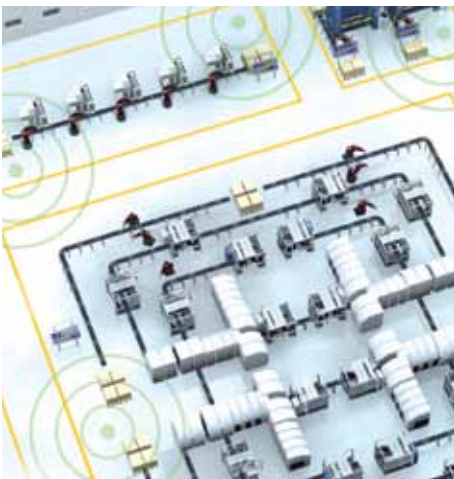


Traceability in Manufacturing

Industrial identification to improve your process chain



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BAUUFF

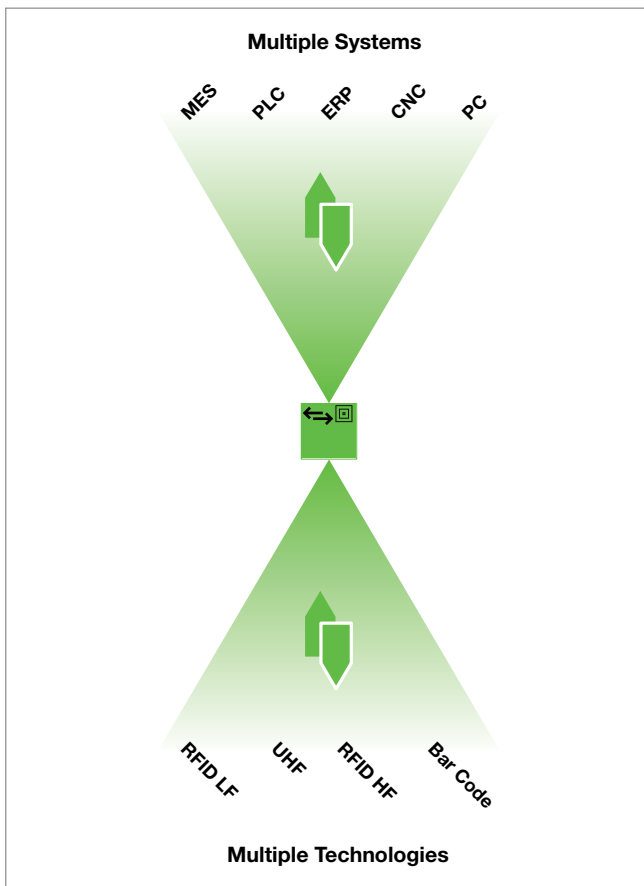
Traceability Partner

Balluff's industrial identification experience goes back to the 1980's. We were a pioneer in the field of industrial Identification with low frequency systems designed specifically for manufacturing.

Today, Balluff is still a leader with a full line of Low Frequency (LF), High Frequency (HF) and Ultra High Frequency (UHF) RFID technologies as well as stationary bar-code readers. Our experience has enabled us to provide field-proven solutions for traceability in advanced manufacturing facilities.

A Multiple Auto-ID Platform Approach

Our systems utilize a multiple platform approach to provide the best solution for integrating traceability into a process. Regardless of the RFID tracing technology or controlling system requirements, Balluff has the platform solution. This approach gives our customers the right architecture and communication structures they need.



Traceability in Manufacturing

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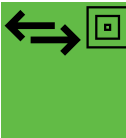
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Traceability in Manufacturing

Reach Your Goals with Traceability

Manufacturers are facing ever increasing competitive pressure and legal requirements. The desire for visibility in the process, customer satisfaction, profits and compliance are pushing many manufacturers to look at traceability as a long-term strategy. Manufacturers have discovered that implementing a traceability program is a proven method to meet their strategic goals.

With all the possible options, implementing a traceability program is a matter of finding a qualified partner. At Balluff, we have been developing traceability solutions for over 25 years. With access to qualified integrators, we know what it takes to have a successful implementation...that is, to ensure quality and maximize your return on investment.



Traceability – Documenting the Supply Chain

Traceability is the act of documenting every step in a process chain. It will record the history, location, or use of an item by means of automated identification. Manufacturers use this information to gain visibility to achieve Just-In-Time (JIT) delivery, lean manufacturing, enhanced quality, and regulatory compliance.

Traceability Goal

Manufacturers utilize traceability to make improvements in the following areas:

- **Comply with regulatory and quality standards**
- **Proactively manage product recalls with near-real-time corrective action**
- **Improve customer safety, customer satisfaction, and profit margin**
- **Manage product quality and reduce the cost of nonconformance**



