

# **Raising RFID Value & Performance with Forklift-Mounted Readers**



## Introduction

As radio frequency identification (RFID) use grows, so does knowledge about the best ways to implement the technology. Installing RFID readers on forklifts is emerging as a best practice that can significantly reduce RFID implementation costs while improving accuracy and efficiency for shipping, receiving and other operations. Forklift-mounted readers can be used as an alternative or complement to dock door and other fixed-position RFID equipment, and provide important flexibility advantages that allow organizations to cost effectively add new applications or reconfigure their facilities.

This white paper describes forklift-mounted RFID reading systems and their uses, explains their benefits and limitations for shipping, receiving, picking, putaway and other common operations, and presents considerations and criteria for selecting equipment.

## System basics

Forklift-mounted RFID systems have the same basic components as other RFID systems: an antenna for sending and receiving RFID signals that is connected to a processor for decoding and communication with the host computer or software application. Unlike fixed readers which in general operate asynchronously, forklift-mounted RFID readers function as a component of a mobile directed RFID solution collecting discrete data as part of a system directed and synchronized operation. A mobile computer on the forklift typically provides the operator instructions associated with a given operation. The mobile computer can also run RFID applications and communicate RFID data to host systems over a wireless LAN – RFID and wireless LAN technologies can be used simultaneously in the same area without interference.

## The performance and profitability case

Forklift-mounted readers improve return on investment (ROI) and reduce costs for RFID implementations because they can be used for multiple applications throughout a facility. This flexibility is a major differentiator and advantage compared to fixed-position readers, which are by definition stationary and limited to the one or two applications.

In the past, when RFID has been used for pallet handling operations, such as outgoing shipment verification, cross docking, or automated receiving, organizations typically installed individual RFID read/write units at each dock door. Contrast this to how material handling equipment is deployed – where one forklift per 10 dock doors is a common ratio. By RFID enabling the forklift, instead of the dock door, organizations can have a ratio of one RFID reader per 10 dock doors. This approach provides significant savings in implementation costs and improvements in asset utilization compared to a fixed-reader infrastructure.

Forklift-mounted readers can also provide accuracy and performance advantages compared to fixed-position readers. RFID readers built for use on forklifts must produce a precise, controlled reading field that accurately identifies objects and locations and provides protection against misreads. Fixed-position readers used at dock doors produce a large reading field designed to blanket the portal. In multi-door environments, the read fields can overlap. This creates the possibility that materials being processed at one dock door will be recorded for another, resulting in data

collection errors. Overlapping fields also increase the possibility of RF interference and slower response times. CIO Insight magazine documented this problem and its effects on distribution center operations at a Kimberly-Clark facility in an article that appeared in its December 27, 2005 issue. Here is an excerpt:

“Mike O’Shea, [Director of Auto-ID Sensing Technologies at Kimberly-Clark ] giving a tour of the lab, pointed to a row of doors that lead onto the shipping dock. There are RFID readers mounted next to each doorway, but they’re useless. “Look how close together the doors are,” O’Shea said. “The reader on one door picks up the signals from something coming into the other door.” In other words, outfitting the roughly 1,000 dock doors at various Kimberly-Clark facilities would not prevent the packing errors that are among the reasons the company is investing in RFID.

Other RFID early adopters have reported similar experiences and reached the conclusion that forklift-mounted readers are a superior alternative to inflexible portal readers for dock doors and other fixed locations.

“We’ve totally abandoned portals,” Pete Rector of Genco told DC Velocity magazine in a December, 2005 article. He estimated Genco will save \$250,000 [per facility] by installing a forklift-mounted RFID infrastructure instead of dock door readers.

“We came to the realization that the way to make money is to put the reader on the forklift,” Procter & Gamble’s Steve Rehling told RFID Journal in a November, 2005 article. Rehling is director of RFID systems at Procter & Gamble and is also co-chair of EPCglobal’s Software Action Group.

