

# 3D MACHINE VISION APPLICATIONS GUIDE

Advanced 3D technology for high-precision measurements and inspections

**COGNEX**

# THE GLOBAL LEADER

## IN MACHINE VISION AND INDUSTRIAL BARCODE READING

**Cognex®, the leading supplier of machine vision and industrial barcode reading solutions.**

With over 3.5 million systems installed in facilities around the world and over forty one years of experience, Cognex is focused on industrial machine vision and image-based barcode reading technology. Deployed by the world's top manufacturers, suppliers and machine builders, Cognex products ensure that manufactured items meet the stringent quality requirements of each industry.

Cognex solutions help customers improve manufacturing quality and performance by eliminating defects, verifying assembly and tracking information at every stage of the production process. Smarter automation using Cognex vision and barcode reading systems means fewer production errors, which equates to lower manufacturing costs and higher customer satisfaction. With the widest range of solutions and largest network of global vision experts, Cognex is the best choice to help you **Build Your Vision.™**

**\$1.04  
BILLION**  
2021 REVENUE

**OVER 41**  
YEARS IN THE BUSINESS

**500+**  
CHANNEL PARTNERS

GLOBAL OFFICES IN  
**20+ COUNTRIES**

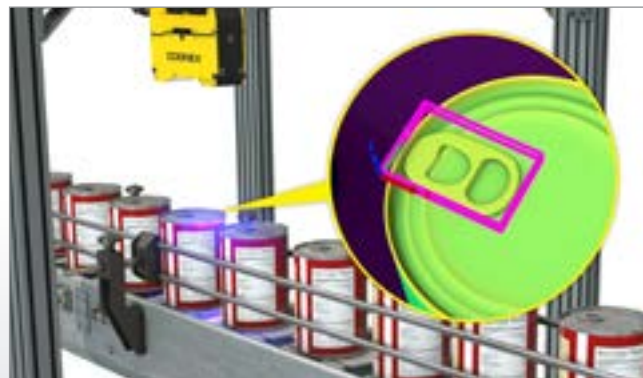
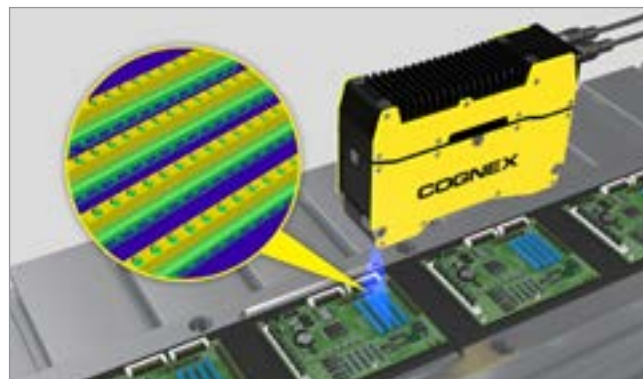
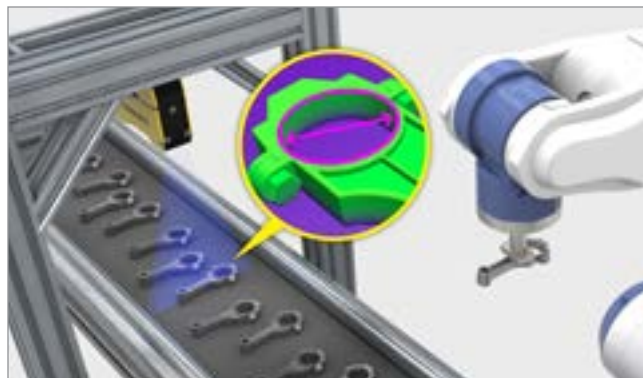
**3,500,000+**  
SYSTEMS SHIPPED



# THE RIGHT CHOICE FOR 3D INSPECTIONS

Whether performing a single profile measurement or scanning an entire surface in 3D, Cognex has the most powerful and robust 3D machine vision solutions. Manufacturers in all industries trust Cognex technology to deliver high accuracy surface feature measurements that go beyond the capabilities of 2D machine vision technology.

<b>Automotive</b> .....	<b>4</b>
<b>Electronics</b> .....	<b>9</b>
<b>Food and Beverage</b> .....	<b>11</b>
<b>Consumer Products</b> .....	<b>13</b>
<b>Logistics</b> .....	<b>15</b>

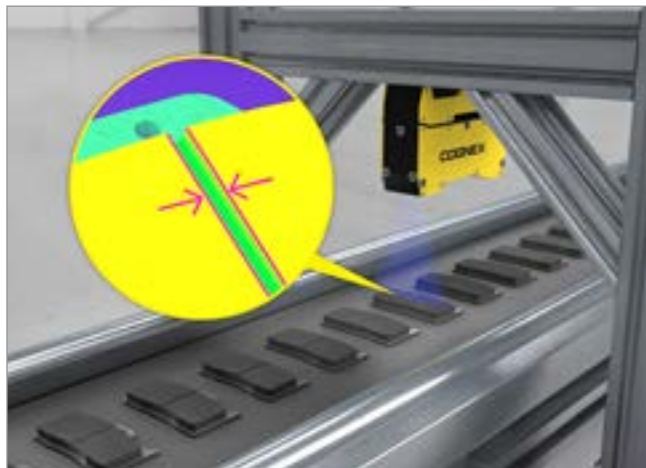


# AUTOMOTIVE

## 3D Machine Vision Solutions that Go the Distance

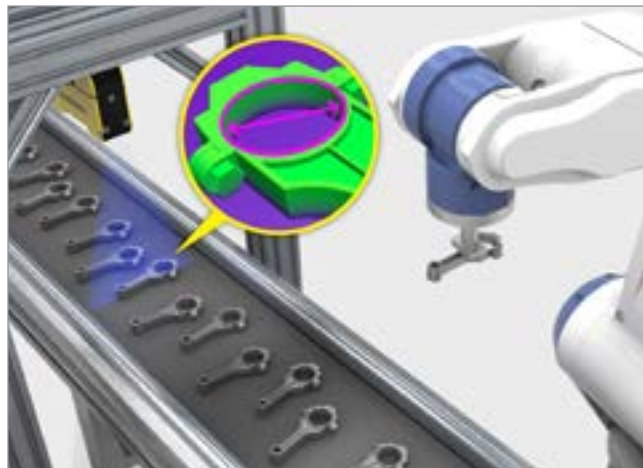
From assembly to final inspection, nearly every system and component within a gas-powered, hybrid, or electric vehicle is manufactured with machine vision technology. Cognex 3D machine vision systems enable automotive part manufacturers and vehicle assembly plants to achieve exceptional quality and safety, and meet their production goals.

### Brake Pad Inspection



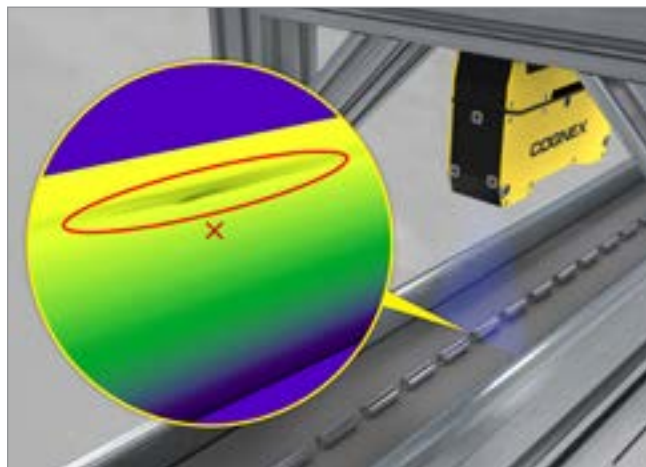
Inspect the gap width for the brake pad and also inspect the angle of the beveled edges.

