COGNEX

INDUSTRY APPLICATIONS

Cognex... for every step of the PV Supply Chain

Solar Photovoltaic (PV) Cells and Modules

Confidence, Every Step of the Way

Whether it's using vision for alignment rather than mechanical mechanisms to minimize wafer damage, tracking your product from wafer to installation, or receiving live feedback to fix product and process problems, vision-based technology adds value every step of the way. That's why Cognex—with over 500,000 installations worldwide—has been the industry leader since 1981. Compared to standalone inspection systems, the flexible, powerful vision products from Cognex offer a higher value, for a much lower cost.

Machine vision for PV production… today and tomorrow

As the solar industry shifts focus from quantity to quality and processes become more complex, the extensive library of Cognex vision tools provides advanced machine vision technology to achieve the most reliable results. The new Solar Toolbox™ provides users a preconfigured set of tools for the most common vision inspection applications in solar production. In addition to the Solar Toolbox, Cognex offers the most advanced vision tools available today, incorporated in our broad range of products such as PatMax®, PatInspect®, and IDMax®, which have the power to handle the wide variety of applications found in solar production.

Solar Toolbox

Start with the basic software library or use our preconfigured alignment and inspection tools. The Solar Toolbox, available with Cognex's powerful VisionPro® software, provides users with a toolset for the eight most common solar production quality issues: edge chip inspection, pin hole detection, back print registration and inspection, front bus bar registration, front finger trace inspection, color uniformity inspection, and crack detection.

PatMax

The critical tool for object location is PatMax, the patented software tool for part location. PatMax uses proprietary geometric pattern-finding technology to locate features of wafers, cells, and modules under extremely challenging conditions with unmatched accuracy and reliability.

Color Vision

Whether it's color sorting or verifying antireflective coating color uniformity, Cognex color tools detect and measure color features. Color search histogram tools are easy to train and provide critical color capabilities that can't be achieved with greyscale vision technology.

PatInspect

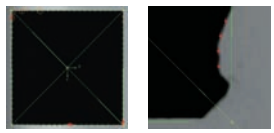
With one-step part location and defect detection using patented algorithms, PatInspect reliably detects flaws even on the edges of parts where other techniques have trouble giving reliable results. PatInspect works under variations in wafer coating and lighting conditions.

IDMax

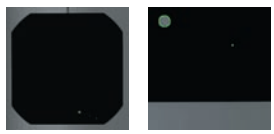
The powerful decoding software tool IDMax is designed to read the most challenging codes. IDMax reliably reads even degraded, reflective, or low-contrast marks, making full wafer-to-panel traceability a reality.

Beyond our broad range of vision-based products, Cognex offers the widest network of vision experts found globally. With offices in over 20 countries throughout the Americas, Europe, and Asia—and a network of over 300 local distributors and partner integrators—Cognex provides local support with a global reach.

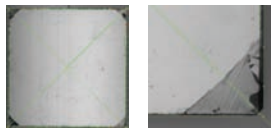
SOLAR TOOLBOX CONTENTS



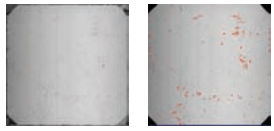
Edge Chip Inspection



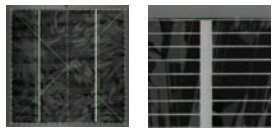
Pin Hole Detection



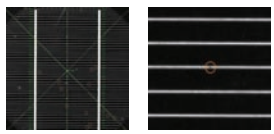
Back Print Registration



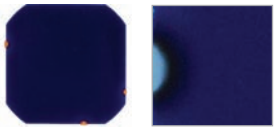
Back Print Inspection



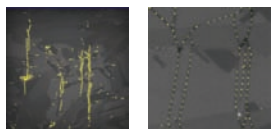
Front Bus Bar Registration



Front Finger Trace Inspection



Color Uniformity Inspection



Crack Detection

It starts with wafer challenges...

Manufacturers must monitor quality from incoming materials and wafers through every step of the PV value chain to achieve high-quality, high-yield solar cell production. Cognex leads the way in precision alignment for automated wafer handling; in ID for part tracking, genealogy, and process control; and in inspection for quality management.

