

## Brewing Success

People have been brewing beer for thousands of years. Beer became a staple in the Middle Ages, when people began to live in cities where close quarters and poor sanitation made clean water difficult to find. The alcohol in beer made it safer to drink than water. For 13 years, starting in 1920, a constitutional amendment banned the production of alcoholic beverages in the United States. Before Prohibition, America had thousands of breweries producing many different types of beer. But Prohibition forced most breweries out of business. By the time the laws were repealed in 1933, only the largest breweries had survived. These breweries sought to brew a beer with universal appeal so that it could be sold everywhere in the country. Then came World War II. With food in short supply and many of the men overseas, breweries started brewing a lighter style of beer that is very common today. Since the early 1990s, small regional breweries have made a comeback, popping up all over the United States, and variety has increased. This journey created some amazing technology and terminology of beer making along the way.



A complex series of biochemical reactions must take place to convert barley to fermentable sugars, and to allow yeast to live and multiply, converting those sugars to alcohol. Commercial breweries use sophisticated equipment and processes to control hundreds of variables so that each batch of beer will taste the same. The smaller operations, micro-breweries, learned to use less expensive and easy to configure micro PLCs to control the batch process that changes slightly with each variety of beer produced. Smaller processes allows for experimentation and tweaking of the process as the beermasters seek to distinguish their product.

The beer making process is a series of heating and holding each ingredient. Barley is allowed to germinate, a process that generates sugars from starches. The sugars feed the yeast to make alcohol in the beer. Hops contain acids, which give beer its bitterness, as well as oils that give beer some of its flavor and aroma. Adding hops to beer also inhibits the formation of certain bacteria that can spoil the beer. Yeast is a single-celled micro-organism that is responsible for creating the alcohol and carbonation found in beer. Yeast also affects the flavor. Different yeasts ferment at different temperatures so beer makers adjust the "formula" depending on the yeast used. The ingredients are treated at temperatures from 32 to 170 °F (0 to 80 °C) and are processed through states known as the Mash and the Wort. The Wort is added to yeast at the beginning of the fermentation process from which the final product emerges.

Well placed RTD sensors monitor the temperatures of each stage. Valves and pumps must be controlled to move the product between vessels designed for each process. Specific gravity is measured with an inline hydrometer with a pulse output. The modules required are: RTD input, digital input, digital output and relay output. Each step is monitored by temperature and time at each vessel with the end of the last step determined by the final specific gravity.



ioSelect offers products from our Distributed IO, Test & Measurement and Industrial Wireless product families to help the micro-breweries produce consistently desirable products. The LogiPro line offers modularity and the LGPRO-DAIO module which may be used as the IO and control for one vessel. The ZNET product line offers the Z-TWS modules in combination with the right number of inputs per module with the Z-4RTD, Z-D-IN and Z-D-IO modules. The LogiPak is a one module solution for a smaller process with on board RTD, DI, DO, AI and AO. Automating the process improves consistency and batch repeatability for beer lovers everywhere.