

Application Brief

Intermec Advanced RFID Extensions (ARX)



Industries:

Transportation and Logistics,
Manufacturing, Consumer Goods, Industrial
Goods, Retail

Products:

CV60, IV7, IF61

Region:

Worldwide

Typical Applications:

Warehouse Operations, Cross Dock
Logistics, Material Handling with Forklifts

Customer Benefits:

- Improve visibility in asset and inventory tracking
- Increase speed of resolving discrepancies and problems
- Reduce capital and operations expenses
- Increase flexibility of data collection systems
- Increase productivity

Intermec introduces the first tag motion software toolkit in a standardized reporting format. Intermec Advanced RFID Extensions (ARX) effectively identifies RFID tags of interest and discriminates surrounding tags, providing customers and software integrators the tools to essentially eliminate false-positive reporting of tags.

Getting the Most out of RFID

RFID provides business benefits and a strong ROI for many applications including asset tracking, materials management, and inventory control. Many processes for identifying objects and recording their movements can be automated by RFID. Unattended readers ensure that asset and inventory movements are recorded and alerts issued if the material is moved to the wrong place or at the wrong time. With a well designed RFID system you know all the intimate details of where everything is, where it's been and where it needs to go. By making your systems smarter, you will be able to:

- Realize huge improvements in asset and inventory visibility
- Resolve problems right when they occur
- Reduce capital and operations expenses
- Increase flexibility of your data collection systems
- Achieve new levels of productivity

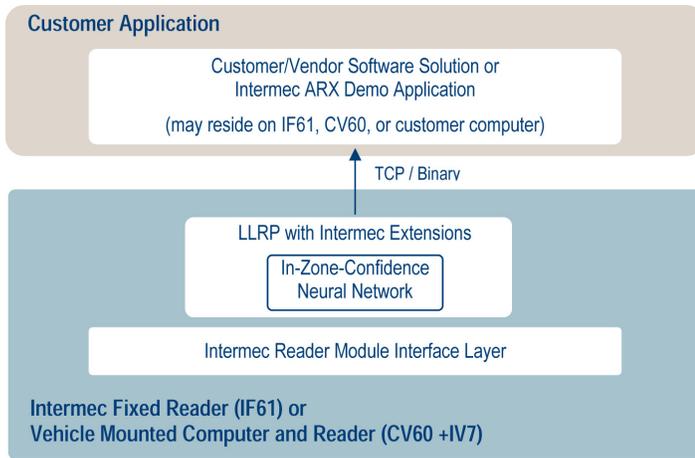
RFID automated processes rely on the accuracy of reading the right tags: those that pass through a portal, are on a forklift, or are passing by a checkpoint on a conveyor. Because an RFID reader indiscriminately reads all of the tags that it activates, the presence of stray tags, such as those that pass through a nearby portal or are stationary on nearby racks or pallets, complicates the identification of the true tags of interest versus those that are not part of the process in action.

Optimize with Confidence

Intermec's RFID readers offer advanced motion data about each activated tag through a combination of hardware and software innovation. Advanced RFID Extensions (ARX) is a set of metadata that adds a new level of visibility to the identification of tags. It is the most accurate and comprehensive solution available to easily determine tags that are in motion and their position relative to the receiving antenna.

Through advanced artificial intelligence and data mining techniques, ARX analyzes low-level information from Intermec's RFID readers, including Received Signal Strength Indication (RSSI), noise-floor, phase angle, detailed timing data, and interference-related information, and combines this data into a confidence level that the tag is in or has passed through the zone of interest. The fully analyzed results are made available to end applications through easy to use EPCglobal Low Level Reader Protocol (LLRP) extensions. ARX is a software solution that bridges the gap between low level visibility and application development.

Intermec Advanced RFID Extensions (ARX) Block Diagram



The Optimal Solution for Improving Confidence

As opposed to many competitors, Intermec designs and builds its own radio hardware for its RFID readers. This drives a distinct competitive advantage because most competitive readers use a third-party module or otherwise do not have the information and data resolution required to effectively characterize the movement of RFID tags. Other elaborate and expensive software and RFID infrastructure products are based on inferior and incomplete information about the RF characteristics of the tags.

Many readers provide the received signal strength indication (RSSI), which is a measurement of the power present in a received radio signal. While stray, ambient tags generally have a weaker RSSI than most of the in-zone tags of interest, the stray tags may have the same signal strength as many of the in-zone tags because of environmental conditions such as signal multi-paths or interference. Using a fixed RSSI threshold to separate the strays is not accurate or successful, yet RSSI is the only tool that most customers can access.

