INTRODUCTION TO

SCAN | LABEL | APPLY | MANIFEST

MHI

SLAM

SCAN | LABEL | APPLY | MANIFEST

powered by MHI

Distributed by:

SLAM Industry Group of MHI
8720 Red Oak Blvd. Suite 201
Charlotte, NC 28217

PREFACE

The **Scan Label Apply Manifest** (SLAM) industry group provides thought leadership for best practices on the “last 100 feet” of every warehouse in the world.

At the core of SLAM's dedication lies the maintenance of a membership that truly represents the industry's knowledge and diversity, curating comprehensive and insightful perspectives. We define and evaluate best practices for the marketplace, upholding the highest standards of excellence to keep end-of-line solutions at the forefront of innovation and efficiency. Through our vibrant and market-driven forum, we facilitate a dynamic exchange of information and expertise, empowering stakeholders to thrive in an ever-evolving landscape. As an information hub, SLAM diligently collects, compiles, disseminates, and exchanges invaluable insights to benefit both our membership and end users, propelling the industry towards even greater heights of success and impact. Additionally, our commitment to education extends beyond our boundaries, as we actively prepare and distribute educational material and continue education endeavors, to inspire new minds that will shape the future of end-of-line technologies and systems. Together, let us embrace this transformative journey, where collaboration, innovation, and user-centricity converge to revolutionize the world of line assembly and manufacturing.

MISSION & VISION

Mission: To be the authoritative resource for transforming today’s end of line fulfillment operations to address tomorrow’s challenges.

Vision: To provide thought leadership for best practices within “the last 100 feet” of evolving warehouse and distribution operations

The **SLAM Industry Group** of MHI combines the knowledge and experience of thousands of installations. For more information, visit **www.mhi.org/slam.**

SLAM
SCAN | LABEL | APPLY | MANIFEST

The Scan Label Apply Manifest (SLAM) industry group provides thought leadership for best practices on the "last 100 feet" of every warehouse in the world.

Industries that Benefit from SLAM Solutions

MANUFACTURING APPLICATIONS

consumer goods

automotive

packaging

LOGISTICS APPLICATIONS

e-commerce

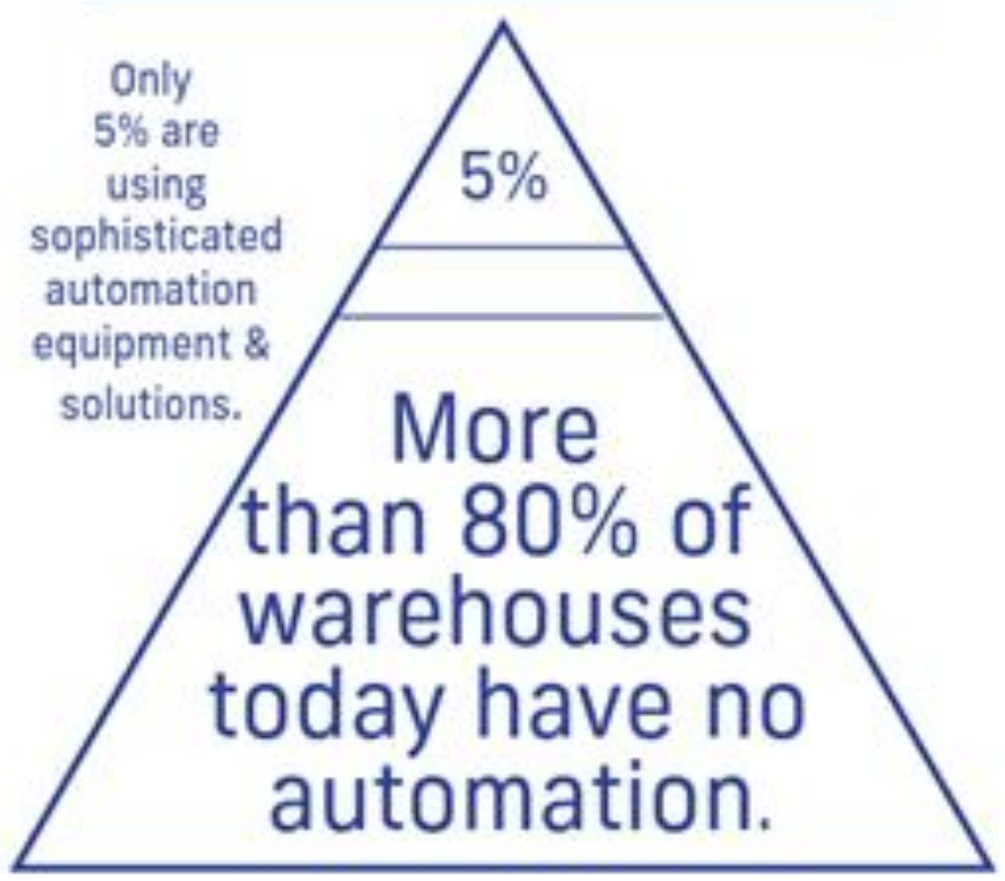
retail

warehousing & distribution

Market Potential for Automation

From 2010 to 2020, eCommerce sales grew at a steady 11% YOY average. **From Q1 2020 to Q1 2022, online shopping grew by 56%!**

Source: FRED Economic Data



View All
SLAM Members
mhi.org/members

Table of Contents

Pack

What is Packing?

