

FAS-200: AUTOMATED FLEXIBLE ASSEMBLY CELL

The system provides professional training by simulating a real industrial assembly process. The system consists of a Flexible Automated Assembly Cell that assembles the different components that make up a turning mechanism.



The device consists of:

- Aluminium base or body.
- Lid

All of the components used in the system are industrial.

To provide the system with greater flexibility, the various 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 twenty-four different assemblies can be obtained enabling the use of production management strategies, which make the most of the cell's flexibility.

The rotating system is formed by the following components:

- Body
- Cover

TRANSPORT SYSTEM:

- SAI4264 - Linear transfer for 5 stations – Quantity: 1.

The pallet transport system is formed by an aluminium structure that connects up to five process stations. It includes a 24VDC motor, mechanical stoppers and barcode reading devices for the pallets. It also allows to configure different layouts and to extend the system in the future.



Each transfer module includes at least two different stop positions with the following components and characteristics:

- Actuators:

- 1 compact double acting cylinders, Ø32, 25mm stroke. Controlled by single 5/2 solenoid valves.

- Sensors:

- 3 inductive detectors.
- 1 microswitch.

- Digital inputs and digital outputs in each stop position: 4 DI and 1 DO. All those inputs and outputs are controlled by the PLC implemented in each process station.

- Size: 2250x315 mm. Height: 940 mm.

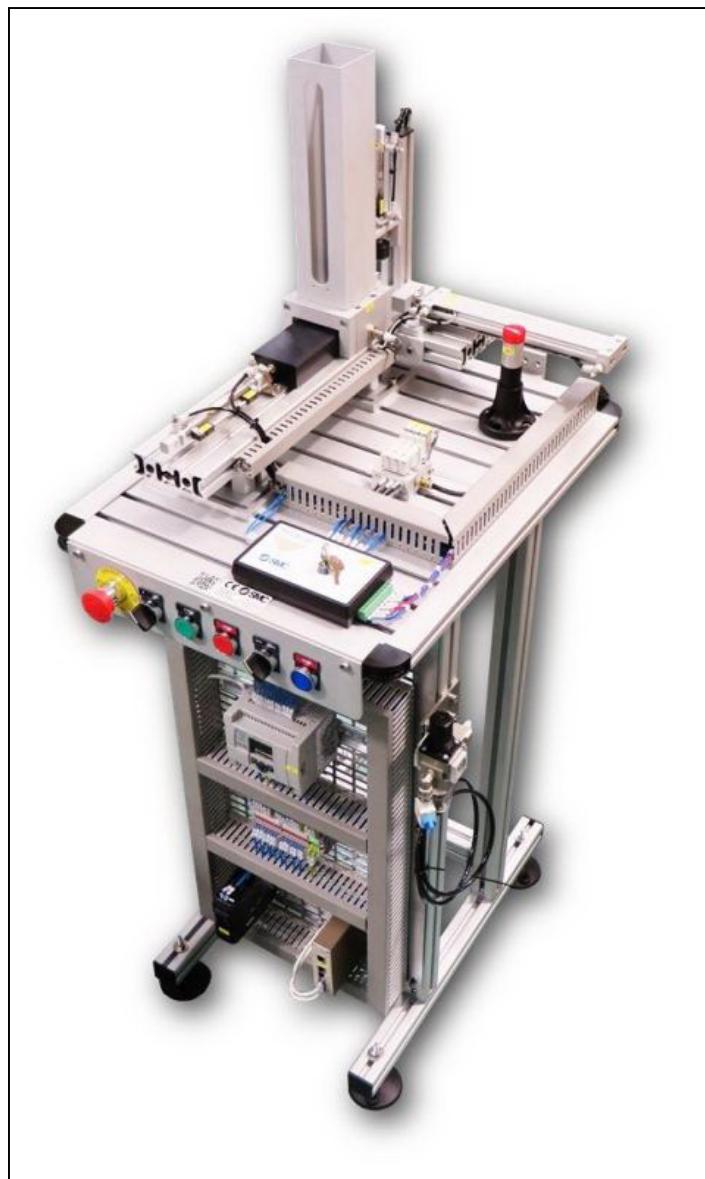
The following stations are used to assemble the turning mechanism components, each of them carrying out one part of the overall assembly process.

