

MAKING THE CASE



MAKING THE CASE FOR IMAGE-BASED SCANNING FOR INBOUND & OUTBOUND LOGISTICS

Making the case for Image-based Scanning for **INBOUND & OUTBOUND** Logistics

IMAGE-BASED BARCODE READERS *enhance efficiency and throughput, improve read-rate performance and enable omnidirectional code reading in warehouse and distribution center operations.*

WITH U.S. E-COMMERCE SALES projected to reach \$482 billion by 2018—accounting for approximately 9% of retail sales nationwide—and with more than 43% of major retailers now offering a form of in-store pickup for orders, the tools and platforms used to support omni-channel distribution are becoming more advanced and efficient.

Integral to the smooth running of any warehouse and DC are barcode readers. The rapid growth of e-commerce and omni-channel distribution has placed new demands on the age-old barcode scanning setups that many companies are using today.

The sheer speed and velocity of e-commerce orders—many of which are packaged individually and shipped directly to end users' doorsteps—require more capabilities and accuracy than the typical laser-based barcode scanner provides. Inbound freight is equally as challenging and must now be maneuvered quickly in order to achieve inventory management goals and avoid shipment delays.

Tackling the rigorous demands of e-commerce with traditional, laser-based scanners is neither cost- nor time-efficient. A large retailer like Target or Walmart, for example, uses both Web and brick-and-mortar stores to sell its goods. This two-pronged scenario requires a great deal of variability and flexibility—something that the classic DC wasn't designed to handle.

On the outbound side, for example, the number of customers a DC is serving can easily multiply exponentially within a short period of time, *and without* the need for new retail stores. In this scenario, every new customer translates into a new address for the DC or warehouse to ship to, and every order requires individualized attention.

For inbound freight, DCs are being asked to manage more suppliers and incoming shipments than ever. With order sizes shrinking, they're also buying in smaller quantities and managing a higher volume of goods. This creates significant complexities for the DC that's set up to work with a fixed number of large suppliers to manage labeling procedures, guidelines, and other variables.

To manage these activities effectively, DCs must receive a higher volume of goods, break those shipments down into small order sizes, and get them back out the dock door as quickly and efficiently as possible.



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The right tool for the job

The right tools for both inbound and outbound freight management are image-based barcode readers that provide optimal read rate performance, support 1-D, 2-D, and omnidirectional code reading, and provides long-term reliability. Image-based readers allow you to see what the barcode reader sees. You can review live images of the barcodes being read or set up the reader to transfer no-read images via FTP for later review. This visualization feature enables you to diagnose no-reads and rejects for process improvement.

Thanks to advances in technology, image-based barcode readers are not only comparable in price to laser scanners, but are also more powerful. Combine these benefits into a single, affordable package and it's easy to see why image-based scanners are becoming a top choice for control engineers, operations personnel, and facility directors across a wide range of industries. ➤

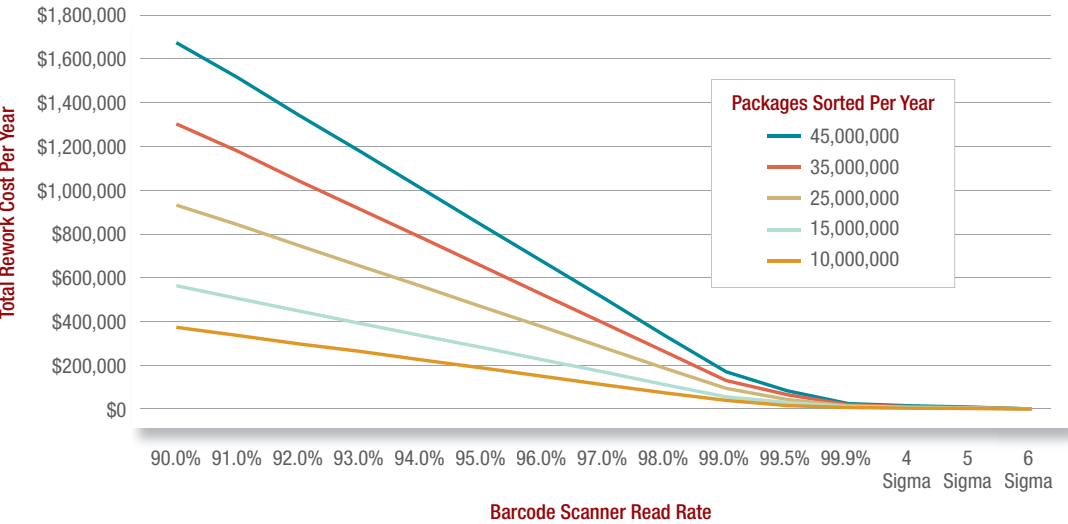
Image-based Scanning: Performance under pressure

DIGITAL DELIVERS INCREASED READ RATES and provides the ability to save “no read” images for performance feedback.

