SMC
INTERNATIONAL TRAINING

M&I 400

M&I-400 - Mechatronics & Industry 4.0

Let students learn by practising on an innovative next-generation platform!

INTERNATIONAL TRAINING

SMC – TRUSTED BY OUR CUSTOMERS SINCE 1959

SMC Corporation is world leader in producing and supplying automation and pneumatic components, with over 60 years experience, working in over 80 countries.

SMC INTERNATIONAL TRAINING - THE EDUCATIONAL DIVISION OF SMC

We can bring you up to speed with all the latest developments in industrial automation to help give you the expertise and technical skills required in today's competitive market.

Taking INDUSTRY's needs as benchmark, our products target universities, vocational training centres and technical training centres, plus major companies who provide their own training internally.

Discover our wide range of solutions in:

- SOFTWARE / eLEARNING - online courses to give you theoretical knowledge in automation technologies, simulation software in automation technologies and the online emulation platform for developing and controlling digital twins.
- TECHNOLOGY TRAINERS - thirteen different product families that allow you to develop skills in specific technologies such as pneumatics, hydraulics, electricity and control, sensors, mechanics or robotics.
- PROCESS CONTROL - two product families specifically designed to develop skills in the field of industrial process control.
- MECHATRONICS - eight different product families designed for training in multiple mechatronics and industrial automation technologies.
- INDUSTRY 4.0 - three product families designed to work with industry 4.0 technologies, advanced manufacturing concepts and the reality of the connected company. As well as special editions of three of the mechatronics families, including Industry 4.0 technologies.
- CERTIFICATION - a comprehensive international certification programme endorsed by the SMC Competence Center.

For more information, visit www.smctraining.com

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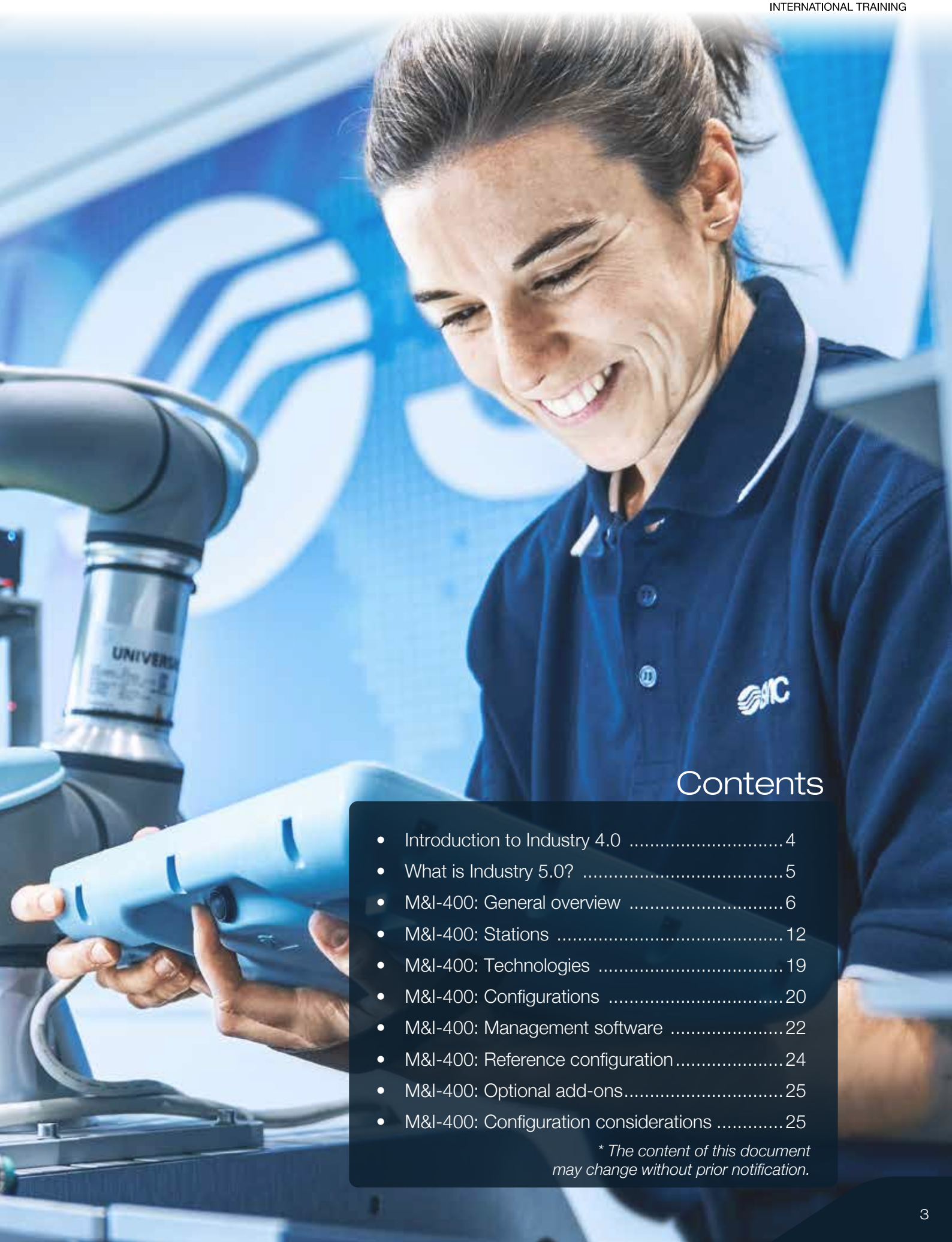

