VISION TOOLS

OBJECT LOCATION ▪ BEAD AND EDGE INSPECTION ▪ EDGE DETECTION ▪
IMAGE PROCESSING ▪ MEASUREMENT ▪ COLOR ▪ IDENTIFICATION

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 million systems installed in facilities around the world and over forty 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.™**

$811 MILLION
2020 REVENUE

OVER 40
YEARS IN THE BUSINESS

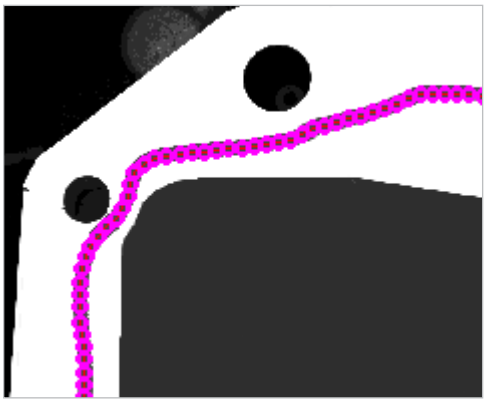
500+
CHANNEL PARTNERS

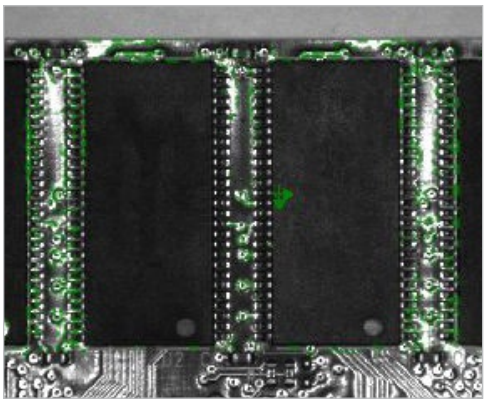
GLOBAL OFFICES IN
20+ COUNTRIES

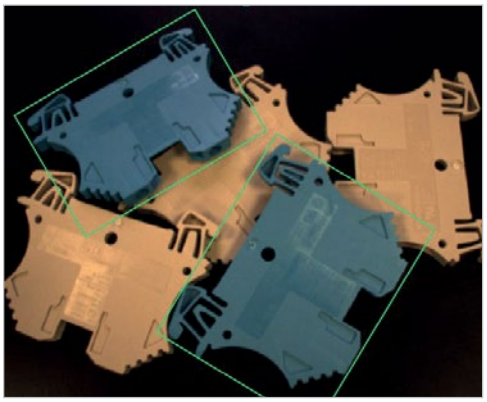
3,000,000+
SYSTEMS SHIPPED

BUILD YOUR VISION

Cognex pioneered some of the earliest commercial applications for machine vision with its vision and barcode reading technology. Today, companies around the world rely on Cognex vision tools and technology to guide assembly, automate inspection, and speed production and distribution. Our patented algorithms produce solutions for diverse applications in virtually all manufacturing and logistics industry sectors.







OBJECT LOCATION

LOCATE GEOMETRIC PATTERNS UNDER CHALLENGING CONDITIONS

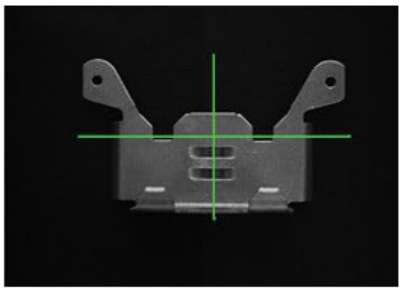
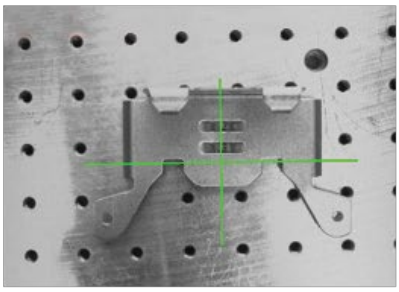
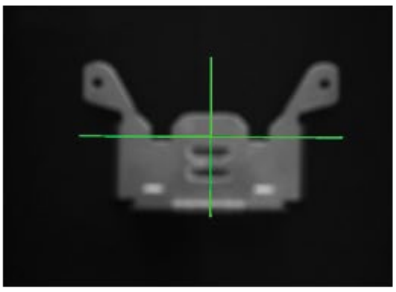
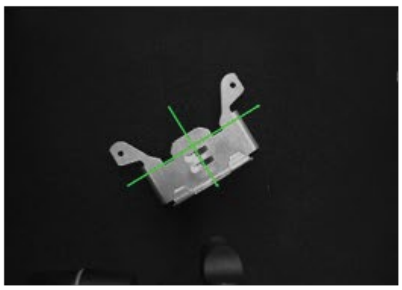
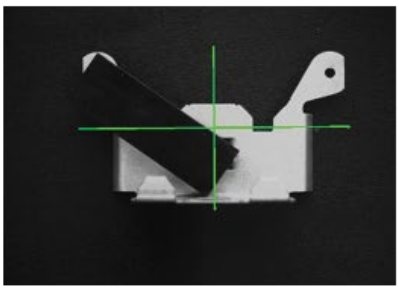
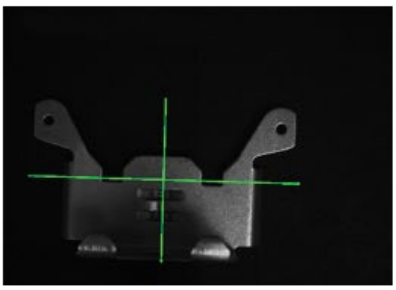
Object location is a manufacturer's most powerful tool for inspection. Yet object location is extremely challenging, as many variables can alter the way an object appears to a vision system. Cognex PatMax® and its companion tools are the industry's gold standard for part and feature location using pattern matching. Cognex object location tools help users identify patterns regardless of rotation, scale, or lighting conditions reliably and accurately using patented geometric pattern matching technology.

