

# **COGNEX**

## **AUTOMOTIVE SOLUTIONS GUIDE**



**TIRES AND WHEELS**  
**SAFETY SYSTEMS**  
**POWERTRAIN**  
**CHASSIS**  
**ELECTRONIC SYSTEMS**

# THE RIGHT CHOICE FOR ALL YOUR AUTOMOTIVE SYSTEMS

## THE MOST COMPLETE PRODUCT RANGE

### Local Expertise, Worldwide Reach

Standardizing inspection and ID solutions across all production lines reduces the total cost of ownership for any enterprise, but it also requires a supplier that's able to deliver and support large scale deployments that require systems at multiple locations. As the undisputed global leader in vision-based inspection and identification systems, Cognex offers greater security for manufacturers and equipment suppliers striving to comply with rapidly approaching regulatory deadlines and has the capacity and resources available to support even the largest enterprise-wide inspection and barcode deployments across multiple production lines.

Rely on Cognex sales engineers and 450+ partners located around the world to provide assistance and help you....BUILD YOUR VISION.

GLOBAL OFFICES  
**20**  
COUNTRIES

1,000,000+  
**SHIPPED** SYSTEMS+

**30+** YEARS  
IN THE BUSINESS

**500+**  
CHANNEL PARTNERS



3D and Multi-camera  
Vision Systems



Barcode Readers



Stand-alone Vision Systems



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# TIRE & WHEEL SYSTEMS

## SORTING & IDENTIFICATION

## TIRE AND WHEEL IDENTIFICATION

### AUTOMATED WHEEL HANDLING SYSTEM

**Problem:**

Automated wheel handling systems are required to identify over thirty different wheel types and sizes without human intervention. Wheels are randomly orientated on conveyors with a small Data Matrix code marked directly on each wheel that is used for identification. The surface finishes of wheels makes reliable reading of these codes challenging for standard barcode readers.

**Solution:**

Cognex tire solutions deliver robust, high-speed, wheel identification using propriety code-reading algorithms that are able to reliably locate codes despite random placement and orientation of wheels on the conveyor. Once the Data Matrix code is located, code reading algorithms adapts to any changes in code appearance caused by marking or contrast differences between the code and its background to achieve high read rates.

## AUTOMATED TIRE SORTING

### TRACK AND SORT TIRES WITH CHARACTER READING VISION TOOLS

**Problem:**

Manufacturers are able to track and sort tires by reading the Department of Transportation (D.O.T.) codes comprised of alphanumeric characters molded into the sidewall. It's critical that the D.O.T. code information be recorded at the manufacturing and assembly plant for effective management of potential tire recalls. Code reading is a challenge because tires are often randomly orientated on the conveyor, and there is little visible contrast between the code's characters and the tire sidewall.

**Solution:**

Cognex tire solutions with character reading vision tools enable tire manufacturers to read codes in the most challenging conditions with very high accuracy. The character reading vision tools accurately locate and read the D.O.T. characters and adapt to changes in code appearance caused by variation in the molding process.



# TIRE & WHEEL SYSTEMS

## HANDLING & ASSEMBLY SYSTEMS

### AUTOMATED TIRE HANDLING

#### READ CODES REGARDLESS OF TIRE ORIENTATION OR SPEED WITH IMAGE-BASED ID READERS

**Problem:**

Tire manufacturers require robust code reading throughout a tires production process. Tire identification verifies that each tire has successfully completed each manufacturing stage and complies with rigorous quality and industry standards. Low read rates during this stage decrease throughput, increase costly tire rework, and may result in recalls that can damage company reputation.

**Solution:**

Cognex ID readers achieve industry-leading read rates, even on the most challenging barcodes to identify tires regardless of orientation and line speed. Cognex ID readers have no moving parts providing a lower cost of ownership than laser readers. Additionally, Cognex ID readers provide visual feedback for troubleshooting and are integrated with factory networks using standard communication protocols.

### TIRE AND WHEEL ASSEMBLY

#### IDENTIFY TIRES BY TREAD PATTERN

**Problem:**

Vehicle assembly plants require that correct tires to be mounted to the correct wheels before being mounted on the vehicle. Incorrect wheel assembly causes rework and slows down throughput. Tires may be identified by tread pattern, label or stripe color, or reading D.O.T. codes molded into the tire side walls. Positional variation of tires and wheels on the conveyor adds to the challenge of identifying the correct assemblies.

**Solution:**

Identification of a tire using its tread is critical to ensure that the correct tire is matched to the correct wheel before it is assembled to the vehicle. Cognex patented PatMax geometric pattern matching tools learn the tire tread pattern and have the flexibility to adapt to the positional variation of tires on the conveyor.



