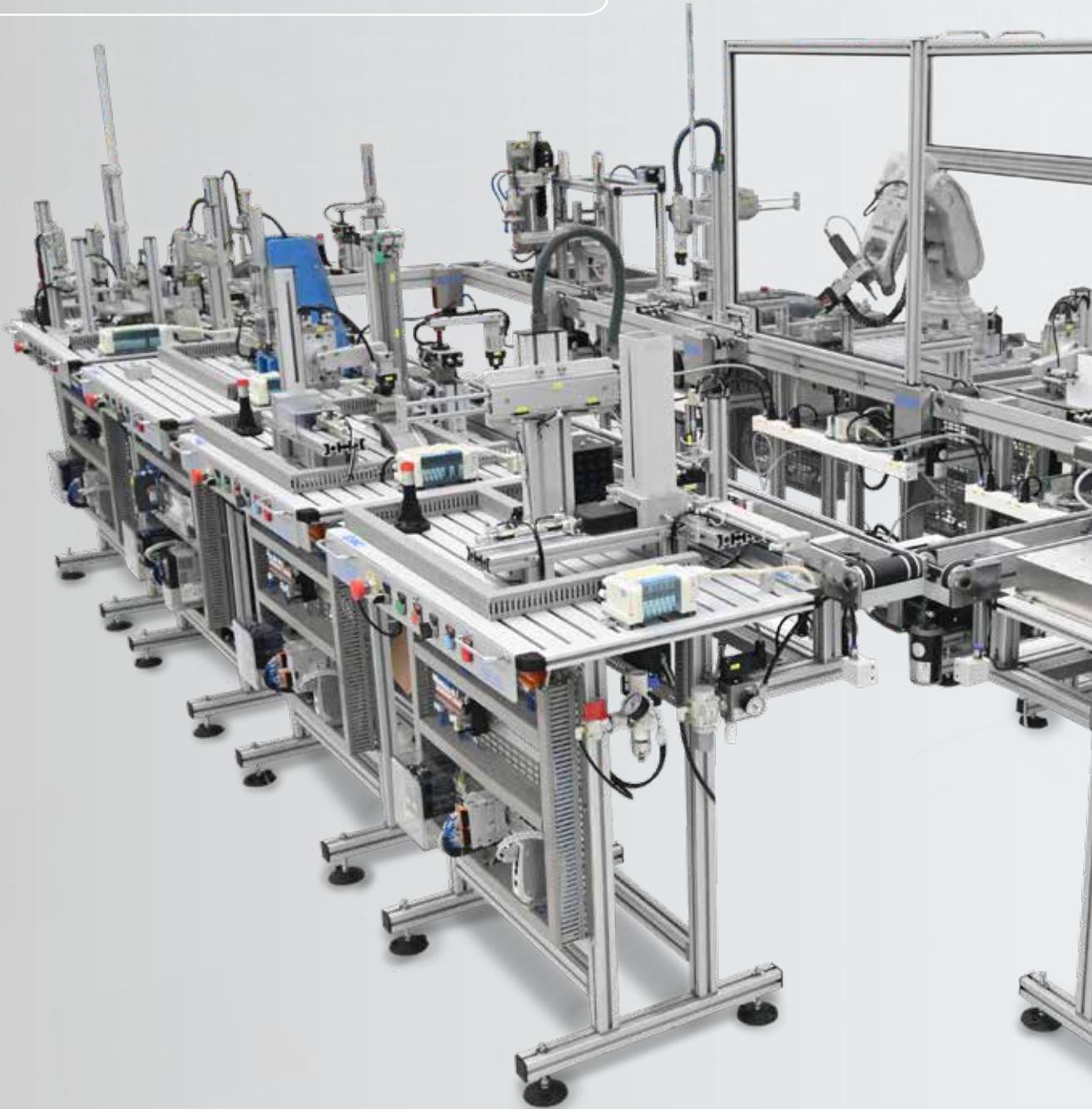




FMS-200

Flexible integrated assembly systems

Integrated training in industrial automation



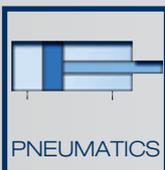
In the following TECHNOLOGIES...