Wafer and PV Cell Identification

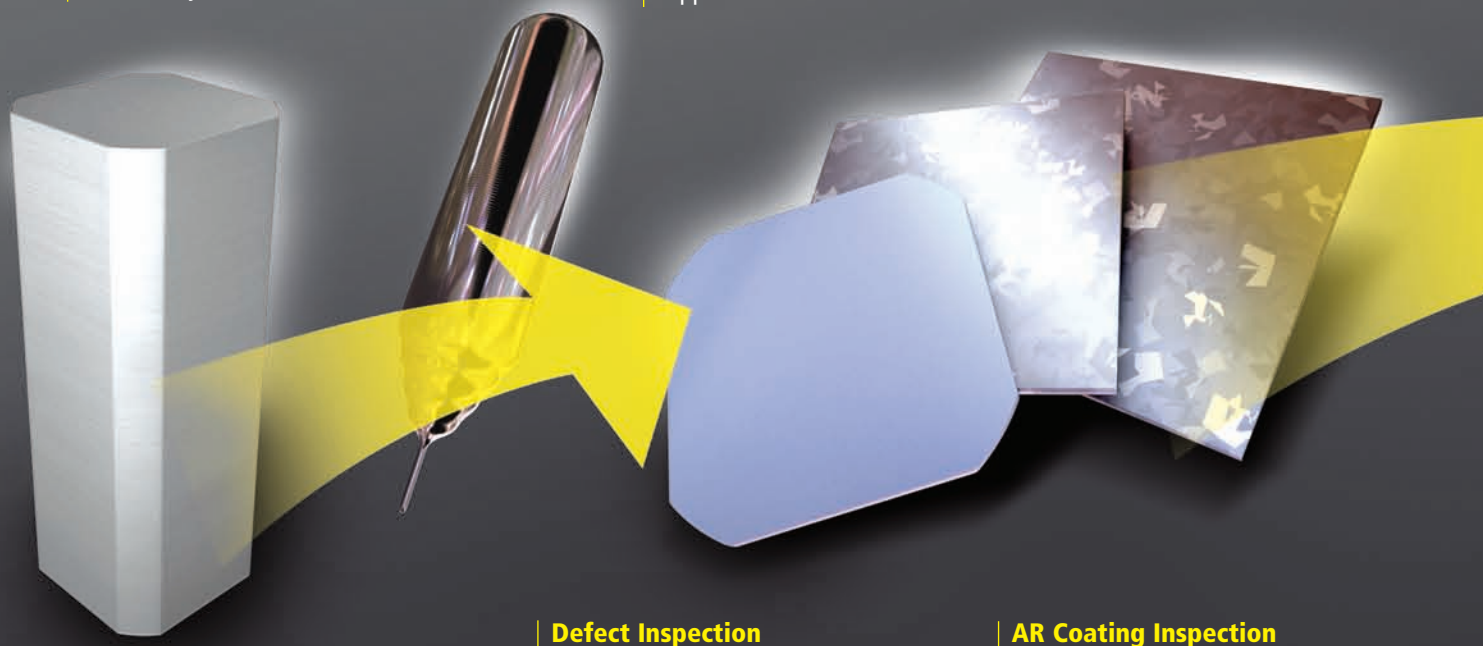
Reliably identify all codes for wafer and PV cell traceability throughout the production process.

Silicon Crystal Inspection

Measure the growth of silicon crystals and provide data to help correlate the relationship between crystal appearance and wafer yield.

Wafer Inspection

Check wafers for stains, contamination, and mesh pattern and ensure dimensions to avoid processing warped or flipped wafers.



Defect Inspection

Detect chipped edges, saw marks, and contour defects on wafers.

AR Coating Inspection

Inspect the antireflective coating thickness and color uniformity on wafers/cells.

... continues with cell fabrication...

Powered by Cognex's industry-leading software, Cognex vision-based products—systems, software, and industrial ID readers—are used for monitoring and inspecting everything from wet processing through metallization, firing, and color sorting.

Cell Defect Detection

Inspect cells for chips and cracks to ensure any defective cells are rejected prior to processing.

Screen Print Alignment

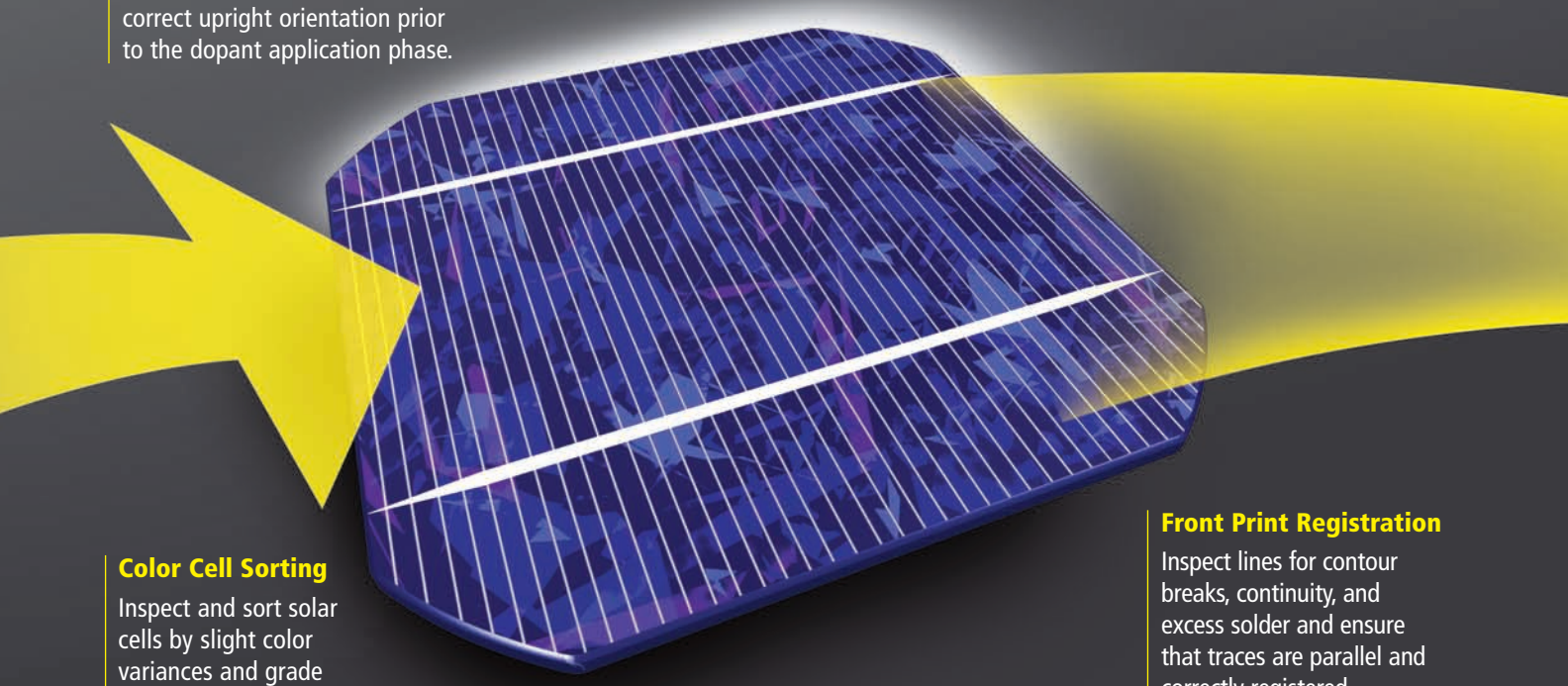
Align solar cells for screen printing.