THE PRESSURE FOR DISTRIBUTION CENTERS (DCs) to increase productivity and reduce labor costs has never been greater. One way DCs are meeting this goal is by upgrading from the mechanical and rigid laser-based scanner technologies to more advanced digital reader technology that provide increased read rates. Increasing read rates by even a small percentage will result in fewer packages handled manually which normally would require the need for relabeling or rerouting rejected packages.

The limitations of laser scanners are well documented. For example, laser scanners only capture a single scan line at a time, which means they have a much more

COST IMPACT OF READ RATES



As the numbers in Figures 1 and 2 show, capital equipment improvement programs that increase read rates are solid investments that have short ROI schedules and have positive impact on profits over time. As distribution centers look to improve profit and throughput and position themselves for expected higher demands in years to come, new image-based barcode readers can help to achieve these goals.

limited ability to obtain a “read”—and especially on barcodes that may be poorly printed or damaged.

Laser scanners also don’t capture the barcode’s image, which is essential for DCs that want to conduct root cause analysis (RCA) on “no-reads” for process improvement. In addition, laser scanners have moving parts that are subject to wear and often require repair or replacement.

Image-based readers like the DataMan product line from Cognex use an imager similar to one found in a digital camera and a microprocessor to analyze the images. They deliver increased read rates on poorly printed or damaged codes, provide the ability to save “no-read” images for performance feedback, and are designed with no moving parts which provides longer usable product life. ➔

Low read rates = productivity and profitability losses

LOW READ RATES cause greater potential losses as the volume of throughput increases. Let’s say a high-volume distribution center that processes 126,760 packages per day and averages 99% read rates has the option to invest \$100,000 into new barcode reading systems.

These new barcode readers will improve overall read rates by 0.9%. What will this investment equate to in real value for the distribution center?

For starters, laser scanners sometimes require repair and replacement because they rely on a motor-driven oscillating mirror to move the laser beam across the barcode. Compare that to image-based readers that are solid state, make it possible to save images of codes that can’t be read for later review, and don’t wear out over time. As a result, image-based barcode readers provide two to three times the life of laser scanners.

The ability to analyze no-reads through image archiving provides the opportunity for continuous improvement. Reviewing saved images of packages or parts whose barcodes were not read can generally reveal if the problem resides within the reader setup or the process (Was the barcode missing? Was it dirty? Was it wrinkled?). With visualization, the root issue can be addressed in a continuous process improvement program.

For these and other reasons, image-based barcode readers are rapidly replacing laser scanners in a wide range of industries including food, beverage, consumer goods, pharmaceutical, and logistics.

Forever 21: Image-based barcode scanning in action

BY DECREASING THE TIME PICKERS spend at the labeling station, the fashion retailer is now able to process more orders with the same number of people—and achieve a read rate over 99%.

LARGE FASHION RETAILER FOREVER 21 recently made the switch to image-based ID readers and hasn’t looked back.

The company fills online orders with a bomb bay sorter line that depends on barcode reading technology to sort and deliver individual items to the correct matching station where they are combined with other items in the same order and prepared for shipment.

The firm’s traditional laser scanners couldn’t read 5% to 6% of the codes; so, running at peak capacity, this meant 1,728 items per hour had to be manually delivered to the correct matching station by the picking team—an exercise that consumed about 15% of the team’s time.

A critical aspect of Forever 21’s sorter operation is the accurate reading of item labels and then the subsequent direction of those items to the correct matching station without manual intervention. In the past, opto-mechanical laser scanners were used to read the tags because of their simplicity, low cost, and ease-of-use. However, this application presented particular challenges for laser scanners, such as the potential for codes to be at varying angles, in different positions, wrinkled, or covered by a plastic bag that generated glare or distortion.

The greatest ID reading challenge in this case is that the barcodes came from two suppliers, and one of the suppliers had lower-quality specifications—so the codes were inherently harder to read.