HYDRAULICS



ELECTRICAL
PANEL



PNEUMATICS



VACUUM



ELECTRIC
MOTORS



SENSORS



IDENTIFICATION
SYSTEMS

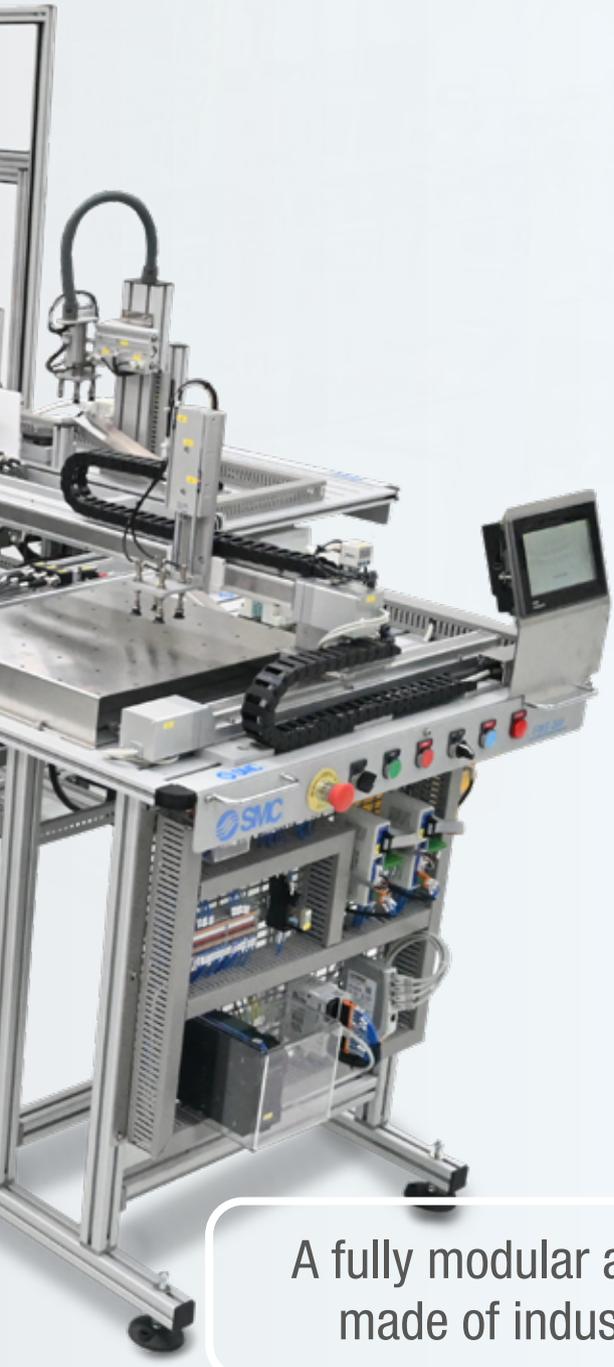


ARTIFICIAL
VISION



CONTINUOUS
PROCESSES

Develop the SKILLS...



A fully modular and flexible system, made of industrial components





■ FMS-200 - Flexible integrated assembling systems

The modular features of this flexible automation cell enables the introduction of variations in its stations so that they adapt to the different requirements of companies and training centers. From a simple configuration of one station only (working fully autonomously) to a complex configuration with eight or ten stations, the possibilities are endless.

In addition, it facilitates a staggered investment, i.e. starting with an initial simple configuration which can be easily enhanced by adding workstations.

All the components in the FMS-200 are used in industry, so that the user can work with real elements at all times making the learning process more meaningful.



The system includes a whole series of feeding, handling, verification and loading operations etc. carried out using components from different technologies (pneumatics, hydraulics, sensors, robotics, communications, control and HMI.).



FMS-200 includes the breakdown simulation system which generates up to 16 different breakdowns to be diagnosed by the user.

The different process stations assemble a turning mechanism. To provide the system with greater flexibility, stations adapt to a wide variety of assemblies, introducing variations in the materials, colours and part sizes. The combination of all these possibilities means that a total of 24 different

assemblies can be obtained enabling the use of production management strategies.

The control panel is completely modular and can be rapidly disassembled so the user can design and integrate a new control.

Each station of FMS-200 carries out one part of the process.



- **FMS-201: Body supply**

In this station, the base which acts as the support to the assembled product is fed.

- **FMS-202: Bearing selection/ supply**

In this station, the bearing is assembled in the base housing. Bearings with different heights can be selected.



- **FMS-203: Hydraulic press**

This phase of the press fits bearing inserted in the previous station using a hydraulic ram.

- **FMS-204: Shaft selection/ supply**

The shaft is inserted into the product. There are two types of shafts manufactured from different materials: aluminium and nylon.



- **FMS-205: Cover selection/ supply**

This station inserts a lid on the set of parts. There are 6 different types of lids: depending on material, colour and height.

- **FMS-206: Screws supply**

This station inserts four screws in the base of the workpiece.





• FMS-207: Robotized screwing

The seventh FMS-200 station integrates robotics technology. The robot screws in the four screws inserted in the product by the previous station. In addition, shaft and lid assembly exchange operations can be carried out.

• FMS-208: Automatic warehouse

This station stores the finished products.



• FMS-209: Paint drying in oven

During this phase of the assembly a paint drying process is simulated using a polycarbonate oven.

• FMS-210: Quality control using artificial vision

The incorporation of this station in the FMS-200 family represents the integration of the quality control technology via artificial vision. The workpiece is transferred to the inspection position in which an artificial vision camera examines it against a known good part. Size, shape, missing holes can all be verified.



The transfer system:



• Linear transfer

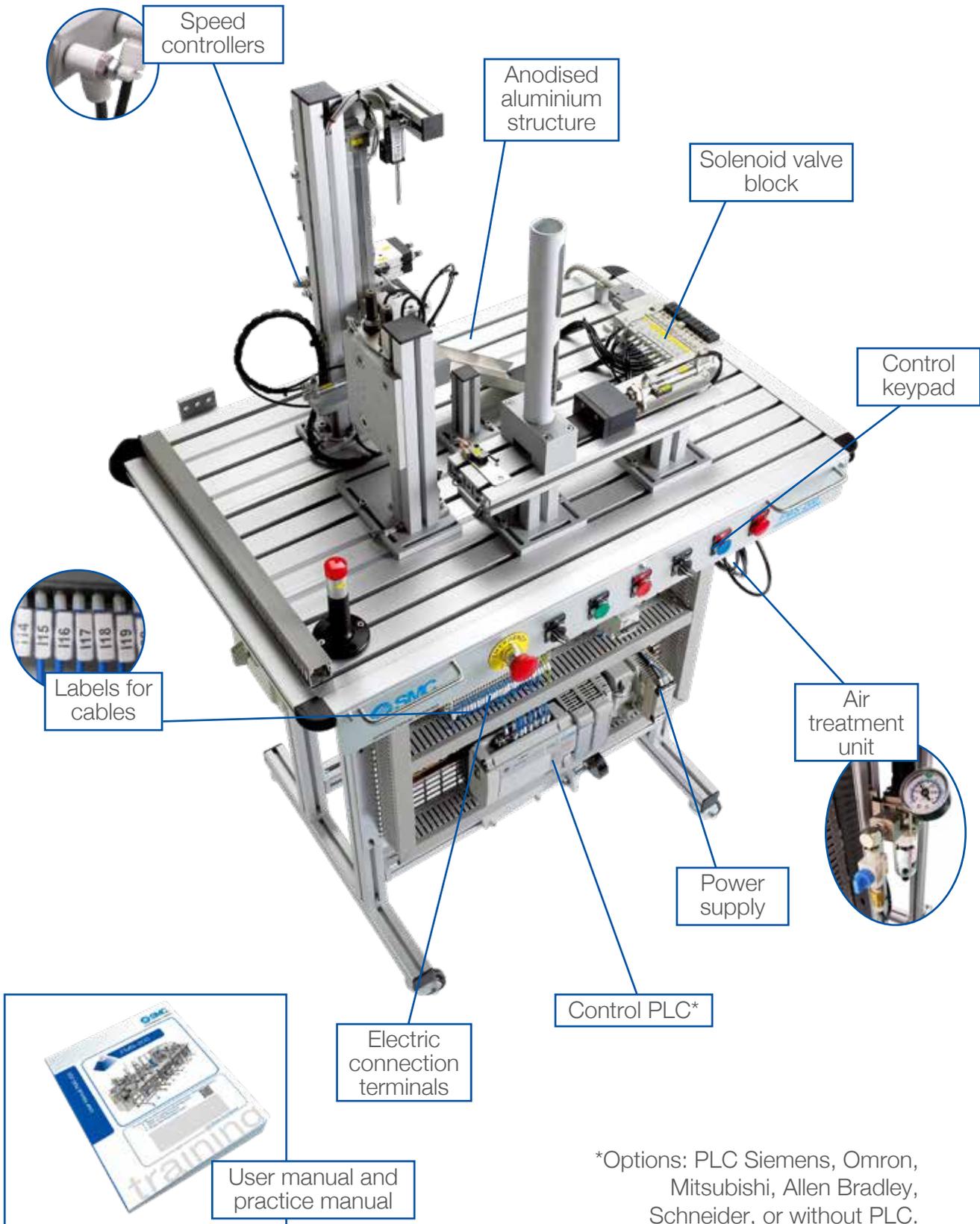
This is a rectangular transfer system through on which pallets containing the workpiece circulate around the stations.

