

MMSpharma® SMART SHELVING SYSTEM

MMSpharma® SMART SHELVING SYSTEM F/SEMI-AUTOMATED SINGLE-DOSE PREPARATION

- Semi-automated system for the management of single-dose order preparation.
- Features Pick to Light technology (PTL) at the head and front of the shelves of the different modules/sections of the U-shaped shelving for preparing the single dose.
- Smart and stand-alone PTL boards; equipped with 8 maximum brightness LEDs (2 per colour), 8 displays indicating the quantity (2 per colour), and 4 push-buttons to validate (1 per colour).
- 4-colour PTL plates to enable simultaneous multitasking of 4 operators on the system.
- On the PTL board itself, it is possible to: Adjust quantity, redefine location, and perform self-tests.
- Multifunctionality of the system: Preparation, Return, Make-up and Inventory.
- Software MMSpharma®, intuitive (low learning curve) and easy integration to ERP.
- Scalable system over time, an increase in SKU capacity can be achieved with great ease.
- Use of bidirectional CAN connectors that ensure safe and fast communications.
- Low system maintenance cost (easy replacement of PTL plates).

DESCRIPTION OF MMSpharma® SMART SHELVING SYSTEM

The MMSpharma® Smart Shelving System enables the Pharmacy Service to semi-automate the picking management in the preparation of single dose orders, using pick to light technology (PTL) at the head and front of the shelves comprising the different modules/sections of the shelving.



MMSpharma® Smart Shelving System

The MMSpharma® software (HMI) manages batches and also has dose management capability, thus it is able to receive partial single dose pill orders for patients. The simultaneous management of the U-shaped pick-to-light shelving system and the multi-order preparation table enables full traceability of the entire process operation.

The MMSpharma |® Smart Shelving system is a simple, modular and scalable technology; its maintenance and configuration can be carried out by the client as explained in the following sections.

TECHNICAL SPECIFICATIONS OF THE MMSpharma® SMART SHELVING SYSTEM

The MMSpharma® Smart Shelving System includes the following elements:

- a. **PTL Plate** - The pick-to-light plates (PTL) are electronic, smart and stand-alone devices. Equipped with 8 high-quality LEDs, with a luminous beam that triples in width to the conventional ones, facilitating the vision and attracting the attention of the picker/operator.



PTL Plate

The 8 LEDs are distributed in 4 colours with 2 LEDs of each colour; thus, 4 pickers/operators can work simultaneously in the installation, each one following their own colour, or 8 pickers combining fixed colours with flashing lights. In case the installation requires more than 4 pickers working at the same time, 2 devices could be installed per position with 8 different colour pairs or it could be possible to configure flashing effects for the LEDs.

The PTL plates also have 8 seven-segment displays. As in the case of LEDs, the displays are divided into pairs by colour. This way, the system informs the picker of the quantity to be taken from each location/SKU, up to a maximum of 99 units per order line item.

In addition, the PTL plate has a button to validate that the picking/return/make-up/etc. of the amount indicated on the display has been made. By double-clicking on the button, an order is sent to the client's management software, validating the correct picking return/make-up/etc. of that reference/SKU. From this point on, it is the task of the management system to update the stock, invoice the material, etc.

Thanks to the presence of a microcontroller in each electronic card, the wiring in the installation is minimised to the maximum, with only 4 cables being necessary to interconnect all the display cards at each shelf level of the structure. The power supply signals (5V) are sent through two of the cables and the communications are sent through two other cables in differential mode. The communication is of half-duplex type, with each pair of LEDs being able to receive orders and respond to the hub equipment to verify that the order has been received and is executed.

The electronic display control board is mounted on a metal profile to protect the circuit and has front machining to show the light of each LED. Each display has 7 segments, with the push button positioned above the metal profile for visual and tactile access. It also has lateral machining to show the input and output connectors arranged on the back of the box. An industrial sticker protects the elements, and its relief improves its tactile sensation.

If a PTL plate breaks down (blown LED, broken microcontroller...), the user simply needs to disconnect the broken device and connect a new one; the system automatically assigns an address to it.

