

RFID

Radio Frequency Identification



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Scope

This document is intended to provide general information and references regarding the current status of, and potential for, RFID technology in libraries.

The information contained will be of value to Library Directors and Managers, and other library team members who are involved in the process of developing library strategic plans and related budgets.

What is RFID

Radio Frequency Identification (RFID) provides for "sightless" or no line of sight identification of items. It includes the ability to facilitate circulation, re-shelving, and theft detection, and it has several other important advantages.

It can either replace or supplement existing library bar codes. When the costs of labour is taken into consideration for tasks such as checkout, check-in, inventory holds, lists, mis-shelved items, etc., RFID can prove to be very efficient when compared to traditional bar codes.

"RFID is a combination of radio-frequency-based technology and microchip technology. The information contained on microchips in the tags affixed to library materials is read using radio frequency technology regardless of item orientation or alignment (i.e., the technology does not require line-of-sight or a fixed plane to read tags as do traditional theft detection systems) and distance from the item is not a critical factor except in the case of extra-wide exit gates."

Boss, Richard, RFID Technology in Libraries, 14 May, 2004 located at <http://www.ala.org/ala/pla/plapubs/technotes/rfidtechnology.htm>

Why RFID

The task of receiving, transporting, sorting and shelving materials has exploded in recent years. Library staff size remains constant at best while circulation and materials management continues to grow. Librarians are now in the business of moving books around rather than practicing librarianship, reference and patron service. RFID provides a solution to automate much of this handling and return staff to the business of customer service.

"The use of RFID reduces the amount of time required to perform circulation operations. The most significant time savings are attributable to the facts that information can be read from RFID tags much faster than from bar codes and that several items in a stack can be read at the same time."

Boss, Richard, RFID Technology in Libraries, 14 May, 2004 located at <http://www.ala.org/ala/pla/plapubs/technotes/rfidtechnology.htm>

Technical specifications

Tags

Bar codes use a line-of-sight read; That is the light or laser must see the bar code in order to read it. This limits reading each item to one at a time and can lead to slow check-in or checkout. RFID scanners can read more than one item at a time.

How RFID works

Each RFID tag has a non-powered radio antenna which can be communicated to by a powered antenna belonging to a tag reader on a scanner or security gate. Although it is not necessary that the two antennas "see" each other as is needed with a traditional bar code, it is necessary that they be relatively close to one another since the wattage used by the powered antenna is very low for health and safety reasons.

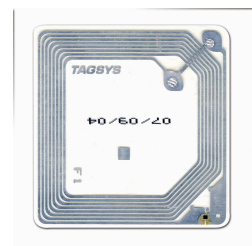
The RFID reader sends out electromagnetic waves and the tag antenna is enabled to receive these waves. "When the tag antenna enters the RF (radio frequency) field, the tag's microchip circuits are powered by signals from this RF field created by the reader. The chip then modulates the waves and the tag sends them back to the reader. The reader converts the signals received from the tag into digital data and sends it to a computer."

<http://www.integratedtek.com/flash/learnrfid.html>

While there are a range of tag types they generally fall into two categories:

Standard tags

Standard tags are used on books, magazines, affixed directly to the face of the video (in most cases covering one of the windows) and can be affixed to cases for those CDs and DVDs that have metallic content. RFID tags are not designed to be placed directly on audiocassettes (not an attractive option from an economy standpoint). Standard RFID tags should be placed on audiocassette cases and audio book albums.



CD/DVD tags

These form factors are circular tags, which are used on CDs or DVDs. They are also called dough-nut. These tags are used because the metallic content of CDs and DVD's may affect the signal of a standard tag. They can be directly affixed to the inner circles of CDs and DVDs that have no metallic content in their inner circles (ie, where no data is stored).



Bursting security is a unique TAGSYS tag feature that uses a dedicated EAS (Electronic Article Surveillance) burst at 106 KHz. It does not require a wake-up signal and is therefore a "Tag Talks First" (TTF) type of modulation. This keeps the detection rate of the system at

consistently above 95% regardless of the number of items that are in the field. All other RFID systems are based on "Reader Talks First" (RTF) type of modulation - down to the 70% range or even below.

RFID Standards

There are two ISO standards pertinent to library RFID systems ISO 15693 and 18000-3.

ISO18000-3 compliance means a read/write passive tag operating at 13.56 MHz. The TAGSYS tag has a 256 bit memory with four data blocks, each of which can be independently locked. Bibliographic information should not be programmed into the tag (that is already stored on the library management system). The item identification (bar code) number can be used to effectively access the item record in the database, which should be the single repository of bibliographic information.

RFID applications generally require the SIP2 protocol to communicate with the library management system. They must be able to communicate with the library's integrated library systems (ILS) to verify the borrower is a valid borrower who has not exceeded any of the library defined limits and that the items are able to be loaned. The checkout (or check-in) information is passed back to the library management system.

