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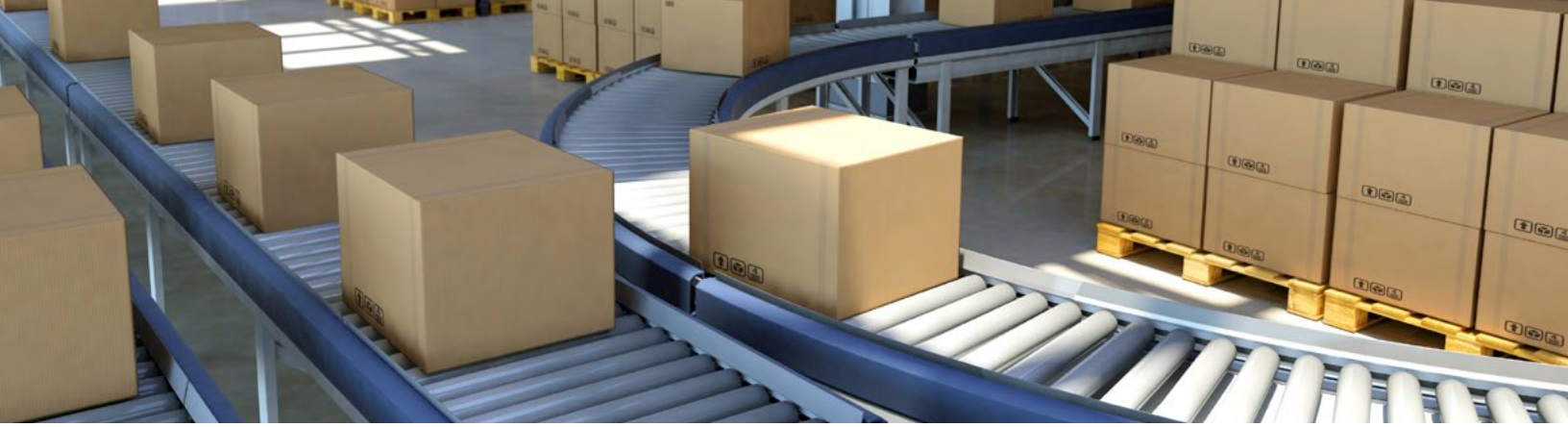
Logistics Knowledge and Cases Studies to Increase Efficiency

# Barcode Solutions for Logistics



Logistics Knowledge and Cases Studies to Increase Efficiency

# Barcode Solutions for Logistics

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## Logistics Glossary

# Logistics Basics

Logistics is the flow that encompasses all of the steps and processes involved in delivering the products of a company to consumers. This flow also includes elements such as storing and packaging goods in addition to carrying and moving those goods. In the background between getting products from the location of production to the consumer, there are functions that include transportation/delivery, storage, packaging, cargo handling, distribution processing, and information processing that serve as the system to deliver products quickly and on time.

This section describes the basics of logistics, which is essential for modern life, through its various types and goals.

## Logistics Basics and Goals

When many people hear the word “logistics,” they imagine a storage location such as a logistics center or warehouse, or they think about transportation and delivery using large trucks packed with cargo and container ships traveling between ports. However, these are a result of incomplete understanding that captures only a small portion of logistics. This section reintroduces the essence and goals of logistics, which is essential for modern life.

### What is Logistics?

Logistics is the flow of goods. The essence of logistics is the flow that encompasses all of the steps and processes involved in delivering the goods of a company to consumers. Storage locations such as logistics centers and warehouses, delivery by large truck, and transportation by ship and airplane are just a simple checkpoint along this flow of goods. Information processing in distribution systems to deliver goods is ultimately included in this flow, and it will be explained in detail later. First understand that logistics is the flow for delivering goods.

#### Distribution and Logistics

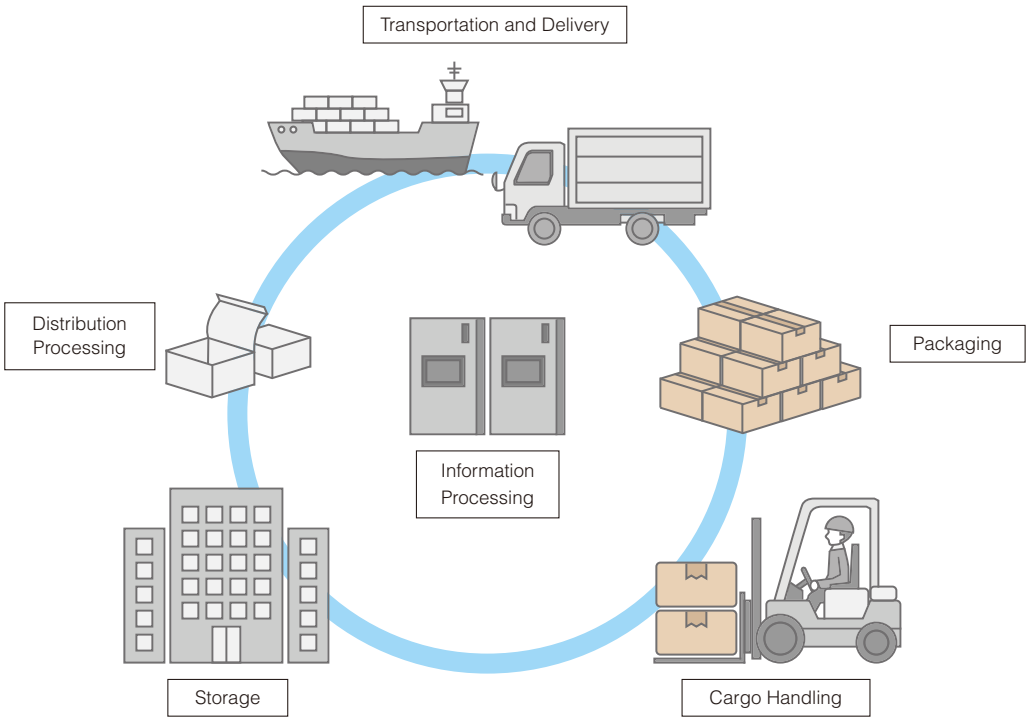
The term distribution is easily mistaken for logistics. Logistics involves planning and carrying out the movement of the necessary materials and soldiers during war, for example. Logistics is an element that makes a difference between winning and losing in war. For that reason the necessary materials need to be supplied speedily and accurately, and the expertise to do that has been accumulated over a long period of time. Distribution is made up of product distribution, sales distribution, and procurement distribution when refined into smaller categories, and the concept of centrally managing this flow of complicated goods and making it more efficient is also called logistics. Logistics is the broad concept for distribution. However, equating distribution and logistics is not correct.

## Goals of Logistics

There is a temporal and spatial gap between production and consumption. The goal of logistics is to fill in this gap. In the past, the main mission of logistics was to deal with the spatial distance by increasing transportation efficiency and reducing the time to deliver goods. However, now an important theme is not only speed but also how timely goods can be delivered to consumers. For this reason, a system is essential that can use functions such as transportation and storage as well as adjust the amount, time, and location of goods to prevent too much or too little inventory while delivering goods efficiently and without waste. The goal now is efficient logistics with no waste.

### Logistics System

The system that delivers goods quickly and on time from the location of production to the consumer is the logistics flow shown below. Logistics also includes elements such as storing and packaging goods in addition to carrying and moving those goods.



**1. Transportation and Delivery**

The functions that send goods from the producer to the consumer are transportation and delivery. Transportation, also called “primary transportation”, serves to carry goods from point A to point B involving long distance movement. Delivery is also called “secondary transportation” and it serves to transport small lots of goods short distances. This function differs from transportation in that it is not a simple flow like movement from point A to point B. Instead, it sends goods from point C to multiple locations. Transportation and delivery are also said to make up about 60% of logistics costs.

**2. Storage**

Logistics centers and delivery centers correspond to storage locations and serve to adjust the time difference between producers and consumers to deliver goods in a timely manner. Storage facilities with functions to maintain the quality and value of goods, such as cooler and freezer warehousing or food processing centers, also correspond to storage locations.

**3. Packaging**

The process to protect products from physical damage (scratches and breakage) that occurs during the logistics processes.

**4. Cargo Handling**

The work process to haul and move cargo in and out of logistics centers and warehouses is called cargo handling. Cargo handling is separated into six processes: assortment, loading/unloading, transportation, allocation (storage), sorting, and picking.

**5. Distribution Processing**

Separating goods that enter a warehouse and distribution center, and then resorting and packaging them into units that are easy for consumers to purchase. Wrapping products, applying price tags, applying labels to imported goods, and checking clothing for needles are also types of distribution processing.

**6. Information Processing**

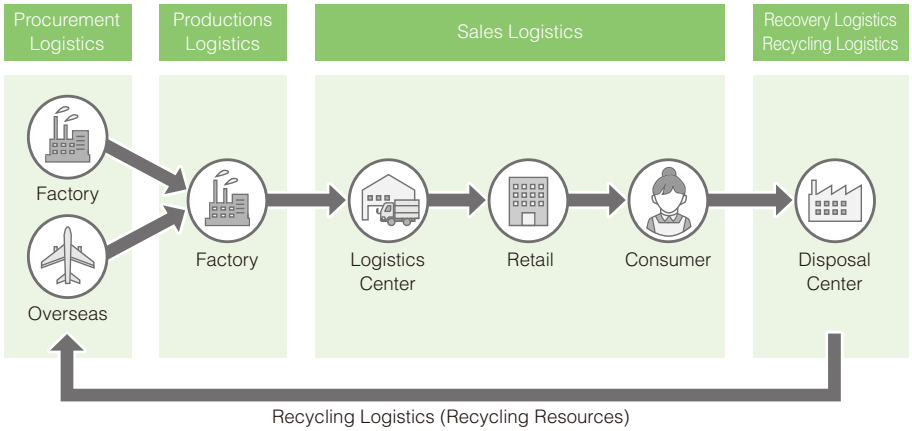
Information systems that perform centralized management of the logistics flow from ordering to picking, shipping, and delivery are now essential to the world of logistics that handles thousands of items each day. This is because information systems are deeply involved in the traceability of goods that allows one to know where products that have been shipped from a production location or factory currently are and how long they will take to reach the assigned destination. IT devices such as handheld mobile computers that link to the internet and intranet are used in these systems.

## Types of Logistics

There are many types of logistics. The most well known type is sales logistics that moves products from the producer to the consumer. In addition, there are a number of other types of logistics, such as procurement logistics which is the flow of raw materials and parts, production logistics which is the flow of materials inside a factory or business, recovery logistics which is the return flow of returns from consumers and waste, and recycling logistics which is the flow of recyclable materials. This section describes the types and fields of logistics in depth.

### Logistics Fields

Logistics can be split into five types by field: procurement logistics, production logistics, sales logistics, recovery logistics, and recycling logistics. Each of these is explained in detail, but first we should learn about logistics fields and types. For recovery logistics and recycling logistics, both types are the same up to the recovery of goods from consumers, but recycling logistics is the type that recycles the goods that are collected.



## Procurement Logistics: Procuring Raw Materials and Parts

Procurement logistics is the flow of goods when the raw materials and parts necessary for manufacturing are procured from suppliers. This field did not attract much attention before, but now that small-lot production of a variety of models is the main type of production, many firms are actively pursuing production by procuring the necessary materials in only the necessary amounts at the necessary times (the shift to just-in-time production) because it is directly connected to reducing inventory costs.

## Production Logistics: Materials Management, Distribution in Factories, Product Management, Shipping

Production logistics is the flow of goods that includes the management of procured parts and materials, distribution inside a factory, product management, packaging, and shipping to warehouse. Delivery management, warehouse dispatch management, and shipping management can be optimized and the state of delivery vehicles can be managed by smoothly linking procurement logistics and sales logistics described later.

## Sales Logistics: Delivery from Warehouse to Wholesalers, Retailers, and Consumers

Logistics typically refers to sales logistics. In the past this was mainly delivery from delivery centers and logistics warehouses to distribution points such as wholesalers and retailers. But now direct delivery also makes up a large amount of this volume due to online shopping and e-commerce. Whether delivery through delivery centers and logistics warehouses or direct delivery from production sites, higher efficiency in transportation and delivery and shrinking inventory are indispensable for delivering the necessary goods to the necessary people in the necessary quantities at the necessary time. This also contributes to improving customer satisfaction.

## Recovery Logistics: Recovering and Recycling Products, Containers, and Packaging

If the flow of goods from production to consumption by procurement logistics, production logistics, and sales logistics is described using the circulatory system of the body, it would be said to be forward logistics. On the other hand, recovery logistics or reverse logistics is the flow that recovers and recycles products, containers, and packaging that have fulfilled their role. Similar to recycling logistics described later, emphasis is being placed on this flow in recycling-oriented societies.

## Recycling Logistics: Recovering and Recycling Recyclable Products and Containers

Typical examples of recycling logistics are recovering and recycling empty cans, plastic bottles, and old paper. Containers, packaging, old computers, and inkjet cartridges can also be recovered and recycled in the same manner. The importance of recycling logistics has been increasing in recent years as measures for the environment and to effectively utilize materials such as minor metals.

# Role of Logistics

Logistics actually has many roles. The most well known role of logistics is sales logistics that moves products from the producer to the consumer. In addition to sales logistics, logistics can also be split into four other roles depending on the field. These are procurement logistics, production logistics, recovery logistics, and recycling logistics.

The roles of logistics feature transportation/delivery, storage, packaging, cargo handling, distribution processing, and information processing, and many systems have been put in place to deliver products from the production location or factory to the consumer quickly and on time.

This section describes the typical functions and equipment to help explain what kinds of materials make up the different types of logistics.

## Transportation, Delivery, and Truck Freight

Logistics is the system that delivers goods quickly and on time from the production location or factory to the consumer. Key functions in logistics are transportation, delivery, and truck freight. This section describes these three functions.

### Flow from Creating the Shipping Instruction Form up to Recording the Transaction

#### Step 1: Create the Shipping Instruction Form and Necessary Documents

When the delivery time gets close, enter a sales slip based on the order and create a shipping instruction form. The warehouse manager proceeds to shipping preparation while checking the delivery statement, receipt, and this shipping instruction form.

#### Step 2: Shipping Preparation

The warehouse manager performs picking according to the shipping instruction form. After the picked products are inspected for problems, they are packed along with the delivery statement and loaded on a truck. Selecting the appropriate packaging materials and type of packing for the shape of the products and the delivery method is important at this time.

#### Step 3: Shipping and Delivery

The products are delivered to the customer. When the products are delivered to the customer, give the delivery statement, copy of the delivery statement, and receipt to the customer. Have the customer confirm the documents, then stamp or sign the receipt and bring the receipt and copy of the delivery statement back to the company.

### Step 4: Create a Sales Slip

The warehouse manager creates a sales slip based on the receipt and copy of the delivery statement and passes this to the accounting manager. The sales are finalized in this manner.

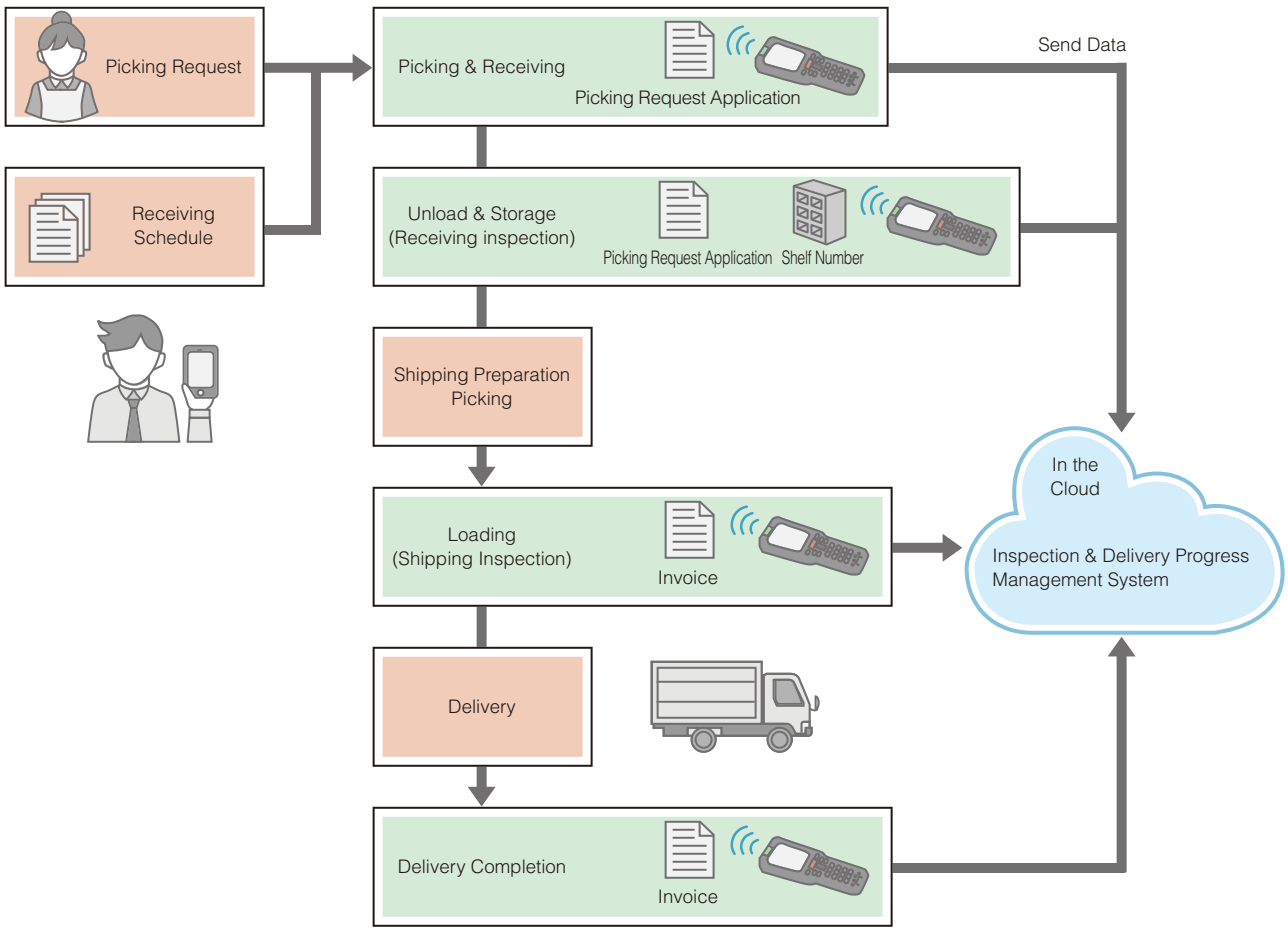
### Step 5: Record the Transaction

The accounting manager who has received the sales slip and receipt from the warehouse manager records the transaction as sales. If cash (bank transfer) is received later as sales, it is handled as accounts receivable.

## Progress Management of Transportation, Delivery, and Truck Freight

### Carefully Check Progress Using Handheld Mobile Computers

It is unrealistic to manage pickup request information from customers as well as daily warehousing and delivery information by entering it manually. Now efficiently performing progress management using handheld mobile computers linked to the internet is common practice in the industry. Real-time work progress can be understood in detail by using barcode scanning and tabulating data in the following processes: pickup and receiving, unloading and storage (receiving inspection), shipping preparation and inspection, loading (shipping inspection), delivery, and delivery completion.



# Storage and Cargo Handling

This section describes transportation and delivery in the logistics functions and the core functions of storage and cargo handling. Storage is a typical term and easy to understand, but cargo handling can be more difficult to imagine because it involves loading and unloading at a warehouse or logistics center, transportation, warehousing management, sorting, and assortment. We need a solid understanding of these functions because they make up a large portion of logistics costs.

## What Is Storage and Cargo Handling?

This section describes the meaning, differences, and roles of storage and cargo handling.

