



Product inspection

Ensuring quality control with NextGuard Pack Division software

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NextGuard C330

Introduction

Product Inspection supports various industries in detecting contaminants and ensuring product quality by utilizing systems such as metal detectors, X-ray detectors, and checkweighers. The Thermo Scientific™ NextGuard™ X-ray Inspection System is an instrumental tool for detecting contaminants and ensuring quality standards for packaged goods. With the introduction of our new software, Pack Division, we are taking another significant step forward in enhancing the quality control for our customers. Pack Division is specifically designed to detect missing products that are in a stacked format within their packaging supporting both circular and rectangular product shapes. This innovative software utilizes a combination of X-ray technology as well as gray scale imaging of each stack of products, ensuring that every package meets the established quality requirements. Products can exhibit variations in weight from batch to batch, sometimes causing the overall package weight to fall within the set acceptable weight range, even when a product is missing. This makes it challenging to detect missing items based solely on package weight. Pack Division software offers a solution by visually identifying missing products and ensuring packages with missing items are rejected from the production line.

Key features

The Pack Division software accommodates various sizes of products, both circular or rectangular, and allows customization of the number of products per stack for your specific application. The Pack Division tool is now part of the Product Verification option within the Nextguard family. Thanks to its user-friendly interface, customers can easily adjust settings to optimize product inspection, even detecting and rejecting half a missing product or less in certain applications. Additionally, users can utilize the Pack Division feature alongside other NextGuard options, such as Contaminant Detection and Mass Estimation.

Pack Division software

The Pack Division tool analyzes stacks of items within a package, evaluates the grayscale levels of the products, and estimates the number of items in each stack, addressing specific needs in quality control. This tool enhances the NextGuard unit's capability by allowing it to reject products based on deficiencies or excesses in mass, differing from traditional mass estimates in two significant ways. First, it divides the package and checks the mass of each division (or "stack") individually, enabling more precise detection of partially missing items. For instance, in a package containing 12 stacks of four items each (48 items total), each item represents only 2% of the overall package mass but 25% of its stack. Without Pack Division, a package missing an item could still weigh as much as 99% of a complete package due to production variability, making it difficult to reliably detect missing items through checkweighing alone. However, with Pack Division, even a quarter of a missing item represents a significant portion of the stack's mass, allowing for a reliable detection range. Additionally, the tool compares discrepancies between stacks within the same package rather than relying on absolute masses, making it adaptable to variations in product density and eliminating the need for frequent recalibrations.

Setup and configuration capabilities

Setting up the software involves inputting several key parameters, which assist in appropriately customizing the Pack Division tool for your specific application. These parameters include:

- **Show Pack location:** This parameter allows users to view intermediate results of the Pack Division algorithm, which first locates the entire package and then the individual stacks. Turn it on to configure parameters, then turn it off once setup is complete.
- **Threshold:** Greyscale threshold used to identify pixels that belong to a stack. Adjust to display products clearly, helping the system identify package boundaries, shown as a green rectangle, with "Show Pack Location" active.
- **Rows and columns:** Specify the number of rows and columns to define the total number of stacks. The tool arranges these stacks with optimal spacing within the rectangle grid limits.
- **Length and width/diameter:** Adjust the size of circular or rectangular items to ensure accurate counting of products per stack. This measures the expected dimensions of the product in pixels.
- **Items per stack:** Input the expected number of products per stack (e.g., 3 products) for accurate measurement. This will tell the software what the maximum number of products in the stack is, so this should be used with an image of a complete package.
- **Stack minimum:** Set the minimum number of products required to avoid rejection. For example, in a package of 3 products stacked, if the application is to determine one missing product in the stack, input 2.5 to reject stacks with two or less items. Precision of the software will depend on the setting, the stack size, speed, and the angle of the package entering the system.

Compilation of the settings on HMI

X-Ray ON Back

Tool Group

Pack Division (Circular)

Threshold 80.00 %

Item Diameter 120.0 px

Rows 1.00

Columns 1.00

Circular product setup.

X-Ray ON Back

Tool Group

Pack Division (Rectangular)

Threshold 75.00 %

Item Width 98.00 px

Item Length 98.00 px

Rows 1.00

Rectangular product setup.