# TIRE & WHEEL SYSTEMS

## ASSEMBLY INSPECTION SYSTEMS



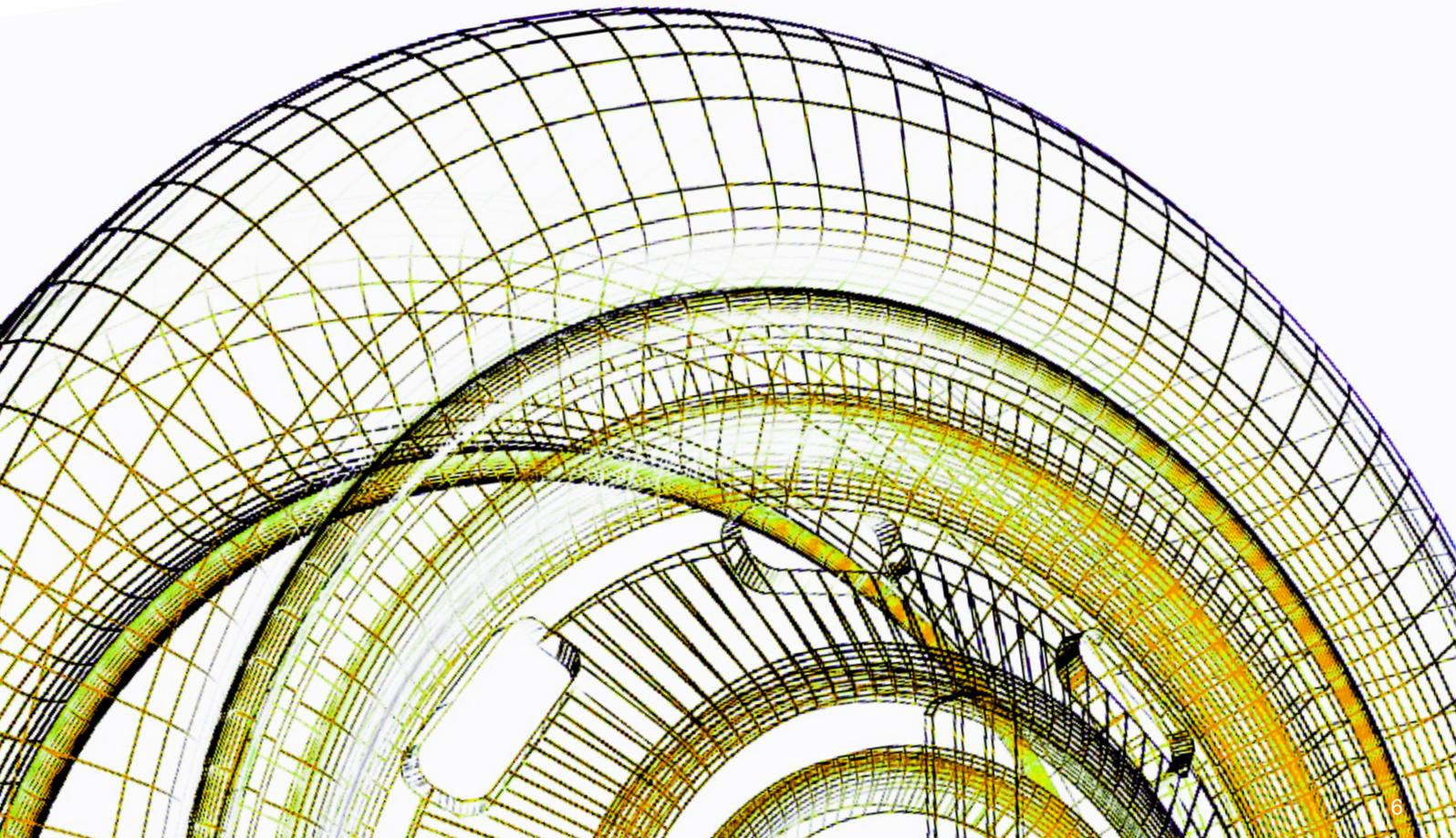
### ERROR PROOF TIRE ASSEMBLY WITH MACHINE VISION

#### Problem:

During the tires manufacturing process, it is critical that defective tires are removed from the line immediately to avoid adding value to scrap. Before vulcanization, the tire plies and the tread bands are assembled onto the carcass, and the tire is then manually inspected to meet quality standards. Manual inspection does not provide the accuracy required to meet the rigorous quality standards.

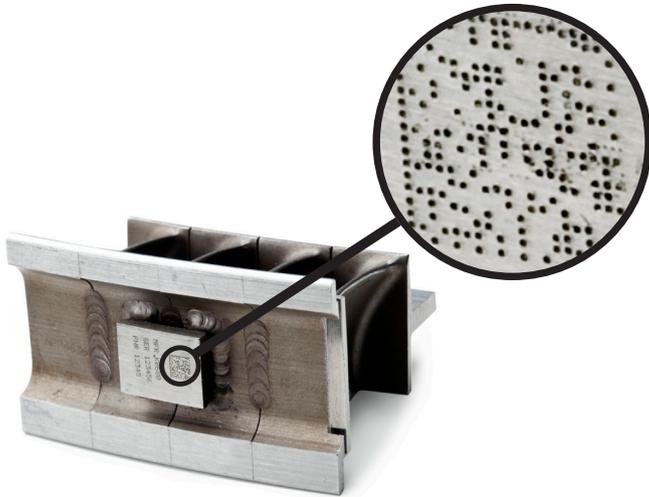
#### Solution:

Cognex vision systems automatically inspect the tire tread band as it is rotated by rollers that bind the tire together. Configured with a few mouse clicks, the vision system makes the necessary measurements of the tire. A rugged industrial design enables the vision systems to make precise, high accuracy measurements, without being affected by harsh production environments.



# SAFETY SYSTEMS

## BRAKE ASSEMBLY TRACEABILITY



### CONTROL TRACEABILITY OF BRAKE PARTS AND FINAL ASSEMBLIES

#### Problem:

Brake components are tracked to verify that parts are assembled correctly. Each part contained in a brake assembly has a Data Matrix dot peen or laser marked code, which are often difficult to read due to poor contrast, surface variation and code quality conditions. Reflective surfaces may provide additional challenges for traditional image-based barcode readers.

#### Solution:

Cognex ID readers achieve high read rates even on the most challenging direct part mark (DPM) codes to verify that the correct components are put together in the final brake assembly. ID readers adapt to the harshest, factory floor environments and allow for faster read rates. Advanced illumination techniques are used to create code contrast and are able to adapt to changes in surface finish and code quality.



# SAFETY SYSTEMS

## BRAKE INSPECTION

### BRAKE PAD MANUFACTURING INSPECTION

#### IMPROVE QUALITY WITH AUTOMATED INSPECTION AND TRACEABILITY

**Problem:**

Safe braking requires high quality brake pads. Each part must be inspected to ensure it meets rigorous manufacturing standards. Typical inspections include verifying that the brake pad includes the correct friction material, its measurements meet specified tolerances, and that the pad has been correctly ground. Manual inspection is difficult to achieve due to the high-speed of production.

**Solution:**

Cognex vision products provide a simple solution for automated, non-contact brake pad inspection. Typical inspections include; reading date and lot codes on labels that have been applied to the brake pad. Vision systems reduce brake pad defects and minimize the chance of part recalls by measuring critical dimensions, confirming the pad has been correctly ground, and checking rivets to ensure friction material is secure.