- b. **PTL Head Plate** - Same type of device as PTL plate. They inform the picker/operator of the number of line items pending preparation in that shelving section; the LEDs colour indicates to which operator each information refers. These PTL plates will be placed at the head of each shelving section.
- c. **PTL Plate Controller** - The PTL controller is in charge of sending the order with all the necessary information (colour, quantity, LED effect...) to each PTL device that needs to be turned on. It also receives the reply or confirmation from each device and sends it to the system's centralised modem. This proprietary design and manufacture controller is capable of managing up to 9 different height levels and, each level, a maximum total of 100 devices per level.

This is a very powerful controller that, thanks to its powerful CPU, makes it possible to quickly manage and refresh information. This controller is powered at 220V and sends commands to the devices via the CAN RS-485 industrial bus (bus through which the devices are powered); this is a very popular bus in the industrial field, due to its great resistance to potential electrical distortions and can communicate with devices located more than 1,000 meters.

The controllers are usually placed in strategic locations within the facility in such a way that they do not disturb or disrupt the daily work of the storage facility.

As with PTL devices, the controller is designed for *Plug&Play* connection, greatly facilitating maintenance work, if any.

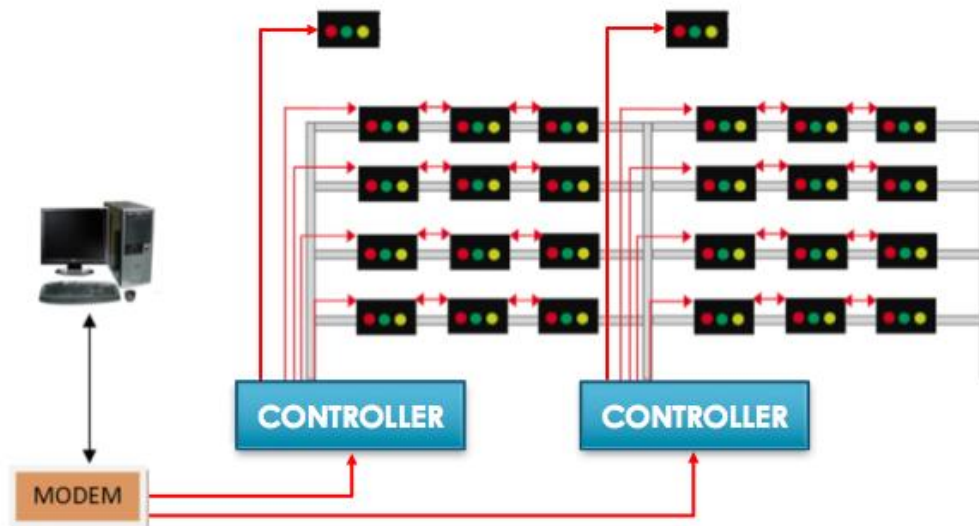
- d. **Modem** - The PTL modem is connected on the one hand to the control PC that communicates with the ERP client and on the other hand, it is connected to as many controllers as the system has.

The modem is in charge of managing and channelling each order issued by the system's ERP to the appropriate controller. Likewise, it identifies which controller, and most importantly, which device each validated or modified order line item confirmation comes from.

The communication between the PC and the modem is via Ethernet, as well as between the modem and the controllers, as indicated in previous pages. The decision to transmit from the modem to the controllers using Ethernet is due to its high transmission speed over long distances. Without a doubt, the communication between the modem and the controllers is the longest in the system (depending on the layout).

ARCHITECTURE AND INTEGRATION OF THE MMSpharma® SMART SHELVING SYSTEM

As it can be seen in the attached diagram/functional architecture scheme, the main computer (which can be a computer already available in the Centre), runs the MMSpharma® management/control software and is in charge of reading the database to receive the relevant LED on/off commands. This software connects to the modem through the serial port.



Architecture of the MMSpharma® Smart Shelving System

The modem communicates with the controllers of the relevant shelving sections via Ethernet. Finally, the controllers are ultimately responsible for transmitting the order to each of the pick-to-light (PTL) devices. This communication network takes into account the colour led to be lit and the quantity on the seven-segment displays.

The installation of the MMSpharma® Smart Shelving System is completed with a complete integration of the different software: Through a simple exchange of files or database to be agreed with the IT department of the hospital, the ERP informs the PTL system which and how many lights to turn on. In turn, the PTL also informs the ERP of the stock validations or corrections, keeping the stock controlled at all times in real time.