### Connecting Rod Inspection and Location



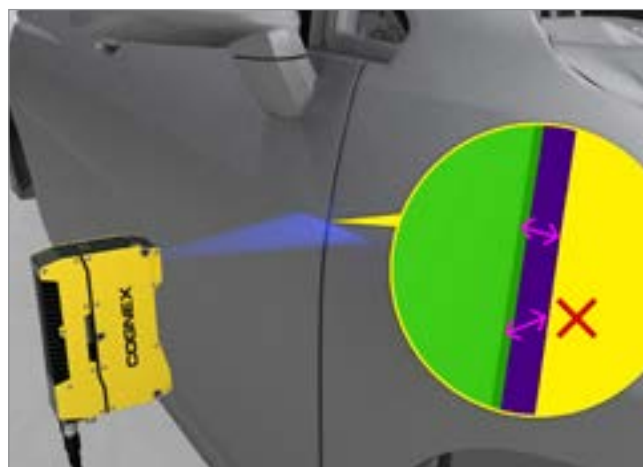
Locate the connecting rod on the belt using PatMax3D and measure the dimensions to ensure there are no part defects.

### Electric Vehicle Battery Inspection



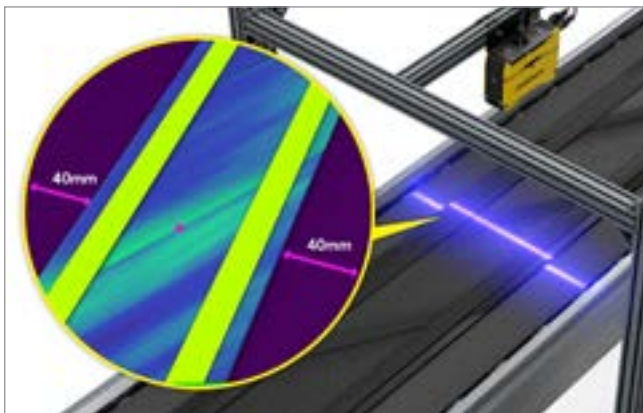
Detect dents, scratches, and other potential defects on the surface of an electric vehicle (EV) battery.

### Flush and Gap Inspection



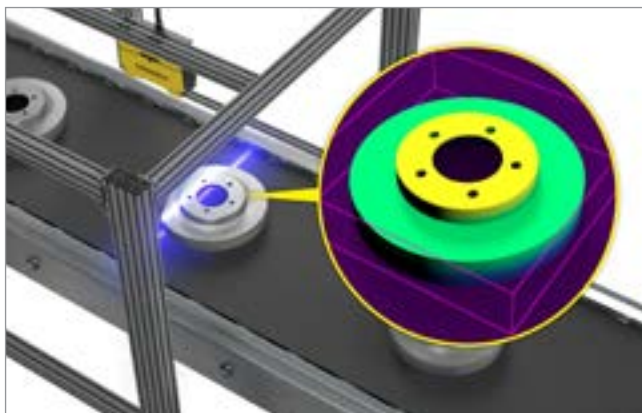
Detect the proper alignment between the door and car body, while ensuring the gap between the two is consistent.

## Extruded Rubber Splice Detection



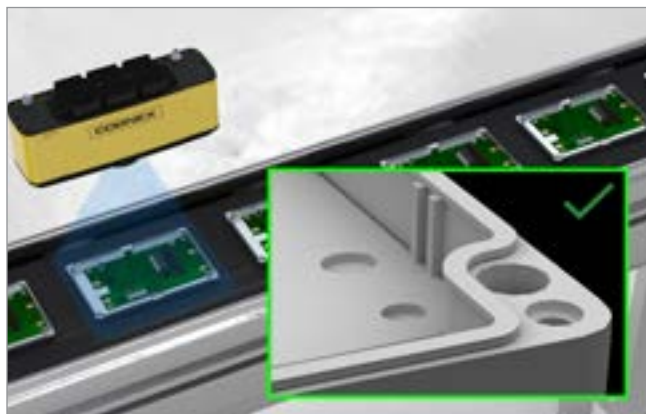
Locate the edge and verify straightness of spliced rubber for tires.

## Automotive Casting Inspection



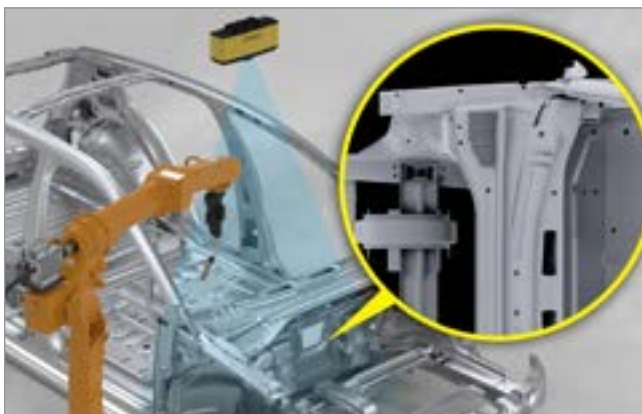
Inspect automotive part volumes for flashing, short shots, and other defects.

## Oil Seal and O-Ring Assembly Inspection



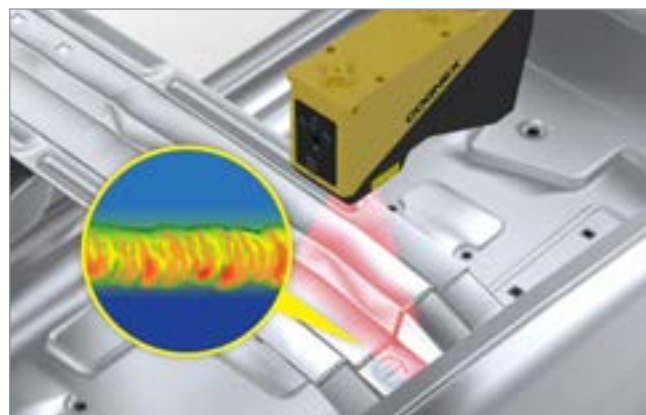
Perform in-line inspection of oil seals and o-rings, and confirm they are set in the correct position to prevent water and oil leakage.

## Welding and Brazing



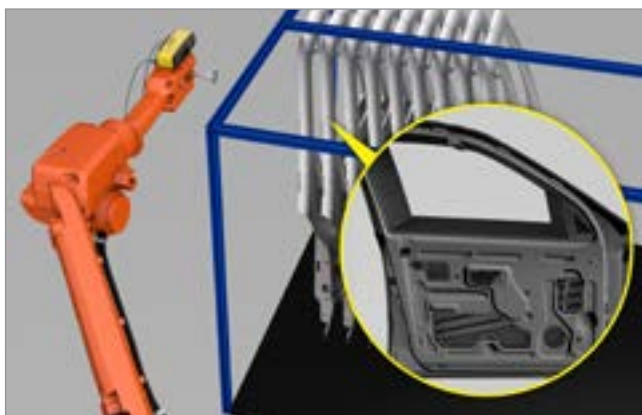
Guide welding robots to the correct location in order to weld the chassis together.

## Weld Seam Inspection



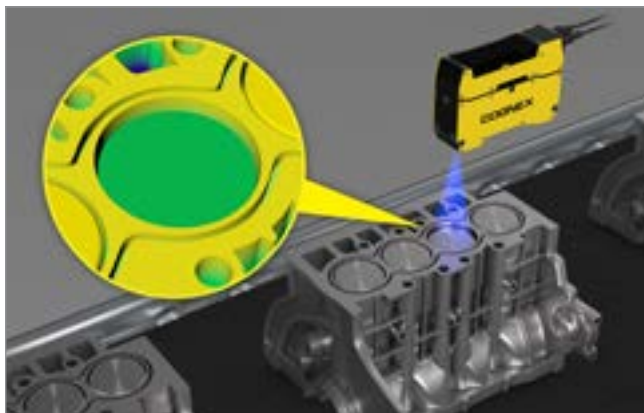
Inspect weld seams to ensure they are complete and the proper thickness.

## Racking and Deracking Identification



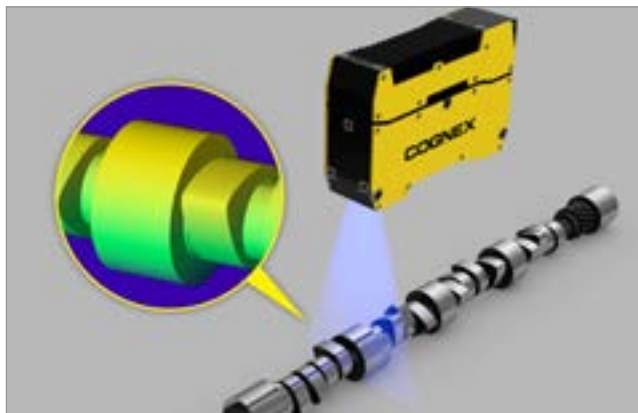
Guide robots to move stamped parts from the line to a rack for inspection and identification.