PatMax Object Location

The industry gold standard for part and feature location

Originally patented in 1997 as the first geometric pattern-based object location technology for machine vision, Cognex PatMax is the industry's leading object location tool. PatMax learns an object's geometry using a set of boundary curves that are not tied to a pixel grid, and then looks for similar shapes in the image without relying on specific gray levels. PatMax finds trained patterns in run-time images no matter what combination of transformations the pattern has undergone. The result is a revolutionary improvement in the ability to accurately find objects despite changes in angle, size, rotation, location, and shading.

- High speed location of objects whose appearance is rotated, scaled, and/or stretched
- Location technology based on object shape, not on greyscale values
- Very high accuracy and robustness

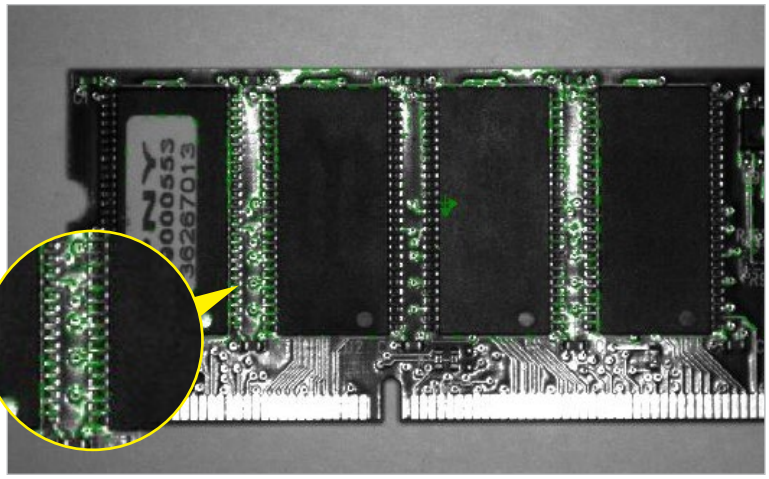







PatMax RedLine

Increase resolution and accuracy without sacrificing speed

PatMax Redline™ marries high-performance with high-resolution analysis. With its fast and accurate object location, PatMax RedLine eliminates the tradeoff between speed and accuracy, so customers don't have to compromise on performance. Unlike other vision tools, PatMax RedLine performs just as fast, if not faster, on high-resolution vision systems.

PatMax Redline offers the object location excellence of PatMax at blazing fast speeds designed for high resolution images. Best of all, there is no loss of search accuracy or robustness. PatMax Redline finds trained patterns in run-time images no matter what combination of transformations—in size, rotation, or location—the pattern has undergone.



Ideal for industries and applications that require:

- Large fields of view (FOV) and regions of interest
- High accuracy
- Large angle and scale tolerances
- Multiple targets

SearchMax

Locate 2D features on a part's surface using color

Advanced feature location technology relies on geometric pattern matching, learning an object's shape using boundary curves that are not tied to a pixel grid. This approach accurately finds objects, despite changes in angle, size, and shading, and without relying on grey levels. But when the geometric data supplied is insufficient, this approach is not feasible. SearchMax uses color features to search for objects when the geometric data available is inadequate.

SearchMax is useful for:

- Grey level images with small models
- Images that would create too many features for PatMax
- Objects that don't segment well due to color variations
- Skewed objects

