MODULA HC

Introduction

Based on thirty years' experience gained in the US market, the new Modula horizontal carousel has been developed according to the most modern criteria of safety, ergonomics and efficiency.

This system is ideal for all **intensive picking** applications, both in the distribution and production sectors. The carousel saves space, reduces labour costs, increases production speed and improves accuracy and inventory control.

Choosing between a horizontal carousel system and a VLM requires careful consideration. The main distinguishing factor is the availability of space in height. If enough space is available in height, the VLM could be the preferred solution as it allows for greater storage density. However, other factors must also be considered, such as the weight and size of the items stored or the business cycle of the company.

In general, the horizontal carousel is suitable for handling small to medium-sized products with a low weight, and a 3-6 week supply cycle.

Each carousel consists of a series of **BINs**, configurable containers with shelves, which slide horizontally on an **ovoid track**.

The bins feature a variable number of shelves, above which the goods are stored.

To increase efficiency reducing picking times, the carousels are organised in **PODs**, groups consisting of 1 to 4 side-by-side carousels, functioning as a single unit.

Operation

The operator controls the machine functions from the Copilot (one for each pod), from the HMI tablets positioned at each automatic door of the carousel, or remotely using the WMS warehouse management software installed on the PC.

Once the commands have been received, the machine recalls the bin containing the requested items, taking it to the machine bay where, through an automatic safety door that opens only when the bin arrives, the operator carries out the picking and depositing operations.
The carousel can rotate in both directions and always chooses the fastest path to bring the bin to the operator.

System

The horizontal carousel works best when configured as a "system" and not as a "standalone" solution.
To significantly increase productivity, Picking Stations can be installed in the operator's work area, configurable workstations specifically designed by Modula for order preparation.
Guided by the WMS, which optimises item handling, and by the Put to light system, the Picking Stations efficiently direct the operator in order preparation.

Overview

1. Structure

The structure of the carousel is modular and consists of one or two <u>drive units</u> placed at the ends (depending on the configuration), and of <u>intermediate sections</u> of different lengths. This makes the system quick to make and install.

The modularity of the system also makes it possible to bypass any structural obstacles in the warehouse, such as load-bearing columns.

The carousel structure is made of resistant steel bars and is bolted to the ground during installation; the track on which the bins run is in stainless steel, for greater durability and easier maintenance.

2. Bins and shelves

The bins are, together with the carousel structure, the core of the system.

They are made with <u>galvanised steel</u> sheets with a thickness of 20/10, used for both the walls (side and rear) and the shelves.

They are hooked to the carousel at both ends, to the upper track, which moves them, and to the lower one, which keeps them vertical.

Spring bushings in the upper part allow absorbing the shocks of the loaded bins.

The bins can be configured with different height, depth and width. The <u>maximum payload never changes</u>, which is 550 kg (1,200 lb), regardless of the configuration.

The number of shelves for each bin is at the client's discretion (maximum 999 shelves per carousel) and for this reason they are considered options. Each bin can also be completed with a dustproof top and with reinforcement brackets for the shelves.

3. Automatic door

The **automatic door** protects the operator while the carousel is in motion, opening only when it has completely stopped and allowing access only to the bin called.
The safety of the operator, and of the machine itself, is guaranteed by multiple devices:
- door with limited manoeuvring force;
- safety interlock switches that lock the door while the carousel is in motion;
- photocells for detecting protruding objects;
- inductive sensor for checking the correct positioning of the bin in the bay.
Each automatic door can be equipped with an LED bar, a device with LED lights that indicates the position of the compartment to the operator, making the picking and depositing operations quick and precise.

4. Controls

The operator controls the machine functions from the main touchscreen control panel called **Copilot** (one for each pod), from the **HMI tablets** (Human Machine Interface) positioned at each automatic door (one for each carousel), or remotely using the WMS warehouse management software installed on the PC.
The **HMI tablets** allow viewing the operations in progress, orders, picking and stocks and the manual controls of the carousels and the warehouse.
Under the HMI tablet there are multi-task and emergency stop buttons to quickly confirm the execution of the picking/depositing operation or to stop the machine immediately.
Instead, the **Copilot** manages the entire pod and all the system start-up and maintenance operations are carried out through it. It is located in the upper part of the cabinet that contains the electrical panel, together with the main isolator switch, an emergency stop button, a multi-task button and the maintenance lock/release key.