### Storage Is Necessary to Fill the Temporal Gap and Steadily Supply Goods to the Market

Storage is the activity of storing products at warehouses and logistics centers. Its role is to provide a steady supply of goods to the market to fill the temporal gap between producers and consumers. It also plays an important role in maintaining quality at warehouses and logistics centers and value of products. For example, the storage function for fresh fish, vegetables, and fruits has dramatically improved with the advent of freezer and refrigerated warehouses. Important logistics centers in storage include: distribution centers (DC), transfer centers (TC), and process distribution centers (PDC).

### Cargo Handling Refers to the Overall Transportation Activities in Warehouses and Logistics Centers

Cargo handling refers to the overall activities in warehouses and logistics centers, such as loading and unloading cargo, transporting cargo, warehousing, picking, and sorting. The main work in cargo handling is separated into six tasks: assortment, stacking/taking inventory, transportation, storage (allocation), sorting, and picking. These tasks greatly effect productivity and quality in logistics. Cargo handling is a very important part of logistics, and losses in cargo handling directly increase logistics costs. Cargo handling involves many different tasks, so next we will explain in detail the most common.

## What Is the Receiving Inspection?

Retailers typically purchase products to sell and sell those products to the end user. In manufacturing, the necessary raw materials and parts are purchased and shipped as products. In logistics as well, cargo is accepted, inspected, stored, and shipped to markets each day.

1. Cargo is received.
2. Received cargo is inspected.
3. Goods are warehoused.
4. Goods are stored and distribution processing and packaging is performed.

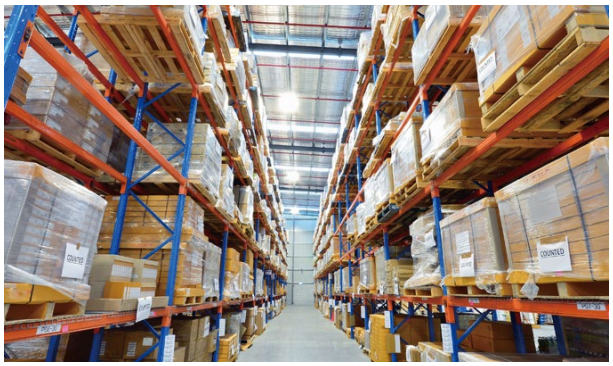
First, received cargo is verified against the receiving cargo list and the products, quantities, and quality are inspected. The inspection may also involve an acceptance inspection, and if there is no problem with the received cargo, the goods are entered into warehouse. Later, the goods are stored and distribution processing and packaging is performed as necessary. Warehousing and inspection data management can be recorded on paper in a ledger if the volume is low, but generally this is performed with management can be performed on cargo from storage to shipping based on the data obtained using a handheld mobile computer when the cargo was received and inspected. This flow that took time to record on paper can now be performed smoothly and accurately.

## What Is Material Handling?

Material handling is a general term for the machines that make cargo handling work (e.g., assortment, loading and unloading, transportation, and sorting) more efficient. More simply, it refers to the machines in general that make it easy to move cargo around or automate handling. This includes simple machines such as carts, pallets, forklifts, and conveyors, as well as industrial robots and automated warehouses that reduce labor requirements and loading times. Material handling also includes automated picking machines, product management machines using RFID tags, and machines that perform automated conveyance and sorting as examples of machines that have been increasing in recent years.

## What Is Taking Inventory?

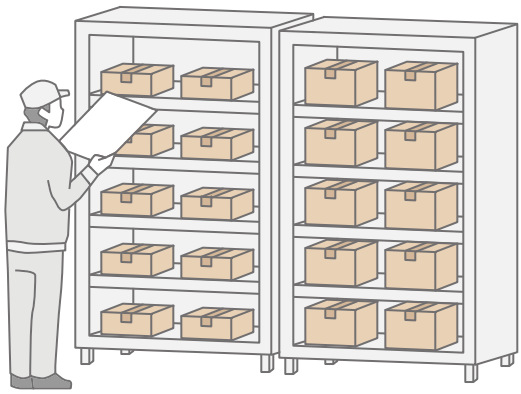
Taking inventory is a task in which the numbers, types, and quality of all items in inventory are checked. Many people imagine inventory being taken by even small retail stores before closing the accounts. The number of products remaining in inventory is counted and the value of inventory is checked so that the amount of profit can be understood accurately, which is useful for making business decisions. Taking inventory is important in inventory and business management. However, it can be difficult in a large-scale facility such as a warehouse or logistics center due to the massive amounts of labor, time, and costs because all goods must be checked. All operations or a portion of operations must also be stopped during the period in which inventory is taken. However, if warehousing management is performed accurately in daily work, the burden of taking inventory can be greatly reduced by adding up that data. Inventory management can be performed in real-time to help make speedy business decisions.



## What Is Picking?

Work in which orders are received for products in inventory or storage (distribution center work)

Single Picking Method



Work in which the various products received that day are sorted for specific delivery destinations (transfer center work)

Total Picking Method


Picking is work to gather products to ship while checking the item numbers and quantities of those products written on a shipping instruction form (picking list). There are two picking methods: the single picking method in which products are collected individually for each shipping destination and the total picking method in which products collected in advance are sorted by shipping destination.

The single picking method is the most typical method in which the products written on the shipping instruction form (picking list) are searched for and then shipped. This is also called order picking, and it is used to send a wide variety of products to many shipping destinations. This picking method is suitable to mail order and other businesses because it is very flexible and products can be shipped immediately after they are picked. However, it takes time and effort for workers to look for products in the warehouse.

The total picking method is also called assort method. This method is optimal for shipping a large amount of a few types of products to a small number of destinations. Products are collected in bulk so the burden on workers can be lessened, but space is required to sort the products. Disadvantages to this method are that it is difficult to know the status of sorting products and handle sudden additions of products.

### Picking Systems

This section gives a simple introduction to picking systems. The simplest picking method is to have a person look at the shipping instruction form (picking list) and search for the products. However, there is a high chance of worker-caused mistakes occurring and the method takes time and effort. At present, many different picking systems are used according to the purpose and products.

#### List Picking

The most basic picking method in which a person looks at the shipping instruction form (picking list), checks the product names and quantities, and searches for the products. This method is easy to implement, but it depends on the accuracy and speed of the worker, and the chance of worker-caused mistakes also increases. To prevent mistakes, checks are required, such as inspecting products with barcodes, before the products are shipped.

#### Digital Picking System (DPS)

In this picking method, digital displays are attached to racks that store cargo and products, and the products are collected according to the instructions on the displays. A advantage of this system is that workers can perform the work easily without any experience because they simply pick the products while looking at the indicators and worker-caused mistakes are kept to a minimum. This system is also desirable because it can be easily adopted and displays can be attached to any storage location.

### Barcodes

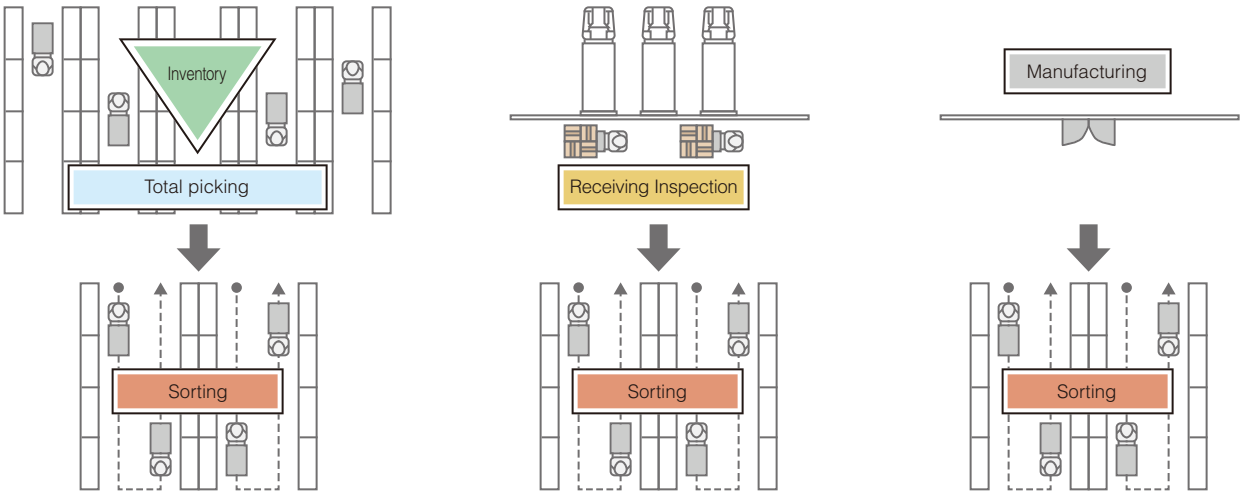
In this method, picking is performed by turning shipping instruction information into barcodes and reading the barcodes of products. If the wrong product is selected, the barcode scanner or handheld mobile computer emits an error sound or vibrates to prevent the wrong product from being picked.

### RFID Tags

Attach RFID (radio frequency identifier) tags, with which information can be exchanged over the wireless network, to product racks to prevent the wrong product from being picked. The advantage is that nothing needs to be read like a barcode, which makes this effective for implementing speedy work.

## Sorting

Just like picking, sorting is a central part of shipping work Sorting is work to separate products by type or shipping destination. There are two broad categorizes of sorting methods: manual sorting and automated sorting. The difference is whether workers perform the sorting or machines. A machine called a sorter is mainly used for automated sorting. Sorting is broadly classified into three types depending on how cargo is brought into the sorting area.




Inventory Type　　Pass-Through Type　　Manufacturing Type

### Inventory Type (Distribution Center)

The logistics center holds inventory and cargo picked from the inventory is sorted.

### Pass-Through Type (Transfer Center)

The logistics center holds no inventory and sorts received products.

### Distribution Processing and Inventory Type (Processing Distribution Center)

Products manufactured in a factory are brought in as-is and sorted.

### What Is the Shipping Inspection?

The same as the receiving inspection, the contents of the shipment are inspected for mistakes when shipped. This is called the shipping inspection.

1. Create a shipping instruction form (picking list) for the contents of the order.
2. Pick the products according to the shipping instruction form (picking list).
3. Perform distribution processing.
4. Inspect.
5. Package.
6. Ship.

In shipping, create a shipping instruction form (picking list) for the contents of the order, and the worker picks the products according to the shipping instruction form (picking list). After the products are picked, distribution processing is performed as required, a shipping inspection is performed to determine if there are any problems with the products before they are packaged, and then the products are packaged and shipped. Data is recorded during picking and the shipping inspection in the same manner as during receiving. If products are managed using a handheld mobile computer by giving them a barcode or 2D code when received, warehousing management and inventory management can be performed accurately.

## Distribution Processing and Packaging

Products are naked when they are produced. In recent years, the demand for distribution processing that performs various types of work during shipping has been increasing to improve the added value of distribution. If products are transported in their naked state by airplane, ship, or truck, they may be scratched, broken, and quality may decrease. Packaging is what prevents this. This section describes the logistics functions of distribution processing and packaging.

### What is Distribution Processing and Packaging?

This section describes the concepts of distribution processing and packaging, basic knowledge about the two, and their differences.

#### Distribution Processing

Distribution processing refers to all of the processing that is performed at the warehouse or logistics center when shipping products. For example, grouping products into sets, applying labels, and putting products into bags, or work such as inspecting for needles, applying tags, putting products on hangers, applying price tags, and putting products into gift boxes, correspond to distribution processing.

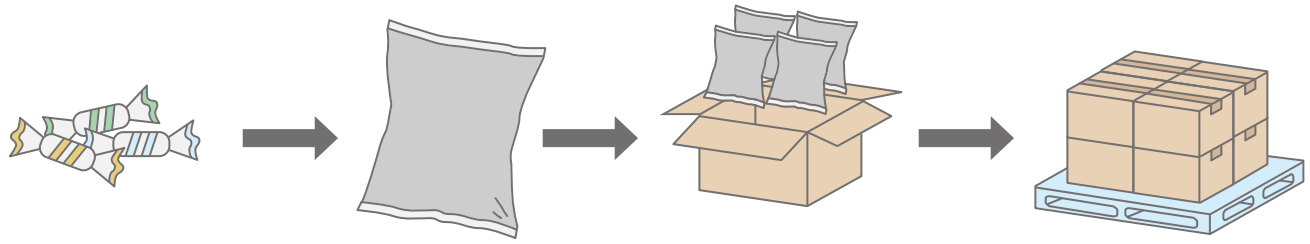
The goal is to increase the added value of the product. There are advantages for both the customer and logistics operator. The customer is happy if this time-consuming processing is completed at the delivery stage, and the logistics operator can differentiate themselves and provide added value. In recent years, demand has been increasing due to costs because it is cheaper to perform distribution processing at a logistics center.

## Packaging to Protect Products and Quality

Products may be damaged and quality may decrease if shipped as is. The purpose of packaging is to protect the product with cardboard or wooden crates to prevent damage and a decrease in quality. With packaging, damage can be prevented due to vibrations and falls and decreases in quality can also be prevented due to mold and rot from humidity. Products can also be differentiated more easily by marking the name of the contents, volume, production date, and lot number on the cardboard box. Products with a difficult shape to carry can be easier to stack on a cart and transport if put in a cardboard box. Packaging is also effective for maintaining quality during storage.

### Types of Packaging

Packaging is split into three types depending on the role and purpose: individual packaging, inner packaging, and outer packaging.



Individual Packaging　Inner Packaging　Outer Packaging

### Individual Packaging

Individual packaging is packaging for individual products. For example, individual packaging is what is used to wrap each individual piece of candy. The purpose is to protect the product from water, humidity, light, and heat.

### Inner Packaging

Inner packaging is used to group individually packaged products in a bag. This is the bag that is filled with individually packaged candy. Inner packaging is the unit that is sold at retail stores, and it is important to design an inner package that expresses the appeal of the product and stimulates the desire to purchase the product to promote sales.

### Outer Packaging

Outer packaging is the unit of the largest package, such as a cardboard box or wooden crate. The main purpose is to protect the product from dirt and breakage.

## Examples of Distribution Processing and Packaging

Now that we have a basic understanding of distribution processing and packaging, we will introduce some examples of how packaging is actually used. These are just few examples. Refer to the distribution processing and packaging that not only protects products but also increases additional value.

### Cutting and Packaging

This distribution processing example cuts cheese to the specified number of grams and individually packages it. Cutting and packaging is performed under strict conditions in a low-temperature clean room to maintain the freshness and safety of the food.

### Assortments (Packing into Sets)

This distribution processing example packages products into sets for sale, such as gift boxes for wine lovers that include chocolate, cheese, and olives.

### Shrink Wrapping

This distribution processing example packages products, such as boxes of candy, toothpaste, and CD packages, with a thin film to maintain the appearance of the product and protect safety and hygiene.

### Volume and Product Inspections

Volume and product inspections are performed to ensure that the contents of the product follow standards. This distribution processing example ensures safety and quality by inspecting the product when shipped. The burden of the inspection process has been increasing in recent years.

### Metal Detection Inspection

This distribution processing example inspects foods with a metal detector to ensure no metal fragments contaminate the food.

### Labeling

This distribution processing example creates and applies labels to the individual packaging and inner packaging.

### Wrapping

This distribution processing example wraps products for events, such as Christmas, New Year's, Valentine's Day, and Halloween.

### Wooden Frame Packaging

Wooden frame packaging is optimal for products that will be stored for a long time after transport and products that require ventilation. This packaging is also used for the domestic transportation and export of large machines.

### Wooden Crate Packaging

Compared to cardboard, wooden crates are stronger and more resistance to rain and dust. Wooden crates are frequently used for home appliances, electronics, and glass products that are susceptible to impacts.

## Information Systems

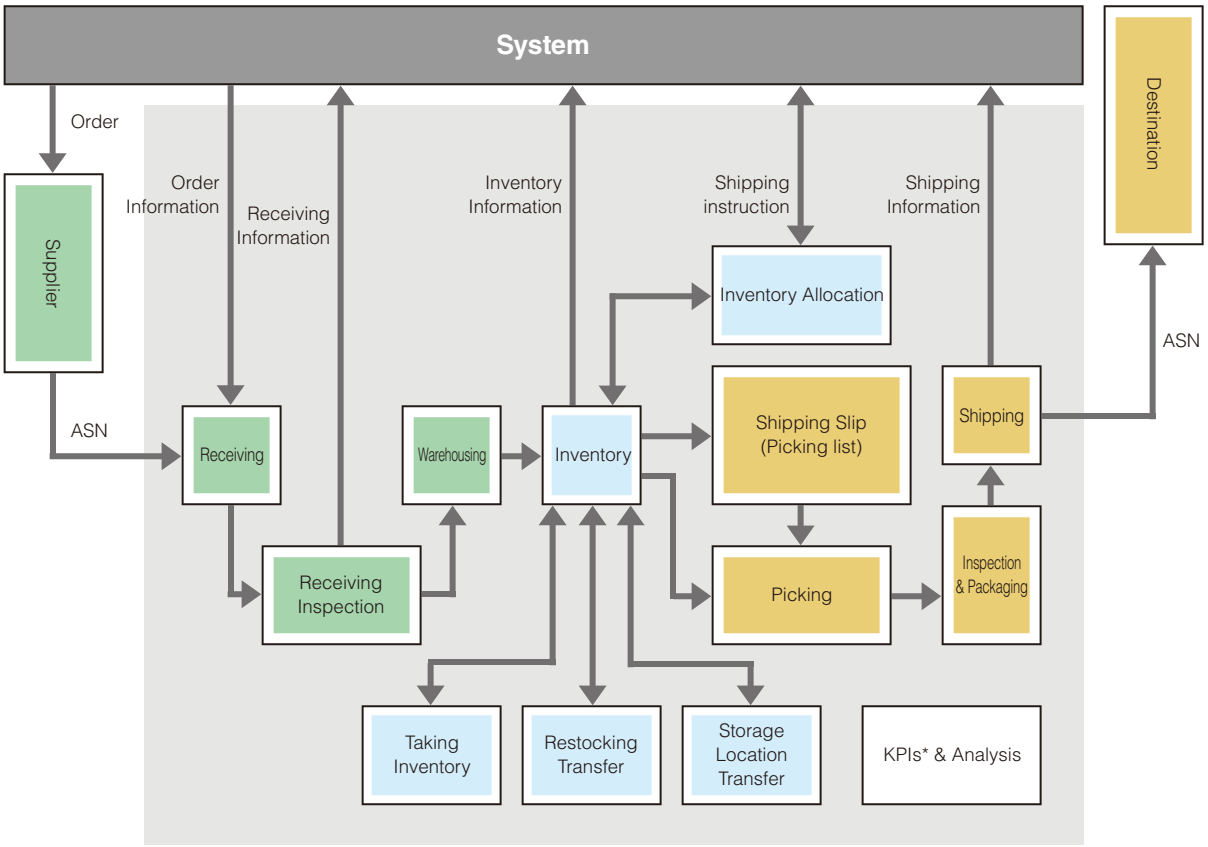
Information systems are indispensable to the diverse logistics worksites of the present age. In the past, existing systems for sales management may have been customized and used as information systems, but at present there are many cases that can be handled only by WMS (warehouse management systems). This section describes information systems in logistics with an emphasis on WMS.

### What Are Information Systems?

As previously mentioned, systems for sales management were conventionally used even in logistics. However, the purpose of sales management systems is to manage commercial distribution, and it is not a system to manage logistics which is the flow of goods. For this reason, even though basic management such as receiving, inventory, and shipping can be performed, location management, date management, and work management that are important in logistics are difficult to perform. If a sales management system is forcibly customized, expenses also increase greatly, and if a problem occurs, there is also the potential that both commercial distribution and logistics will be affected.

What was developed to manage the flow of goods is the specialized warehouse management system (WMS). A system that is specialized for logistics can handle location management, date management, and work management without problems. Adopting an information system that is specialized for logistics can also decrease the load on the sales management system. The biggest advantage of adopting a WMS is that the information systems for commercial distribution and logistics can be separated and each can function at its highest performance. The following diagram is a conceptual image of a WMS in which functions specialized for logistics can be seen.

**Conceptual Image of WMS**




* KPI: Key Performance Indicator

## Advantages of Using Information Systems

Now that we understand an overview of warehouse management systems (WMS), we can explain the advantages of actually using a WMS.

