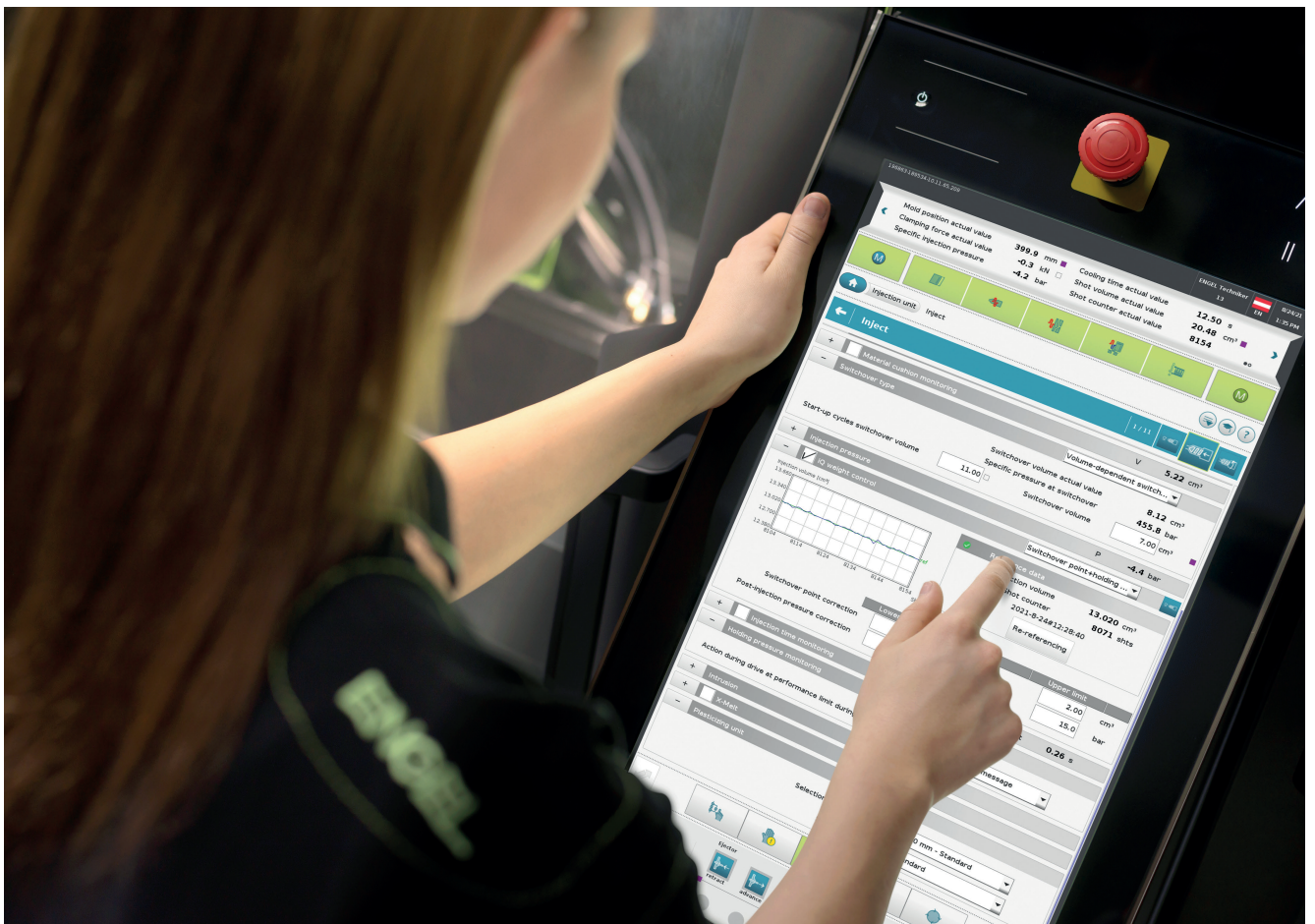


Focusing on the User

The Assistance System iQ Weight Control Promises Greater Clarity and New Functions

Almost ten years ago, iQ weight control launched a range of intelligent assistance systems to support Engel injection molding businesses in the digitization of their production processes. Today that product range is a comprehensive one. At Fakuma 2021, the software will be unveiled with its new interface and expanded functionality. The new developments have been driven by feedback from customers. With its consistently user-centered development approach, Engel is one of the pioneers.