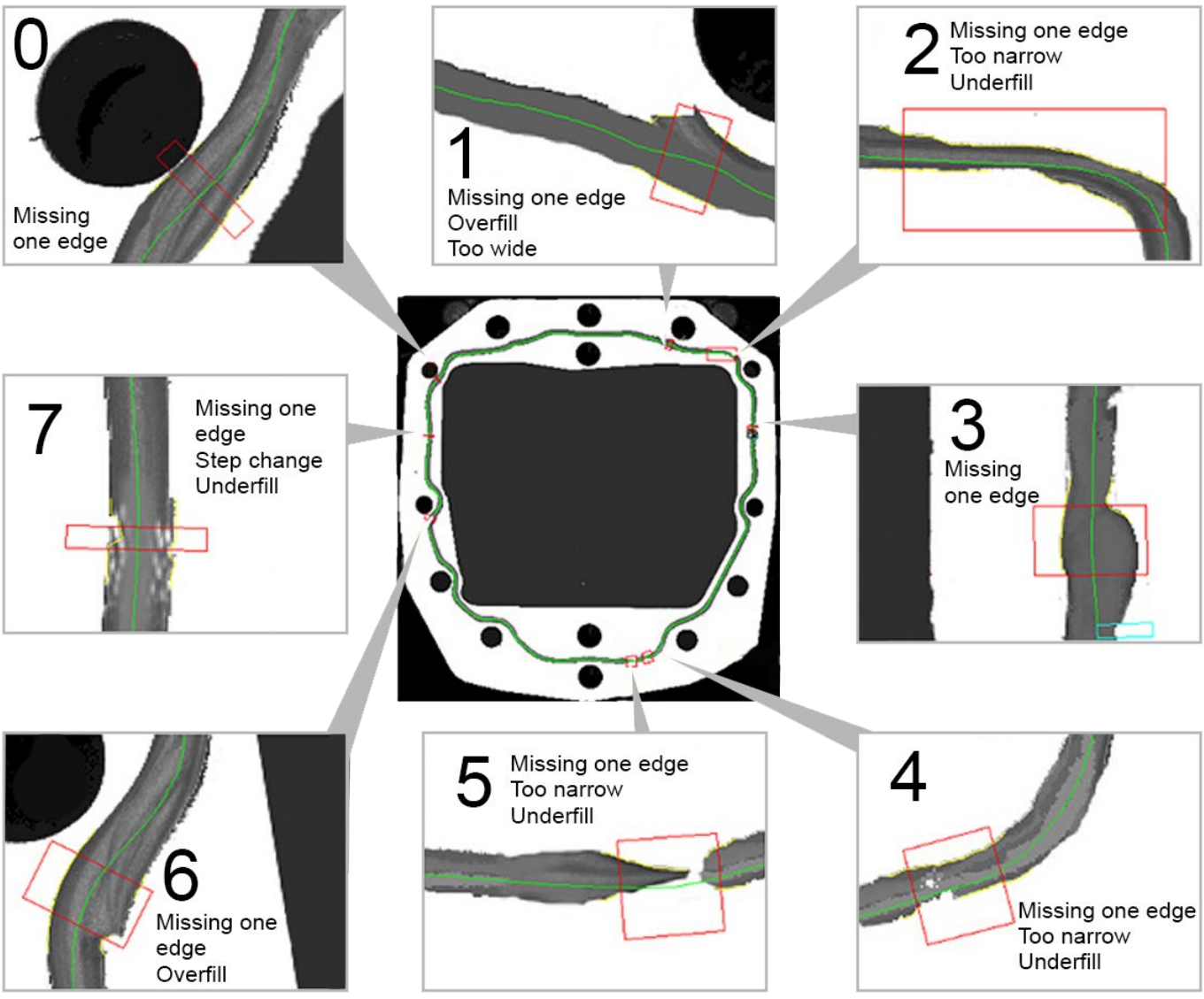
BEAD INSPECTION

A CUSTOMIZED INSPECTION TOOL FOR BEADS AND EDGES

BeadInspect is an all-in-one bead width and position inspection tool used to detect anomalies. BeadInspect offers a robust inspection of the bead line—even if bead size, shape, and appearance change over time. This is important when inspecting a freshly applied, wet, or shiny RTV bead, or when beads vary in location from part to part.

Bead inspection with the Cognex BeadInspect tool helps guarantee that glue beads have been dispensed to the correct volume and precise placement. The tool locates the position of a glue bead on a part surface and detects gaps.

- Easily train the bead path with just a few clicks, using the PolyLine function
- Find defects in beads that change or differ in shape
- Determine width based on defects and gaps
- Remove noise for increased robustness



EDGE INSPECTION

FIND GAPS, DEFECTS ALONG EDGES, AND OTHER AREA-BASED AND SURFACE FLAWS

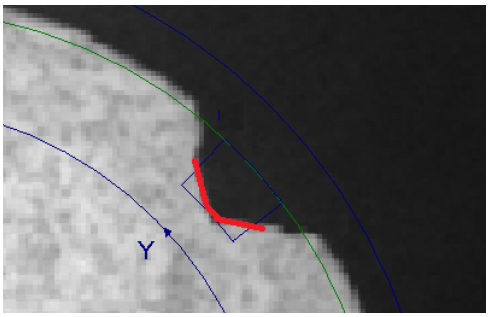
InspectEdge™ and Flexible Flaw Detection tools offer ultimate flexibility to find gaps along a line path and inspect shapes for boundary defects. These tools robustly measure min/max deviations to find edge- and area-based defects on products, as well as surface flaws and print defects. Easily configured for straight, circular, or non-uniform edges, edge inspection tools classify defects by total area, length, or depth.

InspectEdge

Find gaps and defects in straight, circular, and irregularly-shaped edges

The InspectEdge tool solves vision applications that rely on accurate edge detection, such as finding dents in can lids or edge cracks in solar wafers. InspectEdge finds gaps and defects in straight, circular, and irregularly-shaped edges, and can inspect the width of features for gaps and defects by tracking multiple edge pairs. The tool's graphical user interface makes it simple to set up an edge inspection, and also gives users more flexibility to define defect criteria such as size, area, and distance, and the ability to specify outliers in order to eliminate noise.

The InspectEdge tool finds defects around the edges of parts where normal defect detection tools cannot operate. It does all this by defining a region of interest, laying down calipers throughout the search region, and returning edge candidates for every caliper based on contrast and edge width. It also compensates for normal process variation and light intensity variation.