### Advantage 1: Location Management

Location numbers are assigned to all locations in a logistics center, such as the pallets, racks, and shelves where products are stored. If this location number is viewed, anyone can easily arrive at the location and find the product. A WMS can manage these important locations inside a logistics center.

Additionally, if barcode readers and handheld mobile computers are used, locations can be changed easily, such as when receiving goods and when goods are moved to different shelves. Data does not need to be entered manually, so there are no worries about entry mistakes. For systems that were customized conventional sales management systems, locations could not be managed so they had to be handwritten on forms or manually entered using PCs which caused omissions and mistakes. These worries are unnecessary with a WMS. And workers no longer need to search for products while relying on their memory. Everyone can work with the same speed and accuracy.

### Advantage 2: Simplify Arrival and Receiving Management

In a WMS, data (e.g, when, what, where from, how many items were received, and where the order form is located) can be associated with goods and saved in the database. If ASN (advance shipping notice) is used at that time, entry work can also be greatly eliminated.

When using ASN, receiving information can be known at the logistics center before the goods arrive, so those goods can be handled as inventory and allocated. In particular, this information is essential when performing cross docking at transfer centers (a system in which no inventory is held and goods received from multiple factories or sites are immediately sorted by destination for delivery).

#### WMS Terms

**Advance Shipping Notice (ASN)**

Advance Shipping Notice (ASN) is advanced shipping information and pending delivery data so that a supplier can inform the logistics center of shipping information in advance. An ASN informs the logistics center of the pending delivery date, order number, product code, and quantity, and in certain cases, of additional information such as the product lot number and expiration date. ASN is exchanged using electronic data interchange (EDI). When using an ASN, a shipping carton marking (SCM) label is typically used.

**Electronic Data Interchange (EDI)**

Electronic Data Interchange (EDI) is the exchange of electronic data between companies. In transactions between companies, information is exchanged (e.g., order placement and acceptance, shipping and receiving, invoicing and payment). EDI is a system that automates this processing by connecting over a dedicated line (including online).

**Shipping Carton Marking Label (SCM Label)**

Shipping carton marking (SCM) labels are shipping labels with barcodes that are affixed to the delivery boxes of packaged products when shipped. The contents of the box can be checked without opening by displaying the details about the contents and form numbers using the SCM label.

### Advantage 3: Simplify Dispatch and Shipping Management

A WMS can use EDI order data as is, so customers no longer need to be phoned or emailed and memos taken from customer conversations do not need to be manually entered, which greatly saves effort and eliminates entry mistakes. Using the EDI order data, shipping picking lists, delivery labels, delivery forms, and delivery statements can be created and passed to the managers of the relevant worksites. Locations are managed by the WMS, so picking can be performed using the shortest routes to achieve speedy and accurate dispatch and shipping.

#### Advantage 4: Total Management Including Inventory Management, Duplicate Arrivals, and Location Changes

Adopting a WMS can simplify inventory management, duplicate arrivals, and location changes that had to be viewed and checked on site up to now. Using a WMS is extremely efficient because management is performed accurately with barcodes instead of viewing goods.

### Major Information Systems Other Than a WMS

#### Shipping Inspection System Using Barcodes

A shipping inspection system using barcodes is typically the most effective method to prevent shipping mistakes. The shipping list, the products, and the database information are verified by barcodes to inspect the products and prevent omissions and shipping mistakes. This system uses barcode readers and handheld mobile computers because it reads barcodes.

#### Transportation Management System (TMS)

A transportation management system (TMS) is an information system that automatically creates truck assignments, attendance management, delivery instructions, and daily reports. It also automatically calculates freight charges and centrally manages truck transportation. This system effectively implements truck transportation without requiring specialized knowledge of truck assignments.

### Importance of Handheld Mobile Computers Reading Barcodes

There are many types of information systems, such as warehouse management systems, and handheld mobile computers are essential for using these information systems to the fullest extent possible.

Handheld mobile computers can not only read barcodes and QR codes, but also dates and text.
Many types available are rugged for use in harsh environments and superior reading performance for usability at worksites.

## Role of Logistics Equipment (Material Handling Devices)

Material handing is the general term for the machines and equipment used for the purpose of making cargo handling work more efficient and using fewer labor resources in cargo handling work that places a large burden on workers. These machines and equipment are called material handling devices. This section describes the material handling devices used at logistics worksites by the work they perform.

### Equipment Used in Logistics: Material Handling Devices

There is a large amount of heavy labor involved at logistics worksites, such as in loading, unloading, and transporting cargo. Material handling device is a general term for the machines used to make this logistics work more efficient. These machines perform a variety tasks including moving raw materials, works in process, and completed products. There are many material handling devices used at logistics worksites. These include forklifts, carts, pallets, conveyors, conveyance robots, sorters, picking systems, and automated warehouses.

### Loading

Loading is the work to load cargo to ship in a truck. Unloading is the work to unload cargo from a truck. A forklift probably comes to mind when thinking about loading and unloading. If you visit a port area, you can see many forklift drivers loading and unloading cargo.

## Forklifts

Forklifts are used in many locations, including factories, logistics warehouses, port facilities, and cargo terminals. They are infinitely versatile as they can easily lift heavy loads and turn in a small radius. Forklifts come in a variety of shapes and sizes, and they are defined as follows.

### Definition of a Forklift

A forklift is a motorized (e.g., engine) cargo handling and transportation vehicle that is equipped with a device (e.g., fork or ram) to load cargo from the front and a mast that moves the device up and down.

### Major Types

Counterbalanced forklift
Reach-type forklift and others

### Major Power Sources

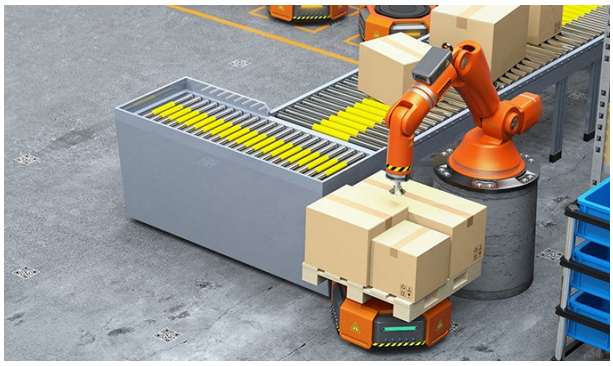
Engine
Batteries and others

## Palletizers

Palletizers are machines that automatically load cargo on a pallet. Palletizers are separated into high-level palletizers and low-level palletizers that load products from those respective levels and palletizing robots that grab (suction) and stack cargo using industrial robots.

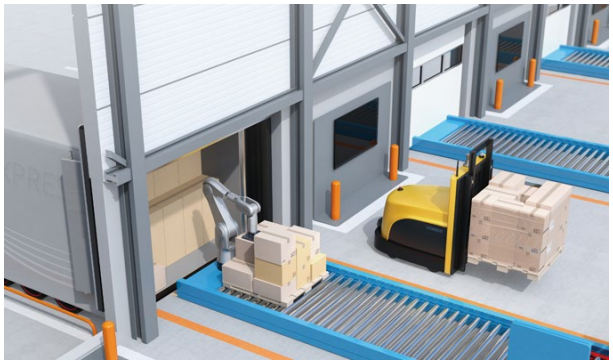
## Depalletizers

The opposite of a palletizer is a depalletizer, which is a material handling device that unloads cargo stacked on pallets. As with palletizers, there are various types of depalletizers according to the type of cargo that is handled.



### Container Vanning and Devanning Systems

Vanning is the work to load a container with cargo and devanning is the work to remove cargo from a container. Normally vanning and devanning are performed manually or with a forklift, but vanning and devanning can be made more efficient and require less labor by connecting a belt conveyor from the container to inside the warehouse and by using vanning/devanning assistance machine.



## Transportation Inside Warehouses

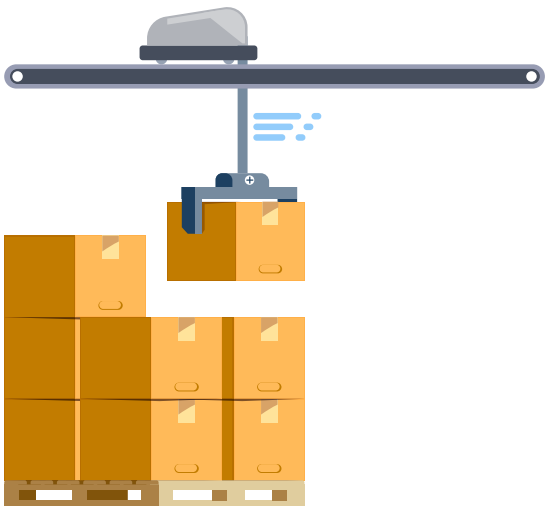
The simplest material handling device that transports cargo in a warehouse or delivery center is a cart. There are also self-propelled automated guided vehicles (AGV), overhead trolleys, and robots for transporting shelves.

### Automated Guided Vehicle (AGV)

An automated guided vehicle (AGV) is a vehicle that guided in an automated manner. Normally magnetic tape or magnetic rods are installed on the floor like rails and the transportation vehicle drives itself along those. There are many types of AGVs according to the application, including conveyor type AGVs, flat body/heavy load type AGVs, low floor type AGVs, and tow type AGVs.

### Overhead Trolleys

Overhead trolleys are carts that run on rails installed on the ceiling using free space. Similar to automated guided vehicles, overhead trolleys are capable of self-sustained operation, and they can be used to transport cargo and in applications such as automatically replenishing goods to picking shelves, sorting goods by shipping destination, and transporting parts between processes in factories.



### Automated Conveyance Robots with AI

In recent years, automated guided vehicles (AGV) have evolved and automated conveyance robots with AI have appeared. These robots also come in many types, such as robots that independently deliver goods to workers without requiring magnetic tape, etc., to be installed like that for AGVs, automated conveyance robots that can follow workers, and also shelf transportation robots that create an easy to work in environment by moving entire shelves.

## Sorting

Conveyors (belt conveyors) and sorters (automatic sorting machines) are used in work to sort large amounts of cargo while also transporting the cargo. Conveyors and sorters are also called sorting conveyors when combined into a set.

### Conveyors (Belt Conveyors)

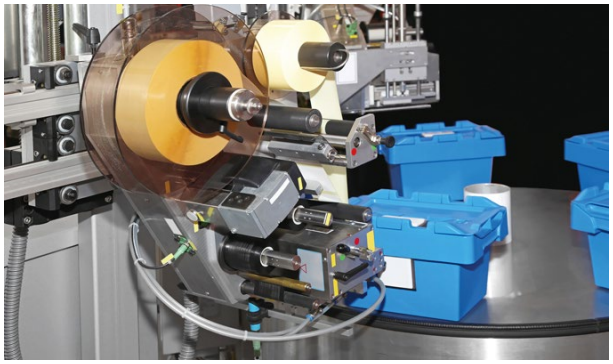
A conveyor is a material handling device that transports goods placed on it at a constant speed. Conveyors (belt conveyors) are used at many worksites.

### Sorter (Automatic Sorting Machines)

There are many types of sorters (automatic sorting machines), such as slide shoe types, pan types, cross belt types, and popup types, and sorters automatically perform sorting work on cargo. The cross belt type that combines longitudinal and traverse belt conveyors is called a cross belt sorter, which is used for high precision and high speed sorting.

### Automatic Labeling Machine

A material handling device that prints labels appropriate to a purpose and automatically applies them to containers and cardboard boxes on a conveyor line.



## Storing

Racks and shelves are typical equipment used for storage, but there are also automated warehouses that automate the storage and management of goods on shelves. In factory automation (FA), there are also designs that include equipment that automatically passes cargo to automated guided vehicles.

### Automated Warehouses

There are many types of automated warehouse in which the storage and management of goods on shelves has been automated, from large types that store and manage goods by pallet to types that are specialized for picking. For large types, there are warehouses in which the entire building has been made into an automated warehouse, and these greatly benefit from higher efficiency and lower labor requirements.

## Preparing for Shipping

In shipping, picking, sorting, and packaging, work is performed and experience is required to find the target products and quickly ship them. Systems that make up for this experience are digital picking systems and automatic case formers.

### Digital Picking Systems

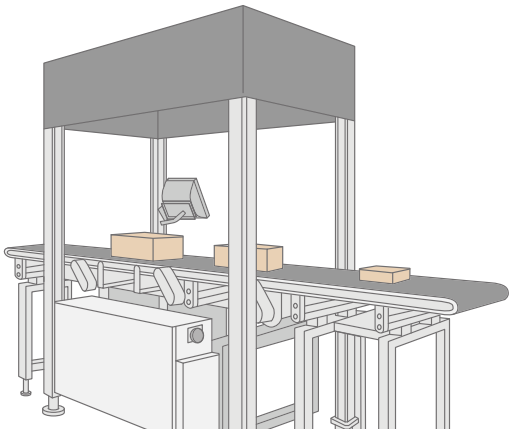
Digital picking systems support picking by workers. Normally workers search for products while checking the product number and quantity, but this increases movement inside the factory and takes time. With a digital picking system, digital picking indicators are installed on shelves and the indicator is lit for the location of the product to pick. This allows workers to immediately reach the desired products. This is efficient and economical because workers can perform the work with the same speed since they no longer need to search for products and worker training can be decreased.

## Automatic Case Formers

Automatic case formers are material handling devices that automate opening a folded cardboard box and applying tape to the opened box. In logistics centers with a large amount of packaging work, it takes time for workers to assemble cardboard boxes, so using automatic case formers allows cardboard boxes to be filled and shipped immediately.

## Dimensioning, Weighing, & Scanning (DWS) Systems

Dimensioning, weighing, and scanning (DWS) systems identify the dimensions, weight, and barcodes of items to ship in a single scan. These systems prevent shipping mistakes and facilitate speedy shipments since they can accurately measure the dimensions and weight of items to ship on a belt conveyor.



## Types of Logistics Centers

There are three types of logistics centers: transfer centers, distribution centers, and process distribution centers. You should have a good understanding of these three logistics centers because they are a basic part of logistics. In addition to the three types of centers, fulfillment centers also exist as centers for the mail order sales industry. This section describes the features and functions of each of these logistics centers.

### Transfer Centers

The primary role of transfer centers is cross docking (e.g., sorting and transshipping goods). Transfer centers fundamentally do not perform storage of goods and other functions. Received goods are immediately sorted and shipped to the next destination. The work performed on cargo at transfer centers is less than that performed at distribution centers and processing distribution centers, so a feature of transfer centers is that they can be operated with devices and equipment on a relatively smaller scale. However, receiving means immediate shipping, so shipping information is required at the same time as receiving and speedy cooperation between receiving and shipping is indispensable.

### Distribution Centers

The purpose of a distribution center is to store and manage inventory at a logistics center, sort those goods by store and region, and deliver those goods to retail stores and end users. This is the standard logistics center that everyone thinks of. The work at a transfer center is simple: receive and then immediately ship goods. A distribution center, however, is equipped with the basic functions of a logistics center, such as shipping work, picking according to the contents of an order, distribution processing such as inspections and packaging, and shipping so that goods arrive by the specified deadline. Compared to a transfer center, though, costs tend to increase because equipment is required on a larger scale.

### Processing Distribution Centers

A processing distribution center is a distribution center with enhanced distribution processing. Relatively simple distribution processing is performed at a distribution center, such as packaging and applying labels, but the difference is that a processing distribution center can perform advanced distribution processing that requires specialized devices and equipment, such as processing fresh fish and meat, as well as assembling and installing parts. In addition to functioning as storage centers, these centers are equipped with an environment that is as close to a factory as possible. High distribution processing functions can increase added value, but this also requires dust-proof facilities, temperature-controlled facilities, and production lines and labor equal to that of a factory.

### Fulfillment Centers

The popularization of sales over the internet has greatly changed the logistics industry, and fulfillment centers are attracting attention in this age. Fulfillment centers are logistics centers that perform management, picking, and delivery of goods in the mail-order industry. It can be said that these are logistics centers that perform the sales work of receiving orders from the end user and promptly shipping goods. The advantage is that all of the work (e.g., receiving goods, receiving orders from end users, packaging, shipping, inventory management, customer data management, handling returns, handling complaints, and payment process) is completed at the logistics center. Operators that conduct mail-order sales can enjoy benefits such as different customers and using new types of payment methods by conducting sales using the services of a fulfillment center.

# Improvement Points for Logistics

Compared to manufacturing in which automation and mechanization was adopted early, manual labor still makes up the majority of logistics work. This means that business practices and the working environment can still be greatly improved. In this section, we will introduce improvement points in logistics worksites.

## How To Improve Logistics Work

You may realize that losses are occurring in logistics work due at many worksites to inefficiencies and a variety of mistakes. But many executives and on-site supervisors involved in logistics and warehousing are concerned that they do not know where to begin making improvements.

In particular at logistics worksites where the volume of receiving and shipping goods varies greatly, it is difficult to assign the correct number of personnel and work must often be performed with a minimum of personnel. This makes process management important.

### Finding Improvement Points

In order to clarify what parts should be improved, a system is required to provide feedback on who was doing what, where, when, and in what part the process from receiving to shipping. For example, if you can know the quantity of goods that was picked in an hour, the number of minutes it took to complete picking to packaging, or how many steps staff on site took to complete picking, you can make a guess as to where waste and mistakes are occurring and in what process. Process management is collecting these kinds of results and performing activities that are useful for making improvements at a worksite.

### Issues in Collecting Results

The issue is how to collect results. The goal in logistics is having the minimum number of workers making their way around the worksite. Having workers record just the starting and ending times of work is a large burden, and it becomes an impediment to their regular work. As a result, various problems may also occur, such as a decrease in work efficiency and making mistakes. In addition, entrusting the collection of results to people will result in omissions and mistakes, so the degree of accuracy and exactness of the collected results cannot be guaranteed, and there is a risk that the results will not help in determining the issues.

## Process Management Using Handheld Mobile Computers is Key

To obtain information for making improvements at logistics worksites, care and attention are required so that work is not interrupted and workers are not burdened. Improvements can be made effectively and with a minimum of effort by using the handheld mobile computers that are being used in inspections and picking to collect results.

A handheld mobile computer can automatically and accurately record the time at the start and end of work and the progress of the work. The read data can also be sent to a PC through a wireless LAN so that results can be checked in real-time, and the waste and mistakes in collection work by human input do not occur. Process management using this kind of the latest tool is the key to making improvements.

# Preventing Mistakes (Pokayoke)

The logistics industry has many jobs that rely on human resources, and the chance that worker-caused mistakes will occur also tends to be high. For example, incorrect shipments due to picking mistakes and selecting the wrong destination are just some examples. These mistakes lead to complaints and waste time and money to deal with if they occur. Pokayoke to prevent mistakes is what is important here. This section describes what causes mistakes to occur and how to make improvements.

## Causes of Mistakes

Often times the cause of mistakes lies with people. For example, human error is a typical example, such as when products A and B are mistaken because they look similar or one digit of a long product number is missed. These might be small mistakes, but they can add up to create serious problems in operations and shipping work. Plus they may negatively impact trust relationships with customers and have a risk of large losses for corporate management. Workers should always work carefully to avoid mistakes at logistics worksites that rely on human resources.

### Examples of Typical Mistakes Due to Misidentification

| Difference is too small and easy to mistake | Products look similar |
|---|---|
| Product No.: DEE-930000800-E<br>Product No.: DEF-930000800-E |  <br>Product A Product B |
| The two product numbers look the same but one digit is different so there is a risk of making a mistake. In particular, the letter O which looks like the number 0 (zero) and the letter I which looks like the number 1 (one) are easy to mistake. | Products with a similar appearance can look the same unless instructions are given ahead of time. For inexperienced operators in particular, these products are easily confused. |

### Other Human Errors

The mistakes above are typical, and there are other reasons unique to humans that cause simple mistakes.