• Modular transfer

In this FMS-200 version, each of the stations includes an individual transfer section. Multiple combinations of layouts can be developed, with the option of joining stations at 90° or 180° (section in curve, straight section).



■ Common element in all stations



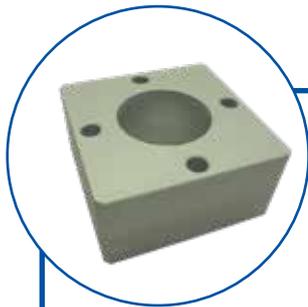
*Options: PLC Siemens, Omron, Mitsubishi, Allen Bradley, Schneider, or without PLC.



■ FMS-201 - Body supply

In this station, the base which acts as the support to the workpiece is fed, its orientation is verified and, if correct it is moved to the pallet located in the transfer system. If the base orientation is incorrect the base will be rejected.

The troubleshooting simulation system is included, which generates up to 16 different breakdowns to be diagnosed by the user.



Breakdown simulation system

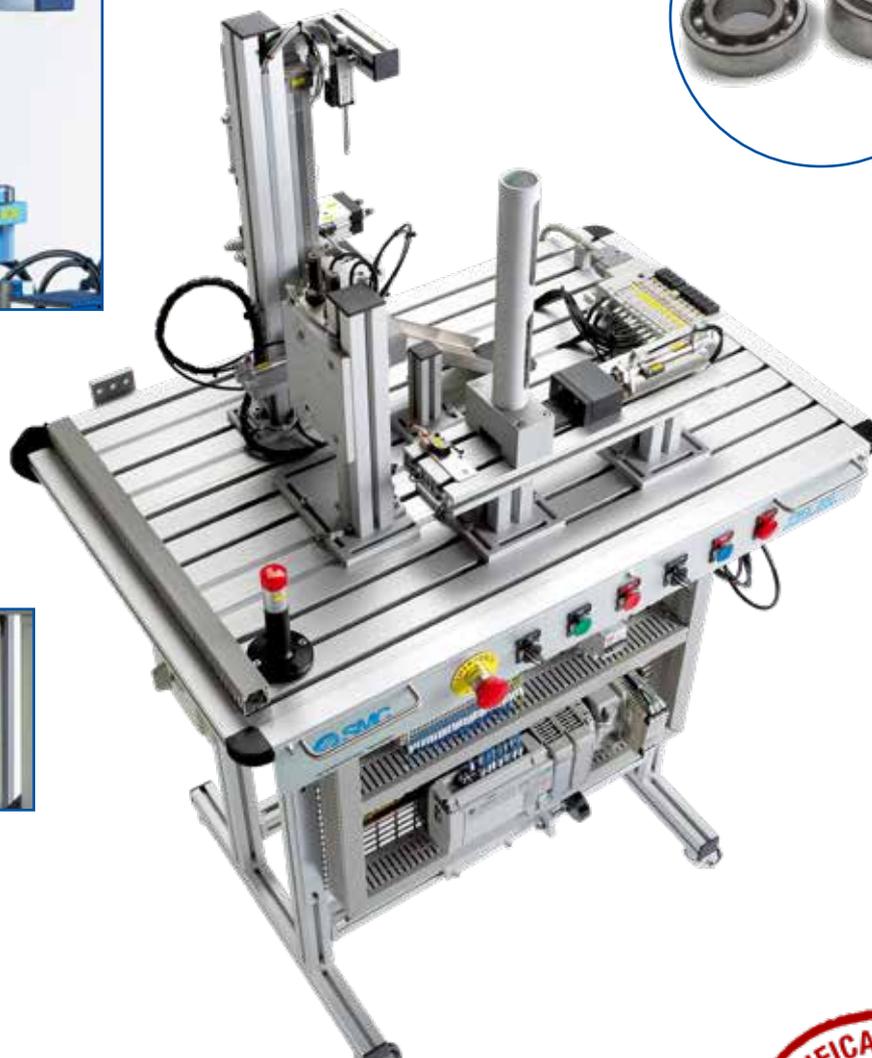


	With modular transfer	Without transfer
FMS-201 Body supply with Mitsubishi PLC	SAI0135	SAI0100
FMS-201 Body supply with Siemens PLC	SAI0163	SAI0114
FMS-201 Body supply with Allen Bradley PLC	SAI0133	SAI0120
FMS-201 Body supply with Omron PLC	SAI0149	SAI0124
FMS-201 Body supply with Schneider PLC	SAI0153	SAI0123
FMS-201 Body supply without PLC	SAI0170	SAI0122

■ FMS-202 - Bearing selection/ supply

In this station, the bearing is positioned in the base housing. To extend didactic options, bearings with different heights can be selected. To do this, a bearing height measurement is taken using a linear potentiometer. If the bearing height is not correct, it will be rejected.

