

# OLDE WORLD MEETS DIGITAL WORLD

Baltimore Brewing's Centuries-Old Formula and PC-Based Automation Produce Award-Winning Beer. **By Theo de Groen**

**T**echnology has allowed the large brewing companies to produce consistency and quality for decades, but the rapid development of PC technologies has also helped microbreweries gain much of the same control at an affordable price. Such is the case of a Maryland brewery that is taking advantage of new PC-based controller and object-oriented human machine interface (HMI) software that provides batch processing capabilities and a digital operator interface for centralized control.

A stone's throw from Baltimore's Inner Harbor sits Baltimore Brewing Co., a microbrewery that is home to the DeGroen's brand of craft brewed beers. Distributed in Maryland, Pennsylvania, Virginia, D.C., and its own pub in the southeast corner of town, our German-style brews are winning a loyal following as well as national acclaim. We have won nine medals, four of them gold, at the Great American Beer Festival in Denver, the country's most prestigious award for domestic beer. In fact, our DeGroen's Weizen was declared the Gold Medal winner out of 65 entries for wheat beers for 2002.

Baltimore Brewing has been in existence since late 1989 but its historic ties convey a strong lineage in beer making as well as American heritage. The building is a mixture of early 19th and mid-20th century and is situated on a small swath of land called "Brewers Park" where brewing operations have been located since colonial times.

Maryland's Charles Carroll, the last surviving member of those who signed the Declaration of Independence, spent the latter part of his life in a house that still stands across the street. On the south side of the original property is the Star Spangled Banner Flag House museum, the site where Mary Young Pickersgill made the flag that flew over Fort McHenry during the War of 1812 and inspired Francis Scott Key to write the poem that became our National Anthem. The building at that time was a brewery under the name of Claggett's, later named the Star Spangled Banner Brewery.

The current Baltimore Brewery began operation in 1989 at a time when there were relatively few microbreweries in the U.S. and virtually none on the East Coast.

## Transformation Begins

Several years ago, the proprietary control equipment on the imported Kaspar Schulz brewing system began showing its age, so a refurbishing project was begun. Up to then, the entire process had been done manually. Control Corp. of America (CCA) ([www.cca-corp.com](http://www.cca-corp.com)) was brought in to inte-

grate an electronic control system that would maintain exacting consistency as well as automate the process.

Adhering to the Bavarian Purity Law (Reinheitsgebot) written in 1516, Baltimore Brewing uses only water, malt, hops, and yeast. Outdoor silos hold imported pale malt that is vacuumed inside for weighing and milling before the start

FIGURE 1

## IS IT BEER YET?



**SENSORS IN THE KETTLES MONITOR VOLUME AND TEMPERATURE, WHERE SIMPLE SUGARS AND PROTEINS FROM MALT ARE EXTRACTED TO ACHIEVE SPECIFIC GRAVITY LEVELS.**

of each batch. From a holding vessel, the malt is pumped into the mash tun located behind the restaurant's bar, setting into motion the roughly eight-hour production process that will yield 17 barrels or about 500 gallons per batch.

Based on this relatively simple batch operation, CCA developed a control system with hardware and software components from Siemens ([www.siemens.com](http://www.siemens.com)) that included Profibus I/O, a micro AC adjustable-frequency drive, a Simatic WinCC HMI and SC/ADA software package, and Simatic WinAC soft controller. The I/O modules and drive were retrofit into the existing cabinet installed on the Kaspar Schulz system.

Sensors inside the mash and wort kettles (Figure 1) monitor volume and temperature, where simple sugars and proteins from malt are extracted to achieve specific gravity levels. The Micromaster AC drive (Figure 2) controls a 1 hp motor/pump combination for flow and appropriate speeds

**FIGURE 2**

**MINI MEISTER**



**A SIEMENS MICROMASTER AC DRIVE CONTROLS A 1 HP MOTOR/PUMP COMBINATION FOR FLOW AND APPROPRIATE SPEEDS FOR THE BAKING MOTION INSIDE THE LAUTER TUN AFTER IT HAS RECEIVED THE MASH.**

for the raking motion inside the lauter tun after it has received the mash. For example, a high-gluten wheat beer needs a lower raking speed as opposed to a pilsner.