5. Perimeter safety guard

Each **pod** is surrounded by a perimeter safety guard integrated with the automatic doors for a completely closed system.
The perimeter fence layout is adaptable to carousel configurations and facility layouts.
An access gate for maintenance is integrated into the perimeter safety guard, equipped with a switch with safety interlock and an internal opening button that interrupts the safety circuit by activating the emergency stop.

6. Motor unit

The horizontal carousel can be moved by one or two motors, positioned above the structure. The choice of one or two drive units determines the maximum load capacity of the machine, therefore the maximum number of usable bins.
The power of the motors is 3 HP (2.24 kW) and the resulting maximum load capacity is about 18,000 kg for the version with one motor, and about 36,000 kg for the two-motor version.
The position of the motor unit above the structure allows easier maintenance of the machine, as it is easier to reach the components.
In any case, the possibility of mounting an inverted motor has been planned, a useful solution in those cases in which the available height space is not sufficient to accommodate a "standard" version of the carousel.

Models and configurability

• Range of models

There are two models of horizontal carousel: the MD and the MG, which differ in the usable width of the bins. Both models can be configured by changing the characteristics and quantity of the bins:

Usable **width** of the **bin**, models available:
- **MD**: **24**″ - 610 mm
- **MG**: **36**″ - 914 mm

Usable **depth** of the **bin**, models available:
- 18″ - 457 mm
- 24″ - 610 mm

Usable **height** of the **bin**, models available:
- 84″ - 2,134 mm
- 96″ - 2,438 mm

Height of the **structure**:
- 84″ Bin = 107″ - 2,718 mm
- 96″ Bin = 119″ - 3,022 mm

Total **height** of the **carousel** (motor included):
- 84″ Bin = 119″ - 3,023 mm
- 96″ Bin = 131″ - 3,327 mm

Length of the **carousel**:
- MD - minimum: 4.53 m | maximum: 51.51 m
- MG - minimum: 4.68 m | maximum: 51.65 m

Quantity of bins per carousel, variable depending on model:
- **MD** models minimum 12, maximum 150 bins
- **MG** models minimum 8, maximum 100 bins

• Bins and shelves

The **bins** are in 20/10 thick galvanised steel. Each container, regardless of width, depth and height, has a **maximum overall payload of 1,200 lb - 550 kg** (meaning the weight of the products plus the weight of the shelves).

The **shelves** are made in the same 20/10 thick galvanised steel as the structure.
The position of the shelves is variable with 2″ - 50 mm increments. The maximum height of the products that can be stored is equal to the distance between the shelves minus the thickness of the shelf itself (1.5″ - 38 mm). Each shelf has a **maximum payload of 250 lb - 113 kg**.
The bins do not have a default number of shelves but this is determined during the configuration phase based on the client's needs. However, a maximum limit of shelves per individual carousel has been set, of 999 units.

Optionally, the bins (and shelves) can be powder-coated, equipped with a dustproof cover on the top and with reinforcement brackets for the shelves. The reinforcement brackets only serve to minimise the bending of the shelves, they do not increase their capacity.

• Pods

In order to increase productivity, horizontal carousels can be used in groups, called **PODs**, consisting of 1-4 side-by-side carousels, functioning as a single unit.
The advantage of such a configuration is that while an operator picks from one carousel, the others rotate and prepare the material for subsequent picks. This way, operator downtime is minimised, increasing performance.

The arrangement of the carousels can be <u>linear</u> or <u>ergonomic</u>, in which case the external units face the central operator position.

Carousels of the same pod can be of different lengths from each other, and therefore have a different number of bins, but the type of bins must be the same for the whole group of carousels.

• Storage limits

To ensure the correct storage of materials, the following criteria must be respected:

- Each shelf has a specific maximum payload;
- Each bin has a specific maximum payload which includes the weight of the shelves and the material stored;
- Each carousel has a maximum load limit due to the towing power of the motors - which depends on the configuration of the carousel itself (number of motors, model and number of bins).

All the limits mentioned above must be taken into consideration based on the configuration and storage methods of the products.

> (!) **REDUCED PAYLOAD** - optionally, the payload of the bins can be reduced in order to insert more bins inside the carousel. The maximum payload of the carousel must however be respected.

• System for batch picking

The productivity of the horizontal carousel is pushed to the highest level when it is integrated with order preparation systems.