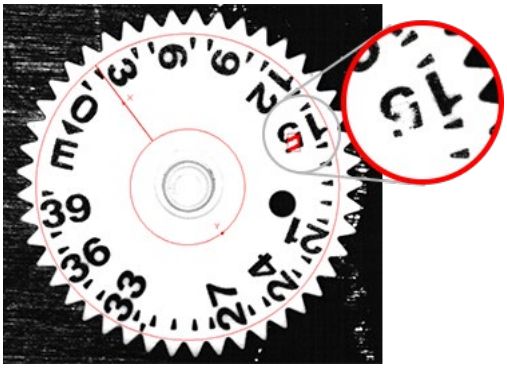


- Track edge contours for minimum and maximum positions and width
- Inspect edges and edge pairs for defects, gaps, and extreme points
- Get line and circle fits to located edge points
- Identify irregular paths

Flexible Flaw Detection

Inspect for boundary and surface defects

Without flexible tools, normal process variation can cause false rejects during inspection. Cognex Flexible Flaw Detection (FFD) offers accurate edge and surface inspection when dealing with lens and perspective distortion, scale changes, print registration errors, and stretching from line scan images. FFD is the ideal tool with which to inspect for boundary defects, such as conformity of shape, and surface defects like stains and scratches. FFD can also be used for print inspections, like inspecting screened logos for defects.



Flexible Flaw Detection is ideal for edge- and area-based inspection of shapes. To find edges and boundaries under error-prone conditions, FFD compares edges in a trained model to edges in the run-time image to check for extra or missing edges. FFD works for both color and greyscale applications, giving users the flexibility to balance accuracy versus speed, and even to ignore defects during run-time.

EDGE DETECTION

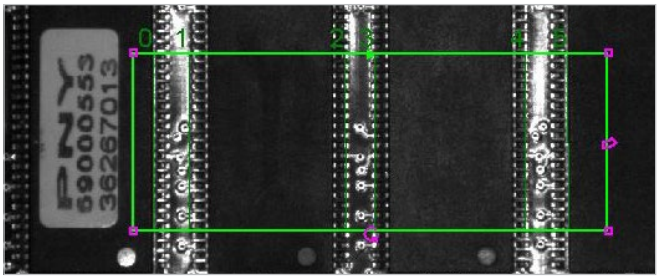
LOCATE EDGES AND FEATURES, AND MEASURE WIDTH

Edge detection is essential for inspection as well as measurement and gauging applications. Cognex offers a large variety of tools to measure the width of objects, locate edges of features, and measure the spacing of pairs despite changes in part orientation and lighting. Cognex offers a variety of edge tools, including Caliper and LineMax, for manufacturers' edge- and line-finding needs.

Caliper

Precise edge/line detection and location to measure object width, edges, and features

The Caliper tool measures the width of objects, the location of edges or features, and the location and spacing of pairs of edges. Using the approximate location and characteristics of the feature or edges you want to measure or locate, the Caliper tool delivers detailed information about the precise locations of features within an object. This offers manufacturers extremely rapid and precise pattern detection and location within a well-defined area of an image.



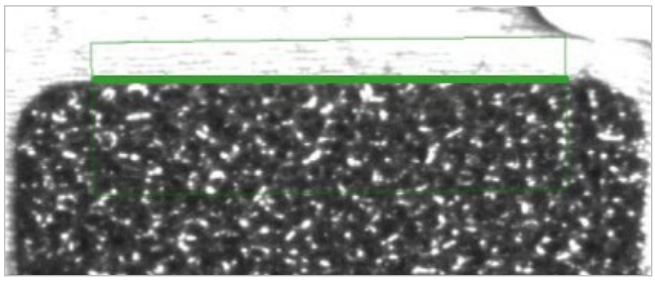
Choose between two methods of locating edges or edge pairs in an image:

- **Edge mode:** Edge peaks are detected using a simple 1D kernel
- **Correlation mode:** Correlation peaks between a 1D sample image and a 1D reference image are located

LineMax

Advanced line finding handles confusing edges under low contrast and noisy conditions

Traditionally, an edge/line finder has been limited in its ability to locate lines and edge features. A number of simplified edge- and line-finding alternatives work well for good quality scenes with well-defined line features. However, these approaches often fail under low contrast and confusing scenes. Cognex LineMax technology is a breakthrough in finding lines under these conditions.



- Extract and locate edge features that make up lines in noisy or low contrast images
- Inspect beveled glass and other confusing edges with ease

LineMax uses a random sample consensus (RANSAC) iterative algorithm to sample the image, locate edgelettes within the image, and then find a statistical best fit for the target line. This reduces the impact of outlier points and random noise within the training program. With further specification of the angle or expected length of the line, LineMax's reliability and speed increase.

MEASUREMENT

ESTABLISH RELIABLE FEATURE-BASED PARAMETERS

Measurement tools help establish reliable feature-based parameters and thresholds. Measurement tools output quantitative information, either in pixels or real-world units, for:

Distance

Measures the distance between features, not just edges. References two edge tools.

Angle

Determines the angle between two edges. References two edge tools.

