Automation technology ensures highly repeatable, top quality roasting results

All-in-one control platform optimizes coffee production

With a 145-year history of building roasting machines and systems, PROBAT-Werke von Gimborn Maschinenfabrik, headquartered in Emmerich, Germany, occupies a leading position in this industry. Based on the company's extensive expertise and passion for making world-class machinery, Probat industrial roasters are known all over the world for exceptional efficiency, flexibility, quality, durability and reliability.

To achieve a consistent and repeatable level of quality, the roaster requires a recipe management system where existing recipes can be selected and new ones created and saved. It must also visualize the measurement curves in order to control and log the roasting processes.

Continuous innovation plays a major role for Probat, the market leader for industrial roasters and in-store roasting equipment. "To maintain our leading position, Probat operates its own technological center for extensive R&D. Starting with raw coffee beans, we test numerous roasting and grinding technologies to achieve the perfect end product," explains Andreas Rinke, Head of Portfolio Management at Probat. Automation plays a key role in the roll-out of reliable mass-production processes after they have been developed in the lab. "High performance, flexible software interfaces and ease of operation were the main requirements when we selected the new control platform for our 'Probatone' in-store roasters. PC-based control technology provides the perfect answer to these requirements," says Rinke, which is why all Probat in-store roasting systems have been equipped with all-in-one HMI and controllers from Beckhoff since 2015.

Automation technology is the key to consistent, high-quality roasting results
At first glance, the coffee roasting process does not seem overly complicated – burner performance is essentially controlled via time and temperature threshold values. In the past, this was achieved using a potentiometer that was manually operated by the roast master. This kind of "automation" delivered often excellent, but rarely reproducible results. To ensure a consistent level of quality for the various roasts, a recipe management system was needed, enabling the user to run existing recipes as well as the ability to create and store new ones. At the same time, the system needed to visualize the temperature curves so that the roasting process could be properly controlled and logged.

Andreas Rinke remembers the first automation solution implemented by Probat. It consisted of two CPUs: a 266-MHz ARM™ processor for the PLC and a 3.5-inch HMI panel (with a similar CPU) to visualize the roasting process. Since integrating recipe management into the system was impossible because of the system's low CPU performance and rudimentary storage options, it was outsourced to apps running under Android, iOS and Windows. The slow user interface and the need to set parameters on two devices were other downsides.

More functionality and user-friendliness – without adding costs
Solving these problems seemed easy: install more CPU power. However, the system also had to stay within the budget set by the existing control solution, necessitating a single-CPU unit. "With this requirement, the decision to use a PC-based control platform was essentially a given," remembers Rinke. The new system is based on a Beckhoff CP6606-0001-0020 Panel PC with TwinCAT PLC runtime and integrated visualization. The process data is transmitted via EtherCAT I/O Terminals. The system has the following specifications:
– ARM™ Cortex 1 GHz processor
– 1 GB DDR3 RAM

Left to right: Andreas Rinke, Head of Portfolio Management at Probat, and Ralf Stachelhaus, head of the Beckhoff Rhein-Ruhr office, in front of the Probatone 12. Since 2015, Probat has equipped all its Probatone in-store roasting systems with PC-based control technology from Beckhoff.

- 256 MB Micro-SD (max. 16 GB)
- Integrated FPU (floating point unit)
- 7-inch widescreen display, 800 x 480 pixels, touchscreen
- On-board Ethernet adapter 10/100BASE-T TCP/IP
- On-board EtherCAT adapter (I/O interface)
- Web server (IIS)
- TwinCAT Runtime
- Integrated visualization (target visualization)
- Interfaces for web visualization (HTML 5, JS) for local visualization, iPhone, iPad, etc.
- Interfaces for JS, .NET, OPC UA, etc. (ADS interface)

This system configuration delivered significant benefits for the Probatone in-store roasting system. The upgraded CPU provides vastly improved control capabilities, and the user interface is faster with additional functions. For example, the system now provides real temperature curves, making operation much clearer and easier to control. The high-quality 7-inch display was highly appreciated as well as it increases operator comfort. Moreover, the recipes are now stored locally and no longer require apps on other devices. Tried-and-tested recipes can now be run with ease. Each roast is logged and stored, including its temperature curve. In order to keep using the existing apps, the controller is equipped with a Modbus/TCP server.

The I/O system is controlled via EtherCAT.

With its clear and ergonomic operation, the operator interface of the CP6606-0001-0020 is exceptionally user-friendly.

Future-ready platform

"The new controller represents a major step forward for us, and we accomplished this without increasing the cost," says Andreas Rinke. The Head of Portfolio Management has no intention to ease up on innovation, however: "For historical reasons, we still must maintain three web applications for Android, iOS and Windows. When we started the development process, no platform-neutral language for web applications was available to reproduce the familiar look and feel people expect from smartphones and tablets. Today, we have such a language in the form of HTML 5, which together with JavaScript and CSS forms the basis for TwinCAT HMI, the new Beckhoff visualization software we fully intend to use." Rinke also commented that this will enable Probat to implement applications on a single engineering platform while significantly reducing development time for new features.

Further information:
www.probat.de/en