When using the Modula WMS to manage picking operations from the horizontal carousel and the Modula put-to-light system to store objects inside containers associated with individual groupings (shipments, orders, kits, etc.), order preparation becomes much more efficient.

PUT TO LIGHT

Put-to-light solutions are the best choice for order preparation when a fast, intuitive, scalable and error-free process is required.

The displays visually guide the operator to the locations where the items are to be deposited. A light display is associated with each location or container assigned to an order. Sorting is carried out by item; once removed from the horizontal carousel, the displays visually indicate to the operator the container in which to deposit it and the quantity required for each order.

The Modula WMS software, which manages the put-to-light system, allows implementing different picking strategies, including batch picking or multi-order.

PIKING STATION

The Picking station is a complete and modular fixed picking station, equipped with various picking positions. It consists of a sturdy painted steel structure, shelves for supporting the containers, and a certain number of put to light displays with relative controller/power supply. The modules can be coupled in order to extend the system for those who need to process many orders at the same time. There are also intermediate modules for installing monitors, label printers, barcode readers or other options. The system must be equipped with the Modula WMS software.


PICKING CART

The Picking cart is a complete and modular mobile picking station, equipped with various picking positions. It consists of a painted steel trolley with 4 castor wheels for easy manoeuvrability, shelves for supporting the containers, a certain number of put to light displays with relative controller, power supply/backup batteries and Wi-Fi system for wireless connectivity. The system must be equipped with the Modula WMS software.

* The software recognises only one batch picking system at a time. The same carousel will therefore not be able to work simultaneously with a Picking cart and a Picking station, but only with one of the two.

• Technical Data
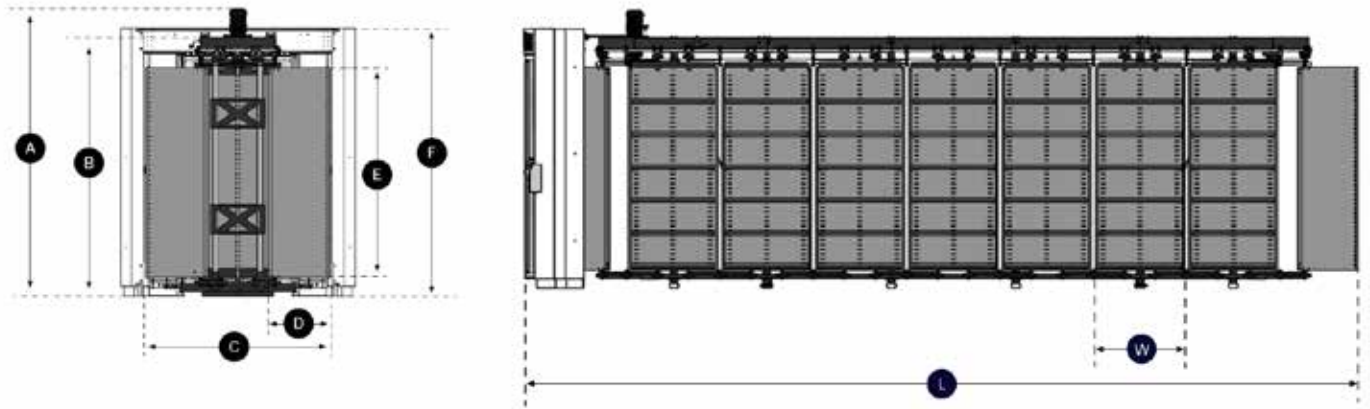
A) Total height of the carousel (motor included)
B) Height of the frame
C) Width of the carousel
D) Usable depth of the bin
E) Usable height of the bin
F) Height of the safety door
L) Length of the carousel
W) Usable width of the bin