- Base feeding/verification.
- Base rejection/transfer.
- Lid classification.
- Lid rejection/transfer.
- Storage.

PROCESS STATIONS AND OPTIONALS:

SAI4201 - FAS-201: BASE FEEDING/VERIFICATION STATION WITH SIEMENS PLC – QUANTITY: 1.

The function of the station is to feed the base which acts as the support to a turning mechanism, and move it to the next station.



The part to be assembled is a 65x65x32mm anodised aluminium block with an opening at the top, 32mm diameter, and another opening at the bottom, 28mm diameter, which is used to detect whether the position is the right one or not.

The station is formed by a 450x600x900 mm height-adjustable aluminium structure, on which the components used to perform the process are mounted, which includes a block of control solenoid valves in the case of pneumatic components and a no material indication lamp.

The electrical panel is on the front, from which the station is controlled.

It also includes the control keypad, with the following buttons and indicator lights: start, stop and reset buttons, continuous/single cycle selector, disconnecting switch, endorsed emergency stop button and error warning light.

On one side of the station there is an air treatment unit comprising a 5µm filter with a pressure controller, pressure gauge, manual 3/2 stop valve.

The station comprises the following modules:

- Base feeder:

A gravity feeder stores the bases. A pneumatic cylinder with a pusher adapted to the size of the base extracts one of these. This module has the following components and characteristics:

- Storage capacity: 10 bases

- Actuators:

- Double acting pusher cylinder, Ø16 and 100mm stroke, with speed controllers and initial and final position switches. Controlled by a single 5/2 solenoid valve.

- Sensors:

- Auto switches, reed type.

- Inductive detector to detect a shortage of material in the warehouse.



- Position verification:

The base includes housing to add the rest of the components, which face a particular direction. A cylinder with a cylindrical part at the tip moves towards the top of the base to verify that the base is facing the right way. This module has the following components and characteristics:

- Actuators:

- Double acting cylinder, Ø12 and 50mm stroke, with speed controllers and final position switch. Controlled by a single 5/2 solenoid valve.

- Sensors:

- Auto switch, reed type.



- Displacement to the transfer point:

A cylinder with a pusher at the tip is used to position the base at the point from which it is transferred to the next station. The cylinder is rectangular to avoid rotating the pusher. This module has the following components and characteristics:

- Actuators:

- Rectangular pusher cylinder, Ø25 and 200mm stroke, with speed controllers and final position switch. Controlled by a single 5/2 solenoid valve.

- Sensors:

- Auto switch, reed type.



- Breakdown generation system:

The station has the possibility of generating up to 16 breakdowns or malfunctions. For this purpose a box is assembled on the side of the station structure, inside which there are 16 switches to activate the same number of breakdowns. When a switch is activated a breakdown occurs in one of the station components. To access these switches, the box lid has to be opened, which can be locked.



- Electrical control panel:

All of the pneumatic cables and tubing are properly identified and labelled at both ends.



- Mounted on a 375x700mm mesh
- Accessible electrical connection terminal box with power input and coded I/O.
- It includes 110-240VAC/24VDC power supply.

- 1 control PLC Siemens S7-1200 wired and programmed to operate the module with 9 digital inputs and 5 digital outputs connected to the hardware.
- Industrial communication via standard Ethernet for communication with the other modules.

**SAI4202 - FAS-202: BASE REJECTION/TRANSFER STATION
WITH SIEMENS PLC – QUANTITY: 1.**

The function of the station is to move the base to the pallet located in the transfer system.



The part to be assembled is a 65x65x32mm anodised aluminium block with an opening at the top, 32mm diameter, and another opening at the bottom, 28mm diameter, which is used to detect whether the position is the right one or not.

The station is formed by a 450x600x900mm height-adjustable aluminium structure, on which the components used to perform the process are mounted, which include a block of control solenoid valves in the case of pneumatic components.

The electrical panel is on the front, from which the station is controlled.