To tackle its read-rate challenges, Forever 21 decided

“The image-based system reduced the number of codes that could not be read to less than 1%, thus improving picking productivity by about 15% and providing a cost savings of approximately \$1 million per year.”

—Jason Kim, Forever 21

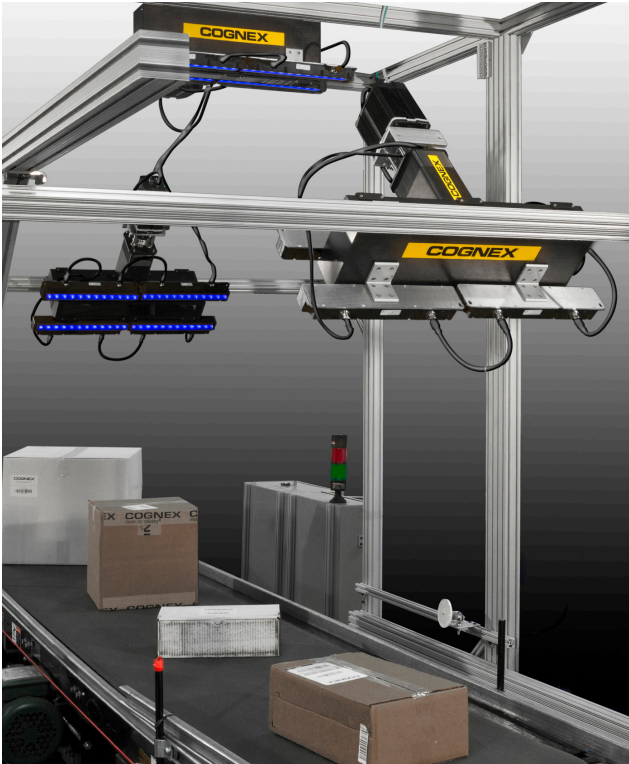
to install Cognex DataMan 503 image-based ID readers that would be able to read the labels that the laser scanners were missing. These image-based readers process the complete image and read codes despite problems that would otherwise make them unreadable for laser scanners.

“The image-based system reduced the number of codes that could not be read to less than 1%,” says Jason Kim, a Forever 21 industrial engineer, “thus improving picking productivity by about 15% and providing a cost savings of approximately \$1 million per year.”

Here’s how the system works:

Online orders received by the company are distributed to pickers who pull the items from inventory and place them on the EuroSort bomb bay sorter line. The items travel in individual trays, the identification label on each tray is read after the item is inducted into the sorter, and then the tray travels around the sorter.

Forever 21
BASED IN LOS ANGELES, Forever 21 is ranked by Forbes as the 122nd largest private company in the United States. The chain helped to pioneer fast fashion at bargain basement prices. Starting with a single, 900-square-foot store in Los Angeles in 1984, the company has grown to over 600 locations around the world that sell clothing both online and in their brick-and-mortar stores to men, women, teens and kids. The retailer also sells accessories and beauty products under the Forever 21, XXI Forever, Love 21 and Heritage 1981 brands.



When the item arrives at its intended destination, the appropriate tray or trays open, swinging down and apart, like the bomb bay doors of a military aircraft. The item drops through the tray into the matching station below. The belt on the sorter moves at about 1 meter per second, and the sorter line at full capacity can handle 28,800 packages per hour.

Today, image-based barcode readers make that process faster and more accurate for Forever 21. Instead of relying on a photocell monitoring the reflections of a single laser beam passing across the barcode to generate an electrical signal, image-based readers capture an image, and then use a series of algorithms to complete the read.

A typical algorithm searches the entire image for the code and identifies the position and orientation of the code. An image-based barcode reader is able to read multiple barcodes in any orientation within a single view.