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** The content of this document may change without prior notification.*

Why Industry 4.0?

Because digitalization is changing our lives. The way we work, relate with each other and consume are different and companies need to adapt to that reality.

Customer requirements:

- Personalisation. Batch size one.
- 24/7 online shopping.
- Full tracking of the order/shipment.
- Competitive prices.
- Fast delivery.
- New products.

Industrial revolutions throughout history:

1st - Mechanisation, steam engine…

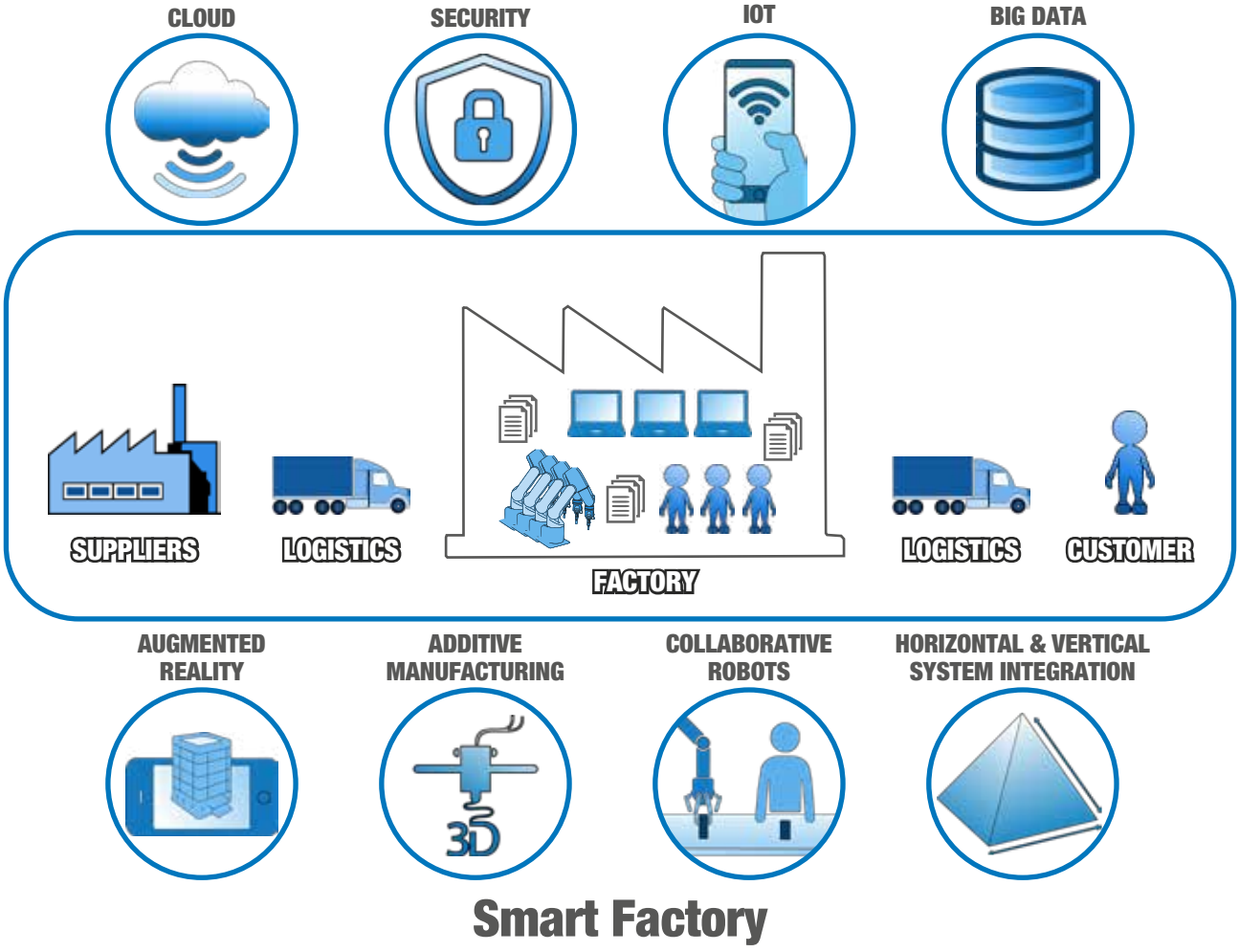
2nd - Mass production, electricity...