Once an order has been picked, items are then consolidated in a workstation/ packstation to either be manually, semi-automatically, or automatically packed using a packaging system. In addition to getting products into its final shipper there are other steps involved which we will cover below. The process of selecting what type of packaging materials to include is very important for a brand image.

Why is Packing important?

The right packaging can improve the customer unboxing experience; reduce shipping damages/returns; increase fulfillment capacity with automation & from a sustainability perspective it can reduce the amount of packaging materials used to allow more packages to ship per truck which reduces the number of trucks on the road and a company's carbon footprint. The type of packaging and materials selected can also demonstrate your position on sustainability.

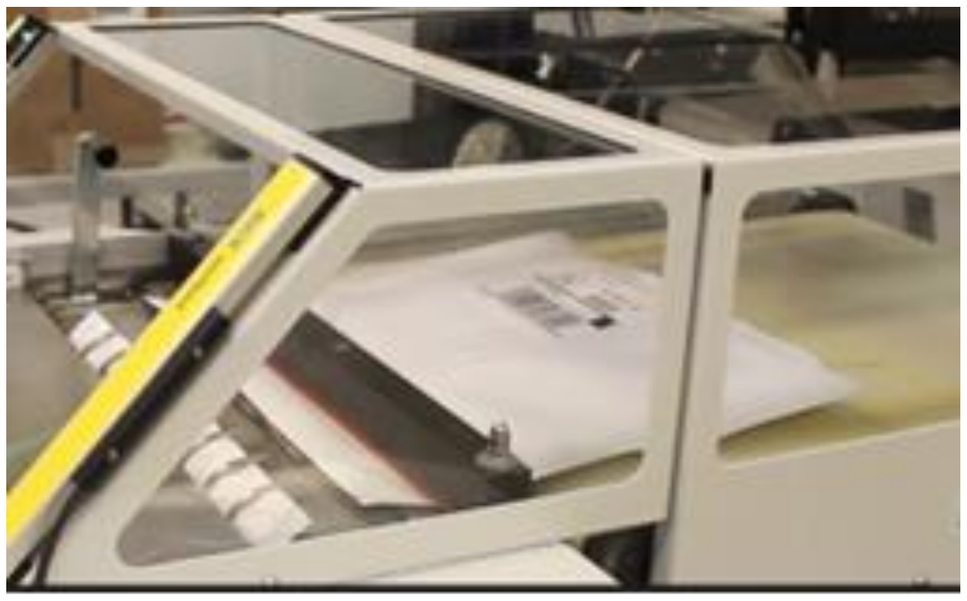
The main types of packaging materials and related packaging equipment are listed below:

Void-Fill Materials – Protect products during transportation by filling the shipper with packaging material in order to eliminate any empty space.

Common types include:

- Air Pillows & Bubble Wrap
- Kraft Paper, Tissue Paper, Shredded Cardboard
- Temperature Insulated materials
- Corrugated Inserts/ Substrates
- Packing Peanuts

Types of Shippers – Depending on the type of products being shipped (apparel, fragile items, liquid products etc.) and the distance it will be traveling there are options when it comes to selecting which package type to choose. There's also the ability to include branding on the outside/inside of shippers as well:



- Corrugated Boxes
- Mailers
  - Poly
    - Ideal for shipping non-fragile items such as apparel & FMCGs (fast-moving consumer goods) etc.
    - Stronger than paper mailers
    - Padded Poly
  - Paper
    - Curbside recyclable packaging solution
    - Padded Paper
- SIOC (Ships In Own Container)
  - This means the product does not require an over-box nor additional packaging fill material in order to be shipped

Packaging Systems –

There are a variety of packaging systems that can help to automate the SLAM process for both corrugated boxes as well as flexible mailers. At a minimum these systems allow items to be packed in shippers faster than an all-manual process.

The steps involved in the packaging system for SLAM can include making the shipper, allowing it to be loaded with goods, closing the shipper, and automatically labeling the package with shipping information.

There's been an increase in demand for right-size packaging solutions that increase throughput & reduce packaging waste by building a custom-sized package for each order. These systems are available for corrugated boxes as well as flexible mailers.

Automatic Bagging – The process involves the scanning of an order, loading an item(s) into a bag, labeling the bag with info, sealing and conveying from the machine

- Types:
  - Vertical or Horizontal
  - Paper or Poly
  - Pre-Made Bags or Made to Size
  - Flat or Padded Mailers

Automatic Boxing – The process for fully automated systems involves placing products onto a conveyor and getting dimensionally scanned in order for the system to create the right-size box for each order. This information is also sent to the labeler for print & apply. The custom boxes are then created, folded around the order, & sealed for shipment.

