Unlocking the Promise of Embedded Barcode Readers and Other Data Collection Tools

A RESCO Electronics Webinar

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Barcodes and the readers designed to decode them are a well-known, structured system of data collection. They are based on the idea of turning a printed pattern of information into a usable piece of data, and are widely used by most businesses in every corner of the globe.

Embedded barcode readers, as the name implies, are readers that are embedded within machines and kiosks. Unlike hand-held readers which are moved by hand to the barcode, embedded readers are typically in a fixed position and the barcode or object with a barcode on it, is moved to the reader. In the case of kiosks the object is typically presented by a person. For machines the barcoded object is typically automatically conveyed past the reader.

Embedded barcode readers combine mechanical components, electrical components, and software. These three aspects of engineering must operate properly and cooperate harmoniously in order to achieve a reliable and efficient reader.

Successfully introducing embedded readers in a host application involves the indispensable stages of design and prototyping. The design stage of any embedded reader project is very important because it answers the most critical questions regarding its overall operation:

- What kind of data needs to be read?
- What kind of label is required?
- How much data needs to be read?

The amount of data ultimately determines whether a 1D (1-dimensional) or 2D (2-dimensional) barcode reader will be used. 2D labels contain more data than 1D labels and are therefore the route of choice for more complex applications. Let's break down the difference between the two:

1D Embedded Readers

1D barcodes is the older of the two technologies. There are two types of 1D readers:

1. **1D laser readers**. These can read large size labels from a long distance in a wide variety of lighting conditions. Because of the potential for damage if a laser has the potential to come in contact with someone's eye, there can be labeling and reporting requirements when using a laser based scanner. This reporting requirement varies based on the strength of the laser.
2. **1D CCD readers.** These are very reliable and do not have the same use limitations as do laser readers as far as reporting. They have limitations in the reading distance and the label sizes.

2D Embedded Readers

While barcode scanning technology has existed for more than 30 years, 2D barcodes have only found wide use in recent years. 2D readers are essentially digital cameras but with software that has the ability to "see" and decode the image. 2D readers are available in two basic configurations:

1. **2D scan engines:** These readers consist of a scanning head and a separate decoder board. The board and the scanning head need to be in close proximity and any project using this configuration must take into account the communication bus between the two.
2. **6-Position 2D readers:** These are single assembly readers that contain both the scanning head and the decoder board. For this reason, 6-position readers are regarded as off-the-shelf components.

Considerations for Successful Scanning Implementations

Every barcode scanning project has to take into account mechanical, electrical and optical aspects. The following are some important design elements to consider:

- **Scanning distance and mounting.** Every reader type has a maximum scanning distance that has to be respected. This holds for both stationary and hand-held/portable applications.
- **Scanning angle.** Despite the popular belief that readers have to be positioned perpendicular to the barcode surface, such an orientation will lead to an effect called “specular reflection”. In effect, the direct reflection from the laser (in the case of a laser reader) or light source (in the case of a CCD reader) can blind the reader. Therefore, the embedded reader should be mounted with a small angle from the perpendicular up to a maximum of about 13^{o}.
- **Power supply constraints.** Providing continuous and uninterrupted power to the reader is essential and must be ensured even for portable and hand-held applications.
- **Data interface.** The two main data interface options are USB and RS232. USB is newer, faster and now more widespread in use than RS232, so it represents a more future-proof choice. RS232 should be the protocol of choice with older legacy equipment that offers no alternative connectivity options.
- **Extra features.** Integrating extra reader features increases system complexity but adds more value for customers. The sensors of 2D readers are ideal machine vision tools, while the lasers of 1D readers can perform tasks like distance measuring or liquid level sensing.

Latest Trends with Embedded Scanners

The introduction of 2D readers just a few years ago has brought significant performance improvements over that of older 1D readers. The following list highlights the main benefits offered by the new generation of readers:

- **Higher reading speeds.** Reading more data via better sensors, optics and software algorithms is a primary development that has led to higher throughput in the host applications.
- **Simultaneous barcode reading.** 2D readers have digital sensors that allow simultaneous barcode reading and processing (typically up to six barcodes), further increasing throughput.
- **Added functionality and simplicity.** Despite increased complexity, the integration of extra functions like machine vision or distance measuring

simplifies client equipment needs, increases throughput and further lowers capital and operating costs.

- **Lower system costs.** Higher data speeds, more widespread use and multi-functionality have all led to lower system costs and are making 2D readers increasingly cost effective.

Application design engineers now have more embedded reader options than ever before!

Consequences of a Bad Reader Choice

Choosing an unsuitable reader for a particular application always has undesired consequences. Beyond a reader simply not working at all, the two main issues are:

1. **Erroneous data.** The most serious problem of scanning arises when we have an erroneous but believable data reading. The result we obtain is quite different to what we are actually trying to read. The consequences can range from annoying to catastrophic. A good example is that of medical applications where the health or life of a patient is at stake and even minute mistakes and wrong decision making can have grave results. Therefore, beyond following a reliable route in selecting the right equipment, it is also essential to configure the reader correctly.
2. **Low system efficiency.** When readers are used to near or beyond their maximum operating range, accuracy and throughput will suffer. In an environment like industrial applications, the reader can then become a bottleneck that has the adverse effect of lowering overall productivity. It is important to correctly define the conditions under which a reader will be expected to perform and choose a reader that can consistently operate in that environment.

How Can RESCO help?

RESCO Electronics has 30 years of experience in the barcode reader industry with an extensive background in clinical chemistry, pharmaceutical, and industrial embedded applications. RESCO has worked on a wide variety of projects and

gone through most or all of the challenges of the design of embedded reader systems.

As a result, RESCO has all the knowledge and tools to help application design engineers work through challenges, avoid pitfalls, and arrive at efficient and reliable data scanning systems. In addition, RESCO provides full support from design to prototyping to production.

To learn more on embedded barcode readers:

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