It also includes the control keypad, with the following buttons and indicator lights: start, stop and reset with warning lamp buttons, continuous/single cycle selector, disconnecting switch and endorsed emergency stop button.

On one side of the station there is an air treatment unit comprising a 5µm filter with a pressure controller, pressure gauge, manual 3/2 stop valve.

The station comprises the following modules:

- Incorrect part rejection module:

If the base position is not the correct one, a single acting cylinder drives the base onto a stainless steel ramp, in order to leave the path unobstructed for the other parts. This module has the following components and characteristics:

- Actuators:

- Single-acting ejecting cylinder, Ø10, 15mm stroke, with speed controller.

Controlled by a single 3/2 solenoid valve.



- Insertion of the base in the pallet:

A handling device with two axis moves the base to the pallet. Each axis contains a cylinder with parallel rods.

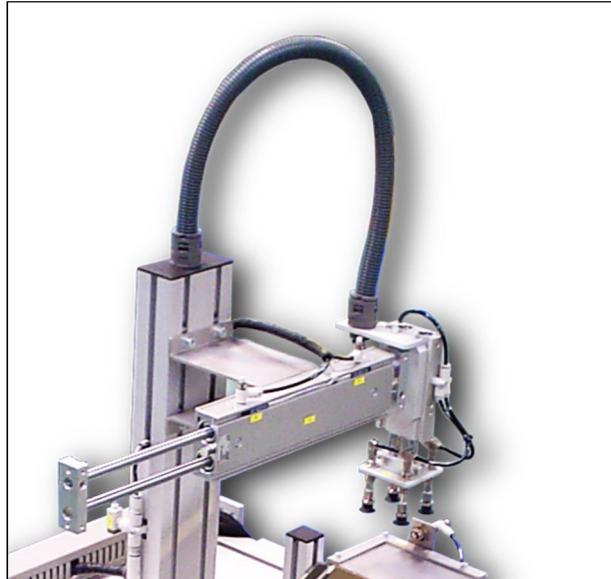
The terminal element is a vacuum holding platform with four vacuum pads to solve possible height misalignments. This module has the following components and characteristics:

- Actuators:

- Horizontal axis: - Parallel-rod cylinder, Ø20 and 150 mm stroke, with speed controllers and initial and final position switches. Controlled by a double 5/2 solenoid valve.
- Vertical axis: - Parallel-rod cylinder, Ø15 and 50 mm stroke, with speed controllers and initial and final position switches. Controlled by a double 5/2 solenoid valve.
- Holding plate: 4 buffer vacuum pads, Ø16, with vacuum ejector. controlled by a single 3/2 solenoid valve.

- Sensors:

- Auto switches, reed type.
- PNP output vacuum pressure switch.



- Breakdown generation system:**

The station has the possibility of generating up to 16 breakdowns or malfunctions. For this purpose a box is assembled on the side of the station structure, inside which there are 16 switches to activate the same number of breakdowns. When

a switch is activated a breakdown occurs in one of the station components. To access these switches, the box lid has to be opened, which can be locked.



- Electrical control panel:

All of the pneumatic cables and tubing are properly identified and labelled at both ends.



- Mounted on a 375x700mm mesh
- Accessible electrical connection terminal box with power input and coded I/O.

- It includes 110-240VAC/24VDC power supply unit.
- 1 control PLC Siemens S7-1200 wired and programmed to operate the module with 9 digital inputs and 7 digital outputs connected to the hardware.
- Industrial communication via standard Ethernet for communication with the other modules.

SAI4209 - FAS-209: LID CLASSIFICATION STATION WITH SIEMENS PLC – QUANTITY: 1.

The function of the station is to feed and to check the lid.



The part to be assembled is a lid. There are six lid options depending on the material: metal, anodised aluminium, black plastic, black nylon and white plastic or white nylon. Each lid has two different heights, regardless of the material.

The station is formed by a 450x600x900mm height-adjustable aluminium structure on which the components used to perform the process are mounted, which include a block of control solenoid valves in the case of pneumatic components and a no material indication lamp.

The electrical panel is on the front, from which the station is controlled.