- Common terms: Auto-Box; Carton Wrap; Automated Cartoning Systems; Case Erector; Case Sealer etc.
- Types/ Right-Sized:
  - Semi-Automatic
  - Fully automated

Other Related Solutions / Processes –

Bundling – Ultrasonic banding unitizes multi-item orders for ease of conveyance, prevents orders from shifting before/after scanning, prints inline LPNs, & protects products during shipment with sustainable materials that reduce packaging mass.

License Plate (LPN) Printing/ Scanning – It's a unique barcode or QR code that represents all products within a multi-item order to ensure quality control during the packaging/ shipping process.

There are many different types of LPN barcode labels (ex: Code 39 & 128). They vary depending on the required size of the label & number of potential characters.

The application of the LPN to the multi-item order can be either pre-printed or print & apply labels. This requires the appropriate connectivity & programming to your WMS for on-demand accurate data.

There are specific scanners that can properly read each type of barcode as well.

For more information, please reference our Scan & Label sections below.

Document Insertion – Various methods for putting marketing material; medical documents; pack slips/ return labels into the shipper.

Automatic document insertion eliminates multiple touches; reduces packaging time & errors.

LPNs are scanned and the appropriate documents are printed in advance, buffered & inserted/ applied when required.

Order Accuracy/ Validation – During the packaging process it's important that orders are validated for accuracy - whether that's through inspection systems or comparing package weight with product weight data there are many technologies available.

See the Inspect & Weigh sections within "Scan" below for more details.

Scan

What is a Scan system?

The SCAN portion of a SLAM line can encompass many components depending on the needs of the system. This can range from a simple design with a triggering photo-eye with a single top-side barcode reader all the way to encompassing several auto-ID cameras, automatic scales, and dimensioners.

Scan System Components

There are four major components of a Scan system: Identify, Inspect, Dimension, & Weigh. This information is important to print and apply the correct shipping label and product information onto the parcel.

Identify

The basis of the Scan portion of a SLAM line is knowing the unique identity of a product or parcel in order to apply the appropriate labels. Auto-ID, or “automatic identification,” can be achieved through a variety of technologies:

Laser Reader – Laser readers use reflected light to decode traditional 1-Dimensional barcodes. International bar code standards define how bar code is embedded with data, which can range from a simple ID to a complex data set. Laser readers are often the most cost-effective way to read a barcode.

Camera Reader – Camera based vision systems can recognize and decode the same barcodes as a laser reader. In addition, they can also be used for decoding 2-Dimensional codes (like QR or DataMatrix) and Optical Character Recognition (OCR), which can recognize human readable text printed on the parcel or product. OCR is especially useful for either quality assurance or reverse logistics applications.

Radio Frequency Identification (RFID) – RFID tags use radio frequencies to transmit data from the tag to the reader. The tag could be encoded with a simple ID or a complex data set up to a few kilobytes. Since RFID tags do not rely on reflected light, they are less prone to lighting issues or poorly located labels.

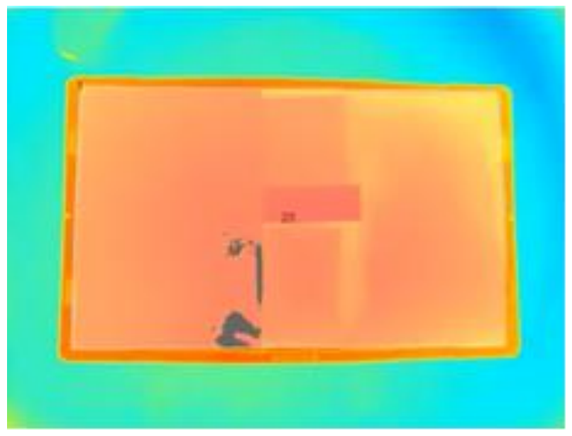
Inspect

In addition to determining the identity of a parcel or product, it is sometimes important to validate the contents or quality. This inspection process can be multifaceted with inspection of the label for print quality & accuracy, label verification for ensuring the package and its contents are going to the correct recipient, and total package inspection for right product in right box as well as for damage inspections prior to carrier handling. Inspection can also include QA/QC processes related to rejection & subsequent diversion of non-compliant parcels for reworks.

Inspection can be done through a variety of methods:

Camera Reader – Camera based vision systems can be used to validate the contents in an open box or tote. Combined with Optical Character Recognition (OCR), cameras can check to ensure the required bar codes or human readable texts have been printed on the parcel or product.

Time of Flight Sensor – Time of Flight sensors measure the time it takes for light to be reflected back to the sensor, providing a distance measurement between the sensor and object. This can be used to validate the contents or amount of dunnage that an open box or tote contains.



