WHITE PAPER

RFID reader options for better RFID solution design

EXECUTIVE SUMMARY

First generation RFID solutions offered only one type of RFID reader — fixed. While the fixed reader enabled tremendous levels of automation in inventory management, its fixed nature presented significant deployment limitations.

Today, there are three types of RFID reader options: handheld and mobile in addition to fixed. These additional readers open up a new world of possibilities for read points, enabling the enterprise to more fully leverage RFID technology to increase benefit levels — as well as the return on investment.

The following white paper provides an in-depth look at the three types of RFID readers available today, from general functionality to typical deployment scenarios. This knowledge will provide a foundation to help create solutions that will enable enterprises to truly maximize the value of RFID technology.

At the dock doors, a portal enclosure protects fixed RFID readers from exposure to the dust, moisture, grease as well as bumps from material handling equipment, such as forklifts.

Background

Whether you are considering or are in the process of planning an RFID implementation, you'll need a solid understanding of the different types of RFID readers that are available today — fixed, handheld and mobile. Each type of reader is designed to meet completely different environmental and application requirements. And the newest member of this product family, the mobile reader, opens up a new world of application possibilities and ways to deploy RFID. Only through a thorough understanding of each of these devices and what they offer can the enterprise develop a plan that maximizes the capabilities, benefits and return on investment for RFID solutions.

Following is a detailed discussion of each of these three types of readers. We will cover general functionality, technical deployment requirements, the broad application set for which the reader is designed, and any related environmental requirements that should be considered.

Fixed Readers

Static primary read zones

Fixed readers are designed for large scale deployments that need to process a large volume of assets at choke points and primary read zones, such as dock doors. Permanently installed in a defined location, these devices are constantly reading, always 'listening' in order to detect any RFID tag that passes within the reader's active zone — typically 10 to 20 feet for passive tags. Return on investment is delivered through the substantial process automation at these check points, such as eliminating the manual reconciliation of shipments with automated purchase orders or advanced shipping notices (ASNs).

Deployment requirements/considerations

Fixed readers require a dedicated power source as well as a connection to the enterprise network. Network cabling, power lines and power outlets will need to be installed for each reader. Government regulations will require some environments, such as manufacturing plants, to run that cabling and wiring in protective conduit.

Operator intervention

Fixed readers offer completely automated reading — there is no operator intervention required to read tags. The data on any tag that passes through the reader's read zone will be instantly captured.

Environmental considerations

Depending upon the specifications of the reader and the environment in which the reader will be installed, you may need a portal enclosure. Portal enclosures provide sealing necessary to ensure reliable operation in spite of exposure to the elements, as well as bumps and vibrations common in industrial environments. For example, readers installed just inside or outside the dock door might

Open view of the portal reveals the fixed reader and antennas in the protective casing.

Fixed RFID readers are ideal for read points that require the bulk capture of data, for example, on the assembly line.

require a NEMA 4 compliant portal enclosure to provide dependable operation in the presence of dirt, rain, snow and ice. In addition, the portal enclosure also enables greater flexibility in the design of the RFID network. For example, dock doors may require the deployment of an array of antennas at specific heights to ensure the consistent and accurate capture of RFID tag information as it passes through the portal.

Single function/single use device

Fixed RFID readers are single-use devices only. These pure RFID data capture devices are designed for one function: to read tags and transmit the captured tag data to other business systems for processing.

Applications

Fixed readers are designed to streamline processes at the major mandatory read points in your facility — key entry and exit points where the business process requires the bulk capture of inventory and asset movement data. Applications typically include:

- Warehouse dock doors to capture incoming and outgoing inventory movement
- Work in process (WIP) to track every step of the manufacturing process
- Parts tracking to ensure adequate inventory levels and protect against loss and theft
- Tool cribs to provide visibility into the availability and location of tools and equipment
- Conveyor belt of the manufacturing production line to document the 'birth' of a product from the moment of its creation (required in some industries due to government regulations, such as pharmaceutical)

Handheld RFID Readers

Point RFID reading where and when you need it

Handheld RFID readers offer an easy-to-carry wireless form factor that allows workers to take the reader to the RFID tag — unlike fixed readers, which require workflows that bring the items to the reader. With a handheld RFID reader, users have complete control over when, where and how the reader will be used. A variety of form factors are available to meet specific needs, including grip-style devices for maximum user comfort, or compact, lightweight easy-to-carry EDA devices. RFID reading capability can be integrated into the device, or available as an add-on, either via a PCMCIA or other card slot, or snap on accessory. Since these mobile computers can also offer flexibility to capture additional types of data, they can be used in a wide variety of areas throughout the business, maximizing cost-efficiencies and delivering a faster return on investment.