- Simple memory lapses
- Oversights and mistakes due to too much information
- Oversights of mistakes that do not stand out
- Oversights of mistakes that occur infrequently
- Mistakes and oversights by mixing up first and last information
- Mistakes and oversights caused by assumptions due to experience

This is not an exhaustive list of reasons that human errors occur. These mistakes are due to the characteristics of the human brain, and it is impossible to reduce them to zero when people are performing work.

## Eliminating Mistakes

When the human brain was evolving, a function started to develop to select only the information best suited to survival. This function of the human brain is what causes simple mistakes, such as omissions and misunderstandings, to occur. The human brain easily misses fine details, so mistakes will occur no matter how carefully inspections and product inspections are carried out. Understanding this cognitive function of humans is the first step to preventing mistakes.

### Specific Examples of Work Where Humans Are Weak

Each day a large amount of shipping and inspection work is performed, depending of course on the scale of the logistics center or delivery center. If this work depends on the eyes of people, then mistakes will occur. This is because the cognitive functions of humans are not suited to mechanically performing this kind of detailed work. Mistakes, such as storing goods on the wrong shelf during receiving or making a mistake with the picking list and sending an incorrect shipment, happen because humans are forced to perform work they're not well suited to. Forcibly performing this kind of work also leads to a decrease in efficiency.

| The human brain is weak at: |
| --- |
| • Holding memories<br>• Identifying small differences<br>• Identifying things that do not stand out<br>• Processing a large volume of information at one time<br>• Identifying things that occur at a low frequency |

→ **Careless Mistakes**

### To Reduce Human Error

There are many methods available to reduce human error. Examples of these methods include taking notes, emphasizing important parts of a picking list with bold text, changing the placement of shelves so that the wrong goods are not picked, having multiple people check for errors a number of times, and reducing excess information. However, it is difficult to completely prevent mistakes even with these methods.

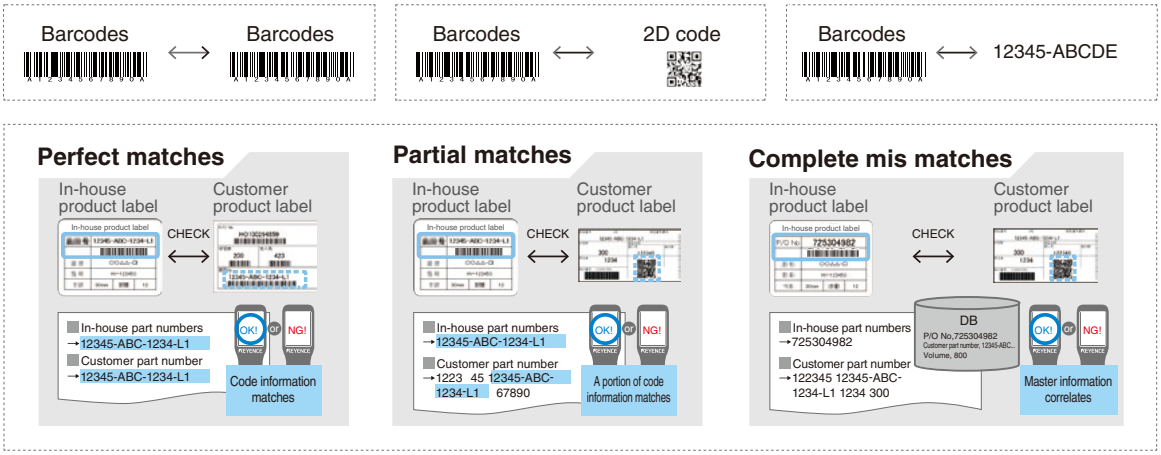
## From the Eyes of People to the Eyes of Machines

To prevent human error, mechanization to perform the work by adhering to a program is most effective. One characteristic of machines is that they can perform work accurately that is difficult for humans, such as remembering things, identifying small differences, and identifying only things that are necessary out of a large volume of information.

For example, many errors that occur in logistics processes are eliminated by adopting handheld mobile computers for warehousing work and inspection work. The key to pokayoke in logistics is the shift from the eyes of people to the eyes of machines.

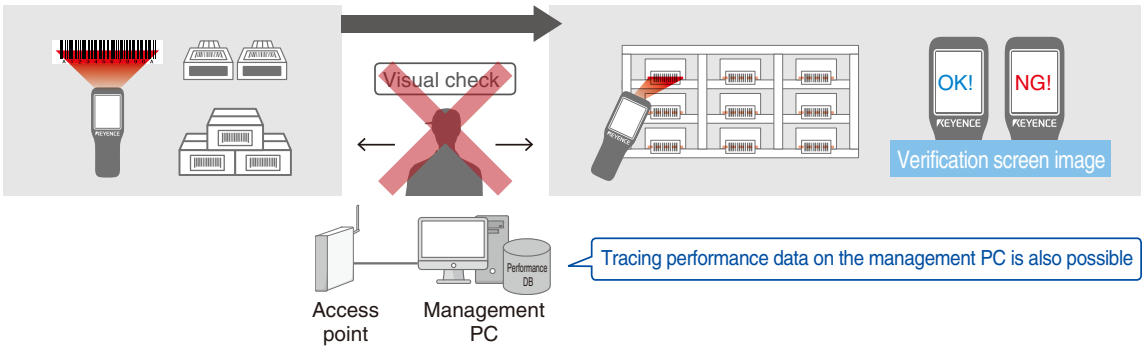
By using handheld mobile computers, strings of letters and numbers that are easily mistaken by humans, as well as barcodes and 2D codes that humans cannot even identify, can be accurately read to identify products and cargo. Handheld mobile computers can compare and verify various types of information, and they can also perform checks by setting conditions such as complete data match, partial data match, and incomplete data match.

### Items That Can Be Compared and Verified with Handheld Mobile Computers




### Pokayoke Effect in Receiving Work

By managing products with barcodes and 2D codes, mistakenly allocating products to the wrong shelves can be prevented. Verification work can also be streamlined by managing information on a PC. Visual checks become unnecessary and smooth product management can be implemented.



### Increased Accuracy, Work Efficiency, and Trust from Customers

Careless mistakes can be prevented and accuracy can be increased by adopting handheld mobile computers as mechanical eyes. Work efficiency can be increased because processes in which visual checks were made are no longer required, and stable shipping work with increased quality leads to obtaining the trust of customers.

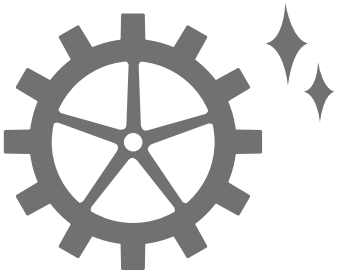
**Increased Accuracy (Quality)**


Quality is greatly increased by accurate work that anyone can do without mistakes.

**Increased Work Efficiency (Productivity)**

Time is greatly saved in visual checks. Costs can be reduced by eliminating personnel expenses.

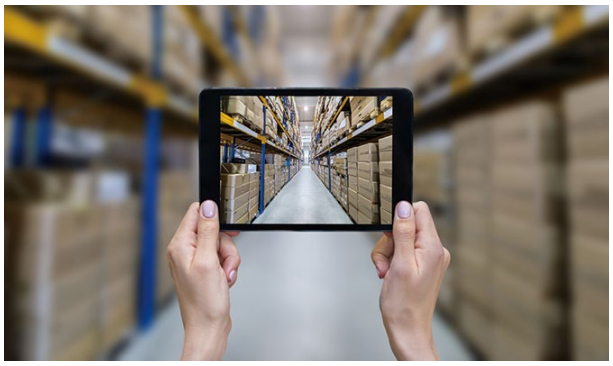
**Increased Trust from Customers**



Mistake-free shipping with good quality also results in increased trust from customers.

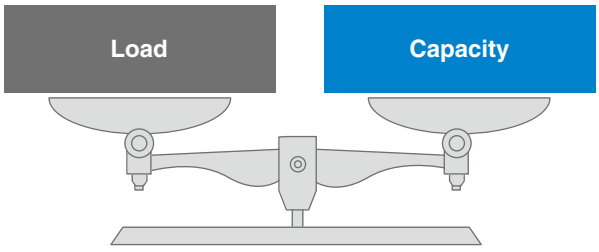
## Eliminating the 3Ms (Muri (Overburden), Muda (Waste), and Mura (Unevenness))

When improving the efficiency of production management and work flows, the elements that should be eliminated are the 3Ms (muri (overburden), muda (waste), and mura (unevenness)), and these same elements exist in logistics worksites. This section explains basic knowledge of the 3Ms, where the 3Ms are latent in logistics worksites, and how to eliminate the 3Ms.



### What are the 3Ms (Muri (Overburden), Muda (Waste), and Mura (Unevenness))?

In an ideal work environment, the load (amount of work) and capacity are even. For example, if a target was set to finish a certain amount of work within a fixed time, muri (overburden) occurs if that cannot be achieved. On the other hand, muda (waste) occurs if the target is cleared with a large amount of spare time. Mura (Unevenness) occurs when both muri (overburden) and muda (waste) exist and the work is unstable.

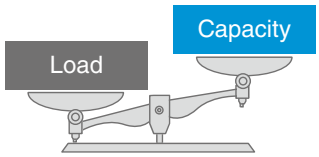



# Improvement Points for Logistics

## Reasons Why the 3Ms (Muri (Overburden), Muda (Waste), and Mura (Unevenness)) Occur

There is an ideal work environment where the load (amount of work) and capacity are even. However, the 3Ms occur when the balance between the load and capacity is upset. Reasons for this may be an inappropriate distribution of personnel or production plan. If the load increases, work becomes delayed. And if capacity increases, personnel become idle. Maintaining this balance is very important.

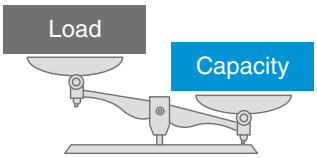
**When load exceeds capacity**




**Work accumulates and backs up**

When a load is applied that exceeds the work capacity, the work backs up and the 3Ms (muri (overburden), muda (waste), and mura (unevenness)) occur.

**When capacity exceeds load**




**Excess personnel and idleness**

When there is plenty of work capacity but the load is small, personnel become idle and the 3Ms (muri (overburden), muda (waste), and mura (unevenness)) occur.

## 3M Problems at Logistics Worksites

| Insufficient Personnel | Excess Personnel |
|---|---|
| •The amount of cargo handled in a day cannot be cleared.<br>• Work becomes easily dependent on personnel capacity, and the risk of mistakes occurring in receiving/shipping goods and inspection work increases. | • Personnel costs increase because there are too many personnel for the amount of cargo handled in one day.<br>• Losses also occur easily between processes when personnel wait for work. |

## How to Eliminate the 3Ms (Muri (Overburden), Muda (Waste), and Mura (Unevenness))

The largest cause for the occurrence of muri (overburden), muda (waste), and mura (unevenness) at logistics worksites is the inappropriate distribution of personnel. It is bad if there are insufficient personnel and it is also bad if there is an excess of personnel. Busy processes and idle processes occurring at the same time or day is also a problem.

However, the amounts of receiving and shipping goods varies greatly depending on the day at logistics worksites, so it can be difficult to know how many personnel to distribute to each section. For this reason, the 3Ms (muri (overburden), muda (waste), and mura (unevenness)) occur easily because personnel cannot be distributed according to a clear production plan like in manufacturing.

To eliminate the 3Ms in logistics, the dependency on personnel needs to be reduced to a level greater than the optimal personnel distribution. One method for this is accurate management using handheld mobile computers.

## Countermeasures by Adopting Handheld Mobile Computers

At logistics worksites where there is less room for automation and mechanization unlike in manufacturing, it is not easy to reduce the dependency on personnel which is a cause of the 3Ms (muri (overburden), muda (waste), and mura (unevenness)). However, adopting handheld mobile computers can be a relatively easy and efficient countermeasure.

At logistics worksites, visual inspection work is performed and invoices/delivery statements and actual goods are checked. The load of this work is great and careless mistakes, such as misjudgments and omissions, occur easily. Large reductions in labor requirements can be made and mistakes, such as shipping the wrong goods, can be prevented by adopting handheld mobile computers for processes in which visual inspections were performed and automating the verification work in those processes. Personnel can be reduced while achieving a balance between capacity and load (amount of work).

Verification by handheld mobile computer is accurate and fast to a degree that it cannot even be compared to visual inspection, so both experienced and inexperienced workers can perform the target amount of work without mistakes and eliminate mura (unevenness). This also simplifies the distribution of personnel.

- Balance load and capacity while reducing personnel requirements in logistics processes.
- Eliminate inefficiencies in inspections and checking invoices against actual goods. Prevent mistakes as well.
- Personnel distribution can be optimized because verification work can be done by even inexperienced workers.

### Improvement Points in Inventory Management

The status of inventory can be verified when an order is made and the accuracy of inventory management can be greatly improved by using handheld mobile computers. Various types of data can be managed if handheld mobile computers are used, which also eliminates handwritten slips, so that input and writing work is no longer necessary and mistakes on slips can be prevented. Handheld mobile computers are also effective in optimizing personnel distribution because work can be reduced and free resources can be assigned to other processes.

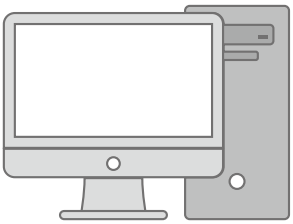
**Data That Can Be Managed by Handheld Mobile Computers**

| Data to Input | Obtainable Data | Applications for Data |
|---|---|---|
| • Representative code (who)<br>• Storage or retrieval<br>• Destination (where to)<br>• Product code (what)<br>• Quantity (how much) | • Processing date/time<br>• Storage and retrieval data<br>• Extracting goods with insufficient quantity | • Taking Inventory<br>• Location Management<br>• Picking |

### Improvement Points in Shipping Inspections

Conventionally, shipping inspections were performed visually, but shipping mistakes would occur and lead to the risk of recovery work. However, visual inspections can be eliminated, the work required to perform those inspections reduced, and shipping mistakes can be prevented by managing goods using handheld mobile computers and barcodes/2D codes. This also frees workers from stress, reduces work loads, and allows capacity to be maximized.

**Shipping Inspections Using Handheld Mobile Computers**

Inspection data is managed in the shipping history on the PC

| Data to Input | Obtainable Data | Main Applications for Data |
|---|---|---|
| • Representative code (who)<br>• Storage or retrieval<br>• Destination (where to)<br>• Product code (what)<br>• Quantity (how much) | • Check product quantity<br>• Verify shipping destination<br>• Check for insufficient package contents | • Inventory management<br>• Print shipping labels<br>• Receiving inspection |

## Making Work Efficient

To solve the issues in logistics worksites, the flow of goods, flow of work, and flow of information at the worksite must be totally optimized, from receiving to shipping. When all work is made more efficient, this is when “Kaizen” can first be achieved. This section explains the points of making work more efficient at logistics worksites from the standpoints of simplifying work, changing the flow of traffic/layout, and automating work using material handling devices.

### Simplifying Work

To implement “Kaizen” of a logistics worksite by making work more efficient, you basically start by simplifying flows and processes. The speed of work can increase, mistakes can decrease, and the number of workers can be minimized through simplification. However, just making complicated work simple is not making it more efficient. The essence of simplifying work is that the work on which time and labor are wasted is uncovered, the current state reviewed, and the measures for improvements and their effects are analyzed.

For example, duplicate work, such as putting a picked product in a box and moving it to a different box when passing it to the packaging worker, is a typical example of inefficiency. It seems very inefficient when you write about it, but at actual worksites, this kind of work has become normal due to habits over many years, and often times nobody notices this waste. What is important is the simple accumulation of questioning these types of habits, keeping the necessary work, and eliminating the wasted work.

### Optimizing the Flow of Traffic/Layout

In manufacturing worksites, in the kitchen, and even in logistics processes, what determines ease-of-use and good efficiency is the flow of traffic and layout of the worksite. It would be ideal for each process to be connected as closely as possible, but a flow of traffic or layout design in which forklifts and workers move in the same area would be a problem for safety. However, being too careful of safety and having the loose goods storage area and pallet area too far away from each other would take time to move and replenish goods and not be efficient. It is important to optimize the traffic flow of work and layout while appropriately adjusting these types of mutually exclusive elements.

For example, there are improvement measures that can be adopted immediately such as creating a work-friendly environment for even shorter workers by consolidating products that are frequently shipped on lower shelves. Packing materials that are frequently used being pushed out to the corner of the materials storage space where they cannot be immediately found when needed is also a basic type of waste. This kind of waste in the traffic flow and layout can be resolved simply by moving the packing materials closer to the packaging section. Hints for these kinds of improvements can be found at any worksite, and optimizing the traffic flow and layout from the accumulation of these small improvements is what is important.

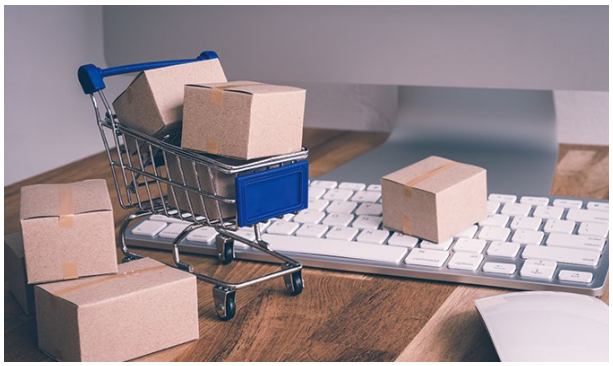
### Automation/Labor Saving Using Handheld Mobile Computers

At logistics worksites, the biggest inefficiency is visual inspection work and checking invoices/delivery statements with actual goods. This work is not only a waste, it also leads to the occurrence of simple mistakes such as oversights and omissions. Using handheld mobile computers for this verification work without relying on humans can make work dramatically more efficient and prevent mistaken shipments and other simple mistakes.

Verification by handheld mobile computer is accurate and fast to a degree that it cannot even be compared to visual inspection, so mistakes in the prescribed work can drastically reduced even when performed by inexperienced staff. When you think of making warehousing work more efficient, effective use of handheld mobile computers is the key.

## Process Management

Even if you want to make improvements to the worksite, you cannot attempt to implement measures for those improvements if you do not know where there is room for improvement or if you do not know what the problems are. In order to make clear what should be improved at the logistics worksite, results must be collected and feedback provided on who was doing what, where, when, and in what part of the process from receiving to shipping. This is process management. This section explains why this process management is necessary for improving logistics worksites and how to make process management possible.



### Process Management to Improve Quality and Accuracy

Problems related to logistics quality and accuracy, such as mistaken shipments, shipping delays, picking the wrong goods to ship, mistakes on forms, system errors, and accidents, happen at any worksite with a certain probability. Therefore, it is important to know what is happening at your own worksite.

You must determine when, where, and at what kind of time problems occur in the work flow from receiving to shipping. Refining the causes of these problems, whether they are human errors, problems in the system, or problems in the working environment like the design of the layout or traffic flow, can be first understood by collecting results.

If you collect results and understand the issues at the worksite from the obtained data, the direction of improvement measures can be seen naturally. Then taking specific measures will lead to improvements.

### Continuous Improvements with the PDCA Cycle

In process improvements, it is important to obtain feedback on how effective an improvement measure is and if there are problems when a measure does not lead to a sufficient improvement. It is also important to keep reviewing the methods of those measures and their accuracy. Process management to increase logistics quality and accuracy is not finished by implementing improvement measures. Those improvement measures are the beginning and following through with the PDCA cycle is the real process management.

### Issues in Collecting Results

As a method to collect results, the manager at the worksite can record on the start and end times of work on the prescribed form and write daily reports about the condition of work and the worksite when problems occur. However, methods that rely on human labor in this way are ineffective because workers cannot concentrate on their real work and they must constantly interrupt the work at the worksite.

And having the worksite manager enter reports created by hand on a PC is duplicate labor that creates further inefficiency. In addition, human errors will also occur such as omissions and mistakes. So the degree of accuracy and exactness of the collected results cannot be guaranteed, and there is a risk that the results will not help in determining the issues.