Radio Frequency Identification (RFID) – RFID tags use radio frequencies to transmit data from the tag to the reader. As a product goes through each stage in the process, the details about the transaction can be written to the RFID tag. This tag can then be checked to ensure the product is ready for shipment

Dimension

Dimensioning systems are automated measurement systems designed to profile a package/parcel's measurements. The dimension information is transmitted to the controller to process in the manifest & label information. Many shippers charge by package dimensions, and so it is important to obtain accurate dimensions of a package. In addition, it is important to inspect for label application, which can be done in the dimensioning process.

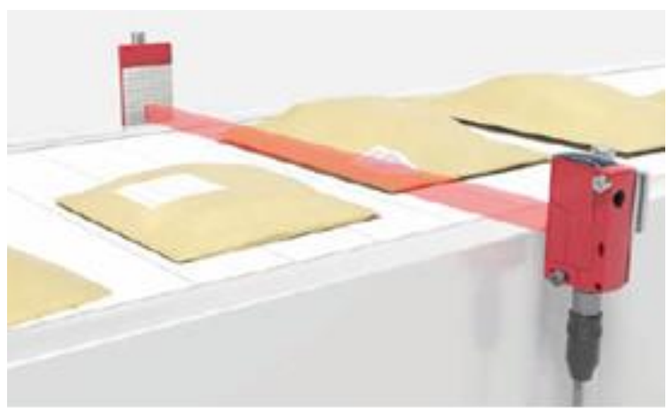
Many shippers charge by weight or dimensions. This weight can either be defined as actual weight or be calculated by a formula to define a Dimensional Weight, as defined by the carrier. For each shipment, you are charged based on the dimensional weight or actual weight of the package—whichever is greater.

Standards and tolerances for dimensions to be considered 'Legal For Trade' are published by NIST.

Overhead Dimensions Sensors – An overhead sensor can use light sensing technology like infrared and laser or 3D cameras to measure the dimensions of a box within its field of vision. This can also be accomplished with ultrasonics for measurement as well as label placement confirmation.

Laser Array – A measuring light curtain grid can detect which individual beams are blocked, giving the dimensions and orientation for a part or parcel passing through.

Photoelectric Sensors – The time that a parcel takes to move past a photo eye can be measured, providing the length of a box, based on encoder feedback from the speed of the belt.



Weigh

Weighing systems in a SLAM line are typically a conveyor designed with embedded load cells. The system is designed to weigh packages and parcels automatically and transmit this information to the controller for processing in the manifest & label information.

Many shippers charge by weight or dimensions. This weight can either be defined as actual weight or be calculated by a formula to define a Dimensional Weight, as defined by the carrier. For each shipment, you are charged based on the dimensional weight or actual weight of the package—whichever is greater.

Standards and tolerances for dimensions to be considered ‘Legal For Trade’ are published by NIST.

Automatic Checkweigher – In-motion scale that uses load cells to check the weight a part or parcel moving over the conveyor

What are the benefits?

A Scan system can provide many benefits to a user who ships parcels. By converting a manual process up to a completely automated with a Scan system, the user is able to increase throughput and reduce errors in shipping & reworks. Automating the code reading, dimensioning, and weighing also improves the ergonomics of an operator’s role.

Label & Apply

What does Label mean?

The Label portion of a SLAM line encompasses the software and hardware necessary to generate and print the labels for your operation. Shipping labels to get the product to its end destination. An LPN for internal tracking. Package contents. Origin, destination and any other information a carrier might need. There are a few key factors to consider when implementing your labeling system.

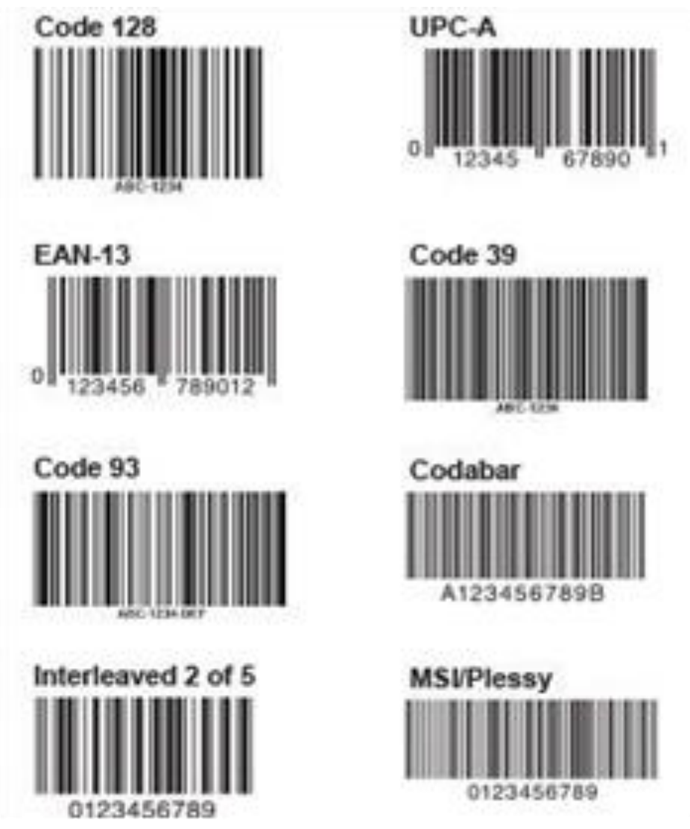
Label Creation

The label creation process begins with the scanning portion of the SLAM process. Once the scan has completed, a software system generates a label format and sends it to the printer. The label can be generated in a few ways. Often, ERP systems will have the label already created in the native printer language, and simply needs to be called from the database and sent to the printer. In other cases, there is variable data that needs to be populated in a stored label format by using label design software. Regardless of how the label is created, it is critical that the label is formatted correctly for the application.