Traceability in Manufacturing

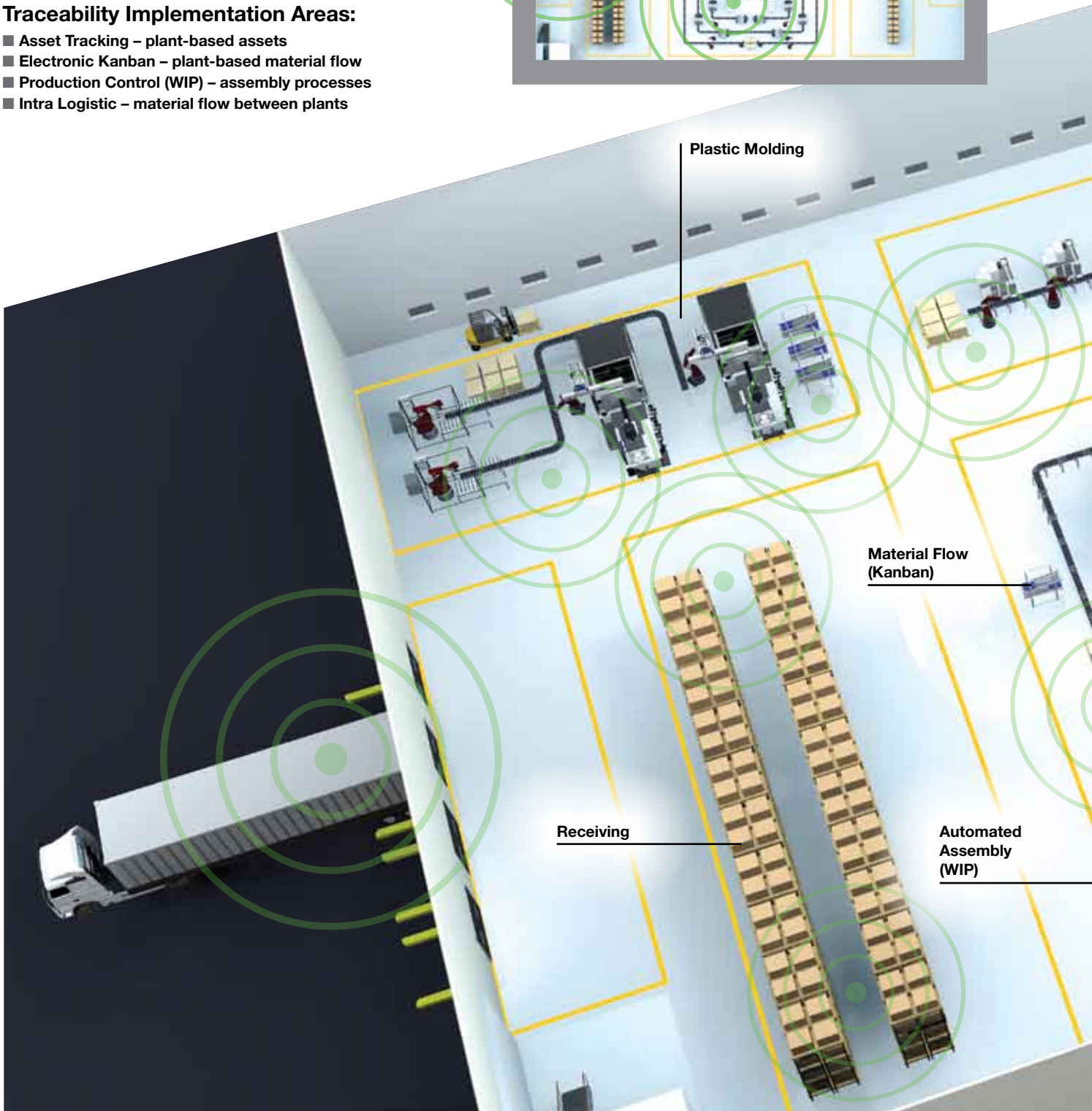
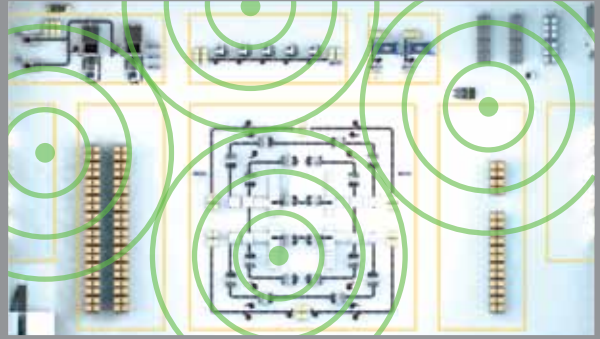
Starting a Traceability Program

This guide provides a comprehensive overview of the four general areas where a traceability program will provide significant return on investments. Included in the overview are key ROI elements to help you plan your strategy. Identifying your area(s) will help shape the type of hardware and software required, as well as process changes, to accomplish your goals.

Traceability Implementation Areas:

- **Asset Tracking** – plant-based assets
- **Electronic Kanban** – plant-based material flow
- **Production Control (WIP)** – assembly processes
- **Intra Logistic** – material flow between plants