“I am very happy with the success that we have achieved with image-based scanners,” adds Kim. “With the image-based scanners, our current read rate is over 99%. Our throughput benefits greatly from decreasing the time pickers spend at the labeling station, and the result is that we’re able to process a lot more orders with the same number of people.” ➡

10 Reasons to choose image-based barcode scanning

TODAY’S MOST ADVANCED IMAGE-BASED BARCODE READERS

offer a more attractive alternative to industrial laser scanners on the factory floor. In use, the latest generation of image-based barcode readers has proven to actually outperform lasers in the following areas:

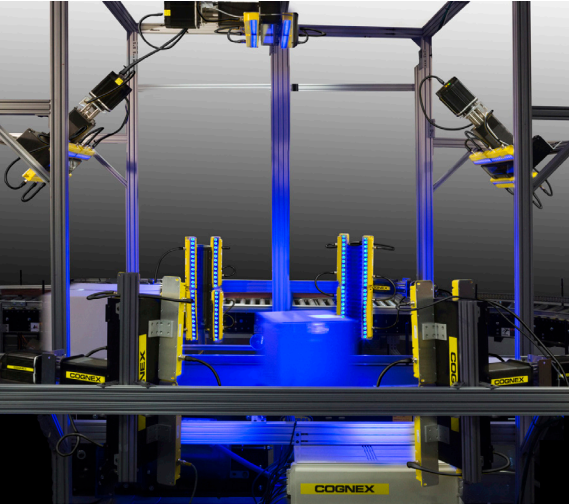
1 READ-RATE PERFORMANCE. The most important way to evaluate barcode reader performance is by its read-rate performance. Read rate is the number of barcodes read divided by the number attempted. It’s usually expressed as a percentage, and the closer to 100% the better. Said another way, read rate is the best measure of how reliable and robust the reader is to the barcodes used in applications.

Image-based readers view the entire barcode, not just a single line, so they can use advanced algorithms to overcome quiet zone violations and other code damage issues that cause no-reads with laser scanners. In addition, image-based barcode readers are able to use light sources to read codes that lasers can’t see, including barcodes printed with UV ink.



2 OMNIDIRECTIONAL CODE READING. One image-based barcode reader is able to read barcodes in any orientation within a single view. In contrast, multiple laser scanners must often be configured together to read barcodes in applications where orientation is not repeatable. Image-based barcode readers not only handle the typical ladder or picket fence orientation of barcodes, but can locate and read barcodes in any orientation. Image-based barcode readers are able to decode 1-D barcodes in any orientation from 0 to 360 degrees.

3 2-D CODE READING. Many industries are making the transition from 1-D to 2-D codes, such as Data Matrix or QR Codes. More information can be stored in 2-D codes to help with product traceability throughout the manufacturing process and supply chain. Often, 2-D codes are used in conjunction with 1-D barcodes in the production process. However, laser scanners can’t read Data Matrix or QR codes. In contrast, image-based barcode readers can reliably read 2-D codes as well as 1-D barcodes—even simultaneously.



4 MULTIPLE CODE READING AND OUTPUT CAPABILITY. Not all image-based barcode readers are equal. The best image-based barcode readers use advanced algorithms that can locate and decode multiple barcodes of any type (1-D or 2-D). These barcode readers also allow the user to configure the order of readout to make it easier to integrate the reader into the production process. In many applications, the order that encoded information is output from the reader is very important. For example, it may indicate which test tube the code is read from or which part on a pallet is in which location.

5 LONG-TERM RELIABILITY. Image-based barcode readers have no moving parts and are designed for long-term reliability and low maintenance. Laser scanners use an oscillating scan mirror to move the laser beam rapidly across the barcode, creating the laser line that reads the code. These moving parts often wear out or break requiring repair or replacement of the laser scanner.

6 VISUALIZATION. Image-based readers are inherently different than laser scanners because they take pictures of the products as they go by and locate the barcode within the image for decoding. When the image-based barcode reader is running on the production line, operators have options that allow them to monitor the read rate statistics and look at the images that the barcode reader takes. This performance feedback allows the operator to understand how the system is working and quickly diagnose a no-read.

7 IMAGE ARCHIVING. With a laser scanner, there is no way to understand what happened if the scanner did not read the barcode. The most powerful image-based readers can be set up to archive images of reads and provide performance feedback. Most often, users archive failed reads to understand what caused them to occur for process improvement. For example, the image can be used to see if the barcode was not present or was too severely degraded to read.

8 BARCODE QUALITY FEEDBACK. On many production lines, it is important to maintain the barcode print quality at a high level to ensure that the code can be read by other readers in the product distribution chain. Image-based readers can provide feedback on the quality of the print so the manufacturers can make adjustments before they ship badly printed codes to their customers.

9 COMMUNICATION. Industrial protocols like Ethernet/IP and PROFINET allow image-based barcode readers to be easily integrated into the factory network. Direct communication with PLCs allows both data communication and control to make the reader part of the quality control process.