The troubleshooting simulation system is included, which generates up to 16 different breakdowns to be diagnosed by the user.



Breakdown simulation system

	With modular transfer	Without transfer
FMS-202 Bearing supply with Mitsubishi PLC	SAI0235	SAI0200
FMS-202 Bearing supply with Siemens PLC	SAI0263	SAI0214
FMS-202 Bearing supply with Allen Bradley PLC	SAI0233	SAI0220
FMS-202 Bearing supply with Omron PLC	SAI0264	SAI0224
FMS-202 Bearing supply with Schneider PLC	SAI0265	SAI0229
FMS-202 Bearing supply without PLC	SAI0270	SAI0222





■ FMS-203 - Hydraulic press

This phase of the process presses the bearing inserted in the previous station by a hydraulic ram. Press fitting is simulated to facilitate the subsequent disassembly of the components and their re-use. Nevertheless, all the elements comprising the module are completely industrial.

The lower part of the station contains all of the hydraulic equipment which is required to feed the press cylinder with high pressure oil.

The troubleshooting simulation system is included, which generates up to 16 different breakdowns to be diagnosed by the user.



Breakdown simulation system



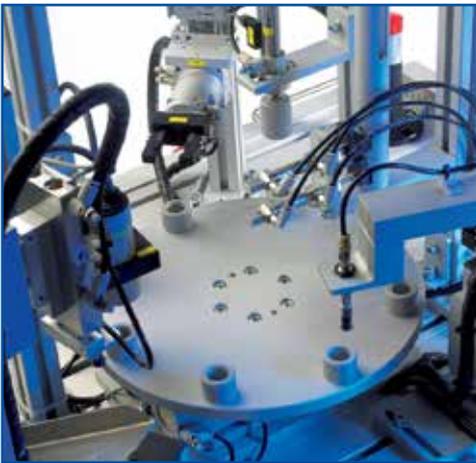
	With modular transfer	Without transfer
FMS-203 Hydraulic press with Mitsubishi PLC	SAI0335	SAI0300
FMS-203 Hydraulic press with Siemens PLC	SAI0363	SAI0314
FMS-203 Hydraulic press with Allen Bradley PLC	SAI0333	SAI0320
FMS-203 Hydraulic press with Omron PLC	SAI0364	SAI0324
FMS-203 Hydraulic press with Schneider PLC	SAI0365	SAI0323
FMS-203 Hydraulic press without PLC	SAI0370	SAI0322

■ FMS-204 - Shaft selection/ supply

In this fourth workstation, the shaft is assembled onto the workpiece coming from the previous station. There are two types of shafts depending on their material: aluminium and nylon. This increases the number of possible finished products, while also increasing the didactic capacities of the FMS-200.

The different operations undertaken in this station are distributed around an index plate. The operations are: shaft feeding, measuring shaft height, positioning the shaft in the correct orientation, material detection, removal of an incorrect shaft and finally the insertion of the shaft into the assembly.

The troubleshooting simulation system is included, which generates up to 16 different breakdowns to be diagnosed by the user.



Breakdown simulation system



	With modular transfer	Without transfer
FMS-204 Shaft supply with Mitsubishi PLC	SAI0435	SAI0400
FMS-204 Shaft supply with Siemens PLC	SAI0473	SAI0414
FMS-204 Shaft supply with Allen Bradley PLC	SAI0433	SAI0420
FMS-204 Shaft supply with Omron PLC	SAI0464	SAI0424
FMS-204 Shaft supply with Schneider PLC	SAI0465	SAI0423
FMS-204 Shaft supply without PLC	SAI0470	SAI0422



■ FMS-205 - Cover selection/ supply

This station inserts a lid on the set of parts which have been assembled in the previous stations. There are 6 different types of lids: depending on the material (aluminium or nylon), colour (light or dark) and height (high or low). This variety offers the station more didactic options due to a whole series of verification and measuring operations that are carried out. The different operations undertaken in this station are distributed around an index plate.

The troubleshooting simulation system is included, which generates up to 16 different breakdowns to be diagnosed by the user.