IMPLEMENTATION AREA Plant Wide

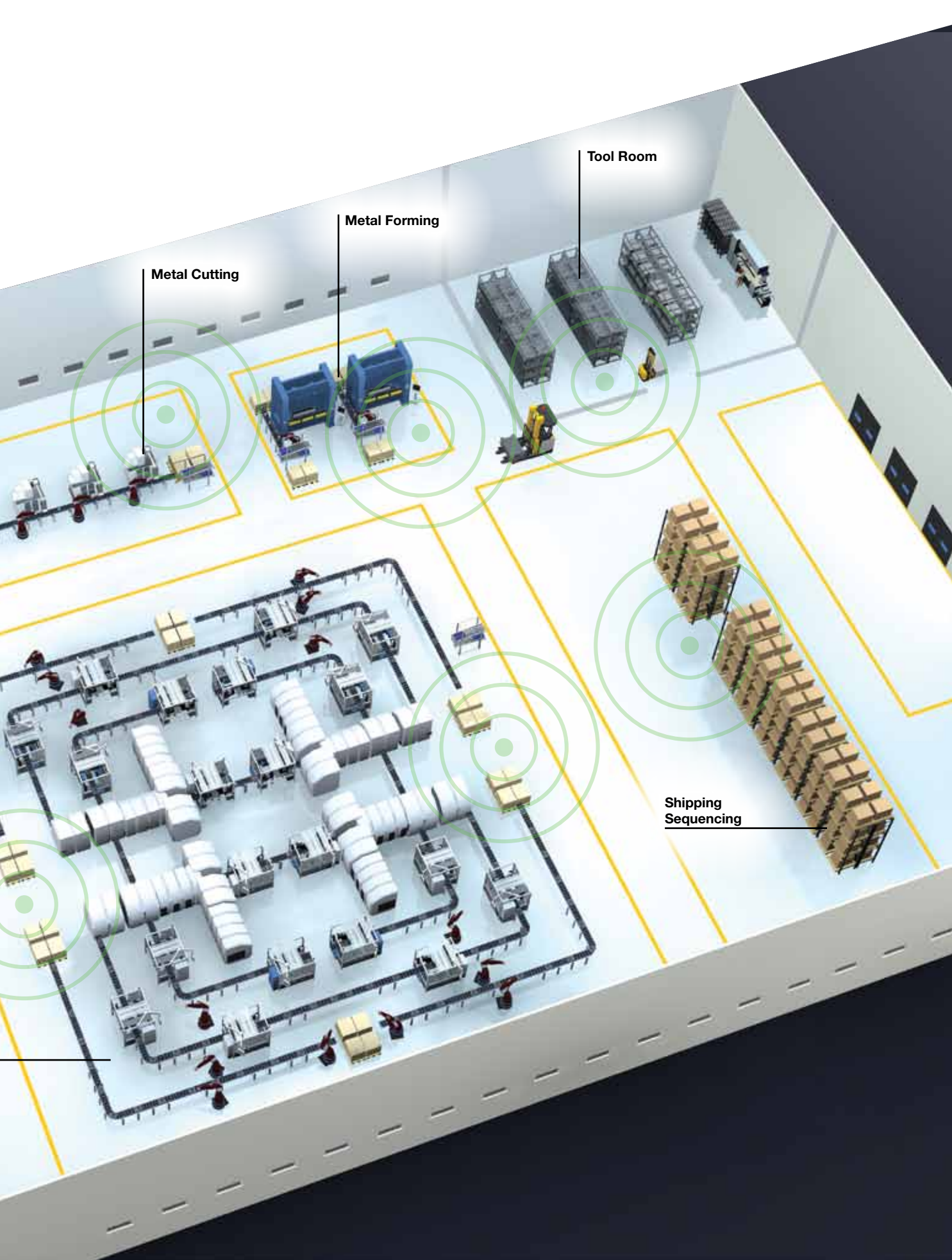


Plastic Molding

Material Flow
(Kanban)

Receiving

Automated
Assembly
(WIP)

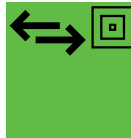


Metal Cutting

Metal Forming

Tool Room

Shipping Sequencing

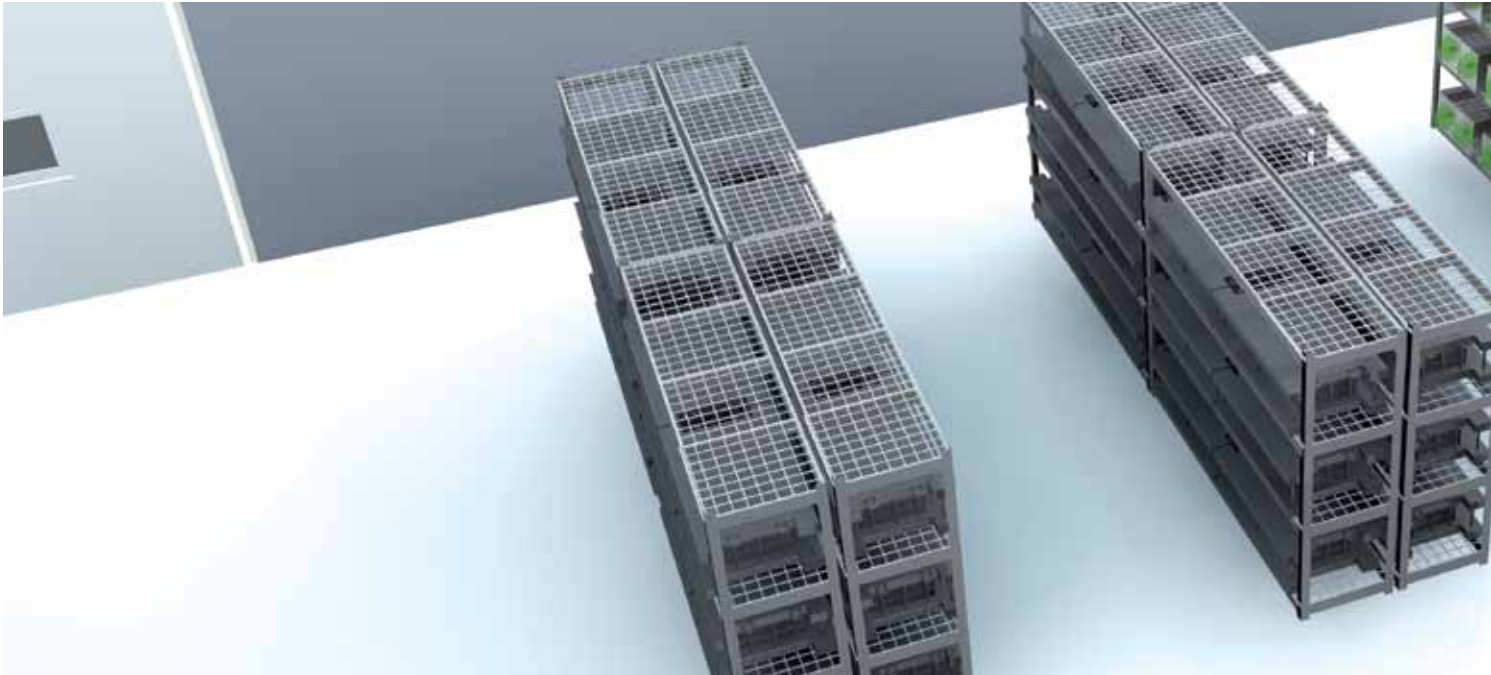


Plant-based Asset Tracking

The goal of plant-based asset tracking is to reduce non-productive time and asset losses, while increasing overall productivity and utilization by accurately tracking assets. Bar code and RFID technologies track changes to an asset's location, condition, conformity status, and availability. Assets can also be matched to intended parts to verify correctness.

Key ROI Elements

- Reduce asset's non-productive time
- Reduce asset losses
- Increase overall asset productivity
- Increase asset utilization



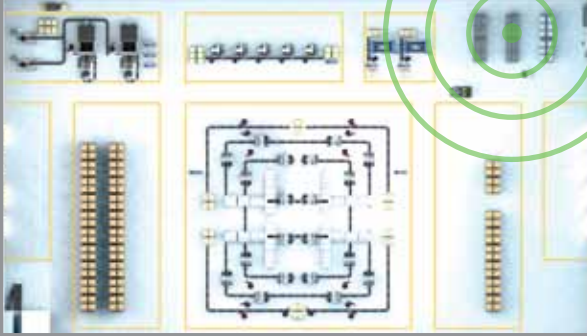
Central tool room holds critical assets that require tracking such as machine tools, dies, molds, calibrated wrenches and modular tooling components.