10 FUTURE PROOFING. While many industries are adding 2-D codes, such as Data Matrix or QR, to provide additional tracking information, not all industries are adopting these types of codes as quickly. If this is the case, it's important to know that some image-based barcode readers help make the transition from laser based to image-based reading easier, with a lower cost model. These readers offer omnidirectional 1-D barcode reading and lower risk with the ability to upgrade those 1-D barcode reading models to enable 2-D codes such as Data Matrix and QR codes.



Edeka benefits from automated, high-speed pallet storage and data capture

IMAGE-BASED BARCODE READERS from Cognex replace laser scanners in German grocery giant's distribution centers.

GERMAN SUPER MARKET CHAIN
EDEKA is investing strongly in new distribution centers. The facility in Berbersdorf, for example, opened in 2015 and has worked successfully thanks in part to the high-level of automation. To ensure smooth operations, Edeka decided to replace their laser scanners with image-based barcode readers from Cognex.

In March 2015, after two years of construction, EDEKA's most modern distribution center located in Berbersdorf opened its doors. The company invested more than 125 million euros in the new 50,000-square-meter building, situated on premises of more than 200,000 square meters.

This new distribution center combines the two Hof and Borna warehouse locations and was designed for high efficiency. The racks are 20 meters high with over 1 million cubic meters of enclosed space available, and the facility is capable of handling up to 400 trucks at the incoming and outgoing goods portals each day.

When the truck arrives at the ramp the portal opens and unloading begins. The pallets are transported by forklift out of the truck to the delivery points, also known as "pick passes." There are a total of 6 pick passes in the dry goods area alone. Around 60 truckloads each averaging 30 pallets need to be processed here every day. Unloading a truck takes an hour on average, which means that there are about two minutes available to move each pallet from the truck into the warehouse.



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Quick and reliable capture of article data

Given the volume of goods received and shipped each day, it's absolutely vital to read and verify the manufacturer labels automatically to ensure that the logistics operation runs smoothly. Cognex DataMan image-based barcode readers read 1-D and 2-D codes extremely quickly and are able to validate the read result immediately.

For this reason, more and more distribution centers are moving away from laser-based devices with complex line scan technology to image-based systems. Cognex DataMan barcode readers facilitate system integration because, thanks to the easy-to-use system interface and simple Java scripting, they can be integrated into the control technology and warehouse management system seamlessly, providing direct connection to the material flow computer.

After entry of the pallet weight and dimensions, it's vital to read and validate the labels containing GS1 codes. GS1 is an organization that issues article numbers, a group to which the EAN International and Uniform Code Council (EAN-UCC) also belongs.

Every pick pass in the dry goods warehouse is equipped with four DataMan 363 fixed-mount barcode readers—two on each side of each pick pass, totaling 64 readers running on a two-shift system every day. The two readers per side jointly cover a very large field of view, allowing them to locate and read the codes no matter the position or orientation of the pallet.

Once the photo eyes have detected the pallet and activated the Cognex barcode readers, the readers identify the labels and acquire the data, even if the conditions are unfavorable. As soon as a label has been read, the DataMan software verifies that the data contained within the code complies with GS1 data formatting rules. If a label is either unreadable or the data does not comply with the GS1 rules, the pallet is rejected and an image of the label is exported via TCP/IP to an FTP network location.

For Edeka, this data has become critical for supplier education on barcode quality and data conformity. It's already improving process quality and performance upstream in Edeka's supply chain with a true approach for logistics 4.0.

Image-based code readers replace laser scanners

It's possible for labels to become damaged during transport or unloading from the truck. Using patented software with Hotbars image analysis technology, Cognex readers decode



The fully automatic high bay warehouse is more than 20 meters high and has enough capacity in reserve.

even the most compromised 1-D barcodes greater than 0.8 pixels per module.

This represents an 8% increase in read rates compared to the previous laser-based system thanks to Cognex readers' ability to reliably read damaged, distorted, blurred, scratched and low-contrast codes and codes with a low height. Not only were laser scanners unable to read these challenging codes, they also did not offer performance feedback available with image-based systems.



The DataMan 363 barcode readers easily read codes under reflective material.

In addition, the DataMan 363 readers are able to read materials covered by reflective, glossy film. This has greatly improved warehouse productivity since, if codes cannot be read, the belt stops and the operator in the receiving area at Edeka has to enter the manufacturer data manually.