X-Ray ON Back

Tool Group

Pack Division (Circular)

Columns 4.00

Items Per Stack 3.00

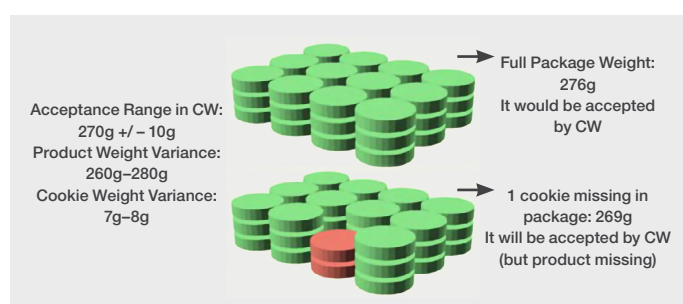
Stack Minimum Items 2.50

Setting rows/columns.

Application corner

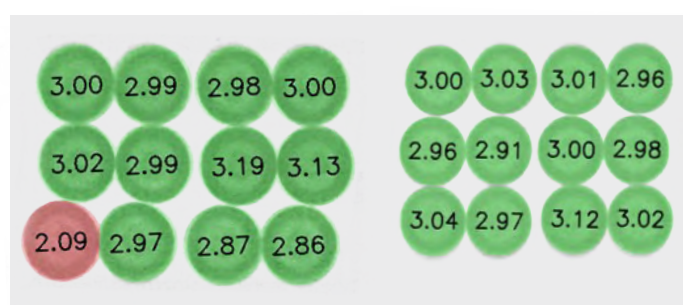
Pack Division in practice

One application that Pack Division supported is a cookie manufacturer in maintaining high quality standards. The customer required a solution for various sizes and stack quantities of cookies in their final packaging. Due to the manufacturing process of the cookies, they can have weight variations in every batch. It was identified that due to the package weight variance, that even one missing cookie would allow the package to still fall within the weight range, resulting in the checkweigher or X-ray Mass Estimation to not accurately account for the missing cookie and reject the bad pack.



Example of missing lightweight product in checkweigher application.

By utilizing the Pack Division Circular software, manufacturers can inspect circular products of varying thickness and styles. The tool was tested in customer facilities and successfully detected missing one cookie, half cookies, even down to a quarter of a cookie. Setting up the appropriate stack minimum is crucial, as the software estimation of cookies in a stack may vary slightly (e.g., ± 0.1). The selected value will depend on the



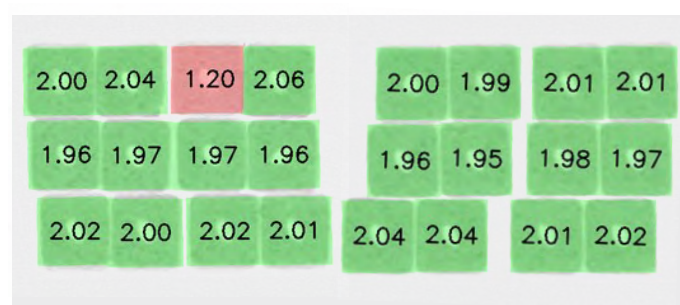
Pack Division image identifying missing and complete package in circular format.

stack and settings of each product recipe to ensure the best outcome for the customer. Additionally, there was a variety in the final product such as packages with stacks ranging from two to four cookies, and common configurations such as three rows by four columns or four rows by four columns. Managing different settings was crucial for this customer.

Similarly, the Pack Division Rectangular tool effectively handled square cookies, reliably detecting and rejecting missing portions, including half a cookie. The software not only provides solutions for customers but also offers ease of use and adaptability to different designs and sizes, proving to be an asset for quality control.

Conclusion

The introduction of the Pack Division software significantly enhances NextGuard's capabilities in quality control for packaged goods. This innovative tool addresses the challenges of detecting missing lightweight products in a stack format, by utilizing advanced X-ray technology and analysis of stacked products. Pack Division software supports various cookie sizes and stack configurations, whether circular or rectangular, and allows for precise detection of missing items, including fractions of a cookie. With its user-friendly interface and integration with other NextGuard features, such as Contaminant Detection and Mass Estimation, Pack Division provides a robust solution for maintaining high quality standards in the food industry. This adaptability and precision make it a valuable addition to the Product Verification library, ensuring that every package meets our customers most stringent quality requirements.



Pack Division identifying missing and complete package in rectangular format.