Machine tools can be fitted with RFID tags to track and download offset measurements (from presetter), set-up parameters, usage, and tool life data.

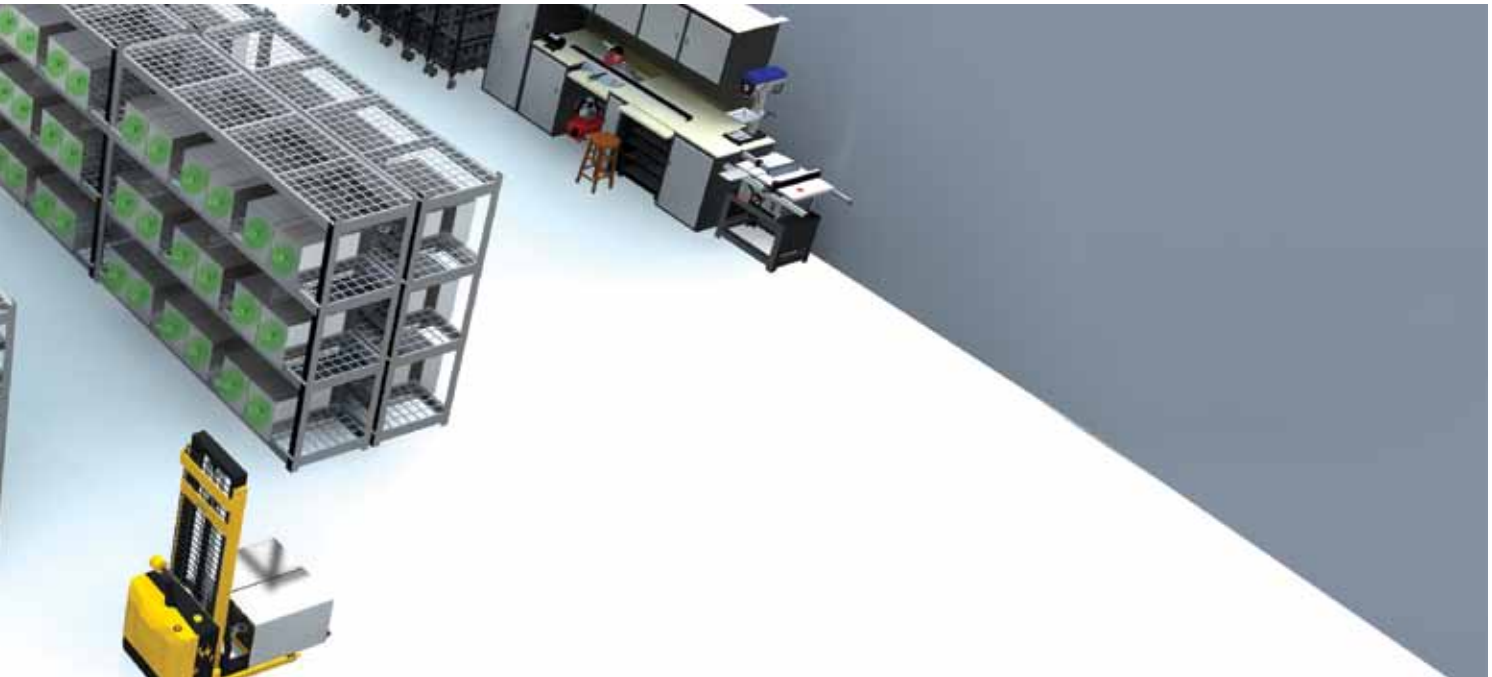
IMPLEMENTATION AREA

Asset Tracking

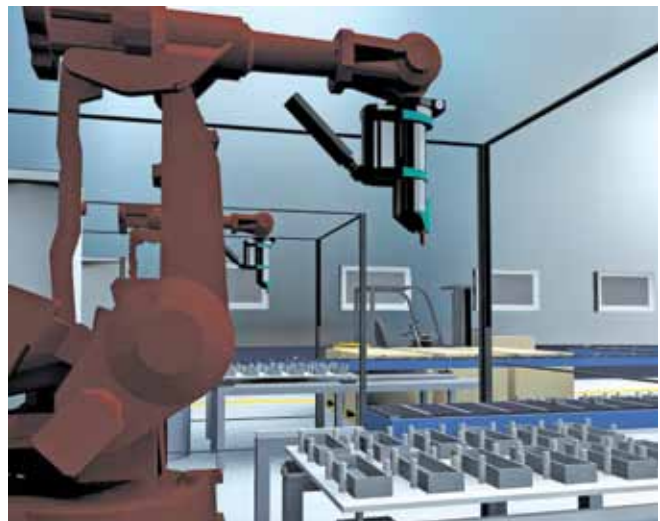


Commonly Tracked Assets:

- **Machine tools:** Offset measurements (from presetter), set-up parameters, usage, and tool life data
- **Modular automation sub-systems:** Set-up parameters, usage, maintenance, and component matching
- **Automated part-change identification**
- **Molds and dies:** Set-up parameters, usage, maintenance, and part matching
- **Totes/containers:** Location, usage, and tracking data
- **Hand tools:** Calibration data, location, use level, and part matching
- **Storage tanks and vessels:** Confirm contents, usage, and maintenance



By attaching an RFID tag to molds and dies, set-up parameters, usage, maintenance, and part matching can be tracked and downloaded.



Modular automation sub-systems such as End-of-Arm tooling (EOT) benefit from automated set-up parameters, usage, maintenance, and component matching.