3rd - Automated production, computers...

4th - Cyber-physical systems.

Technology at the service of the business

Companies need highly qualified experts able to interact with factories and intelligent machines, to respond to the needs of customers.



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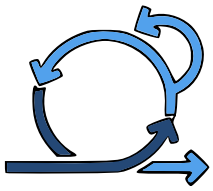
Benefits of Industry 4.0

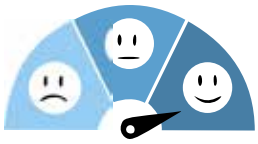
Industry 4.0 brings with it significant business value for companies. Its main benefits are:

EFFICIENCY



AGILITY

INNOVATION



INCREASED CUSTOMER SATISFACTION

REDUCED COSTS

INCREASED REVENUE

What is Industry 5.0 or Society 5.0?

The concept of Industry 5.0 complements Industry 4.0, making research and innovation drive the transition towards a sustainable, human-centred and resilient industry.

While Industry 4.0 is primarily a techno-economic vision, describing how industry uses technology to function better in a changing world and economy, Industry 5.0 focuses its vision on the impact that industry can have on society.

That's why the M&I-400 system presented below has been designed, not only focussing on the use and training of the technologies used by INDUSTRY 4.0, but also taking into account important aspects such as SUSTAINABILITY and PEOPLE.

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Discover the cyber-physical system, compact and modular, which allows us to enter the reality of the Smart Factory

The training equipment for developing skills in mechatronics and industry 4.0 technologies

Scan to browse the web

Let students learn by practising on an innovative next-generation platform!

M&I-400

Mechatronics and Industry 4.0

M&I-400 - Mechatronics and Industry 4.0

M&I-400 is a learning system designed to help technology instructors who are looking for innovative formulas to help their students to develop skills and get used to the most sought after mechatronics and industry 4.0 technologies.

Designed to help the instructor

This training equipment makes it possible to carry out projects and activities that motivate students during their practical classes due to the relevance of the integrated industrial components and its attractive design.

M&I-400 emulates a highly automated factory, where different types of products are produced, packed and shipped. The M&I-400 training system makes it possible to work on advanced and connected manufacturing concepts.

Its modular nature allows the user to configure the system that best suits their needs, also enabling staggered growth over time. Starting from an initial basic configuration, a subsequent expansion is possible, adding new work stations and, therefore, new technologies.

The M&I-400 training equipment offers a professional training experience that matches the industrial reality, where all the components are of standardised use in the industry. What's more, it's a flexible system that allows the user to customise certain parameters, such as the range of controller used.

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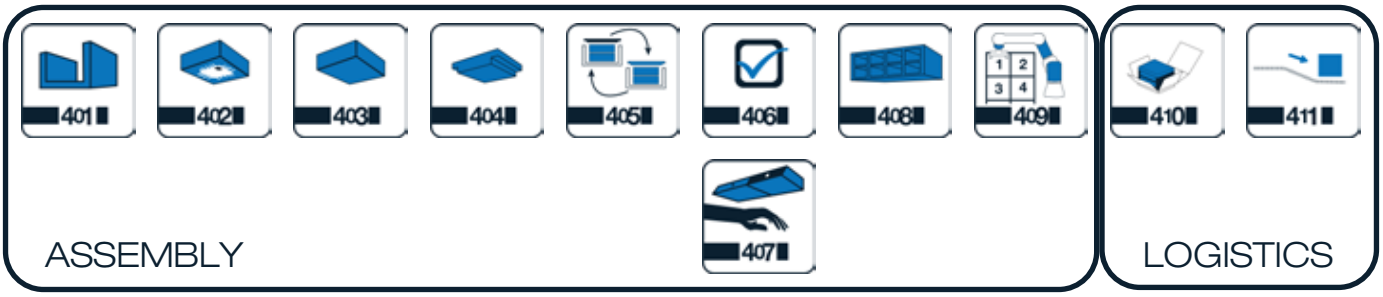
M&I-400 - Conceptual layout

The M&I-400 training equipment has two work areas, the assembly area and the logistics area.