Label Formats

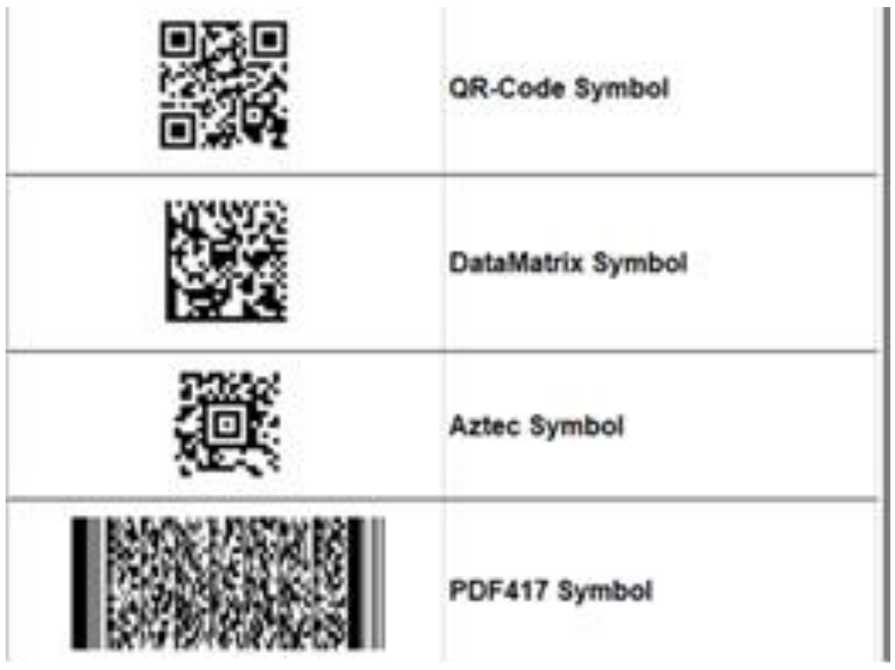
There are a few key elements to your label format. They include but are not limited to human readable information, barcode symbology, images, or RFID encoding. The most important of these is the barcode. There are one-dimensional (1D) and two-dimensional (2D) barcodes, and there are different types of each barcode. For example, Code 39, Code 128, and UPC (universal product code) are types of 1D barcodes. Similarly, Data Matrix and QR (quick response) are common types of 2D barcodes.

1D Barcodes – Laser readers use reflected light to decode traditional 1-Dimensional barcodes. International bar code standards define how a bar code is embedded with data, which can range from a simple ID to a complex data set. Laser readers are often the most cost-effective way to read a barcode. To the right are the most common examples of 1D barcodes.



2D Barcodes – 2D barcodes are typically seen as a box or square with random dots and blanks in no discernable pattern.

These are designed to store more complex data and are read by a laser or camera that reads in two directions (left and right, up and down) across the barcode.



Shipping Label – Shipping labels are used to send the product to its final destination. Each carrier has its own requirements and standards for its shipping labels. The shipping label will be generated with the label software and sent to the printer. There are even software systems that will rate shop for the best price of delivery and print the appropriate carriers label.

Below are two different shipping label examples: FedEx and UPS.

FedEx Shipping Label

UPS Shipping Label

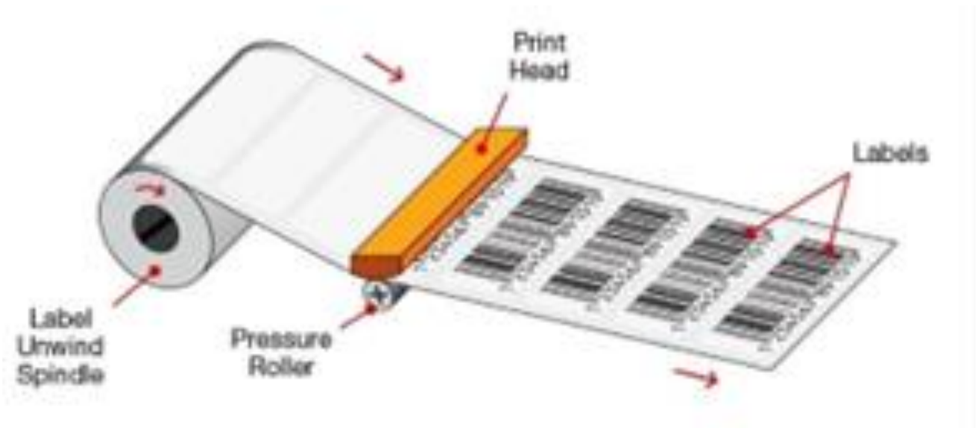
License Plate Number (LPN) – An LPN is used by companies for internal tracking of products. This tag will then be scanned to link the relevant information to that particular product such as dates, batch numbers, locations, etc. This LPN can then be used anywhere within the facility to know what exactly is supposed to happen with that product. The LPN generally consists of human-readable numbers as well as a 1D barcode.

