



Buffering Potatoes

Turck's QR24 encoder is demonstrating the superiority of its contactless measuring system on a buffer conveyor in the potato processing area at Schaap, a company based in the Netherlands

The cultivation of the potato spread slowly in Europe at the end of the 16th century. Spanish conquistadors brought it from the New World to the Iberian Peninsula and from there also to the Netherlands, which at that time was ruled by the Spanish. Initially, the plant was passed around the courts of Europe more as a botanical rarity than as an agricultural miracle food. At first it was difficult to cultivate this relative of the deadly nightshade profitably and for a good taste. However, once cultivation got under way, the root crop ensured the population growth in Europe at that time. In the technical journal Social Research, the American historian William McNeill even named the potato as an essential factor in the astonishing rise of the West.

Compared to the initial difficulties at that time, today's problems in potato production are relatively small. Nowadays, it is less a matter of life and death than agricultural efficiency. Major potato producers such as Schaap Holland B. V., based in the Dutch town of Biddinghuizen, try to achieve this with the optimal automation and food-oriented processing and packaging of their potatoes.

Around 300 farmers supply the plant and thus make a considerable contribution to Schaap's ability to supply 45,000 tons of potatoes a year to commercial customers and the food service industry. The plant offers potatoes in two processing forms: Cleaned unpeeled potatoes or peeled, refrigerated potatoes for direct processing. Both product groups are available in different potato types, shapes and packaging sizes. The Biddinghuizen plant is divided up accordingly into two main areas. A hygienic area for the peeled potatoes



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Schaap Holland B.V.

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The weakness of many different encoder types is seldom due to the limits of the measuring principle, nor their electromagnetic compatibility or other interference factors: The Achilles heel is mostly the mechanical system. At the potato processing plant of Schaap Holland B.V., Turck's QR24 now contactlessly monitors a buffer conveyor, saving technical personnel the need for complex mounting solutions and the regular maintenance of traditional encoders.

Buffer conveyor: Up to 500 kilos of potatoes can be buffered on both belts



Double protection: The stainless steel guard covers the entire motor together with the encoder during operation

and an area in which the unpeeled potatoes are washed, sorted and packaged.

Fully integrated process

The sorting, washing and peeling of the potatoes is largely automated. A continuous conveyor section takes the potatoes from the washing area into the refrigeration tunnel. However, the full integration of the entire process also presents the automation engineers at Schaap with some challenges. For example, a machine stop at the packaging machine at the end of the production line causes the entire line to stop as well. In order to prevent this, Schaap uses buffer conveyors in front of the weighing system at the packaging machine.

When the packaging material has to be reloaded, the entire process no longer has to stop, since the buffer conveyor reduces its speed and compensates for the delay. A contactless inductive QR24 encoder from Turck has recently been installed to monitor the motion of the motor driving the belt. This enables up to 500 kilos of potatoes to be buffered in the process. "We use laser sensors to measure the height of the potatoes on the belt so that we know how many potatoes are on it. For every centimeter we need a pulse from the encoder in order to adjust the speed," says Henk van Raalte, technical and maintenance manager at Schaap.

High mechanical stress

The shaft of the motor rotates slowly. The QR24 was therefore set to twelve pulses per revolution. The linear motion of the cooling conveyor has to be monitored with just one pulse every five centimeters. However, this presents us with a major mechanical challenge. The previously used incremental encoder based on the optical measuring principle had to be spring-mounted.

It was mounted on the housing around the shaft with two small spring plates. "The stability and precision of these encoders were not an issue, but this previous solution brought with it some mechanical problems," van Raalte explains. "Due to the vibration of the motor, the spring was always moving so that after two years it didn't work any more."

No need for bearings or spring couplings

With Turck's contactless encoder, this is no longer a problem. Spring couplings are unnecessary since there is no mechanical connection between the shaft and the sensor unit. Only the position element is fastened directly to the shaft. "We have been looking for an encoder like this for years," states Raalte. "When I saw the device on the title page of the customer magazine, I knew: we need something like this."

On all QR24 models the sensor and the positioning element of the encoder are fully encapsulated and designed as two independent and fully sealed units that can withstand vibration or knocks on the shaft. Wear-intensive ball bearings or seals which lead to machine downtimes or long maintenance times are not required. The QR24 series thus has the edge over both optical and magnetic encoders.

Van Raalte assigns the output signal of the QR24 to a standard input of the PLC, a Siemens S7 1500. He set the encoder parameters using the Pactware parameterization program on the PC. Although Turck's easy-teach adapter also enables nine preset values to be selected at the machine, these frequently used values are often between 360 and 5,000 pulses per revolution. Pactware enables between 1 and 5000 pulses per revolution to be selected as required. Schaap selected the output of twelve pulses per revolution because the downstream conveyor belt is monitored with six pulses per revolution. This there-



Previous solution: The spring mounting of this encoder was susceptible to mechanical faults and wear



The two belts with the potatoes (in white) are visualized on the operator panel of the 57 controller

fore simplifies any conversions necessary. Turck's encoder is fitted on the motor underneath a metal protective cover. Turck has recently been offering the stainless steel version of the QR24 as a particularly robust solution that can be installed in food sector applications without any protective measures. Every week, Schaap employees spray the entire plant of the potato production area with a cleaning foam, which is washed off at a pressure of 15 bar after an exposure time of 20 minutes. The entire plant is then disinfected as well.

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Avoiding encoder wear

Encoders are also used in the area of the plant for processing unpeeled potatoes. Problems with vibrations or intricate mounting assemblies often take up a great deal of time on the part of the technicians at Schaap. For example, an optical encoder on a roller dryer measures the linear motion of the belt with 4,096 pulses. When the unit has to be emptied for a batch change, a rake moves over it and pushes all the potatoes down. The absolute encoder fitted here also has spring elements and a coupling that are susceptible to wear. Result: This encoder also has to be replaced or repaired regularly due to mechanical faults.

An optical incremental encoder currently measures the linear movement of another severely vibrating conveyor belt. The technicians have up to now fitted a double bearing shaft in order to keep vibrations down to a minimum. When the QR24 is soon fitted here, this time consuming assembly will also become unnecessary.

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