Circle Radius

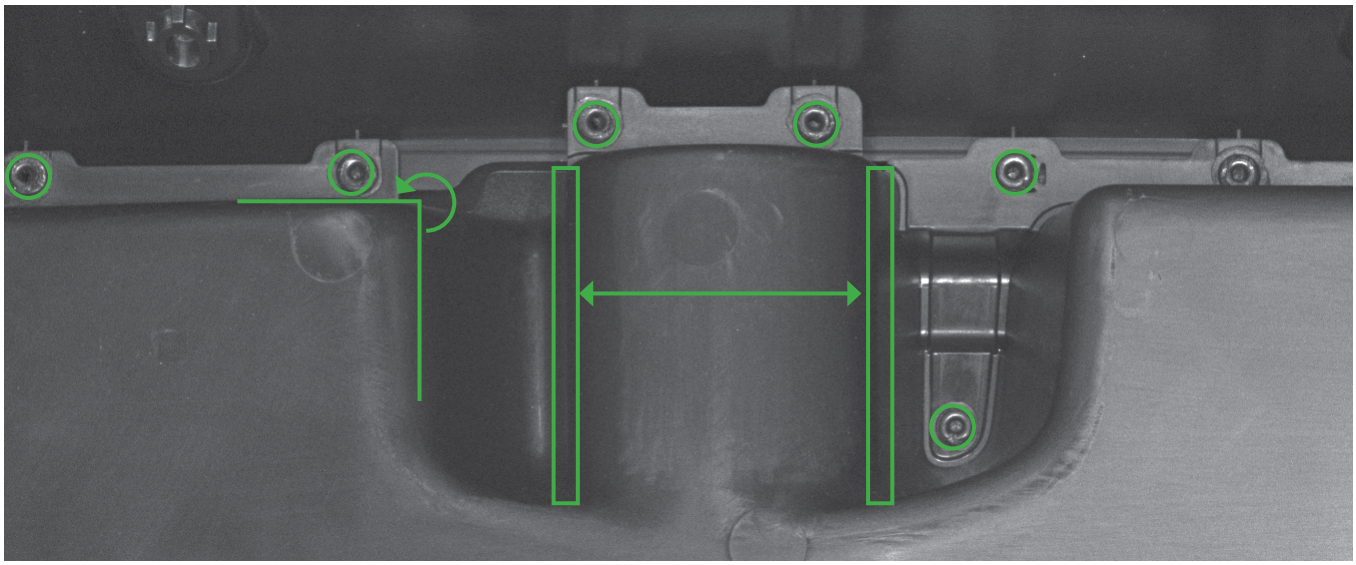
Measures the distance from the center of a circle to its edge. Creates an arc finder and returns the radius measurement.

Calibration

Calibrates camera pixels to real-world units.

Measurement information may be used as:

- Pass/fail criteria
- Data to be used by another tool
- Data to send to an external device



COLOR

COLOR ANALYSIS FOR MEASUREMENT, PRESENCE/ABSENCE, AND IDENTIFICATION

Color analysis can be used for quality inspection in manufacturing applications that include presence/absence detection based on the pixel count of a reference color model with which the object is associated. Cognex color tools help ensure an accurate color match between components used in the same product while interpreting subtle color differences, such as between shades in the same color family.

Cognex offers advanced color tools for applications including part sortation, color recognition and matching, assembly verification, and inspection. These tools include:

SearchMax

Finds colored patterns allowing translation, rotation, scale, and skew

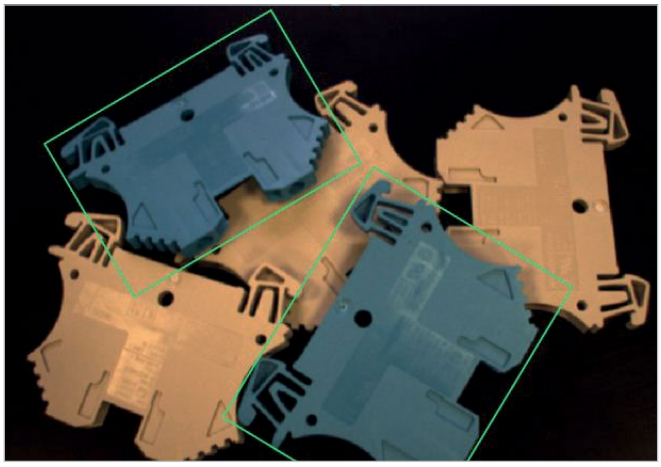
Color Extractor and Segmentation

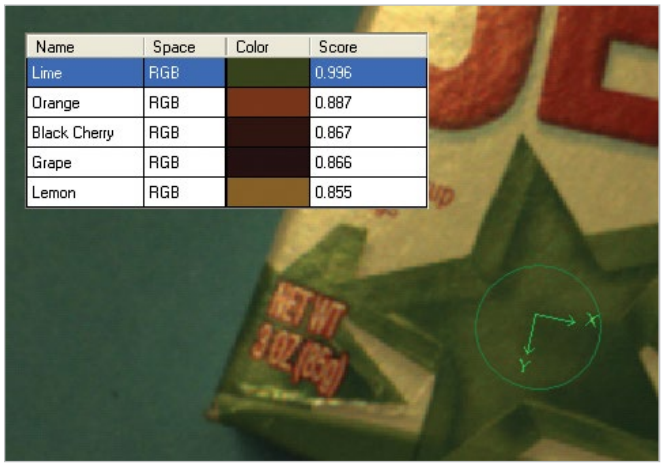
Provides simple color definition for complex color scenes, and high-speed color extraction for food and packaging applications

Color Match

Enables high-speed identification and sorting of colored parts

Color analysis can also be used for quality inspection in manufacturing applications that include part identification where the colors of the part are analyzed. Cognex technology extracts a pre-trained color, pixel by pixel, for processing with greyscale vision tools. Powerful color extraction tools can extract a combination of colors at the same time.