A flexible, forklift-mounted RFID infrastructure can also provide ongoing cost advantages. For facilities that don’t have readers at each dock door, forklift-mounted readers provide the flexibility to unload RFID-tagged shipments anywhere without having to schedule specific deliveries for specific RFID-enabled doors. If the facility layout changes, there is no labor required for cabling and reinstallation. Additional equipment purchases may not be necessary when RFID applications expand beyond the dock door because forklift-mounted readers can be used in warehouse aisles, in the yard, at inspection areas and many other locations.

## Applications

Forklift-mounted readers provide excellent performance and economic benefits for applications that take place right at the dock door, including receiving, shipping and cross docking. They are also an accurate and efficient resource for supporting a variety of other RFID applications. For example, pallets are typically identified each time they are moved and the transaction is recorded into a WMS or inventory control system. Putting RFID reading capability on the forklift is an efficient way to support pallet identification and movement reporting. Forklift readers reduce or eliminate the manual labor required to record information by bar code scanning or manual data entry, and are more practical than installing fixed-position RFID readers throughout the facility to record movements.

The following sections describe some of the applications and advantages for forklift-mounted readers. For additional information about RFID applications and benefits, see LXE’s white papers “Mobile RFID Advantages: RFID in Motion – Don’t Get Caught Standing Still” and “RFID Technology for Warehouse and Distribution Center Operations,” which are available free from the [White Papers](#) section of [www.lxe.com](http://www.lxe.com).

**Receiving** – Forklift-mounted readers eliminate the need to install fixed-position readers at each dock door, or to carefully schedule and coordinate deliveries so that RFID-enabled dock doors are available when tagged shipments arrive. The specialized antennae used on forklift-mounted readers help ensure that only desired objects are identified and that nearby cases and pallets are ignored.

**Cross docking** – The receiving location flexibility and accurate pallet and case identification that forklift-mounted readers provide are of great value in cross docking applications, where speed and accuracy are critical. Forklift readers also enable materials to be unloaded in the yard or temporary storage locations that may not be covered by a fixed-reader infrastructure.

Putaway – Permanent RFID location tags can enhance putaway accuracy because the forklift reader can automatically record the location without requiring the operator to scan a bar code or enter a location code. This is a simple and cost-effective way to leverage an investment in forklift-mounted RFID systems originally installed for dock door applications to maintaining accurate real time inventory.

Picking – Reading RFID tags at the time pallets and cases are picked can prevent picking errors and help ensure orders and pallets are built accurately. Automatic, accurate identification during picking could eliminate the need for a separate validation step.

Shipping – All the economic and performance benefits associated with forklift-mounted readers apply to shipping applications, such as when pallet or case tags on outgoing shipments are read to validate that contents match the order. If permanent RFID tags are used to identify dock doors or trailers, the forklift-mounted reader can automatically confirm drop-off locations for a complete end to end transaction.