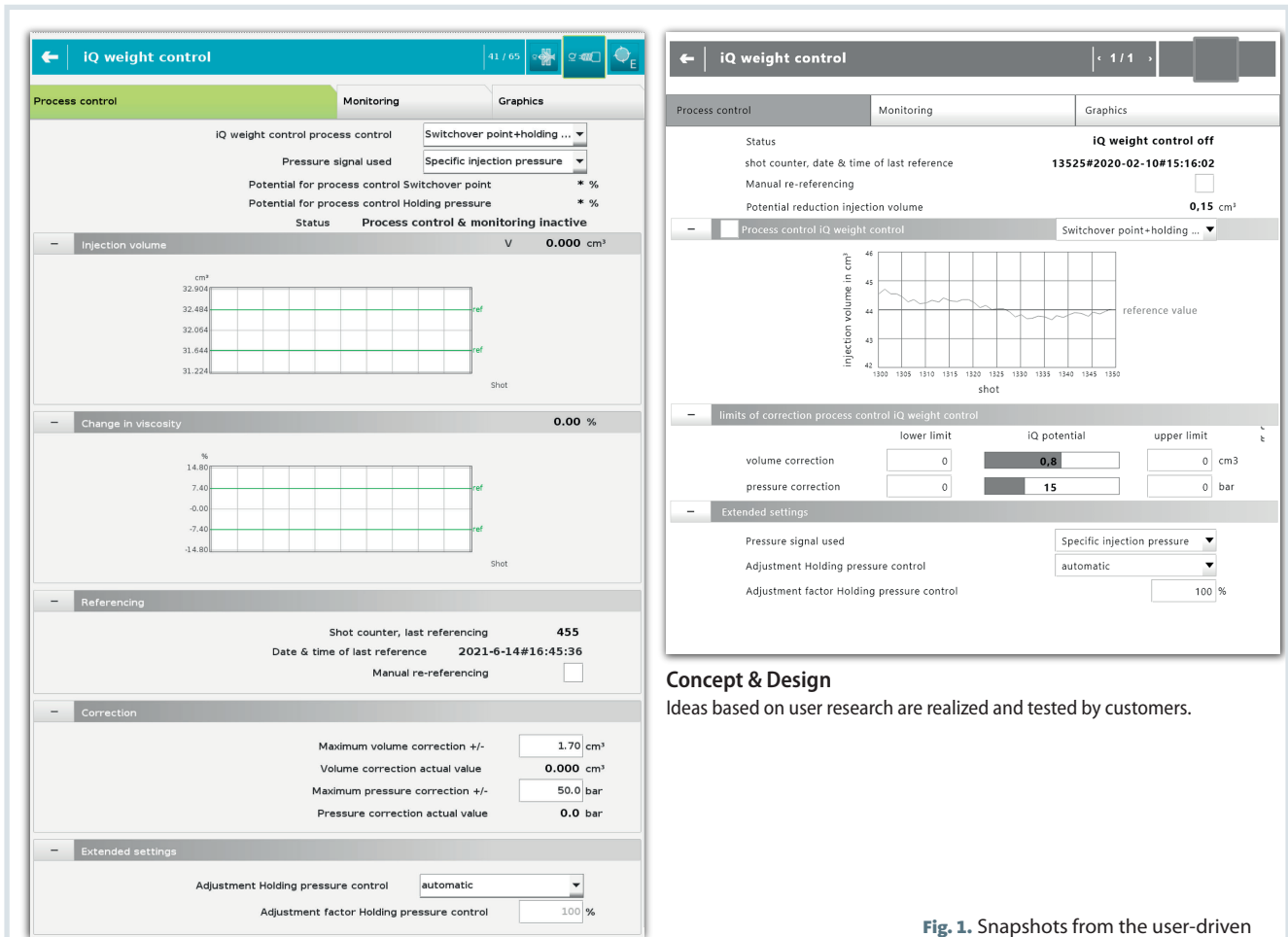
The new release of iQ weight control is based on feedback from users. In the user-centered development process, Engel closely involves its customers at all stages © Engel

