed to handle high temperatures (up to 70° C) and humidity. “I’ve been amazed at the performance of the hardware,” Irwin says. “I was worried about some of the high-temperature environments. It has gotten so warm in the cabinets that the SNAP Ethernet system becomes almost untouchable, almost as hot as a light bulb. We’ve cooled some of that with fans, but the I/O has been unfazed so far.”

Callaway soon realized the benefits of their newfound ability to run real-time quality control tests on their golf balls. “Most people don’t realize the precision needed in manufacturing our golf balls,” says Irwin. “The three or four layers of material have to be perfectly centered and perfectly weighted to obtain optimum



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flight characteristics. They also have to meet United States Golf Association (USGA) specifications. We never know when the USGA will walk into a pro shop, buy a package of Rule 35s, and run tests on them. If they're not within established conformance limits, pros can't use them in tournaments. So testing is a very big deal to us."

Previously, Callaway would take 50-ball samples, test the core, plug, ball, thickness, and several other factors manually, then write everything down on paper. Data was collected every hour, reviewed and analyzed, and findings were reported at the next day's morning meeting. This method worked fine—except all the data was a day old. If a batch of balls failed the tests, they had to be scrapped or set aside as range balls. When the plant first began operations, only 33 percent of the balls produced passed USGA specs.

Once SNAP Ethernet I/O was in place, however, Callaway was able to automate its testing procedures. Now, the critical measurements are taken during the manufacturing process in real time and the data is sent to the SCADA system via the Ethernet network where it's analyzed immediately. If any variables begin to drift out of range, corrections can be made on the spot.

"We have three production lines, each with four major pieces of equipment. We take product off those lines and test them, sometimes every ball and sometimes 50 balls an hour. We can now react much more quickly to the changing conditions of the material, labor, resources, equipment, or other factors," says Irwin. "If we have simple things like mold releases failing or temperatures drifting out of spec, we'll see that right away in these tests. Our ability to test on-line was the key to increasing our yield of balls to 99 percent on spec in a year's time."

After just more than a year's experience of working with the SNAP Ethernet I/O system, Irwin has learned several tricks that make his life much easier. "I know that a big discussion is going on about Ethernet protocols and that many control equipment manufacturers are trying to make the industry standardize their particular protocol," Irwin says. "I don't want to be trapped by anyone's proprietary system, so I make sure that whatever equipment I buy is permitted to have its own IP address and can communicate using multiple protocols."

Irwin has also learned to bypass PCs. "We still send data via Ethernet to the SCADA system or to a client-server system, but those systems are all based on PCs, which are prone to failure," states Irwin. "There are too many steps involved getting from SNAP Ethernet I/O to an enterprise database when going through PCs, so now we send data directly from the I/O to the database." Irwin also logs data in the SNAP Ethernet brain's memory, so engineers can access it locally when troubleshooting problems.

SNAP Ethernet I/O is now allowing Callaway to become much more flexible in its "long game," day-to-day plant management. "As most plant managers know, the production floor is a constantly changing place," explains Irwin. "With SNAP Ethernet I/O sending data directly to both the SCADA system and enterprise applications, we now are able to look at the same data in a completely different way and make it immediately available to everyone in the plant, from operations to upper management. For example, the management people can look at real-time or historical data and production people can get information on quality specs. It also lets operators get information directly, instead of waiting for a quality person to check the data."

"We're eliminating all these problems one by one," says Irwin, "and we're also eliminating a lot of scrap—thanks to the SNAP Ethernet I/O system."

## About Opto 22

Opto 22 develops and manufactures hardware and software products for applications in industrial automation, remote monitoring, and data acquisition. Using standard, commercially available Internet, networking, and computer technologies, Opto 22's input/output and control systems allow customers to monitor, control, and acquire data from all of the mechanical, electrical, and electronic assets that are key to their business operations. Opto 22's products and services support automation end users, OEMs, and information technology and operations personnel. Founded in 1974 and with over 85 million Opto 22-connected devices deployed worldwide, the company has an established reputation for innovation, quality, and reliability.

Opto 22 products are sold through a worldwide network of distributors, partners, and system integrators. For more information, contact Opto 22 headquarters at 800-321-6786 (951-695-3000) or visit the website at [www.opto22.com](http://www.opto22.com).