### AUTOMATED BRAKE VALVE INSPECTION

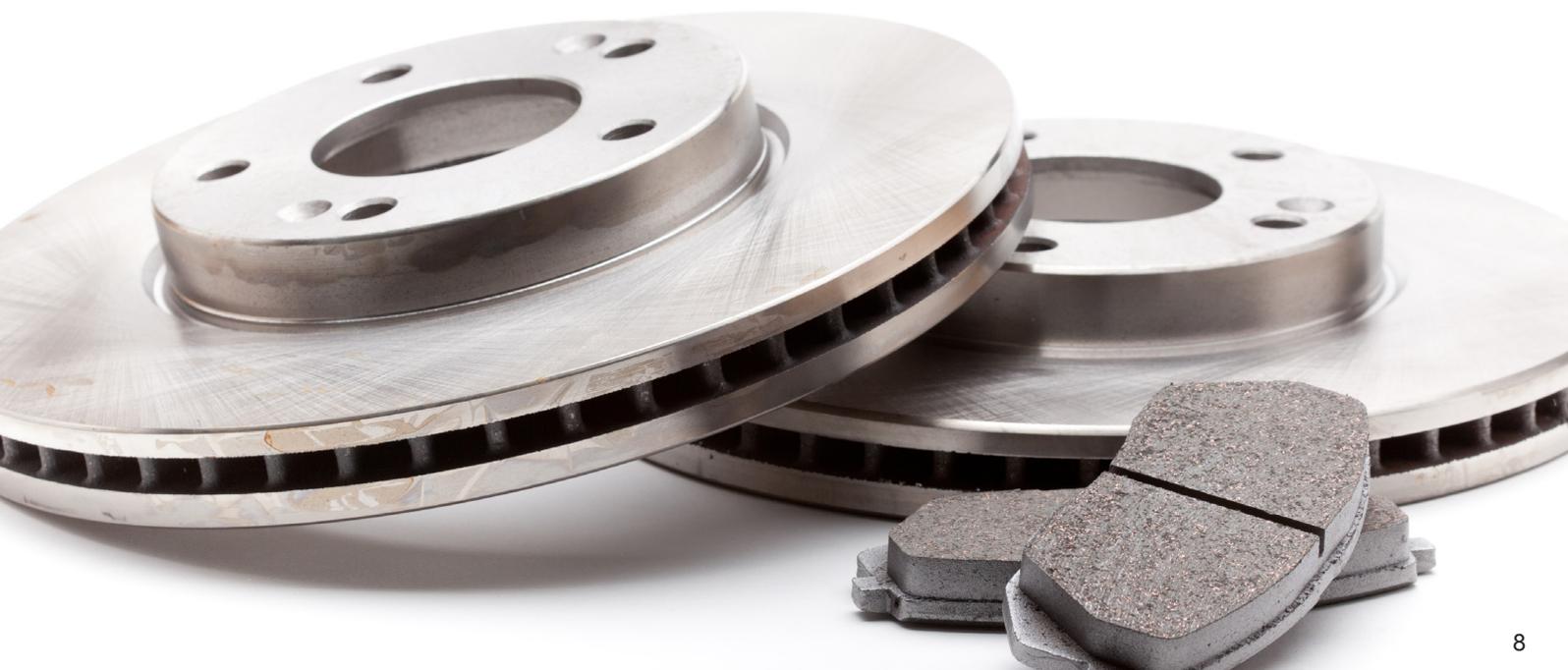
#### MEET STRICT QUALITY STANDARDS WITH AUTOMATED INSPECTION

**Problem:**

Maintaining quality is a key challenge when manufacturing electronic brake valve components. Each part must be individually scrutinized to eliminate defects and product recalls. Assemblies may have missing, loose or damaged components. Manual inspectors are not always able to find all of the defects and meet strict safety quality standards.

**Solution:**

Meet and maintain quality and safety standards by automating inspection with Cognex vision systems. A robot presents each part to a fixed-mount vision system for inspection. If the part passes it is transferred to a conveyor for packaging. Failed part defects are categorized and sent to a secondary conveyor for rework. The robot and the vision system have the flexibility to be reconfigured to accommodate new valve designs. Brake valve component inspection using a vision system mitigates the risk of defective braking systems reaching the vehicle assembly plant.



# SAFETY SYSTEMS

## AIRBAG INSPECTION

### AIRBAG COMPONENT INSPECTION

#### MEASURE STITCH LENGTH AND POSITION ON BAG FABRIC

**Problem:**

Airbags are subject to strict quality control to ensure passenger safety. The fabric and stitching affects the final product, and therefore must be inspected for features such as stitch length, missed stitches and seam issues. These kinds of quality issues are often missed or hard to detect in manual inspection.

**Solution:**

Cognex vision systems enable manufactures to automate the airbag stitching inspection process and achieve greater accuracy compared to manual inspection. The vision system verifies that air bags meet specification by accurately measuring stitch length and seam location, regardless of material or process variations.

### AIRBAG CANISTER INSPECTION

#### VERIFY CRITICAL COMPONENTS ARE ASSEMBLED IN AN AIRBAG CANISTER

**Problem:**

The gas generators used to inflate airbags are critical to automotive safety system performance. Proper function of the gas generator requires that all components be included and positioned correctly. It's difficult to meet rigorous specification standards because manual inspection does not provide the positional accuracy required.

**Solution:**

Cognex vision products enable manufacturers of safety-critical components and assemblies to automatically inspect for presence and verify part location with high accuracy. Cognex vision tools locate the position of the airbag canister in the field of view and adapt to changes in lighting caused by the parts' curved reflective surface to make a pass or fail decision based on standard specifications.



# SAFETY SYSTEMS

## SEATBELT COMPONENT INSPECTION

### DETECT MISSING COMPONENTS ON SEATBELT TENSIONING SYSTEM

**Problem:**

Production defects and presence/absence of critical components in seat belt tensioning systems are often missed when inspected manually. The various parts required for different models and other unique seat belt configurations introduce a high level of complexity that challenges manual inspection, and reduces production yield.

**Solution:**

Cognex vision systems inspect the complete seatbelt assembly to check for defects and verify that all of the correct components have been properly assembled. Part variability is easily accommodated by selecting the product type on a display, to simplify product changeovers and streamline the inspection processes while increasing production yield.



# POWERTRAIN SYSTEMS

## TRANSMISSION SYSTEMS

### TRANSMISSION CONTROL MODULE

#### REDUCE RECALLS WITH AUTOMATED INSPECTION

**Problem:**

Electro-hydraulic automatic transmission control modules are complex parts with multiple features requiring exceptional product quality. Inspecting all of the control module features manually is a lengthy process and provides no assurance that all defective features will be identified. The delivery of defective products to customers can result in warranty claims and damage to the manufacturer's reputation.

**Solution:**

Automating the inspection of electro-hydraulic automatic transmission control modules with a vision system enables manufacturers to ensure the control module is assembled correctly. Parts are tracked by marking a 2-D Data Matrix code on its surface and read with Cognex ID reader. The Cognex vision system confirms the presence and position of bolts and adhesive tape and gauges contact pins on connectors. The vision system sends the inspection result with images for archiving to the plants IT system which can be used to help minimize recalls and enhance customer satisfaction.