MODEL	W	D	E	C	B	A	F
MD	24″ 610 mm	18″ 457 mm	84″ 2,134 mm	64″ 1,626 mm	108″ 2,743 mm	119″ 3,023 mm	110.5″ 2,807 mm
MD	24″ 610 mm	24″ 610 mm	84″ 2,134 mm	76″ 1,930 mm	108″ 2,743 mm	119″ 3,023 mm	110.5″ 2,807 mm
MD	24″ 610 mm	18″ 457 mm	96″ 2,438 mm	64″ 1,626 mm	120″ 3,048 mm	131″ 3,327 mm	122.5″ 3,112 mm
MD	24″ 610 mm	24″ 610 mm	96″ 2,438 mm	76″ 1,930 mm	120″ 3,048 mm	131″ 3,327 mm	122.5″ 3,112 mm
MG	36″ 914 mm	18″ 457 mm	84″ 2,134 mm	64″ 1,626 mm	108″ 2,743 mm	119″ 3,023 mm	110.5″ 2,807 mm
MG	36″ 914 mm	24″ 610 mm	84″ 2,134 mm	76″ 1,930 mm	108″ 2,743 mm	119″ 3,023 mm	110.5″ 2,807 mm
MG	36″ 914 mm	18″ 457 mm	96″ 2,438 mm	64″ 1,626 mm	120″ 3,048 mm	131″ 3,327 mm	122.5″ 3,112 mm
MG	36″ 914 mm	24″ 610 mm	96″ 2,438 mm	76″ 1,930 mm	120″ 3,048 mm	131″ 3,327 mm	122.5″ 3,112 mm

The length (**L**) of the carousel is calculated using the following formula:

L = OAL carousel base + (bin multiplier * bin quantity)

where:

OAL (overall length) is the length of the carousel structure, regardless of the number of bins.
- bin with **depth 18"** = 29" - 737 mm
- bin with **depth 24"** = 40" - 1,016 mm

Bin multiplier depends on the carousel model.
- **MD** = 13.26" - 337 mm
- **MG** = 19.89" - 505 mm

• Technical specifications of the <u>bins</u>

Models	MD	MG
Internal width (usable)	24" - 610 mm	36" - 914 mm
Internal depth (usable)		18" - 457 mm | 24" - 610 mm
Shelf position increment		2" - 51 mm
Maximum load height		Distance between the shelves minus 1.5" - 38 mm
Maximum payload of BIN		1,200 lb - 550 kg
Maximum payload of shelf		250 lb - 110 kg
Volume of bin **18"** x **84"** - 457 x 2134 mm	21 ft³ - 0.59 m³	31.5 ft³ - 0.89 m³
Volume of bin **18"** x **96"** - 457 x 2438 mm	24 ft³ - 0.68 m³	36 ft³ - 1.02 m³
Volume of bin **24"** x **84"** - 610 x 2134 mm	28 ft³ - 0.79 m³	42 ft³ - 1.19 m³
Volume of bin **24"** x **96"** - 610 x 2438 mm	32 ft³ - 0.91 m³	48 ft³ - 1.36 m³
Storage density of bin **18"** x **84"**	57 lb/ft³ - 26 kg/m³	38 lb/ft³ - 17 kg/m³
Storage density of bin **18"** x **96"**	50 lb/ft³ - 23 kg/m³	33 lb/ft³ - 15 kg/m³
Storage density of bin **24"** x **84"**	43 lb/ft³ - 20 kg/m³	29 lb/ft³ - 13 kg/m³
Storage density of bin **24"** x **96"**	38 lb/ft³ - 17 kg/m³	25 lb/ft³ - 11 kg/m³
Construction material of bin		Galvanised steel with 20/10 thickness
Weight of bin (empty) **18"** x **84"**	134 lb - 61 kg	152 lb - 69 kg
Weight of bin (empty) **18"** x **96"**	150 lb - 68 kg	168 lb - 76 kg
Weight of bin (empty) **24"** x **84"**	148 lb - 67 kg	169 lb - 77 kg
Weight of bin (empty) **24"** x **96"**	167 lb - 76 kg	187 lb - 85 kg
Construction material of shelf		Galvanised steel with 20/10 thickness
Weight of 18" shelf	10.1 lb - 4.6 kg	14.2 lb - 6.4 kg
Weight of 24" shelf	12.8 lb - 5.8 kg	17.9 lb - 8.1 kg

• Technical specifications of the <u>carousel</u>

Models	MD	MG
Upper track	Upper track Rod in AISI 304 stainless steel Ø1-1/4" - 32 mm	
Lower track	Corner in steel, powder-coated 2x2x3/16" -51x51x4.8 mm	
Final structure of carousel	Welding in steel, min thickness 1/4" - 6.4 mm powder-coated	
Intermediate structure of carousel	Steel thickness 1/4" - 6.4 mm, powder-coated	
Carousel support columns	Galvanised pipe 2-3/8" - 60.5 mm, Sch40	
Carousel motor	Direct drive, planetary gear	
Carousel load limit	1 motor 40000 lb - 18144 kg 2 motors 80000 lb - 36287 kg	
Quantity of bins per carousel	from 12 to 150	from 8 to 100
Maximum speed of carousel	85 ft/min - 0.43 m/s	
Automatic door adjustment	Standard	
Connection between carousels	Standard	
Connection between carousel and automatic door	Standard	
Operator interface	Touchscreen tablet	
Other operator commands	Multi-task button, E-stop	
Command devices	Timeout sensors for door, obstruction, door and bin position	
Colour and structure of carousel	RAL 7021 - Black grey	
Automatic door colour	RAL 7035 - Light grey	