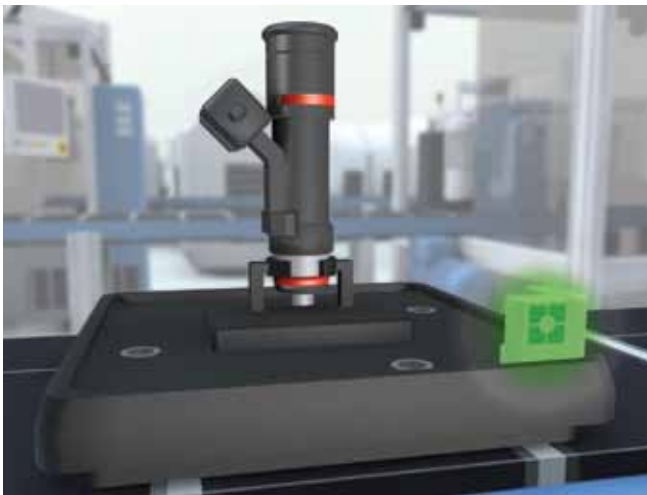
Production Control in Assembly Automation

Full Transparency for Manufacturing Execution Systems (MES) in Your Automated Assembly Process

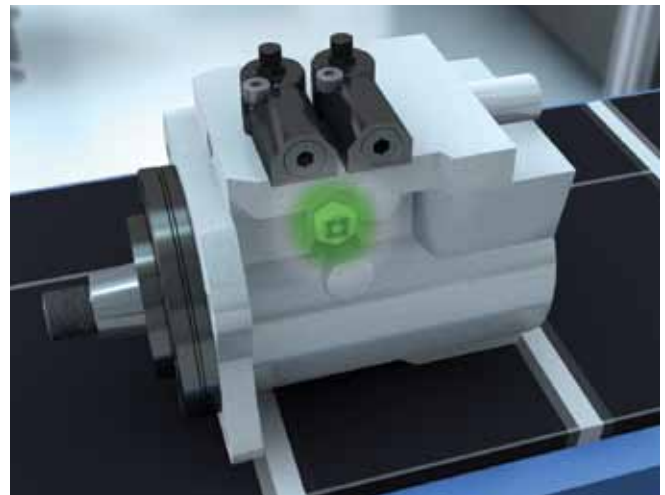
Manufacturing plants utilizing automated assembly have unique requirements when it comes to tracking their work-in-process (WIP). Tracking can also include all the lineage information from all the components used in the final assembly. Most automated manufacturing lines also utilize flexible manufacturing where multiple product versions are made on one line. When we look at automated assembly in total, there are three primary areas of tracking: Build, Process, and Lineage Information.

Key ROI Elements

- Enable flexible manufacturing
- Track the rework process
- Effectively handle product recalls
- Maintain regulatory compliance



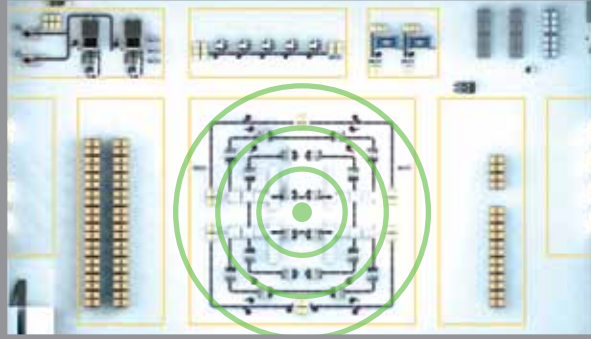
When a build pallet is utilized, RFID tags are permanently mounted on the pallet to enable traceability.



With no build pallet or if parts leave the build pallet, RFID tags are temporarily attached to the manufactured part to enable traceability.

IMPLEMENTATION AREA

Production Control



Build Information

Used heavily in flexible manufacturing environments, build information fully describes all variables in producing a specific part. It is essentially a build sheet that instructs the automated assembly equipment what is required to produce that unique version. Build information can be held locally on an RFID tag or in a centralized database identified by the tag.

Process Information

With dual uses, process information is critical to the manufacturing process. It holds the results from all the in-process test and error proofing devices. There are two main uses; flow control and archiving. With flow control, in-process test results are conveyed downstream so the process flow can be adjusted accordingly. If a particular part failed a test, downstream processes can be bypassed and the part can be sent to a rework area, where the exact problem is then presented to rework technicians. Archiving is used for post-production tracking. Process data is stored for later use in recall, liability, and regulatory situations.

Lineage Information

Similar to archiving process data, lineage data adds the additional step of tracking each component used in the final assembly. By consolidating all component data with the process information, a part's complete construction is documented. This is vital in the event of a product recall, and to maintain regulatory compliance.



E-Kanban Process

Electronic Kanban (E-Kanban) is a messaging system that uses a mix of technology to trigger the movement of components and materials within a manufacturing facility. E-Kanban differs from traditional Kanban in that it uses technology to replace traditional elements such as Kanban cards with barcodes or RFID tags.

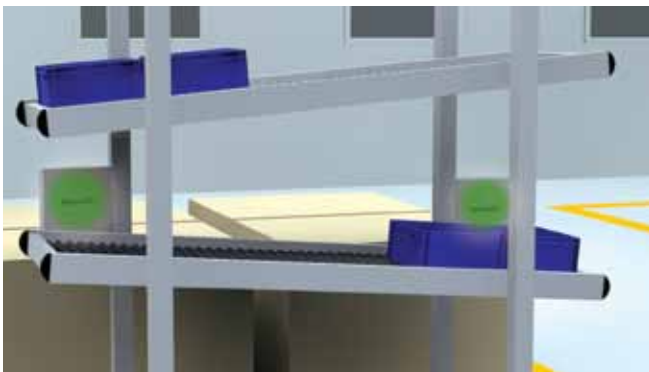
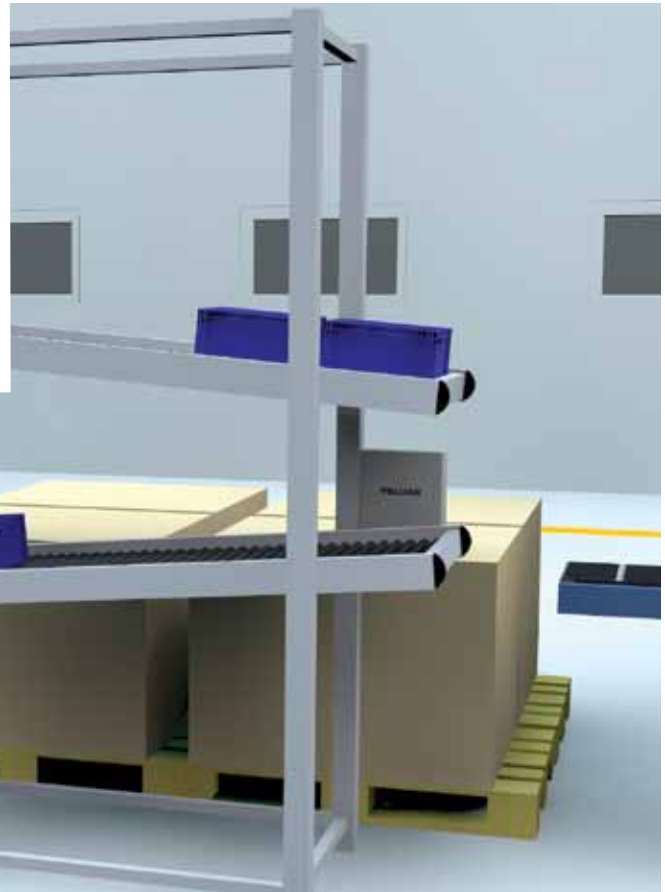
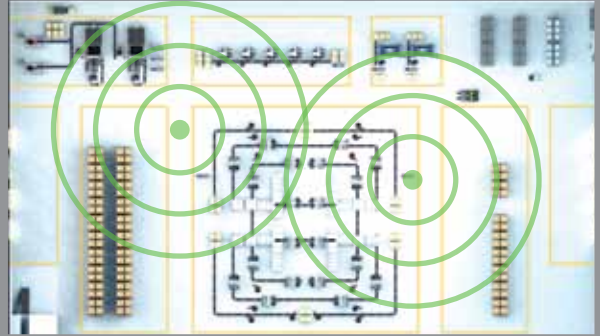
With RFID technology, there is the possibility to fully automate the identification process. This will result in faster tracking with more reliability and less operator intervention.