Having control of the RF hardware gives visibility into the low-level operations of the radio. Intermec uses RSSI data along with the phase angle of the received RF wave, which changes over time and can be used to compute a tag's speed. Additional metadata is created from the minimums, maximums, averages, standard deviations, etc. of the low-level radio data. ARX uses artificial intelligence and data mining techniques to combine the complex metadata into a confidence level that indicates whether a tag is in the zone of interest.

There are often impairments to the signal strength and phase angle measurements while reading the tag, such as the presence of a large metal forklift that reflects the tag's signal. ARX uses neural network processing on multiple factors to minimize the influence of environmental impairments and accurately determine a confidence level. This network has been trained using a wide variety of data from forklifts, portals, and conveyors in typical operation.

In addition to the confidence level, ARX provides a quality level that tells the customer about the data the confidence level is based upon. For example, ARX could provide high confidence that a tag is stray, but the quality of the decision is very low. A low quality indicates that the confidence was based on only a few responses of a particular tag.

LLRP Extensions

ARX provides results attached to each tag's EPC ID via LLRP. This information is leveraged and made available for real business benefits. End applications use the results to discern whether tags should be considered in the zone of interest or are stray. Available extensions include:

Enhanced Tag Signal Information

IntermecHighResolutionRSSI

High Resolution Received Signal Strength Indication. A measure in tenths of dBm of the strength of a tag's response.

IntermecRNSI

Received Noise Strength Indication. A measure in tenths of dBm of the noise floor before the tag was read. If this is subtracted from the high resolution RSSI, you have an estimate of the signal to noise ratio (SNR).

Motion Information

IntermecTagMoving

Confidence that a tag is moving, relative to the antenna, on a scale of 0 to 100. This is based on the standard deviation of the phase angle across multiple reads.

IntermecTagSpeed

The speed of the tag, relative to the antenna, in millimeters per second.

Confidence Information

IntermecTagInZone

Confidence that a tag is on the forklift, on a scale of 0 to 100. 0 would indicate that there is a high likelihood that the tag is not on the forklift. 100 would indicate that there is a high likelihood that the tag is moving with the antenna. Forklift movement is necessary during the read cycle to make this determination. Without movement, most tags would be considered "moving with the antenna".

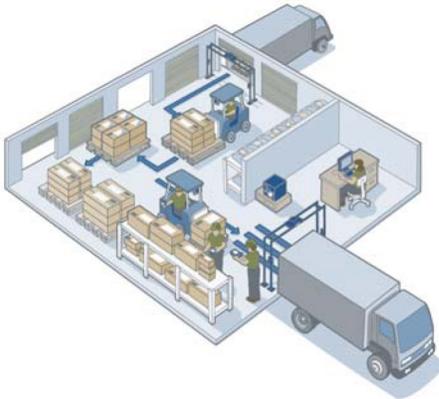
IntermecTagInPortal

Confidence that a tag is moving through the portal, on a scale of 0 to 100. 0 would indicate that there is a high likelihood that the tag is not moving through the portal. 100 would indicate that there is a high likelihood that the tag is moving through the portal. Tags must be moving (not sitting stationary inside the portal) to be considered moving through the portal. Without movement, most tags would be considered "not moving through the portal".

ARX in Practice

Accurate Identification of Material Movement for Portal and Conveyor Systems

Large distribution centers and manufacturing facilities have many RFID portals in close proximity, increasing the potential for cross-reads from items being moved through neighboring portals and tagged items sitting nearby. Specialized portal designs can focus much of the RF energy inside the portal but even with enhanced portal designs, energy leaks from the portal to activate surrounding tags that are not moving through the portal of interest. Procedural adjustments also attempt to keep the dock area clear of pallets and adjacent doors closed, but changing operating processes is difficult, not foolproof, and should not be necessary. Some industry experts believe that the failure to identify stray tags is the main reason that RFID has not been widely adopted.



Intermec ARX takes the work out of building complex business logic designed to identify and filter the stray tags.

ARX provides accurate results for identifying a tag in the portal, those near the portal, and the tag speed. In addition, ARX extensions provide sequencing information useful for identifying the order of tags as they move along a conveyor or through a portal. The ARX extensions process low level data from each tag to create comprehensible, higher level information, removing the need to be an expert in radio frequency science.

Using advanced artificial intelligence and data mining techniques, the underlying ARX algorithms have been trained using real applications. The LLRP extensions are easily deployed in end applications to enable significant improvements in identifying tags of interest versus stray tags without re-engineering an RFID installation or developing complex yet incomplete filtering.