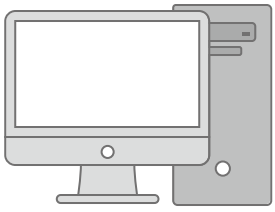
There are still other issues in collecting results by human labor. One point is the time lag from writing the results to when feedback can be provided. This can lead to issues where emergency problems cannot be handled because a prompt response is not possible when the problem occurs.

## Collecting Results in Real-Time Using Handheld Mobile Computers

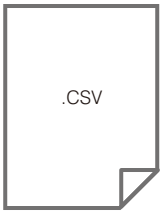
To overcome the weaknesses in process management that relies on humans, it is essential to adopt a system that automates results collection using handheld mobile computers. Each time a product is picked, inspected, and verified, a handheld mobile computer automatically records the time at the start and end of work and the progress of the work every second. The read data can also be sent to a PC through a wireless LAN so that results can be checked in real-time and there is no waste in collecting results by human labor.

The progress status can be graphed by instruction number and by process based on the collected data, so it can be understood at a glance when work delays and mistakes occur and at which worksite. This makes it easy to identify processes that are the cause of problems. And because these results are not entered manually, there is no room for mistakes to occur in writing or copy results due to misunderstandings and misconceptions. Handheld mobile computers used in regular work can accomplish a second goal by being a powerful tool for use in process management.

### What Can Be Accomplished by Adopting Handheld Mobile Computers



Easily Search and Check
Collected Data Using a PC




Output Work Data to CSV


Analysis of Processing Bottlenecking
from Collected Data

# Case Studies to Increase Efficiency for Logistics

Many tasks at logistics worksites depend on manual labor and visual contact, and human error tends to occur at these worksites. On the other hand, there is also ample room for improvements. For example, mistakes can be greatly reduced and work efficiency can be improved by simply introducing handheld mobile computers and code readers. In this section, we will provide useful information to help you understand the role and flow of logistics and delivery centers and provide approaches to making business improvements. We will also explain in an easy to understand manner case studies in which handheld mobile computers and code readers are used.

**For Warehouses and Delivery Centers**

## Overview

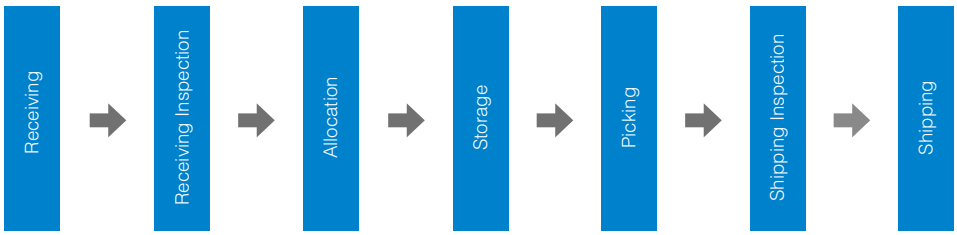
Warehouses and delivery centers are important facilities that support logistics. Warehouses and delivery centers have various functions, and the most important of those functions are storage and cargo handling.

Storage is the function to store and manage products until they are shipped. Cargo handling is the function involved with receiving and shipping products. This also includes picking and sorting by destination. These functions are connected in warehouses and delivery centers to achieve a smooth flow of goods from producers to consumers and customers.

### Flow at Logistics Worksites

In order to deliver products from producers to consumers and customers without delay, the processes from receiving to shipping and the status of inventory must be strictly managed at warehouses and delivery centers. There are seven processes between receiving and shipping, and many of these rely on human labor and visual checks. As a result, simple mistakes happen and problems occur such as mistaken shipments and inventory discrepancies. To solve these problems at logistics worksites, it is first important to understand the flow in warehouses and delivery centers.

**Basic Flow from Receiving to Shipping**



## People Are the Cause of Mistakes and Inefficiencies at Logistics Worksites

Many of the problems at warehouses and logistics centers are inspection mistakes during receiving and shipping. Especially at conventional worksites that have not adopted devices, such as handheld mobile computers, products are visually checked against receiving and shipping lists, so these worksites have problems in which oversights and omissions occur easily. The cause of these mistakes and inefficiencies lies in work that relies on human labor and visual checks.

Inventory management is very important at logistics worksites. If there is a flaw in the inspection work, a discrepancy will occur between the recorded inventory and the actual inventory, and waste will occur when moving products, such as by verifying products again or stopping work. And if there are mistaken shipments due to inspection mistakes, this can lose customer trust.

## Move from the Eyes of People to the Eyes of Machines for Higher Efficiency and to Eliminate Mistakes

As mentioned above, the cause of mistakes that occur at logistics worksites is people. Mistaking products A and B because they look similar or missing one digit of a long product number are typical examples of human error due to false recognition by the brain. These kinds of mistakes and problems cannot be eliminated as long as inspections rely on visual checks. Mechanizing the confirmation work that relies on visual checks is important. And handheld mobile computers are used as the eyes of machines.

## Greatly Change Worksites by Adopting Handheld Mobile Computers

The cognitive functions of humans, such as visual checks and memory, have limits. Machines can accurately execute tasks that are difficult for humans, such as remembering things, identifying small differences, and identifying and recording only the desired item out of a large volume of information. If handheld mobile computers are adopted for inventory management overall in the logistics processes and not just in receiving inspections, many of these human errors that have been problems up to now can be eliminated.

This section describes the logistics improvement case studies separated into the following parts: receiving inspections, allocation, picking, shipping inspections, taking inventory, and automation in warehouses and delivery centers. These case studies solve various issues and problems by using handheld mobile computers. Also provided are additional sections that cover logistics improvement case studies at manufacturing factories and in transportation. Be sure to read these case studies if you are concerned about higher efficiency and making improvements at logistics worksites.

For Warehouses and Delivery Centers

# Receiving Inspection

Human error, such as omissions or forgetting to write things down, occurs frequently in conventional receiving inspections that use an inventory ledger. And this causes discrepancies in the recorded inventory and the actual inventory which leads to shipping mistakes. Even when handheld mobile computers are used, cases stand out in which management of products without barcodes is difficult and the necessity to perform visual inspections leads to shipping mistakes. Visual inspections also take effort and use up human and time resources. This section gives receiving inspection methods and problems, and case studies using handheld mobile computers that resolve these problems and make work more efficient.

## Receiving Inspection Methods

### Conventional Management Method Using Paper

Receiving at logistics worksites refers to receiving products that are delivered from suppliers or your own factory. During receiving work, the delivered goods are verified against the delivery statement sent with the goods to determine if there are mistakes in the product numbers and quantities, and the products themselves are inspected for damage and problems with quality. The receiving inspection is the process in which this receiving and inspection work is performed. For product management, the typical method is to write this down in a book called an inventory ledger.

### Accurate Bookkeeping Is Important

Accurate bookkeeping of receiving and shipping goods is important in inventory management, and receiving inspections are important work in achieving accurate inventory management. If mistakes happen in the receiving inspection, discrepancies will occur between the recorded inventory and actual inventory, and when goods are moved, such as when they are allocated, picked, or taken out of inventory, the record will need to be verified again, work will stop and wasteful work will be necessary. For this reason, accurate bookkeeping is required in the receiving inspection.

## Problems with Conventional Methods

### Simple Mistakes in Manual Bookkeeping

Damage to goods and quality problems can be improved with methods such as opening the packaging and inspecting a portion or all of the goods, increasing the number of inspectors, and adopting various types of inspection equipment. However, when those results are recorded in the inventory ledger, mistakes occur such as skipping entries and omissions so long as that work is performed by humans. These simple mistakes due to manual work are explained in “Preventing Mistakes (Pokayoke)”. These are fatal errors that occur because human cognitive functions are not suited to mechanical work and memorization. In other words, so long as receiving inspections and other work are performed manually, mistakes in the inventory ledger will continue to occur at a constant rate.

### Problems with Barcode Management

Receiving inspections by barcode are given as a method to implement accurate inventory management. Scanning with a handheld mobile computer is fast and accurate and it can identify small differences in numbers that are easy to miss due to the cognitive capacity of humans, so receiving and shipping management using barcodes and handheld mobile computers can be thought of as the ideal method with few mistakes. However, sometimes goods to receive have no barcodes and only a product name written on the box. And often times, it is difficult to put a barcode on small parts and products due to the shape and materials. These kinds of products that lack barcodes are difficult to manage with handheld mobile computers and require visual receiving inspections. This takes time and effort and also leads to mistakes.

## Case Studies for Handheld Mobile Computers

This section introduces case studies using handheld mobile computers that solve issues and problems in receiving inspections. Using handheld mobile computers is effective for reducing receiving inspection mistakes and it leads to efficiency which also reduces time and costs.

### Case 1 Prevent Receiving Inspection Mistakes by Adopting Handheld Mobile Computers

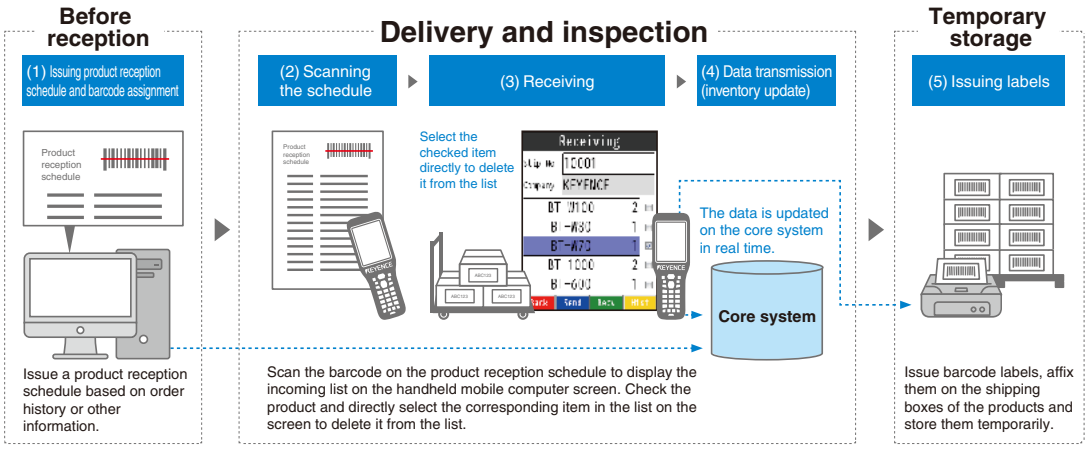
There are limits to visual receiving inspections. However, adopting handheld mobile computers can prevent these human errors. If handheld mobile computers are adopted for inventory management overall in the logistics processes and not just in receiving inspections, information can be transmitted smoothly and waste can be eliminated for higher efficiency.

There are many types of handheld mobile computers including those that can read various forms of information with OCR (optical character recognition), such as product numbers and quantities, in addition to reading barcodes and 2D codes. The read information can also be managed in a database and shared across the warehouse or delivery center to make later processes, such as picking and shipping work, more efficient.

### Case 2 Products without Barcodes Can Also Be Managed

One of the issues with adopting handheld mobile computers is products that lack barcodes during receiving. Normally, for products without barcodes, the product name, part number, and quantity must be checked visually and entered in the inventory ledger manually. With handheld mobile computers, you can link to the system, perform a receiving check, update inventory, and issue a barcode label even for products without barcodes. This allows for reliable receiving inspections and inventory management for products without barcodes.

**Flow of Receiving Inspection Work Using Handheld Mobile Computers**



For Warehouses and Delivery Centers

# Allocation

In logistics, allocation is the process of putting goods into inventory or simply storing them. Allocation is not simply storing goods. It involves inspecting the received goods and putting them on the prescribed shelf in order to facilitate effective picking and shipping from inventory. Mistakes in allocation lead to mistakes in picking and shipping from inventory, as well as lost time, so performing allocation accurately is important. This section gives problems and issues in allocation, as well as case studies that resolve these issue and make work more efficient.

## Allocation Methods

### Location Management

Received goods are moved to a temporary storage area after the receiving inspection and then stored on the specified shelves. This series of processes is called allocation. What is important in allocation is appropriate inventory management so that goods do not run out and there is no excess inventory. Accuracy is required in allocation so that mistakes do not occur in the subsequent processing of picking and shipping from inventory.

This is because it takes time to check the inventory area if the goods are not stored in the proper location and there is a risk of sending the wrong goods to be shipped. To prevent these kinds of problems, the most important thing is to arrange the position between goods and shelves so they can be understood at a glance. This is called location management in logistics.

### Fixed Location and Free Location

There are two types of location management methods: fixed location and free location. Fixed location is a method in which the shelves that goods are placed on is determined in advance. Free location is a method in which goods are stored in free space and racks in succession and the position and other information are managed by computer.

#### Advantages and Disadvantages of Fixed Location

The relevance between shelves and goods and the position are clear, so the advantages are that goods are easy to find and lack of inventory can be seen at a glance. However, wasted space occurs easily because shelves are required for each good, which is not the best method from the standpoint of storage efficiency.

#### Advantages and Disadvantages of Free Location

Unlike fixed location, inventory can be stored in free shelves in succession, so storage efficiency is high and goods of different types can be received in succession and handled flexibly. The advantage that this method allows for first-in first-out management cannot be overlooked. However, a disadvantage is that shelves are not fixed, so one type of good may exist in multiple storage areas which makes picking work inefficient.

## Problems with Conventional Methods

### Low Work Efficiency with the Free Location Method

The free location method that allows the efficient use of limited space is ideal. But when compared to the fixed location method in which a relevance is made between shelves and products as described above, a drawback is that it can easily take an excess amount of time to find products. To overcome the disadvantages of the free location method and maximize its advantages, an inventory management system must be created, but this also brings up issues of cost.

### Management of Products without Barcodes

If there are no barcodes on products and packaging during receiving, allocation work will become inefficient and accuracy will be lacking. The result is mistakes in the later processes of picking and shipping and a decrease in work efficiency.

## Case Studies for Handheld Mobile Computers

This section introduces case studies using handheld mobile computers that solve issues and problems in allocation. Using handheld mobile computers is effective for reducing allocation mistakes and it leads to efficiency which also reduces time and costs.

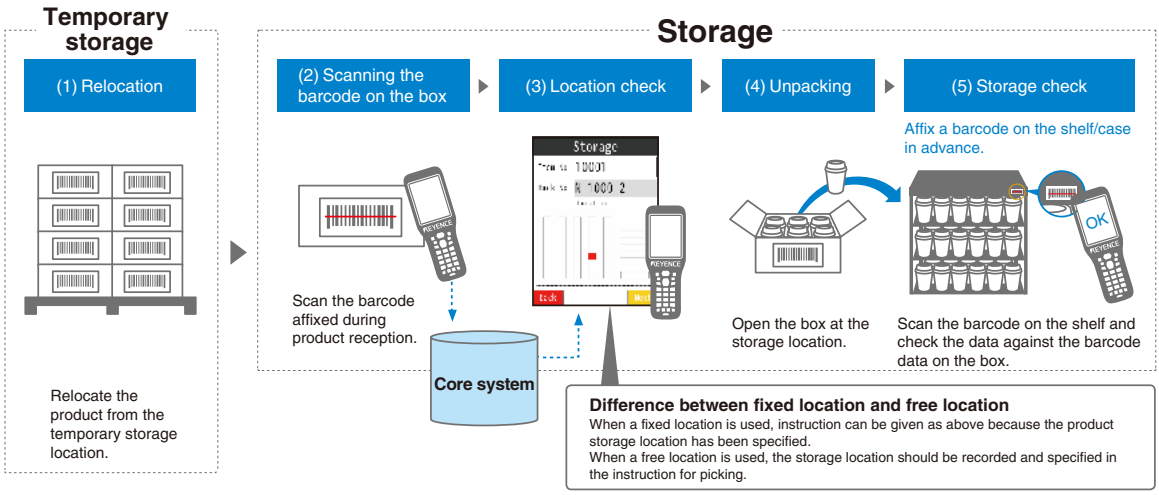
### Case 1 Increase Work Efficiency Using Handheld Mobile Computers and the System

Acquiring storage areas and improving storage efficiency are issues at warehouses and logistics centers. The free location method in which goods can be stored on free shelves in succession is ideal in this regard, but work efficiency can fall if there are inventory management problems. To improve both storage efficiency and work efficiency, handheld mobile computers must be linked to the system. If handheld mobile computers are adopted and product information is linked to shelf information, the allocation area can be provided to the worker by simply scanning the barcode with the handheld mobile computer and allocation can be checked at the same time to make work faster and more accurate.

### Case 2 Higher Efficiency in Allocation Work by Giving Products Barcodes in Receiving

Management becomes easier and allocation work more efficient by giving barcodes to products in the receiving inspection process that lack barcodes during receiving. With handheld mobile computers, you can easily link to the system and simultaneously perform the receiving check, update inventory, and issue a barcode label to dramatically speed up the series of work from temporary product storage to allocation. And if the same barcodes are applied to the cases and racks at the same time as allocation, the allocation check (data verification) can also be performed easily.

**Flow of Allocation Work Using Handheld Mobile Computers**



For Warehouses and Delivery Centers

# Picking

Picking is the work to gather allocated products according to the shipping instructions. Picking is one process at logistics worksites that relies on human power to a large degree, so there are many inefficiencies and mistakes occur easily. This section gives picking methods and problems, and case studies using handheld mobile computers that resolve these problems and make work more efficient.

## Picking Methods

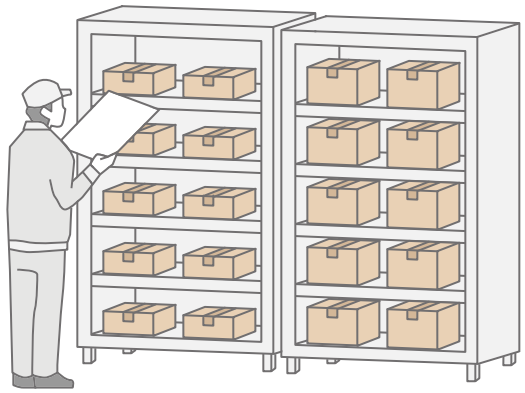
### Single Picking and Total Picking

Picking is broadly split into two types: single picking and total picking. In single picking, the necessary products are gathered per order. One advantage of this method is that the picking unit and packaging unit are the same, so the gathered products can be packaged and immediately shipped. In total picking, the quantity collected is the total amount for all orders per product, and when all the products are picked, they are then sorted by destination. Total picking is an effective method when there are many items and few destinations.

### Effectively Using Single Picking and Total Picking

Single picking is the typical method for mail-order and home delivery. It is best suited when the number of items to ship per order is low. On the other hand, total picking is best suited to shipping many items to a predetermined number of destinations, such as convenience stores.

Single Picking



A method in which the necessary items are gathered per order.

Total Picking


A method in which the necessary quantity of products is gathered per item and sorted by destination.

## Problems with Conventional Methods

### Single Picking is Inefficient and Prone to Mistakes

A disadvantage in single picking is the distance traveled for one trip is far and the burden on the worker increases because products are repeatedly picked per destination. In single picking, there are often many cases that do not adopt handheld mobile computers and instead use paper shipping instruction forms (picking lists) and rely on the experience and memory of workers. This means variations in work efficiency occur easily and the chances of making a mistake also increase.

### Total Picking Increases Work by Adding Sorting

Total picking gathers all products for the total amount of shipments, so the amount of travel and traffic for the worker can be greatly reduced when compared to single picking. On the other hand, the addition of sorting and the necessity of a sufficient amount of space for sorting are disadvantages. It is also difficult to know the progress of work until sorting is completed, so it is difficult to flexibly handle orders, such as when there are emergencies and when there are additional products ordered. How to simplify sorting is an issue in total picking.

