Be proactive about your productivity

Modernize your conveyor lines with AI-powered jam detection and increase throughput by up to 30%

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ZEBRA

Intelligent jam detection for modern fulfillment centers

Today's distribution and fulfillment centers operate under relentless pressures: Customers expect rapid delivery and real-time visibility into the location and status of their packages. Retailers demand accurate reporting and on-time delivery. Service-level agreements (SLAs) leave little room for disruption.

In this unforgiving, schedule-driven environment, uninterrupted flow of materials through your facility isn't just a competitive advantage, it's an absolute necessity.

Conveyor networks and automated sorters are critical systems in modern fulfillment centers. Even minor interruptions in conveyor operations can have major downstream consequences. A single jammed sorter can disrupt a line, divert labor, delay shipping, and break delivery commitments. So it's vitally important to detect and respond to jams as quickly as possible.

"False jams" can be nearly as disruptive to smooth operations, needlessly diverting workers from important tasks, causing delays and damaging productivity. Traditional, sensor-based jam detection systems often misinterpret temporary slowdowns as actual blockages, triggering false alarms.

AI-powered machine vision introduces a layer of operational intelligence beyond traditional binary sensors, combining smart cameras with advanced analytics to accurately identify true jams and ignore false positives, keeping personnel on task and improving throughput by up to 30%.

The importance of dependable conveyor networks

Small disruptions have large consequences

Every second of uptime contributes to throughput, labor efficiency, and on-time delivery. Because conveyor systems are so deeply embedded in fulfillment workflows, any interruption can affect your entire operation. When a sorter is blocked, packages are recirculated, staying on the conveyor loop until the issue is resolved.

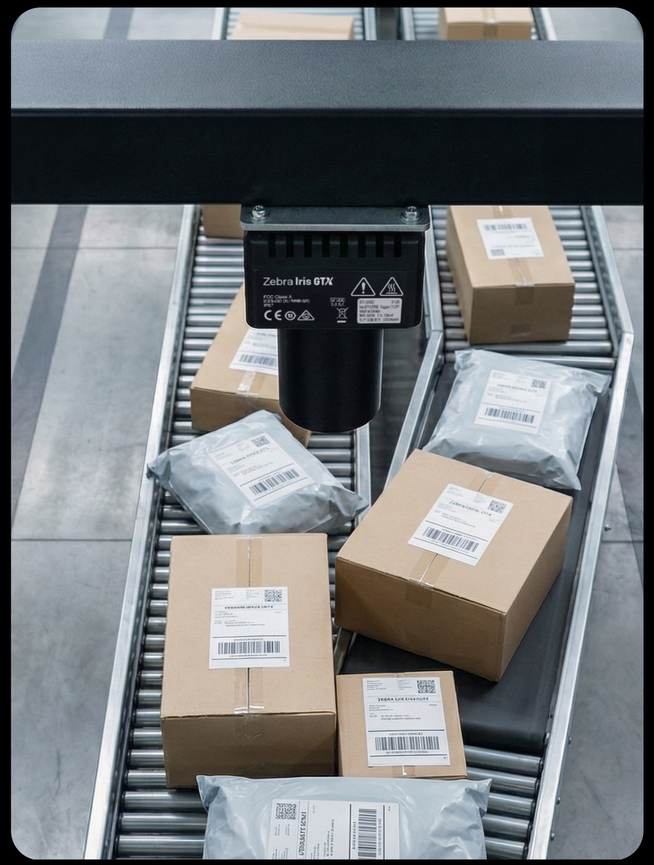
The need for greater visibility

In high-speed environments, downtime becomes expensive very quickly. And as e-commerce continues to gain momentum, fulfillment operators are challenged to minimize interruptions and maximize uptime. Implementing faster conveyor systems with greater throughput can be part of the solution, but this also creates greater risk of significant disruptions. You also need smarter, more dependable operational visibility.