• Technical specifications of the <u>pod</u>

Models	MD - MG
Carousels per Pod	from 1 to 4
Type of Pod	In line (A) or ergonomic (B)
Electrical Panel	single NEMA 12 per pod
Control platform	Copilot controls: master on panel, remote on each carousel
Control panel operator commands	Copilot touchscreen Master HMI, E-Stop, maintenance key
Power supply options[1]	1PH[2] 208V/240V or 3PH 208V/240V/400V/480V
Perimeter safety guard	Standard, includes access door
Perimeter safety guard colour	Panels in powder-coated black metal mesh, yellow posts

[1] - Power supply options concern the North American market
[2] - The 1-phase version cannot support more than two carousels

Installation

Installation, carried out by a minimum of two installers, requires a minimum of five working days; times vary depending on the size of the system.
A forklift truck and a mobile elevating work platform are required for installation (mobile and elevating workstations, pantographs or similar are fine in any case).

It is necessary to provide a support area for storing packages and the installation area for the carousel, defining the distance between the two areas, as well as the presence of obstacles and constraints along the material transfer path.

The units that make up the carousel are pre-assembled at the factory and are delivered to the client ready to be assembled; the parts of the structure, which are modular, are assembled directly on site.

• Minimum clearances

AREA	VALUE	DESCRIPTION
Front	36" - 914 mm	From front edge of door
Rear	30" - 762 mm	From the swing radius of the rear bin to the construction wall, the perimeter safety guard may be closer.
Sides	30" - 762 mm	From the edge of the bin to the construction wall, the perimeter safety guard may be closer.
Distance between pods	18" - 457 mm	Distance between pod and pod, between bins
Electrical Panel	36" - 914 mm	Front clearance

• Operator stations

The operator's workplace depends on the installation layout, which includes building features, adjacent and related equipment.

The main work area is the area in front of the bays. If the operator has all the necessary resources to carry out the work in this area it will increase efficiency, i.e. the order lines executed for each hour.

The perimeter safety guard surrounding the pod allows operators to move safely around the outer perimeter of the machine.

• Maintenance

Most machine maintenance can be done through regular inspections by the maintenance technician and annual inspections. Storing key spare parts can also reduce downtime.
In addition, most components are accessible from outside the horizontal carousel, simplifying repairs and speeding up maintenance. This also reduces downtime and repair costs. In particular, the drive units have been positioned above the structure precisely to facilitate maintenance.

• A unique software

Modula WMS is a warehouse management software with traditional storage systems (manual areas and shelves) and automatic storage systems.
It is more than just software: it is an integrated solution for the entire warehouse organisation system that addresses all the problems of <u>organisation, safety, speed, efficiency, accuracy and payload</u>.

The same software <u>can manage all the Modula products present at the same time</u>: whether they are horizontal carousel systems or vertical automatic warehouses.
Furthermore, by integrating the Manual Warehouse package, it is also possible to manage a possible traditional warehouse.

• Packages available

Modula WMS - BASE
The BASE version is the default version supplied when the system is purchased and allows the management of the main functions of the machine and any LED bars (optional).
Specifically, this package allows:
• Item register management;
• Warehouse locations management using a graphical tool;
• Materials handling management through picking/depositing orders;
• Materials handling management through immediate requests;
• User management with three levels of access;
• Management of physical inventories of the warehouse;
• Manual import/export with the company management system through the exchange of fixed format ASCII files;
• Advanced security management limiting access to item codes and trays based on the user's role.

Modula WMS - PREMIUM
The PREMIUM version of the software adds features to the BASE version to optimise the management of items stored in the warehouse.
The main characteristics of this software package are:
• Automatic item-compartment allocation and dynamic location management;
• Dynamic management of serial number and batch picking;
• FIFO material management and expiration dates.
It also provides tools for statistical analysis of the warehouse as well as the ability to print customised reports.