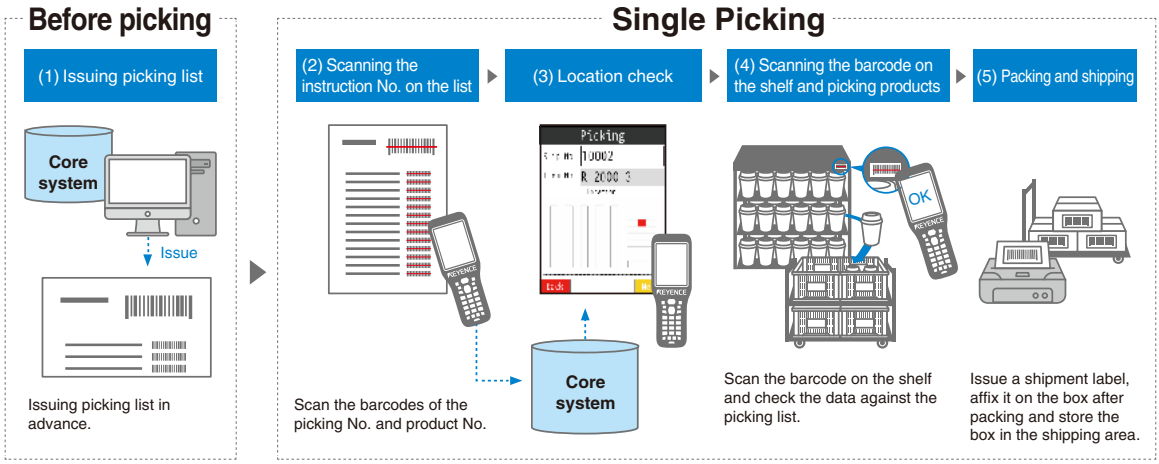
## Case Studies for Handheld Mobile Computers

This section introduces case studies using handheld mobile computers that solve issues and problems in picking. Using handheld mobile computers is effective for reducing picking mistakes and it leads to efficiency which also reduces time and costs.

### Case 1 Single Picking
### Higher Efficiency Picking by Using a Terminal to Confirm the Location of Products

If handheld mobile computers and the system are linked, the shelf that holds the product can be found immediately just by scanning the picking list. This helps to eliminate unnecessary movement and make work more efficient. Products can also be verified with the barcode applied to the shelf to eliminate the reliance on memory and experience and to prevent picking mistakes.

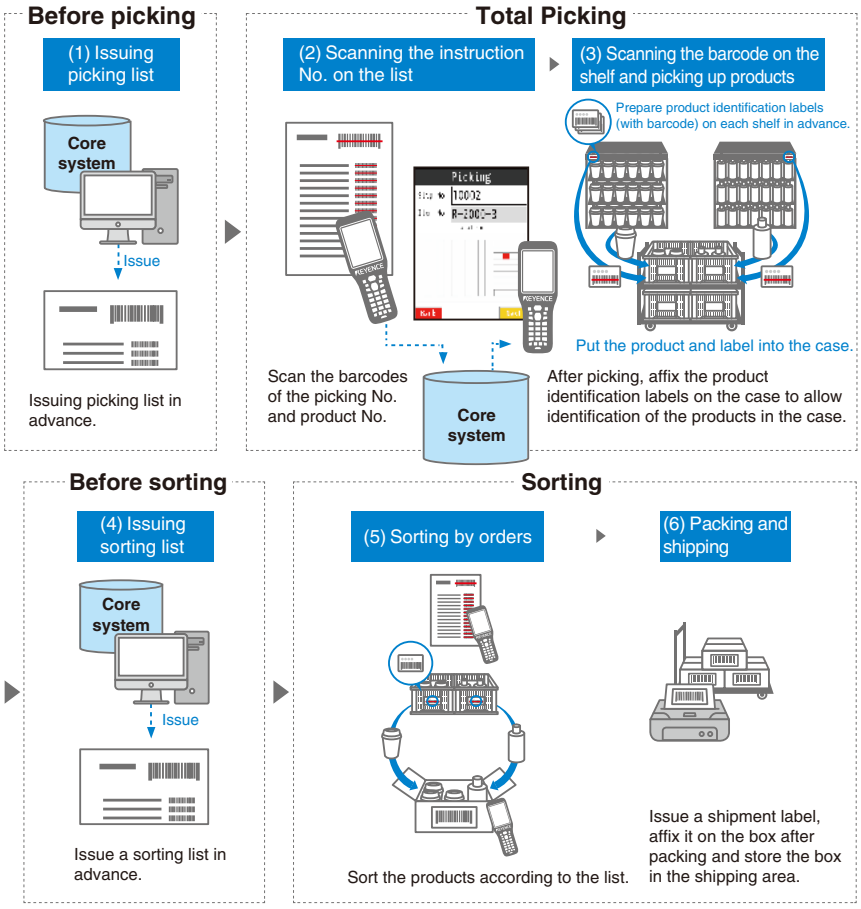
**Flow of Simple Picking Using Handheld Mobile Computers**



## Case 2 Total Picking
## Sorting Is Also Faster with Handheld Mobile Computers

If handheld mobile computers are used, the storage area of products can be easily found just by scanning the picking list in the same manner as in single picking. If the functions to issue sorting lists and shipping labels are also used, burdensome sorting work can be simplified and mistakes in shipping can also be prevented.

**Flow of Total Picking Using Handheld Mobile Computers**



For Warehouses and Delivery Centers

# Shipping Inspection

Checking if picked products are different from the shipping request information (order information) is called the shipping inspection. At logistics worksites, there is a chance for mistakes to occur that will cause mistaken shipments in all processes, from receiving and allocation to picking. The last point at which these risks can be prevented is the shipping inspection. This section gives shipping inspection methods and problems, and case studies using handheld mobile computers that resolve these problems and make work more efficient.

## Shipping Inspection Methods

The shipping inspection is work in which the destination, product name, product number, and quantity of products sorted by destination are checked to determine if they were picked according to the shipping instructions while viewing the shipping instructions form or picking list. If there is a picking mistake, there will be a mistaken shipment which will cause problems for the receiver and result in lost trust. And if there is a mistake in the shipping work, it can lead to internal problems, such as inventory discrepancies. The shipping inspection has a very important role in the logistics process since it is the last point to prevent mistaken shipments. Packaging in which products are placed in cardboard boxes and other distribution processing for the product are also performed in the shipping work.

## Problems with Conventional Methods

A problem that frequently occurs at worksites in which a system has not been created for inventory management is visual verification mistakes. In warehouse work, shipping inspections are often performed during the evening hours when workers fatigue is at a peak, so that mistakes occur easily and mistaken shipments and inventory discrepancies also tend to occur. In the same manner as mistakes in visual checks, inspection mistakes due to assumptions also lead to mistaken shipments. When the fatigue of workers performing shipping inspections increases, these assumptions also tend to occur easily.

## Case Studies for Handheld Mobile Computers

This section introduces case studies using handheld mobile computers that solve issues and problems in shipping inspections. Using handheld mobile computers is effective for reducing shipping inspection mistakes and it leads to efficiency which also reduces time and costs.

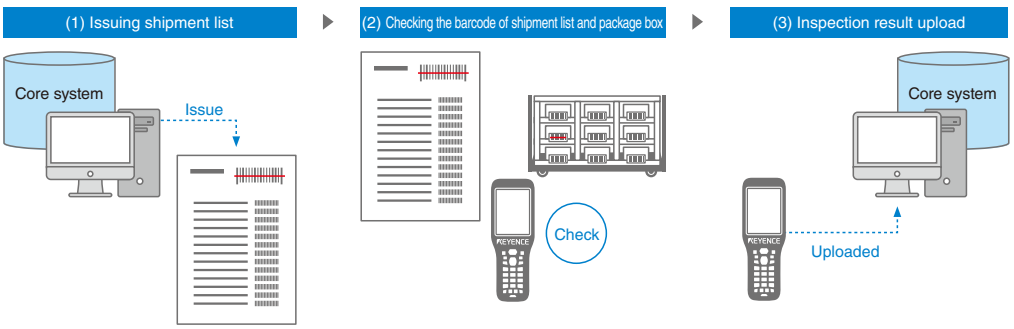
### Case 1 Reduce the burden on workers, eliminate shipping mistakes, and improve work efficiency with barcode inspections.

Conventionally, workers performed the shipping inspection visually while viewing the shipping instruction form (picking list), but the burden on workers can be reduced, shipping mistakes eliminated, and work efficiency improved by switching from the eyes of humans to the eyes of machines. Shifting from visual inspections to barcode inspections using handheld mobile computers can greatly improve verification accuracy. In conventional inspection work that relies greatly on human labor, the occurrence of mistakes due to fatigue tends to increase because the burden on workers increases, but this need not be a concern with barcode inspections using handheld mobile computers and mistaken shipments can be consistently reduced.

### Case 2 Link handheld mobile computers to the system to understand the status of inventory in real-time.

The advantages due to adopting handheld mobile computers are not only in preventing incorrect shipments. If handheld mobile computers are used and linked to the system, product and quantity information that has been confirmed to be shipped can be fed back to the system in real-time, so that accurate inventory data can always be known.

**Flow of Shipping Inspections Using Handheld Mobile Computers**



For Warehouses and Delivery Centers

# Taking Inventory

Taking inventory is the work to check actual goods and verify the actual numbers of goods in inventory with the numbers in data. In the logistics industry, taking inventory mainly refers to counting the number of products and goods held from customers. This process is important in settling the assets in inventory of the company that owns the goods in the yearly and semiannual results, so there must be no differences between inventory recorded on the ledger and actual goods. This work takes a lot of time and effort. For example, when taking the inventory of a store, this can be completed in a few hours to a day because the quantity of goods is low. But in warehouses and delivery centers that store thousands of SKUs(*) for product numbers and tens of thousands of items for total inventory, the burden of taking inventory is large and counting mistakes occur easily. This section gives methods for taking inventory in warehouses and delivery centers, problems related to taking inventory, and case studies using handheld mobile computers that resolve these problems and make work more efficient.

* SKU (stock keeping unit) = Unit for performing inventory management

## Methods for Taking Inventory

### Advance Preparations for Taking Inventory

Advance preparations are important at worksites, such as warehouses and delivery centers, that have large storage areas. For simultaneous inventory in which all normal work is stopped and all workers count the actual goods, preparations before taking inventory (e.g., establishing the inventory schedule, creating inventory lists, and training for all workers on how to check inventory and fill out inventory lists) are directly connected to work efficiency and eliminating mistakes.

### Two Methods for Taking Inventory: Tag Method and List Method

Taking inventory by checking actual goods is called physical inventory, and it is broadly split into the tag method (shelf tag method) and list method.

#### Tag Method

This is the typical method of taking inventory. Tags managed by sequential number are attached to the shelves that store inventory in advance. The worker in charge checks the items and quantities and records those on the tag. Then the tags are collected after all inventory is counted. Tags are attached to all shelves and actual goods, so the inventory can be counted without omissions. Tags managed by sequential number are also used, so it is clear if any tags are not collected or not filled out, and inventory assets can be counted fully.

| Advantage | Disadvantage |
|---|---|
| Tags are directly attached to shelves and actual goods to prevent omissions in counting. | Tags must be managed by sequential number, so it takes time and effort to collect and check the tags. |

#### List Method

With the list method, the quantity of actually stored inventory assets is checked based on lists output from the inventory management system. This method of taking inventory is primarily used at automated warehouses and similar facilities. A feature of this method is that taking inventory can be completed in a shorter amount of time than with the tag method. However, the inventory on the list and the items and quantities in actual inventory must be the same, so this method assumes that an inventory management system is used that can output lists in real-time.

| Advantage | Disadvantage |
|---|---|
| Work is completed relatively quickly because the inventory on the list (theoretical inventory) is matched to the goods and quantities. | Omissions in counting inventory not recorded in the system occur easily. |

# Case Studies to Increase Efficiency for Logistics

The flow of work described here is based on the tag method.

## Flow of Advance Preparations

- Create Implementation Schedule
  Create a schedule for taking inventory that includes the worksite overall and each department.

- Decide Workers in Charge of Taking Inventory
  Decide the locations, workers, and roles for taking inventory.

- Prepare Inventory Tags
  Prepare the inventory tags that will be used on the day to take inventory. Write down the sequential numbers at the preparation stage.

- Implement Training
  Train workers on how to fill out inventory tags and other matters.

## Inventory Day

On the day of taking inventory, all workers split up and attach inventory tags to the actual goods, and then check if the inventory tags match the actual goods. Lastly, all of the contents are totaled, official inventory tags are created, and the data is entered into the computer. When the data is finished being entered, the inventory results are compared to the inventory in the ledger and the discrepancies can be extracted. Then the discrepancies between inventory in the ledger and actual goods become clear and can be investigated, and measures for those discrepancies can be taken. Lastly, the inventory data in the computer is overwritten with the accurate inventory figures determined by taking inventory.

## Flow of Inventory Day

- Fill Out Inventory Tags
  Count the number of actual goods and attach the inventory tag to the actual goods.

- Check Inventory Tags
  The responsible worker checks the actual goods and inventory tags and determines if there are any mistakes. If an external auditor joins the work, an employee of the auditor will perform the check. If there are many mistakes, fill out the inventory tags again.

- Remove the Inventory Tags
  Remove all inventory tags from the actual goods and check the sequential numbers and missing tags.

- Data Entry
  Enter the numeric values listed on the inventory tags into the computer.

- Data Verification
  Verify the inventory results and inventory data and extract the discrepancies in inventory.

- Review Countermeasures
  If there are discrepancies between the inventory data and the actual inventory data, review the causes and propose countermeasures.

- Overwrite Inventory Data
  Lastly, overwrite the inventory data with the actual inventory data to complete taking inventory.

## Problems with Conventional Methods

With physical inventory, workers visually check actual goods with the inventory in the ledger, so omissions in checking may occur. Another issue is that variations occur easily in verification speed and accuracy due to differences in the experience of workers. There is also a risk that mistakes will occur when entering the totaled inventory tags into the computer. Attention is required because there is a risk of human error occurring in all of the work involved in physical inventory. There are also large problems when it comes to efficiency because preparation and training are performed alongside normal work and then normal work is stopped for taking inventory.

**Problems with Physical Inventory**

- Omissions in checking inventory and the ledger
- Mistakes when counting quantities
- Variations occur in the speed and accuracy of verification due to differences in experience
- Typing mistakes occur when entering inventory tags into the PC
- Burden on staff during preparation stage
- Inefficiencies due to stopping normal work on the day of inventory

## Case Studies for Handheld Mobile Computers

This section introduces case studies using handheld mobile computers that solve issues and problems in taking inventory. Using handheld mobile computers helps to achieve fast and accurate inventory work and make costs and time more efficient.

### Fast and Accurate Inventory without Relying on Visual Checks and Manual Entry Work

As described in “Preventing Mistakes (Pokayoke)”, there are limits to the cognitive performance of humans in identifying small differences and memorization, and this causes errors to occur in work such as checking quantities and verifying tags in taking inventory. In particular, the frequency of errors also increases as simple tasks are repeated and workers become fatigued. Using electronic devices, such as handheld mobile computers, is preferable for performing continuous verification work like taking inventory.

### Directly Reduce Time and Human Costs

If handheld mobile computers are used for taking inventory, verification mistakes due to visual checks, manual entry, and entering data into a computer can be eliminated, which also leads to reductions in time and human costs. This allows the value of inventory to be totaled and inventory forms to be created more accurately than can be done by people. This also decreases the dependency on visual checks and manual labor, so cycle counting can be conducted to verify work in sequence from a portion of shelves without stopping normal business to achieve greater efficiency in inventory management.

#### Physical Inventory

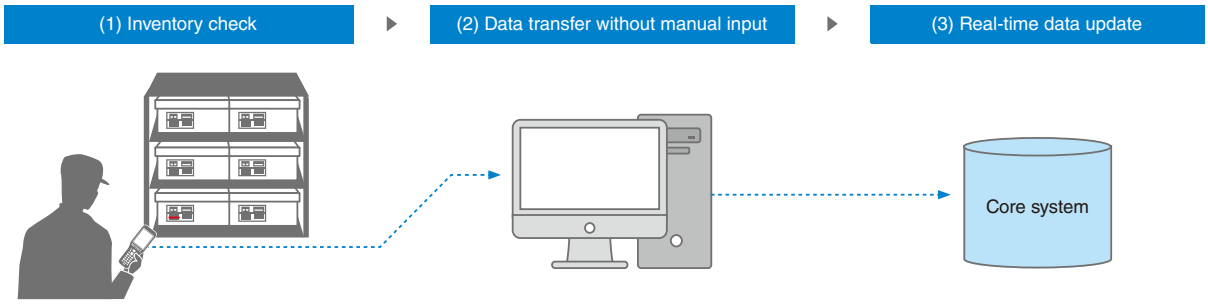
A typical method for taking inventory in which work stops and all workers count inventory and fill out inventory tags.

#### Cycle Inventory

A method for taking inventory in sequence from a portion of shelves without stopping work. This is also called cycle counting.

### Flow of Taking Inventory Using Handheld Mobile Computers

The data read with the handheld mobile computer is sent to the system as is, so there is no room for errors to occur such as omissions and typing mistakes.

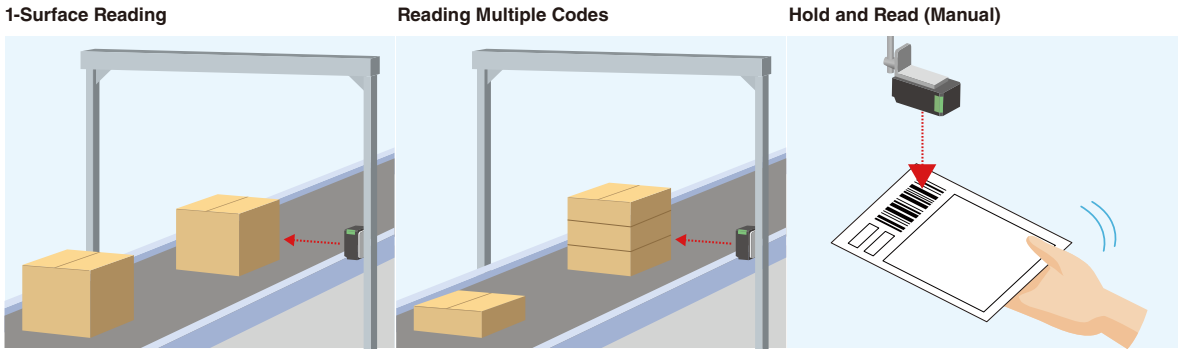



For Warehouses and Delivery Centers

## Warehouse and Delivery Center Automation

The key to higher work efficiency in warehouses and delivery centers is automation, which equates to reduced labor requirements. In recent years, productivity has been greatly improved by automating receiving work through the adoption of automatic aligning machines on receiving transportation lines and automating replenishment work for picking shelves by using automated warehouse systems. Code readers, one type of material handling device, continue to evolve according to the needs of automation. This section gives case studies for code readers that are essential for automating warehouses and delivery centers.

### Case Study of Orthodox Using a Code Reader



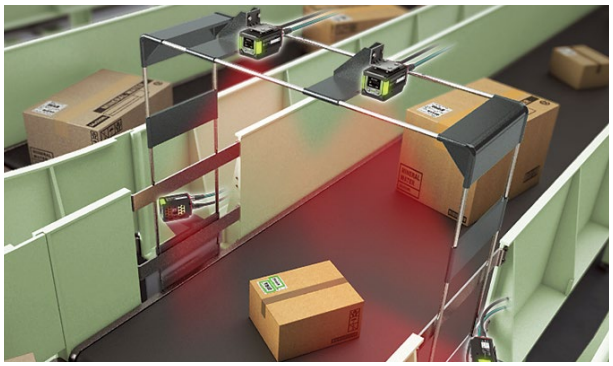

Using handheld mobile computers is effective for accurately performing barcode reading without mistakes, but the conventional method involved three actions: take the product in one hand, take the handheld mobile computer in the other, and then scan the code. What came to market to eliminate the waste in these actions was a code reader with a scanner lit at all times. With this type of code reader, code reading is completed with a single action of just holding the product in the light. This is also called scan reading because the code is read just by holding the product.

For example, if code readers are embedded in the line and the cargo that flows past is automatically read, then complete automation is easy without the intervention of people. If the position of labels and slips is determined to a certain degree, code reading can be performed with a method called 1-surface reading that uses a single code reader, and installation costs can be minimized. Typical methods also include embedding code readers in sorters and belt conveyors and reading codes by manually holding slips under fixed code readers.