SINGLE-DOSE PREPARATION STEPS W/MMSpharma® SMART SHELVING SYSTEM

Attached there is a detailed step-by-step operation of single dose preparation with the MMSpharma® Smart Shelving system,

1. The user is identified on a PC terminal by entering their user code and selecting a colour (4 colours available for 4 operators working simultaneously). All picking operations carried out by each user are registered.
2. An order/patient is selected and all locations/SKUs of the order line items to be prepared are illuminated, as well as the number of picking units of each reference/SKU.

The system displays the optimal route following a circuit in which the LED of the nearest PTL is flashing while the rest of the LEDs remain lit. As the position is validated with the flashing LED, the next LED that was on starts flashing.

If there is not enough stock in a position, the quantity of product collected (picking) can be modified using the push buttons, being zero if there is no medication.

The system is complemented by head PTLs that are used to indicate at all times the shelving sections in which there are items with medicines pending picking. When all the head LEDs of all the shelving modules are off, the preparation of that order is complete.

3. The "finished order" confirmation is issued in the PC software with the receipt of a confirmation of "process completed successfully." Information about the location of the trolley/item on the multi-order preparation table is displayed on the screen, where the order for newly prepared medications needs to be entered.

This same pick-to-light (PTL) process can also be used for the return and replacement processes of medicines in boxes on the single-dose shelving. In this case, the system works in put-to-light mode.

HIGHLIGHTS OF THE MMSpharma® SMART SHELVING SYSTEM

Below there are some highlights of the MMSpharma® Smart Shelving System,

Simultaneous Orders - This process enables the preparation of four orders simultaneously by assigning each operator a colour among the four available (red, green, blue, and yellow), or the performance of several operations at once, such as product pickup, make-up or taking of stocks. It is possible to extend the installation to add more operators by adding more PTL devices with other coloured LEDs.

- 8 high visibility LED devices (2 per colour for greater reliability).
- 4 push buttons to validate the collected goods (1 per colour).
- 8 displays indicating the quantity to be served (2 per colour, although larger quantities can be shown by rotating the digits).

Smart Modules - Each PTL plate has a unique and programmable address on the card itself, thus enabling simple and effective replacement and expansion of the installation without the need to redesign the entire system or alter the setup of the other PTL plates.

Ease of Installation - The PTL plates have 4 holes that enable a simple installation, that can be connected using foldable flanges and easily removed in case of a malfunction.

Aesthetics and Robustness - The PTL plates are securely built in and protected from the environment by aluminium housing. The elements for operator interaction (push buttons, displays, and LED devices) will be accessible and at the same time protected by means of a sticker.

Head/Section Indicators - The purpose of head PTL plates is to initially inform the picker which shelving section has lighted front PTL plates or shelves, and what is the total number of outstanding picking points in that shelving section. This saves the picker plenty of time, as there are no unnecessary visual search times in sections without picking points.

This device not only helps when making the decision to work or not in front of a shelving section, but also, as the picker confirms the line items of the order, the head PTL display of that section decreases until it is turned off, when all the line items of that order are complete.

Technical characteristics of PTL devices,

Internal Voltage Regulator - It maintains the internal supply voltage of the board at 5V providing flexibility to the type of supply voltage built in the installation. The permitted supply voltage is 8 V to 24 V DC.

CAN Bus - Bidirectional CAN connectors that ensure safe, fast and error-free communications. The connectors at the ends provide a robust and safe interconnection.

PIC Microcontroller - Each PTL plate has a Microchip brand PIC microcontroller in charge of controlling the programming, communication and user interface functions of the PLT plate.

Programmable Addressable Modules - The PTL plate address is determined by default using the following patterns: Section, Level and Location. By means of these three parameters, the location of each PTL plate can be precisely defined, providing a unique address, which ensures that there can be no device ignition errors due to cable transmission problems. The setup of these parameters is carried out via communications or using the push buttons on the device itself, as explained in the following section.

High Performance LEDs and push buttons - High luminosity and wide viewing angle LED diodes are used. The LED is duplicated for each colour, which gives greater strength in the event of a malfunction, since at least one LED is always working. The push buttons are of the highest quality and are ready for millions of manoeuvres.

Testable Modules - Each PTL plate has an individual testing feature that verifies the correct operation of the plate elements (7-segment displays, LEDs, and push buttons).