- ASSEMBLY: The assembly process is made up of 9 sequential stations. During this process, the container is supplied, as well as the different fillings, smart or basic. As well as this, the capping, quality inspection and storage of the product takes place.

  "Pick to Light" Station - The M&I-407 corrections station is included in the assembly process. It's a guided correction station, with manual interaction, where PTL (Pick / Put to Light) technology is used.

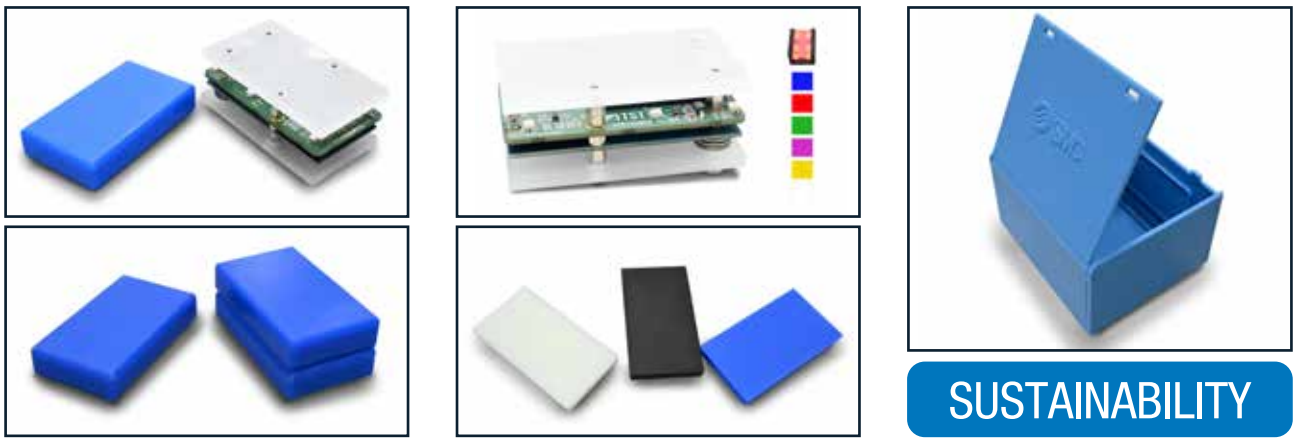
- LOGISTICS: The logistics block is made up of 2 stations, also sequential, the packing station and the dispatch station. In this part of the process, the products can be packed in secondary packaging and then dispatched along the different ramps.



M&I-400 - The products

The M&I-400 training equipment makes it possible to carry out multiple product configurations:

- Content type: smart (iProduct) or basic.
- Smart content settings: colour definition (6 options available).
- Basic content settings: number of fillings to include (none, 1 or 2 heights).
- Cap colour: white, blue, black or no cap.
- Secondary packaging: Possibility of packing the product in a box.



SUSTAINABILITY is an important factor that has been taken into consideration during the conception and design of this system. That's why all of the materials that make up the products made by the M&I-400 system are reusable, avoiding the use of disposable consumables.

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M&I-400 - Stations

The M&I-400 stations have a new and attractive design. It's a compact design that makes it possible to integrate a larger number of technologies into less space.

The station concept is also modular, made up of five blocks that are interconnected with each other in a very intuitive way via connectors. The five basic models are:

- The structure, with a distinguishing aesthetic finish.
- The transport system in its two pneumatic and electric versions.
- The electrical cabinet with integrated control.
- A control panel.
- The table where the functional blocks of each station are located.

Each station has TWO CONTROLLERS, one in the main cabinet for station control and another located in the transport module. It's worth highlighting the autonomy of the transport system which, thanks to the inclusion of a PLC, can operate as an independent unit simply by connecting it to a power supply.

The M&I-400 system allows the integration of the WiFi AP & Server or AMS cabinet in the M&I-401, M&I-408 or M&I-409 stations:

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• AMS CABINET

Includes:

- Access point to the local network described in the wireless system (WIFI AP).
- Pre-configured compact computer. This computer acts as a web server where the system's management software and database are located.
- Augmented Reality Server for the SMC AR-Viewer application.
- AMS (Air Management System) which allows the management and pressure and flow savings of the system.
- EDR (Energy Data Receiver) that receives power consumption information from the power tags.