IDENTIFICATION

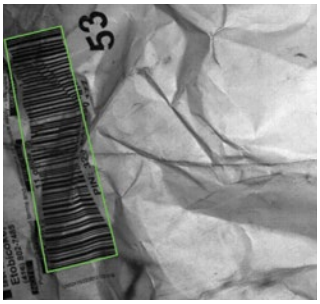
ADVANCED ID TOOLS READ THE MOST DIFFICULT CODES

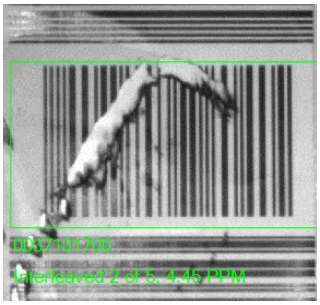
Cognex code reading technologies ensure high read rates of 1D and 2D symbols, as well as read and verify difficult characters, in the most challenging manufacturing and logistics applications.

1DMax with Hotbars

Advanced algorithms read any code, every time

1DMax™ is a 1D barcode-reading algorithm optimized for omnidirectional barcode reading. Hotbars® is a best-in-class technology that locates, extracts, and decodes 1D barcodes quickly and accurately. Combining these two powerful technologies offers extraordinary read rates. 1DMax with Hotbars reads damaged codes and can handle extreme variations in contrast, blur, damage, voids, specularity, resolution, quiet zone violations, and perspective distortion.

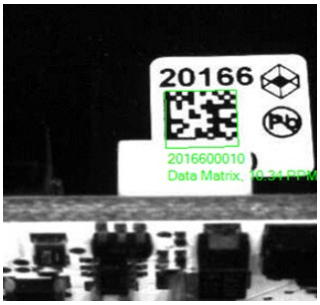


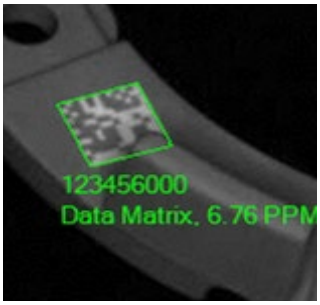


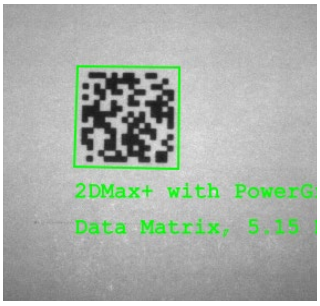
2DMax with PowerGrid

2D algorithm combines texture and shape for superior code reading

2DMax® is a 2D code-reading algorithm that handles a wide range of degradations to 2D direct part mark (DPM) code quality. 2DMax with PowerGrid® technology combines both textural and geometric data to reliably read low quality 2D codes, including codes with defective quiet zones and finder and clocking patterns. 2DMax offers exceptional 2D code read rates and robustness on the most difficult and degraded codes—even those where vital elements of the DataMatrix code are missing or damaged.







IDMax

Fast, reliable code reading for high-speed production lines

IDMax® is a breakthrough code reading software based on the 1DMax and 2DMax tools. This technology can read 1D code symbologies such as UPC, PDF, stacked and postal codes; 2D code symbologies such as DataMatrix and QR; or a mix of barcode and 2-D codes simultaneously. IDMax provides fast, reliable code reading that can meet high-speed production requirements.

- Real-time reading of 1D and 2D codes at rates over 7200ppm
- Industry-standard mark quality assessment metrics for 1D and 2D codes
- Fast setup, plus reliable, robust operation

OCRMax

99% accuracy for difficult-to-read characters

OCRMax™ is a font-trainable Optical Character Recognition (OCR) and Verification (OCV) tool that offers 99% accuracy on difficult-to-read characters. It prevents misreads, handles process variations, and provides easy font management with minimal training. OCRMax achieves unprecedented read rates for OCR and OCV applications even under the most challenging conditions, while giving the customer the flexibility to optimize their system for speed, read rate, or a combination of both. This gives users the chance to optimize the OCR/OCV for millisecond character reads, 99.99% read rates, or anywhere in between.

Unlike other OCR reading tools, OCRMax technology includes an auto-tune capability. With a few clicks, auto-tune dramatically decreases the time it takes to set up the tool by acquiring a sample image and automatically training fonts and adjusting the tool to its optimal segmentation parameters.

- Learn and read any printed font
- Read text even when there is little contrast between type and background
- Read text even when there is significant variation in width and height
- Read text when letters are touching, skewed, and distorted
- Differentiate between similar shapes, such as the letter "O" and the number "0"

HISTOGRAM AND IMAGE PROCESSING

MEASURE THRESHOLDS AND PREPARE IMAGES FOR ANALYSIS

Histogram

Generate statistics

Histograms can be used to measure the brightness threshold for an image or section of an image in order to determine the presence/absence of a part or to determine relative fill levels. Users generate a histogram by supplying the Histogram tool with an acquired image. The Histogram tool returns a histogram in an array of 32-bit values and can generate a number of statistics, including: pixel count; mean, median, and modal pixel value; minimum and maximum pixel values; and standard deviation and variance.