Additional modules
In addition to the WMS PREMIUM package, the following additional modules can be added to increase WMS functions and application potential.
Advanced item management: this module extends the functionalities for item management;
Advanced Picking: provides features to improve picking and depositing; allows management of the PTL system;
Manual warehouse: allows software management of the manual areas of the warehouse;
Radio frequency terminals: allows extending manual warehouse management with the use of radio frequency terminals for all warehouse operations;
SAP IDOC protocol: this is a data exchange between SAP WMS and Modula WMS via IDOC.

Modula Link

If the client uses a different management software, the Modula Link package allows creating a link between the software and the horizontal carousel.
Modula Link is a software tool that enables an external Host System to control at low level the horizontal carousel using a set of commands managed via communication on a TCP/IP channel socket.

HC vs VLM - What's the difference?

Given the variety of the horizontal carousel system compared to the traditional Modula VLM, the software has been updated with dedicated graphics and functions.

Copilot

Probably the most obvious innovation is the presence of two types of Copilot, each with different features. The traditional Copilot, placed near the electrical panel, is used to carry out all installation and maintenance activities; the HMI tablets, on the other hand, placed next to each automatic door, are used for picking and order execution activities.
The OS software home page has been updated and now shows a schematic representation of the carousels that are part of the same pod. When a blinking "X" appears, the related carousel is offline.

LUs and picking

Another major difference between the two software versions concerns the concept of LU.
If in the "standard" version the VLM trays were considered the LUs, in the version for the horizontal carousel these are the shelves, and not the bins as one might mistakenly think.
On the picking page, the graphic representation that we will see will therefore concern the shelf with its possible division into compartments.

POD batch picking

The **Pod Batch Picking** feature is unique to the horizontal carousel.
It is available upon purchase of the Premium package in combination with the advanced Picking module and optimises batch order picking management.
It facilitates work in the POD when there are multiple operators, constantly reporting the situation of the locations, prepares orders and assignments to operators.

*For technical reasons, the page can also be viewed with the BASE version of the software, but it cannot be used as it uses the order preparation locations that are part of the advanced Picking package.

Check in

To increase the efficiency of the system in the likely scenario where multiple operators work simultaneously on the same pod, the concept of "**check in**" was introduced.
Upon checking in, the operator receives an identifying colour that guides him while running the orders. In the picking screen, the order detail boxes change background colour according to the operator responsible for the operation.

Partial confirmation of the task

In the case of integration with the Put to Light system, the concept of **partial confirmation of the task** was introduced. This "intermediate" status, which is activated by confirming the picking of the item and which remains valid until the deposit on the PTL system is confirmed, frees the machine which can thus activate itself to execute the next order line.

Options

The machine can be equipped with the following auxiliary equipment (options):

- **LED Bar**
  The automatic doors can be fitted with an LED light device that indicates the position of the compartment where to carry out the picking operations to the operator.

- **Picking station**
  A complete and modular fixed picking station, equipped with various picking positions. It is installed in the operator's work area to significantly increase productivity.

- **Picking cart**
  A mobile picking station, it consists of a steel trolley equipped with shelves to support the containers, a certain number of put to light displays, power/backup batteries and WiFi system.

- **Additional access gates for maintenance**
  The perimeter safety guard is supplied with a standard access gate; optionally it is possible to add additional gates to allow access to the machine from multiple points.

- **Put to light**
  A system of displays that visually guide the operator towards the containers in which the items of each order must be deposited.

- **Badge reader (magnetic or RFID)**
  These devices protect the stored material from prying hands. Login is done via badge, which makes the operation extremely fast and denies access to unauthorised persons.

- **Barcode reader (1D/2D)**
  The barcode readers are often used when the elements stored have complex codes or are difficult to distinguish. The barcodes can also be used to confirm orders and/or make a user login.

- **Label printer**
  This if for printing customised sticky labels and posters with information on stored material. The operator can enter the information via the command console and print it onto the labels to then attach them directly to the boxes, sacks or to identify the goods.

- **Counting scale**
  It is the ideal tool when a certain number of small objects (bolts, screws or similar) need to be picked up or deposited rapidly and with precision. The unitary weight is set for each item and the operator, during picking or depositing, weighs an amount of items on the scale. The number of items automatically appears on the Copilot console.