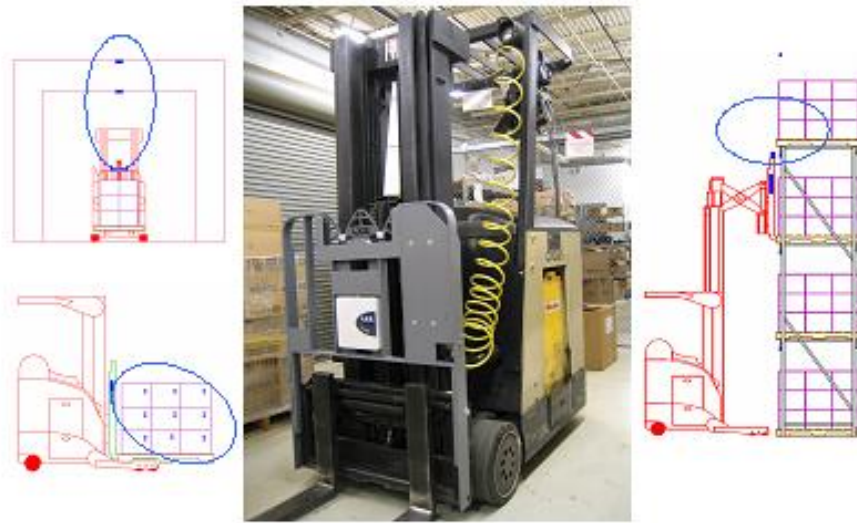
## Equipment considerations

Forklifts are used in environments and applications that require different performance characteristics than other mobile or fixed-position RFID equipment. Simply using a handheld RFID reader or off-the-shelf fixed RFID readers on a forklift won't ensure efficient performance or even survivability. For example, handheld readers still require human initiation of data collection while fixed readers typically create a broad read zone with a signal designed to detect every tag in the area. But as the application examples presented in this paper illustrated, forklift operations require a discrete signal that will ensure only the desired pallet or location tag is identified. This is just one example of the specific performance requirements and why organizations need engineered, purpose-built equipment for successful forklift RFID applications.

Antennae are a key component of forklift systems and are also unlike the antennae used in other types of RFID readers. For forklift operations, read range is not one of the most important and valuable performance attributes, so antennae designed to provide long range may not be suitable for the application. More important is the ability to control the read zone so you can read only what you want and when you want it. This may dictate different antennae depending on the object to be identified and the use case. For example, unit loads consisting of multiple case and pallet tags may be effectively identified using a high performance patch antenna and an adjustable power output, while location identification may require an antenna with a narrowly controlled beam in order to singulate on a single tag located on a storage rack (see below). Case picking requires an even more sophisticated solution with a highly controlled read zone capable of validating and quantifying cases on the pallet but not on the adjacent pick face.

Antenna placement is also an important consideration. To prevent misreads, antennae should be located as close to the target as possible. On forklifts, this means mounting antennae on the load rest. Because the cable between the antenna and the reader carries an analog signal, the reader must also be located on the loadrest to ensure minimum signal loss. This limits wiring between the cab and loadrest to power and communications, which are easier to run, and in some configurations can even be avoided.

### Rugged Forklift-Mounted Reader with Patch and Upward Antennas in Loadrest for Case/Pallet and Location ID



Being located on the business end of the forklift, the RFID reader and antennae must be ultra-rugged and able to withstand the shock and vibration and impact associated with forklift-mounted use. Furthermore, the equipment must offer temperature specifications, intrusion protection from water and dust, and a robust power supply supporting a broad range of input and providing immunity to noise, dips and surges, consistent with the demands on a forklift.

As part of a mobile directed RFID solution, the forklift-mounted reader should also support a variety of interface options including waterproof Ethernet and serial connections to new and legacy mobile computers, as well as an option for a direct wireless connection to a host network. Of course, the mobile computer should also have features that make it convenient for forklift drivers to use, such as a large screen, large, easy-to-use keys and controls, support for legacy computer systems (e.g. Windows, terminal emulation, wireless connectivity and security, etc.).

## Conclusion

Building mobile RFID processing capability into forklifts, instead of into fixed infrastructure, is an extremely practical method to deploy RFID technologies. Organizations are taking advantage of this emerging best practice to hold down their implementation costs and to gain flexibility to cost effectively add new applications. Purpose-built forklift reading systems also provide important performance benefits for a variety of common RFID applications.

LXE Inc. offers forklift-mounted RFID systems among its complete line of rugged mobile computer products. LXE improves supply chain performance by applying over 36 years' experience developing rugged wireless computers and RF data collection networks. From handheld and vehicle-mounted computers, advanced auto-identification technologies, and RF network infrastructure, to our award-winning customer support – LXE's easy-to-use, mobile computing products are as reliable as the people who install and support them. For more information visit our Website at [www.lxe.com](http://www.lxe.com).

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