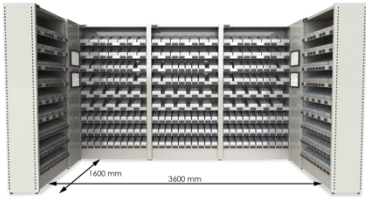
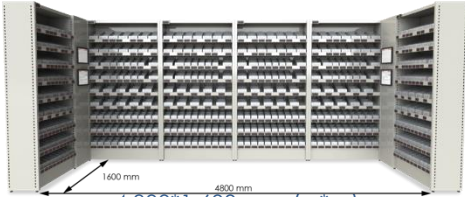
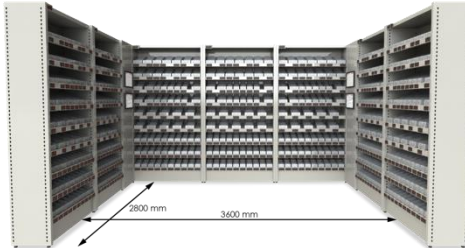
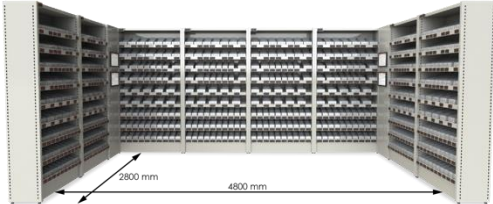


PTL plate without sticker or housing

COMPARISON OF THE MMSpharma® SMART SHELVING SYSTEM

CONVENTIONAL SYSTEM	PICK-TO-LIGHT SYSTEM
Manual picking of order form, identification	Automatic order launch to the pick-to-light system: 2 seconds
Reading of each delivery note line item, product and location	Automatic location identification by light: 2 seconds (20 s for 10 line items)
Location search and product recognition	Optimised guidance to the optimal route location
Reading of the quantity of product to be removed and picking of the products. Marked with a pen on the delivery note.	Product pickups with marking of the quantity in the location itself
Acknowledgement of end of order on the order form	End of order preparation indicated by pick-to-light

REFERENCES AND DIMENSIONS MMSpharma® SMART SHELVING SYSTEM

Reference	Description	Image / Dimensions
SS00-1000450	MMSpharma® SMART SHELVING SYSTEM ASSEMBLY SET FOR 450 DRUGS/SKUs	
<p>It includes,</p> <ul style="list-style-type: none"> • 5 Shelving modules with 9 inclined shelves • 450 Pick-to-light devices with 4 colours • 5 Pick-to-light modular devices with 4 colours • 4 PC Panels for computerised system management • 1 Controller with 320 W industrial power supply • 1 Pick-to-light communication modem • 1 MMSpharma System (HMI) Management Software Licence 		 <p>3,600*1,600 mm (w*d)</p>
SS00-1000540	MMSpharma® SMART SHELVING SYSTEM ASSEMBLY SET FOR 540 DRUGS/SKUs	
<p>It includes,</p> <ul style="list-style-type: none"> • 6 Shelf modules with 9 inclined shelves • 540 Pick-to-light devices with 4 colours • 6 Pick-to-light modular devices with 4 colours • 4 PC Panels for computerised system management • 1 Controller with 320 W industrial power supply • 1 Pick-to-light communication modem • 1 MMSpharma System (HMI) Management Software Licence 		 <p>4,800*1,600 mm (w*pr)</p>
SS00-1000630	MMSpharma® SMART SHELVING SYSTEM ASSEMBLY SET FOR 630 DRUGS/SKUs	
<p>It includes,</p> <ul style="list-style-type: none"> • 7 Shelf modules with 9 inclined shelves • 630 Pick-to-light devices with 4 colours • 7 Pick-to-light modular devices with 4 colours • 4 PC Panels for computerised system management • 1 Controller with 320 W industrial power supply • 1 Pick-to-light communication modem • 1 MMSpharma System (HMI) Management Software Licence 		 <p>3,600*2,800 mm (w*d)</p>
SS00-1000720	MMSpharma® SMART SHELVING SYSTEM ASSEMBLY SET FOR 720 DRUGS/SKUs	
<p>It includes,</p> <ul style="list-style-type: none"> • 8 Shelving modules with 9 inclined shelves • 720 Pick-to-light devices with 4 colours • 8 Pick-to-light modular devices with 4 colours • 4 PC Panels for computerised system management • 1 Controller with 320 W industrial power supply • 1 Pick-to-light communication modem • 1 MMSpharma System (HMI) Management Software Licence 		 <p>4,800*2,800 mm (w*d)</p>