Paul is responsible for the sampling of new molds and optimizing injection molding processes. Having spent many years working with Engel injection molding machines, he utilizes the potential of innovative digital solutions wherever the option presents itself. Paul may be fictitious, but his requirements are very real: he represents the sum of experience with

digital solutions gained by Engel customers in all regions of the world. The creation of personas – typical representatives of a target group – in the first phase of the development process (user research) provides the basis for user-focused development (**Title figure**).

Who uses our product? What is he or she doing with our product? What are

his or her needs and expectations? To arrive at precise answers to these questions, Engel involves customers in the development and enhancement of products at a very early stage, analyzes their working environments and conducts interviews with a view to gathering specific information on user behavior.



Concept & Design

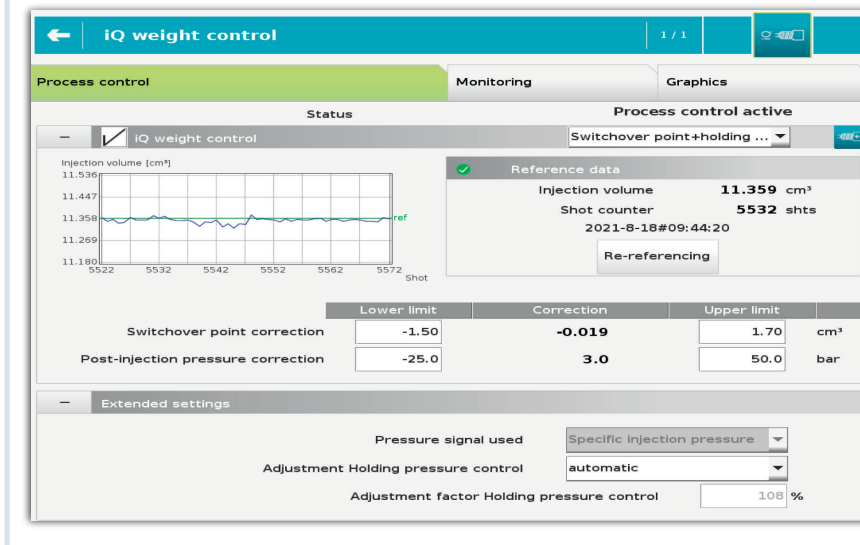
Ideas based on user research are realized and tested by customers.

User Research

Customers are asked about the existing solution.

Fig. 1. Snapshots from the user-driven development of iQ weight control. The interface, which has evolved over time, now has a new, slimline design

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Development & Operation

The solution preferred by the test users is established in the control software and refined to production readiness together with customers.

As an expert in injection molding, Paul is receptive to digital products and has high expectations of them. Knowing the added value offered by iQ weight control, he has a clear idea of how the software could make his work easier in the future. Here he shares his

ideas with Engel in the form of feedback.

