Digital temperature control with e-flomo and iQ flow control

Success is driven by people

The globally active Utz Group has developed its own solution for temperature control of injection moulds using ENGEL modules for e-flomo and iQ flow control digital temperature control. Following this, the Austrian solution provider collaborated with Utz to implement this solution practically in several new production cells. In digitalising temperature control, Utz is taking a further step towards Industry 4.0. The solution is so successful that it is to become the group standard at all production locations.

"Despite all the digitalisation, our success is driven by people, as this project has once again demonstrated," as Frank-Olaf Schütte, Technical Manager at Georg Utz in Schüttorf, makes clear right at the start of our visit. "If I can motivate the whole team and take them with me, then people of all ages will also be enthusiastic about the digitalisation project. The older ones are happy that they are finally getting what they have been dreaming about for 20 years, and the younger employees are excited about the modern control unit."

"Utz is a classic family business with its heart in the right place," says Dr. Jan Giesbrecht, CTO of Georg Utz Holding in Bremgarten/Switzerland, explaining the company's philosophy. "We attach great importance to people and employees here. This is not just a mission statement; we are also very much involved in dealing with this issue. For example, we have over 40 trainees here who we regularly support and who can complete a dual course of study with us after completing their training. Particularly in the current discussion about plastics – although we are a reusables-only producer – our focus is on sustainable and energy-efficient production."

The Utz Group, headquartered in Bremgarten, Aargau, operates internationally with eight locations worldwide. The group specialises in the manufacture of containers for warehousing and transporting goods as well as load carriers and pallets made of recyclable plastics. With 500 employees, the Schüttorf location in northern Germany is the largest in the group. This location has three production areas, the injection moulding area being the largest.

Significant reductions in energy consumption

The idea behind the new production line was examined in detail in a bachelor thesis by Jannik Vrielink, a former trainee and now process engineer at Utz. The topic was "Modern cooling systems". "In recent years, we have faced the challenge in this area of optimising these processes in various fields," says Schütte. The focuses are mould set-up, energy efficiency, process stability and sustainability. "We have broken this down into different projects, one of them being state-of-the-art cooling," Schütte continues. "We equipped a prototype injection moulding machine with a cooling system up front and gained experience with it. This meant that we were able to implement a complete package for the new machines – together with the findings from the bachelor thesis."

One result of the bachelor thesis was that often not as much temperature control is required as is set using analogue controls. In tests, Vrielink determined the extent to which the flow can be reduced without impairing the quality of a part. This made energy consumption double-digit percentage energy savings possible.

Cooling has relied on analogue controls up to now at Utz. "The water quantities were adjusted manually on the machine by means of a classic volume flow controller with a sight glass", as Schütte reports: "Until now we have not had any way to validate these processes. We see great potential for the future in this approach to digitalising cooling and temperature control. For the future, however, we are looking to make cooling more transparent, not only here at this location, but throughout the entire Group, and to push forward with digitalisation as a result." It was in this context that the use of ENGEL e-flomo was discussed and implemented at Utz.

Dynamically controlled multiple-circuit temperature control

e-flomo is the electronic temperature control water manifold which plays a central role in the digitalisation and networking of mould temperature control in ENGEL systems. The iQ flow control software developed by ENGEL controls the flow rates on the basis of the measured values determined by e-flomo and adapts the temperature control process dynamically and independently to the respective process conditions. Where ENGEL e-temp temperature control units are used, this can also include demand-dependent control of the pump speed in the

temperature control units. Through this interaction, iQ flow control makes it possible to combine maximum temperature stability with maximum productivity and energy efficiency.

The reason why ENGEL is focusing so intensively on temperature control is that mould temperature control has a very significant influence on the efficiency and quality of the injection moulding process and that, in many cases, too little attention is paid to this in practical applications. "We have succeeded in initiating a rethinking process with many of our customers," says Klaus Tänzler, Product Manager Temperature Control at ENGEL. "In 2010, we entered the world of temperature control with the flomo. Classic temperature control uses a static flow. If you have six temperature control channels on the mould and something changes in one of them, the flow rate changes in all of them. Thanks to our dynamic system, we can now react to this change and balance all the channels." ENGEL continuously works intensively on this subject, as shown by the further enhancements: e-flomo, e-flomo premium, iQ flow control and e-temp. As a systems expert, ENGEL therefore considers the continuous optimisation of the temperature control process to be one of its core competencies and is actively promoting digitalisation in this area.

The solution based on e-flomo and iQ flow control, which Utz and ENGEL have developed over the past one and a half years, has been implemented in a total of four identical production cells. More e-flomos have been installed in each of the 1000-ton injection moulding machines than in any other ENGEL project to date. The e-flomos have been arranged in an extremely compact way, both on the sides and at the rear of the machine. Each machine is equipped with several temperature control units, which are also located on the sides and at the rear of the machine. Up to 60 temperature control circuits are supplied on a single mould. ENGEL has configured the system such that it is possible for each individual temperature control circuit to switch between cooling, heating, leak-stop and purging operating modes at the machine control panel without having to move a single hose coupling.

