# Considerations for Use of Data Acquisition Technology in Harsh Industrial Environment

## Background

Data Acquisition is essential in asset transactions for tracking, managing, and monitoring data. The volume of assets is growing at an exponential rate. It runs in thousands for small companies, hundreds of thousands for medium enterprises, and in millions for large corporations. On top of this, for returnable assets like industrial gas and LPG cylinders, the process is repeated multiple times during receiving, filling, issuing, and tracking.

During data acquisition, one must read the asset identification number, write it on paper, read it, enter, and validate it in the asset tracking system. Typical transcription errors occur during manual acquisition resulting in the need to go back to asset and re-read the asset identification to correct the error.

Manual data entry leaves a lot of room for error. People in the industry know that reading, writing and entering asset data take up much of their workers' time. Today, people are not available to do this kind of tedious, repetitive and manual error prone work. When you have numerous people throughout the company inputting and reviewing asset data, there are going to be mistakes. The manual data entry process is repeated multiple times during receiving, filling, issuing, and tracking. As assets grow from hundreds to thousands, the errors grow exponentially. Up to 20% of manual entries are incorrect, and this sets a chain reaction with the result that neither you nor your customer trusts your data. These errors aid in losing the asset and results in low productivity and big losses to the bottom line.

# Current Environment


Today, it is not only about asset tracking and management, stopping losses, or identifying slow movement; it is more and more about visibility and traceability of the asset during manufacturing, movement through logistics and supply chain, delivery to end user, and servicing the same. Companies must be able to track the asset at any point of time and ensure that unscrupulous people in the supply chain may not insert fake\duplicate assets in the distribution. Both the company and the end user suffer and pay for this – the company unnecessarily earns a bad reputation and a tarnished brand image – the end user pays for the quality asset but gets a fake. End users are now demanding confirmation about the genuineness of the asset and want to ensure the same by being able to view tracking information of a physical asset's chain-of-possession from manufacturing to delivery.

Creating, managing, and auditing accurate asset tracking is a time consuming, disruptive process that can pull valuable employees from their normal jobs. Implementing an automated data acquisition solution can dramatically reduce the time and manpower required to identify an individual asset, provide better visibility, and optimize usability.

# Data Acquisition Technology

Current auto identification-based data acquisition technologies include Barcode and Radio Frequency Identification (RFID). There are two components to the technology –
1) The label to identify the asset and
2) The device to read the label and decode the identity.

Barcode labels are easy to produce, have an initial low cost, and are preferred for indoor environments. The price of labels vary and the price increases when factoring in harsh environments, resistance to heat, cold, moisture, UV light, and rough handling. Handheld barcode scanners are also simple to use, highly portable and very affordable. However, barcodes do not provide a unique identity, may be easily duplicated\faked, may become unreadable as they are prone to ripping\scratches, may be covered with soiled or by oily film and may periodically fall off or get mutilated.

RFID is the next generation of AutoID and overcomes the issues associated with barcode labels. Each RFID tag has a unique number that may not be duplicated. Since RFID tags do not need a direct line of sight, they are encapsulated in materials that are able to withstand the harsh environments. As the cost of scanning devices and tags continue to drop, many consider RFID to be the future, claiming that traditional barcoding will soon become obsolete. Some issues exist with regards to radio interference, scanning of another item, or missing a scan. Global RFID standards and the ability to acquire data without line of sight has made it the only viable technology for automated tracking solutions. Both barcode and RFID technologies bring their own advantages, disadvantages and benefits. RFID a lower Total Cost of Operation (TCO) and excellent Return on Investment (ROI), however, may be costly initially.

# Comparision

| BENEFITS & FEATURES | BARCODE | UHF RFID |
|---|---|---|
| Unique Identity | No | Yes - Digitally Unique Identity Code (UIC) embedded on microchip that may not be changed |
| Stop Counterfeit | No | Yes -May not duplicate |
| Ease of Use | Simple - Peel and attach | Simple to Moderate – use case based |
| Initial Cost | Moderate - Paper labels and Scanners – Suitable for low value items | Moderate to High – use case based Indispensable for high value assets |
| Total Cost of Operation (TCO) | High - Recurring cost to identify and replace labels | Low - Attached permanently |
| Return on Investment (ROI) | Low - Do not detect counterfeit labels – not able to protect brand identity | High - May not counterfeit – iron-clad protection for brand identity |
| Use in Harsh Environment | No - Environment sensitive; Generally, degrade when used, stored, or handled in a non-office environment | Yes – Withstand Harsh Environment - Chip encased in high resistant material as per requirement |
| Lifespan | Limited – Easily degradable and for use in non-industrial environment | Multi-year - Embedded in a protective casing |
| Physical Size | Larger - Very sensitive - Aspect ratio of a barcode's length vs. width is critical to its operation | Small - Use case based - Aspect ratio of a tag's length vs. width is very flexible and not a significant factor |
| Traceability | More suitable for entire class of products than identification | Combination of unique identity + user data, suitable to track, recall or document the life span of a single asset |
| Line of Sight | Scanner must "see" the barcode label to read it | Does not require line of sight |
| Manual Orientation | Manually required to re-orient the device to match barcode position | No orientation required |