### TRANSMISSION ASSEMBLY

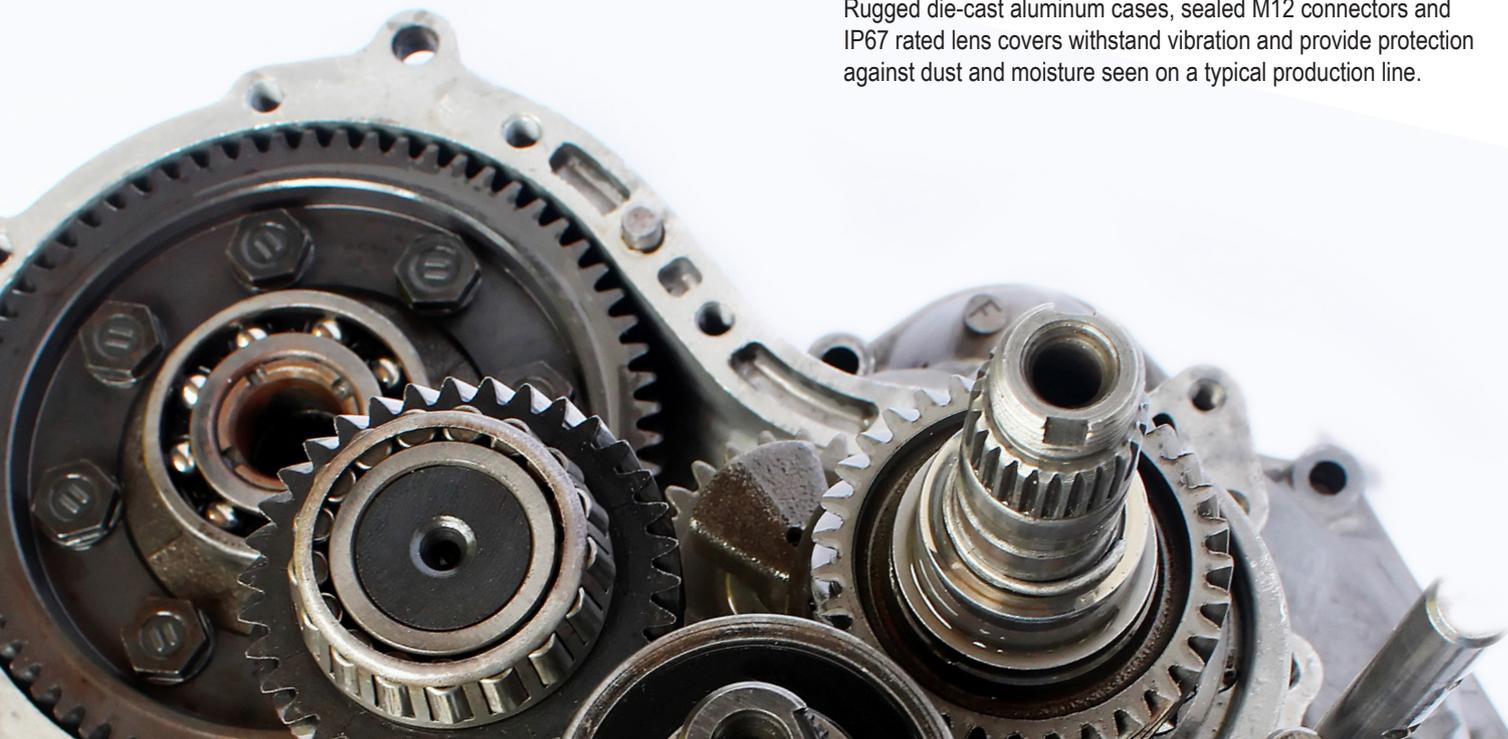
#### VISION SYSTEM ERROR PROOFS TRANSMISSION ASSEMBLY AND WITHSTANDS HARSH ENVIRONMENTS

**Problem:**

Transmission assembly lines accommodate a wide variety of parts including clutch packs, carriers, constant velocity joints, valve bodies, pistons, seals and snap rings. A missing part or an assembly defect may affect vehicle performance. Each assembly step requires visual inspection to ensure that the correct parts have been used, and that they meet rigorous tolerance requirements. If incorrect parts are used this can result in costly recalls for the manufacturer. The production environment also needs to be considered before automating as this inspection requires robust camera enclosures, periodic lens cleaning and high flex cables if cameras are moving with a robot.

**Solution:**

Automatic inspection with Cognex vision systems can help reduce the risk of defects and product recalls. The vision systems have powerful patented vision tools, configured without the need for programming, as well as integrated factory protocols to communicate with production line systems. Cognex vision systems are also designed to operate and withstand harsh industrial environments. Rugged die-cast aluminum cases, sealed M12 connectors and IP67 rated lens covers withstand vibration and provide protection against dust and moisture seen on a typical production line.



# POWERTRAIN SYSTEMS

## ENGINE SYSTEMS

### ENGINE BLOCK

#### ENGINE BLOCK IDENTIFICATION AND TRACEABILITY

**Problem:**

Automotive part suppliers use traceability to track parts through the supply chain. Engine blocks are tracked with a 10-digit alphanumeric serial number cast into its body, and the serial numbers are used to identify the blocks through the final machining stage. When a defective engine block is identified, the root cause and operation are determined. Since all engine blocks have a unique serial number, future recalls can be isolated to only those affected.

**Solution:**

Combining Cognex vision software and hardware, a very fast error-free visual confirmation of serial numbers for engine block traceability is achieved. Vision tools are used to determine the 3D orientation of the serial number. Once the location of the serial number is found, the Cognex vision software reads the individual characters with the flexibility to adapt to changes in character appearance and the variation of the engine blocks background.

### TORQUE CONVERTERS AND ENGINE VALVES

#### IMPROVE TRACEABILITY WITH AUTOMATED CODE READING

**Problem:**

Controlling traceability of torque converters and engine valves is necessary to verify the correct part type is matched with the engine. Data Matrix codes are laser marked directly on the surface of the converters and valves to control traceability. Code contrast is typically poor and parts are often coated in oil. Because each part has specific characteristics that affect engine performance, if the incorrect part has been assembled into the engine it will negatively impact its performance and potentially result in a recall.