Breakdown simulation system

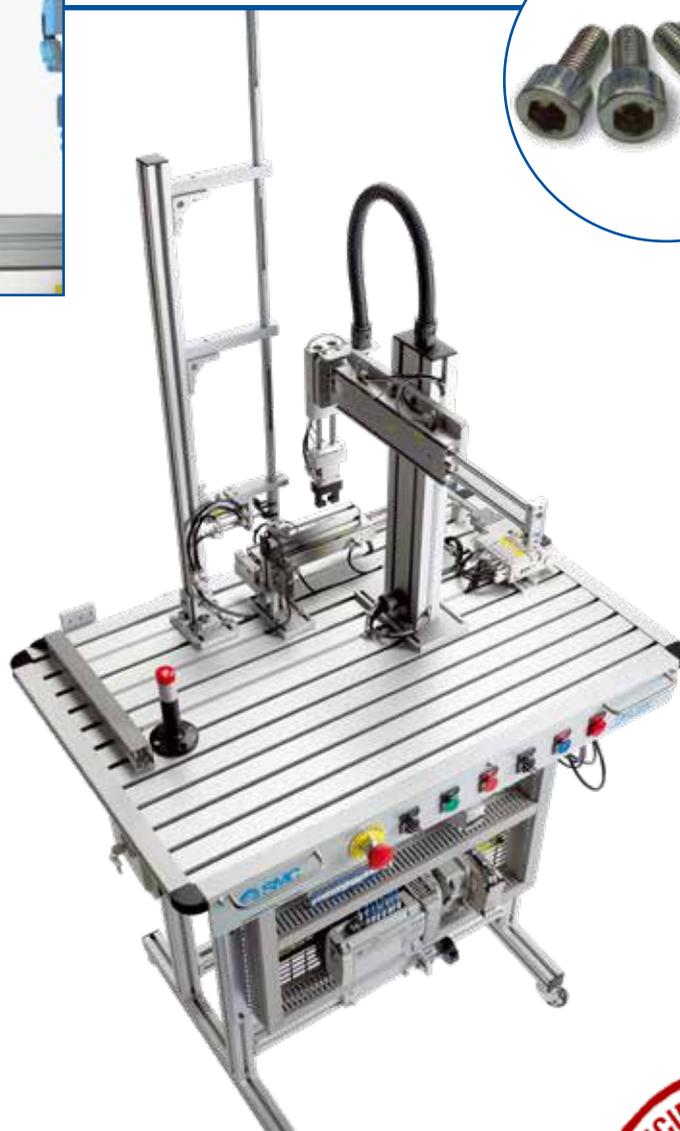


	With modular transfer	Without transfer
FMS-205 Cover supply with Mitsubishi PLC	SAI0535	SAI0500
FMS-205 Cover supply with Siemens PLC	SAI0551	SAI0519
FMS-205 Cover supply with Allen Bradley PLC	SAI0553	SAI0520
FMS-205 Cover supply with Omron PLC	SAI0550	SAI0524
FMS-205 Cover supply with Schneider PLC	SAI0554	SAI0523
FMS-205 Cover supply without PLC	SAI0552	SAI0522

■ FMS-206 - Screws supply

The sixth station supplies and inserts four screws in the base of the workpiece. Given that feeding is only carried out at only one point, an additional mechanism has been included in the transfer system to carry out successive rotations of the pallet. This element is comprised of a lifting cylinder and rotary actuator.

The troubleshooting simulation system is included, which generates up to 16 different breakdowns to be diagnosed by the user.



Breakdown simulation system

	With modular transfer	Without transfer
FMS-206 Screws supply with Mitsubishi PLC	SAI0635	SAI0600
FMS-206 Screws supply with Siemens PLC	SAI0637	SAI0616
FMS-206 Screws supply with Allen Bradley PLC	SAI0633	SAI0620
FMS-206 Screws supply with Omron PLC	SAI0638	SAI0624
FMS-206 Screws supply with Schneider PLC	SAI0639	SAI0623
FMS-206 Screws supply without PLC	SAI0650	SAI0622





■ FMS-207 - Robotized screwing

The seventh FMS-200 station integrates robotics technology which is widely used in automated environments.

An industrial robot is used to screw in the four bolts supplied by the previous station. The robot has a tool attached with a pneumatic gripper and an electric screwdriver and the station table includes material stores (with capacity for 6 lids and 6 shafts). In addition to the screwing operation, the robot can also be used for assembly and dismantling operations, plus exchanging material between stores.

These applications support an extensive range of possible programs for the robot controller which significantly extends its didactic capacities.

**Check available robot options.*



	With modular transfer	Without transfer
FMS-207 Robotized screwing with Mitsubishi PLC	SAI0762	SAI0700
FMS-207 Robotized screwing with Siemens PLC	SAI0763	SAI0716
FMS-207 Robotized screwing with Allen Bradley PLC	SAI0733	SAI0720
FMS-207 Robotized screwing with Omron PLC	SAI0760	SAI0724
FMS-207 Robotized screwing with Schneider PLC	SAI0764	SAI0723
FMS-207 Robotized screwing without PLC	SAI0761	SAI0722

■ FMS-208 - Automatic warehouse

This phase of the assembly process consists of the storage of finished products.

In FMS-200, the warehouse has been set up using a system based on three coordinate shafts, two of them servo-controlled (X-Y axis) and a third vertical pneumatic shaft (Z axis) for collection / deposit of the material.

There is an optional version that includes a colour touch screen operator terminal.



Optional HMI screen SAI0811



	With modular transfer	Without transfer
FMS-208 Storage station with Mitsubishi PLC	SAI0835	SAI0800
FMS-208 Storage station with Siemens PLC	SAI0863	SAI0813
FMS-208 Storage station with Allen Bradley PLC	SAI0833	SAI0820
FMS-208 Storage station with Omron PLC	SAI0849	SAI0824
FMS-208 Storage station with Schneider PLC	SAI0851	SAI0823
FMS-208 Storage station without PLC	SAI0850	SAI0822





■ FMS-209 - Paint drying

The paint drying phase is simulated using a polycarbonate oven. The workpiece is inserted into the oven which uses a bulb to simulate the paint drying process. Once this has finished, the product leaves the oven to go on to the next phase of the process. The system allows the user to modify the temperature value and the transit time of the assembly through the oven dependant on the requirements of the workpiece.



	With modular transfer	Without transfer
FMS-209 Paint drying station with Mitsubishi PLC	SAI0181	SAI0171
FMS-209 Paint drying station with Siemens PLC	SAI0177	SAI0173
FMS-209 Paint drying station with Allen Bradley PLC	SAI0182	SAI0174
FMS-209 Paint drying station with Omron PLC	SAI0176	SAI0172
FMS-209 Paint drying station with Schneider PLC	SAI0183	SAI0180
FMS-209 Paint drying station without PLC	SAI0179	SAI0175

■ FMS-210 - Quality control using artificial vision

The incorporation of this station in the FMS-200 family provides the integration of the artificial vision technology which is in frequent use in automated productive processes for quality control. The product in process coming from the previous station is transferred to the inspection position in which an artificial vision camera examines a series of variables in two of the four bolts. The results obtained from the examined variables are used to perform quality control of the product in process.

The troubleshooting simulation system is included, which generates up to 16 different breakdowns to be diagnosed by the user.