Process of Continual Enhancement

During the speed-controlled injection process, iQ weight control continually

analyzes the pressure profile in real time via the screw position and compares measured values against a reference cycle [1]. On this basis, new process parameters are calculated and settings are automatically readjusted for the current cycle. This calculation and readjustment takes »

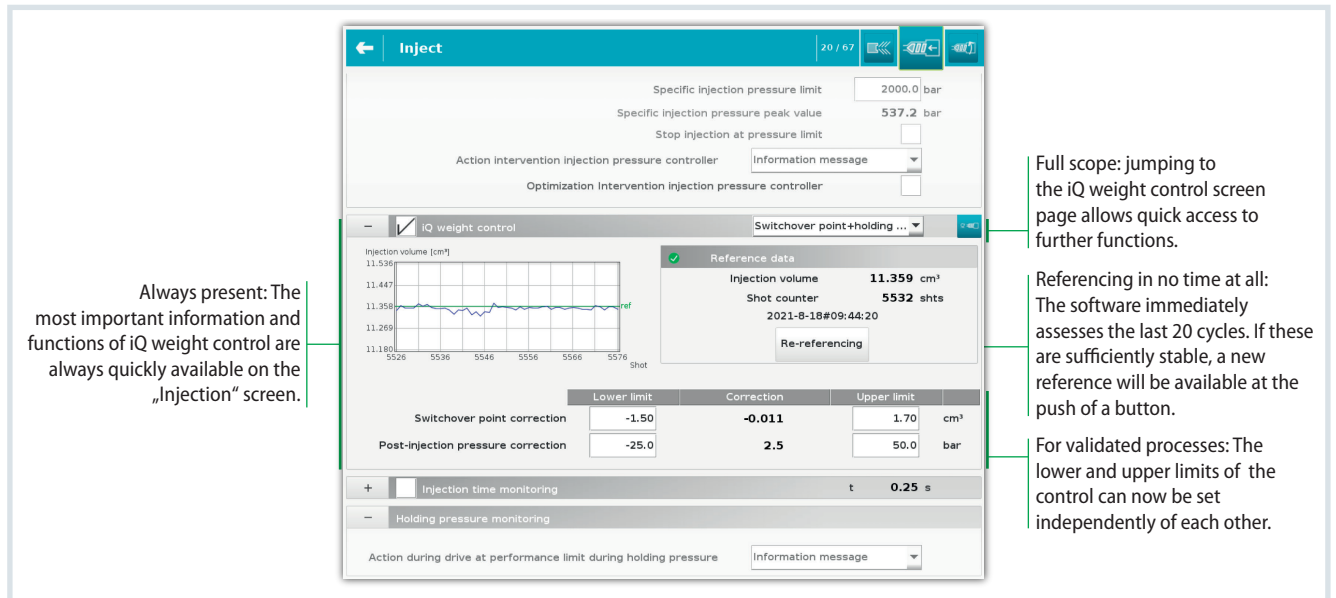


Fig. 2. Overview of the principal new features of iQ weight control © Engel

place in fractions of a second, and is repeated for each cycle. The regulation influences the speed profile during injection, the switchover point and the holding pressure profile. In this way, fluctuations in environmental conditions and in the processed material are balanced out, thereby ensuring consistently high product quality while proactively preventing rejects.

Since its launch in 2012, the software has been updated several times (see Box p.61). At first it was only available for injection molding machines with electric injection units; some time ago, though, it also became possible to equip injection molding machines using hydraulic injection units with iQ weight control. Shortly after this, the application range was expanded when adjusting the holding pressure profile became the third control variable. While automatic readjustment of the switchover point and injection profile increases weight consistency, especially in the production of thin-walled parts, the holding pressure phase is critical to quality in the production of thick-walled components. In the case of molds with several hot runner nozzles which are opened and closed in a cascade, iQ weight control can also be used to improve process consistency.

Time Needed for Referencing Significantly Reduced

One new feature to be unveiled at Faku-ma 2021 is the new referencing concept. Let us get back to our process engineer. Paul wants to implement iQ weight control as fast as possible following process optimization, a material change or mold maintenance (for example). On the “Injection” screen, he is quickly able to find the product and also perform referencing; beforehand, he would have to wait through 20 cycles for this, which took a

great deal of time. Thanks to the new version of iQ weight control, in which referencing is always running automatically in the background, Paul is able to save that time. As soon as a process is stable, a new reference can be set at any time – practically at the touch of a button.