**Solution:**

A Cognex ID reader with an advanced image formation system creates code contrast and achieves industry leading read rates. The ID reader quickly reads challenging codes without manipulating the part. The data from the ID reader is used to verify that the correct components are assembled into the engine which minimizes the risk of recalls.



# POWERTRAIN SYSTEMS

## RTV INSPECTION SYSTEMS

### RTV GLUE BEAD SEAL INSPECTION

#### ENSURE SEAL INTEGRITY WITH AUTOMATED RTV INSPECTION

**Problem:**

Room Temperature Vulcanizing (RTV) silicone is a type of rubber used to create a seal between two surfaces to prevent a leak while under compression in an engine. It is critical that a consistent and correct amount of RTV is dispensed to prevent oil and coolant leaks to minimize potential recalls. Manual visual inspection of RTV does not always provide the accuracy needed to verify that the correct amount has been dispensed.

**Solution:**

Cognex machine vision systems provide a flexible solution for RTV glue bead inspection. A 2D vision system accurately locates the position of the glue bead on the part surface and detects gaps and measures its width with high accuracy. As an alternative solution, a 3D laser displacement sensor mounted on a robot or in a fixed position, calculates the RTV bead volume around the perimeter of the engine block to ensure the correct amount of RTV has been dispensed. Automating the inspection of seal integrity can eliminate costly engine recalls.



# CHASSIS SYSTEMS

## BODY PART INSPECTIONS

### GAP AND FLUSH INSPECTION

#### SPEED UP ASSEMBLY PROCESS WITH AUTOMATED GAP AND FLUSH INSPECTION

**Problem:**

Gap and flush inspection between assembled automotive doors and bodies is a critical factor in a car's aerodynamic performance and determining its fuel efficiency. Doors can become misaligned from body panels during the assembly process. Portable handheld scanners are often used to sample a selection of vehicles to assess proper body alignment. This process does not provide full inventory inspection and slows the overall assembly process.

**Solution:**

A Cognex 3D vision system either mounted in a fixed position or on a robot has the ability to measure the gap and flush of every car with high accuracy. This improved automation eliminates ineffective manual inspections and provides complete inspection of all assembled vehicle doors and bodies.

### BODY PANEL DE-RACKING AND INSPECTION

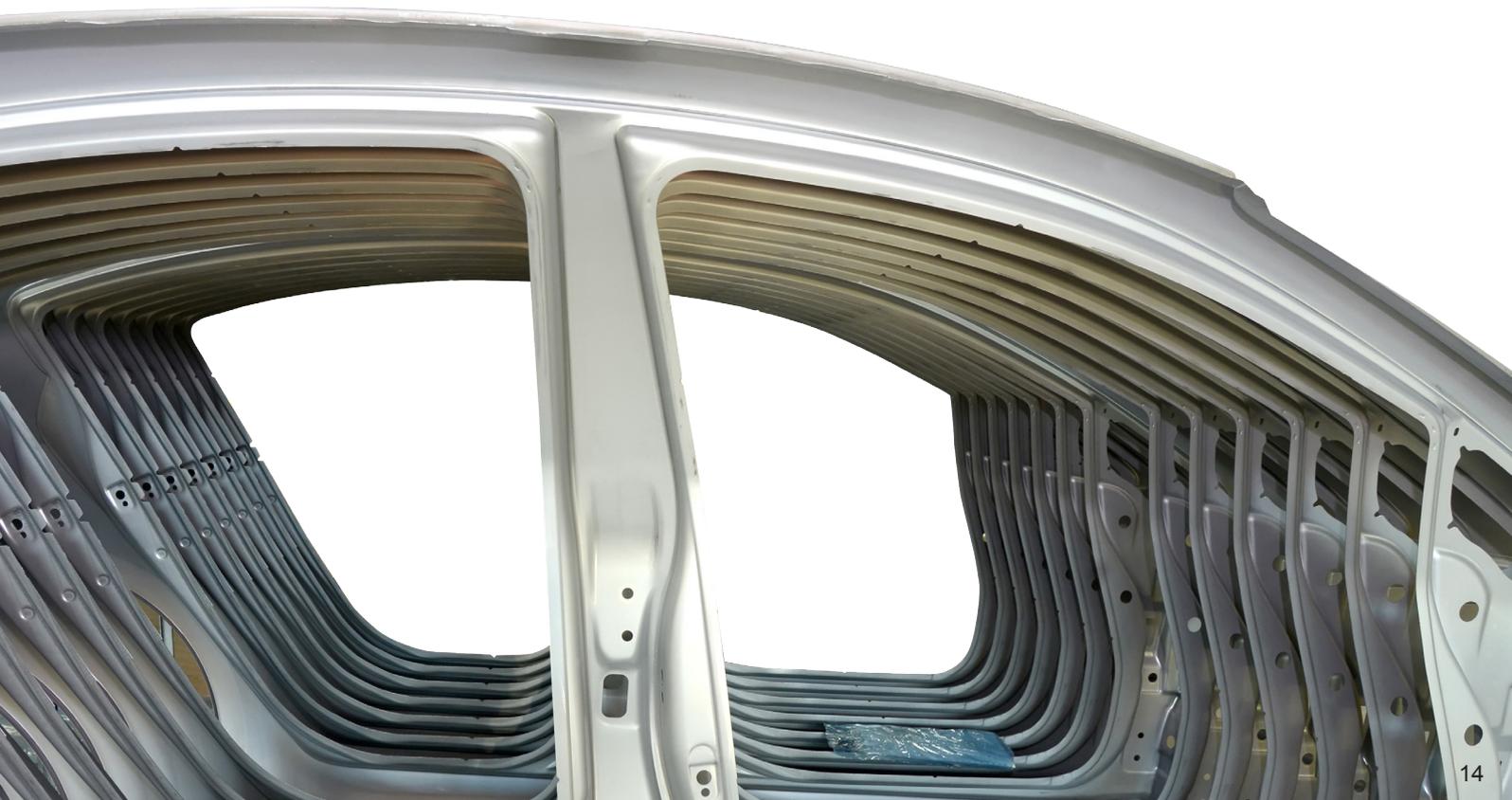
#### QUICKLY LOCATE AND INSPECT BODY PANELS FOR DEFECTS

**Problem:**

Automotive facilities have typically relied on manual labor for de-racking and inspection of body panels because racks may not be dropped in exactly the same location in the work cell. This positional variation of each panel on the rack has made manual handling and visual inspection challenging to automate because a blind robot cannot consistently locate panels with enough accuracy for a robot to pick them up.