A typical E-Kanban system will see inventory marked with barcodes or RFID tags that are scanned at various steps in the manufacturing process to signal usage levels that are sent back to an ERP system for replenishment. This method ensures a constant flow of material while keeping inventories to a minimum.

An additional benefit of E-Kanban is the integration of outside suppliers through an ERP system. By relaying this information, the entire supply chain can be optimized for Just-in-Time inventory flow.

Key ROI Elements

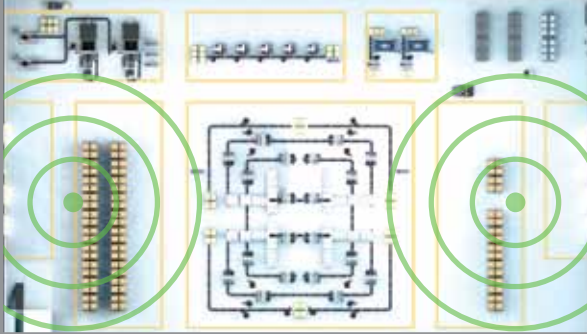
- Reduce levels of in-process inventory
- Maintain tight control of in-process inventory levels
- Implement Just-in-Time inventory flow with outside vendors



New assembly components are added to cell racks in boxes with UHF tags affixed.

Box contents are automatically read by UHF reader and that information is sent to the ERP system to ensure proper levels are maintained.

IMPLEMENTATION AREA Intra-logistics



Intra-logistics

Inter-plant Product Flow

Intra-logistics track incoming and outgoing shipments of parts and products between the final assembly plant and various sub suppliers. RFID tags and barcodes are affixed to containers or pallets, so parts can be tracked coming and going from individual facilities.

As parts are loaded onto the pallets or in containers, the exact quantity, version number, serial number, etc. are written to a permanent or disposable RFID tag for tracking. When the container arrives at the destination facility, readers automatically verify the contents. As parts are used and inventory levels drop, the ERP system will signal the need to replenish. When the pallet or container is empty, the RFID tag is erased for reuse or is destroyed. The container is then sent back to the supplier where the process starts all over again.

Key ROI Elements

- Maintain tight flow control with multiple sub suppliers
- Reduce time and potential errors when receiving components
- Maintain high level of visibility and traceability from sub suppliers to finished products
- Maintain regulatory compliance



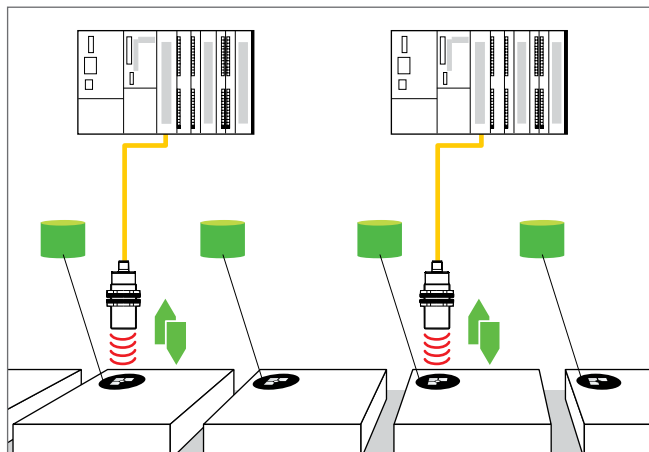
From incoming components to outgoing final products, UHF RFID tags track all movements between manufacturing facilities.

The System

Systems start by developing a data map. This map defines the type of data being tracked and the source of the data. A physical bar code or RFID tag is attached to the asset or product. The data can be decentralized by using a read/write RFID tag. Bar coding and RFID also offer simple read only, but will require a centralized database to store the actual data. Readers are positioned at critical locations to track movement, provide setup information, and record events related to the process.

Decentralized Data – Read/Write

When using a decentralized approach, the tracking system typically uses RFID that supports both read and write functions. All tracking and traceability data is held on the RFID tag and travels with the product or asset through its process. This is an ideal method to share traceability information in a non-networked environment. Basically, it will interconnect islands of automation.



RFID – Read/Write

Example of Decentralized data control: All information is read and written to the RFID tag. Central database is not required. Data can be shared between work cells using the RFID tag.