It also includes the control keypad, with the following buttons and indicator lights: start, stop and reset (with lamp) buttons, continuous/single cycle selector and disconnecting switch and endorsed emergency stop button.

On one side of the station there is an air treatment unit comprising a 5µm filter with a pressure controller, pressure gauge, manual 3/2 stop valve.

The station comprises the following modules:

- Dividing plate:

Made from anodised aluminium, this module is used as an alternative rotary drive system, such that with each rotary movement it advances 45 degrees. This is achieved by a pneumatic pusher cylinder with oscillating drive. It also has another two limiter cylinders operating alternately, one of them moving which holds the plate while it turns, and the other fixed, which locks it once the turning movement has stopped so that the plate is held firmly in place, and the pusher cylinder can return to its initial position to wait for a new cycle. This module has the following components and characteristics:

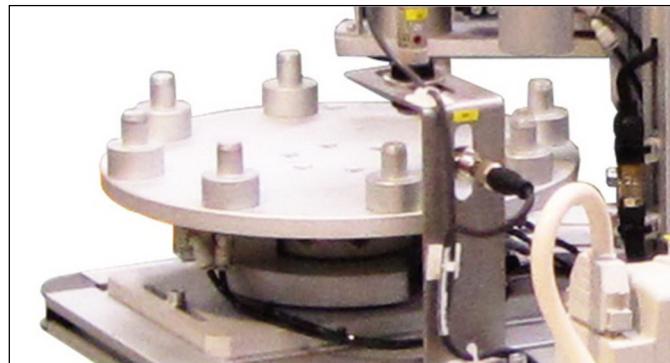
- Actuators:

- Compact double acting pusher cylinder, Ø25 and 40mm stroke, with speed controllers and initial position switch. Controlled by a single 5/2 solenoid valve.

- Limits: 2 compact cylinders, Ø16, 10mm stroke. Controlled by a single 5/2 solenoid valve.

- Sensors:

- Auto switch, reed type.



- Feeding the lid

The lids are stored in a gravity feeder including two pneumatic grippers with two parallel-opening jaws. This module has the following components and characteristics:

- Storage capacity: minimum 19 lids.

- Actuators:

- 2 gripper with two parallel-opening jaws. Controlled by 5/2 solenoid valve.

- Sensors:

- Presence sensor: fibre optic photocell.



- Material detection:

Two measurements are taken to determine the lid material using inductive, and photoelectrical detectors. This module has the following components and characteristics:

- Sensors:

- Inductive detector.
- Photoelectric detector.

**- Lid measuring station:**

The lid height is measured using a pneumatic cylinder that moves a plunger with regulated pressure until it touches the lid. This cylinder includes a digital transducer that sends a linear encoder with pulse output, depending on the cylinder's stroke. This module has the following components and characteristics:

- Actuators:

- Double acting cylinder with stroke reading, Ø20 and 50mm stroke, with speed controllers. Controlled by a single 5/2 solenoid valve.

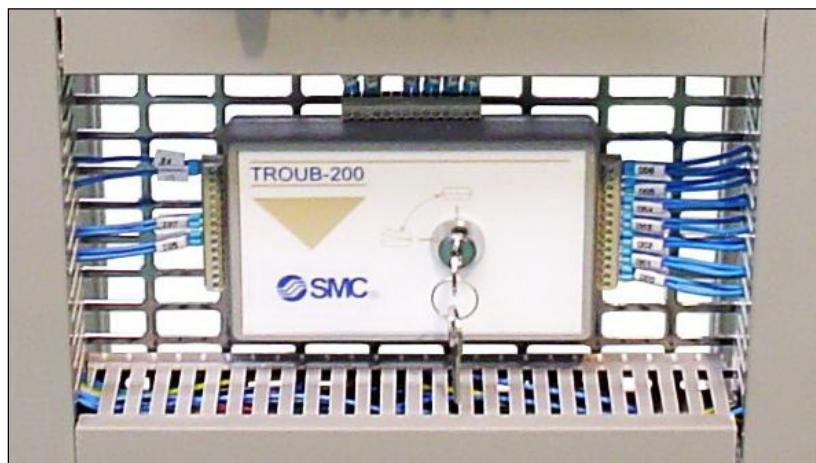
- Sensors:

- Linear encoder built into the cylinder.
- Pressure regulator.