**Solution:**

Automated racking, de-racking and inspection of body panels in supply racks is possible with Cognex 3-D vision systems. The vision system locates the position of racked parts, identifies part defects and sends the information to a robot controller. The robot controller uses the real time data from the vision system to adapt the robot's approach to the parts position. The 3-D vision system also has the ability to detect part defects in the racks before being picked up by a robot which eliminates scrap parts being welded together.



# CHASSIS SYSTEMS

## STEERING AND WHEEL INSPECTIONS



## STEERING KNUCKLE INSPECTION

### AUTOMATED STEERING KNUCKLE INSPECTION

#### Problem:

Inconsistencies often occur in the manual assembly of steering knuckles. Automating this operation is challenging since the position of the steering knuckle, its surface finish and the position of the characters used to identify it changes. Due to the manual assembly process, it is possible that the incorrect steering knuckle is assembled to the car which may result in recalls.

#### Solution:

A robot-mounted Cognex vision system, with patented geometric pattern matching tools, identifies the steering knuckle by reading the characters cast into its surface. The vision system automatically adapts to changes in part position, appearance, surface finish and character spacing. Once the vision system identifies that the correct steering knuckle has been assembled to the vehicle, it sends the data with images for archiving, to the plant's database for inventory control.

## WHEEL AND LUG NUT TORQUING

### VISION SYSTEMS LOCATE NUTS FOR AUTOMATED ROBOTIC NUT RUNNER

#### Problem:

Manually torquing wheel lug nuts during the assembly process is a labor intensive operation. Nut runners are typically large and heavy and are manually presented to each wheel to apply the necessary torque. Maneuvering these heavy pieces of equipment presents safety issues for workers. Additionally, vehicles arriving in the torquing stations are not always in the same position, and vehicle wheels are often allowed to rotate and tilt. This variation along with the size and weight of the nut runner presents a major challenge to automating the process.

#### Solution:

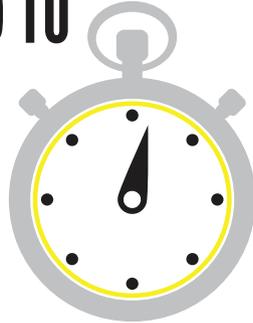
A Cognex 2-D vision system recognizes the type of wheel and locates the axle's center using geometric pattern matching tools. The vision system also inspects the wheel's rim to determine its angle of rotation and measures the difference between two laser cross hairs to calculate the angle the wheel is turned and tilted. The vision system data is sent to the robot controller and the robot swivels its wrist to match how the wheel is tilted and turned and rotates to match the nut runner's angle of rotation. The robot then guides the nut runner onto the lug nuts and the nut runner provides the necessary torque. Automating this application offers significant process efficiencies and eliminates safety concerns associated with repeatedly manipulating heavy nut runners.



# CHASSIS SYSTEMS KITTING PROCESS SYSTEMS

WORKFLOW TIME  
REDUCED TO

1  
SECOND



## REDUCE WORKFLOW TIME IN KITTING PROCESS

### Problem:

Low cost competitive barcode readers are often used to scan multiple codes on parts before they are assembled to a vehicle. Scan rates using handheld readers can vary between three and twelve seconds per code. Difficult to read codes increase the operator's workflow time and restricts the number of cars produced each day.

### Solution:

By implementing Cognex presentation style ID readers into the kitting process the operator's workflow time is able to be reduced to less than one second. This workflow optimization results in the vehicle spending less time at each assembly station and more vehicles produced each day.



# ELECTRONICS SYSTEMS ELECTRICAL INSPECTIONS

## ELECTRICAL COMPONENT INSPECTION

### QUICKLY SORT AND INSPECT ELECTRICAL COMPONENTS FOR DEFECTS

#### Problem:

Accurate sorting of electrical components is a critical step in the kitting and assembly process. Small components that look very similar often result in picking and installation errors, which can culminate in assembly rejects and product quarantine. Manual sortation is time consuming, error prone, and is often difficult to achieve with high accuracy.

#### Solution:

Cognex vision products with color and shape recognition tools speed up and error proof the sorting process. Components are identified with color and pattern matching tools and inspected for defects including damaged parts and missing features.