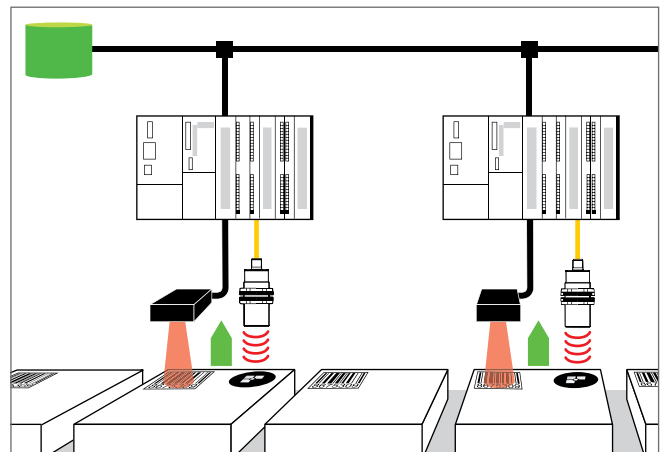
Decentralized Data Map Example

Manufacture	Quality Inc.
Location	Tuscaloosa
Date	June 2012
Lot	87
Sequence	902
Options	1LRT
Color	Neutral
Current	2.23
Load Test	89.5
Color Match	Pass
Part Status	Pass

- Data on RFID tag
- Data map labels

Centralized Data – Read Only

This method only requires reading a unique identifier, or license plate, to be carried on the product or asset. All relevant tracking and traceability information is actually stored in a central database. When detailed information is required, it is accessed only in the central database. The unique identifier is stored in the form of a barcode or an RFID tag. RFID is preferred in harsh environments where barcode reliability would be problematic due to uncontrolled lighting and debris build up. RFID also provides user defined identifiers.



Optical/RFID – Read Only

Example of Centralized data control: License number is the only information read from the barcode or RFID tag. The license value is used to point to location of actual data in the centralized database. All reading and writing of actual data is done in the database.

Centralized Data Map Example

License No.	123456
Manufacture	Quality Inc.
Location	Tuscaloosa
Date	June 2012
Lot	87
Sequence	902
Options	1LRT
Color	Neutral
Current	2.23
Load Test	89.5
Color Match	Pass
Part Status	Pass

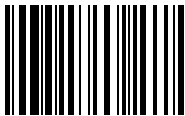
- Data read from Barcode or RFID tag
- Data held in central database – referenced by License No.
- Data map labels

Tracking Technologies

There are two basic technologies for tracking systems: Barcode and Radio Frequency Identification (RFID). Each technology has multiple versions to address specific needs. Barcode and RFID can even be combined to provide more visibility to your process.

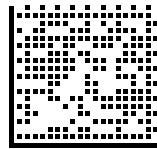
Barcode

1D Bar Code



- extremely common
- multiple formats
- lowest data content
- requires line-of-sight
- read-only data
- requires fairly clean environment
- lowest cost
- applied by direct-printing or labeling

2D Bar Code



- very common
- multiple formats
- higher data content
- requires line-of-sight
- read-only data
- requires fairly clean environment
- lowest cost
- applied by direct-printing, labeling or direct part-mark (DPM)

RFID

Low Frequency (LF)



- very tolerant in metal environment
- inductive coupling, near-field communication
- read and write data
- medium data content
- low data rate
- single tag reading
- proven technology
- low read ranges

High Frequency (HF)



- worldwide standardized frequency band
- inductive coupling, near-field-communication
- read and write data
- high data content
- high data rate
- multiple tag reading possible
- proven technology
- low to mid read ranges

Ultra High Frequency (UHF)



- worldwide standardized air interface protocol EPC Gen 2
- back-scatter, far field communication
- read and write data
- low data content
- highest data rate
- best multiple tag reading
- emerging technology
- high read ranges

Tracking Hardware

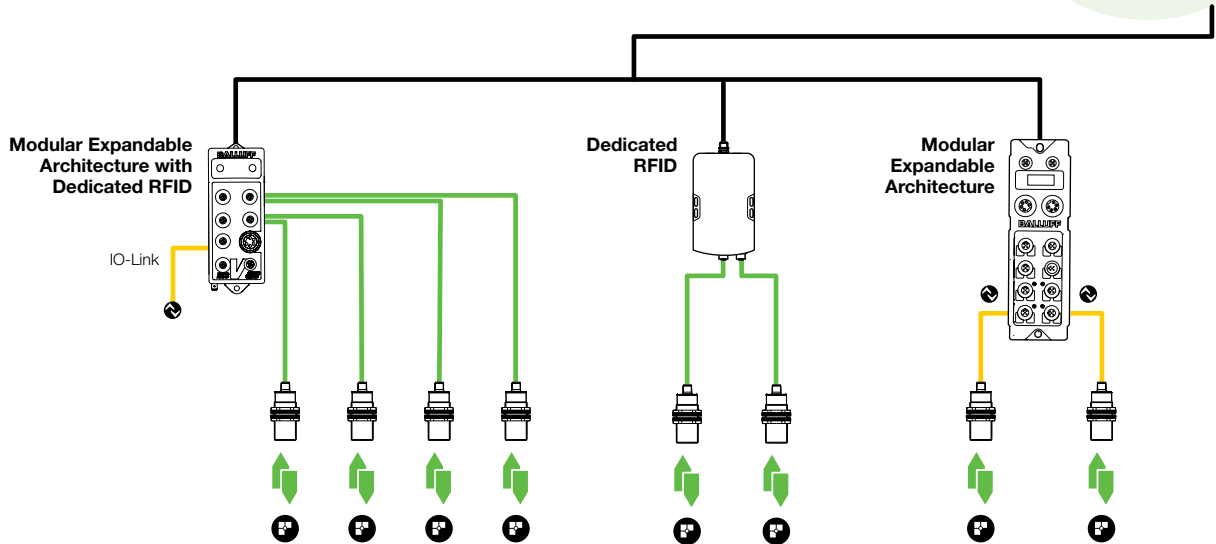
There are two possible options for barcode scanning or RFID read/write points – fixed and handheld. Fixed points are the most economical and provide a fail-safe method to ensure the intended data is connected with the appropriate asset or product. Handhelds are powerful alternatives that offer great flexibility to your process, but care must be taken that the user connects the data with the appropriate asset or product.