RFID vs. Bar codes

Feature	RFID Tags	Barcodes
Read more than one item at a time	✓	✗
Read while item is moving	✓	✗
Programmable	✓	✗
Line of site read not required	✓	✗
Lifetime guarantee (100,000 reads)	✓	✗
Sturdy in harsh environments Might want to consider use of the term "environmentally hardened", this term is becoming more common place in USA electronics markets. (I am not certain of global acceptance of this term)	✓	✗
Able to resist water damage	✓	✗
Built-in security	✓	✗
Inventory tool without handling items	✓	✗
Able to locate specific items on shelves	✓	✗
Use with borrower self checks units	✓	✓
Use with automatic returns units	✓	✗
Use with automated sorting and handling systems	✓	✗

RFID hardware will not create any interference with current security systems, PCs, phones or other electronic devices. The system is not harmful to persons, including those with hearing aids or pacemakers. RFID hardware will not affect magnetic media, including library cards, credit cards, video cassettes, etc

Features

Patron self checkout/check-in

Patrons can have the benefit of easy self checkout using RFID checkout systems. They can checkout a number of items at once, making the self checkout process faster than with bar code self-check systems. RFID systems also do not require careful placement of the items for checkout (as is required for bar code checkout systems). This means that the checkout process is faster and easier for borrowers to use.



Libraries can also offer automated holds pickup and check-in systems.

Automated holds pickup systems deliver the holds waiting for a patron when they insert their borrower card at the pickup point. This can mean holds are available for pickup 24-hours a day.



Automated check-in systems can be used to check-in items via internal or external book drops. Borrowers can receive a check-in receipt, detailing check-in date and time when using an RFID self-check-in system. Staff receives a holds slip and a transit slip when items are checked-in using RFID. Check-in systems can also have a range of sorting equipment to facilitate not only the check-in of items, but also the pre-reshelving sorting process.

These range from:

- basic implementation - items fall into two bins (one for re-shelving on library's shelves and the other for further action such as transit or holds shelf)
- advanced sorting systems – sorting into multiple bins for multiple sites, shelving areas and holds pickup

Security



Security can be improved with RFID-based security systems. A single tag can be used for identifying items and securing them, removing the need to purchase and install additional tags or strips for security.

RFID provides an added layer of security through the use of a theft detection bit on the tag which can be turned on or off in the CKI/CKO process. When coupled with an automated materials handling system, RFID vastly improves the effectiveness of automated check-in, check-out and theft deterrent systems.

Security is managed differently according to the tag supplier, however an RFID system may manage security using a 'theft' bit on the tag that can be turned on or off, or it may interface with the library management system and query to determine the security status. TAGSYS tags use the 'theft' bit activation / de-activation process for speedy and reliable security checking.

"Librarians also report that lost or hidden items are more easily retrieved using the portable readers. At the session, "Tiny Tracker: The Use of RFID Technology by Libraries and Booksellers" (ALA Annual Conference, 2004, Orlando), Karen Saunders of Santa Clara City Library reported at that many DVDs were being hidden by patrons for their own use later. Using the RFID reader, staff located these lost items and returned them to circulation."

Ayre, Lori Bowen, in Position Paper – RFID and libraries, 30 August, 2004 located at http://libraryrfid.typepad.com/libraryrfid/2004/08/position_paper_.html

Features, advantages and benefits

Features	Advantages	Benefits
Sightless identification	<ul style="list-style-type: none"> - More than one item can be checked out or checked in at the same time - Items can be placed on reader without the careful placement required with line of sight reading (barcode scanner) 	<ul style="list-style-type: none"> - Reliable borrower self-checkout - Immediate and consistent borrower self-checkin - Circulation staff freed for other library tasks
Theft detection	<ul style="list-style-type: none"> - Increases the difficulty of intentional or accidental removal items from the library without checkout 	<ul style="list-style-type: none"> - Reliable knowledge of stock locations (i.e. checked in or checked out) - Financial - reduces costs of replacing stock
Ability to scan and 'read' item numbers on shelves quickly and without handling each physical item	<ul style="list-style-type: none"> - Faster inventory process - Ability to locate specific items - Mis-shelved reports 	<ul style="list-style-type: none"> - Labour savings on inventory processes, filling holds lists, shelf reading and correction processes, etc. - Higher customer satisfaction with correct and reliable shelving order
Integrates with automated materials handling systems more effectively than traditional barcodes	<ul style="list-style-type: none"> - Automated check-in chutes can provide 24-hour check-in - Automated sorting units including ability to sort into specific bins - Automated 24-hour holds pickup and checkout units - Books get sorted and back on the floor quicker for enhanced circulation capabilities 	<ul style="list-style-type: none"> - Lower labour costs on <ul style="list-style-type: none"> - checkin processes - re-shelving - holds pickup - Customer satisfaction increase due to 24-hour access
Saves processing time	<ul style="list-style-type: none"> - Tags are guaranteed for the life of the item - Once only operation for item lifecycle 	<ul style="list-style-type: none"> - Financial and labour savings associated with barcode replacement removed
Less staff handling of each individual item	<ul style="list-style-type: none"> - Protects staff from many materials handling-related injuries (e.g. RSI) 	<ul style="list-style-type: none"> - Higher staff job satisfaction - Financial: <ul style="list-style-type: none"> - Cost of qualified staff exploited with increase in added value work - reduced cost associated with staff down-time through RSI type injuries -
Permits borrowers to self-manage standard checkin and checkout processes reliably	<ul style="list-style-type: none"> - Staff can exploit their profession skills as opposed to clerical skills - Staff redeployment to customer facing duties 	<ul style="list-style-type: none"> - Staff experience greater job satisfaction from less repetitive tasks, i.e. productivity gains - Ability to expand and improve customer services
Flexibility and modularity	<ul style="list-style-type: none"> - Many levels of sophistication and implementation allowing the library to start simply and expand the solution as funding and/or processing needs progress - Ability to manage the expenses over a number of years - Ability to add newer products and features as finances and customer needs dictate 	<ul style="list-style-type: none"> - Lower initial capital investment allows for easier approval for start-up solutions - Allows for phased funding and more effective user of Institutional budgets.

