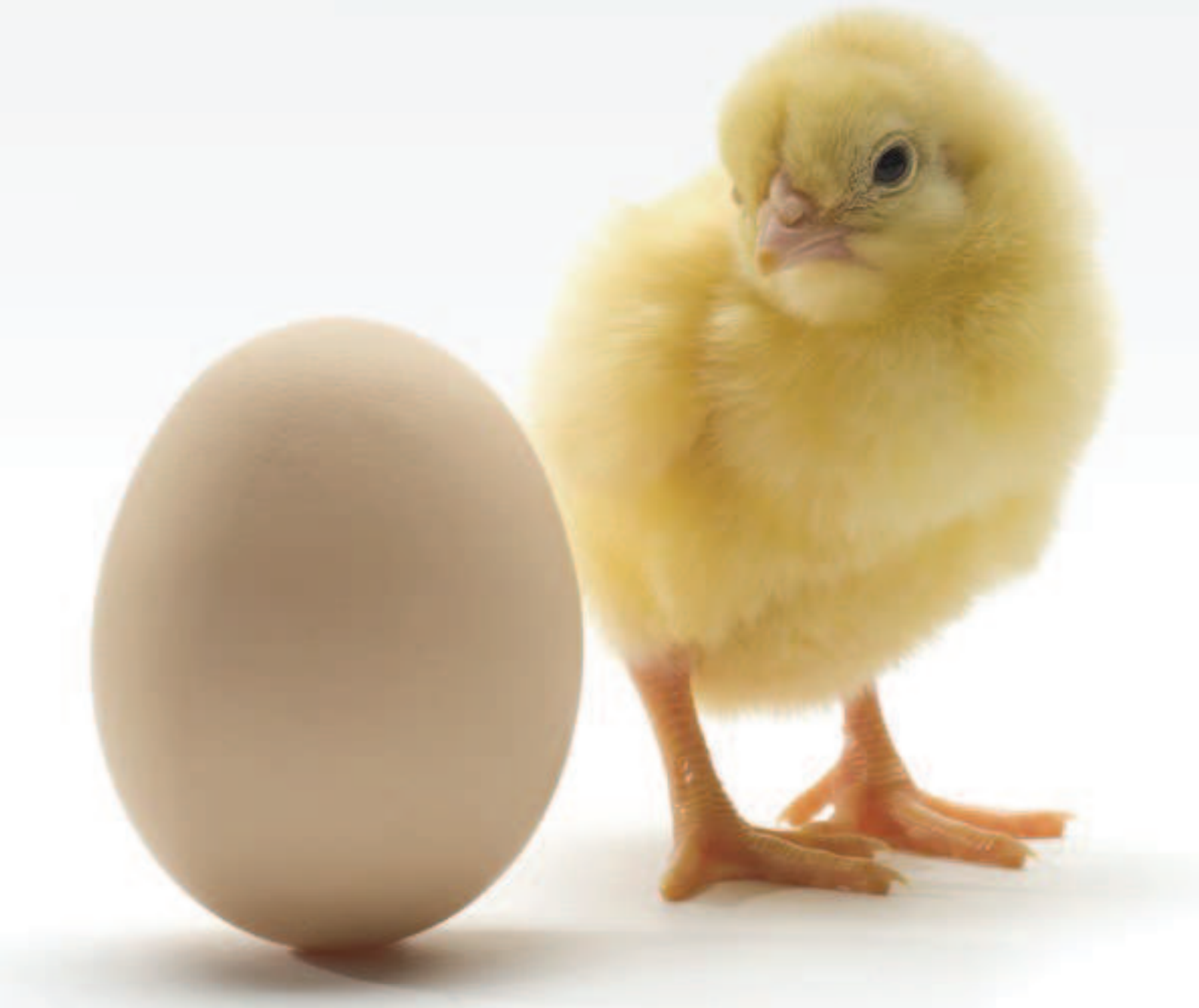
Dynamic weighing

The chicken or the egg



While many eggs are destined to be fried, scrambled or poached, those that meet the weight requirements are selected to be incubated and hatched. Prinzen, the Dutch egg-handling specialist, has developed a machine able to weigh an impressive 30,000 eggs per hour. The controller that runs it comes from B&R.

Prinzen's Ovograder weighs 30,000 eggs per hour – twice the speed of its predecessor, the Elgra 3. The primary market for Prinzen's Ovograder is the broiler industry. The machine performs fast, linear grading of fresh-laid hatching eggs, and has been on the market for nearly two years now. "Equipment for processing hatching eggs is one of our strengths," says Willy Groot Zevert, product manager at Prinzen. "These are eggs that will be incubated, hatched and the chicks raised for consumption. We pack the eggs in trays or brood frames for convenient transport to the hatchery."

A good egg

Only eggs weighing in between 50 and 70 grams are acceptable for hatching. Chicks from lighter or heavier eggs don't meet the standards of poultry farmers, whose feed calculations depend on them having a relatively uniform weight. Eggs that don't meet these criteria will go on to be sold for consumption or processed into animal feed.