Artificial vision camera

Breakdown simulation system

	With modular transfer	Without transfer
FMS-210 Quality control station with Mitsubishi PLC	SAI0281	SAI0271
FMS-210 Quality control station with Siemens PLC	SAI0277	SAI0273
FMS-210 Quality control station with Allen Bradley PLC	SAI0283	SAI0274
FMS-210 Quality control station with Omron PLC	SAI0282	SAI0272
FMS-210 Quality control station with Schneider PLC	SAI0276	SAI0280
FMS-210 Quality control station without PLC	SAI0279	SAI0275





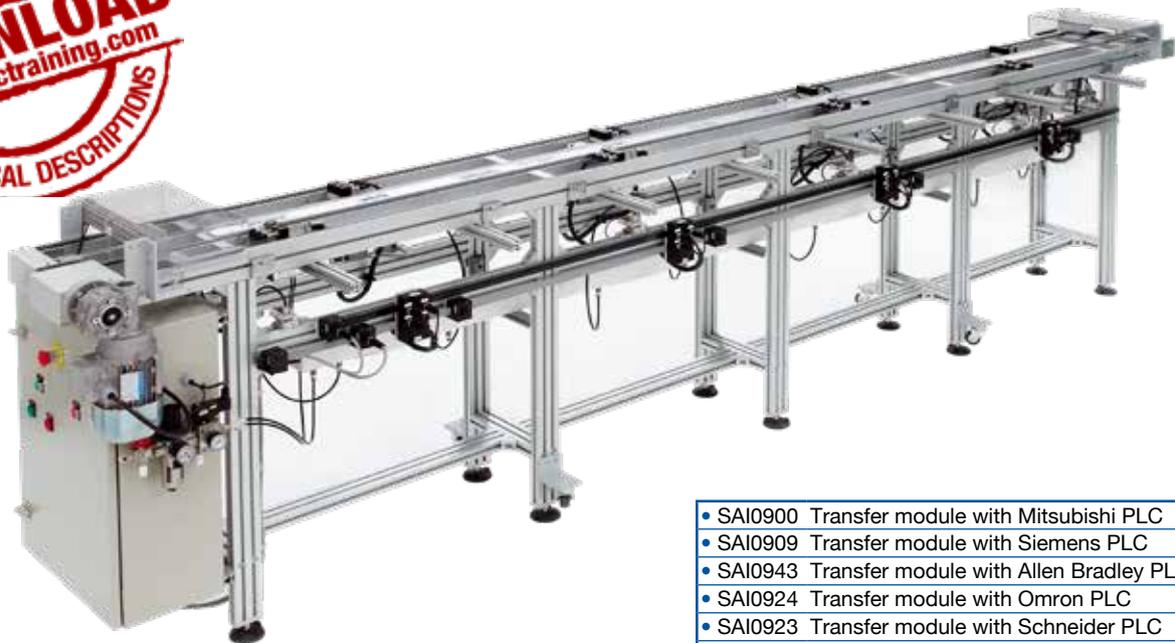
■ The transfer system

In order to provide the most flexible solutions for our customers needs, FMS-200 is available in two different versions: with a four meters long linear transfer system or with modular transfer sections coupled to each station. The two options are described below.

Linear transfer

This is a rectangular transfer system through which the pallets containing the workpiece circulate around the stations. These pallets are provided with a binary identification system.

It allows the integration of up to a maximum of eight workstations which are easily and quickly connected.



- | |
|--|
| • SAI0900 Transfer module with Mitsubishi PLC |
| • SAI0909 Transfer module with Siemens PLC |
| • SAI0943 Transfer module with Allen Bradley PLC |
| • SAI0924 Transfer module with Omron PLC |
| • SAI0923 Transfer module with Schneider PLC |
| • SAI0922 Transfer module without PLC |

In addition, the linear transfer enables extension and/or modification of the stations without having to construct a new interface. This supports making a staggered investment over a period of time, starting with a simple configuration and progressively extending stations.

The transfer includes the following elements:

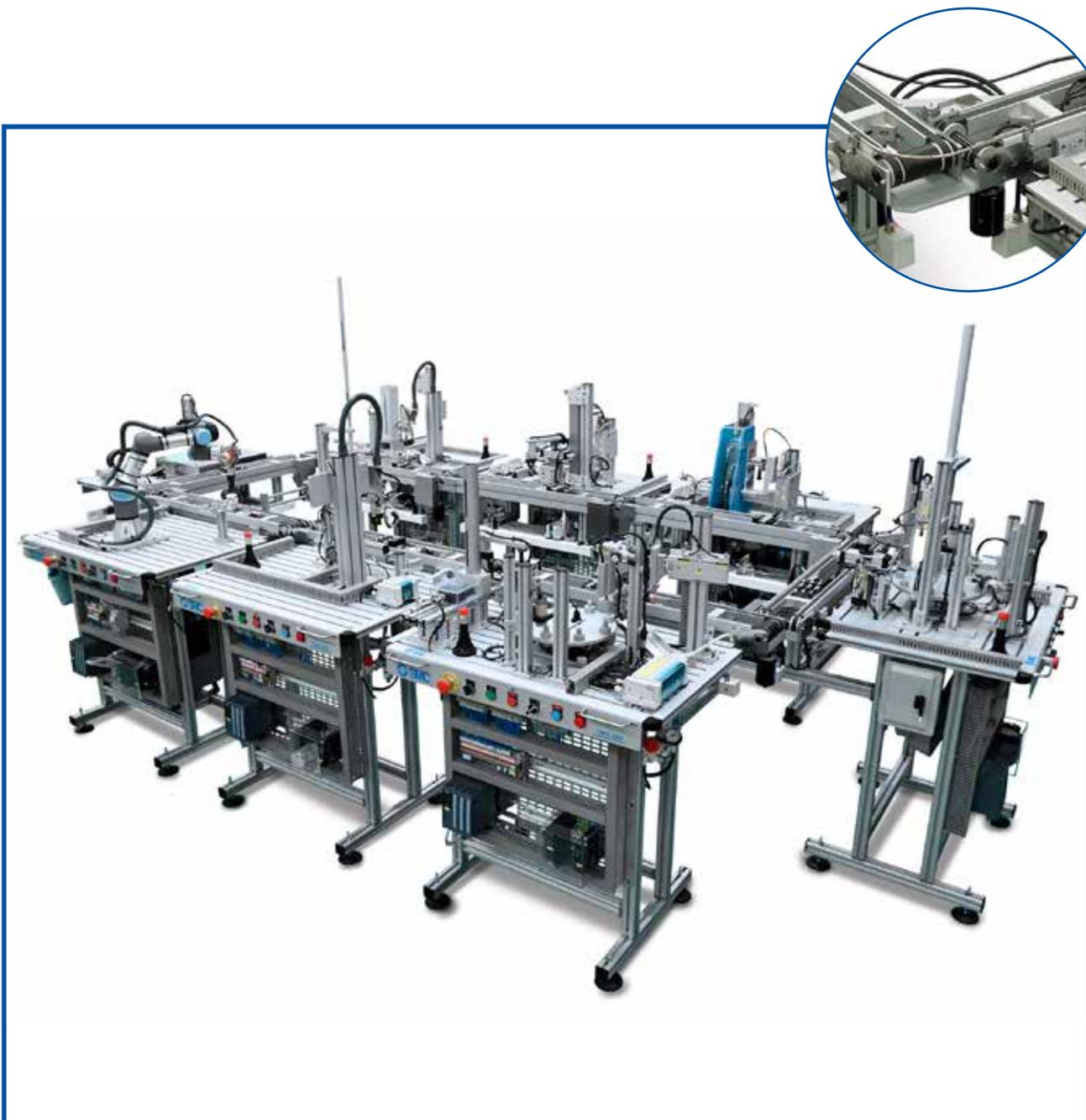
- Command and control cabinet.
- Connections conduit.
- Air treatment unit.
- Emergency stop button.
- Retaining stops and pallet lifters (both located at the height of each process station).
- Pallet identification system.
- Buffers, risers and pallet turners.
- Product in process transport pallets.