Problems addressed

Budget shortfall

“There is little doubt that RFID usage in libraries is becoming a necessity. There is pressure on both public and academic libraries to increase productivity and become more like “for profit” institutions and to do more with smaller budgets.”

Ipsen, Eric, in Librarians focus on RFID, 15 March, 2004 located at <http://www.rfidjournal.com/article/view/829>

Library budgets are tight and increasingly libraries are trying to expand services and hours of opening while coping with increased circulation needs. Self-check systems are one way that increasing circulation can be managed without increasing staffing. Libraries that use RFID self-check systems find that less staff are needed at circulation desks. RFID self-check systems improve the value of self check systems by allowing patrons to check-in or checkout several books at the same time rather than just one at a time.

While RFID tags are falling in price they are still more costly than bar codes, however they do offer long term reliability. “RFID tags last longer than barcodes because nothing comes into contact with them. Most RFID vendors claim a minimum of 100,000 transactions before a tag may need to be replaced.

Boss, Richard, RFID Technology in Libraries, 14 May, 2004 located at <http://www.ala.org/ala/pla/plapubs/technotes/rfidtechnology.htm>

Occupational Health and Safety

Processing books in most libraries still entails the back-breaking, time wasting ritual of extracting books from deep bins and hand sorting the books onto carts. This is not only detrimental to the health of the workers but seriously damages the books themselves. Automated RFID units can remove much of the potential risk.

“According to a report commissioned by the San Francisco Public Library (SFPL), its circulation staff members perform 768 risky motions each hour while checking-out items conventionally. The number of motions for checking-in and sorting items is, respectively, 575 and 940 per hour. These motions include grasping, reaching, and lifting. SFPL spent \$265,000 [USD] in direct costs for repetitive strain injuries over the past three years. Injured employees lost 260 days of work and had to have 500 hours of work modified to accommodate their injuries. SFPL anticipates that RFID will substantially reduce the risky motions and mitigate worker compensation expenses.”

Smart, Laura, Making sense of RFID, 15 October, 2004 located at <http://www.libraryjournal.com/article/CA456770>

RSI injury caused by repetitive action in library processes is a major concern for library staff and management. The repetitive actions of checkout and check-in can be reduced greatly by the implementation of RFID technology where the library patrons can checkout and/or check-in their own items.

“The San Francisco Public, Berkeley Public, and Santa Clara City Libraries all report that reduction of RSI injuries is one of the reasons

they have implemented, or are considering implementing, RFID systems (Molnar, 2004; Santa Clara City Library, 2004; Flagg, 2003)."

Ayre, Lori Bowen, in Position Paper – RFID and libraries, 30 August, 2004 located at http://libraryrfid.typepad.com/libraryrfid/2004/08/position_paper_.html

Inventory



Inventory tasks using RFID can be completed in a fraction of the time required for barcode reader systems. Whole shelves can be checked with a sweep of the reader.

Singapore National Library has introduced RFID technology for its whole collection. "We can do a stock-take of 100,000 items in just four hours now," says Wong Tack Wai, senior manager of service innovation and development at Singapore's National Library Board. "Previously, we had to close the library for a week."

Yap, Jimmy, in Are we ready for radio? April 5, 2004 located at <http://www.theage.com.au/articles/2004/04/05/1081017086098.html>

The Chronicle of Higher Education reports that "the University of Nevada libraries found more than 500 lost items after officials tagged 600,000 items in its collection -- which saved the library \$40,000 [USD] in replacement costs. The library does inventories more frequently now.

Carlson, Scott, in Talking Tags, 6 August, 2004 located at <http://chronicle.com/free/v50/i48/48a02901.htm>

Increased circulation

Circulation increases, with the same or less staff numbers, are an experience common to libraries that have implemented RFID technology. "Singapore's public libraries have drastically increased their lending capacity as a result of using RFID. In financial 2003, the board projects that it will make 31.7 million loans and handle 31.5 million customers. In 1997, before the system was implemented, the libraries handled some 22 million loans and 12.8 million customers."