Although the Ovograder was developed for hatching eggs, the system can also handle eggs bound for consumption. This segment deals in larger volumes, yet Prinzen believes it is able to cover a significant portion of it. The Ovograder has three outfeed channels for hatching eggs. "OK", "Too small" and "Too big". Consumption eggs, however, are graded into four different weight classes: S, M, L and XL.

"In reality, all the eggs produced by a given poultry farm are very close in size," explains Zevert. "The vast majority of them fall in the M and L categories, so each of these gets its own outfeed. Sizes S and XL can land together in the third tray," says Groot Zevert. Since sizes S and XL come in such small quantities – typically no more than 5 to 8% – most users choose to sort these by hand.

The electronic testing egg

The Ovograder is one part of a highly automated system that begins directly at the nests, where the freshly laid eggs immediately roll out onto the first conveyor. Carried by a network of conveyors, the eggs converge at the packaging line at the front of the stall. Before they reach the Ovograder, they pass through the inspection table, where an employee sorts out cracked or irregularly shaped eggs. "We're currently

The dynamic weighing process makes Prinzen's Ovograder twice as fast as its predecessor. Prinzen achieved this performance leap using automation solutions from B&R.

working on an automation solution for this step," reveals Zevert.

A row of vertical wedges arranges the eggs into six columns on the conveyor, sliding carefully forward and backward to create space and prevent bottlenecks.

"An egg is strongest at its ends," notes Groot Zevert. "We use this property to our advantage by ensuring that any jolts the egg does have to endure are absorbed by its ends." On the whole, of course, the goal is make each egg's journey through the machine as smooth as possible. "Each step in the process bears the risk of cracking the shell," says Prinzen software engineer Gerben Kuenen. That's why the company uses soft materials wherever possible. "We also first test every system with an electronic egg. The test egg is packed with electronics to measure the g-forces. This way we find out exactly where fine tuning is needed."

Precise measurements with B&R software filters

The eggs are carried in six columns on a roller conveyor. The rolling motion naturally aligns the eggs side-ways for more efficient handling. Next, a guide bar sends six eggs at a time down a slight incline, where they experience a brief moment of free – yet guided – rolling. This offers the perfect opportunity to weigh them.

The previous-generation Elgra 3 weighed each egg statically. With the goal of increasing output to an impressive 30,000 eggs per hour, Prinzen realized static weighing would no longer be an option. Instead, they developed a concept that allows the eggs to be weighed dynamically as they roll. Each egg rolls freely across a scale that is connected to a load cell.

"We take measurements every few milliseconds," explains Kuenen. "With all the jostling that goes on at these speeds, we need multiple samples to get a reliable measurement. We do this using B&R software filters, complemented by a few that we've developed ourselves. The results are accurate to the tenth of a gram, although the specifications allow a tolerance of half a gram."

"For a businesses dealing in very large quantities, this level of precision is a very big deal," says Kuenen. Prinzen even goes so far as to re-zero the scales between measurements. This quickly compensates for any debris or egg mass that might accumulate on the scale.

POWERLINK and remote diagnostics from B&R

When it comes to controlling the Ovograder, Prinzen relies on B&R, who also provided the control solution that served them so well on the Elgra 3. "When we introduced the Elgra 3 in 2006, we were the first on the market able to perform linear electronic measurement. From a control perspective, that was significant in a number of ways. Our partner at the time wasn't able to offer us the solution we had envisioned. What we needed was a partner able to give us a PLC with integrated load cell cards – and not only that, but six of them, side by side."

Prinzen also wanted to have one central operator terminal. "POWERLINK allows us to

Eggs being transported by Prinzen's Ovoset Pro, which also features B&R technology.

The Ovograder's controller comes from B&R.

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connect all our systems linearly and run them from a single screen – it really works great," says Kuenen. "No other supplier was able to offer us this combination. Of the numerous programming languages B&R offers, we chose to use Structured Text and found it very easy to work with. The remote diagnostics are a great help, because the level of training varies greatly between operators around the world. B&R's solution ensures they get the help they need quickly and reliably."

"Prinzen was looking for an automation partner to participate actively in the solution. B&R also had the hard-ware Prinzen needed to integrate the load cells. We were able to process all the samples in a single automation object. This data if then fed into the calculations of the B&R controller. When you begin a project like this, you also look at all the other components in the machine that are going to be automated. We don't see the sense in getting more suppliers involved than necessary," says Wico Reineman, sales representative for B&R. That's why B&R also provides the Power Panel 65. "It's a controller and an HMI system all in one," says Reineman. The Power Panel 65 also generates helpful management-level information, which can be accessed easily via USB or viewed in a web browser.

Prinzen has especially demanding requirements for speed and precision. "For the Ovograder, we had to adapt the hardware to get where they wanted to be," says Reineman. "The egg industry works in mysterious ways. Prinzen uses a load cell able to weigh up to three kilograms. This cell is used to measure quickly-rolling eggs with an average weight of 64 grams – to the tenth of a gram. This is a level of speed and precision you don't encounter very often."

Prinzen expects to see several hundred Ovograder installations in the coming years. Reineman and Kuenen are convinced, that the next big step – up to 40,000 eggs per hour – could yet be achieved with the current hardware setup. ←

Gerben Kuenen
Software Engineer, Prinzen

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