ETEK
TOTAL AUTOMATION SOLUTIONS

20
25

Training Equipment

MECHATRONICS

ETEK Automation Solutions

etek.edu.vn

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TRAINING CONTENT

PACE OF CONTENTS

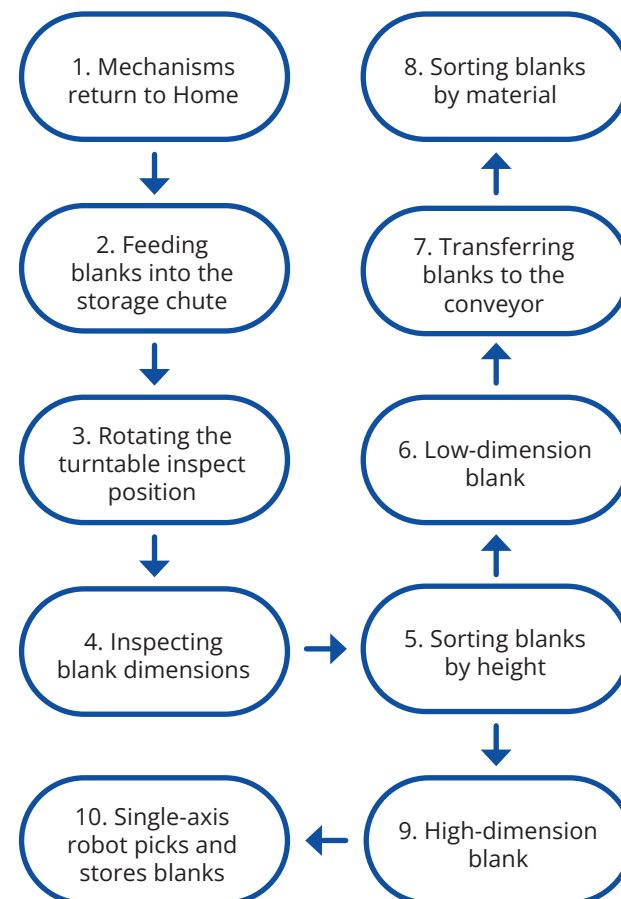| MODULE	CODE
1-AXIS ROBOT TRAINING MODEL	ST.ME.A0001
X-Y COORDINATE POSITION CONTROL DRIVE MODEL	IE.E6300
SPEED AND TORQUE CONTROL DRIVE MODEL	IE.E6100
POSITION AND ROTATION CONTROL DRIVE MODEL	IE.E6200
PRODUCT SORTING CONVEYOR MODEL	TPAM.A0100
FOUR-STORY ELEVATOR ACTUATOR MODEL	ST.ME.A6050
MODEL FOR CONTROLLING MIXING, HEATING, AND PRESSURE PROCESSES	ST.IE.A0770
BOTTLING AND FILLING MODEL	ME.A8024
ROBOT TRAINING MODEL	ST.ME.A1008
ROBOT COLLABORATIVE TRAINING MODEL	TPAM.G6010
BASIC ROBOT TRAINING MODEL	TPAM.B9010
SMALL-SCALE FLEXIBLE PRODUCTION STATION	ST.ME.A6001
FACTORY AUTOMATION TRAINING SOLUTIONS	ST.ME.A8030
MECHATRONICS INSTALLATION AND MAINTENANCE PRACTICE SYSTEM - MPS	ST.ME.A4000
SENSOR AND PROCESS CONTROL TRAINING SYSTEM - DCS	ST.ME.A5002
SENSOR AND PROCESS CONTROL TRAINING SYSTEM	ST.ME.A5010
SMART FACTORY MODEL	TPAM.A6701
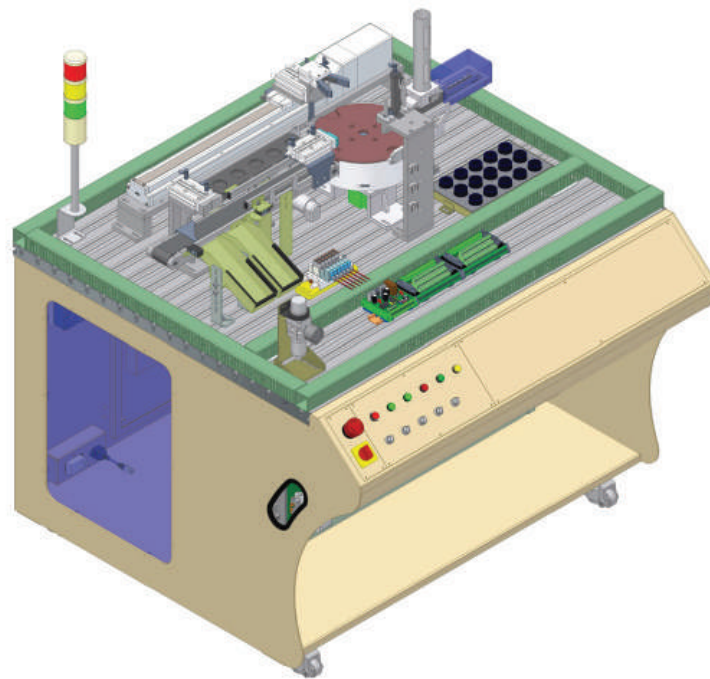
TRAINING CONTENT

Using compact mechanisms, simulating common stages in the factory automation,
- Learn the principles and basic structures of 1-axis robots, PLCs, pneumatic devices, sensors, Servo motors.
- Practice connecting electrical devices according to electrical drawings
- Practice setting parameters on Servo motors.
- Practice programming on PLCs to control actuators.