Label and Printer Properties

Once the label format has been created, the printer and label material are the next important factors to consider. There are many types of labels: thermal transfer, direct thermal, inkjet, laser, laser rewritable, linerless, and RFID. There are also many different variations to these types of labels, including different face stock, adhesives, and liners. The environmental conditions of the facility are very important to consider when choosing the type of label material for the operation. For example, extreme temperatures, humidity, and dust are critical factors that may change the type of label material or printer used in the SLAM process. Please talk to your solutions provider to get more detailed information on how environment can affect your choice in label material and print heads.

The following will describe the most common types of labels and the associated printers.

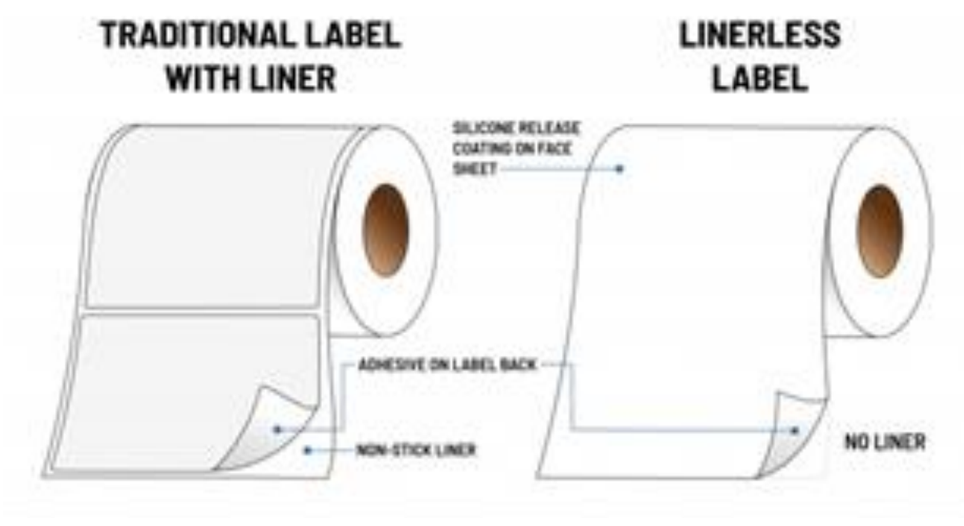
Direct Thermal (DT) – These are the most common types of labels used in SLAM applications. The DT label is typically paper based with a specially formulated material that reacts to heat. As the label passes under the printhead, the printhead applies heat to the label, triggering a chemical reaction in the thermal layer of the label causing it to change color and create the image. DT printing will be standard for most industrial/OEM printers and print engines. DT is best used for label applications where the label is always in a temperature-controlled environment with a short shelf life. DT's biggest disadvantage is its sensitivity to heat and light.



Thermal Transfer (TT) – Thermal Transfer is similar to DT, but with one major difference. TT labels and printers use a wax or resin ribbon that moves with the label under the printhead. The printhead applies heat to the ribbon to melt and transfer the wax or resin from the ribbon to the label creating the image. TT labels and printers create a far crisper and longer lasting image. They are also more durable in higher/lower temperature environments. TT's biggest disadvantage is higher consumable costs and the necessity for the ribbon and label to be compatible.

Laser Rewritable – A new advancement in label technology that uses a direct thermal substrate and laser to write, erase, and rewrite the image on a label. Instead of using a printhead to trigger the chemical reaction, a laser is used to penetrate several top layers that protect the image and then interact with the thermal layer. The label can be reused up to 1000 times. This technology is optimized for reusable totes in a circular shipping environment.

Linerless Labels – Traditional DT labels in SLAM applications use a liner that is leftover at the end of a label roll. With linerless labels, 100% of the label material is consumed in the operation leaving no waste. This results in more labels per roll and quicker roll changes reducing downtime in the SLAM operation. Furthermore, since the labels can be cut to the necessary length, excessive waste is avoided. This is especially beneficial in applications using rate shopping software for shipping.



What does Apply mean?

After the labels and printers are ready, the application method must then be determined. The apply portion takes the properly printed label and applies it to the product in the correct orientation. There are numerous ways to apply a label to a product, but the applicators all follow the same general operation: the printer receives the data for the correct label, prints the label, and feeds the label onto the applicator arm which places the label on the package. Within the industry, the printer and the applicator are referred to as one system. The following are all common terms used when describing the combined label printing and application system.