The monitoring screen page indicates whether a process is stable; the specific process parameters of iQ weight control (injection volume, change in viscosity and alignment of pressure profile) over the last 50 cycles are displayed in the form of a trend graph. In the ongoing development of the interface, one priority was to create a clear display. All of the key information is now available at a glance. Information that is not relevant to a quick assessment of process consistency has been omitted.

Setting Upper and Lower Tolerance Limits Independently

Where a production process requires validation as in the case of medical technology, readjustment can only be performed within very narrow and clearly defined limits. Paul now wants to transfer this process window to the upper and lower limits for the two parameters adjusted by iQ weight control (switchover point and holding pressure). The fact that the process window is not always symmetrical presents a challenge here: in many cases, the reference value

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from the validation is closer to either the maximum value or the minimum value, rather than the middle of the reliable adjustment range. Excessively high holding pressure, for example, could result in overmolding of the component and damage to the mold; for this reason, it is a more critical consideration than holding pressure that is too low.

With this in mind, Paul wants to limit the upward correction more than the lower correction. The new release offers a convenient solution: the upper and lower tolerance limits can now be set independently of one another. Since the readjustments automatically performed by iQ weight control are generally within limits specified by the user, there is nothing to prevent the use of iQ weight control in validated processes [2].

Tutorial on the New Functions

In addition to customer feedback from sales and service dialogue, specific customer surveys, workshops and prototype tests are conducted in subsequent phases of the user-focused development process (concept and design, development and operation). Findings and results are duly applied to the design process (Fig. 1).

Overall, the new iQ weight control incorporates numerous small improvements that are visible to users on first glance. The interface is now even clearer. Another new feature is the compact summary of parameters for a very fast overview.

Not least, Engel's tutorial concept makes implementing the new software version simplicity itself [3]. Accessed via

the machine control unit, the tutorial guides users intuitively through all the steps and clearly shows how to maximize the potential of iQ weight control and the new functions (Fig. 2).

User-centered development is an ongoing process. By the time the new release reaches the market, phase one in the continued development of the product will already have commenced. Paul also stays on the ball, expanding his expertise and gaining experience. Smart assistance systems, which can seem alien and difficult to gauge at first, soon become second nature. Encouraged by early successes, Paul quickly develops ideas for new fields of application; he is now ready to take the next step.

Test Version as Standard in All New Injection Molding Machines

Will iQ weight control prove to be an advantage on his future projects as well? For an easy answer to this question, Engel is planning to integrate a test version as standard in all new injection molding machines, to run for a defined period. This will be available with the next release, which comes onto the market in 2022.

The test version will be of particular benefit to processors who have never worked with iQ weight control before and wish to evaluate its potential. In future, test versions will also be provided for other iQ products. ■

Milestones in Development

2012: Engel introduces iQ weight control, its first smart assistance system. Available for injection molding machines with electric injection units, the system corrects the injection profile and switch-over point.

2014: Enhancement of software performance spectrum to include correction of the holding pressure profile.

2015: iQ weight monitor installed as standard in all new Engel injection molding machines [4]. The software includes indicators for monitoring the injection molding process; unlike iQ weight control, however, it does not automatically re-adjust parameters.

2016: iQ weight control made available for injection molding machines with hydraulic injection units.

2018: Engel expands the software to include cascade injection for components with very long flow paths. Process parameters can now be adjusted at several injection points connected in series.

2019: At the K event, Engel unveils iQ weight control complete with a recycled material application – thereby showcasing the major potential of inject 4.0 to the circular economy.

2021: iQ weight control benefits from a new and clearer interface. Improvements to referencing facilitate very fast commissioning.

2022: All new Engel injection molding machines are equipped with a viable test version of iQ weight control for a defined period.



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