- Breakdown generation system:

The station has the possibility of generating up to 16 breakdowns or malfunctions. For this purpose a box is assembled on the side of the station structure, inside which there are 16 switches to activate the same number of breakdowns. When a switch is activated a breakdown occurs in one of the station components. To access these switches, the box lid has to be opened, which can be locked.



- Electrical control panel:

All of the pneumatic cables and tubing are properly identified and labelled at both ends.



- Mounted on a 375x700mm mesh
- Accessible electrical connection terminal box with power input and coded I/O.
- It includes 110-240VAC/24VDC power supply unit.
- 1 control PLC Siemens S7-1200 wired and programmed to operate the module with 10 digital inputs and 7 digital outputs connected to the hardware.
- Industrial communication via standard Ethernet for communication with the other modules.

SAI4210 - FAS-210: LID REJECTION/TRANSFER STATION WITH SIEMENS PLC – QUANTITY: 1.

The function of the station is to reject the incorrect lids and to assembly the correct ones.



The part to be assembled is a lid. There are six lid insertion options depending on the material: metal, anodised aluminium, black plastic, black nylon and white

plastic or white nylon. Each lid has two different heights, regardless of the material.

The station is formed by a 450x600x900mm height-adjustable aluminium structure, on which the components used to perform the process are mounted, which include a block of control solenoid valves in the case of pneumatic components.

The electrical panel is on the front, from which the station is controlled.

It also includes the control keypad, with the following buttons and indicator lights: start, stop and reset (with lamp) buttons, continuous/single cycle selector and disconnecting switch and endorsed emergency stop button.

On one side of the station there is an air treatment unit comprising a 5µm filter with a pressure controller, pressure gauge, manual 3/2 stop valve.

The station comprises the following modules:

Removal of the incorrect lid module:

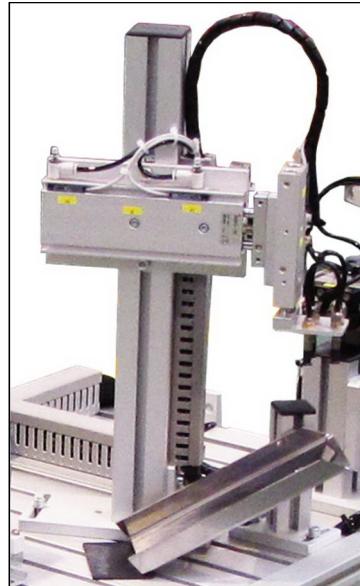
It consists of a handling device that, when it receives the command, removes the lid from the plate. It consists of two pneumatic shafts that have three vacuum pads as the terminal elements. Each one contains a pneumatic cylinder with parallel rods. This module has the following components and characteristics:

- Actuators:
 - Horizontal axis: Double acting parallel-rod cylinder, Ø15 and 100mm stroke, with speed controllers and initial and end position switches. Controlled by a double 5/2 solenoid valve.
 - Vertical axis: Double acting parallel-rod cylinder, Ø10 and 50mm stroke, with speed controllers and start position switch. Controlled by a single 5/2 solenoid valve.

- Fixing arm: 3 Ø8 vacuum pads, with vacuum ejector. Controlled by a single 3/2 solenoid valve.

- Sensors:

- Auto switches, reed type.
- PNP output vacuum switch.



- **Lid insertion module:**

The lid is inserted in the assembly by a handling device formed by a rotolinear unit with a gripper with two parallel-opening jaws. This module has the following components and characteristics:

- Actuators:

- Compact linear and rotary drive cylinder, Ø32, 25mm stroke, with speed controllers and initial and end of stroke position switches during linear movement and 0° and 180° during rotary movement. Controlled by two single 5/2 solenoid valves.

- Fixing arm: Pneumatic grippers with two parallel-opening jaws. Controlled by a single 5/2 solenoid valve.

- Sensors:

- Auto switches, reed type.



