Improving Product Quality & Process Efficiency

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Today’s fast-paced pharmaceutical manufacturing and processing environments rely on high precision performance to ensure consistent product identification, monitoring and tracking. Further, these products must be verified to be of the highest quality — from manufacturing to delivery. In the past, barcode technology was commonly used to monitor and track these processes, providing users with reliable product information to ensure quality and consistency.

Due to recent technological advancements, manufacturers are moving towards the use of a more sophisticated solution, radio frequency identification (RFID), to track and trace products. By gathering more data through tags or transceivers, RFID allows users to read the authenticity onto the tag and write them to a data carrier. Further, RFID systems offer diverse I/O capabilities for superior communication and connectivity — allowing for maximum performance. Data carriers can also provide a high quantity of read or write operations with high speeds, ultimately increasing tracking capabilities to improve operations.

RFID vs. Barcode

Utilizing separate operating principles and tracking methods, RFID and barcode technologies each have their own distinct advantages and purposes. Industries that manufacture products that significantly impact health and wellness, such as pharmaceutical and medical industries, require a track and trace technology with intelligent, advanced data management capabilities.

Barcode

A barcode is an optical machine-readable representation of data that is physically attached to a product, and stores information about that object. Originally, barcodes conveyed data by varying the widths and spacings of parallel lines, presented in linear or one-dimensional shapes. In recent years, barcodes have evolved to include rectangles, dots, hexagons and other two-dimensional shapes for increased application compatibility and readability. Though barcodes have progressed, they still face challenges that limit their suitability for industrial applications.

One common performance limitation associated with barcode technology occurs when attempting to read barcodes. To obtain readings, barcodes require line-of-sight with the reader, which means a product must be properly aligned in order for a barcode reader to identify the product by its code. This can be a time-consuming and costly process during manufacturing if it takes several attempts to align the product — impacting worker productivity and overall profitability.

Additionally, barcodes do not have the same inherent resilience and re-usability that RFID tags offer. When used for industrial Works-in-Progress (WIP), barcodes lack the durability to deliver consistent performance in diverse environments. The stickers can peel off and the numbers can become quickly illegible through rubbing or exposure to water or other elements. Often, workers will be required to replace barcodes at each stage in the manufacturing process, which ultimately reduces operations efficiency.

Though barcodes are not ideal for all processing applications, they do provide the necessary performance capabilities required for commercial use since they do not require information regarding product quality or quantity. In commercial applications, such as retail, barcodes are used to provide inventory information for a product or object.

RFID

Originally developed as a method to remotely gather data through tags or transceivers, RFID was not historically used to track and monitor materials throughout the manufacturing process. However, now, given their data storage capacity, these tags are attached to or embedded in an object during the manufacturing process and is programmed with information about the product — enabling users to monitor it throughout production.

RFID systems contain three parts: RFID transceivers to read/write data to RFID tags, network media to transfer data to industrial controller, and the RFID tag, which is programmed with information. These tags contain internal circuitry and antennas to emit a radio frequency wave that is secured and analyzed by RFID readers. During operation, when the RFID tag passes through the field of the RFID transceiver, it detects the signal from the antenna. This activates the RFID tag, signaling it to transmit the information on its microchip to be picked up by the RFID transceiver.

The versatility of RFID performance capabilities enables the technology to be used in situations where barcodes or other optically-read technologies are impractical. Unlike other trace and trace methods, RFID tags do not need to be on the surface of the object to obtain an accurate reading. By embedding the tags, they can still offer the desired reliability without being subjected to environmental elements. This protects them from wear and saves manufacturers significant replacement costs. Additionally, with their compact, sophisticated electronic design, RFID tags come in virtually any housing style for maximum application compatibility.

In addition to its longevity and durability, RFID is also fast and accurate — increasing efficiency and productivity. The read time is typically less than 100 milliseconds, allowing large numbers of tags to be read at once rather than scanning item by item. Further, each tag contains a unique serial code which allows a product to be scanned and tracked throughout the entire manufacturing process — eliminating both human and production errors. By enabling users to track a product so closely, RFID prevents counterfeit products from entering the stream of commerce — which is particularly important in pharmaceutical applications where a counterfeit product can cause health concerns.

The Advanced Monitoring Solution

In the beginning, connectivity was limited, with only two channels of RFID allowed on a single node of the network. Today, advancements in technology allow RFID to optimize data management by maximizing communication capabilities. RFID systems integrate with common industrial networks, such as PROFIBUS, DeviceNet, Modbus, PROFINET and Ethernet, to communicate with existing technology and effectively store critical data and process information. Further, these systems can also incorporate more channels on a single node, with newer RFID systems integrating up to eight channels per node, and providing options for analog and discrete I/O points on the same node within

the network.

Along with enhanced connectivity, today's systems also offer advanced memory storage technology, delivering an even longer operational life. Tags implementing ferroelectric random access memory (FRAM) data carriers can process data approximately ten times faster than those utilizing electrically erasable programmable read-only memory (EEPROM). FRAM-enabled tags can process data for reading and writing at an unprecedented rate of 10ms. Additionally, tags with FRAM capabilities can withstand significantly more write operations, with some up to one billion.

Users also have a variety of frequency options to choose from with newer systems. Traditionally, RFID was offered in one frequency range, 125 and 250 kHz, which was the most familiar to manufacturers since nearly all inductive sensors have been working in this range for decades. Now, RFID systems offer a range of frequencies to choose from, including 125 kHz to 13.56 and 433 MHz — even up to 5.8 GHz. While this makes selecting the proper system more complex, it also offers enhanced compatibility with a greater number of applications.

In the Field

RFID technology is a critical component to ensuring product quality in pharmaceutical processing applications. With the capacity to store more intelligent data about the product, its components and origin, the likelihood of counterfeit products entering the stream of commerce is significantly reduced.

Due to strict regulations enforced by the Food and Drug Administration (FDA), many pharmaceutical manufacturers are using RFID tags to imbed specific information about their products to prevent counterfeit. Counterfeit occurs in the pharmaceutical industry when products do not contain the necessary drug pedigree. By embedding information about a product's raw materials, batch orientation, original manufacturer and more, this data can be tracked from initial manufacturing through delivery — allowing any counterfeit products to be easily identified and discarded.

Another example where RFID is used within the pharmaceutical industry is monitoring portable tanks. In these applications, the RFID tags are used for tank identification. Further, by using RFID, manufacturers can easily track the chemicals stored in the tank itself.

Looking Ahead

Within the medical and pharmaceutical industries, product quality is vital, as they are often used to impact the health and well-being of society. RFID delivers features that enable manufacturers to have more control over their products, and enables them to remove counterfeit and poor quality products sooner, improving consistency and production efficiency.

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