# Case Studies to Increase Efficiency for Logistics

## Case Study of Scanning Cargo Flowing Randomly

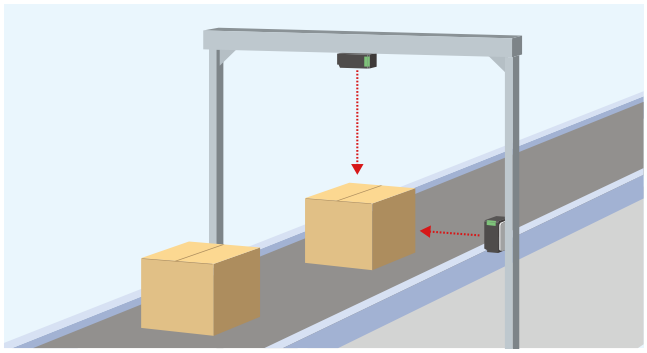
At logistics worksites, cardboard boxes often do not flow down the line neatly. Typically the direction of those boxes and the position of their barcodes are random. Gate-type code readers are what can read the barcodes of boxes flowing randomly in this way without mistakes. Codes can be scanned over a wide area, and if there is a barcode on any of the five surfaces (excluding the bottom), then that code can be read without problems. This eliminates the need to have workers stand along the line and adjust the position of cardboard boxes, which can contribute to saving labor resources.



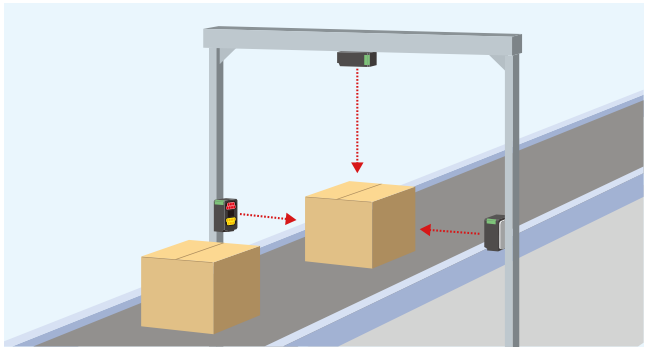
## Case Study of Reading Using Multiple Code Readers

There are also cases in which barcodes are read using multiple code readers when it is difficult to scan boxes with a single code reader, such as when there are barcodes attached to multiple surfaces and when there are different box sizes. To automate reading barcodes using code readers, the optimal code reader installation method must be selected according to where slips are attached, the number of slips, and the shape of the box. For example, 2-surface reading involves scanning the top and side of the box. 3-surface reading involves scanning the top and both sides of the box. 5-surface reading (tunnel scanning) involves scanning all surfaces except the bottom. Lastly, 6-surface reading involves scanning all sides of the box, including the bottom. However, the more code readers that are used, the more installation costs will be required and the greater the effort will be to verify data, so it is important to select the optimal method for the cargo.

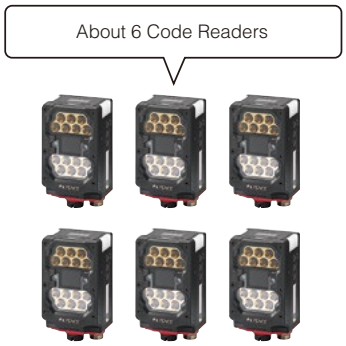
### 2-Surface Reading

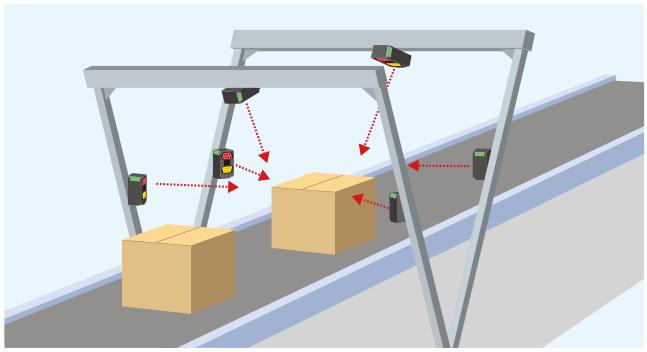



### 3-Surface Reading

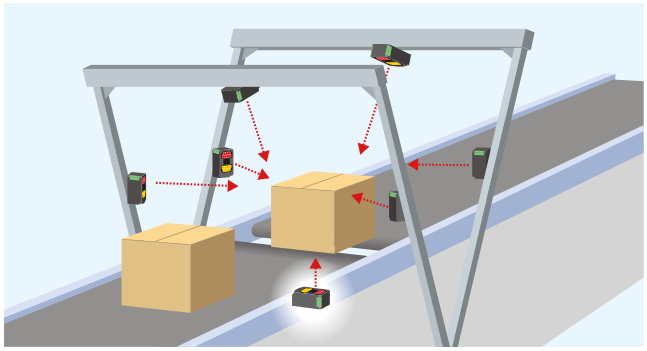



### 5-Surface Reading

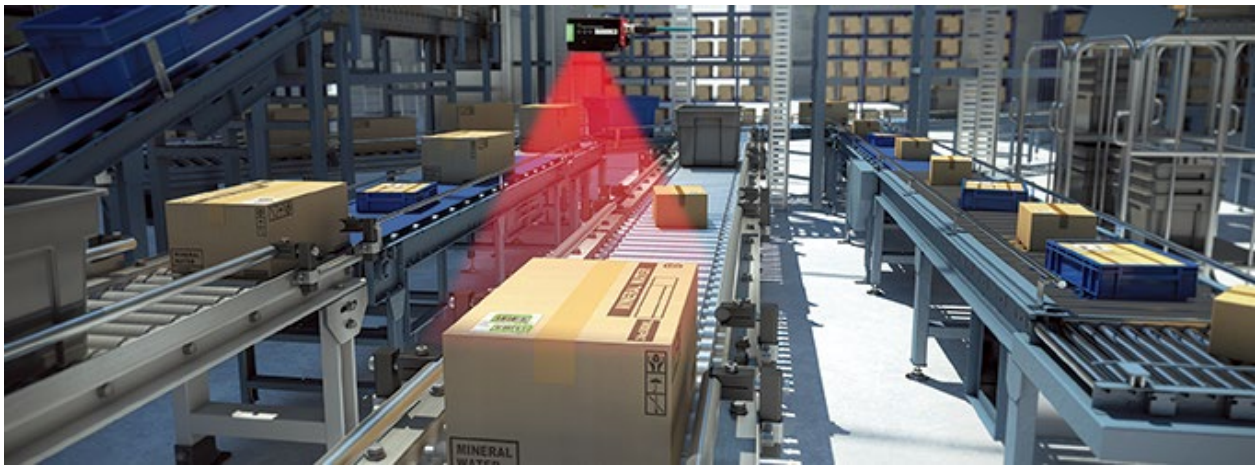


### 6-Surface Reading

## Reading on a Line with Cardboard Boxes of Mixed Sizes



In large logistics centers, warehouses, and delivery centers, a wide variety of cardboard boxes in different sizes are handled every day. Conventional code readers had difficulty with stable detection due to problems involving the field of view, depth, workpiece vibration, and workpiece travel speed. Now if there are cardboard boxes with different sizes, multiple code readers must be installed to handle this situation. There is some frustration because this involves extra costs and slows down processing because the read data is verified.

Recently, there have also been wide-field type and long-depth type code readers, as well as methods to implement stable reading with few code readers regardless of the size of the boxes and the location of the barcodes.

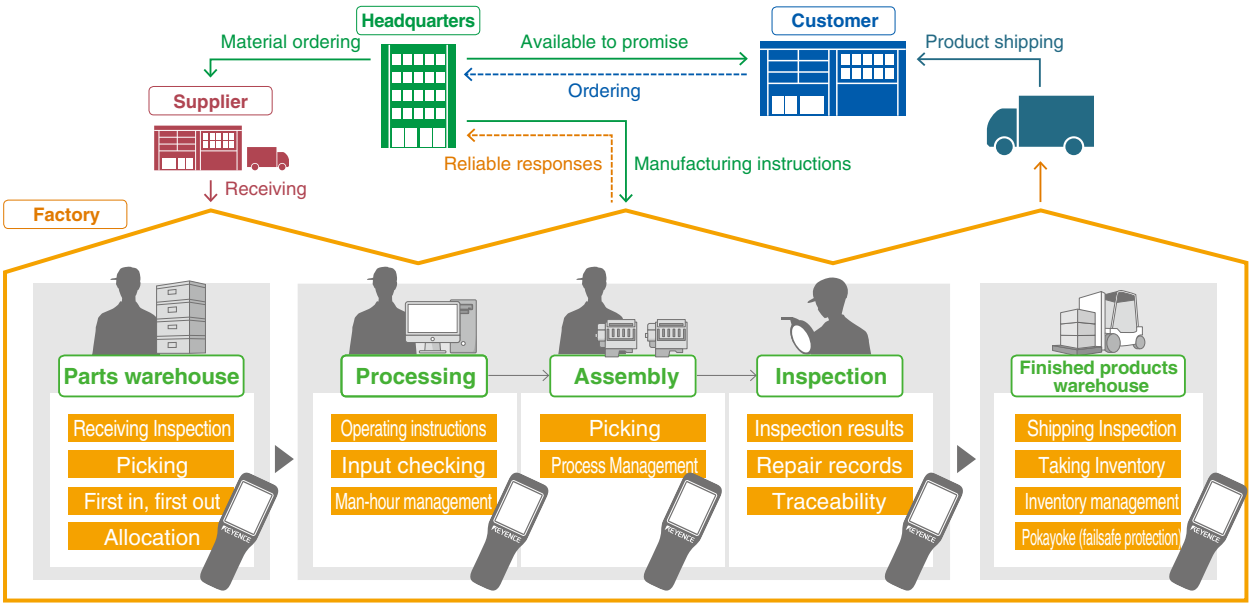
For Manufacturing Factories

# Overview and Case Studies

## What Is Logistics at Manufacturing Factories?

There is a type of logistics called production logistics that differs a little from logistics in the pure logistics fields. Production logistics refers to the flow of goods that occurs in the series of processes at manufacturing worksites, from procuring parts and materials, to manufacturing, inventory management of products, and shipping (sales). This section provides an overview and flow of production logistics, a basic understanding of each process, and case studies in which processes are made more efficient by using handheld mobile computers.

## Case Studies for Production Logistics and Handheld Mobile Computers




Production logistics refers to the flow of goods at manufacturing sites. The processes can be broadly split into parts/raw materials warehousing, the manufacturing process, and shipping area/completed product warehousing. This section gives an overview of these processes and case studies using handheld mobile computers for higher efficiency and labor savings.

### 1. Parts/Raw Materials Warehousing Overview and Issues

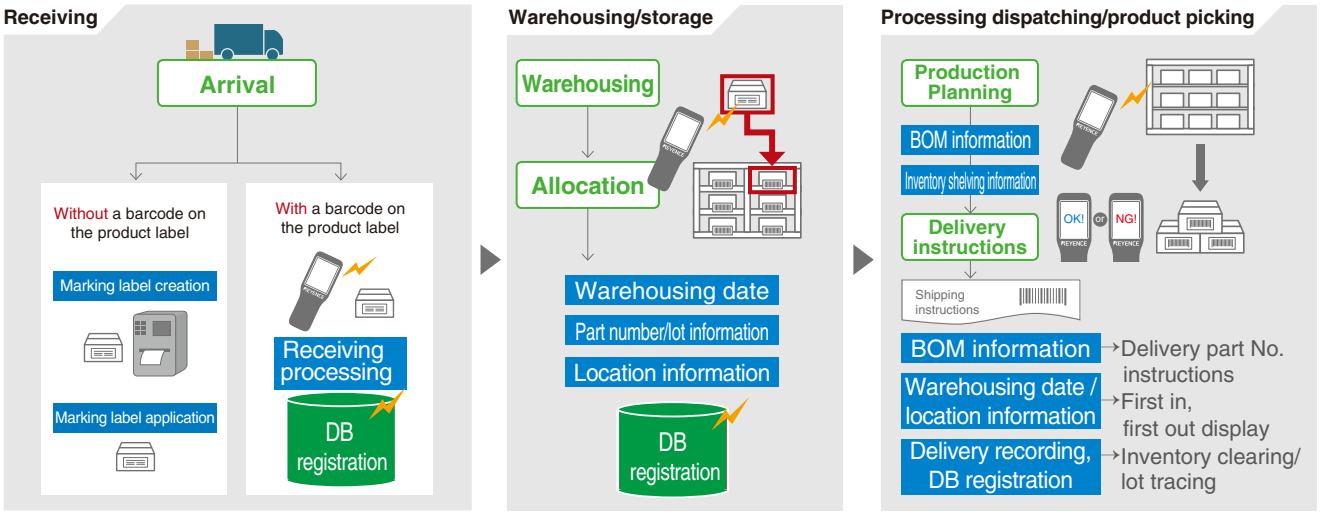
If the planned parts and raw materials cannot be correctly procured in the necessary quantities at manufacturing factories with superior production equipment, the manufacturing lines cannot operate according to schedule. To achieve stable operations at manufacturing factories, it is important to stabilize receiving and receiving inspections that serve as the gateway for procuring parts and raw materials.

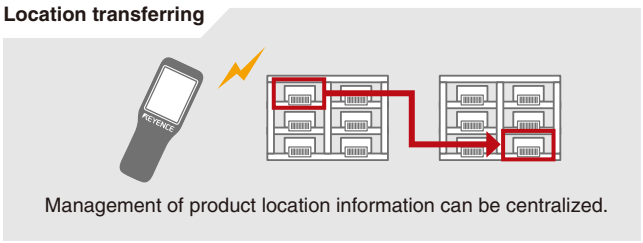
Additionally, if parts or raw materials are incorrectly allocated, this will lead to mistakes in picking and increase efforts to pick the correct parts or raw materials again. If those incorrect parts or raw materials are moved to the manufacturing process as is, it can cause defects. Many mistakes in receiving inspections, allocation, and picking in parts/raw materials warehousing are often due to human errors such as picking or identifying the wrong items.

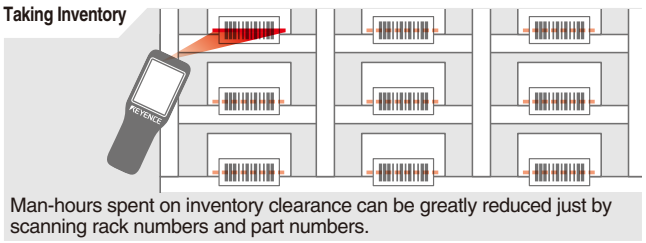
Parts and raw materials are managed with product slips and other means. However, humans are not suited to verifying lengthy numbers and text strings, so it is impossible to avoid the occurrence of human error, such as omissions in the inventory ledger and mistakes when verifying information. To prevent this kind of situation, inventory management using barcodes and handheld mobile computers is the most rational choice.

### Case Studies for Handheld Mobile Computers

If inventory management is used with barcodes and handheld mobile computers, even if the product to receive lacks a barcode, the handheld mobile computer and system are linked and a barcode label can be issued. And if warehousing, allocation, process withdrawal, parts picking, location moving, and inventory are managed with that barcode issued during receiving, product management can be implemented without waste. Adding information such as the date the item was entered into inventory provides smooth first-in first-out instructions and makes ordering parts and raw materials more efficient.




## 2. Manufacturing Process Overview and Issues

Many parts, raw materials, and tools are used in the manufacturing process. Mistakenly selecting one of these is directly connected to the occurrence of defects. For this reason, the correct parts, raw materials, and tools must be selected, but taking the wrong parts and raw materials with similar shapes and product numbers or mistaking the tool to use happens frequently at worksites. Handheld mobile computers and barcodes can be used in a number of ways to prevent these types of mistakes in the manufacturing process.

### Case Studies for Handheld Mobile Computers

#### Process Management

The results of work processes can be recorded by linking handheld mobile computers with the system. Accuracy of work can be improved and efficiency can be increased to enable production without mistakes and problems. Process management is performed wirelessly in real-time, so progress can be checked from remote locations, such as from headquarters.

#### Management of Work Hours

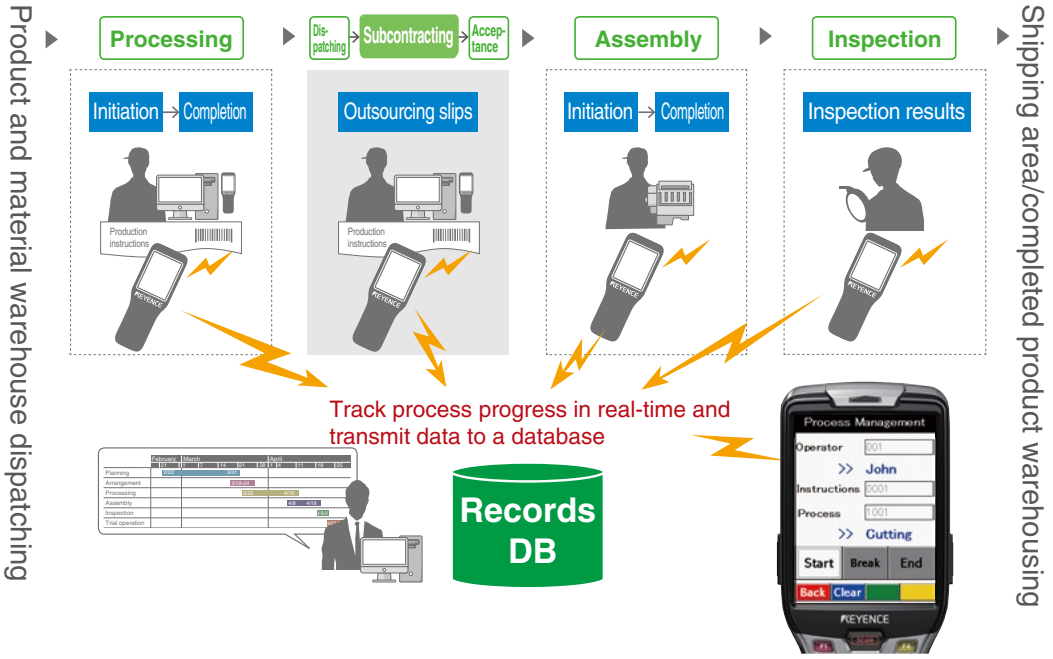
By recording the start and end times of work using handheld mobile computers, the amount of labor and the length of time that a worker takes to complete the necessary work can be quantified and turned into data. Then by performing statistical analysis on this data, the causes of inefficiencies can be uncovered and improvement plans can be created more easily.

### Traceability

Traceability is the method of using information that allows tracking at anytime when, where, who, and in what manner shipped products were produced, distributed, and shipped. Another way of saying this is to keep a history of all processes involved in producing a product, from receiving parts and raw materials to shipping the completed product. If all processes can be traced in an integrated manner through management that uses handheld mobile computers and barcodes, then the causes of defective products and the applicable lots can be identified when those defective products occur.

In manufacturing equipment as well, automatically reading all items with fixed code readers and collecting the data is typical.

**Process progress management/Work-in-progress inventory control/ Work performance tracking (traceability)/Man-hour management**

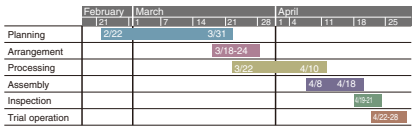



**Process information can be collected in real-time and used for efficiency and process improvements!**

Process information collection can be performed accurately and by anyone in real time just by reading a barcode.

