

2D Barcodes 101: The Advantages of Adding a New Dimension





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Barcodes have become an increasingly essential element of manufacture and commerce ever since the first Universal Product Code (UPC) barcode was scanned on a pack of gum in 1974. Now, barcodes can be found on everything from consumer goods, mailing labels, and coupons to driver's licenses and airline, train, or concert tickets. They convey complex data in a compact, machine-readable format. GS1, an organization that helps to establish global standards for barcodes, estimates that there are currently more than 5 billion barcodes scanned every day.

Barcodes have evolved in recent years, and a growing number of businesses are upgrading to matrix or two-dimensional (2D) barcode technology. This switch can offer your warehouse significant advantages over a system of 1D labeling and scanning for data collection.

What are 2D Barcodes?

Instead of only storing data vertically, 2D barcodes store data both vertically and horizontally. 2D barcodes are usually square or rectangular and often consist of a grid of black and white "dots" in varying patterns. Some 2D barcodes, however, are a series of lines resembling 1D codes.

Because 2D barcodes can store information both horizontally and vertically, they can hold much more data than 1D codes and in a smaller space. An average 2D barcode can contain up to 2,000 characters, or about 100 times more than a 1D code. In fact, one type of 2D code, PDF417, can store the entire Gettysburg Address in a 1"x1" space. It's even possible for 2D barcodes to include encrypted information for extra security.





Just as there are several different types of 1D barcodes (such as UPC, MSI, Code 25, and EAN-8 or EAN-13), there are also many forms of 2D codes. Some of them may look similar, but they are encoded using different machine languages. Each type has its own symbology, which is a map or key to decoding the information the barcode contains. If a scanner supports a particular symbology, that means it can read that type of barcode.

Some common 2D barcodes include:



QR Code

QR, or quick response codes, were initially designed by Denso Wave (a Toyota subsidiary) for use on car parts, but they are used much more widely today. They can encode images, music, and URLs as well as text and binary data. They are identifiable by the finder patterns — larger squares that help the scanner find and orient the barcode — in three of their corners.



Aztec

These codes have a single bullseye finder pattern in the center. Unlike QR codes or data matrix codes, they do not need a quiet zone, or area of white space around their outer edges, to be read properly. Therefore, they display better on consumer cell phones and have faster scan times.



Data Matrix

These codes are especially good for smaller items (such as electronic components or prescription medications) because they can fit a lot of data in a tiny space. They are also scalable up to as large as a 3-foot image on a billboard. They can be marked directly onto manufacturing components.



PDF417

These 2D codes are used often on driver's licenses and other identification cards and can store a great amount of data. A PDF417 code on a shipping label, for example, can include many specific product details for more efficient put-away and record-keeping.

All of these 2D barcode symbologies are in the public domain. There are others that are proprietary or privately owned and only readable by software developed by the owner. The barcode choices that are best for a particular company will depend upon the amount and types of data to be encoded.



The Differences Between 1D and 2D Technology

There are several limitations to 1D barcode technology that are overcome by 2D barcodes. Laser scanners used for reading 1D barcodes can only read 1D codes on printed media. They are not able to read codes displayed on screens or digital media, and they cannot read 2D codes. Warehouse staff must also hold a 1D barcode scanner at a specific distance and angle from the barcode in order to read it correctly. In addition, if a 1D code is damaged in any way, it cannot be read, and the data may be destroyed.

2D barcodes are read with 2D imagers, which far outperform laser scanners. When imagers were first introduced, they were offered at a significantly higher price point than 1D laser scanners, but now prices are comparable — and imagers provide more for the money. Imagers use camera technology that makes them capable of reading both 1D and 2D barcodes. Moreover, they can read barcodes on both print and electronic media; this allows you to send and read 2D barcodes on a smartphone or other mobile device. Imagers can also read direct parts marks (DPMs), documents, and images, and support optical character recognition (OCR) for reading numbers and signatures on checks, invoices, and more. This flexibility is especially beneficial for manufacturers and warehouses that use multiple symbologies.

Unlike laser scanners, imagers are multidirectional. The imager does not have to be aligned directly with the barcode in a certain orientation, so scanning can be done more quickly and efficiently. Imagers can also be used at greater distances and can read codes that are under plastic packaging or pallet wrap.

Both 1D and 2D barcodes have error detection functionality, so a code that cannot be read properly because of damage or tampering will be rejected. But 2D symbologies also has error correction — the ability to read and extract data even from barcodes that are scratched, smudged, or partially torn away. Just as the human brain can still read words with letters that are partially obscured or missing, a 2D imager can process enough of the remaining data to fill in what's missing.





The Advantages of 2D Barcodes in the Warehouse

The enhanced capabilities of 2D barcodes and imagers make them an excellent choice for manufacturing and warehouse environments. There are many benefits to upgrading to 2D from 1D barcode technology:

Streamline Shipping and Receiving

Shipping labels may include both 1D and 2D barcodes, so the ability to read both types and a variety of symbologies with a 2D imagers can make processes more efficient. Receiving components from a partner that uses a different barcode type? No problem! Imagers can read multiple barcodes and populate multiple data fields with a single scan. And since 2D barcodes can contain more information, labels can provide more accurate and detailed data to streamline recordkeeping.

Boost Pick and Pack

Shelf labels, product labels, and other labels with 2D barcodes can make it easier to find the right items. 2D barcodes can hold more information in a smaller footprint helping to increase pick and pack speed and accuracy — and increased speed and accuracy can lead to greater customer satisfaction.

Track and Trace Components

A 2D barcode can include many important details, such as serial number, lot number, plant location, and date of manufacture, providing thorough records throughout the product's life cycle. And when this information is readily available, it's easy to quickly locate and pull bad or recalled lots.

Track Production with Work in Process (WIP)

Partially finished products can be tagged with barcodes at different stages of production, allowing managers to monitor productivity and workers to make sure the right part is in the right place at the right time.

Increase Efficiency and Productivity

The multidirectional readability of 2D barcodes makes scanning faster but still highly accurate. An item on an upper shelf can be read without the worker having to climb a ladder and line up the scanner in a specific way. A single scan can also accommodate multiple barcodes, rather than having to handle each separately.



Manufacturing facilities and warehouses also have the choice of selecting rugged 2D imagers, such as the DS3608 Series from Zebra Technologies, that resist damage from water, exposure to dust or dirt, extreme temperatures, or a drop to a hard surface. Rugged imagers also have features that make them ideal for industrial environments such as long-range scanning and the ability to capture multiple barcodes with one scan.

Overall, 2D barcodes increase productivity, efficiency, and accuracy, while lowering cost and eliminating waste. With the many advantages of this technology, and the comparable prices of 2D imagers, more manufacturers and warehouses are choosing to migrate from 1D to 2D barcode technology.

It takes careful evaluation of your operation, however, to know if upgrading from 1D to 2D will have an ROI for your business. Before you make a decision on such an investment, it's wise to speak with experts who can help you weigh the options and make the choice that will best fit your needs. Barcodes has an entire staff of barcode specialists ready to share their knowledge of data collection products, software, and services. For more information, visit Barcodes at www.barcodesinc.com.



About Barcodes

Barcodes is an industry-leading integrator of business solutions across barcoding, card, and GPS applications. From device configuration to network provisioning, equipment staging, kit delivery, solution implementation, and ongoing support, we make sure the solution addresses your business' unique needs.

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About Zebra Technologies

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