• WiFi AP & SERVER

Includes:

- Access point to the local network described in the wireless system (WIFI AP).
- Pre-configured compact computer. This computer acts as a web server where the system's management software and database are located.
- Augmented Reality Server for the SMC AR-Viewer application.

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INTERNATIONAL TRAINING

M&I-400 is composed of up to 11 independent stations with integrated control.

The production, packaging and dispatch of different types of products are carried out at the different processing stations. All managed using an M.E.S. system.

Each of the M&I-400 system stations carries out a different part of the process.

ENERGY EFFICIENCY

IO-Link SMART DEVICES

680x482x1300mm

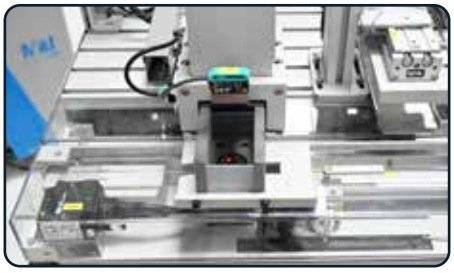
• M&I-401 - Container feeding, checking and rejecting station

401

The function of this station is to feed containers to the system, which are stored in a gravity feeder.

All of the containers have an RFID tag that allows them to be identified and traced throughout the whole process.

Once supplied, the position of the container is verified and, if this is not correct, the container is rejected and removed from the system.



Program in Arduino IDE!

ENERGY EFFICIENCY

IO-Link SMART DEVICES

680x482x1300mm

• M&I-402 - iProduct feeding station

402

This station feeds the smart fillings (iProduct) from a horizontal store and inserts them into the product container.

This smart filling, based on a compact development board with an integrated microcontroller, will light up with the colour defined for the product to be manufactured, identified in the RFID tag. The iProduct has 6 different colours that the product can be illuminated with.

ENERGY EFFICIENCY

IO-Link SMART DEVICES

SAFETY

680x482x1350mm

• M&I-403 - Filling feeding station

403

This station feeds the basic fillings from a vertical store and inserts them into the product container.

One or two heights of this type of filling can be inserted. The quantity to be fed will be defined in the RFID tag according to the product being manufactured.

This station has built-in security technologies. It has an electromagnet closure that only allows it to be opened in order to refill the raw material safely.

IO-Link SMART DEVICES

680x482x1250mm

• M&I-404 - Lid sorting and feeding station

404

There are three different types of caps according to their colour: white, blue and black.

This station feeds the caps to an index plate where they are sorted. Then, it fits the cap for the product being manufactured, identified in the RFID tag, onto the container.

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• M&I-405 - Disturbance station

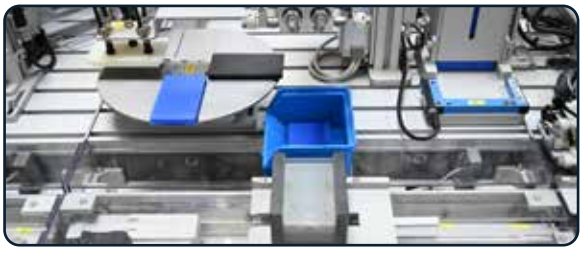
This station is 100% educational. It aims to create disturbances / modifications, in the manufactured product.

You can choose which orders will have disturbances in the management software. These disturbances are created randomly, following a predefined percentage.

The station will modify the product components - type and/or amounts of filling, and/or cap - based on the defined disturbances.

IO-Link SMART DEVICES

680x482x1200mm



• M&I-406 - Final inspection and rejection station

This station carries out quality control of the product once assembled, and rejects it if the result of the inspection is unsatisfactory. To do this, it has an artificial vision camera.

This camera has the option of creating a history with the photos taken, providing a database of photos that the user can use to carry out their own projects.

ENERGY EFFICIENCY

IO-Link SMART DEVICES

ARTIFICIAL VISION

680x482x1200mm

Pick to Light - Assisted manual interaction

PICK TO LIGHT

680x482x1250mm

- **M&I-407** - Assisted manual interaction station

If the M&I-406 station rejects the product in manufacturing, its defects can be corrected so that it can be re-entered into the system.

This station allows the defective product to be corrected and recovered through manual interaction, assisted by “Pick to Light” technology. Using numerical and luminous indicators, this technology guides the user in correcting the components.

The station has a key user identification system with integrated RFID that, depending on the type of user, will allow different actions to be carried out.

IO-Link SMART DEVICES

680x482x1250mm

- **M&I-408** - Pneumatic warehouse station

The function of this station is to store the finished product.