Strong benefits for logistics

Image-based readers, like the Cognex DataMan 363, are faster and more flexible than laser scanners. Using high depth of field and a large field of view, they're able to read several codes simultaneously, regardless of the orientation of the label. Unlike laser-based systems that have moving parts that can wear out or fail, DataMan image-based barcode readers have a robust, solid-state design which also means less wear and less maintenance.

DataMan 363 barcode readers are also easier to set up and install. The integrated and controllable lighting and the liquid lens option with adjustable focus enable optimum setup in order to achieve the best-possible read rates.

An intelligent auto-tuning function automatically selects the ideal settings for the integrated lighting, autofocus and imager for every application. This tuning process cleverly ensures that the reader attains the highest read rates possible for 1-D and 2-D codes thanks to the optimum setup, and thus it contributes to a substantial increase of productivity in in the receiving area at Edeka. ➡



Closing Arguments: Image-based scanning by the numbers

THE BENEFITS FOR CONTROL ENGINEERS, OPERATIONS PERSONNEL, AND FACILITY DIRECTORS

IN AN ERA WHERE MAKING THE “business case” for technology investments isn't always easy, image-based barcode scanning stands on its own when it comes to return on investment (ROI).

By making a \$100,000 investment into new barcode reading systems, companies can reduce the number of packages that must be manually reworked and fed back through the sorting machine by 1,141 packages per day, or 399,350 packages per year.

Assuming that a typical operator making \$15 per hour requires 1.5 minutes to rework a “no-read” package, then this investment saves \$149,756 per year, allowing the center to achieve full ROI for its \$100,000 in just eight months.

After two years, this adds \$199,512 in profits to the company's bottom line. With long life cycles, the new image-based barcode readers can add hundreds of thousands to the bottom line year after year with just a 0.9% improvement in read rates.

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In a low-volume DC, the sample numbers are smaller, but no less important to their operations. Consider, for example, the DC that's processing 82,368 packages per day. If barcode scanners fail to automatically read just 2% of the packages passing through the sort machine, that equals 1,647 packages per day, or 494,100 packages per year requiring manual rework. As a result, daily throughput drops from 82,368 to 80,721 packages, reducing annual throughput from 24.7 million packages to 24.2 million.

Using the same 1.5 minutes for a \$15 per-hour operator to rework a package, and an overall read rate failure of 2% of packages, this equates to more than 41 hours per day in additional labor at a cost of \$185,175 per year.

If the fulfillment center invests \$30,000 in new image-based barcode readers, read rates will improve by 1% and the firm saves \$92,587 in labor each year. This, in turn, translates into 100% ROI in just four months—while increasing line throughput by 823 packages per day.

Now, if the same line outlined above was running at 99%, and achieved 99.5% as a result of the upgrade, the savings is still more than \$46,000 per year. This would allow the center to achieve full ROI for its \$30,000 in less than eight months, while increasing throughput to 81,874 packages per day.

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THE CASE FOR CONTROL ENGINEERS: For control engineers, image-based barcode scanning equipment is easy to deploy within the current framework of a company's existing controls architecture. From the integration perspective, Cognex's image-based systems can interact with all industrial POC protocols and don't require converters for installation and use. Plus, device input is much easier to understand versus that of laser-based reading technology, which works off a “reflection.” This makes it easier for engineers to analyze and assess performance, pick up on areas of concern, and optimize their company's hardware for best results. In fact, even a novice installer can troubleshoot and maintain the system with just some basic training.

THE CASE FOR OPERATIONS: For operations personnel, the use of image-based barcode readers translates into fewer packages being handled manually in the DC. As packages pass through the automation system, for example, the system can accurately read a higher number of packages than a laser-based solution, thus reducing the amount of human involvement.

THE CASE FOR FACILITY DIRECTORS: Facility directors also benefit from image-based solutions that—along with all of the positive results mentioned above—also ensure a smooth-running operation that runs at a higher level of efficiency and with better throughput and predictability. This, in turn, translates into increased brand trust and happier customers who get their orders on time.

As the numbers show, capital equipment improvement programs that increase read rates are solid investments that have short ROI schedules and have a positive impact on profits over time. As DCs and warehouses look to improve profits and throughput, more effectively deal with the demands of the omni-channel distribution environment, and position themselves for expected higher demands in years to come, image-based barcode readers can help to achieve these goals. ➡