Temperature control integrated into machine control unit

The global idea behind Utz's temperature control concept is that the setter no longer adjusts the process settings manually, but that the settings for cooling and temperature control are completely integrated into the CC300 control unit on the ENGEL injection moulding machine. During a mould set-up change or a continuous production process, the machine operator can call up these parameters or monitor them continuously during running production.

"For us, sustainability not only means optimising set-up times and reducing rejects, but also making the mould set-up easier for our employees," says Schütte. "When you perform the mould set-up manually, there is always a certain proneness to errors. But if the data is available on the control unit, and is automatically transferred, you can repeat the optimum process without error. The rejects when ramping up a machine, are reduced significantly." And during production, too, Utz's very clear goal is to avoid rejects.

Empowering maximum flexibility

"The important thing about our machines is that they can be used universally," says Schütte, addressing another key issue. "Different moulds are used on each machine. Flexibility is very important to us. The machines are all the same and each one must be able to repeat the respective processes one to one". The particularly demanding range of products includes large, thin-walled containers made of polyethylene. Maximum stability is crucial here in order to avoid distortion.

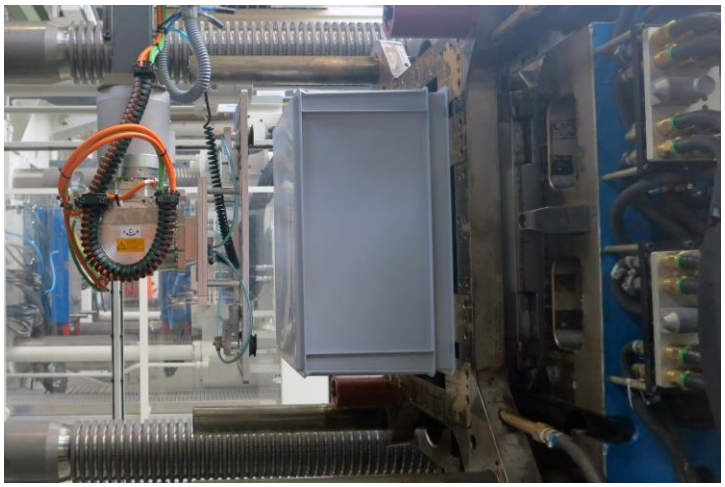
Polyethylene and polypropylene make up the lion's share of the raw materials processed in Schüttorf. On top of this, there are electrically-conductive polymers and a large number of recycled materials. Often, different materials that require different mould temperatures are processed in one and the same mould in rapid change cycles, which, in some cases, only relate to individual temperature control circuits. "Thanks to dynamic single-circuit temperature control, we can change the material within a very short time and immediately return to a stable process," says Schütte.

Automation of manifold purging in the mould

A higher level of process stability is another benefit. After all, cooling circuits can become clogged. "With analogue cooling, you wouldn't notice that in on-going production," says Schütte. "But if you monitor each cycle individually, you detect clogging at an early stage and can take remedial action. In the digital system, you can set intervention limits for alarm signals."

Residual water and dirt in the temperature control channels of injection moulds can lead to corrosion, shortening the service life of the moulds and impacting on temperature stability. Before moulds and mould inserts are changed, the temperature-control channels are there-

fore usually blown out with compressed air. Traditionally, this is a manual process that not only takes a lot of time, but also involves a residual risk, as compressed air often does not flow evenly through the ducts. In order to ensure greater efficiency and safety here, ENGEL has extended the functional scope of the premium version of its e-flomo electronic temperature control water manifold system to include automated sequential purging of the manifold circuits. "By automating the purging process, we can extend the maintenance intervals for the mould and reduce maintenance costs," says Schütte. "A further benefit results when mounting the mould. The new feature ensures optimum ventilation of the temperature-control channels, ensuring premium part quality from the outset."



Especially with large parts, temperature control plays a very important role with regard to dimensional changes and distortion.

Ingo Schohaus (left) and Jannik Vrielink have intensively supported and co-developed the project right from the outset.

Compact integration: the production cells are equipped with e-flomos and temperature control units located on the sides and to the rear of the machine.

From left to right: Jannik Vrielink, process engineer, Josef Krnak, injection moulding production manager and Ingo Schohaus, plastics process mechanic (all Georg Utz), Klaus Tänzler, product manager temperature control, ENGEL AUSTRIA, Christoph Hölscher, sales engineer, ENGEL Deutschland, Frank-Olaf Schütte, technical manager Georg Utz and Dr. Jan Giesbrecht, CTO Georg Utz Holding.

Pictures: ENGEL