



Embracing the **next generation** of machine vision

Advances in machine vision continue to redefine how businesses in manufacturing, transportation, logistics, and beyond can transform their operations





New realities have changed the game

Industries worldwide continue to evolve rapidly. With rising labor shortages, growing e-commerce demands, and ever-increasing requirements for improving speed and quality, industrial automation technology is becoming increasingly important to address market-changing trends.

Labor shortage woes persist

In its 2025 Global Talent Shortage survey, workforce solutions company ManpowerGroup reports that 74% of employers are struggling to find the skilled talent they need.¹ As a result, industrial automation technologies like machine vision and robotics remain indispensable for businesses looking to ensure steady operations, especially during turbulent times. Automation technology provides future-proof solutions, delivering a level of consistency and speed that humans simply cannot. In many ways, automation technology has become essential.

Pushing new heights with e-commerce

In 2025, retail e-commerce sales are expected to exceed US \$4.3 trillion globally.² Businesses operating in e-commerce rely on several types of automation technology: Fixed industrial scanners and software are used in applications ranging from pack bench scanning to reverse logistics, and machine vision hardware and software are needed in tunnel scanning and label verification. Businesses looking to improve throughput can partner with leading industrial automation companies like Zebra for flexible and future-proof solutions for all areas of the supply chain.

Meet or exceed customer expectations

One drawback in e-commerce is that the customer can't touch and inspect a product prior to purchasing. Consumers expect products to be of high quality and to arrive fast. If an order isn't 100% correct and free of defects, the customer will not hesitate to send it back—which costs the industry both financially and in reputation. Retailers estimate that nearly 17% of annual sales were returned in 2024³ and that by 2029 the global reverse logistics market could exceed \$954 billion.⁴

Adapt and thrive

The modern-day shopper's on-demand mindset has spurred manufacturers and logistics providers alike to improve their operational efficiency and product quality to meet rising consumer expectations. At the same time, enduring labor shortages are straining resources and leaving companies looking for new ways to automate tasks and reduce costs. More than ever before, it is imperative for businesses to put their trust in a company that offers a full automation technology ecosystem without having to worry about complex integration, lack of support, or inefficient technologies.

Industrial automation, evolved

As more businesses in manufacturing, transportation, logistics, and beyond seek to address growing customer demands in an increasingly competitive landscape, the need for industrial automation systems shifts from desirable to essential. Today, fixed industrial scanning and machine vision technologies are simple to use, providing a vast range of capabilities that easily integrate into existing operations.

In the past, machine vision technology adoption involved many challenges. Early systems required specialized knowledge for system specification and integration, without the standards and interoperability available today, making it difficult to use components or technologies from different vendors. Even today, some vendors develop and market proprietary solutions, requiring integrators to purchase and support a variety of different products and applications to manage machine vision projects.

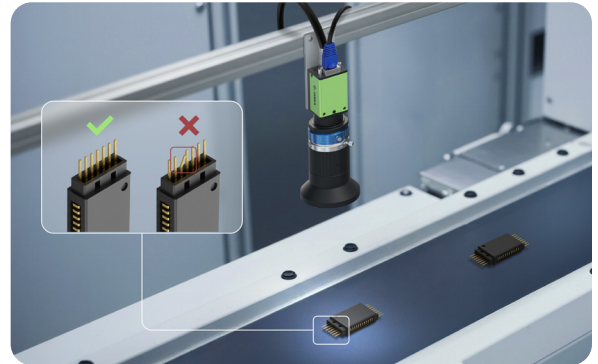
Older machine vision systems also lacked user-friendly interfaces, with no graphical programming or drag-and-drop environments. Old machine vision technologies were also larger and more expensive. They had limited processing power, frame rates, and resolution, among other drawbacks.

Modern machine vision looks significantly different. Making machine vision easier to integrate, deploy, and operate has lowered the barrier to adoption. In addition, user-friendly machine vision software removes the need for deep coding expertise for those working with machine vision and fixed industrial scanning technology.

Fixed industrial scanning technologies help enterprises in warehousing, logistics, and transportation environments keep inventory flowing in and out to keep pace with customer needs through reliable, intuitive scanning solutions. The continuously evolving technology leverages AI technologies to make even challenging optical character recognition (OCR) applications simple, while improving interoperability and shortening learning curves—essential for today's fast-moving environments.

Even small and midsize industrial companies can now realize the many benefits of industrial automation without all the headaches involved with managing cumbersome legacy systems. In doing so, these businesses become much less dependent on manufacturers' representatives or technical support to implement these solutions.