It has a vertical store with 8 positions, where the product containers are placed through pneumatic handling.

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• M&I-409 - Robotic warehouse station

The function of this station is to store the finished product, using robotic technology.

It has a horizontal store with 8 positions, where the collaborative robot places the products being manufactured.

COLLABORATIVE ROBOTICS

680x482x1400mm

• M&I-410 - Packaging station

The function of this station is to insert the finished product into secondary packaging, a box, for subsequent dispatch.

The secondary packaging is labelled beforehand, incorporating a barcode to identify the product.

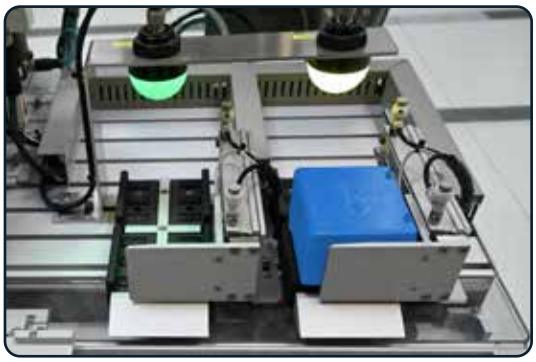
IO-Link SMART DEVICES

680x482x1350mm

• **M&I-411** - Dispatching station

The finished product will be dispatched from this station.

The station has 2 different ramps, each with 2 locations. Each ramp has an indicator light that makes it possible to identify the location of the ramp.



ENERGY EFFICIENCY

IO-Link SMART DEVICES

680x482x1200mm

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Scan to watch the video

Scan to watch the video

• **M&I-412** - Autonomous mobile robot

Is a technological proposal that merges an ***Autonomous Mobile Robot (AMR)***, a control service and a mobile application to optimise inventory management through the automation and coordination of activities. The system will detect by itself the shortage of raw materials or the need for recycling in a specific station, and the robot will move to carry out the corresponding task.

The special version of the mobile robot, the ***MoMa***, is an innovative solution that combines the power of a mobile robot with the precision of a collaborative robotic arm. This integrates a RobotIQ collaborative electric gripper and artificial vision technology.

M&I-400 - Technologies

The M&I-400 stations have a new and attractive design. It's a compact design that makes it possible to integrate a larger number of technologies into less space. The M&I-400 system includes the following technologies per station, some of which are common to all stations.

The most sought after mechatronics and industry 4.0 technologies

	401	402	403	404	405	406	407	408	409	410	411
PNEUMATICS	✓	✓	✓	✓	✓	✓		✓		✓	✓
SENSORS	✓	✓	✓	✓	✓		✓			✓	✓
ARTIFICIAL VISION						✓					
MANIPULATORS	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
PICK TO LIGHT							✓				
MOTION CONTROL	✓	✓		✓	✓					✓	✓
VACUUM		✓		✓	✓					✓	
ELECTRIC ACTUATORS	✓	✓		✓	✓					✓	✓
ENERGY EFFICIENCY	✓	✓	✓			✓					✓
SAFETY			✓								
IO-Link SMART DEVICES	✓	✓	✓	✓	✓	✓		✓		✓	✓
COLLABORATIVE ROBOTICS									✓		

Technologies that are common to all stations:

INDUSTRIAL COMMUNICAT. · HMI · DISTRIBUTED I/O · MANAGEMENT SOFTWARE · WEB SERVICES · ELECTRICAL PANEL · IDENTIFICATION SYSTEMS · AUGMENTED REALITY · INDUSTRIAL CONTROLLERS · MQTT · AMR

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SMC AR Viewer - Augmented reality

The augmented reality software is an application that facilitates the visualisation of information from the physical system to which it is associated, enabling real-time interaction by combining elements of the real and virtual world.

The operability of this software application is based on the implementation of strategically placed markers at each station of the physical equipment, which act as links to additional information for users.

This technology is included in all stations of the M&I-400 system.

Scan to watch the video

M&I-400 - Possible configurations

The modularity and flexibility of the M&I-400 training system allows multiple configurations, from a minimum of 2 stations, to the complete system of 11 stations.

8 station configuration - Assembly & Logistics

Enter the product configurator and access the specifications and technical descriptions!

Complete configuration - 11 stations

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3 station configuration -
Logistics

Many configurations possible!

5 station configuration -
Assembly

M&I-MES - Management software

This allows the user to control and manage the M&I-400 system, storing and monitoring all process data. It is structured in four blocks: management, movement, supervision and administration.

