

The Benefits of
Omni-Directional
Imaging Scanning
Technology in Retail
Point-of-Sale Applications

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Introduction

Few developments have affected the enterprise's supply chain as the ability to automatically capture bar code data. This is especially true at the point-of-sale in the retail industry. Capturing and analyzing bar code data has enabled significant operational efficiencies in ordering and inventory, merchandising, checkout productivity and customer service. The retail checkout was forever changed in 1974 when the first bar code was scanned at a grocery store in Troy, Ohio (U.S.A.) with a scanner manufactured by Datalogic Scanning, Inc. Over the past three decades many changes and advances have been made in scanning technology that have increased scanning speed while also improving accuracy and usability.

Current Technologies

Historically, there have been essentially two categories of technologies employed to read bar codes at the retail checkout: lasers and imagers. Laser bar code scanners employ either a single or multiple visible light lasers and either move the laser beam in ways to create an individual scan line or reflect the laser beams from strategically placed mirrors to make various "patterns". The objective in either case is to create a scan line or lines that will span the width of the bar code and transmit the reflected light variances from the bars and spaces of the bar code to a light collection device that the scanner then decodes and transmits to the host terminal. One advantage of laser scanners is their ability to capture bar codes that move through the scan zone at high speeds, which can approach 100 inches per second (IPS).



Figure 1: QuickScan® QS6500BT Handheld Scanner



Figure 2: Magellan® 8500 Bi-optic Stationary Scanner

Because of this capability, laser scanners, in certain configurations, are especially suited to high volume checkouts like those found in supermarkets. There are three basic types of laser scanners: single line, used primarily in handheld scanners; single plane using a pattern of scan lines that are created by reflecting the laser from a series of mirrors; and bi-optic, essentially two single plane scanners combined to form both horizontal and vertical planes. Bi-optics and single plane scanners can read part of a bar code label with one scan line



Figure 3: Magellan® 1000i Presentation Scanner

(or one plane) and part of the label with another and combine or “stitch” the label fragments together to decode the entire label.

Imaging scanners operate somewhat like a camera. They capture a “picture” of the label, and unlike laser scanners have no moving parts (motors or mirrors). Imagers are primarily available in two types. The first type, linear imagers, capture a “picture” using a single row of pixels and then use a processor to decode the label “picture” and transmit the decoded bar code data to the host terminal. Linear imagers must be aligned along the perpendicular axis of

the bar code, a characteristic that has mostly limited their use to handheld scanners.

Array imagers, the second type, are even more like a camera. The array imager captures a picture of the entire bar code, in any orientation, and its processor re-oriens the data picture and decodes the label. Array imagers usually have the additional ability to decode 2D bar codes. Array imagers are typically more expensive than linear imagers and are primarily used in handheld scanners. Like cameras, imagers need a light source to illuminate the bar code. These light sources are usually Light Emitting Diodes (LED's). Also, like cameras, imagers are more susceptible to motion (which can blur the image) than lasers are. Therefore, imagers have traditionally been used in handheld scanners where the scanner is brought to the bar code to minimize relative motion between the bar code and the scanner.

Presentation Scanners

In addition to handheld, single plane, and bi-optic scanners, there is another type: the presentation scanner. Presentation scanners are typically used in retail checkout environments that have a relatively small number of items per transaction such as convenience stores, drug stores, and certain specialty stores.

The distinguishing characteristic of these environments are transactions that are made up of mostly small to medium-sized items where the most operationally efficient method of scanning is to bring (or present) the item to the scanner. It is also required in these environments that the operator need not orient the bar code to align with the scan pattern, hence the term, omni-directional scanner.



Figure 4: Magellan® 1400i Presentation Scanner

Because these environments occasionally sell large, heavy, or bulky items, it is necessary that the presentation scanner also have a size and shape that is ergonomically capable of being picked up and used as a handheld scanner.