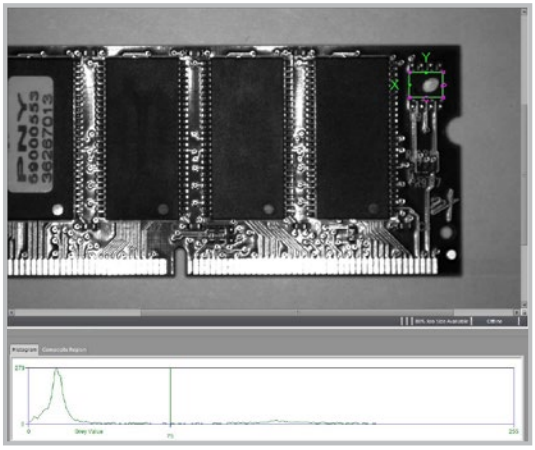


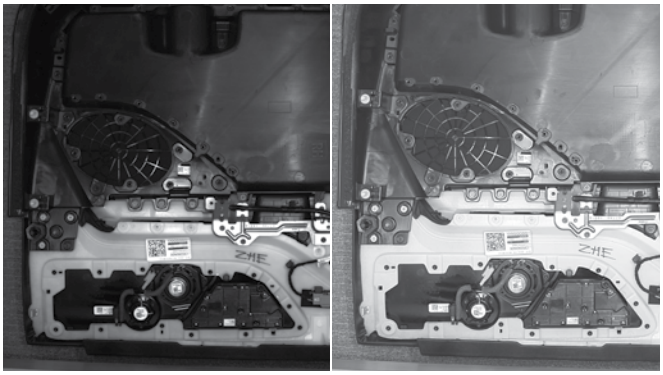
Image Processing Tools

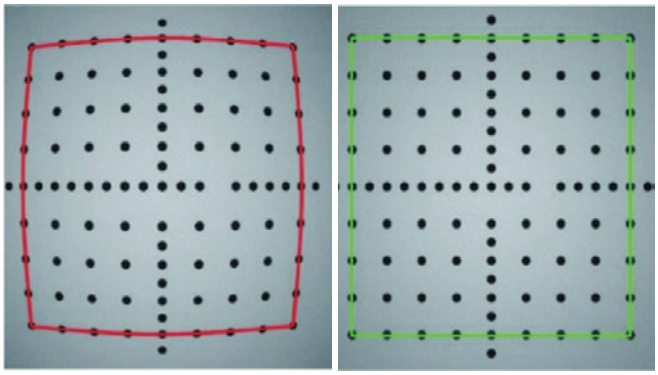
Optimize images

Image processing tools help optimize images for analysis by removing unwanted or distracting features, heightening contrast, and removing noise. This critical first step helps ensure accurate, repeatable inspections once image analysis tools are applied.

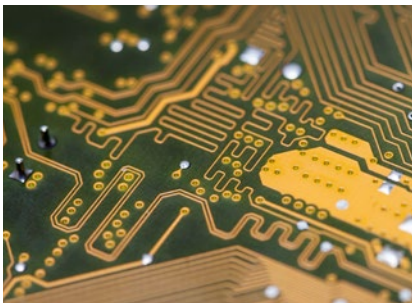
Cognex image filters further optimize images by filtering out noise due to lighting or poor contrast, smoothing and sharpening edges, and removing specular glare. The Image Transform tool changes an image's pixel coordinates into real-world calibrated units and can even adjust curved lines to straight lines for the most accurate measurement during inspection.

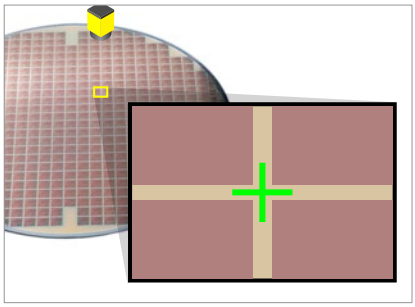
- Correct uneven lighting or shading from your image for a clean, clear image to work with
- Filter out unwanted or confusing backgrounds to highlight the part to be inspected
- Filter out all colors except for the one(s) you want for easy detection and inspection
- Rotate and unwrap acquired images





THE MOST INDUSTRY EXPERIENCE





Semiconductor

- Wafer and die alignment
- Wafer and IC package ID
- Semiconductor and PCBA inspection
- Fiducial alignment

Consumer Electronics

- Pre-assembly component check
- Robot guidance and alignment
- Touch panel assembly and alignment
- Barcode reading

Medical

- Medical device ID and traceability
- Weld and adhesive inspection
- Surface defect detection
- Optical character recognition

Pharmaceutical

- Package and tablet inspections
- Safety seal presence and verification
- 1D, 2D, date and lot code reading
- Label presence and verification