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Machine vision and fixed industrial scanning benefits

- Faster product assembly
- Fewer manufacturing defects
- Increased quality control throughout the supply chain
- Lower overall costs
- Faster inbound and outbound order processing
- More efficient sorting and shipping
- Higher customer satisfaction
- Stellar customer relations and company reputation
- Better product tracking and traceability

Flexible automation for today's warehouses and factory floors

Today's industrial automation technologies are designed with flexibility in mind, allowing businesses in manufacturing, transportation, and logistics—among others—to more easily adopt, operate, and even repurpose systems. Software-defined solutions support both machine vision and fixed industrial scanning with the same hardware. Companies need only invest in one portfolio to manage multiple operations. This can provide a path for navigating an upgrade from simple barcode reading to advanced machine vision inspection.

With businesses and the processes that support their operations constantly evolving, system flexibility helps keep products flowing out the door of the warehouse and parts moving on the factory floor. The need to capture 1D or 2D barcodes at slow speeds may evolve to a need for OCR, potentially with the assistance of deep learning technology for challenging applications. Further down the line, machine vision inspection tasks like 3D measurements or vision guided robotics may be required. All these capabilities are possible using the same solution vendor. The potential to add automation technologies like radio frequency identification (RFID) and robotics without changing suppliers is also a key consideration.

Today, instead of needing to replace components and solution vendors, plant managers and warehouse employees alike can enhance their barcode scanning or machine vision capabilities quickly, often with just a software update. Working with companies that have a wide range of hardware and software options to choose from allows businesses to right-size their applications without paying for unnecessary features—while still allowing for upgrades as requirements change. This software-based approach significantly reduces deployment and integration complexity and makes machine vision much more accessible for small and midsize companies.

Adaptable, approachable automation

A flexible, interoperable approach allows companies that require flexibility and minimal downtime to repurpose or retask existing systems, whether for barcode reading, OCR, more complex machine vision inspection, or robot guidance applications.

Build on incremental automation wins

While a solution built from interoperable and flexible components streamlines how users can qualify, procure, and deploy automation solutions, large-scale enterprise-wide automation projects can still be daunting. Implementing smaller projects impacting one stage in the process or one part of the operation can be a good first step to ensure the tools and vendor you have chosen offer the right support and ease of deployment for your operations.

Smaller-scale adoption of this technology also helps users test the ROI and avoid potential objections to a larger-scale investment. To achieve the best results on smaller test projects, choose a solution provider that offers a flexible, easily modified or upgraded solution that can be scaled as the project grows.



Future-proof manufacturing with machine vision

Manufacturers of all types—from automotive to semiconductor—need real-time visibility in their operations, which are constantly evolving and challenging to oversee. A machine vision solution delivers quality control and efficiency improvements at every step of the process.

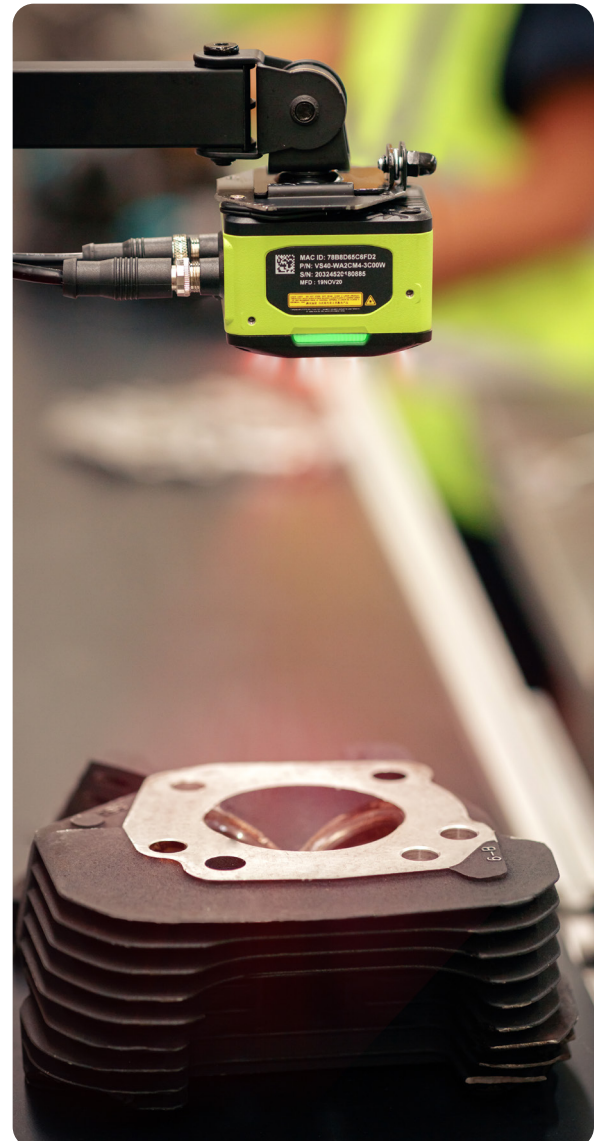
For instance, within the automotive manufacturing space, machine vision solutions can:

- Efficiently perform OCR on direct part marking codes, even in low-contrast conditions or when a code is slightly damaged
- Ensure that metal cast parts are correctly assembled and without any defects, such as voids or foreign materials
- Verify the presence of machined features such as through holes and threaded holes on engine blocks while also inspecting for defects, roughness/smoothness, and joining surface quality
- Perform final assembly inspections, including glass decking inspection, wheel mounting inspection, painted surface inspection, and gap-and-flush inspection

From raw materials to final assembly, a comprehensive machine vision ecosystem and deep industry expertise can improve virtually every step of your manufacturing process.

The Zebra machine vision difference

- Unmatched software and hardware products to meet all use cases
- Industry-leading AI and 3D capabilities
- Deep legacy of success and investment in vision tools
- Vast, experienced partner network for support and scalability
- Ease of integration across technology platforms



Market-leading scanning and traceability

In warehousing, transportation, and logistics, businesses face increased pressure to keep goods moving out the door on time, at high speeds, and with accuracy. Fixed industrial scanning provides powerful and easy-to-use track-and-trace technologies, which can be applied from the pack bench to the dock door, to keep inventory moving at the speeds you need.

Fixed industrial scanning solutions can:

- Quickly and accurately read and decode labels on pack bench and reverse logistics setups
- Deliver reliable track-and-trace in high-speed scan tunnel applications
- Provide hands-free scanning with forklifts approaching a pallet
- Ensure that the correct pallets are being received, moved, or loaded through dock doors

From the moment material enters a facility to the time a package is loaded onto a truck for delivery, fixed industrial scanning technology helps speed up your warehousing and logistics operations while also improving accuracy.

The Zebra fixed scanning difference

- Fast, streamlined system deployment
- Short learning curves and ease of use
- System interoperability, including third-party systems
- Pain-free integration, expansion, and scalability



Machine vision without limits

For higher-quality output, increased traceability, faster production times, and better overall use of resources, manufacturers and logistics companies need easy-to-use solutions that help elevate quality and drive production performance. Zebra Technologies has 50-plus years of experience in industrial automation and a unique understanding of what technology is required to advance both business strategy and operational goals.

Zebra's comprehensive machine vision portfolio is designed to be easily integrated into all steps of the supply chain, from processing raw materials to delivery to the end customer. Offering innovative technologies—from industrial cameras and frame grabbers to AI software and 3D sensors—Zebra supports all your machine vision needs. In addition, Zebra's fixed scanning solutions ensure real-time visibility into track-and-trace operations for today's fast-moving warehouse environments.

With unique features designed for easy setup, deployment, and maintenance, Zebra's machine vision and fixed industrial scanning technologies offer our customers a flexible, interoperable portfolio—one that helps companies keep pace with the demands of industrial manufacturing and logistics. Whether they need equipment to read challenging barcodes or perform complex quality inspections, industrial companies of all sizes can rely on Zebra's future-proof technologies.

Ready to improve your margins and metrics? So are we.

At Zebra, we lead the development of intelligent automation technology. Zebra products can be integrated seamlessly with existing hardware, including third-party systems, offering enterprise-level solutions that deliver measurable and scalable productivity improvements no matter the use case. Zebra offers continuously improving AI-enabled tools that make track-and-trace and defect detection easier and more accurate.

With a range of powerful software, fixed scanners, smart cameras, 3D sensors, industrial cameras, frame grabbers, industrial vision controllers, and scan tunnel solutions, Zebra has a broad interoperable portfolio of technology to streamline operations and lower costs throughout any warehouse or manufacturing facility.



For more information on Zebra's machine vision and fixed industrial scanning solutions, visit zebra.com/machinevision

SOURCES: ¹ ManpowerGroup, 2025 Global Talent Shortage survey. ² Statista, eCommerce: market data and analysis, 2024. ³ National Retail Federation and Happy Returns, 2024 Consumer Returns in the Retail Industry. ⁴ Statista, Global reverse logistics market size forecast 2022–2029, June 27, 2025.



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