Deployment requirements/considerations

There are no major deployment requirements for handheld RFID readers. The devices are ready to use, right out of the box, with integrated batteries, integrated antennas, integrated wireless LAN connectivity and a display and keypad for application interface. The need for power and cabling is eliminated, enabling rapid implementation with minimal investment, making handheld RFID readers ideal for initial RFID deployments and pilots.

Operator intervention

Handheld RFID readers are completely controlled by the user — the device reads only when the trigger is pulled, with the read zone determined by environment and tag type.

Environmental considerations

While there are no real deployment considerations associated with handheld RFID readers, due to the mobile nature of these devices, there are multiple environmental considerations that must be taken into account to control maintenance costs and ensure a low total cost of ownership.

For example, if your handheld RFID readers will be utilized in the warehouse and at the dock doors, you'll need to select rugged devices designed to handle the toughest environmental conditions — from dust, moisture and grease as well as extreme temperatures. For less demanding environments, such as the retail floor, you can select a more cost-effective device designed for use in more moderate temperatures with less exposure to the elements.

A critical factor for handheld readers is the drop specification. Unlike a fixed reader, a handheld reader is very likely to be dropped one or more times over its lifetime. Be sure that the handheld device you choose has been tested on the various different flooring surfaces where the device will be used — for example, a device with a drop specification test that is performed only on vinyl flooring may provide reliable performance if dropped inside the warehouse — but not on the concrete by the dock doors. Also, it is important to note that all drop specifications are not created equally. Drop tests are often performed only on a portion of the operating temperature range, substantially narrowing the effective available temperature range in which you can operate and still expect reliable performance in the event of a drop. And lastly, make sure the drop tests were performed on all sides of the device to ensure dependable operation, regardless of which part of the device strikes the ground first.

Multiple function/multiple use device

Since handheld RFID readers are actually mobile computers, they can offer a wide range of features and functions. In addition to reading RFID tags, some handheld readers offer the ability to read additional types of data, such as 1D and 2D bar codes as well as images. Ideal when multiple types of product identification and tracking systems are in place, handheld readers enable the deployment of a single device, reducing the total cost of ownership for data capture solutions — there are fewer devices to purchase and support. And robust battery support ensures adequate power for a full shift, eliminating the need for employees to spend time locating and changing batteries, and reducing the quantities of on-hand batteries required to support the mobile workforce.

Three Types of RFID Readers at a Glance

The following chart lists the basic specification differences between the three types of RFID readers, as well as a wide variety of applications across industries — and the type of RFID readers that are best suited for those applications.

	Fixed	Handheld	Mobile
Specifications			
Static read points	•		•
Mobile read points		•	•
Point reading		•	
Operator interaction required		•	
Battery power		•	•
DC power	•		Optional
Wireless networking		•	•
Ethernet networking	•		
Bluetooth networking		•	•
Antennas	External	Integrated	Integrated
Multiple data capture capabilities beyond RFID		•	
Applications			
Manufacturing/Warehouse			
Shipping and receiving	•		•
Conveyor belt/ production line	•		•
Put-away			•
Picking		•	•
Packing			•
Cross docking		•	•
Work-in-process	•		•
Asset tracking material handling equipment, tools, pallets, totes, roll cages and more)	•	•[1]	•
Yard management			•
Returns processing		•	
Exception management		•	
Shelf tag audits		•	
Personnel tracking	•		
Regulatory compliance (genealogy, etc.)	•	•	•