Yap, Jimmy, in Are we ready for radio? April 5, 2004 located at <http://www.theage.com.au/articles/2004/04/05/1081017086098.html>

This is also found in the Australian RFID experience. Baulkham Hills Library, in New South Wales was an early adopter of RFID technology. "It cost \$1.6 million for Baulkham Hills Council in Sydney's west to introduce its RFID Self Server Kiosks to four library sites, with the majority of that cost being tagging. Yet systems technology team leader Murray Lawler says even at that price the council is achieving a major return on investment, after surveys showed 85 per cent of library staff's time was previously taken up with circulation duties. Now that we have had our RFID in for six months, basically we've found only around 5 or 6 per cent of their time [is spent] on circulation duty, and the rest is free for them to do other things. So as far as that goes there's a return on investment," Lawler says."

Bushell, Sue, in Tags, You're It, CIO Australia, 10 March, 2004 located at http://libraryrfid.typepad.com/libraryrfid/2004/04/labor_savings_d.html

RFID tags have allowed the University of Connecticut library to set up self-checkout stations. "That has freed up staff members, whose salaries total about \$120,000, [USD] for other tasks around the library."

Carlson, Scott, in Talking Tags, 6 August, 2004 located at <http://chronicle.com/free/v50/i48/48a02901.htm>

Patron Privacy

Patrons' privacy is more secure using RFID technology. Library staff members don't see what patrons checkout and, in libraries with automated book-drop-off stations; staff also do not see who returns a particular item.

While there has been some media coverage on privacy concerns (tracking borrowing via scanning for RFID signals) this is not an accurate reflection of RFID technology. The RFID read range is very low and data stored should not contain any borrower detail or title detail. At the Public Library Association convention in Seattle in 2004 "most librarians understand the limitations of RFID read ranges in libraries—the government is unlikely to track what people are reading if it has to get to within a foot of someone to scan a tag. They also understand that information on customers and the materials they have checked-out is stored in the library software systems, so the threat to privacy isn't about the misuse of RFID."

Ipsen, Eric, in Librarians focus on RFID, 15 March, 2004 located at <http://www.rfidjournal.com/article/view/829>

Automated check-in

Sophistication of check-in system implementation varies from library to library, however in the most advanced implementations sorting can be accomplished automatically with RFID. As books are dropped into the book drop, the RFID reader reads the tag and uses the automatic sorting system to place the book on shelving trolleys or bins that relate to library location.



Implementation processes

Tagging

Item tagging is a simple process taking 1-2 seconds per tag programming:

1. Attach tag to item
2. Scan existing bar code – activates tag
 - Can add sorting information
 - location
 - collection
 - item type

A guide to labour requirements is 20,000 items per person per month (includes attaching tags).

Staged implementation

For some libraries staged implementation will be the best approach. The approach the library will implement includes the following phases:

Stage One – year one

- Tag items as they pass over the check-in counter
- Tag new stock
- Tag reference collection

Stage Two – year two

- Implement patron self-checkout
- Implement basic check-in
- Stock take (popular, new and reference items are already RFID tagged at this point so items without tags can be assessed for potential weeding out. Stage Three – year three)
- Implement added features, e.g. :
 - sorting units
 - automated holds pickup units

Full implementation

Libraries building new branches, or re-designing existing buildings have the opportunity to implement RFID during this process. At this time, consultation should occur between architects, library staff and RFID providers to ensure accommodation is made in the building plans for future RFID technology.

A library that approaches a full implementation for a new branch will need to develop a tagging plan and may need to employ temporary staff for the conversion (20,000 items per person per month). The process is simple and staff will require limited training.

The following table provides a guide to estimate how long it would take to convert your collection to RFID tags.

Days required to complete tagging operations				
# of Items in collection	50,000	250,000	500,000	750,000
Using 1 Station	10 weeks	50 weeks	100 weeks	150 weeks
Using 2 Stations	5 weeks	25 weeks	50 weeks	75 weeks
Using 3 Stations	3.5 weeks	17 weeks	34 weeks	51 weeks
Using 4 Stations	2.5 weeks	12.5 weeks	25 weeks	37.5 weeks
Using 5 Stations	2 weeks	10 weeks	20 weeks	30 weeks
Using 10 Stations	1 week	5 weeks	10 weeks	15 weeks

Phased implementation

It is not necessary to commit the whole library service to RFID at the same time.

For some libraries there is value in implementing RFID in certain branches while not at others. This may be due to a phased implementation where branches will be implemented one after the other over time, or because the library wishes to undertake a pilot at a specific branch first.

This can be a valuable experience and provides the library with the ability to:

- monitor and assess the return on investment
- assess customer acceptance and educational needs
- identify impact on staff and opportunities for service adjustment
- refine implementation processes

RFID equipment can be configured to read both bar codes and tags. This will permit libraries to implement RFID in one branch while other branches maintain bar-coded items.