- Breakdown generation system:

The station has the possibility of generating up to 16 breakdowns or malfunctions. For this purpose a box is assembled on the side of the station structure, inside which there are 16 switches to activate the same number of breakdowns. When a switch is activated a breakdown occurs in one of the station components. To access these switches, the box lid has to be opened, which can be locked.



- Electrical control panel:

All of the pneumatic cables and tubing are properly identified and labelled at both ends.



- Mounted on a 375x700mm mesh
- Accessible electrical connection terminal box with power input and coded I/O.
- It includes 110-240VAC/24VDC power supply.
- 1 control PLC Siemens S7-1200 wired and programmed to operate the module with 12 digital inputs and 10 digital outputs connected to the hardware.
- Industrial communication via standard Ethernet for communication with the other modules.

SAI4216 - FAS-216: STORAGE STATION WITH SIEMENS PLC – QUANTITY: 1.

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



The assembly to be stored is a turning mechanism formed by a 65x65x32mm anodised aluminium block with an opening at the top, 32mm diameter, and an opening in the bottom, 28mm diameter.

The station is formed by a 450x600x900mm height-adjustable aluminium structure, on which the components used to perform the process are mounted, which include a block of control solenoid valves in the case of pneumatic components.

The electrical panel is on the front, from which the station is controlled.

It also includes the control keypad, with the following buttons and indicator lights: start, stop and reset (with lamp) buttons, continuous/single cycle selector and disconnecting switch and endorsed emergency stop button.

On one side of the station there is an air treatment unit comprising a 5µm filter with a pressure controller, pressure gauge and manual 3/2 stop valve.

The station comprises the following modules:

- Vertical axis:

The vertical axis is formed by a parallel rod pneumatic cylinder to which a platform is attached with four vacuum pads to hold the part. This module has the following components and characteristics:

- Actuators:

Double acting parallel-rod cylinder, Ø20 and 75mm stroke, with speed controllers and initial and end position switches. Controlled by a single 5/2 solenoid valve.

- Holding system: 4 Ø16 vacuum pads, with vacuum ejector. Controlled by a single 3/2 solenoid valve.

- Sensors:

- Auto switches, reed type.
- PNP output digital vacuum pressure switch.



- Positioning axis:

The system to position the assembly at the different points on the desktop surface is formed by two linear axis: one of them electric and the other one pneumatic.

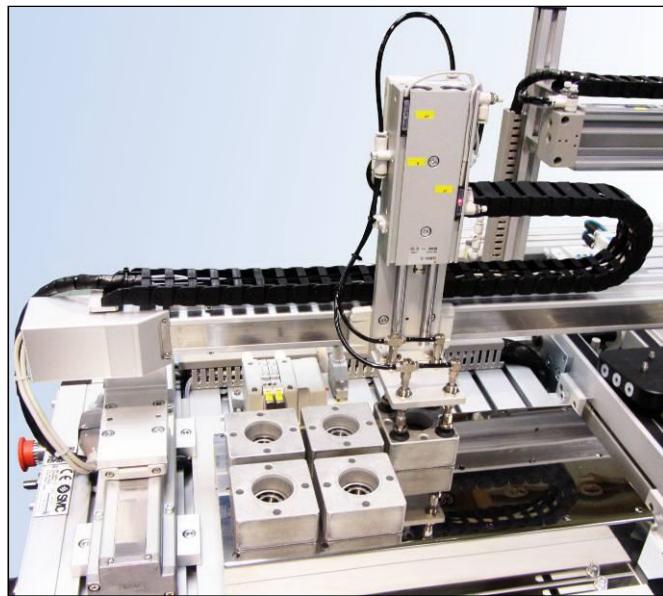
This module has the following components and characteristics:

- Actuators:

- 1 linear servodriven actuator.
- 1 double effect parallel-rod cylinder: Ø20 and 75mm stroke, with speed controllers and initial and end position switches. Controlled by a double 5/2 solenoid valve.

- Sensors:

- Auto switches, reed type.



- Electrical control panel:

All of the pneumatic cables and tubing are properly identified and labelled at both ends.