MANAGEMENT MODULE

This module allows you to manage resources and send orders to the system. There are different functions within this module:

- **Order Management**: allows you to create, view, edit, and delete orders in the M&I-400 system. You can send different types of orders: MTS (Make to stock), MTO (Make to order), shipping or a combination of MTO and shipping.
- **Product management**: allows you to create different products, choosing between the existing raw material options, as well as naming the product created.
- **Customer management**: allows you to create, view, edit and delete the customers that have placed orders in the M&I-400 system.
- **Dispatcher**: this is the function in charge of sending orders. The disturbance configuration will be selected from this function if the M&I-405 station is available.
- **Warehouses**: M&I-400 has 2 warehouse-type stations. From this function, both warehouses will be displayed and can be edited, as well as making it possible to select the warehouse filling policy if both stations are available.

MOVEMENT MODULE

This module defines the physical layout and allows you to view the status of the system. There are different functions within this module:

- **Physical layout**: allows you to define the physical layout of the stations, activating those that are available.
- **System Status**: this feature allows you to view the status of each station. You can monitor when a station is in use or on alert, find out if the stations are connected, the work in progress and change the operating mode of the system.

SUPERVISION MODULE

This module monitors the alarms and the traceability of the orders. There are different functions within this module:

- **Tracking**: allows you to view the progress and tracking of customer orders, manufacturing and shipping orders, and products, both in real time and in order history.
- **Notifications**: this is an alarm and notifications manager. Notifies the user, in real time, of an alarm and also saves a history of notifications with data on resolution times, product being manufactured related to the alarm, etc.

ADMINISTRATION MODULE

This module allows you to edit the data of the user that you are working with in the management software.

M&I-MES - SMC Goods Receiver & Delivery

SMC Goods Receiver & Delivery is a mobile application available for Android and iOS devices and integrated with the management software through an API. This integration enables the customer's signature to be recorded as proof of product delivery, with the signature stored for later consultation from the management software.

In addition, the application simplifies warehouse management by allowing the creation, editing, and deletion of individual items and packs directly from mobile devices.

**Requires M&I-MES version 1.2.0 or later.*

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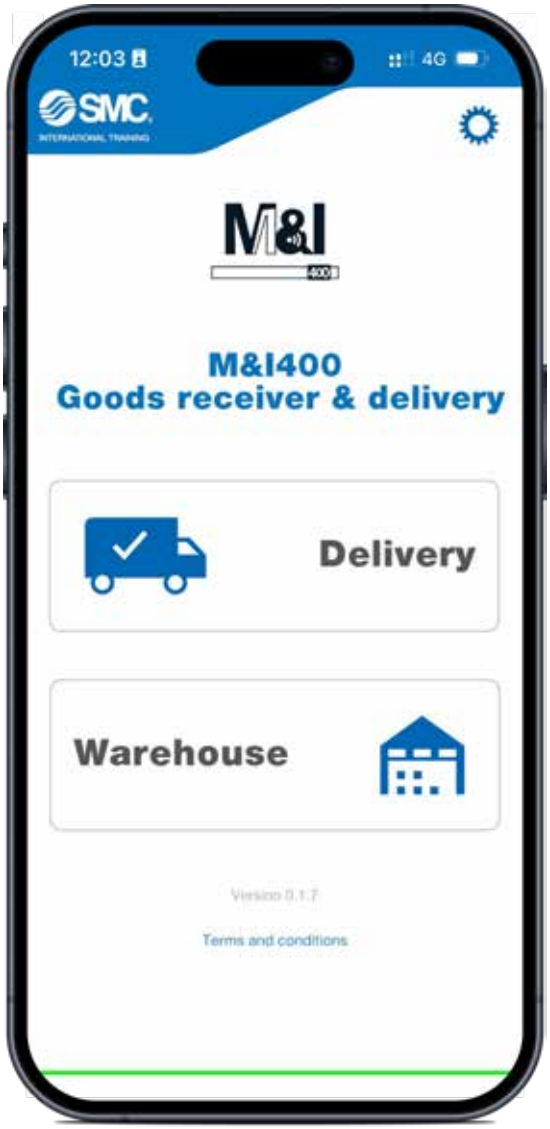

Android & iOS mobile application

API integration

Delivery signature recording

Item and pack management

1 2 3 4 5

Preparation - Delivery - Digital signature - Storage - Consultation

M&I-400 - Reference configuration

The M&I-400 training system allows you to choose from a series of options in its different stations.
The M&I-400 order references are as follows:

Reference for the stations with WiFi AP & Server*

**There must be ONE station with WiFi AP & Server in an M&I-400 system. It's a good idea to make it the first in the configuration.*