Modular transfer

In this FMS-200 version, each of the stations includes an individual transfer section. Multiple combinations of layouts can be developed, with the possibility of joining stations at 90° or 180°.

The retainers and pallet lifters, electrical connections, air vents and the other elements required for the operation of each transfer are included in each of the corresponding stations.

This system also allows scalability of the product over time, enabling a greater number of stations to be joined.



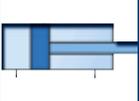


■ FMS-200 - With this system you could...

FMS-200 comes up with different practical activities targeting skills in the technologies featuring in the table (below).

TECHNOLOGIES

SKILLS

	 HYDRAULICS	 ELECTRICAL PANEL	 PNEUMATIC	 VACUUM	 ELECTRIC MOTORS	 SENSORS	 IDENTIFICATION SYSTEMS	 ARTIFICIAL VISION	 CONTINUOUS PROCESSES	 P CC
 ANALYSIS	■	■	■	■	■	■	■	■	■	■
 TROUBLESHOOT	■	■	■	■	■	■	■	■	■	■
 DESIGNING	■	■	■	■	■	■	■	■	■	■
 TECH DOCUM. CREATION	■	■	■	■	■	■	■	■	■	■
 INSTALLATION AND ASSEMBLY	■	■	■	■	■	■	■	■	■	■
 TECH DOCUM. UNDERSTANDING	■	■	■	■	■	■	■	■	■	■
 OPERATION	■	■	■	■	■	■	■	■	■	■
 PROGRAMMING	■	■	■	■	■	■	■	■	■	■
 SETTING UP	■	■	■	■	■	■	■	■	■	■

■ This shows how the FMS-200 is suitable to develop skills in the specific technology.

■ This shows that FMS-200 can help develop skills in the specific technology even though there are other more appropriate products in the range.



■ FMS-200 - Options

FMS -200 has a series of optional extras.

• Programming tools

The programming tools comprise the appropriate programming software, the industrial system communication programming software and cables for the chosen PLC.

**See Programming Tools chapter*

• SCADA: Supervisory Control and Data Acquisition



This is a standard-use software application in industry, making it easier to supervise and control processes from the computer screen.

• SAI0048 SCADA application FMS-200

• FMS-200 application for autoSIM-200

We have a 3D application where users can simulate, supervise and control FMS-200 from an autoSIM environment.



*autoSIM is required. See autoSIM-200 chapter

LICENSES	ONE YEAR (electronic dispatch)	PERMANENTS (electronic dispatch)	PERMANENTS (physical dispatch)
3D simulator for FMS-200, 1 license	SAI1973-001	SAI1981-001	SAI2523
3D simulator for FMS-200, 8 licenses	SAI1973-008	SAI1981-008	SAI2524
3D simulator for FMS-200, 16 licenses	SAI1973-016	SAI1981-016	SAI2525

■ FMS-200 - Configuration

Getting the right FMS-200 specification is as easy as:

• Steps to follow

- 1.- Choose the PLC.
- 2.- Select the transport system type.
- 3.- Select the required stations.
- 4.- Add any optional extras.

• Considerations

- Any station can operate independently and be purchased separately.
- To work with the full system, it is recommended to use:
 - FMS-201 station: Body supply.
 - FMS-208 station: Automatic warehouse.
- With linear transfer, the maximum number of process stations is 8.