The Concept behind Datalogic's Omni-Directional Imaging Scanners

The Datalogic Magellan® 1000i and Magellan® 1400i scanners are the market's first omni-directional imaging presentation scanners. Before the technology behind these innovative scanners became available, the ability to scan a bar code in any orientation was limited to either a laser using a series of mirrors that created a pattern of intersecting scan lines or an array imager that captured a picture of the entire bar code.

The Magellan presentation scanners have all the benefits of a laser-based presentation scanner without the moving parts required to create a pattern of scan lines. Essentially the Magellan presentation scanners take a "picture" of the label with a digital scan pattern having lines that are one pixel wide. This vastly reduces the processing required versus that needed to decode a full two-dimensional image. Imagine looking at an object through a picket fence. Without seeing the entire object your mind is still able to recognize and identify the object.

Virtual Scan Lines

The Magellan 1000i and Magellan 1400i scanners use these virtual scan lines, which accurately, aren't lines at all but "pictures" taken along the lines. The combined pattern of these virtual scan lines is actually formed by cycling through four differently positioned pattern layouts every 100 milliseconds. A single pattern from the Magellan 1000i is depicted in Figure 5. The complete composite pattern for the Magellan 1000i, which scans approximately ten times a second is depicted in Figure 6.

As soon as the Magellan omni-directional presentation scanners have captured enough of the bar code, they decode and send the data to the host terminal. That recognition may occur during the first, second, third, or fourth pattern. Bar codes are viewed using a lens, designed for extended depth-of-field and efficient light collection.

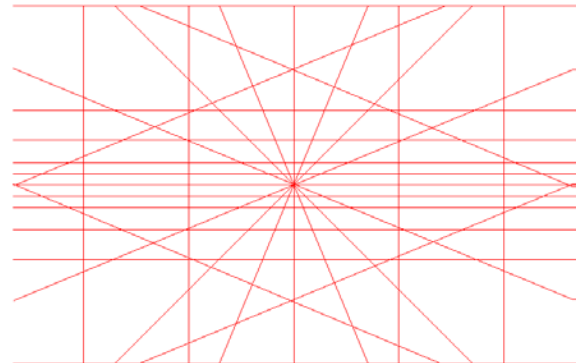


Figure 5: Omni-Directional Imaging Pattern One

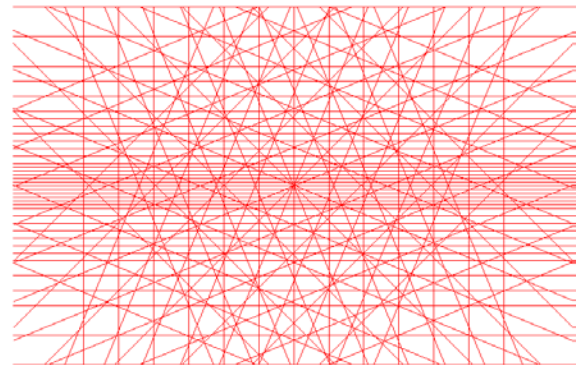


Figure 6: Combined Omni-Directional Imaging Pattern



Figure 7: Omni-Directional POS Pattern

Illumination, required for imagers and somewhat akin to a flash for a camera, is provided by using an array of LED's. In order to read bar codes at high sweep speeds, the LED's are pulsed once per frame during the imager's exposure time. The LED's are pulsed at a high frequency, primarily to reduce motion blur, but also to avoid any flicker effect that could be visible to the human eye. The captured image is then enhanced in the processor along the virtual scan lines and decoded.

What does this mean for the user? Because of this dense virtual scan line pattern, the Magellan presentation scanners have outstanding speed and first-pass read rates which improve productivity and make it easy to scan in any orientation. Because of the two different types of pulsed illumination, these scanners have a closely defined depth-of-field and read very well throughout their range. Unlike traditional imagers, the Magellan presentation scanners are also very good at reading items swept through their scan volume which allows them to adapt to the user's scan technique; either sweep, presentation, or a combination. Unlike traditional lasers, these omni-directional scanners accomplish all this without any moving parts which renders them extremely durable and reliable.