## Engine Component Matching



Gauge whether pistons are seated properly in a cylinder block.

## Cam Shaft Inspection



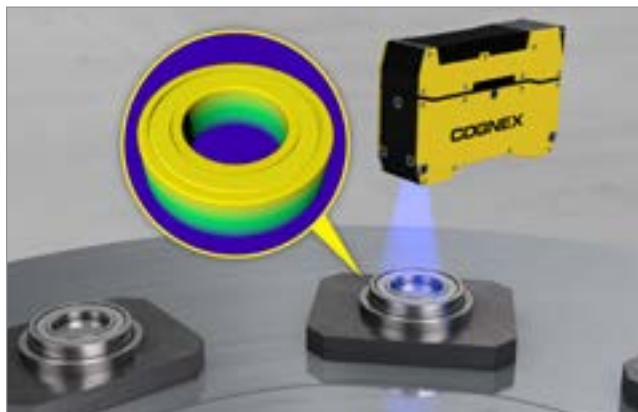
Verify the dimensions of cast parts are manufactured within tolerance.

## Airbag Compartment Cover Gap Measurement



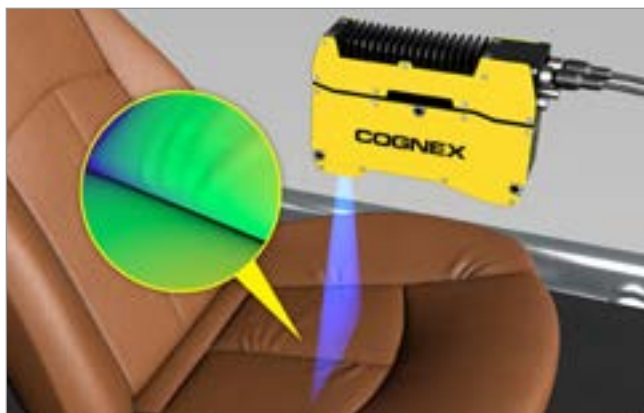
Ensure proper alignment of airbag compartment cover and flushness with the dashboard.

## Bearing Inspection



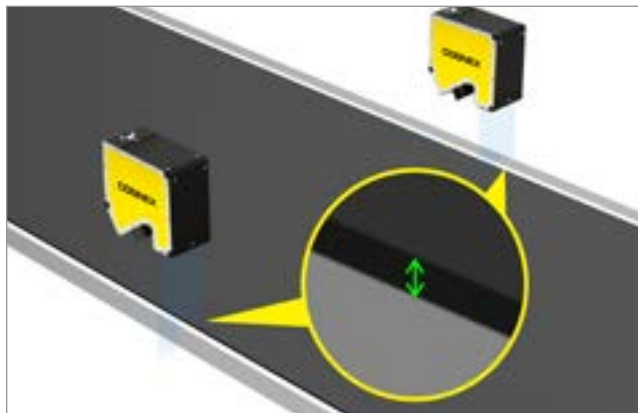
Inspect metal surface for burring and other defects.

## Car Seat Wrinkle Detection



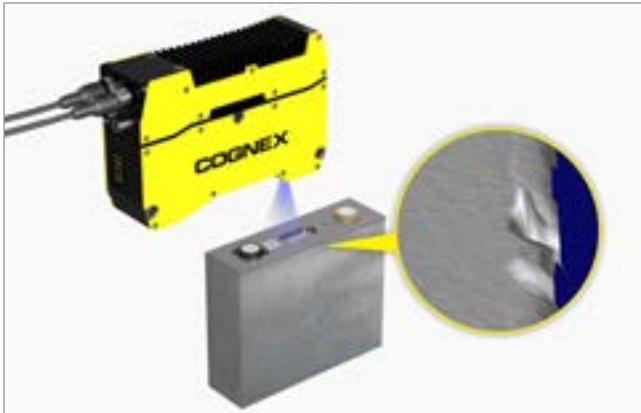
Verify flatness of car seat material and ensure surface is free of wrinkles and unintended creases.

## End Face Profile Measurement



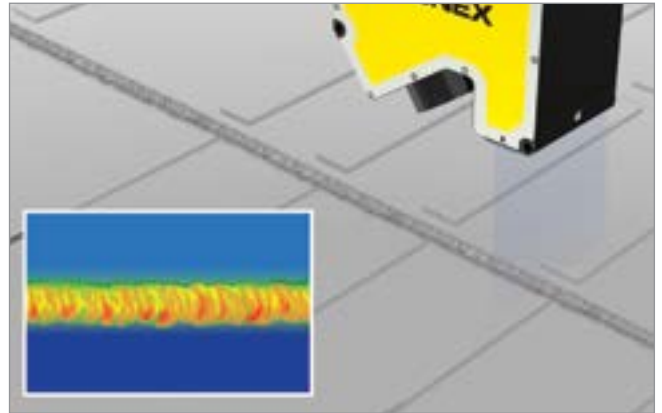
Continuously measure black electrode coatings, even when wet, to detect any waviness in real time.

## Cap Welding Guidance and Inspection



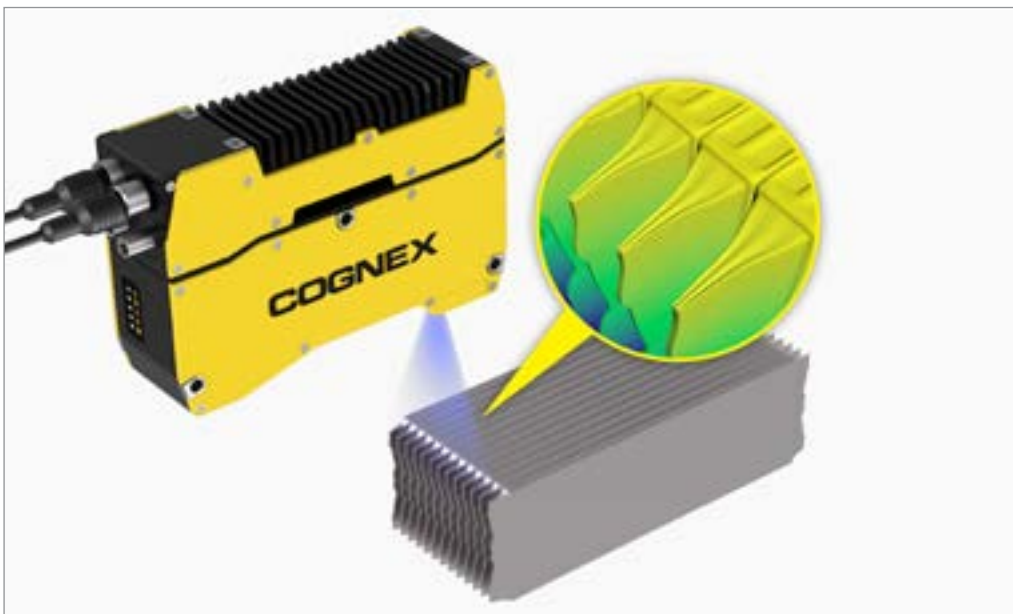
Measure the height difference between the cap and battery case prior to welding. Afterwards, inspect the welded seams to ensure they are fully sealed and free of defects.

## Battery Pack, Module, and Busbar Welding Inspection



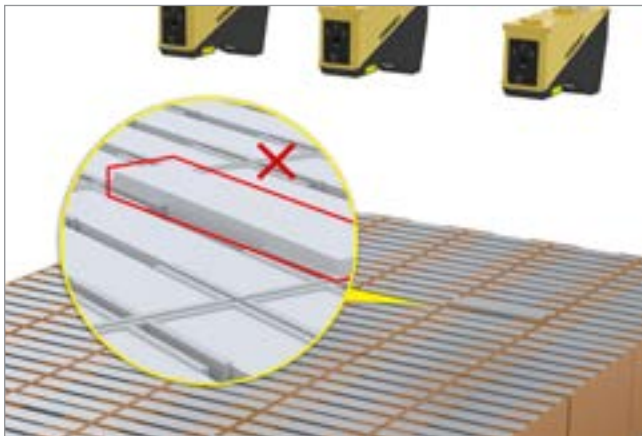
Perform surface measurement of the welds on battery packs and inspect the welds on a battery pack's modules and busbars.