	Fixed	Handheld	Mobile
Applications (continued)			
Enterprise			
Asset tracking (tools, IT assets and more)	•	•	•
Records tracking	•	•	•
Maintenance and repair		•	•
Energy & Utilities			
Field tracking		•	•
Asset tracking	•	•	•
Transportation and Logistics			
Mail and parcel tracking	•	•	•
Fleet vehicle tracking			•
Healthcare			
Records tracking	•	•	•
Asset tracking (medical equipment and supplies)	•		•
Personnel and patient tracking	•		
Retail Food			
Food safety		•	
Cold chain		•	
Retail			
Price audits		•	•
Inventory mgmt.	•		•
Store receiving	•		•
Warehouse mgmt.	•		•
Returns processing		•	
Exception processing		•	
Shelf tag audits		•	
Aviation			
Parts tracking		•	•
Baggage	•		•
MRO	•	•	•
Defense			
Logistics supply	•	•	•

1. Typical RFID handheld usage for asset management includes commissioning an asset into the tracking system, or locating an asset in inventory.

Handheld RFID readers are ideal for on-demand reading of RFID tags. For example, in picking operations, a work order can be sent to the handheld display, and a quick read of the RFID tag verifies that the right item was selected.

Applications

Handheld RFID readers are easily moved to the 'point of read', ideal for on-the-spot reading anywhere in the enterprise. Designed for applications where user-controlled operation is desirable (similar to bar code scanning), these devices bring a new level of efficiency to exception handling, pricing audits, shelf tag audits, price changes and picking operations for smaller items. In addition, handheld RFID readers that are capable of also capturing bar codes enable employees to easily read either product identification data type with a single device, easing the enterprise transition from bar codes to RFID tags or simplifying data capture in environments that will continue to utilize bar codes as well as RFID tags.

In addition to inventory applications, handheld RFID readers are also ideal for tracking assets — such as ingress and egress of vehicles at the yard gate, construction supplies in the yard or IT assets, such as laptops and servers.

Mobile RFID Readers

Read points that move with your products

The newest category of RFID readers is the mobile RFID reader. This cable-free device is completely self-contained, with integrated battery, antennas and wireless communications capabilities. The mobile RFID reader can be used on material handling equipment (MHE), such as forklifts, clamp trucks and skate wheels or on other moving equipment like mobile carts. It can also be installed as a stationery device in hard to cable areas. Where the fixed RFID reader requires product to be brought to the reader, this device allows you to bring the reader to the product — like the handheld RFID reader. But where the handheld reader requires user intervention to read (via the pull of a trigger or press of a button), the mobile RFID reader offers hands-free operation that enables a new level of automation in areas of the business that were previously out of reach for RFID. The mobile reader allows to you to insert RFID capability virtually anywhere in your existing business procedures, simplifying the integration of RFID technology and enabling the enterprise to fully exploit the RFID data throughout operations.

Deployment requirements/considerations

Because of its lightweight footprint, there are no major deployment requirements for mobile RFID readers. The readers are completely self-contained and available with integrated batteries, antennas and wireless communications — eliminating the need for network, power and antenna cabling.

Operator intervention

Mobile RFID readers function much like fixed readers — tags within range of the reader are automatically read, no user interaction is required.

Environmental considerations

The mobile RFID reader will be exposed to some of the toughest environmental challenges — it may be installed in demanding stationery locations, on the move on a forklift or pushcart, or moved back and forth between different types of equipment to support different applications throughout the enterprise. The mobile RFID reader must be

Until the development of the mobile reader, bulk reads required the items to be brought to a fixed reader. Now, a mobile RFID reader can be attached to a rolling cart, allowing employees to take RFID to the items — and enabling a complete inventory to be taken in record time.

designed with maximum rugged specifications, ensuring reliable performance in spite of the inevitable bumps, drops and exposure to extreme heat, cold, grease, moisture and more.

Single function/multiple use device

Like the fixed RFID reader, mobile RFID readers are single function devices, capable of reading RFID tags only. However, unlike the fixed RFID reader, these highly flexible devices are easy to install as well as uninstall. This unique design aspect allows the same device to serve a variety of applications throughout the enterprise, reducing investment requirements and the cost per read point for a lower overall total cost of ownership.