- Mounted on a 375x700mm mesh

- Accessible electrical connection terminal box with power input and coded I/O.
 - It includes 110-240VAC/24VDC power supply unit.
 - It includes 1 servodriver to control the motors built into the linear actuator.
 - It includes programming software and cable for the servodriver.
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- 1 control PLC Siemens S7-1200 wired and programmed to operate the module with 13 digital inputs and 12 digital outputs connected to the hardware.
 - Industrial communication via standard Ethernet for communication with the other modules.

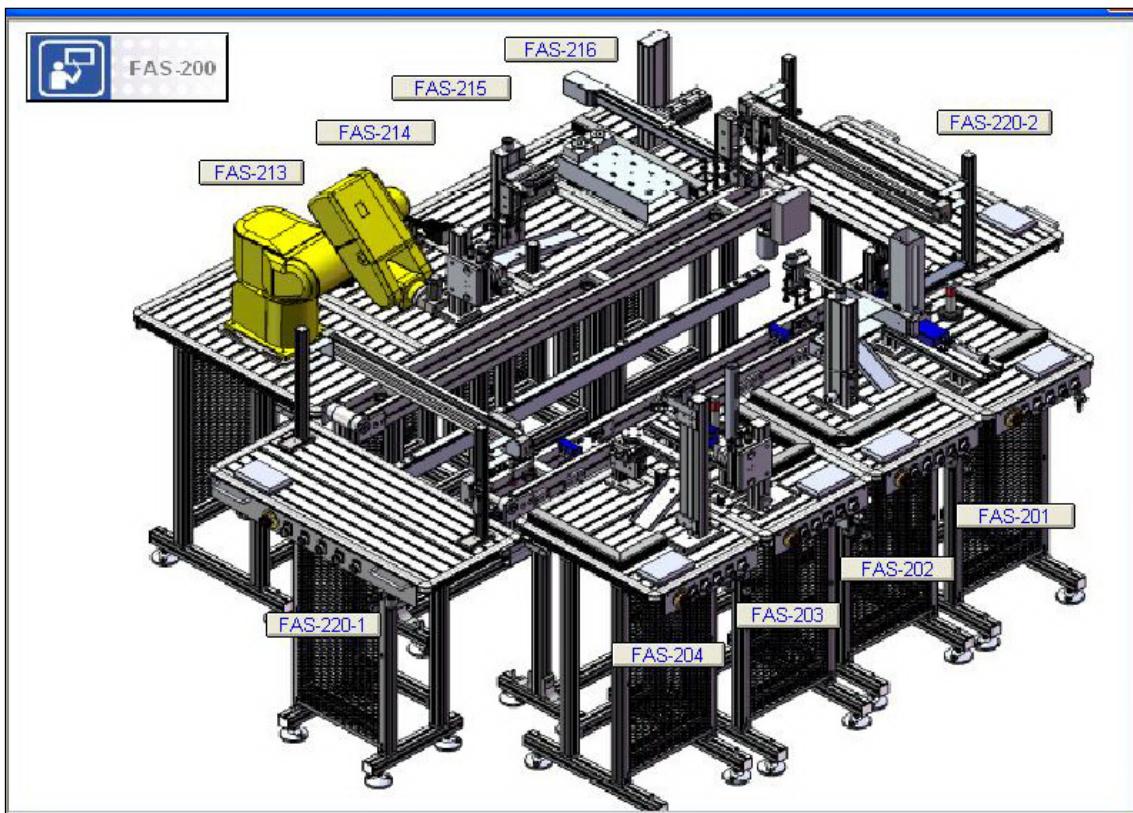
SAI0811 - HMI (operator terminal) for storage module – Quantity: 1.

- It allows the user to move the product in progress:
 - * Input of product.
 - * Product movement.
 - * Product output.
 - * Select different type of assemblies.



SAI4998 - SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEM – QUANTITY: 1.

The system includes a SCADA application to supervise the process carried out. This is open and allows other projects to be changed or implemented (alarm manager, report editor, graphics, etc...).



The SCADA structure is via screens, i.e. the screen for each station can be accessed from a main screen.