## Cell Stacking Height Measurement



Measure the height of cells stacked inside a battery module to verify uniformity.

## Electric Vehicle Battery Module Inspection



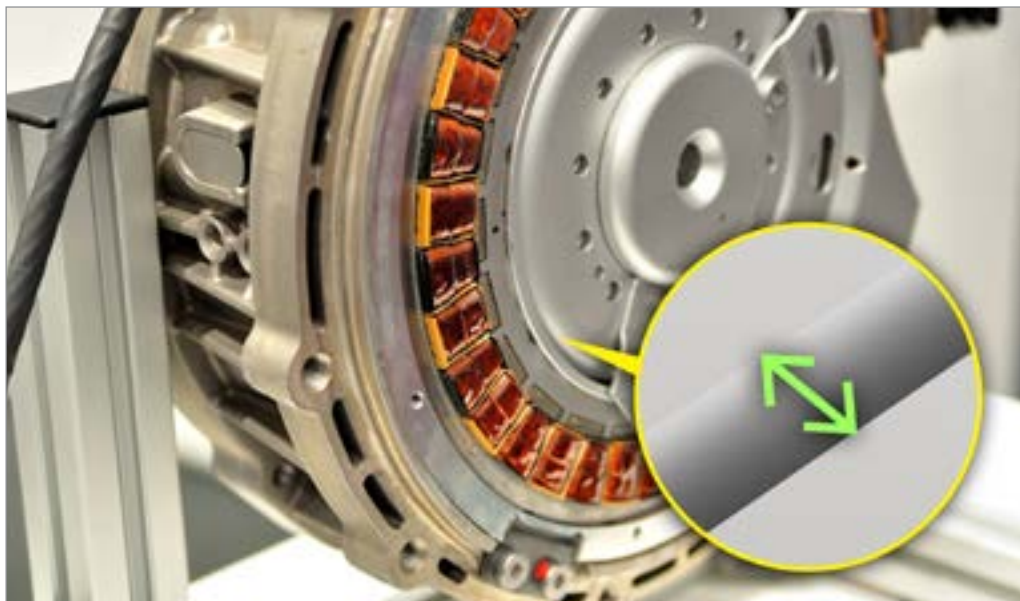
Inspect the seating of EV battery modules.

## Terminal Height Measurement



Measure the height profiles of connectors to make sure they are coplanar.

## Rotor/Stator Inspection



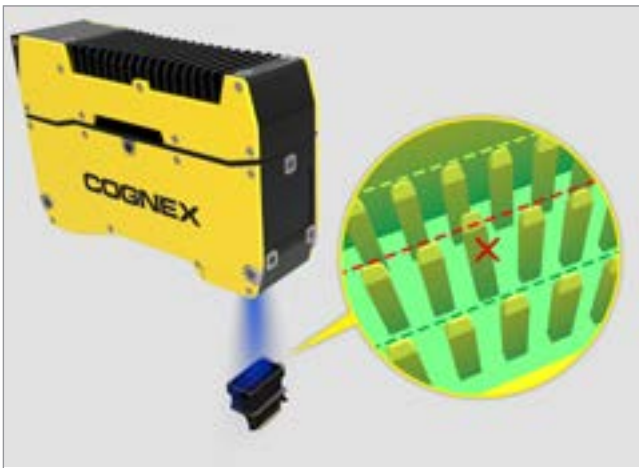
Perform in-line inspection of the narrow gap between rotor and stator, and assess wedge tightness for the magnetic field.

# ELECTRONICS

## Guide, Inspect, Align, and Identify with 3D Machine Vision

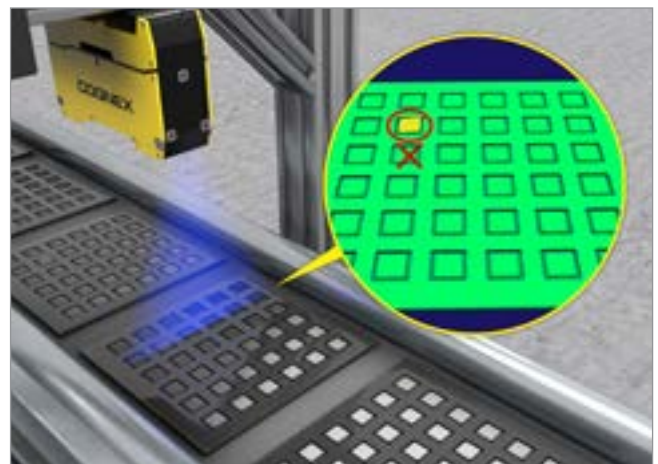
Electronics manufacturers and suppliers rely on Cognex's machine vision solutions to solve their most difficult production and packaging challenges while meeting stringent safety and quality requirements. Cognex laser profilers and 3D vision systems satisfy the toughest applications for electronic materials, semiconductors, components, integrated circuit (IC) packaging, and finished electronic equipment. Driven by powerful vision technology and robust hardware, Cognex tools eliminate defects, verify assembly, and track and capture information during the production lifecycle to achieve maximum quality, high yields, and traceability.

### Connector Pin Height Inspection



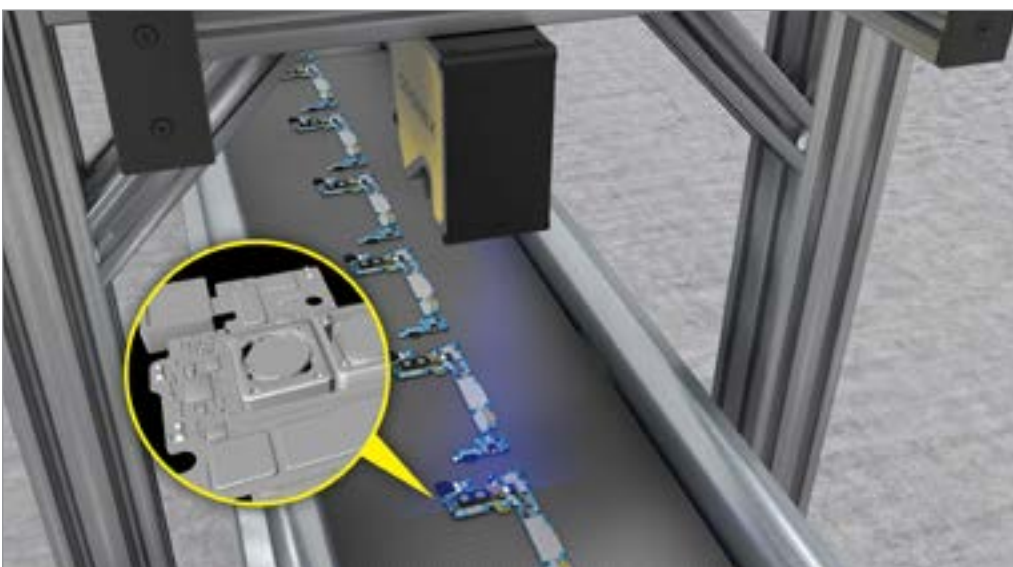
Verify the correct number of pins on the connector and ensure the pins are in the correct position while being free from damage or tilted.

### Carrier Flatness Inspection



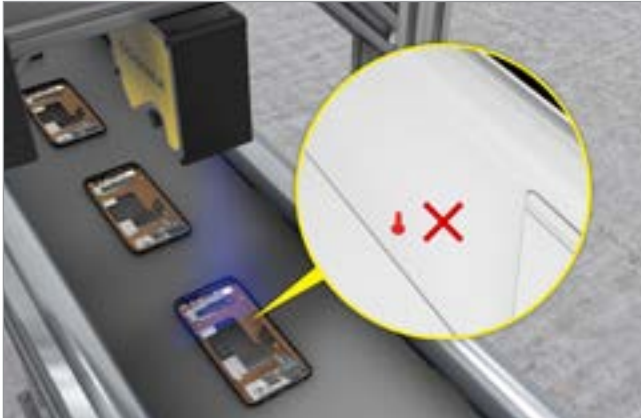
Determine if chips are correctly seated inside the carrier tray by measuring position and flatness.