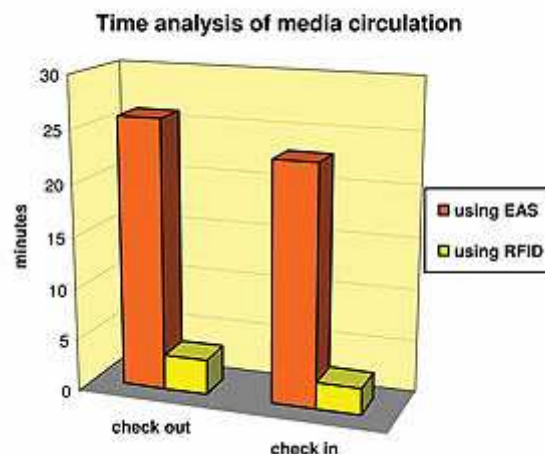
Return on investment

The following are factors to be considered in assessing ROI:

1. Time, labour, and materials costs for processing new materials
2. Time and labour associated with checking-in, sorting, and shelving materials
3. Percentage of staff time spent on the above circulation tasks
4. Percentage of staff time spent training and managing part-time workers/volunteers performing the tasks listed above
5. Number and value of lost items for a specified time period
6. Time spent searching for lost items
7. Time spent doing inventory and the amount of inventory completed
8. Time and labour spent in shelf reading and maintenance
9. Percentage of circulation currently being done by self-check
10. Average wait at circulation desk during a busy period
11. Number of staff at the circulation desk during a busy period
12. Number of requests caused by mis-shelved materials
13. Ongoing equipment maintenance costs
14. Workers compensation costs from repetitive strain injuries

Smart, Laura, Making sense of RFID, 15 October, 2004 located at <http://www.libraryjournal.com/article/CA456770>

"The Mastics-Moriches Community Library in the state of New York carried out a time and cost analysis to compare the use of Electronic Article Surveillance (EAS) and RFID systems for circulation and found that the latter gave a saving in labour time of around 85 percent."



Research Information located at <http://www.researchinformation.info/rimayjun04radiotagged.html>

SirsiDynix solutions

Automated Materials Handling

Automated checkout/check-in

Automated return systems

- Circulation Desk
- Interior/exterior wall units

Automated holds pick-up systems

Library Carts

Automated Sorting Systems

Conveyor Systems

RFID Tags

Tags

- ISO18000-3 item tags with or without coloured labels
- 'Dough-nut' CD & DVD tags

Our volume purchasing power gives you the pricing accorded to much larger organizations. While the specific tags being offered can be purchased from a variety of vendors, SirsiDynix has purchasing power that will result in a highly competitive price.

Frequently Asked Questions

TAGS AND PROGRAMMING

Can tags be used with other RFID readers?

ISO-18000-3 defines a standard set of communication guidelines for 13.56MHz RFID tags. *(NOTE: Some companies have tried to promote an earlier standard, ISO-15693, as an RFID standard. While the "prior art" of ISO-15693 was incorporated into ISO-18000-3, unlike ISO-18000-3, it is not an RFID standard. ISO-15693 was developed for contact-less access control cards, which, though similar in certain aspects to RFID, does not contain precise guidelines for several RFID features).*

While ISO-18000-3 establishes a standard for RFID, it is a general technology standard, not an application standard specifically designed for libraries. In theory, this means that all tag and reader manufacturers that adhere to the standard will be capable of reading each other's tags. In practice, however, it is important to remember that tags and readers are designed to work together within a matched component system and that full functionality of additional features may be dependent on this appropriate match.

What is the read range of the tag?

While the security gates are capable of reading information within the 91 cm aisle width, the other readers used with the system can read from a distance of no more than 15 cm. This range is large enough to provide valuable multiple tag reading functionality while limiting the possibility of reading extraneous tags.

Are preprogrammed tags available with an imprinted bar code number?

Yes. However, this is generally discouraged. They are significantly more expensive (approximately double the cost of standard tags) and will not provide time savings during processing. Following the initial conversion, a library may want to order custom printed overlays that include a barcode number.

Where on books and other printed materials should tags be affixed?

It is generally recommended that tags be placed at the bottom of the inside of the back cover as close to the spine as possible. Strict consistency should be avoided and actual height of the tag placement should be staggered in approximately four different positions.

Should a protective cover be placed over each RFID tag that is placed in a book?

Using protective covers is cost effective and provides additional protection for the RFID tag while camouflaging its purpose. A custom label can be provided (usually with the library logo).

Where on CDs and DVDs should tags be affixed?

The CD/DVD "dough-nut" tag may be directly affixed to disks that have no metallic content in their inner circles (where no data is stored). Standard tags should be affixed to cases for those CDs and DVDs that have metallic content.

Can the dough-nut " tag be stamped, written upon, or covered with an identity label?

Yes to all.

Where on videocassettes should tags be affixed?

The standard tag can be affixed directly to the face of the video, in most cases covering one of the windows.

Where on audiocassettes should tags be affixed?

RFID tags are not designed to be placed directly onto audiocassettes (not an attractive option from an economy standpoint). Standard RFID tags should be placed on audiocassette cases and audio book albums.

