

Reliable multi-station access guarding

Application report

When apples go swimming



Fruit experts

By the time an apple reaches the supermarket and the consumer, it has already been through many different processes: It has been picked, checked, stored, sorted and packaged. Few companies are as familiar with these processes as BayWa Obst GmbH & Co. KG. The company's main location for the sorting and packaging of pome fruit is located in Kressbronn am Bodensee. BayWa has had premises there since 1967. A glimpse behind the scenes is exciting for apple fans, but also from a production-related point of view because Leuze sensor technology is used at multiple points to enable the processes to function safely and efficiently.



In the Lake Constance region, the apple harvest begins already in August with the early varieties and lasts until the end of October. © BayWa AG

Space for 14,000 tons

The BayWa fruit wholesale plant in Kressbronn is surrounded by fruit plantations: Around 1,200 businesses grow juicy apples, pears, strawberries, plums and many other types of fruit on the German side of Lake Constance. The region is ideal for this, thanks to its mild climate and many hours of sunshine. With around 8,000 hectares of fruit-growing land, the Lake Constance region is the second biggest fruit-growing region in Germany. "The apple harvest begins already in August with the early varieties, and it lasts until the end of October," says Dr. Markus Bestfleisch, Location Manager. With around 30 apple varieties supplied, there is something for everyone. The process begins with storing the apples: Once the fruit growers have delivered their apples in bins of 300 kg each, the apples are first checked for their quality characteristics. If they are suitable for long-term storage, they are placed in a CA warehouse. The conditions are cool because CA stands for "controlled atmosphere": The temperature is kept constant, at between one and three degrees Celsius depending on the variety. In addition, the oxygen level is kept below two percent. "In this way, the apples are effectively put into a type of hibernation and we slow down afterripening and aging," explains Dr. Bestfleisch. In Kressbronn, BayWa Obst has plenty of space for produce: There are 40 warehouses, each of which holds around 350 tons – that's easily 1,000 bins. The warehouses are opened one by one as the months go by, and the fruit is then sorted and packaged. In this way, BayWa is able to continually supply its customers with many different varieties until the end of July the following year – then, it's time for the next harvest.



The BayWa fruit wholesale plant in Kressbronn is the main production location for pome fruit – a view of the sorting system, the heart of the location.



After the quality characteristics are checked in the sorting machine, the apples are transported in tray chains along a total of 50 water-filled channels and are deposited in the channel for the corresponding sorting criteria. Image source: BayWa.

Sorted according to customer requirements

Once a CA warehouse has been opened, the apples are transported in bins to the sorting area by high-lift truck. This area is the heart of the Kressbronn location. BayWa Obst has been sorting fruit there since 1969. In 2004, the current system was built and has since been gradually modernized and expanded. After being emptied from the bin, the apples spend part of the subsequent process in water – this is a protective and practical way of transporting them. While the empty bins are automatically cleaned, the apples swim to the ten-lane sorting unit. Upon arrival, the fruit is separated out onto conveyors and each apple ends up in a type of tray in which it travels through the system. The complex camera technology in the sorting unit takes up to 60 images per apple within fractions of a second. Using the images, the software sorts the fruit fully automatically. "We sort the fruit based on criteria such as the proportion of the apple skin color, size, weight and the internal quality," says Dr. Bestfleisch. "We are able to define these sorting criteria according to customer requirements." The system processes up to 20 tons per hour. Next, the apples continue in the tray chain to a total of 50 water-filled channels. For each apple, the control system now opens the transport tray directly above the channel that is assigned to the respective sorting criteria. As a result, apples with a specific proportion of red skin color and a certain weight all land in one channel, for example. What is more, no produce is wasted: Fruit that is not suitable to be sold fresh goes to the processing industry and is turned into apple slices, apple sauce or apple juice.



A transverse transfer car (Binmatic, front right) picks up the bins containing the sorted apples and stacks them on the opposite side to be collected by the high-lift truck drivers.



In the transfer area, it is essential that processes are safe – people must not be able to enter the danger zone unnoticed. Access guarding solutions from Leuze are installed above the stations.

Safety matters at the transfer station

After being sorted, the apples are put back into bins and are ready to be transported again – this time to the packaging area. For this purpose, the bins are picked up by an autonomous bin stacker, which is a railbound transverse transfer car similar to a forklift truck. The autonomous vehicle distributes the bins containing the sorted produce between 34 transfer stations with corresponding bin spaces. Up to four bins containing sorted apples are stacked on top of one another in each case. High-lift truck drivers then transport these stacks to the packaging area or back into the warehouse. At the transfer station, the know-how of the safety experts from Leuze comes into play: To prevent people getting injured by the bin stacker, a gapless safety device was requested. "It was important to us to have a reliable solution that provides maximum safety at the transfer station without interfering with the operations," says Markus Bestfleisch. The safety solution from Leuze achieves precisely that. After an initial inspection, the experts from Leuze developed a safety concept for this application that enables bins to be transferred through a vertical protective field and can differentiate between people and forklift trucks. In this way, Leuze ensures two safety functions at once:

- The bin high-lift truck is stopped as soon as a person enters the danger zone
- Only forklift trucks have interruption-free release of access to the danger zone

Made-to-measure protective field release

"The multi-station access guarding at BayWa Obst in Kressbronn is based on sequence- and time-monitored protective field adjustment that fits the zone precisely," says Matthias Bristle, Product Manager Safety Solutions at Leuze. Thanks to the intelligent and scalable safety concept, the project could be implemented with an efficient use of resources and just a few safety components. This is because just one RSL 400 safety laser scanner from Leuze was installed for every two transfer stations. Thanks to its high operating range of up to 8.25 meters and the parallel operation of different protective fields, the RSL 400 can monitor both transfer stations simultaneously. In addition, an ultrasonic sensor and a radar sensor are mounted on each station. All the (safety) technology is installed above the transfer stations to allow optimal use of the space underneath without barriers. A programmable safety control with the safety program developed by Leuze ensures that the individual components interact correctly.



A view of the safety technology in the transfer area: An RSL 400 safety laser scanner from Leuze (center) generates a protective field that covers two transfer stations at the same time. In addition, an ultrasonic sensor and a radar sensor are mounted on each station (to the left/right of the scanner). An illuminated display shows the status for each station.

Interruption-free working

Matthias Bristle explains the operating principle: "A laser scanner generates an adjustable protective field in front of two transfer stations. The additional ultrasonic and radar sensors detect when a forklift truck drives forwards into one of the stations. Only under these circumstances does a defined area in the protective field of the laser scanner open for the forklift truck." The forklift truck can then collect boxes from this station. "Another advantage for productivity is that the bin high-lift truck can continue working in the background even while the bins are being taken away," says Markus Bestfleisch. This is because, during this process, all the other stations remain safeguarded by their own laser scanner protective fields, which are still active. Once the high-lift truck leaves the released area in the protective field, the protective field is automatically reset to its default setting. The area is safeguarded again. The system reliably differentiates between forklift trucks and people: Evading detection by entering alongside a forklift truck while it is collecting bins is almost impossible. If someone enters the danger zone, the system registers it immediately. The bin stacker is then stopped and a warning signal sounds. A clearly visible illuminated display is also installed above each station. It shows the status of the respective transfer station: Green when an area in the protective field is released and the high-lift truck can enter; red when the protective field is closed.

Dynamic material flow control

Once the high-lift truck drivers have delivered the sorted fruit to the packaging area, the next step is to get the produce ready for sale. According to Markus Bestfleisch, every packaging need is met: "Our customers can choose from over 200 different packaging types." For example, apples can be packaged in foodtainers, bags, nets or boxes, or as loose products. Across 14 packaging lines, the fruit is arranged and packaged entirely based on customer requirements. Up to 80 employees work in the packaging area in the peak season. Here too, sensors from Leuze monitor everything closely: PRK retro-reflective photoelectric sensors installed on the conveyor sections detect the transported produce, such as cardboard trays, each holding four or six apples. These sensors make it possible to optimally control the conveyor speed.



Sensor technology from Leuze is also installed in the packaging area. PRK optical sensors installed on the conveyor sections detect the transported goods. As a result, the conveyor speed can be optimally and automatically controlled.

Safety right to the curb

The final selling units made up of small packages and outer packaging are loaded onto pallets and transported to the shipping area. To ensure that this process is also free from danger, MLD 500 multiple light beam safety devices from Leuze safeguard the transfer station against people accessing the area when this is not wanted. Three-beam versions with separate transmitter and receiver including muting function were installed at BayWa Obst. "Through muting, we temporarily bridge the safety sensor and enable the transported goods to pass through," explains Matthias Bristle. Once the packaged fruit has passed the access guarding solution, an automatic transport system takes the pallets to the binding unit and then to the shipping area. From there, they are loaded onto the freight truck and delivered to the commercial recipient: Each day, 20 to 30 trucks leave the yard of BayWa Obst in Kressbronn carrying fruit.



Ready to go: The sorted and packaged produce is ready for collection.



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Safety solution also ideal for retrofitting

The innovative multi-station access guarding of the Sensor People from Leuze has already proven effective for BayWa Obst. It separates the transport and the transfer area in a way that is both elegant and particularly reliable. With this safety solution, BayWa Obst is at the cutting edge of safety technology. It is suitable for retrofitting existing systems as well as for new systems. An additional benefit: If other transfer stations are ever added, the Leuze system can also be expanded. The Sensor People from Leuze offer this concept as a safety solution in a complete package. For Location Manager Markus Bestfleisch, it was a successful collaboration: "We are fully satisfied with the safety solution and all-round service from Leuze: The sensor experts have supported us optimally, from the hazard assessment and the target/actual analysis right through to the implementation with start-up support and validation of the application."



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