### PCB Inspection



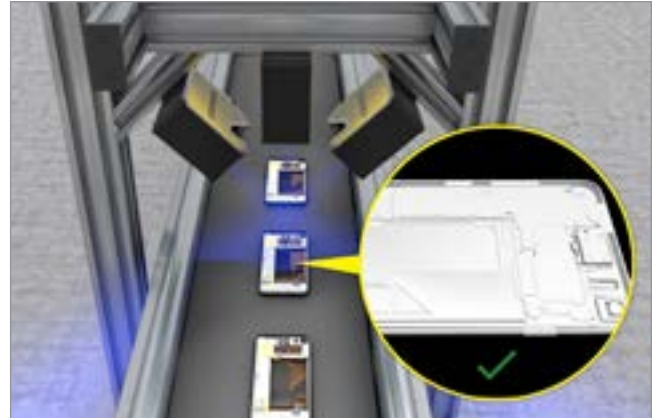
Inspect PCBs for the proper number, size, and placement of components.

## Pre-Assembly Insertion Check



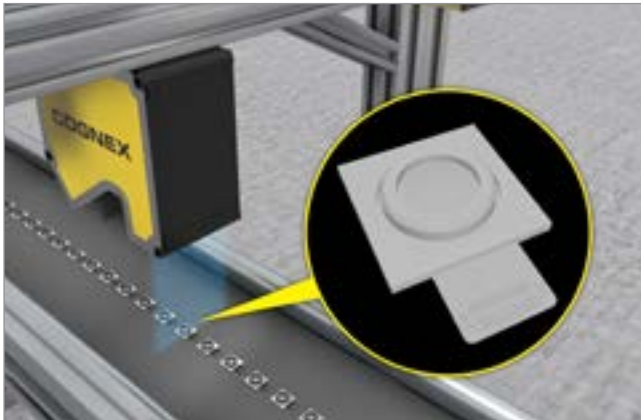
Ensure the module mounting area is free of potential obstructions.

## Post-Assembly Verification



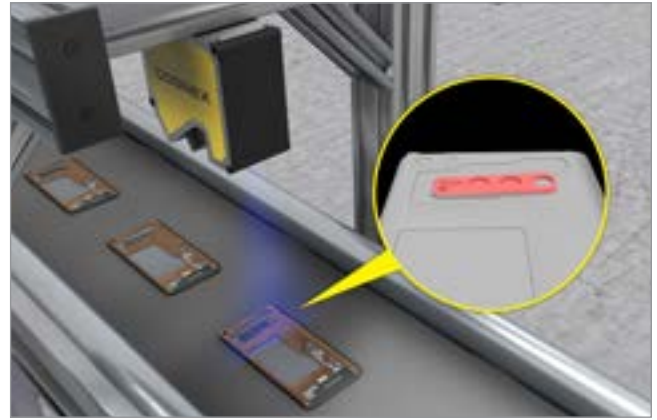
Verify that components are properly installed and meet quality parameters.

## Smartphone Camera Height Measurement



Gauge the height dimensions for a complex, transparent camera assembly.

## Smartphone Housing Flatness Inspection



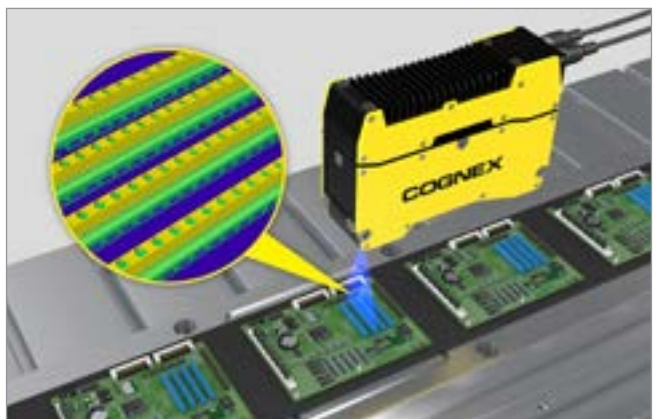
Measure the height of housing and detect the smallest dents to micron-level accuracy.

## Screw Assembly Height Measurement



Determine whether the height of the screw is within the accepted range.

## Terminal Height Measurement



Confirm height of terminals in PCBs.

# FOOD AND BEVERAGE

## Protect Your Customers and Your Brand with 3D Machine Vision

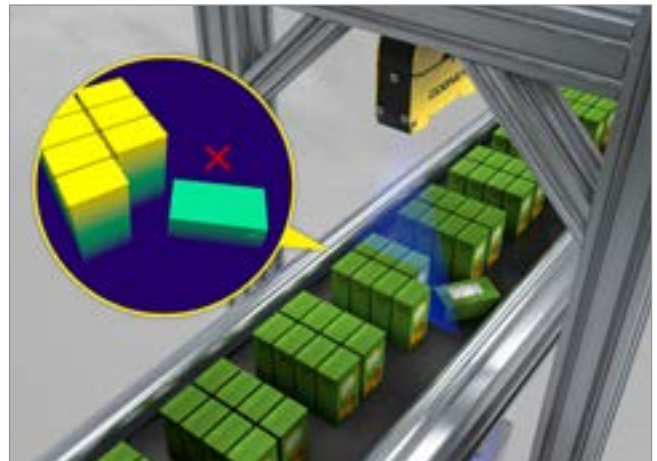
With lean operations and thin margins, the pressure on the food and beverage industry to optimize overall equipment efficiency without compromising quality is challenging. Successful manufacturers embrace machine vision solutions to minimize downtime and consistently deliver safe, high-quality products. With a wide selection of 3D machine vision systems, Cognex solutions help food and beverage manufacturers solve some of the most challenging inspection and verification applications.

### Package Inspection



Determine the presence or absence of items in the packaging and verify the volume of the package.

### Item Location



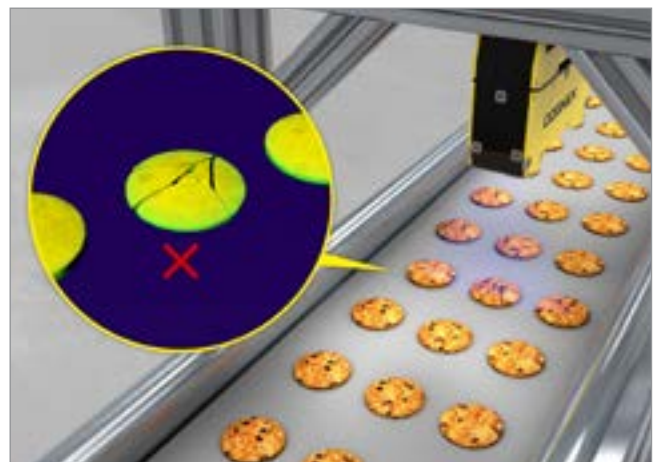
Inspect packages to determine correct number and proper orientation. Also, check for defects in the packaging such as dents or tears.

### Cap Inspection



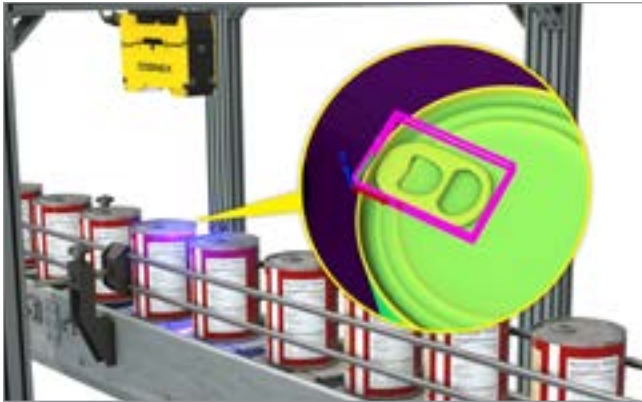
Ensure the bottle is properly sealed by checking the height and tilt angle of the bottle cap.