| | | |
|---|---|---|
| **Scan Range** | Inches | Range in feet through dirt, oil or snow |
| **Remote Scan** | No | Yes - allows automation - may not need any human involvement to operate |
| **Simultaneous Scan** | No – read one at a time individually | Yes – Scan multiple items at once providing exponential gains in output |
| **Speed** | Slow – Read one at a time | Fast - Very quick - easily scan a lot of tags in a shorter period |
| **Data Security** | No | Yes - Data may be encrypted and password protected |
| **Dynamic Data Update** | No - once printed it remains frozen | Yes - may be re-written with on-board user memory for additional information retention - store product calibration history, preventive maintenance and other information. Updates may be made quickly and automatically without human intervention |
| **Product Code** | No - Major vertical markets such as Retail have created standards which are excellent at coding product type and manufacturer. Including information beyond these basic parameters is not feasible as the size of the barcode becomes too large and price is higher | Yes - Digital data stored and provides a significant capability to encode:<br>1) Tag originator<br>2) User data needed<br>3) Serial number |
| **Geo Location** | Yes - GPS enabled scanning device - capture GPS coordinates on every scan | Yes - GPS enabled scanning device - capture GPS coordinates on every scan |
| **Accuracy** | Good | Good – Auto electronic data acquisition eliminates manual data entry and transcription errors - that may be as high as 20 percent |
| **Proof of Receipt** | Yes – Scanner enabled with touch screen and electronic signature software enabled | Yes – Scanner enabled with touch screen and electronic signature software enabled |
| **Use with IoT** | No – Needs line of sight | Yes – Automate data acquisition with IoT readers\sensors |

## What is RFID?

Radio Frequency Identification (RFID) technology uses radio signals to read identification codes - Electronic Product Codes (EPC), and unique Tag Identification Codes (TID). RFID technology helps increase data identification, acquisition efficiency and data integrity. Unlike barcode technology which requires line of sight (LOS), an RFID tag does not need to be seen to read it or write it. Even an RFID tag covered in dirt can be read. The RFID tag offers a reading range from inches to hundreds of feet and does not require line of sight.

## How does RFID Technology work?

RFID employs a reader as a radio signal initiator and a receiver that listens to signals sent from RFID passive tags. Pulling the trigger on the RFID reader causes the tag to be read, providing a unique identification code making it possible to track an asset. RFID tags are small with no moving parts. A unique identification code embedded digitally on a microchip makes the tag extremely resistant to counterfeiting. Microchips are embedded in a protective material housed in a high impact resistant case. Tags have a multi-year lifespan, function well in extreme environments and withstand rough handling.

With RFID technology, one can read multiple tags simultaneously. When the trigger on the RFID interrogator is pulled, all the tags that can respond to the radio energy emitted by the reader are read.

## RFID Tag

RFID Tags are produced with a unique identification code (UIC\TID) or serial number from the manufacturer. This number is embedded digitally on the microchip and may not be changed, thereby making them extremely resistant to counterfeiting. The combination of UIC, user data, serial number and on-board memory makes it possible to track, recall, or document the life span of a single item.

The RFID Tag is encased in an impact resistant curved casing customized for the cylinder industry to withstand harsh conditions. The RFID tag can also provide a robust local and secure read-write data cache, which may contain the most recent information pertinent to the cylinder. The tag is attached to the cylinder with special permanent bonding material.

## RFID Reader

A RFID reader is a radio signal initiator and receiver that listens to the signals that are sent back from the RFID Passive tags. Today more and more IoT (Internet of Things) based fixed readers are being deployed to automate the supply chains.

## How are the RFID tags attached to cylinders and where are tags read?

RFID tags are attached to the cylinders with a permanent bonding agent. Primarily, tags are read on the unloading dock, production floor or the shipping dock, but may also be read anywhere in a plant for inventory purposes. For use in distribution, cylinders may be read at the point of delivery or pickup.

## What happens to the read data?

Before batches of jobs are started, the handheld reader is synchronized with the tracking system. The handheld reader scans the tag on the cylinder and the data is validated and saved on the reader. Once a job is completed, the handheld is placed on a cradle for synchronization. Synchronization is then activated and the data from the handheld reader is uploaded to the tracking system.

## How is data filtered?

Filtering of the data is built into the RFID reader software. Although a tag may be read multiple times, it will only create one record in the reader, as each tag is unique. In addition, the status of each unique cylinder is validated on the reader.

## What systems is the data passed on to and how is the data used?

Data is synced from reader to main system over internet\Wi-Fi. Cylinder data attached to closed jobs is processed in the tracking system which updates the cylinder inventory, production and identifies cylinders for testing.