Are there any materials to which an RFID tag cannot be applied?

RFID tags should not be placed inside of metallic materials. Metallic book jacket covers should be avoided. In those cases, the library may choose to make a photocopy of the original cover. Where this is not possible (paperbacks), the RFID tag may be placed on the outside of the cover.

How are multi-part items tagged?

The library may decide to use only one RFID tag per item, regardless of how many parts that item may include. If it does so, it may tag the case or one of the parts. (We recommend that the last part of a set be tagged since that is the one most likely to be left in the patron's player.) If individual item parts are uniquely identified in the library's circulation database, they may be individually tagged and identified with their item identification numbers. If the library's circulation database is not set up to uniquely identify the individual item parts, it still is possible to include information in the tag indicating, for example, "part 1 of a 4 part set." Doing so secures each part independently and informs the library or patron if all parts of a multi-part set are present at the time of checkout and check-in.

How are tags deactivated, removed or replaced when they are discarded from the collection?

Cutting of a tag's antenna circuitry will render it inoperable. Should the library desire to remove the tag from the item, it should use an adhesive or label remover such as "un-du."

PROGRAMMING OF TAGS (CONVERSION)

What is the approach to retrospective conversion (programming of tags)? The scanning of an item's existing bar code is all that is necessary to program the item ID number into the tag and activate the tag's security bit. If desired, the RFID tag may be placed on the item prior to programming (back inside cover at bottom near spine for books and under the face label, over a window or under the spine label of a video). It is best to program a CD and DVD tag before applying it to the disk. The library may choose to cover RFID tags with custom printed protective overlays. If desired, sorting information (branch ownership and shelving area), item type information (e.g. "reference") and multi-part set information may also be written to the tag. It is anticipated that the conversion process will be done on a section by section basis. Therefore, sorting and item type information need not be individually set for each individual item since that information will be the same for all items in any particular section. *Note that this process does NOT require communication with the library's ILS. It therefore can be done as quickly as the staff person is capable of placing an item on the reader, scanning the bar code and checking a field on the monitor to see if the conversion was successful.* During the retrospective conversion process, the library may choose to place a computer workstation or laptop on a mobile cart that may be wheeled through the aisles.

How long does it take to program a tag?

It only takes a second or two to program the tag. Most of the time needed for collection conversion consists of placing the tag and overlay on the item. A single individual working at a steady pace can easily convert over 20,000 items a month (without overtime!).

Is there any verification process to ensure that tags are programmed correctly?

The programming station is usually configured so as to ensure that all of the digits in the bar code are read from the bar code label and written to the tag. Experience has shown that this effectively eliminates programming error. If the library chooses, it may allow the operator to verify the information on screen before writing it to the tag.

Is there any reason that a tag should be placed on an item but not programmed at the very same time?

No. The programming of the tag is so fast and easy that this option should not even be considered. Furthermore, not programming a tag at the same time as it is inserted into the item can easily lead to confusion.

Once a tag has been programmed, can it be reprogrammed at a later time?

While an option does exist to allow the bar code on tags to be reprogrammable, it is strongly recommend that the programming station be set so that once the barcode number has been programmed into the tag, the number is "locked" and may not be changed. Other information may, however, be changed easily at any time.

Once the initial conversion is completed, how should the library process new materials?

The library continues to bar code its materials as usual or have bar code numbers printed on tag overlays. From that point forward, the tagging process described above should be followed. The library may choose to have books processed with an RFID tag by an outside vendor (Baker and Taylor, Ingram, etc.). The library may decide to have the vendor *program* the tag as well, but, if the library chooses to put sorting or item type information into the tag, we recommend that the actual tag programming (as opposed to tag insertion) be done by the library itself.

Once the library is using RFID, will it be able to dispense with putting bar code labels on items?

For the foreseeable future, libraries will continue to need bar codes for the purposes of interlibrary loan. And since an eye-readable number is needed should the library lose electrical power, it makes sense to ahead and have a barcode backup as well. As noted above, following the initial conversion, libraries may choose to have the barcode imprinted on the tag overlay.

CHECKOUT**Can a bar code scanner be used concurrently with an RFID reader?**

A bar code scanner may operate along with an RFID reader on the same PC. Most RFID software applications accept scanned barcode input in addition to RFID input. The majority of libraries continue using bar coded patron cards and some libraries may choose not to place RFID tags in all items. In most cases, the library needs to be able to process materials that come from other libraries that do not have RFID tags, thereby necessitating a barcode scanner.

Will the system alert staff if one or more parts are missing from a kit or a set?

The library may choose to utilize this option if it tags each item individually as described in question above concerning multi-part tagging. If any one item of the set or kit is detected, the system will look for all items in the set and will not proceed with the transaction unless all or detected.

In what situations would checking out items one at a time be recommended?

This is well suited in those situations where a significant percentage of items available for check out do not have RFID tags. The one at a time process may be set up so that if the RFID reader fails to detect an RFID tag, it then instructs the user to scan the item's bar code label.