Laser Edge Isolation

Align cells and inspect the edge groove cuts along the wafer edges to isolate the emitters from the back sides of the cells.

Cell Orientation Detection

Monitor solar cells to ensure correct upright orientation prior to the dopant application phase.



Front Print Registration

Inspect lines for contour breaks, continuity, and excess solder and ensure that traces are parallel and correctly registered.

Color Cell Sorting

Inspect and sort solar cells by slight color variances and grade the cells based on inconsistencies in the color.

Back Print Registration Inspection

Measure the position, width, and distance between the bus bars and check the continuity of finger lines.

Robot Guidance

Transmit placement information for robot guidance applications used throughout the solar panel manufacturing process.

... and ends with module assembly.

As technologies evolve, so do production and quality goals. Cognex vision systems empower manufacturers by providing the flexibility to adapt quickly to a wide range of applications and continuous process improvements, minimizing variability and reducing failures in the field.

Solar Panel Traceability

Track individual modules through production and into the field by reading 2D (Data Matrix) codes marked directly on panels.

Cell Spacing

Ensure uniform cell spacing in the finished module.

Connector Inspection

Ensure solder is present and at the correct location for attaching electrical plugs to the solar module.

Tabbing/Stringing Alignment and Inspection

Center the PV cells, minimizing the need for mechanical contact, and examine the cells for defects while also verifying the continuity and correct assembly of each string.

Frame Inspection

Ensure screws are present and in the right position on the aluminum frame.

Panel Assembly Verification

Perform a final quality inspection on the panel assemblies to ensure accurate cell spacing, construction, and part placement.

The Cognex Product Family

You may need more than one type of vision product to tackle challenging tasks—but you don't want the complexity of dealing with multiple vendors, or the difficulty of integrating their technologies. What you need is a company that offers a complete line of vision-based products. And that means Cognex! In addition to our industry-leading products, Cognex Vision Solutions® offers custom application services for end users who utilize Cognex vision software, giving you direct access to our vision experts.

Vision Software

A library of powerful Cognex vision tools with open flexibility allows you to use cameras, frame grabbers, and peripherals of your choice. Cognex VisionPro software combines the power and flexibility of advanced programming with the simplicity of a graphical programming environment. Providing extreme high-resolution capabilities and the new Solar Toolbox, VisionPro is a powerful solution for your solar inspection needs.

Vision Systems

Rugged systems provide an easy-to-use interface for configuring applications in a fully integrated package. Cognex In-Sight® vision systems are ideal for alignment and inspection projects and offer a wide range of models, including line scan and color systems, to meet all price and performance requirements.

Industrial ID Readers

Handheld and fixed-mount products read and verify 1D and 2D codes in direct part mark and high-speed applications. Cognex DataMan® products offer the most reliable vision-based industrial ID solutions on the market and are equipped with Ethernet capability for ease of networking to factory platforms.

Vision Sensors

Easy, affordable sensors replace photoelectric sensors for more reliable inspection and part detection. Cognex Checker® vision sensors allow users to perform multiple inspections with just one Checker, and the Checker 3G offers onsite configuration, with no need for a PC.

Web and Surface

Industry-leading inspection technology detects and classifies surface defects in glass, plastics, paper, nonwovens, and metals at full production speeds. This complete solution for continuous processes ensures the highest level of quality where maximizing yield, productivity, and quality is critical.

COGNEX **Companies around the world rely on Cognex vision to optimize quality and drive down costs.**

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