Presentation Scanner Use Environments

The Magellan 1000i and Magellan 1400i scanners are designed for convenience stores, drug stores, specialty stores and other medium volume checkout environments. The Magellan presentation scanners' solid-state construction increases reliability while the ultra-small size frees up valuable counter selling space.

Common requirements and constraints of these retail checkout use environments include:

- Relatively small counter space, which necessitates minimizing the scanner's footprint; both to save room for items the consumer places on the counter and to free up additional revenue producing space for counter displays of higher margin items. Magellan presentation scanners have a very small size and footprint, allowing optimum placement on the checkout counter while maximizing available high margin selling space
- Relatively low number of items per transaction, where a single plane or presentation type scanner is adequate to maintain acceptable checkout productivity. Magellan presentation scanners are performance-optimized to be very productive in medium volume checkout environments by enabling omni-directional scanning while maintaining the balance between cost and value.
- Primarily smaller-sized items that lend themselves to be picked up by the cashier and either "presented" to or swept past the scanner. Magellan presentation scanners match cashier scanning styles by allowing them to either "present" items or "sweep" items past the scanner's window.



Figure 8: Magellan® 1400i Presentation Scanner

- Occasional larger items that are either too heavy or too cumbersome for the cashier to orient towards a presentation or single plane scanner. While excelling in presentation mode, Magellan presentation scanners —because of their small size, light weight, and rubberized grip area — enables the checker to easily use them in the handheld mode.
- A relatively high incidence of hard-to-read bar codes is caused by very small bar code labels, crinkled or folded codes, items from smaller manufacturers, or in-store printed systems that may lack normal label quality. Decoding software in the Magellan presentation scanners allows fast and reliable reading of even the toughest bar codes

Summary

The Magellan presentation scanners incorporate omni-directional imaging technology that provides aggressive performance in a space saving design. These scanners excel at capturing hard-to-read bar codes omni-directionally and support both presentation and sweep scanning styles. They also offer an optional targeted scanning mode for scanning close proximity bar codes like those on a Price Look Up (PLU) list.

Designed for “small-counter” retail environments, the Magellan 1000i and Magellan 1400i scanners incorporate several design wins for the user. The design objective was simple: improve checkout productivity while protecting the customer’s investment by adding capabilities that would extend the typical life of the scanner. Datalogic has developed a bar code scanner with outstanding ergonomics especially when handheld use is required, and has an excellent price-to-value ratio.

Datalogic’s imaging technology has no moving parts, providing excellent reliability and durability. This technology has a significant software component that makes adding features and enhancements much easier. Magellan 1000i and Magellan 1400i scanners have Datalogic’s multi-interface support built-in, allowing the user to select a new interface with a simple program parameter change and a cable switch.

The Magellan 1000i and Magellan 1400i omni-directional imaging presentation scanners provide an excellent performance value with outstanding reliability in a small and ergonomic space-saving package.



Figure 9: Magellan® 1000i Presentation Scanner with and without stand

About Datalogic Scanning, Inc.

Datalogic Scanning, Inc., an autonomous division of Datalogic S.p.A., is the recognized worldwide leader in retail fixed position scanners and hand-held scanners. Datalogic Scanning leads the market with its flexible, responsive customer service and offers a broad array of technology, products, and services in the retail automation and automated data-capture market. Datalogic Scanning products and services support multiple industries throughout the retail supply chain, distribution channel, manufacturing, government, healthcare, banking and finance sectors.

Datalogic has developed a worldwide network of over 500 partners in over 40 countries, selected and qualified to offer the highest level of services and solutions in the industry. With a presence in over 100 countries, the headquarters, primary development, marketing, and major manufacturing facilities for Datalogic Scanning are located in Eugene, Oregon, USA, while sales and service offices are located throughout the Americas, Europe, Asia, and the Pacific Rim.



Figure 10: Magellan[®] 1400i Presentation Scanner



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