Is there any limit to the number of items that can be read in a single stack?

This varies from system to system. While the anti-collision features of the tags and the system would allow over 20 items to be processed simultaneously, tests have indicated that that people start making counting mistakes when they go above five and certainly ten. Therefore, we recommend that the system be configured to allow for no more than 10 in a stack.

If a stack of items is being processed simultaneously, what happens if an RFID tag is absent from one or more items or if one or more tags is not detected?

Most modern self check units can be configured to read barcodes as well as tags.

If a stack of items is being processed simultaneously, what happens if one or more items are not approved for checkout (non-circulating item or item held for a different patron)?

The patron is instructed to remove any items not approved for checkout before the checkout process can be completed.

Is there a limit to the number of stacks that the patron can checkout, one right after the other?

Other than a total book limit imposed by the library itself, there is no limit to the number of stacks that a user may checkout during a single transaction.

Can CDs and DVDs also be placed in a stack?

In many cases, there is no problem in reading multiple CD and DVD tags, even when the disks are stacked.

AUTOMATED CHECK-IN

What is the RFID approach to automated check-in?

As items pass through the system, they are automatically checked into the library's database. The security bits on the tags will also be reactivated at this same time. The automated returns system may be configured to generate a receipt for the patron. On most systems as an item on reserve is returned, an audio alarm is sounded so that staff in the area may immediately pull it for special handling. A report showing all items on reserve that have been checked in may be generated or, if desired, a separate ticket may be generated for each returned item with a hold status, thereby alerting staff to special and immediate handling needs. Automated check-in requires SIP2.

What are the key advantages and disadvantages of RFID book drop style?

No change in patron behavior is required; patrons may continue to return items as they always have in the past. Multiple items may be dropped simultaneously. The book drop style return is relatively inexpensive and installation requirements are minimal. In some cases, the library's existing book drop can be retrofitted to accommodate the RFID reader. The same style drop may be used for external (exterior wall) and internal (interior wall) installations. It is not recommended to be configured to provide receipts for patrons since items that do not have an RFID tag or whose RFID tag may have been damaged will not be detected.

How do the returns and sorting systems communicate with the library's database?

Communication is done through SIP2 working over TCP/IP on a 10/100/1000 Base T Ethernet network. While not recommended, wireless network adapters may be used if necessary. Installation requires a valid IP address configured locally or through DHCP. If the computer is on the same network segment as the SIP server, no gateway is necessary.

What happens should the library's server go down?

Should, for any reason, the returns system lose contact with the server, most systems will automatically store the item numbers in a separate file that can be sent to the library's database once the server is again operating.

SORTING

What options does RFID provide for sorting return items to facilitate re-shelving?

There are two approaches:

Items checked in at a standard RFID configured book drop, as described above, would be taken to a staff station consisting of an RFID reader connected to a computer. Upon placement of an item on the reader, the computer will indicate the library shelving location and, if desired, a standard book truck location upon which the item should be placed. This can be done using the SIP2 sorting extension or without SIP using the sorting information programmed into the tag (items on hold should have already been removed).

...Or

As described in the automated check-in section above, this system uses a standard in-wall book return (one handed face plate is recommended). Patrons are instructed to insert one item at a time into the chute. After an item goes down the chute, it is directed to a conveyor belt that moves it up and across RFID readers that read the tag and reactivate the security bit. Items are then sorted according to library defined criteria as described above. In the automated sorting process, items without RFID tags are delivered to the exception bin.

How does the automated sorting system work?

The front end (patron interface) part of the system is the same as described in the automated check-in section above. The system may be configured to accept bar code input so that items without RFID tags or items with damaged tags may also be returned through the system.

In the simplest three-bin system, for example, items would most likely be sorted by holds (this bin would have a receipt printer attached that produces a ticket with information about the patron waiting for that item), in-branch items to be re-shelved and exceptions. Automatic sorting requires SIP2. Some sorting capabilities may require the SIP2 sorting extension. To the extent that the library does not require re-shelving classifications beyond those programmed into the tag, the SIP extension is not necessary. There is virtually no limit to the number of sorting locations that can be created.

What if non-RFID tagged items are returned to the library?

In the automated sorting process, items without RFID tags are delivered to the exception bin.

SECURITY

What is the recommended approach to security?

When library materials are checked out, either at staff or self checkout stations, the tags' security bits are disarmed. The security bit is however, different from any other bits on the tag. There is a unique TAGSYS tag feature that uses a dedicated EAS (Electronic Article Surveillance) burst at 106 KHz. This EAS burst is issued only if the EAS bit is set to the on position (which it would be unless it has been turned off during a check out). It does not require a wake-up signal and is therefore a "Tag Talks First" (TTF) type of modulation. The functional effect of this is that the security gates only detect security bits in the "on" position; they do not attempt to read each tag to determine if the bit is on or off. This keeps the detection rate of the TAGSYS system at consistently above 95% regardless of the number of items that are in the field. All other RFID systems are based on "Reader Talks First" (RTF) type of modulation. The security gates are attempting to read every tag in the field in order to determine if the designated security bit is either "on" or "off" (3M, Bibliotheca, Libramation) or to read the entire item identification number (Checkpoint). In this scenario, one can easily see why performance will suffer as there are more tags in the field. This degradation may not be readily apparent when there are only one or two tags in the field, but when there are five or more, the drop is considerable (down to the 70% range or even below).