Process information

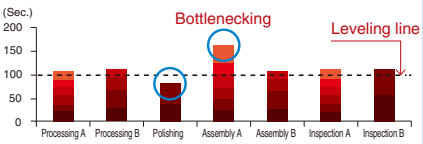

Progress and delivery management




IN-process inventory management, yield rate comprehension, performance tracing

| Instruction number | Move data | Source | Destination | Volume | Operator |
|---|---|---|---|---|---|
| JPX850A2U | 2105/1/20 | Pre-processing | Plating process | 100 | Ishikawa |
| JPX850A2U | 2105/1/21 | Plating process | Finishing | 20 | Suzuki |
| ... | ... | ... | ... | ... | ... |

Process analysis, cost management



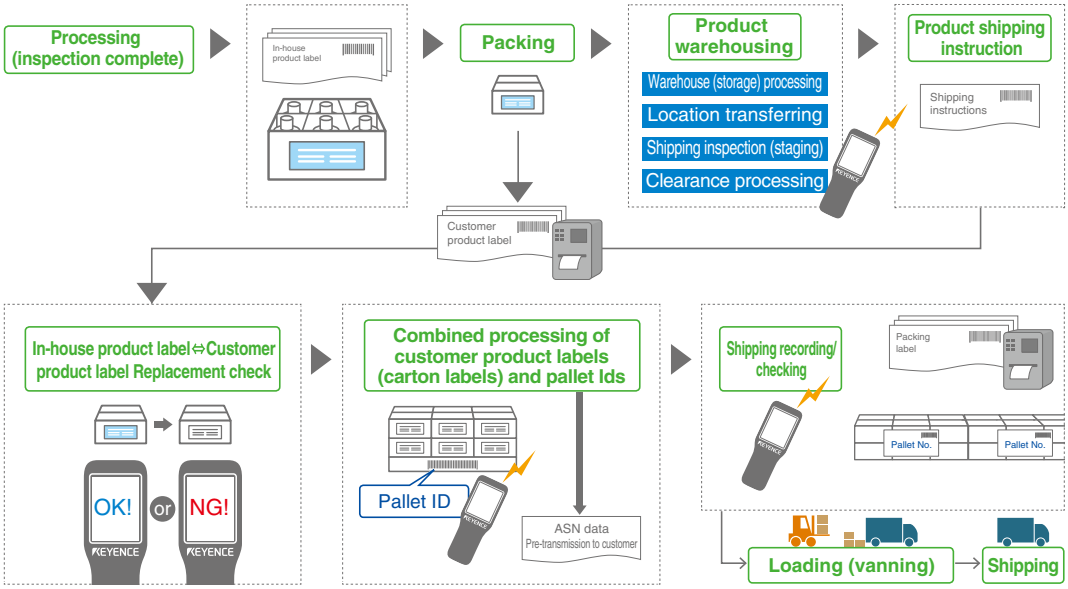

**No need for manual input or input via PC**

### 3. Shipping Area/Completed Product Warehousing Overview and Issues

The shipping inspection is work in which the destination, product name, product number, and quantity of products sorted by destination are checked to determine if they were picked according to the shipping instructions while viewing the picking list and shipping instructions form. When shipping inspections are performed visually in the same manner as the receiving inspection in 1., mistaken shipments occur with a fixed probability.

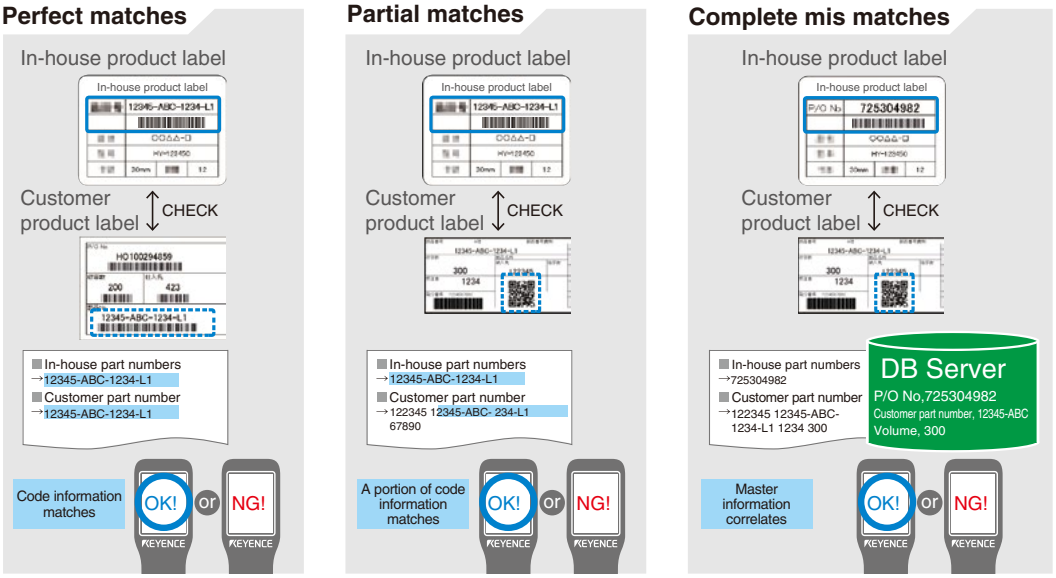
#### Case Studies for Handheld Mobile Computers

Shifting from visual inspections to barcode inspections using handheld mobile computers can greatly improve verification accuracy and eliminate mistaken shipments that lose customer trust. The advantages due to adopting handheld mobile computers are not only in preventing incorrect shipments. If handheld mobile computers are used and linked to the system, product and quantity information that has been confirmed to be shipped can be fed back to the system in real-time, so that accurate inventory data can always be known.




Also when shipping, a portion of product numbers on in-house product slips and customer product slips may differ or they may also be completely different, which means mistakes occur easily and extra effort is required in management.

By using handheld mobile computers, many situations can be handled flexibly, even cases where the product numbers on in-house product slips and customer product slips change (complete match, partial match, incomplete match).



For Transportation

# Overview and Case Study

Logistics is the flow of transferring goods and products from the producer to consumers. Transportation plays an important role in logistics. This section introduces the types of improvements and streamlining that can be made at the forefront of the transportation industry.

## Case Study for Cargo Sorting in Commercial Aircraft

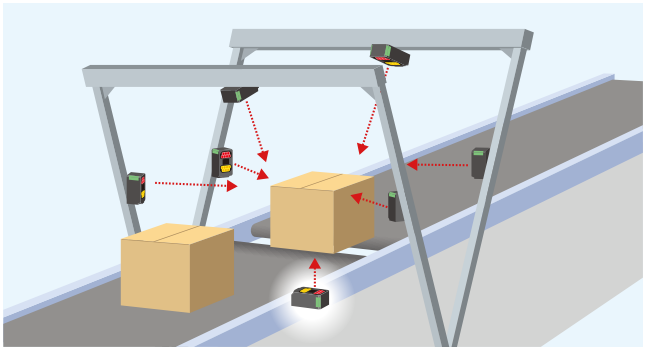
This case study introduces a sorting line for airport luggage as an actual example of using code readers in the transportation industry at the forefront of logistics.

### Scan Every Direction with Seven Code Readers

Lines to sort passenger luggage can be automated using barcode tags and code readers because luggage must be sorted by target aircraft without mistakes in the limited amount of time until take-off. In worksites where an emphasis is placed on quickly and accurately sorting items, perform scanning from every direction by installing seven code readers along the conveyor belt that feeds luggage in a tunnel shape with code readers placed front/back, left/right, and top/bottom. In this way, barcode tags can be read at high speeds regardless of the position of the luggage.

Normally, the bottom is the blind spot for luggage placed on the conveyor and carried on the line. However, 6-surface reading is possible in this case because the code reader can illuminate the luggage from slits in the connected surfaces of the conveyor belt to allow for mistake-free scanning regardless of the state of the luggage.

**6-Surface Reading**

# Logistics Glossary

| Term | Meaning |
|---|---|
| **A** | |
| Asset type | A type of business in which a logistics operator provides their own logistics services using their own warehouses, information systems, and transportation means |
| Automatic labeling machine | A material handling device that prints labels appropriate to a purpose and automatically applies them to containers and cartons on a conveyor. |
| **B** | |
| Block stacking | A method of stacking cargo on a pallet so that the shape and direction of each stacked level are the same. |
| Brick stacking | A method of stacking cargo on a pallet with switching the horizontal and vertical direction of the cargo on each level. Products are easy to see and this stacking method is effective for keeping the cargo from toppling. |
| Bulk loading | Loading cardboard boxes as is without using a pallet. |
| Bulk transportation | Cargo that is loaded as is without packaging. |
| Business continuation plan (BCP) | A plan to continue and quickly recover a business when a disaster occurs. |
| **C** | |
| Cargotainer | A cart for transporting goods. It is used to move goods around a warehouse and to load trucks. |
| Carousel | Rotating consolidated shelves that move to the required location for warehousing and picking. Carousels increase storage density. There are horizontal carousels and vertical carousels. |
| Cart | A cart with a handle and casters for transporting loads. |
| Cart picking | Picking using a cart. |
| Carton clamp | A forklift attachment. It can be used to pick up and transport box-shaped loads. |
| Case rack | A special rack that can store products by the case. |
| Cellular method | A production method in which one person or a small team completes or inspects the assembly process of a product. |
| Co-loading | Consolidating mixed cargo by two or more carriers into units of one container. |
| Cold chain | A low-temperature logistics system used in the transportation of fresh foods and pharmaceuticals. |
| Container | A shipping container. The dimensions of containers for international ocean freight are defined by ISO. |
| Cooperative delivery | Multiple shippers delivering cargo using a single truck. A facility for cooperative delivery is called a cooperative delivery center. |
| Courier delivery | Door-to-door transportation of a small package overseas using an airplane. This is also called international parcel delivery. |
| Cross belt sorter | A material handling device that is one type of automatic sorter in which conveyance units equipped with one or two conveyors in the horizontal direction are connected together. Each conveyor operates independently to automatically sort products. |
| Cycle inventory | A method to sequentially take inventory by determining the predetermined number of goods at a fixed cycle. A benefit is that entering and dispatch work is not stopped with this method. |
| **D** | |
| Dead stock | The bad inventory that is not likely to be shipped. |
| Depot | A logistics site that performs deliveries for a limited area. Or a small delivery center. |
| Devanning | Unloading cargo from a container. The term “vanning” is used for loading a container. |
| Double transaction | A method in which the interior of the warehouse is managed by splitting it into a picking area and stock area. |
| DWS | An abbreviation for dimensioning, weighing, and scanning. A dimensioning, weighing, and scanning system identifies the dimensions, weight, and barcodes of items to ship on a belt conveyor. This system helps prevent mis-shipments and facilitates speedy shipments. |

# Logistics Glossary

| Term | Meaning |
|---|---|
| **F** | |
| FIFO | An abbreviation for “first-in first-out”. |
| First-in first-out | The first item to enter the warehouse is the first item to leave. |
| First-in last-out | The first item to enter the warehouse is the last item to leave. |
| Fixed location | Fixing the location to store products in a warehouse and always using that same location. |
| Floor load capacity | The weight that the floor can withstand when an even weight is applied to it. |
| Fluted corrugated sheet | The sheet of fiberboard that composes the corrugated part of a cardboard box. It is classified by strength. |
| Foam peanut | A cushioning material made of expanded polystyrene. The curled-shape creates cushioning properties. |
| Free location | A location management method in which the locations where goods are stored are given location numbers. |
| **G** | |
| Gantry crane | Large cranes installed on the docks of a bay. They are used to load and unload cargo, such as containers. |
| Green logistics | Logistics with a goal of reducing the burden on the environment. This corresponds to modal shifts, cooperative transportation, consolidating logistics sites, and higher efficiency with electronic tags. |
| **H** | |
| HHT (Hand Held Terminal) | An information terminal with excellent portability. |
| **I** | |
| Intranet | An in-house computer network that uses internet devices and protocols. |
| ITS | An abbreviation for “intelligent transport systems”, which is an approach to making transportation more efficient by using cutting-edge information and communications technologies. A good example of ITS is the ETC (electronic toll collection) system used at highway tollbooths. |
| **L** | |
| Lead time | The time which takes from when a product is purchased until it is delivered. Production and transportation are included in this figure. |
| Linerboard | Paperboard that is used for the front and back of cardboard. It is classified by strength. |
| Logistics ABC | An abbreviation for “Activity Based Costing”. This is one method for managing logistics costs. |
| **M** | |
| Mast | Refers to the pillars of the lift on the front of the forklift. |
| Mobile rack | A movable rack that moves on floor-mounted rails. The rack can be moved horizontally. |
| Modal shift | Switching from trucks to a high-volume transportation method such as rail or ship. This contributes to reducing the burden on the environment. |
| **N** | |
| Nestainer | A nested steel pallet using for storing cargo in warehouses and factories. |
| Node | Refers to a logistics site, such as a freight terminal, port, airport, delivery center, or truck terminal. |
| **O** | |
| One-way pallet | A disposable pallet that can be used for importing and exporting cargo. |
| Overhang | Cargo that extends from a rack is said to be overhanging. |
| **P** | |
| Pallet | A wooden base on which to place cargo. Pallets are used to transport cargo with forklifts. |
| Parcel | A small package. |
| Polypropylene strapping | Plastic strapping used for bundling packages. |
| Power gate | A device that makes the tailgate at the back of the truck bed flat to raise and lower loads between the ground and truck bed. This makes loading and unloading heavy loads easier. This is also called a tailgate lifter. |

# Logistics Glossary

| Term | Meaning |
|---|---|
| **R** | |
| Ratio of actual driving distance | The ratio of the distance that cargo was loaded and transported to the total distance traveled. |
| Reach-type forklift | A type of forklift in which the forks extend forward and the load is supported by the front wheels. These are also called straddle reach trucks. |
| RFID | Devices that can read information without touching small tags. |
| Risk management | Managing risk within a company in a systematic manner to prevent or reduce losses. |
| Roll box | Another term for “roll-box pallet” and “cargotainer”. A cart with side fencing on which products are placed in cartons or collapsible containers and carried. |
| Roll clamp | A forklift attachment. This attachment is used to safely and reliably clamp rolls of paper and cargo in the shape of a cylinder. |
| Rotating fork | An attachment that rotates around the face to which the fork was installed. Loose materials, powders, and liquids can be transported and released by using a special carton. |
| Route delivery | A delivery method in which vehicles are allocated and delivery is made according to a predetermined route. |
| **S** | |
| SCM | Supply chain management. A strategic business management method that takes all of the processes from the procurement of materials to sales as a single business process. Supply chain management attempts to optimize the entire supply chain without being stuck in the framework of a company or organization. |
| Shrink wrapping | A packing method in which the load is covered in a special vinyl film and heat shrunk to firmly hold the entire load. |
| Side-shift fork | A forklift attachment. The two jaws can slide horizontally. |
| Single picking | Picking goods by destination or in units of stores. |
| Spring balancer | A machine for hoisting and moving cargo horizontally. |
| Stacker crane | A crane with a front-back travel function and up-down elevator function. It is installed between racks in an automated warehouse. |
| Stretch wrap | A cling film used to secure cardboard boxes loaded on a pallet. It can prevent loads from toppling during storage and transportation. |
| Subcontracting | Delivering cargo by temporarily borrowing trucks and drivers from other truck freight operators when loads cannot be handled by the company's own vehicles, such as during peak times. |
| Supply chain | The chain of all processes from the raw materials stage until the product or service reaches the consumer. |
| **T** | |
| Tailgate lifter | A device that makes the tailgate at the back of the truck bed flat to raise and lower loads between the ground and truck bed. This makes loading and unloading heavy loads easier. |
| Ton-kilometer | A unit that indicates a quantity of freight carriage. The unit is the transportation distance (kilometers) multiplied by the weight of the freight (tons). |
| Total picking | A work method in which products are picked for multiple destinations in batch and then sorted by shipping order at a temporary storage area or sorting area. |
| Total picking method | A method in which the items and goods are picked for multiple destinations in batch and sorted by destination in the cargo handling area. |
| **U** | |
| Unit load | Cargo in which multiple items of cargo are grouped together using a container, pallet, or case. |
| Utilization efficiency | An indicator of vehicle use efficiency. This is the value of the total number of operating days of a vehicle that has been driven loaded with cargo in a certain time period divided by the total number of days the registered vehicle is in possession. |
| **W** | |
| Wing body truck | A type of truck in which the sides of the cargo bay can be opened. This makes loading and unloading with a forklift easier. |
| Working load limit | The maximum load permitted for the crane. |

## SR-2000 Series

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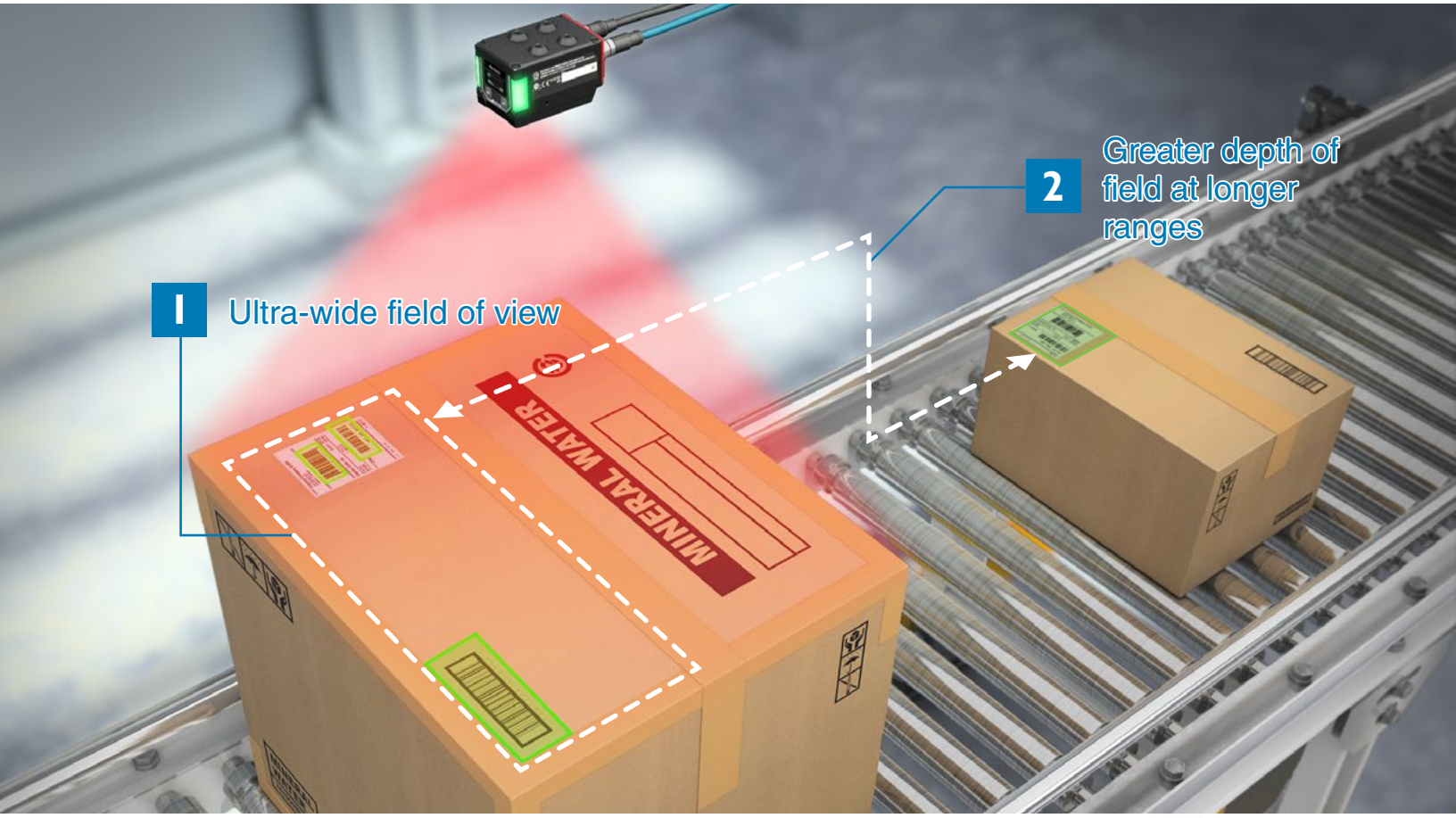


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