The hidden costs of conveyor chaos

Jammed sorters and recirculating packages create costly problems:

- **Reduced capacity**
- **Increased congestion**
- **Repeated package processing**
- **Labor-intensive manual intervention**
- **Delayed shipments and missed SLAs**
- **Increased operational stress**

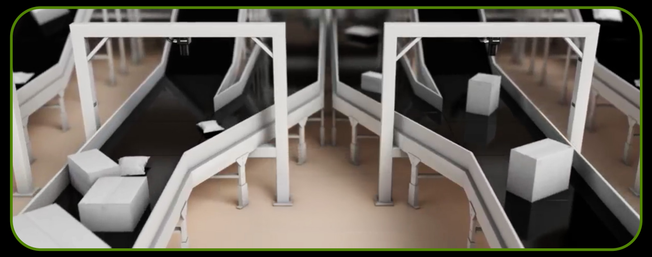


Differentiating false jams from true jams

The limitations of traditional sensors

Most existing jam detection systems rely on simple photoelectric sensors (or “photo eyes”), which have only two possible observations: blocked or not blocked. While these may have been minimally effective in past decades, they struggle to meet the challenges of modern fulfillment centers:

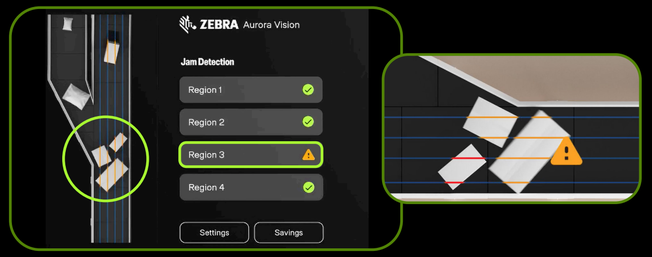
- High conveyor speed
- Dense package flow
- Irregular package shapes
- Reflective packaging materials
- Polybags and lightweight parcels



The impact of false jams

Legacy sensors frequently mistake temporary slowdowns for critical jams, sounding a false alarm even when packages would have continued moving naturally. These “false jam” events create operational inefficiencies:

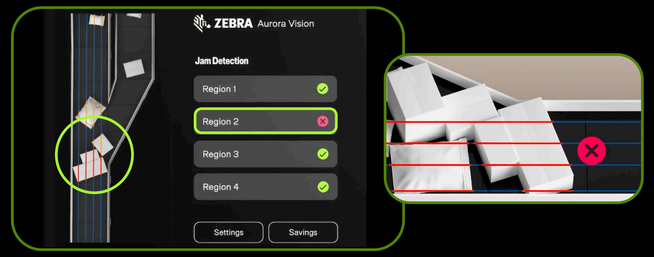
- Unnecessary shutdowns of sorters or conveyors
- Workers diverted from important tasks to investigate alarms
- Packages recirculated through the conveyor loop, causing delays and repeat processing
- Significant decreases in overall throughput
- Alert fatigue, contributing to distrust of alarms and slower response times



Recognizing true jams

True mechanical jams will still occur, requiring immediate attention to avoid widespread disruptions. Personnel need to respond to these alerts promptly, which means they must be able to trust that the alarms are genuine.

In order to distinguish true jams from false ones, sensors must do more than simply detect motion; they must recognize context and differentiate between temporary slowdowns that will self-correct and true pileups that require human intervention. Without that intelligence, operations teams are trapped in a reactive cycle of unnecessary stoppages and manual responses.