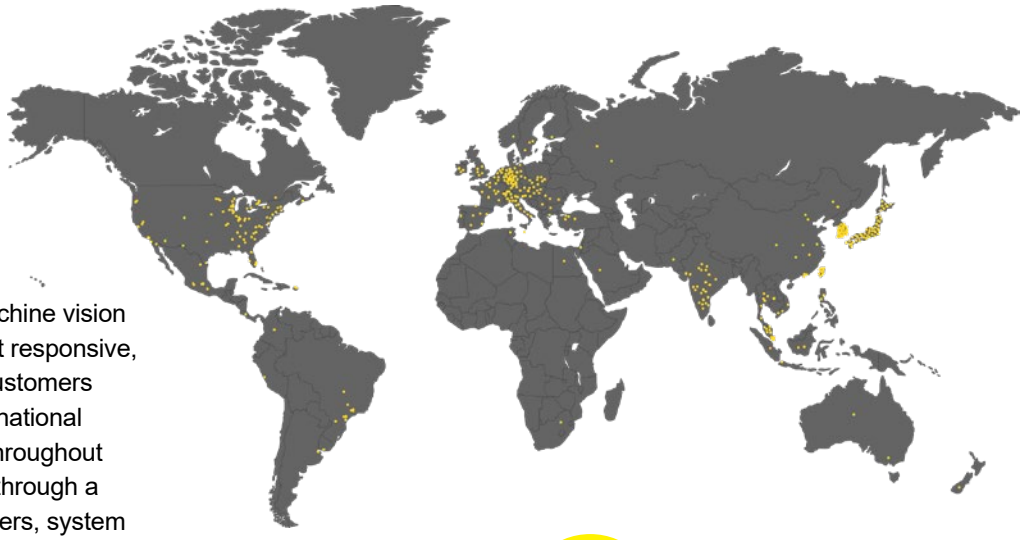
Automotive

- Part inspection
- Part orientation and presence detection
- Part and assembly inspections
- DPM code reading

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



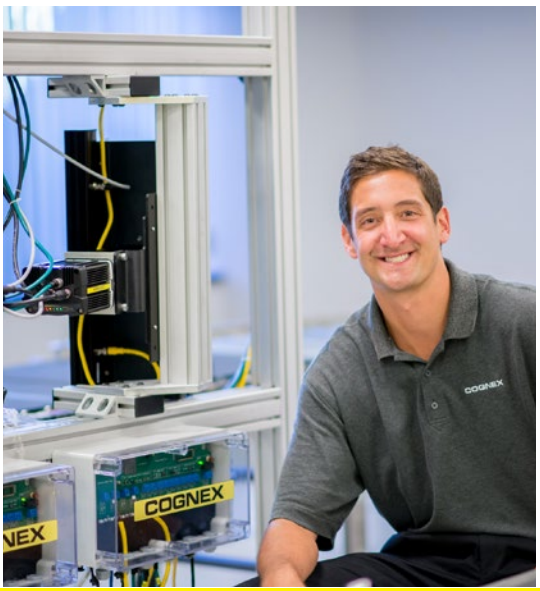
When it comes to protecting your machine vision investment, Cognex understands that responsive, expert service is an expectation all customers should have. Cognex serves an international customer base from offices located throughout the Americas, Europe, and Asia and through a global network of highly-trained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

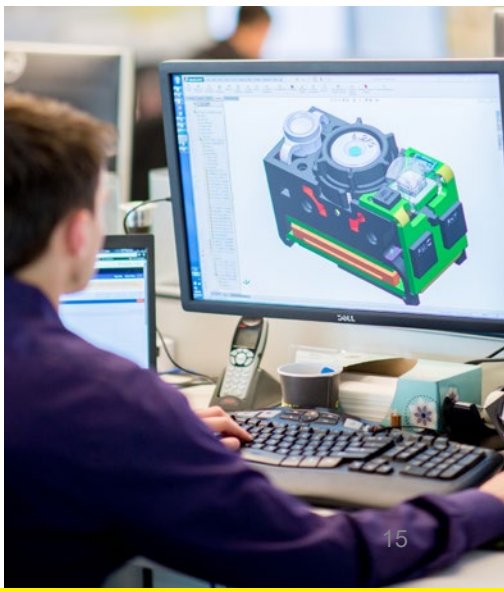
From development to deployment, Cognex is there to help you get your vision systems up and running as fast as possible. Whether you're considering machine vision for the first time or are already an expert user, Cognex global services provide the expertise to help your organization succeed.

cognex.com/support/Cognex-services

OFFICES IN 20+ COUNTRIES

500+ GLOBAL PARTNERS IN 30 COUNTRIES





BUILD YOUR VISION

2D VISION

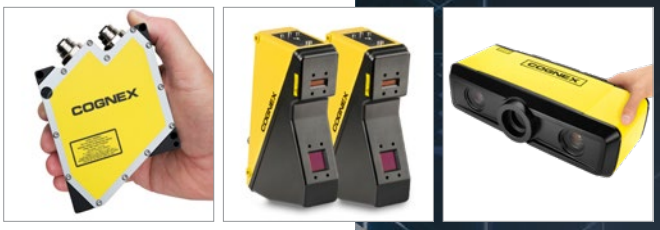
Cognex machine vision systems are unmatched in their ability to inspect, identify and guide parts. They are easy to deploy and provide reliable, repeatable performance for the most challenging applications.

www.cognex.com/machine-vision

3D VISION

Cognex In-Sight laser profilers and 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-laser-profilers



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.

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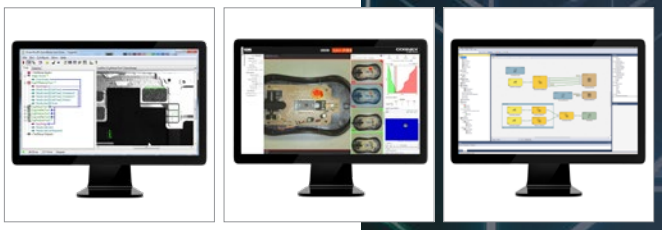

BARCODE READERS

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 to optimize quality, drive down costs and control traceability.

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