- Print and apply
- Printer applicator
- PandA
- PnA
- LPA (Label Printer Applicator)

Apply Methods

There are different types of applicators used depending on the requirements of the application. This section will describe the most common applicators used in SLAM applications.

Tamp – The most common type of applicator is a top apply tamp. This is a single axis motion generated with electric motors or pneumatics to extend the applicator to apply the label to the top of the product. A standard tamp applicator will make contact with the product to apply the label.

Tamp-Blow – This is very similar to the tamp above except instead of making contact with the product, the label will be blown on to the product's surface for contact-free application of the label. This is especially useful for sensitive products or to ensure adhesion around an irregular surface.

Swing Arm – A swing arm is a rotational applicator that can be used to apply to the front and/or side of the product. It can also be adapted for corner wrap applications.

Merge – With a merge applicator, the applicator does not move. Instead, the label is fed directly from the printer onto the product with the integration of a wipe on mechanism. Used most commonly for high speed applications with consistent products. Merge applicators can apply to the top, side or bottom of a product depending on the requirements.

Custom Applicators – Many print and apply companies provide custom applicators to suit different customer needs. For example, some will integrate two labels to print and apply shipping labels and pack slips to one product. Please talk to your solutions provider if your application requires something unique.

What are the benefits?

A label and apply system has four main benefits to a SLAM application: reducing expenses, eliminating human error, increased throughput, and improved inventory tracking. Print and apply systems reduce labor costs. This is a major expense for most companies, especially when turnover is included in the calculation. With proper preventative maintenance, print and apply systems will run for years without major issues. When higher throughput and reduced downtime are factored in, the ROI is immense. Print and apply systems allow the correct data to automatically be populated and printed on the label and applied to the correct product. Additionally, when the process is completely automated, labels can be applied at rates of up to 100 labels/minute. When using an automated print and apply system, there is far less room for error in identifying products when using integrated scanners for verification purposes. All of these benefits are enhanced when used in conjunction with the rest of a fully automated SLAM line. Please refer to the rest of the document to see how Label and Apply are correlated to the Scan and Manifest portions of your SLAM line.

Manifest

Software

Software is the lifeblood of a SLAM system. In its various forms, the software integrates hardware components, interfaces them to warehouse order entry, inventory management, and control systems, and manifests shipments with freight carriers.

User Interface (UI) – Software running on a hardware Human Machine Interface (HMI) or computer can give a “window” into the system, allowing system control, performance data analysis, and report generation.

Data Collection, Label Request and Print – A computer software application or PLC code used to integrate the captured data representing the physical attributes of a package. This usually includes package ID (barcode or RFID), dimensions, and weight. The data packet is an input to the shipping software. This software also sends a label request to the shipping software, receives the label back, and sends it to the printer applicator.

Order Management System Interface – A middleware interface application that retrieves customer and order information from the shipper’s order management system. Information relevant to the current package in the SLAM system is an input to the shipping software.

Label Application Control – Program code either in the printer applicator PLC or the conveyor control system PLC that controls the application of the label on the package in focus.

Warehouse Control System – Warehouse Controls Software (WCS) is used to control and execute all aspects of automation throughout the warehouse and distribution center. It is the heart of connecting devices, and controls to machine and software-controlled functions and interfacing back to host environments such as warehouse management software, ERP systems, and other services.

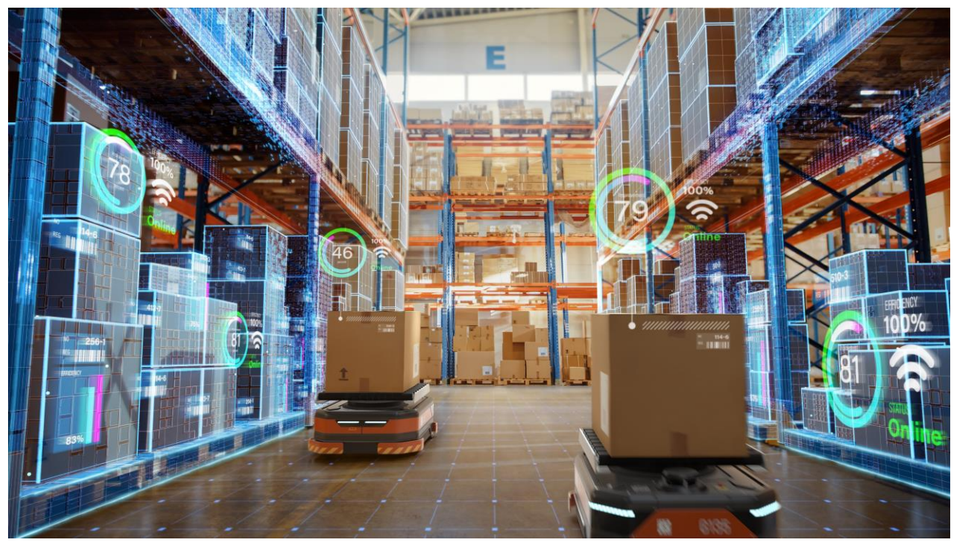
Also known as: Conveyor Control System

Shipping and Barcode Label Software – Shipping software is an application that receives the package attributes, customer and order information and business rules to manifest the shipment of the package. The shipping software executes carrier specific Application Programming Interface (API) calls to access carrier rate tables, create and return shipping labels to the Data Collection, Label Request and Print software.