Example of possible configurations

8 station configuration - Linear transfer



6 station configuration - Linear transfer



4 station configuration -
Linear transfer





10 station configuration - Modular transfer



6 station configuration -
Modular transfer



4 station configuration -
Modular transfer



■ FMS-200 - Technical features

FMS-201 900x580x1480mm	Modules	Sensors (type & quantity)	Input / Output
	Base feeding Position verification Displacement Rejection of incorrect base Insertion on pallet	Auto switch, Reed type (x8) Vacuum pressure switch(x1) Inductive (x1)	Digital 14/10
	Other devices (quantity)	Actuators (type & quantity)	
	Vacuum pad(x4)-Vacuum ejector(x1) Three-colour indication light (x1) Breakdown simulation system (x1)	Pneumatic linear (x6)	
FMS-202 900x580x1430mm	Modules	Sensors (type & quantity)	Input / Output
	Bearing feeding Transfer to the measuring station Height measuring Bearing insertion	Auto switch, Reed type (x10) Microswitch (x1) Linear potentiometer (x1)	Digital 15/13 Analog 1/0
	Other devices (quantity)	Actuators (type & quantity)	
	Three-colour indication light (x1) Breakdown simulation system (x1)	Pneumatic linear (x4) Pneumatic gripper (x2) Pneumatic rotolinear (x1) Pneumatic rotary actuator (x1)	
FMS-203 900x580x1400mm	Modules	Sensors (type & quantity)	Input / Output
	Insertion / extraction of the workpiece Press feeding Bearing pressing	Auto switch, Reed type(x11) Vacuum pressure switch(x1) Security magnetic (x1)	Digital 16/10
	Other devices (quantity)	Actuators (type & quantity)	
	Vacuum pad (x4) - Vacuum ejector (x1) Breakdown simulation system (x1) Safety relay (x1) Hydraulic equipment (x1) Frequency converter (x1)	Pneumatic rotary actuator (x1) Pneumatic linear (x3) Hydraulic linear (x1)	
FMS-204 900x580x1800mm	Modules	Sensors (type & quantity)	Input / Output
	Dividing plate Shaft feeding Shaft height measuring Position shaft in the correct position Shaft material detection Removal of incorrect shaft Insertion of the shaft in the assembly	Auto switch, Reed type(x12) Inductive (x1) Capacitive (x1) Vacuum pressure switch(x2)	Digital 20/16
	Other devices (quantity)	Actuators (type & quantity)	
	Three-colour indication light (x1) Vacuum pad(x2)-Vacuum ejector(x2) Breakdown simulation system (x1)	Pneumatic rotolinear (x1) Pneumatic linear (x9) Pneumatic rotary actuator (x1) Pneumatic gripper (x1)	



FMS-205 900x580x1400mm	Modules	Sensors (type & quantity)	Input / Output
	Dividing plate Lid feeding Loading station Material detection Lid measuring Removal of the incorrect lid Lid insertion	Auto switch, Reed type(x13) Inductive (x1) Micro-switch (x1) Capacitive (x1) Photoelectric (x1) Linear encoder (x1) Vacuum pressure switch(x1)	Digital 24/16
Other devices (quantity)		Actuators (type & quantity)	
Breakdown simulation system (x1) Three-colour indication light (x1) Vacuum pad(x3)-Vacuum ejector(x1) Pressure regulator (x1)	Pneumatic linear (x7) Pneumatic roto-linear (x2) Pneumatic gripper (x2)		

FMS-206 900x580x1930mm	Modules	Sensors (type & quantity)	Input / Output
	Screw feeding Transfer Screw insertion handling device	Auto switch, Reed type (x6) Fibre optic photocell (x1) Solid state auto switch (x2)	Digital 13/9
Other devices (quantity)		Actuators (type & quantity)	
Breakdown simulation system (x1) Three-colour indication light (x1)	Pneumatic linear (x5) Pneumatic gripper (x1)		

FMS-207 900x580x1500mm	Modules	Sensors (type & quantity)	Input / Output
	Shaft and lid stores Robot tools Robot arm and controller components	Auto switch, Reed type(x1) Security magnetic (x1)	Digital 12/12
Other devices (quantity)		Actuators (type & quantity)	
Robot controlling unit (x1) Robot programming console (x1) Security lock (x1) Safety relay (x1)	Electric screwing tool (x1) Pneumatic gripper (x1) 6 axis robot (x1)		

FMS-208 900x580x1500mm	Modules	Sensors (type & quantity)	Input / Output
	Vertical shaft Positioning axes	Auto switch, Reed type(x2) Digital vacuum pressure switch(x1) Security magnetic (x1)	Digital 16/15
Other devices (quantity)		Actuators (type & quantity)	
Vacuum pad(x4)-Vacuum ejector(x1) Servo-controller (x2) Driver programming software and cable (x1) Safety relay (x1) Security lock (x1)	Pneumatic linear (x1) Servo-controlled linear actuators (x2)		

FMS-209 900x580x1500mm	Modules	Sensors (type & quantity)	Input / Output
	Insertion/extraction handling device Electric shaft Oven	Auto switch, Reed type (x7) Vacuum pressure switch(x1) PT100 temperature probe(x1) Security magnetic (x1)	Digital 23/24
Other devices (quantity)		Actuators (type & quantity)	
Vacuum pad(x4)-Vacuum ejector(x1) Servo-controller (x2) Potentiometer (dimmer) (x1) PID temperature controller (x1) Safety relay (x1) Driver programming software and cable (x1) Security lock (x1)	Pneumatic linear (x4) Pneumatic rotary actuator (x1) Servo-controlled linear actuator with brake (x2) 90° track AC motor with analogue control (x1)		

FMS-210 900x580x1500mm	Modules	Sensors (type & quantity)	Input / Output
	Insertion/extraction handling device Revolving table Artificial vision system Evacuation of the faulty product in process	Auto switch, Reed type (x7) Vacuum pressure switch(x2) Artificial vision camera (x1)	Digital 18/18
Other devices (quantity)		Actuators (type & quantity)	
Vacuum pad(x8)-Vacuum ejector(x2) Servo-controller (x1) Vision processing unit (x1) Breakdown simulation system (x1) Vision system programming software and cable (x1)	Pneumatic rotary actuator (x1) Pneumatic linear (x2) Electric turntable (x1)		

LINEAR TRANSFER 4250x700x1040mm	Modules	Sensors (type & quantity)	Input / Output
	Linear transfer	Auto switch, Reed type (x4) Inductive (x24) Micro-switch (x8) Capacitive (x2)	Digital 43/21
Other devices (quantity)		Actuators (type & quantity)	
Frequency converter (x1) Modules for field bus (x10)	Pneumatic rotary actuator (x1) Pneumatic linear (x13)		

MODULAR TRANSFER 1000x210x970mm	Modules	Sensors (type & quantity)	Input / Output
	Modular transfer	Inductive (x3) Micro-switch (x1)	Digital 4/2 Digital 4/3 * Digital 4/4 **
Other devices (quantity)		Actuators (type & quantity)	
Modules for field bus (x1)	DC motor (x1) Pneumatic linear (x1/x2*/x2**) Pneumatic rotary actuator (x1)**		

* Only in modular transfer for FMS-202 and FMS-207 stations.

** Only in modular transfer for FMS-206 station.