Scanning in Manufacturing

Barcoding was first patented in 1952, so it is a well-established and evolving technology. The need to have a part in the right place at the right time for the Just In Time (JIT) inventory process and Make to Order (MTO) production strategy, has been the ideal condition for implementing barcode scanning to improve efficiencies and accuracy.

Organisations that have integrated the use of barcode scanning into their processes receive multiple benefits, including cost savings, better information and traceability. Barcode technology can accurately capture data almost instantaneously in contrast to how long it takes to manually enter information. Instead of a warehouse worker keying in a part number, then re-keying it, and then perhaps entering the wrong part number, they just grab a handy barcode scanner and trigger it for a correct part number. Sometimes barcoding is mandatory to meet customer or regulatory requirements. Beyond this, the benefits include improved real-time data collection for management reporting, increased accuracy in data collection, and traceability.

Barcode scanners can streamline operations and enable efficiency for high volume production lines without user intervention, providing high-speed and hands-free scanning for applications in manufacturing and logistics operations such as automatic part tracking and label validation (ensuring every part / package has the correct label and that the label is readable). Other applications include airport kiosks, retail POS (Point Of Sale), grocery store checkout, hospital and healthcare for drug dispensing and for the traceability of medical instruments in operating theatres.

There is some regulatory requirement, particularly in the pharmaceutical industry, to facilitate reliable identification and tracking of their products, whilst other industries can benefit from improved tracking of products to assist in data logging for safety and warranty issues.

Types of Barcodes in Manufacturing

There are multiple technical standards for barcodes; using the wrong one may affect your future ability to use the barcode or meet requirements of customers. Consider the following:

- Symbology: There are hundreds of barcode symbologies, but only a small percentage are in use today. Some symbologies were designed for different industries and applications. Each has unique characteristics that appeal to different users. You need to pick a symbology that works with your software, barcode scanner, and printer. You also must consider the type and amount of data to be encoded.

- 1 Dimensional Barcodes: these are the traditional linear barcodes you are most likely to see, and include UPC codes, Barcode 39, 128, etc. and you only need to scan across the barcode, observing the width and distance between the vertical bars to interpret Symbology

- 2 Dimensional (2D) Barcodes: these two-dimensional matrices of black and white "cells" vs. bars are commonly used for small parts and products, as they can encode up to 50 characters into tiny barcodes, readable at sizes as small as 2mm. Examples of a 2D code are the Data matrix and the QR code we are all familiar with, especially since the pandemic! 2D barcodes are more damage-resistant than 1D barcodes. The need for anti-counterfeiting has seen 2D barcodes used to mark all pharmaceutical products with a unique code to enable each individual pack to be traced from manufacture, through the supply chain, all the way to the pharmacy counter where it is dispensed to the customer.

- RFID: these are not barcodes, but radio frequency tags embedded in the product that a radio scanner can read.

- Direct Part Mark (DPM) is a process to permanently mark parts with product information including serial numbers, part numbers, date codes, and barcodes. This is done to allow the tracking of individual parts through the full life cycle such as in the aircraft industry. The DPM barcodes are commonly laser etched onto metal parts.

- Optical Character Recognition (OCR) to be able to scan and capture a combination of text and barcodes.

- The barcode could be displayed Direct Part Marked, on a Printed Label, or on a Mobile Phone or Computer Screen.

Hardware Needed for Barcode Scanners in Manufacturing

You will need hardware and infrastructure to support Barcoding in Manufacturing: invest in good equipment; scrimping in here will cost you later.

You will need good barcode printers. Whilst you can use dot matrix printers, these are problematic. Focus on three things: clean prints, long lasting ink, and good adhesive properties. Any problems in these areas will compound later and make product identification and scanning difficult. Good barcode printers include thermal printers available from Zebra. These printers are industrial strength and pay for themselves in the long run.

And finally, you will need **good scanning devices**. These may include handheld devices from Zebra (Symbol), Honeywell (previously Intermec) and Datalogic, and also mounted scanners, such as from **Omron** (previously **Microscan**), which can scan many times a second on a conveyor.