All of the various sensors, probes, and actuators are wired to the IO modules, which are connected with a single Profibus cable to a PCI slot in a standard office PC (Windows NT) sitting across the room.

**One Box Controls Cost**

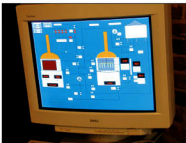
Baltimore Brewing personnel monitor and control the process with the HMI's graphical interface presented on a desktop CRT, from the outdoor silos up to the adding of yeast to the wort (Figure 3). A PC mouse on the desk replaces a series of pilot devices located on the original control cabinet. An operator simply calls up one of the 10-plus beer recipes stored in WinCC and lets the tightly integrated WinAC PC-based controller take over.

Water volumes, temperature "rests" and lauter speeds are key variables administered by the system, in addition to monitoring manual drains, spray heads, and valves. An alarm system built into WinCC signals appropriate times to manually add hops for each batch, or calls attention to any problems such as blocked pipes, spoons, stuck valves, and the like.

CCA designed the control system based on Baltimore Brewing's desire to minimize complexity and cost. By consolidating both the controller, SCADA, and HMI in a single PC, they didn't have to deal with a separate PLC or the requisite Ethernet hubs, switches, and network configurations. It not only simplified matters for Baltimore Brewing, but

**FIGURE 3**

**IT'S AUTOMATIC**



**PERSONNEL MONITOR AND CONTROL THE PROCESS WITH A DESKTOP CRT. AN OPERATOR CALLS UP ONE OF THE 10-PLUS BEER RECIPES AND LETS THE TIGHTLY INTEGRATED PC-BASED CONTROLLER TAKE OVER.**

reduced the equipment costs by 20%. The lack of a network also means updates between the PC controller and HMI are much faster than would be with a PLC.

Keeping things simple also means that automation extends

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only so far in the process. From the lauter tun, wort goes to a whirlpool for particle separation, through a heat exchanger to cool, and is sent to a fermentation tank while yeast is dosed in-line. The recipe stored in WinCC tells operators how much yeast to add, depending on the type

phased in over several years and has reached a point where we are looking to expand the WinCC package to integrate more of the operation, perhaps having automated control from end to end, up to and including storage if not packaging. Also on the horizon is the integration of

**FIGURE 4.**

## BOTTLE OR KEG?



THE PC HANDS THE BATCH OFF TO OPERATORS FOR MANUAL CONTROL. THE FINISHED WORT GOES TO FERMENTATION VESSELS FOR TWO WEEKS, THEN SPENDS THE NEXT FOUR WEEKS IN STORAGE VESSELS INSIDE A CLIMATE-CONTROLLED ROOM BEFORE KEGGING AND BOTTLING.

of beer and volume. Temperature is also key: In general, the yeast functions best at 48° F for lager fermentation, while ale would call for 65° F.


At this point, the PC hands the batch off to operators for manual control. The finished wort goes to fermentation vessels for two weeks, then spends the next four weeks in storage vessels inside a climate-controlled room before keggling and bottling (Figure 4).

### More of a Good Thing

With an output of 5,500 barrels per year, sophisticated automation may appear extreme for Baltimore Brewing's operation. But the consistency, stability, and labor savings afforded it through digital control are ensuring maximum yield, which is vital even on this small scale.

The current system was gradually

IT services for easier record keeping and remote operation via the web. An immediate desire is to have operators alerted to any changes in process conditions through wireless pagers. WinCC offers this functionality as options.

And then? National distribution may sound like a far-off goal, but given the DeGroen's reputation, the only obstacle would be capital and an extremely competitive U.S. market. For now, Baltimore Brewing is looking to grow DeGroen's into a strong regional brand. Yet having won gold medals, it may not be too long before you see a DeGroen's in your neighborhood bar. 

**Theo de Groen, brewmaster of Baltimore Brewing Co., Baltimore, comes from a family of Dutch brewers that has been making beer for more than three centuries.**



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