### Cookie Defect Detection



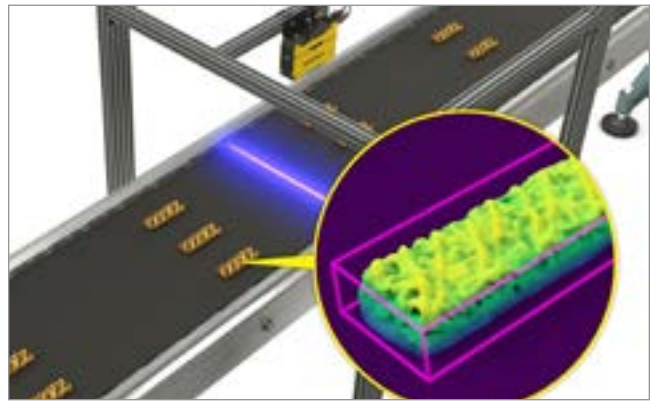
Verify the uniformity of cookies by measuring the length, width, and height. Inspect for defects such as breaks or cracks.

## Aluminum Can Inspection



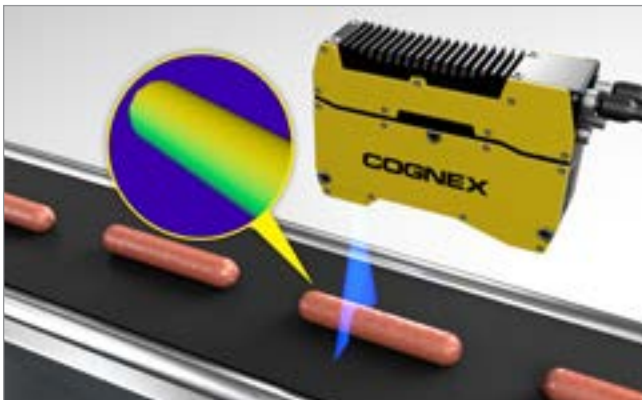
Check for dents, missing tabs, lifted tabs, and other defects to reduce scrap.

## Cereal Bar Inspection



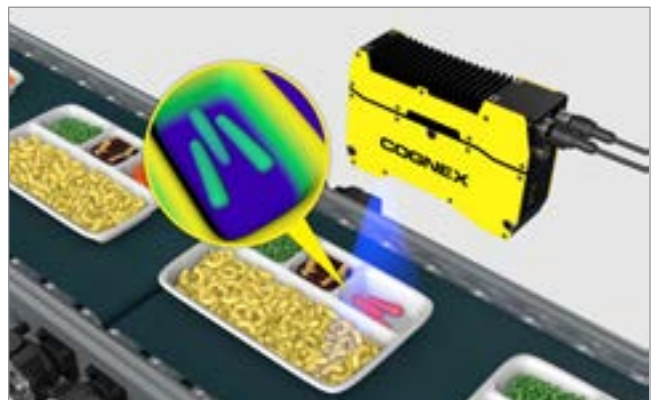
Ensure proper volume, detect defects, verify frosting/decoration location, and validate flatness.

## Food Uniformity Inspection



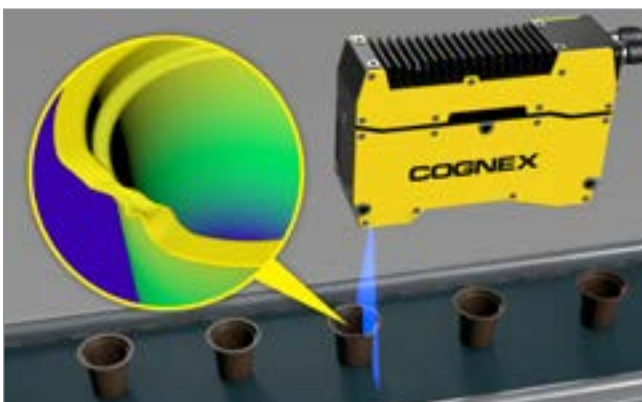
Measure height, length and width and calculate volume to detect minor variations in food uniformity.

## Food Portioning Inspection



Measure portions in kitted meals.

## Injection Molded Cup Inspection



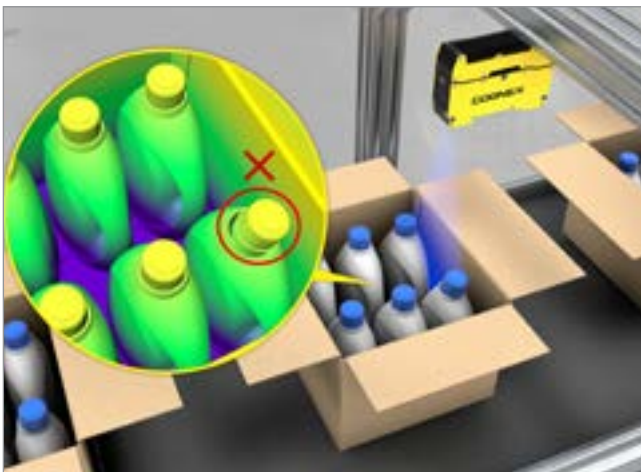
Inspect injection molded cups and verify proper dimensioning.

# CONSUMER PRODUCTS

## 3D Machine Vision Solutions Deliver Product Quality, Safety, and Integrity

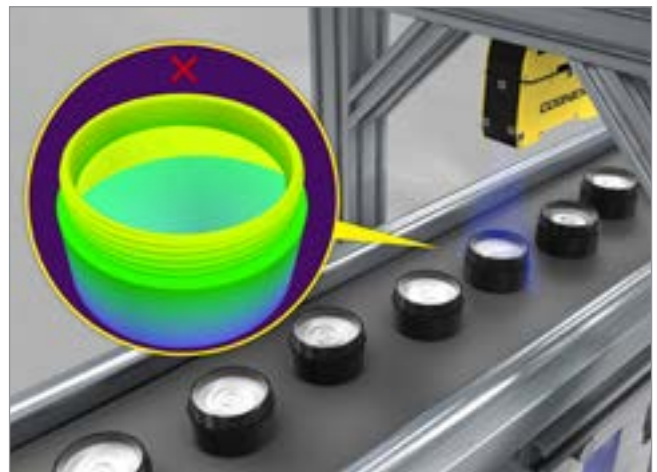
The consumer product and packaged goods industry demands high throughput, cost efficiency, and accuracy for its material handling, inspection, labeling, and assembly needs. Cognex is uniquely positioned to deliver the highest level of performance in product safety, product quality, and productivity improvements for consumer packaged goods (CPG) manufacturers. Cognex provides 3D machine vision solutions for every application, helping manufacturers maximize gross margin and customer satisfaction by improving product quality.

### Cap Inspection



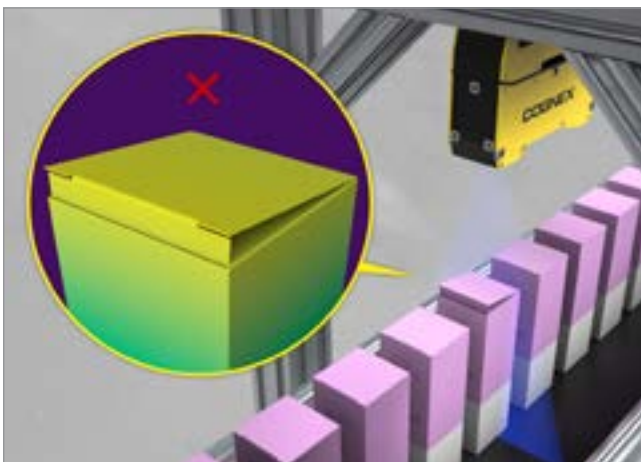
Verify the presence and position of the cap by checking the height and tilt.