The SCADA screen for each processing station comprises:

- Keypad: including the “start”, “stop”, “auto/man” and “reset” buttons.
- Display of alarms generated in each station, for example, air shortage, shortage of raw material, station switched off and station malfunctioning.
- Station synoptic screen: includes the different station modules that allow the process carried out in each station and each of the movements in real time to be monitored remotely.

It includes a software license to control at least 50 variables and a run-time licence for 2 hours of continuous running.

SAI2538 - 3D SIMULATION APPLICATIONS FOR AUTOSIM – QUANTITY: 1.

It allows the user to simulate, control and supervise the real automated process from a virtual environment.



It is comprised of software applications which include 3D models of the real process.

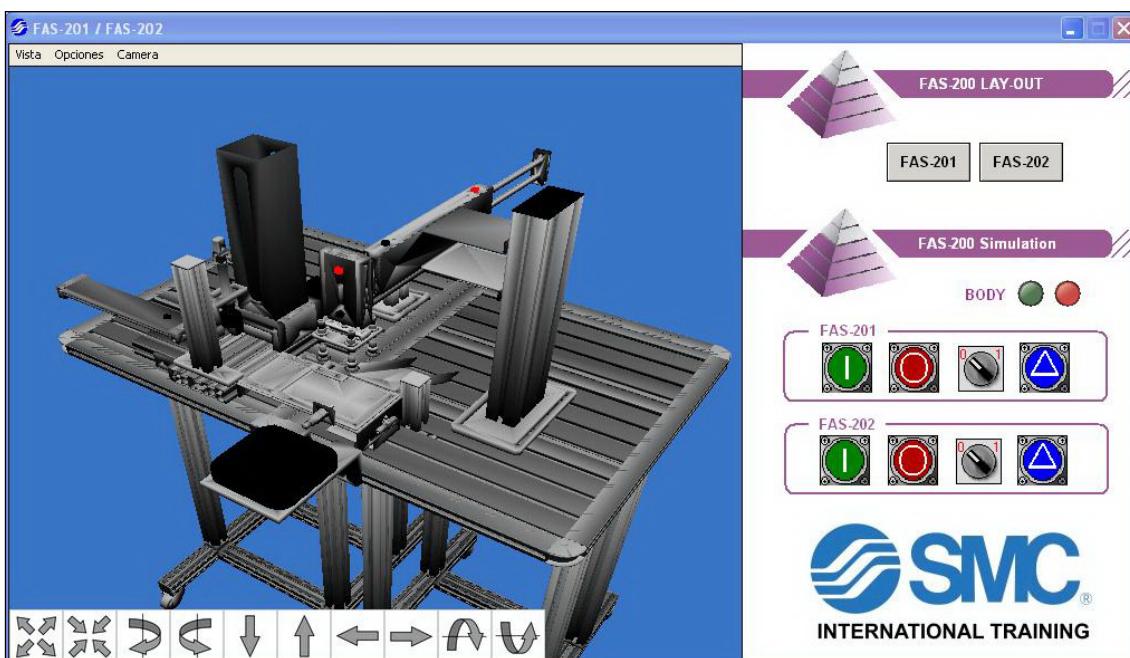
Each application includes the following features:

- Compatibility with simulation software in automation applications.
- Independent window with 3D model.
- Independent window with keypad and control commands.

- Access to the programming editor of a built-in virtual PLC responsible for controlling the movements of the 3D model.
- Access to the symbols table in the virtual PLC.
- Access to the libraries and to the simulation panel for components in pneumatics, electro-pneumatics, hydraulics, electro-hydraulics and electrics.

The simulator includes the following applications:

- Automated flexible assembly cell comprised of:
 - o Supply / verification – rejection base transfer.
 - o Supply / transfer – measurement / bearing transfer.
 - o Transfer and hydraulic pressing.
 - o Classification – rejection / axis transfer.
 - o Classification of caps - rejection / transfer.
 - o Screw dispenser and insertion unit.
 - o Transfer and visual inspection - rejection.
 - o Storage.
 - o Pallet transfer.



The package includes 16 licences for its use along with simulation software for automation applications autoSIM-200.