In the event your forklifts are on the move all day, you might opt to purchase a mobile reader that would be permanently installed on each machine. However, if you have a number of different applications that all have lower transaction volumes, a single mobile RFID reader may be able to meet the needs. For example, in a small retail store, the same mobile reader can be used on a skate wheel to automatically reconcile the two or three shipments received daily. And when the device is not in use in shipping, store associates on the sales floor can wheel the device through the aisles on a mobile cart to conduct a full store inventory or locate a misplaced item for a customer.

Mobile RFID readers also provide the flexibility to allow businesses to reconfigure the business as needed to accommodate seasonal peaks and valleys in volume — for example, a small electronics manufacturer who ships a large percentage of the annual volume during the holiday season. By deploying mobile readers instead of the traditional fixed readers at dock doors, one manufacturer was able to easily add and change RFID-enabled dock doors as needed to increase shipping capacity to match the increase in order volume.

Applications

Mobile RFID readers are highly flexible devices designed for a wide range of applications — both stationary and mobile. While fixed readers allow you to capture movement as product passes by your major check points, it is mobile readers that provide the ability to follow product as it moves throughout your manufacturing plant, warehouse or retail store. By combining fixed and mobile readers, you obtain the best of both worlds — RFID technology and data can be leveraged throughout all your business processes, maximizing the value of your RFID investment.

In addition, mobile readers also enable easy and cost-effective asset tracking. With an RFID reader on a mobile cart, a single person can take inventory of all the equipment in an expansive laboratory or all IT assets in a matter of hours — a task that could otherwise require multiple people for multiple days.

Stationary applications

Since the mobile RFID reader is completely self-contained, it can be quickly, easily and cost-effectively installed in challenging locations. For example, when installed on a stretch wrap machine, product can be verified prior to shrink wrapping. And when installed on a trash compactor, materials are validated prior to destruction and recycling. While mobile RFID readers do offer an integrated battery, they also offer DC operation, eliminating the need to manage batteries when installed in stationary applications.

Mobile RFID readers have an additional advantage — hook and loop mounting allows a single device to be used in a variety of applications, delivering an unparalleled low cost per read point. For example, a mobile RFID reader can be attached to a mobile cart to take inventory on the retail floor, and then removed and installed on a pallet jack in seconds to reconcile incoming shipments as they are unloaded at the receiving dock.

Mobile applications
The cable-free design allows you to install the mobile RFID reader on virtually any type of moving equipment. In a retail back room, the device can be deployed on rolling ladders to quickly locate a misplaced item. On the retail floor, the mobile RFID reader can be attached to a cart in moments with a hook and loop fastener and rolled through the store to conduct a complete inventory in just minutes. In the warehouse, the mobile RFID reader can be paired with a vehicle mount mobile computer on a forklift to automate and error-proof put-away and picking operations. Put-away and pick orders can be delivered to the mobile computer, complete with the shortest route to the right shelf, and the ability to read the tag on the product to verify the right product was selected, or placed on the right shelf. When deployed on a clamp truck, the RFID tag data can be utilized to automatically control the amount of pressure applied based on the product that is selected, helping to protect against damage from excessive pressure.

Fixed versus mobile RFID readers at static read points

Fixed or mobile RFID readers can be deployed at static read points, such as dock doors. How do you know what choice is right for your fixed read points?

- Determine the cost difference. While mobile RFID readers are more expensive than fixed readers, they are self-contained with maximum rugged specifications, and will likely not incur any costs for deployment other than the cost of the reader itself. Fixed reader cost need to factor in the cost of running power to the device as well as a network connection if required, antennas, cabling and any portal enclosure that might be required.
- Determine if flexibility is an issue — and the cost of lack of flexibility. Through application reuse, mobile readers can reduce your overall RFID footprint.D11 Do you need the ability to re-configure your business on demand to accommodate major fluctuations in volume? What is the cost of that re-configuration with fixed readers? With mobile readers?

Summary

Through a thorough understanding of the three types of available RFID readers, enterprises can envision all the possible areas in the business where RFID can be deployed. Through this vision, enterprises can determine how, where and what type of readers to deploy to achieve maximum efficiency and maximum value from RFID deployments.

To find out how Motorola can help you get the most out of your RFID deployments, please visit us on the web at www.motorola.com/rfid or access our global contact directory at www.motorola.com/enterprise/contactus

About Motorola

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