### Fill Level Inspection



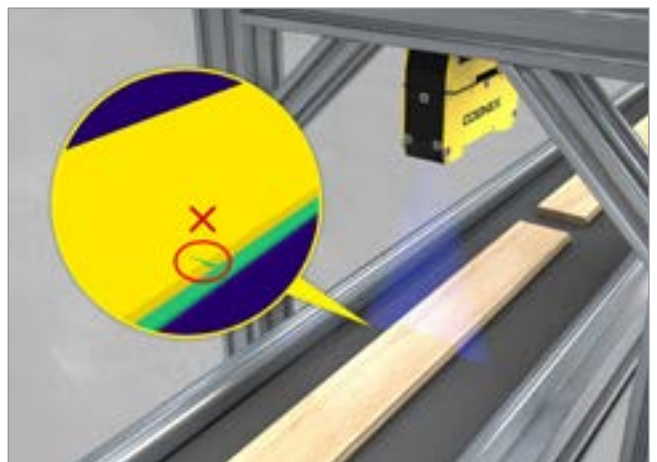
Inspect the height and volume of the contents to ensure the correct amount of product is in each container.

### Packaging Quality Inspection



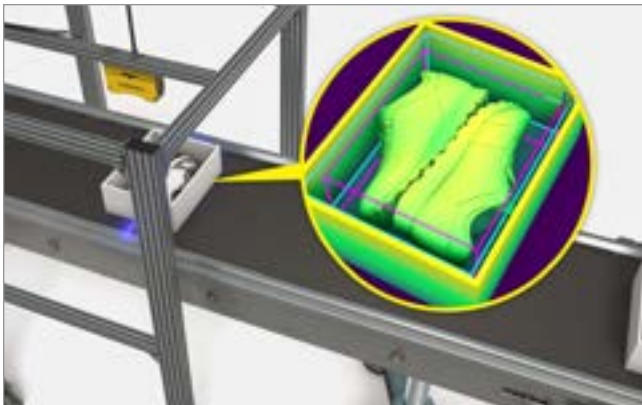
Verify the box is intact and sealed while inspecting for potential quality issues such as crushed corners, tears, or open flaps.

### Flooring Inspection



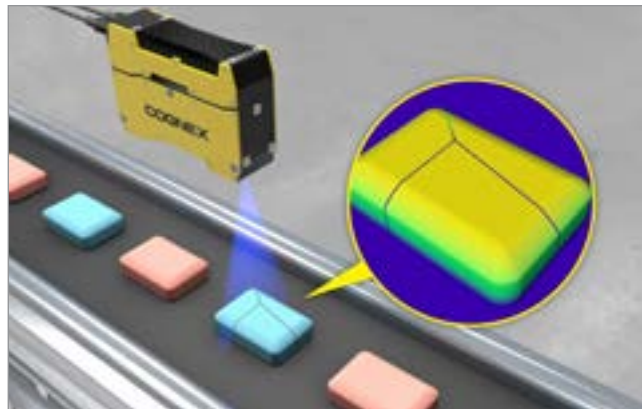
Inspect floorboards for orientation using the tongue. Check for surface defects including gouges, bowing, splits, and knotholes.

## Shoe Detection and Inspection



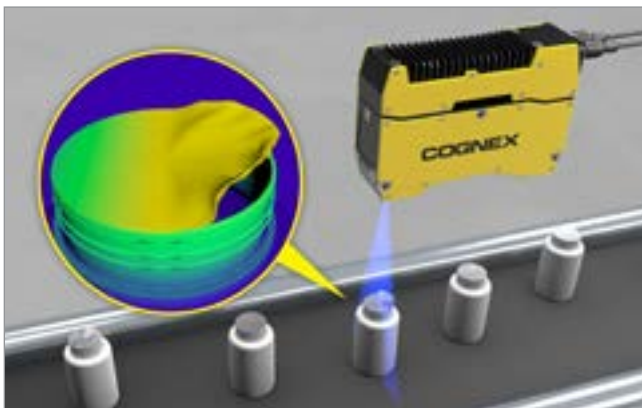
Ensure proper pairing, quality, aesthetics, and object presence/absence.

## Soap Bar Inspection



Inspect bar for damage and confirm dimensions prior to packaging process.

## Tamper and Safety Seal Inspection



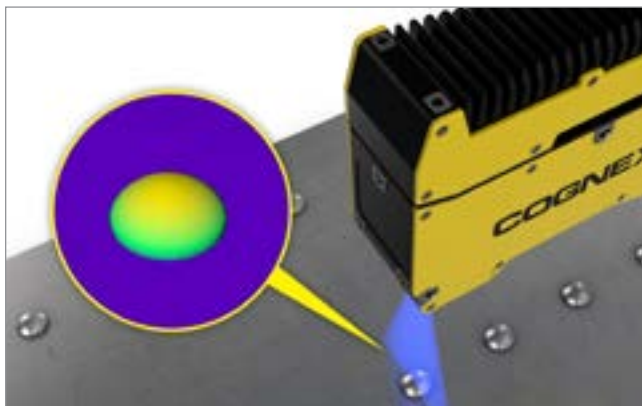
Verify seal integrity to avoid potential recalls and instill customer confidence.

## Angled Sheet Metal Inspection



Measure curvature and edges of angled sheet metal to ensure proper dimensioning.

## Rivet Inspection



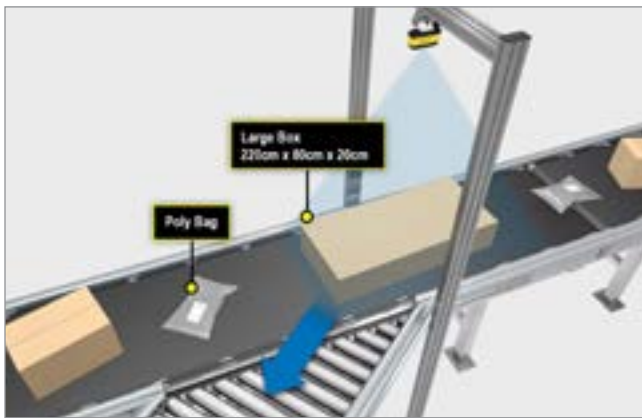
Confirm height of rivets and detect defects prior to sending sheet metal to the next stage of manufacturing.

# LOGISTICS

## Power Up Your Operations with 3D Vision Systems

As retail distribution, e-commerce fulfillment, and parcel processing industries continue to grow, the pressure to meet customer demands and performance metrics is greater than ever. Successful companies are scaling and optimizing operations while minimizing manual work and equipment downtime. Cognex 3D machine vision solutions deliver high accuracy and robust performance which helps improve traceability, increase throughput, and reduce costs associated with manual rework. In addition, these solutions provide rich real-time performance data and trending insights that help optimize operations.

### Inbound Product Categorization



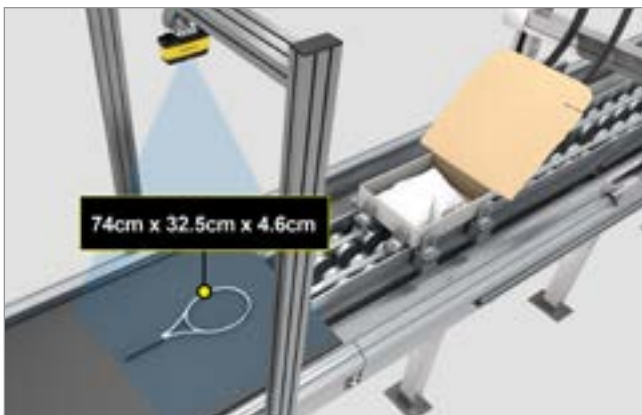
Capture dimensional information, categorize incoming freight, and provide item data for proper storage.

### Manifest Verification



Capture volumetric and dimensional information of incoming products, improving traceability and verifying what was on the manifest.

### Packaging Optimization



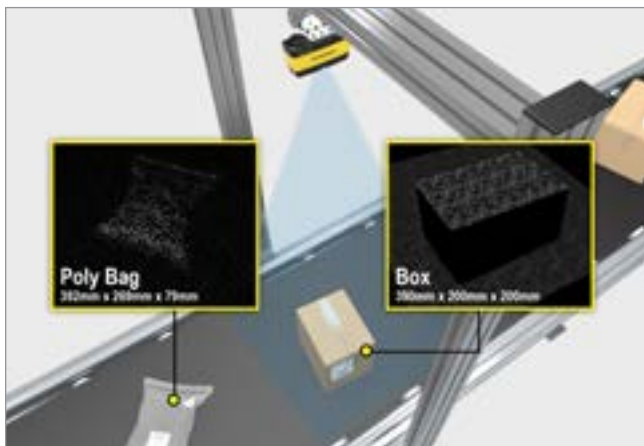
Automate volumetric measurement of picked products, reducing manual handling and measurement time, and lowering overall shipping costs.