Barcode label software is used for designing and printing labels. Product specific information can be received via data interface or retrieved from a database and inserted into a stored label template and sent to a print engine.

Warehouse Management System – Primarily responsible for the flow of inventory within your facility, from receipt of product to putaway, replenishment, and shipping. This means that the Warehouse Management System (WMS) has historically performed the following functions: Transportation management, ERP integration, Management reporting, Supply chain integration, Labor management, Receiving, Reserve putaway, Shipping management, Yard management

Warehouse Execution System – A Warehouse Execution System (WES) provides functionality to optimize the manual and automatic workflows within a facility. While some of these functions could be built into a Warehouse Management System or Warehouse Control System, the WES is emerging as a standalone offering focused on optimizing operations. Functions include; Wave and order management, Bin level inventory management, Manifesting, Business intelligence, RF scanner integration, Voice integration, Manual picking (paper slip), Forward pick replenishment, Automated picking management, Pick label creation, Pick-to-light management, Full system routing management, QC/QA management, Packing station management, Print and Apply



Transport & Sort

What is a Conveyor system?

Conveyors systems allow for more efficient movement of materials within retail, wholesale, distribution, and manufacturing operations. Because they are engineered to transport and organize large volumes of materials rapidly through a process, conveyor equipment save labor expense and increase handling productivity.

CONVEYORS

Used for movement of materials, products and loads throughout a manufacturing or distribution facility, conveyors are horizontal, inclined or vertical mechanical devices. They are ideal for movement of heavy or bulky materials, as well as for quick, efficient transportation of multiple packages or objects at high speeds.

Conveyors can be powered by gravity or by hydraulic or electric power. Loads ride atop rollers or a looped belt or chain that travels along a fixed path with specific points for loading and discharge. Because they enable large volumes of material to be moved rapidly through a process or facility, conveyors reduce labor costs by eliminating non-value-added travel time.

Typical conveyor applications include movement of cases, totes or palletized loads into and out of a trailer, to and from static or automated storage systems, or from a picking area to packaging for shipping.

How Are Conveyors Used?

Conveyors are used in a variety of areas to move materials throughout the SLAM process, including:

- **Infeed –** In highly automated operations, conveyors bring the product into the SLAM line from the packing station.
- **Process Sections** – Higher precision conveyors may be required for accuracy when going through the Dimension, Weigh and Label processes.
- **Reject Lane** – Also known as the “Hospital” or “Jackpot” lane, this conveyor section serves to handle exceptions identified in the SLAM process and allow for manual intervention.
- **Sort to Destination** – Once the product has been labeled & manifested, it is sorted by carrier, destination, or mode of transportation for downstream handling.

What Are The Benefits Of Conveyors?

Conveyors provide a variety of benefits:

- **Ergonomics** – Because they do the work of load movement, conveyors eliminate the chance of operator injury from pushing or pulling a load
- **Process flow** – Conveyors can be used as a part of an assembly or manufacturing process
- **Safety** – Because they move loads along a fixed path, conveyors eliminate the chance of collisions associated with forklift or manual product movement
- **Speed** – Conveyor speed can be set to accommodate slow and peak demand periods
- **Transportation** – Conveyors facilitate the internal movement of totes, cases or pallet loads throughout a facility with minimal or no labor required

ADDITIONAL RESOURCES

SLAM
SCAN | LABEL | APPLY | MANIFEST
powered by MHI

SLAM Site

Case Study (5)

VIEW ALL CASE STUDY RESULTS

CASE STUDY

How Tension's SLAM Solution Helped Kredo, In...

July 22, 2023
By Tension Packaging & Automation

Tension Packaging & Automation is a global leader in complete packaging and automation solutions. Specializing in a wide variety of results-driven processes, we offer customers...

CASE STUDY SLAM

CASE STUDY

Increasing Productivity and Reducing Turnove...

June 19, 2023
By Gorbel Inc.

Gorbel provides an ergonomic solution increasing productivity and reducing turnover rates for a large retail outfitter.

CASE STUDY EASE

+ 2 more

CASE STUDY

Optimizing Unloading Activities with...

June 19, 2023
By Gorbel Inc.

Gorbel provides an ergonomic solution optimizing unloading activities for a large retail outfitter.

CASE STUDY EASE

+ 2 more

SLAM Case Studies

Order Fulfillment Fundamentals