MAI 401 - A0 - 01 - 01 00

1

401	M&I-401 – Container feeding, checking and rejecting station
408	M&I-408 – Pneumatic warehouse station
409	M&I-409 – Robotic warehouse station

2

A	220-240 V	E	220-240 V
B	110-120 V	F	110-120 V
C	220-240 V	G	220-240 V
D	220-240 V	H	220-240 V

3

01	PLC Siemens S7-1500 (+ HMI standard)
02	PLC Siemens S7-1200 (+ HMI advanced)

4

01	With WiFi AP & Server
02	AMS Cabinet

5

00	Without robot
01	Robot UR3e*

**Only available in M&I-409 - Robotic warehouse station.*

Reference for M&I-MES Management software

MAI MES

Reference for AMR - Autonomous Mobile Robot for M&I-400

MAI 412 - 00 - 00 00 20

1

00	AMR standard
03	MOMA version with TM5 90 robot

2

20	AMR OMRON LD 60
21	AMR OMRON LD 90 (for MOMA version)

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Reference for the stations without WIFI AP Server / AMS Cabinet

MAI 401 - I0 - 01 - 00 00

1 2 3 5

1

401	M&I-401 – Container feeding, checking and rejecting station
402	M&I-402 – iProduct feeding station
403	M&I-403 – Filling feeding station
404	M&I-404 – Lid sorting and feeding station
405	M&I-405 – Disturbance station
406	M&I-406 – Final inspection and rejection station
407	M&I-407 – Assisted manual interaction station
408	M&I-408 – Pneumatic warehouse station
409	M&I-409 – Robotic warehouse station
410	M&I-410 – Packaging station
411	M&I-411 – Dispatching station

2

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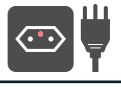
J		M	
K		N	

3

01	PLC Siemens S7-1500 (+ HMI standard)
02	PLC Siemens S7-1200 (+ HMI advanced)

4

00	Without robot
01	Robot UR3e*

**Only available in M&I-409 - Robotic warehouse station.*

M&I-400 - Optional add-ons

The M&I-400 system has a range of optional add-ons.

- Raw material

The raw material is required for the operation of the system. All stations include the station's own raw material. If additional raw material is needed, the following references are available on request.

RAW019	Containers with integrated RFID tag for M&I-401 station (8 units)
RAW020	iProduct smart filling for M&I-402 station (8 units)
RAW016	Basic filling for station M&I-403 (16 units)
RAW017	Blue caps for station M&I-404 (8 units)
RAW018	Black caps for station M&I-404 (8 units)
RAW023	White caps for station M&I-404 (8 units)
RAW021	Secondary packaging with BCR code for M&I-410 station (6 units)
RAW022	RFID tags for containers supplied at the M&I-401 station (8 units)

- eLEARNING-200

Find out more about the theory behind the technologies developed in M&I-400 with our eLEARNING-200 courses.

**See eLEARNING-200 catalogue.*

- Cibersecurity kit CBS400

Optional designed to adquire basic knowledge about cybersecurity.

The kit includes:

- Pen drive with the proposed exercises and installation guide for the required software.
- Compatible USB Wireless Adaptor.

- Implementation and training

Consult our implementation and training service for the M&I-400 system.

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- SMCTwin-400 - Tool for the development and use of digital twins

SMCTwin-400 is an online emulation platform where, through annual subscription licences, you will be able to develop and control your digital twins and work with some of those created for SMC International Training's didactic equipment. It is an intuitive and easy-to-use tool that has been developed in response to the demands of Industry 4.0.

	First subscription	Subscription renewal
25 floating licenses	TWN025-00-CAA	TWN025-00-DAA
50 floating licenses	TWN050-00-CAA	TWN050-00-DAA
100 floating licenses	TWN100-00-CAA	TWN100-00-CAA

* PLC and HMI programs and programming software are not included.

** One-year duration and electronic delivery.

M&I-400 - Configuration considerations

M&I-401

M&I-408

M&I-409

Possible **STARTING** stations.
Start of configuration.

**There must be ONE station with WiFi AP & Server in an M&I-400 system. It's a good idea to make it the first in the configuration.*

M&I-408

M&I-409

M&I-411

Possible **END** stations.
End of configuration.

M&I-407

- Independent station. Does not include transport system. Manual transfer.
- The M&I-407 station requires the M&I-406 station in order to operate correctly.

HMI

- It is not possible to combine HMI standard with PLC Siemens S7-1500
- It is not possible to combine HMI advanced with PLC Siemens S7-1200

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