Belden

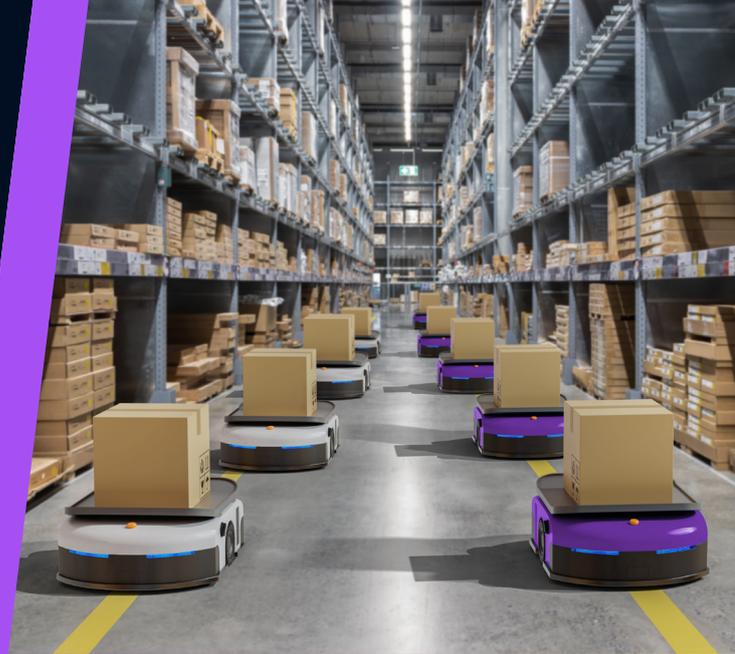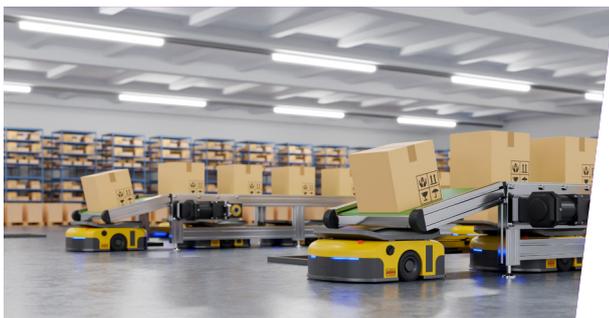# Anomaly detection

Gather up-to-the-minute health data at the machine level, uncover operational anomalies and avoid costly operational disruptions.

Solution Brief

In today's always-on warehouses, the pressure to maintain secure, uninterrupted operations has never been greater. As the complexity of your systems grows, so does the risk of unexpected downtime. A single component failure can trigger a cascade of disruptions that threaten throughput, erode profits and damage customer relationships.

To meet prevent costly equipment failure and meet critical throughput and delivery targets, visibility into critical assets is no longer optional. It unlocks the capabilities required for proactive maintenance and operational foresight at the machine and system level so you can keep orders moving on schedule.

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Having secure, real-time, 24/7 visibility into critical equipment, systems and processes allows you to detect subtle changes, such as shifts in vibration or temperature.

With this level of insight, your warehouse can move toward a **proactive maintenance model** that:

- Keeps operations moving and reduces unplanned downtime
- Extends equipment life by pinpointing problems early
- Improves quality by spotting potential failures that could result in damage or delivery mistakes
- Reduces maintenance and repair costs
- Ensures alignment with important operational KPIs

>>> **Anomaly detection unifies your asset data so you can spot early warning signs of equipment failure.**

Warehouse challenges put reliability at risk

In a warehouse filled with complex automation and assets, implementing anomaly detection is no easy task. It should be handled with a well-structured approach guided by specialized expertise. Otherwise, even a small problem or failure can trigger a costly chain reaction that impacts productivity and profitability.

During deployment, challenges can take many forms:

- **Fragmented data:** Siloed OT systems, disparate PLCs and legacy equipment that aren't "visible" make it difficult to predict and prevent failure
- **Scalability and integration:** Rapid tech adoption can outpace legacy network capacity and cybersecurity practices, creating weak spots across the warehouse
- **Congested networks:** Dead zones, insufficient bandwidth and dropped packets prevent the continuous real-time data flow necessary for anomaly detection

⟫ Anomaly detection

To achieve visibility, you need a network strategy that segments automation and control from monitoring. This ensures stability, performance and security by eliminating network congestion and preventing interference. Belden's complete connection solutions give your warehouse a solid foundation for anomaly detection by unifying sensor data collection, edge analytics, network infrastructure and IT/OT integration.

Together, these building blocks enable:

- **Uninterrupted data flow** across your machines
- **Continuous operations** through automated alerting
- **Real-time visibility** into assets and inventory to detect anomalies
- **Secure connectivity** with built-in network segmentation, encryption and access controls

Achieve seamless automation and integration on a secure, reliable network. With this resilient infrastructure in place, you can gather up-to-the-minute health data at the machine level, uncover small but critical operational anomalies and avoid costly operational disruptions.

3 steps to anomaly detection implementation

Our projects follow a clear plan to connect your business goals to technical execution. By creating an implementation roadmap together, we guide you through every stage of your project, from mapping operational needs to designing robust infrastructure and sustaining performance over time.

> ## Define the data you need to track uptime
> STEP 1

Belden begins by identifying your critical machines and assets, such as conveyors, palletizers, AMRs, sorters, etc. Then, we map out how existing instrumentation and control data used for automation can support condition monitoring and early failure detection. By capturing and analyzing detailed performance data, you can more easily identify deviations that signal potential issues.

For example:

- **Cycle time** → barcode scans + traffic sensors + battery voltage
- **Uptime** → motor current + vibration sensors + run/stop status

By connecting automation data and operational KPIs in one view, you close the loop between the work order you're launching and what's really happening on the floor.

> ## Build the right infrastructure & analytics
> STEP 2

Anomaly detection depends on seamless integration, reliable network performance and device connectivity across the warehouse floor.

- **Conducting a network assessment**
  First, we conduct thorough surveys (for single machines, rooms or entire sites) that involve mapping device locations, evaluating wireless coverage, assessing bandwidth usage and identifying sources of interference. By mapping the protocols used across your environment, we'll make sure that data from every source (regardless of format, vendor or age) can be unified into a single, consistent flow.

- **Designing the infrastructure**
  Next, we help you choose the right network topologies and data-flow architectures to withstand harsh warehouse conditions and maintain high availability of mission-critical information.

- **Integrating and securing devices**
  Finally, we leverage Belden's complete connection solutions to standardize secure data collection across new and legacy equipment.

We make sure our solution delivers sustained value and integrates seamlessly into your daily maintenance practices by:

- Connecting data to the maintenance, operations and quality tools you already use (or plan to use)
- Identifying the right platforms for your environment and supporting every phase of implementation
- Running a pilot, iterating alarm thresholds and validating with trending historical data
- Refining alert response and tying in to daily operational practices for continuous improvement
- Continuously tuning your KPIs through our services and support

>>> Customer success story

Challenge

Limited by disconnected systems and a lack of real-time visibility, a large warehouse faced persistent challenges in addressing equipment issues and making timely decisions.

Solution

A unified platform was implemented to support real-time data collection from every sensor. Now, advanced anomaly detection improves quality checks and triggers automated alerts across IT and OT environments.

Impact for the end user

- Improved response speed from automated work orders
- Early identification of quality issues
- Rapid transition to proactive maintenance and KPI tracking

We're available where and when you need us. Let's get in touch!

>>> **Ready to prevent problems before they happen?**

Contact us →