Intelligent jam detection with AI-powered machine vision

Replacing simple sensors with smart cameras

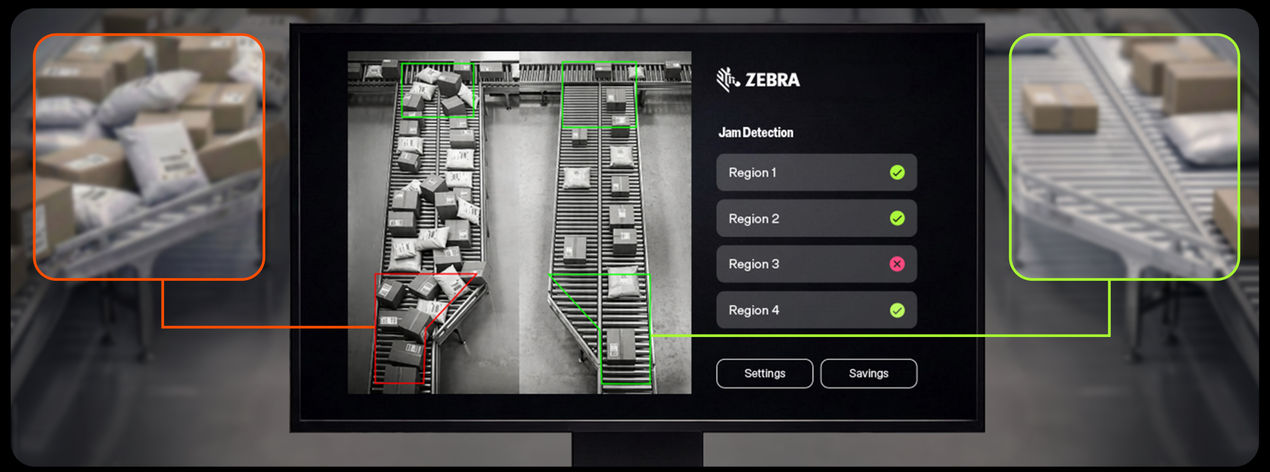
Zebra's jam detection solution revolutionizes conveyor monitoring by replacing traditional photoelectric and mechanical sensors with intelligent machine vision. Smart cameras mounted above the conveyor system provide complete, real-time visibility over package flow, continuously monitoring package movement, flow patterns, and object behavior. Photo eyes can only tell you if something is there; machine vision can tell you what is happening.

Understanding traffic flow

Unlike conventional sensors, our AI-powered software analyzes a broad segment of the conveyor line, not just a single point. Vision-based, context-aware software examines multiple factors, such as:

- Package velocity and movement
- Conveyor density and congestion
- Flow patterns over time

This enables the system to accurately distinguish between temporary, self-resolving blockages and true mechanical jams.



Actionable insights and real-time decisions

When the system identifies a true jam:

- Conveyor systems can stop automatically
- Operators receive precise, timely alerts including real-time visuals of the situation
- Personnel can respond quickly to the exact location, knowing what to expect

When it recognizes a false jam:

- Packages clear themselves
- Conveyor operations continue uninterrupted
- Personnel remain on task and productive

The result is a more efficient, predictable workflow.

Key components

Zebra Iris GTX Smart Camera

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Zebra Aurora Suite

Zebra Aurora™

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The business case for intelligent automation

Increase throughput

By accurately distinguishing between true and false jams, Zebra machine vision can help you avoid disruptions and increase capacity:

- **Up to 30% greater throughput**
- **Fewer package recirculations**
- **Meet service-level agreements (SLAs)**

Optimize labor efficiency

False jam alerts frequently pull workers away from critical tasks to investigate non-issues, with cascading impacts on overall performance and productivity:

- **Respond only when human intervention is truly necessary**
- **Increase efficiency in maintenance and operations teams**
- **Utilize human resources more effectively**

Create a smarter fulfillment operation

Zebra's flexible machine vision systems are easy to deploy across any number of outbound sorter lanes, providing a scalable system for detecting jams as well as intelligent technology to support future automation and machine vision initiatives.

Improve throughput and optimize workflows

In modern fulfillment centers, every minute matters. Any disruption to your conveyor network can directly impact your overall efficiency and reputation.

Traditional sensor systems do not provide the level of intelligence required to manage a high-speed, high-volume fulfillment operation. Their inability to distinguish true jams from temporary slowdowns creates false alarms, avoidable downtime, and operational inefficiency.

Zebra's AI-powered machine vision changes this model entirely.

By combining our smart cameras and real-time visual analytics, your fulfillment center can realize accurate, contextual awareness of your conveyor activity. Your operations teams can identify true jams immediately while allowing self-correcting jams to resolve themselves without interrupting your workflows.

And perhaps more importantly, Zebra machine vision can provide a scalable foundation for future automation and operational intelligence initiatives throughout your facility. Organizations that invest in machine vision technology today will be well-positioned to outperform competitors tomorrow.

Vision made easy. Powerfully simple. Always scalable.

We make machine vision better every day by making it easier to access, simpler to deploy, and more scalable to ensure it can address your automation goals today and tomorrow—so you can go from pilot to production with confidence—from your simplest use cases to your most challenging applications.

For more information

Ask your Zebra representative about jam detection and other machine vision solutions, or visit our website for more information: **zebra.com/jam-detection**