## PRINTED CIRCUIT BOARD INSPECTION

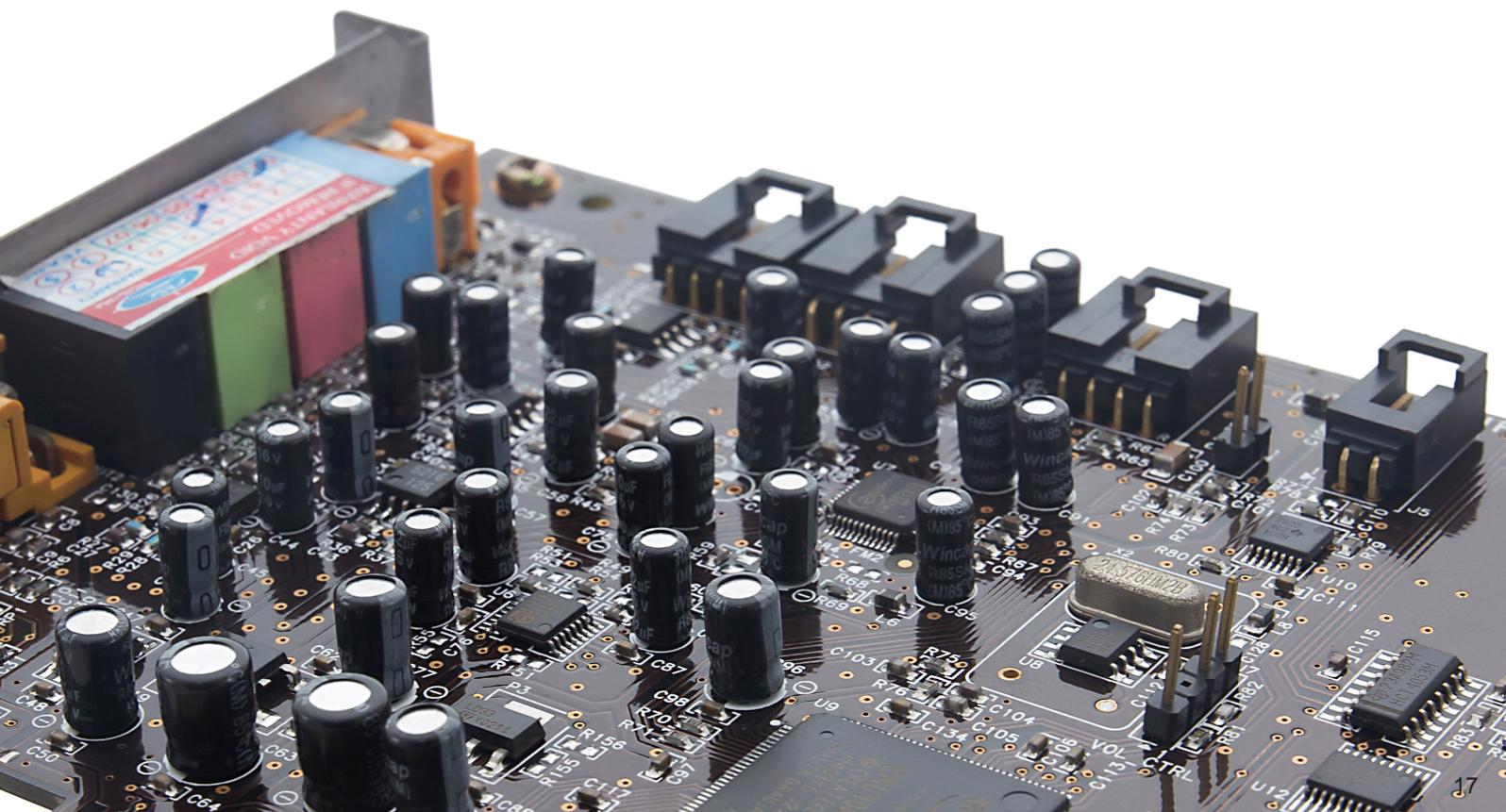
### IMPROVE SOLDER-JOINT INSPECTION WITH PATTERN RECOGNITION TOOL

#### Problem:

Inconsistencies in manual or automated soldering may result in faulty connections between components on PCBs, and cause short circuits when the solder bridges extra components. In other cases, these inconsistencies result in open circuits or intermittent electrical connections. Failures often go undetected until final testing, leading to increased scrap, slowed throughput and high quality control costs.

#### Solution:

Cognex vision systems with specialized illumination and pattern recognition tools automatically inspect solder joint connections for missing or excess solder. Pattern recognition tools are used to analyze the shape of the solder to ensure it meets rigorous tolerances.



# ELECTRONICS SYSTEMS

## ELECTRICAL COMPONENT INSPECTION



## ELECTRICAL MODULE SEAL INSPECTION

### REDUCE PRODUCT FAILURE RATES WITH AUTOMATED GLUE BEAD INSPECTION

#### Problem:

Sealing gaskets on electrical modules help minimize failure in vehicles. A robot equipped with a glue nozzle applies adhesive, which must be inspected. Manual inspection is challenging because it's difficult to view the bead's complete path, and calculate its volume. The integrity of the gasket may be compromised if the bead of glue is too thin, in the wrong position or contains gaps.

#### Solution:

Cognex 3D vision systems automate the glue bead inspection process by accurately locating the glue bead position, detecting any bead gaps and measuring bead width and volume. This automated process reduces product failure rates and increases inspection speed.

## ELECTRICAL SWITCH ASSEMBLY INSPECTION

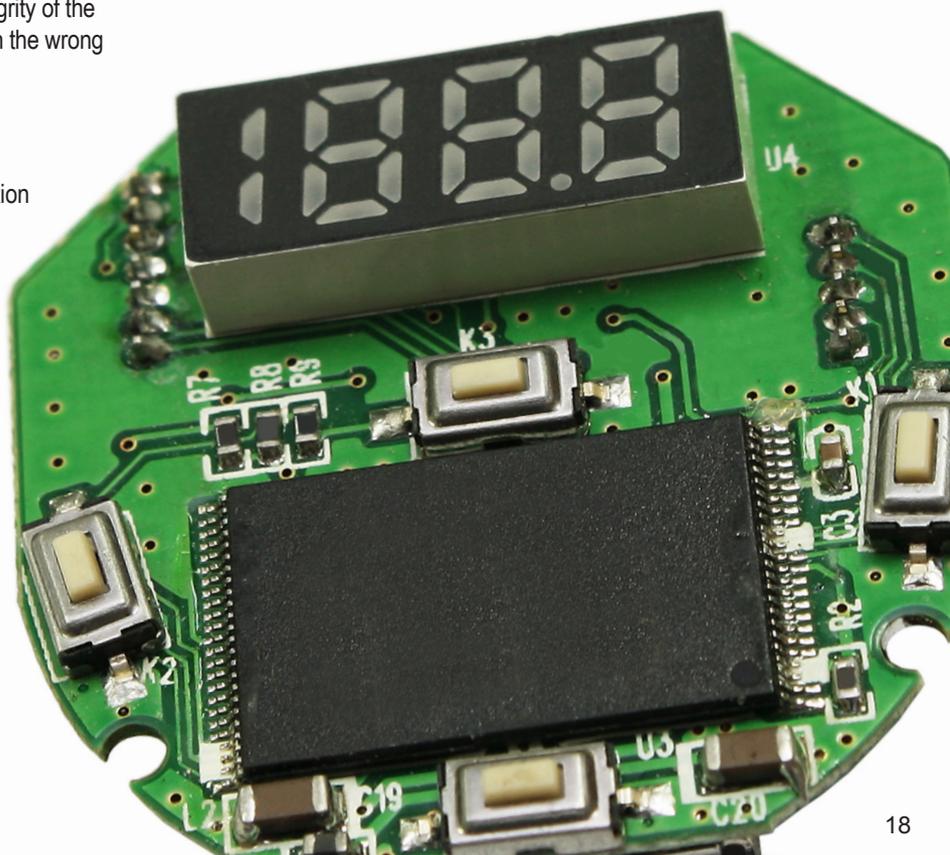
### CONFIRM SIZE AND TOLERANCE OF ELECTRICAL SWITCH COMPONENTS

#### Problem:

Electrical switch assemblies often contain many small components such as clips and bushings that require very precise dimensional and positional accuracy to reliably perform during vehicle installation. It's often difficult to achieve this high degree of accuracy with manual inspection of switch components consisting of complex shapes. Assemblies that fail electrical testing must be scrapped.