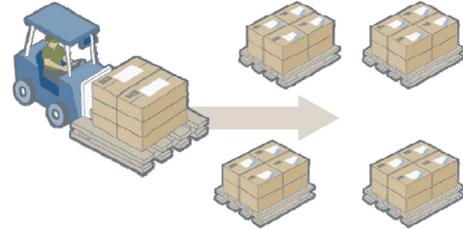
Available on the IF61 smart reader, Intermec ARX, in concert with a full line of antenna options and enhanced portals, helps customers achieve the accuracy they need for improved efficiency and true visibility to their assets and material movement operations.

Solution Elements:

- IF61 running Intermec ARX
- Intermec recommended portal and antennas.

Accurate Load Identification for Material Handling Forklifts

Material handling solutions using forklift mounted RFID systems rely on effectively discriminating between tags that are on the forklift pallet versus tags that are in the background. These include RFID solutions for returnable containers and racks, bulk material movement, and work-in-progress management. Reliably identifying what the forklift is carrying reduces unnecessary work and ensures that the operator has the right product for the right reason and has performed the correct action.



In warehouses, backs of trucks and industrial environments where RFID tagged items are prevalent throughout the facility, it is difficult to read only the tagged assets that are on the forks of the material handling forklift. Even with well designed hardware configurations and deployments, stray tags are often in the read zone of the forklift's RFID antennas.

Intermec's ARX solves the problem of accurately identifying the tags on the fork and reduces "false positive" reporting errors.

The ARX software service provides software solutions running on the vehicle mounted computer with confidence and quality data that is used to determine whether pallets or assets are on the forklift immediately after the operator picks up the assets and begins driving to the destination location.

ARX is used to determine if an RFID tag is stationary on the forklift or moving relative to the backrest antennas. The ARX software reports the confidence data to the edgware software solution in EPCglobal LLRP extensions. Edgware solutions can then leverage the data to provide the operator with directed movements, increasing the accuracy and efficiency of warehouse operations.

Across the supply chain, forklifts are being transformed from material handling vehicles to information technology tools with computers, barcode scanners, RFID and software. Vehicle mounted computing and data collection means that systems get used more often in more locations producing a higher ROI.

Intermec ARX, when used with the industry-leading Intermec Forklift System hardware, provides customers and software solution vendors the tools to optimize their solutions with confidence.

Solution Elements:

- CV60 Vehicle Mount Computer running Intermec ARX
- Intermec's Forklift System, featuring the IV7 Vehicle Mounted RFID Reader, antennas, and adaptable load backrest.

Intermec's Forklift System provides RFID hardware that is plug-and-play with virtually every make and model of forklift, helping you maximize the assets you already own with the addition of mobile computing, automated data collection, RFID and wireless communication.

Demonstration Software

Intermec offers software to quickly and easily demonstrate the capabilities and data available with ARX. The demonstration software can be installed on the CV60 Vehicle Mount Computer or a PC to get you started with understanding the benefits of

ARX data for your application. The software lists the tags that are determined to be in and out of the zone of interest based on configurable options, allowing you to evaluate specific scenarios and become familiar with how the ARX capabilities can be used in end software applications.

Intermec Forklift ARX Demo

File Tools About

In Zone

From File	RFID Tag Number	% Confidence
	00112233445566778899AA00	99
	48454C4C4F5F4D4154543443	99
	AD8307001C97B9672E0000C7	98
	AD8307001C97F9712E0000CF	90
	3005FB63AC1F3681EC880468	99
	AD8307001C9801662F0000D0	96

Out of Zone

From File	RFID Tag Number	% Confidence
	AD8307001C97D1632F0000CA	2
	AD8307001C97D56D2E0000C9	0
	AD8307001C97B1692F0000C6	14
	AD8307001C97E9682D0000CD	1
	AD8307001C97D96B2C0000CB	4
	AD8307001C97FD672E0000CE	4
	AD8307001C97A96F2F0000C5	0
	AD8307001C97E1652E0000CC	4
	AD8307001C97C15F310000C8	3

Summary for Last Scan: **6** Tags determined to be "In Zone"
9 Tags determined to be "Out of Zone"
N/A Tags missed
N/A True positives (0.0%)
N/A False Positives
N/A False negatives (0.0%)



The SMS Group
 1085 Fairington Dr,
 Sidney, OH 45365
 (937) 498-2700
 www.thesmsgroup.com



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