Choosing a Barcode Reader/Scanner

Scanner Type

Aside from knowing whether you want a fixed mount or handheld scanner, one of the most important concerns when choosing a suitable scanner is the type of scan engine it has. There are 2 main types of scan engines:

- **Laser**
  Laser Scanners read 1D codes. These are usually characterised by the visible red line (or multiple lines) that scan across the lines of the barcode.

Pros	Cons
~ Easy to setup, ~ Very fast scanning rates, ~ Ideally suited to fast moving production lines, ~ Scanners with multiple lines are better at reading barcodes which might be slightly damaged / poorly printed, ~ Well proven technology resulting in low cost and high reliability.	~ Any given laser line has to bisect all the lines of the barcode at any given instant, therefore, they can realistically only read barcodes which all have the same orientation. ~ Cannot read 2D codes, ~ Contain moving parts, so eventually wear out and susceptible to damage if dropped.

- **2D Area imager**

  Imagers are camera-based barcode readers.

Pros	Cons
~ Can read 2D and 1D barcodes	~ More difficult to setup
~ Rotation independent – can read barcodes in any orientation	~ Sometimes cannot cope with fast moving parts due to blurring caused by motion
~ Sometimes better at reading damaged / poorly printed barcodes	~ More difficult to maintain the software settings requiring more skill in the end user
~ Can also contain other machine vision tools such as Optical Character Recognition and tools to check features such as label position and straightness,	
~ No moving parts so long lifetime	

Connectivity

Every scanner has to communicate with a host. Some scanners can be programmed with the expected barcode and then they compare each subsequent barcode to the original. They then simply have to output a Pass / Fail signal which is simple digital I/O. Other applications need the scanner to transmit the decoded information into the software that you are using. The two main ways scanners communicate this are:

- Wired - Ethernet, USB or Serial (RS232 or TTL)
- Wireless (Bluetooth)

Readability

Fixed mount scanners are generally used in automated environments where the barcodes are being presented to the scanner. Several factors can affect the ability of the scanner to read a barcode:

- Orientation (Vertical, Horizontal, Variable)
- Motion Tolerance (Scanning Speed)
- Read Range and Field of View
- Barcode Quality

Triggering

A barcode scanner needs to be illuminated in order to scan a barcode. The most common operation modes for fixed mount scanners are:

- Presentation (always on)
- Sensor (by motion)
- Controller (by software)

Mounting Options

If you require a mounted scanner, there are a few options to enable hands-free or automated scanning operation: Brackets, Stands, Kiosk, Mounting Kits

Environment

The environment will determine several factors about the type of barcode scanner you need. Industrial or rugged barcode scanners are designed to be durable and reliable even in harsh conditions including: Dust, Moisture, Temperature, Chemicals, Lighting

How do I get started with Barcode Scanners in Manufacturing?

You should now have a good idea of the considerations, but below are some steps to follow:

1. Check your ERP (enterprise resource planning) software – see what built in capabilities or requirements exist to integrate bar code scanners in your ERP/MRP/Line of Business Application.

2. Check with your Suppliers, Customers, and any government or industry compliance requirements. This will speed your ability to work across organisations and increase the value of your external relationships.

3. Purchase the needed equipment or software:
   1. Purchase quality components – cheap knock-offs are always out there at tempting prices but unreliable equipment will severely impact the process and become a hindrance to the process, removing all of the expected value.
   2. Consider the support offered by a vendor – will they be there for you if things go wrong?
   3. Consider expandability and flexibility – the ability to print or scan other barcode formats later can be helpful when you want to work with a new customer or expand capabilities.
   4. Consider Security – You will have more devices on the network, and any device represents an entry point for viruses, malware, or malicious activity. Make sure the device is secured and can be managed by the IT support team.
   5. Wireless Expansion – if you decide to go down the wireless route a solid wireless network is essential, so make sure every area where scans may occur have solid, reliable Wi-Fi access.