### Item Verification



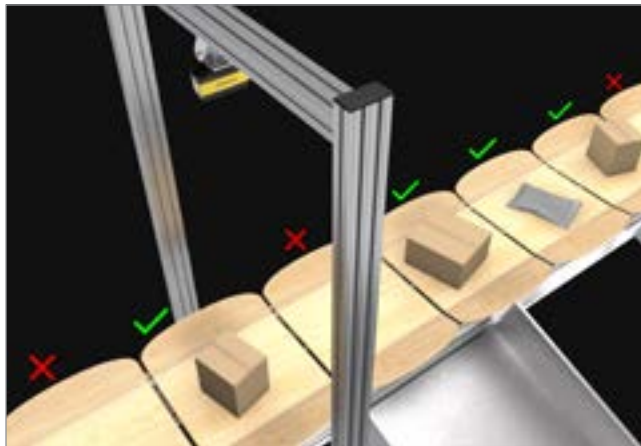
Capture volume and dimensioning data of picked items, increasing order accuracy, improving inventory management, and reducing return costs.

## Categorizing Packages Prior to Shipment



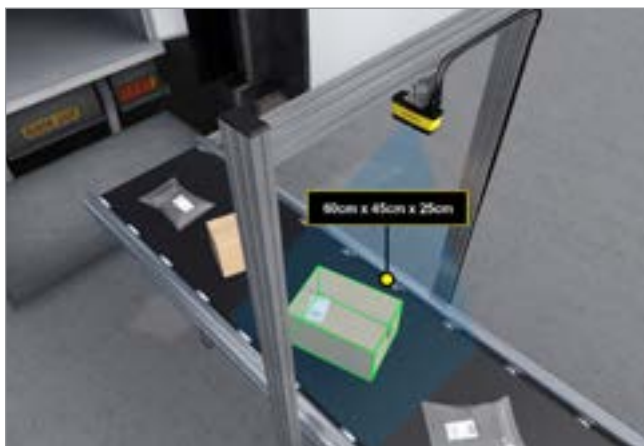
Categorize products to ensure proper handling and reduce damage to packages.

## Item Detection



Identify products among dirt, dust, and foreign objects on the sorting belt, and monitor error codes to keep sorting systems running efficiently.

## Estimating Shipping Costs



Capture and report dimensional and volumetric information, allowing operators to select the optimal packaging and more accurately estimate shipping costs.

## Truck Load Optimization



Collect dimensional and volumetric information for outgoing freight, enabling outbound handlers to pack their trucks efficiently to optimize transportation costs.

# 3D MACHINE VISION SYSTEMS

Cognex laser profilers and area scan 3D vision systems provide ultimate ease of use, power, and flexibility to achieve reliable and accurate measurement results for the most challenging applications.

## In-Sight 3D-L4000 Series

A unique vision system combining 3D laser displacement technology with a high-performance smart camera allowing factory engineers to quickly, accurately, and cost effectively solve a wide variety of inspections thanks to a comprehensive suite of true 3D vision tools, easy setup, and speckle-free blue laser optics.



## 3D-A5000 Series

State-of-the-art area scan 3D camera captures high-resolution 3D point cloud images in a fraction of the time of current methods. Using unique 3D imaging technology, it solves challenging assembly verification, in-line metrology, and robotic guidance applications.

## 3D-A1000

3D-A1000 vision systems provide ease of use, simple setup, and high accuracy for dimensioning and item detection applications. They capture 3D and 2D images of objects and provide key operational information for logistics control systems.



## DSMax

Fast, high-definition laser displacement sensor for accurate 3D inspections of small, detailed parts. Ideal solution for electronic components which can contain highly reflective or dark features.

# COGNEX GLOBAL SERVICES

Customers get more than software when they purchase from Cognex. They get a company focused exclusively on machine vision, with the most comprehensive application experience. Add direct, high-quality worldwide service and support, and it's easy to see why Cognex is the machine vision company that industries rely on.

## Technical Support Product Training Hardware Programs Product Lifecycle

When it comes to protecting your machine vision investment, Cognex understands that responsive, expert service is an expectation all customers should have. Cognex serves an international customer base from offices located throughout the Americas, Europe, and Asia and through a global network of highly-trained partners, system integrators, and distributors.

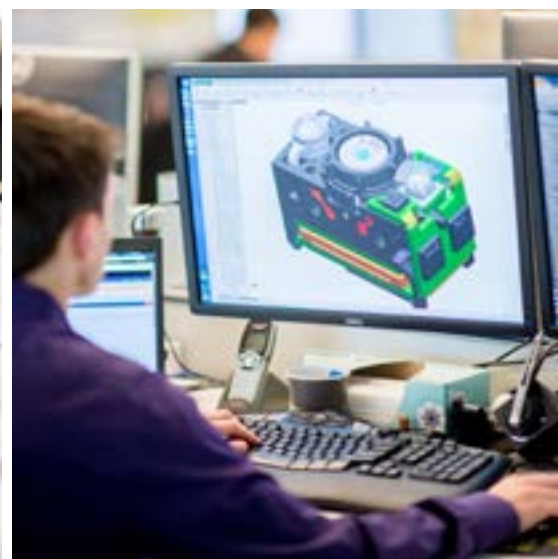
From development to deployment, Cognex is there to help you get your vision systems up and running as fast as possible. Whether you're considering machine vision for the first time or are already an expert user, Cognex global services provide the expertise to help your organization succeed.

[cognex.com/support/cognex-services](http://cognex.com/support/cognex-services)



Offices in **20+** countries

**500+** Global Partners  
in 30 Countries



# COGNEX TRAINING

We want to make YOU the most effective vision professional at your organization. Cognex offers a variety of training options dedicated to optimizing manufacturing processes and increasing organizational expertise. Through its global training organization, Cognex operates classroom facilities that deliver a variety of courses lasting 1–4 days for beginners to advanced users. Topics include the fundamentals of machine vision to real-world applications for complex tools.



## Customized, Anytime

For groups of six or more, all Cognex classes are available at **your facility** so that your team can work and learn together in your own real-world environment. For on-demand convenience, the Cognex online training portal lets you access on-demand training videos of many Cognex courses, participate in online courses, view tutorials, examine application examples, and watch lighting and optics videos.

By combining key training classes and system integration services into training service packages, Cognex can help focus and accelerate your learning.

Our three most popular packages—Building Vision Competence, Upgrading Vision System, and Factory Level Service Program (FLSP)—address common customer challenges and can be customized to suit your specific needs.

[www.cognex.com/training](http://www.cognex.com/training)



# 10,783

Attendees in 2020



# 1074

Worldwide classes in 2020



# 18

Different languages

# BUILD YOUR VISION

## 2D VISION SYSTEMS

Cognex machine vision systems are unmatched in their ability to inspect, identify and guide parts. They are easy to deploy and provide reliable, repeatable performance for common to complex tasks.

[www.cognex.com/machine-vision](http://www.cognex.com/machine-vision)



## 3D VISION SYSTEMS

Cognex laser profilers and area scan 3D vision systems provide ultimate ease of use, power and flexibility to achieve reliable and accurate measurement results for the most challenging 3D applications.

[www.cognex.com/3D-vision-systems](http://www.cognex.com/3D-vision-systems)



## VISION SOFTWARE

Cognex vision software provides industry leading vision technologies, from traditional machine vision to deep learning-based image analysis, to meet any development needs.

[www.cognex.com/vision-software](http://www.cognex.com/vision-software)



## BARCODE READERS

Cognex industrial barcode readers and mobile terminals with patented algorithms provide the highest read rates for 1D, 2D and DPM codes regardless of the barcode symbology, size, quality, printing method or surface.

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# COGNEX

Companies around the world rely on Cognex vision and barcode reading solutions to optimize quality, drive down costs and control traceability.

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