Is there an option available that will inform the library of items that have passed through the security gates without their security bits being disarmed?

This is possible with some units. When the security gates detect an “on” security bit, they will also record the item ID number of that same tag. This information may be uploaded periodically in batch mode to a computer. Alternatively, a computer can be connected permanently to the security system so that staff can see in real time the item number of the tag that has alarmed the security gate. The “item ID” security gates are more expensive than the standard gates equipped with ability to detect the “bursting security bit” only.

What types of alerts are activated when an “on” security bit is detected?

As noted above, when library materials are checked out, either at a self-checkout station or by staff, the security bits in the RFID tags are automatically deactivated (no additional steps are required). Should a non-deactivated item pass through the security gates, an alarm will sound and lights will flash.

Can external devices be connected to the gates?

Yes. CCTV may be connected to the security gates as well as other external alarm or recording devices that need to be activated by an electronic impulse. This allows the library to record the image of anyone exiting through the gates when the alarm sounds.

Does the security system require a separate server?

Modern units do not require a separate server.

What is the security gate range of detection?

The transmission radius is generally 45 cm to each side of each pedestal. Two pedestals, therefore, create an aisle measuring an ADA compliant width of over 91 cm. This means that there is detection not only between the gates but outside of them (to prevent the pass-around move). The system detects up to 1.65 m above the floor. There is no limit to the number of items that can pass through the gates at any one time if using TAGSYS tag bursting technology.

Do the security gates need to be located away from metal door frames or computers?

Gates should be at least two feet away from metal door frames and eight feet away from computers.

Will electronic devices interfere with the system?

No standard electronic devices are known to consistently set-off the alarm.

Are security pedestals wired directly into electrical outlets?

Yes. All pedestals operating at the same exit doors should be operating on the same electrical circuit.

What design options are available for security gates?

Standard gates feature heavy duty plastic covers. The library may choose to have the standard plastic covers replaced with customized wood covers designed to match the library's décor. The library has the option of mounting gates into the floor or into portable base plates. The latter option may also eliminate the need to drill into flooring for the purpose of placing conduit.

SHELF READING

What is the RFID approach to inventory maintenance?

An inventory unit antenna is waved along the base of shelves. The wand's antenna is designed to allow the user to easily access upper, middle and lower shelves. The library's database may be imported in shelf list order into the laptop so as to detect items that have been shelved outside of a predetermined range. Specific items may be uploaded into the laptop from the database so that when operating in tag search mode an alarm will sound when a designated item is detected. When not being used for inventory or item searching, the inventory reader becomes an invaluable everyday tool used to scan reference books before they are returned to the shelves, thereby collecting usage information.

GENERAL

Will RFID hardware interfere with other electronic devices in the library?

RFID hardware will not create any interference with current security systems, PCs, phones or other electronic devices.

Are there any health risks associated with RFID?

No. The system is not harmful to persons, including those with hearing aids or pacemakers.

Is the system in any way harmful to library materials, including audio-visual materials?

No.

Are there any issues of patron privacy affected by the implementation of an RFID system?

No. We recommend that the tag contain only the following information: (1) the item identification (bar code) number, (2) the security theft bit, (3) variable memory that we recommend be used for storing branch ownership information and shelving location (optional), (4) item type, such as non-circulating reference material (optional), and (5) multi-part set information, such as par 1 of a 4 part set (optional). We discourage the inclusion of author, title or call number information. While the security gates are capable of reading information within the 91 cm aisle width, the other readers used with the system can read from a distance of no more than 1.8 m. This applies not only to tags affixed to books but also tags placed on or embedded within patron cards.

Does RFID have any effect on magnetic media?

RFID hardware will not effect magnetic media, including library cards, credit cards, video cassettes, etc.

based on *Answers to Frequently Asked Questions* - Integrated Technology Group

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Useful Links

ALA RFID site at <http://www.ala.org/ala/oif/ifissues/rfid.htm>

Fact sheet (bibliography) at <http://www.ala.org/ala/alalibrary/libraryfactsheet/alalibraryfactsheet25.htm>

RFID Blogs at <http://libraryrfid.typepad.com/libraryrfid/> (old) and <http://www.libraryrfid.net/> (new)

RFID Gazette site at <http://www.rfidgazette.org/>

RFID in Libraries site at <http://www.libraryrfid.net/wordpress/index.php?cat=6>

RFID_LIB – electronic list subscription detail at <http://witloof.sjsu.edu/ecommunication/electroniclists.htm>

TAGSYS RFID – <http://www.tagsysrfid.com>

Note – please be aware that RFID information dates quickly and you should check current standards and technical detail.

Further Information

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