#### Solution:

Cognex vision systems provide micron-level accuracy to reduce scrap with time-efficient, automated electrical switch component measurement. Configured to quickly and accurately measure critical dimensions on even the smallest components, these systems readily identify switch assembly defects for rework prior to electrical testing.



# ELECTRONICS SYSTEMS

## BATTERY SYSTEMS

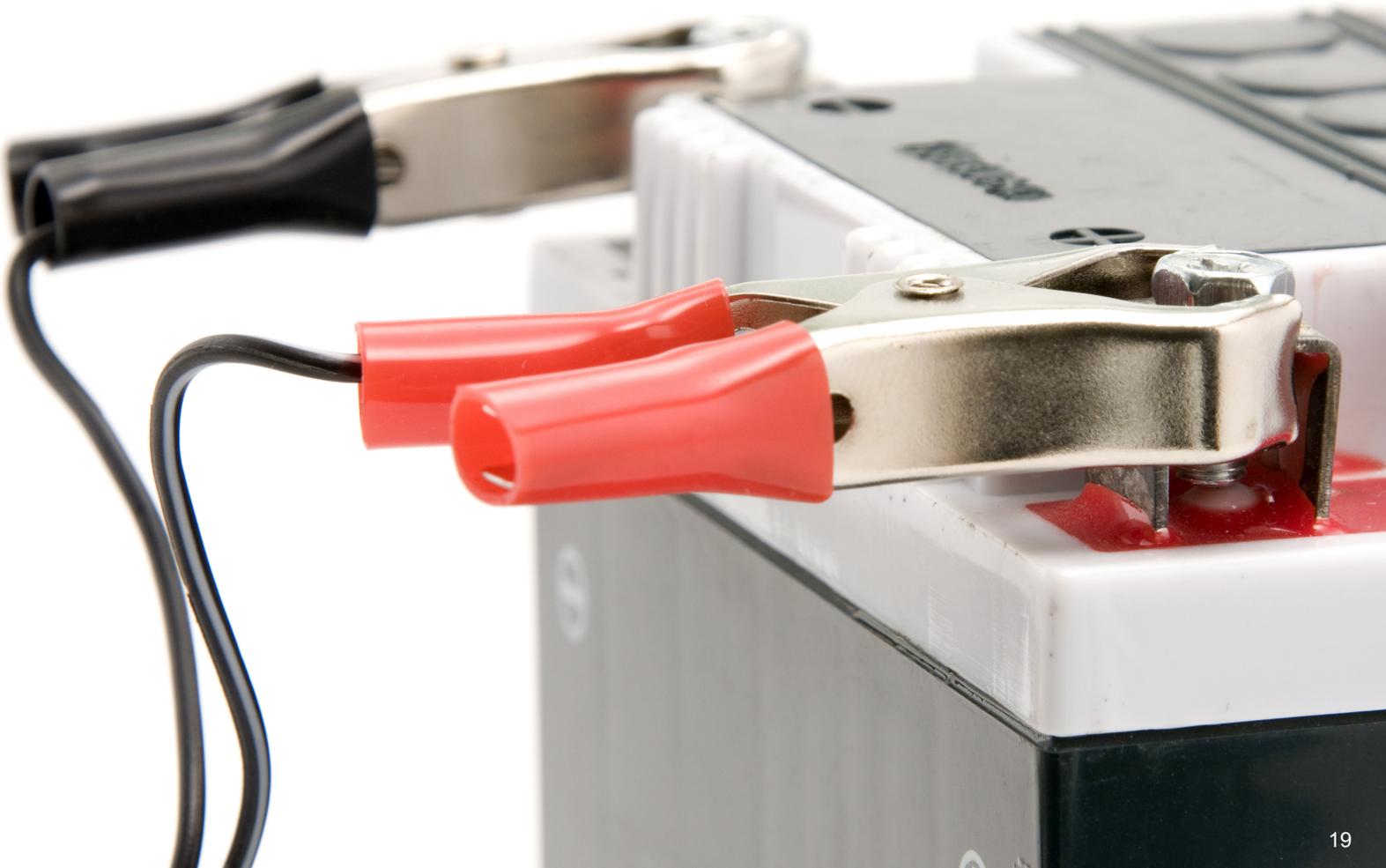
### BATTERY INSPECTION

#### **Problem:**

Due to the repetitive nature of manual battery inspection, operators often lose concentration and make mistakes. Operators check battery pole caps, correct seating of grips, measure battery vents and check the position and content of labels. Product defects missed during the inspection process result in rework by line operators and a reduction of production line throughput.

#### **Solution:**

Cognex vision and ID products eliminate mistakes in the manual inspection process. Vision products verify label content and position, presence of pole caps and grips, and measure the size of the battery and vents. If any of the critical battery features do not meet rigorous tolerances, the battery is removed from the production line for rework. Traceability for the battery is also critical for the manufacturer since it contains information about product type and date of manufacture. Once the battery is inspected, product information is transferred to a label printer that prints a Data Matrix code used for traceability, a major factor in locating parts if recalled.



# BUILD YOUR VISION WITH COGNEX VISION AND ID PRODUCTS

## Cognex Machine Vision Systems

Cognex machine vision systems are unmatched in their ability to inspect, identify and guide parts. These vision systems are easy to deploy and maintain, while providing reliable, repeatable performance for the most challenging applications.

- Industrial grade with a library of advanced vision tools
- High speed image acquisition and processing
- Exceptional application and integration flexibility

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



## Cognex 3D Displacement Sensors

Cognex 3D laser displacement sensors optimize product quality by providing three dimensional inspection of your products. These industrial sensors deliver sub-micron level accuracy and can measure volume, height, cross section and do plane fitting.

- Sensors are factory calibrated and deliver fast scan rates
- Includes industry-leading vision software with powerful 2D and 3D tool sets
- Compact, IP65-rated design that withstands even the harshest factory environments

[www.cognex.com/3DVision](http://www.cognex.com/3DVision)



## Cognex Industrial Barcode Readers

Cognex industrial barcode readers include groundbreaking algorithms that allow our customers to read damaged and challenging codes on wide range of surfaces. Cognex reads more codes and delivers the highest read rates – that's why we have become the preferred choice for industrial barcode reading.

- High speed imaging and reading of 1-D and 2-D codes for conveyor and in-line systems
- Flexible and modular fixed-mount systems
- Rugged and industrial strength handheld ID readers

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



# COGNEX

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

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