Hand Held



Fixed Mount





Low Frequency (LF) BIS C, BIS L, BIS V

Technical characteristics

- 125 kHz
- up to 100 mm read range
- 192 byte user memory

Advantages

- best metal tolerance
- read-only and read/write tags available
- common bus interfaces available
- I/O-Link (with BIS V and stand-alone)

Typical applications

- production control
- assembly line
- tool identification



High Frequency (HF) BIS M, BIS V

Technical characteristics

- 13,56 MHz
- up to 400 mm read range
- 2000 byte user memory

Advantages

- worldwide standardized: ISO 15693, 14443A
- high data rate
- high memory tags available (FRAM)
- high temperature tags available
- metal mount tags available
- common bus interfaces available
- IO-Link (with BIS V and stand-alone)
- various read/write heads available
- various transponder form factors available

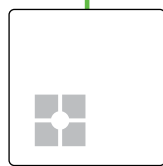
Typical applications

- production control
- life-cycle management
- intralogistics
- anti-counterfeiting
- assembly line





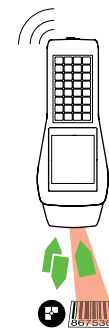
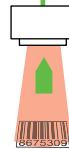
Read-only RFID



Long-range UHF



Vision Sensor
Bar Code



Mobile
Handheld
Read/Write

Ultra High Frequency (UHF) Industrial Identification BIS U

Technical Characteristics

- 865 (EU) / 915 (US) MHz
- up to 6 meters read range
- 512 bit user memory

Advantages

- worldwide EPC Gen 2 standard,
- ISO 18000-6C
- highest data rate
- multi-tagging
- high temperature tags available
- serial or Ethernet TCP/IP

Typical applications

- container tracking
- supply chain management
- production control
- asset tracking



Barcode Identification BVS Vision Sensor and ID Handhelds

- up to 1000 mm
- 1D and 2D Codes

Advantages

- reads and verifies most common 1D Barcodes
- reads and verifies ECC 200 Datamatrix codes
- reads and verifies direct part marked Datamatrix
- multiple code reading at one time (BVS)
- verifies characters (BVS)
- easy and safe to use
- quick and reliable identification
- output codes and results via RS 232 (BVS)
- BVS Monitor accessory allows to see what the sensor sees
- easy digital I/O PLC integration (BVS)

Toolsets Included



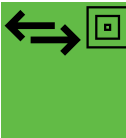
Optical Character Verification (OCV) – Compares characters from taught references

- Check label text
- Monitor printing (e.g. ensure quality and correct dates for different lots)
- Check logos



Detect and identify barcode and Data Matrix code

- Code verification
- Documentation of parts used
- Monitor print quality





A successful traceability project requires a competent partner for the life of the system. This includes conception, planning, testing, and training.

Balluff has experience in assisting customers develop the architecture for their unique needs. Additionally, Balluff works with partners, such as qualified systems integrators and machine builders, that can provide complete traceability solutions or simply help with integration or more advanced automation.

Application advice through our Tech Support

Discuss your technical requirements and take advantage of our expertise.

More information can be found in our services brochure.



Real-world examples

- Assist in defining data maps and data locations – central vs. decentralized
- Review tracking technologies – bar code and LF, HF and UHF RFID
- Architecture layout to ensure the most cost-effective system
- Component selection assistance

Customized software for handhelds

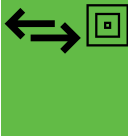
Balluff can custom-configure the software for handhelds for your mobile tracking needs.



As a user of industrial RFID or barcode, you need a handheld that speaks your language. Balluff engineers can program the handheld screens to convey the tracking information in your terms. That means a data field will appear in real language, such as “Tool Usage Counter”, and not an obscured address reference within an RFID data tag.

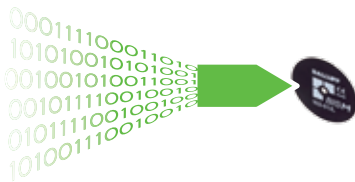
The advantages

- Access to all tracking information
- Intuitive interface drastically reduces learning curve
- Maintain process and corporate names throughout the plant floor
- No additional resources required



Individually programmed RFID tags

Balluff can pre-program your data tags to get you up and running faster.



For centralized data systems utilizing read-only functionality, the data tags only require a serial number or a special code. Balluff offers a service to pre-program your data tags at the factory with exactly what you need. They are ready to install and require no writing hardware or user intervention. Just leave the programming to us!

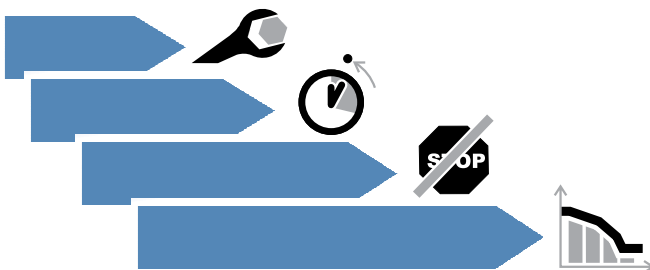
The advantages

- Cost-effective – no need for separate hardware
- Time-saving – programming of write routines can be eliminated completely
- Easy to place a repeat order – data tags with the same specifications can always be obtained again

Workshops

Make use of Balluff's vast knowledge in traceability solutions.

Have one of our regional tech engineers meet with your project team to discuss your traceability project.



Target learning areas

- Modular expandable architectures
- Dedicated RFID systems
- RFID based traceability solution
- Vision sensor based bar code
- Mobile handheld solutions

BALLUFF

sensors worldwide



Object Detection



Linear Position and Measurement



Fluid Detection



Industrial Identification



Industrial Networking and Connectivity



Accessories



Service

USA

Balluff Inc.
8125 Holton Drive
Florence, KY 41042
Phone: (859) 727-2200
Toll-free: 1-800-543-8390
Fax: (859) 727-4823
E-Mail: balluff@balluff.com

Canada

Balluff Canada, Inc.
2840 Argentic Road, Unit #2
Mississauga, Ontario L5N 8G4
Phone: (905) 816-1494
Toll-free: 1-800-927-9654
Fax: (905) 816-1411
E-Mail: balluff.canada@balluff.ca

Mexico

Balluff de México SA de CV
Anillo Vial II Fray Junípero Serra No. 4416
Colonia La Vista Residencial.
Querétaro, Qro. CP76232
Phone: (+52 442) 212-4882
Fax: (+52 442) 214-0536
E-Mail: balluff.mexico@balluff.com