GENERAL SPECIFICATIONS

- Dimensions: 910x917x1350mm (LxWxH).
- Power supply: 220VAC/50HZ.
- Air source: 5bar.
- All components mounted on a CT3 steel frame with powder coating and casters for mobility.
- The rotating disk uses a stepper motor controlled by the included driver.
- Single-axis AC servo robot from SMC.
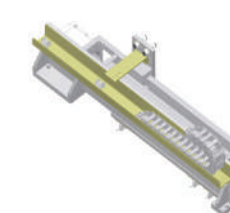- Conveyor belt driven by a DC servo motor.

OPERATIONAL PROCESS

1. Mechanisms return to Home
↓
2. Feeding blanks into the storage chute
↓
3. Rotating the turntable inspect position
↓
4. Inspecting blank dimensions →
5. Sorting blanks by height
↓
6. Low-dimension blank
↑
7. Transferring blanks to the conveyor
↑
8. Sorting blanks by material

10. Single-axis robot picks and stores blanks ←
9. High-dimension blank
↑

TRAINING CONTENT

- X-Y Coordinate Position Control Drive Model
- Used for position control drive experiments on the X-Y coordinate plane
- Practice programming the HMI (Human-Machine Interface) screen
- Practice PLC and HMI programming for servo motor control
- Practice controlling position on a coordinate axis system
- Practice controlling position on the X-Y coordinate system
- Practice with a system that includes a pen and plane for position control, visually representing the control process through drawing
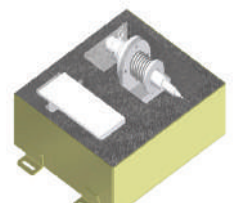- Practice entering control parameters on the HMI screen
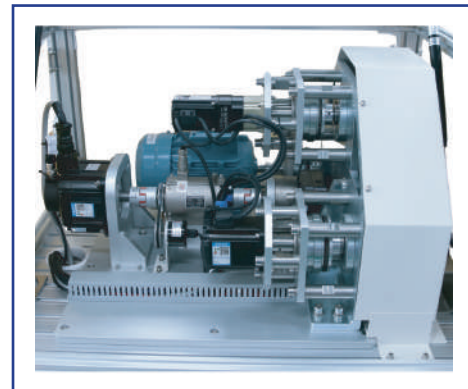
GENERAL SPECIFICATIONS

- Dimensions: 910x917x1100mm (LxWxH).
- Power supply: 220VAC/50HZ.
- Air source: 5bar.
- 2-axis electric drive system using PLC to control DC Servo motor.
- All components mounted on a CT3 steel frame with powder coating and casters for mobility.
- Motors are controlled by an accompanying driver ntegrated HMI for monitoring and control.
- Whiteboard for writing and drawing.

EQUIPMENT LIST

X-axis Robot



Y-axis Robot

Drafting Board

Toolbox

TRAINING CONTENT

- Used for experiments on stable speed and torque control of motors.
- Experiment on stable speed control of AC servo motors.
- Experiment on stable speed control of DC servo motors.
- Experiment on stable speed control of three-phase asynchronous motors.
- Experiment on stable torque control of AC servo motors.
- Experiment on stable torque control of DC servo motors.
- Experiment on stable torque control of three-phase asynchronous motors.

GENERAL SPECIFICATIONS

- Dimensions: 910x917x1500mm (LxWxH).
- Power supply: three-phase 380VAC.
- Electric drive system using PLC to control .3-phase asynchronous motor, AC servo and DC servo.
- All components mounted on a CT3 steel frame with powder coating and casters for mobility
- Motors are controlled by an accompanying driver.
- Loads utilize motors to simulate load.
- Integrated HMI for monitoring and control.
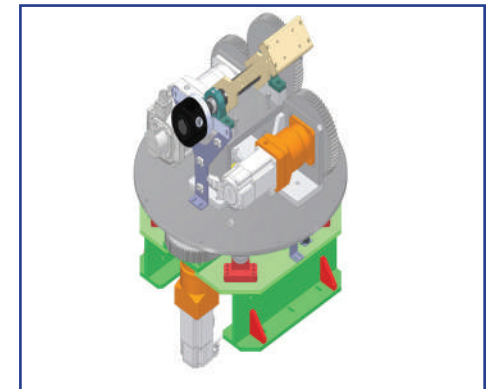
TRAINING CONTENT

- Used for experiments on position and rotation control
- Practice PLC programming
- Practice programming the HMI (Human-Machine Interface) screen
- Practice PLC and HMI programming for servo motor control
- Practice controlling the position and rotation angle of the mechanism

GENERAL SPECIFICATIONS

- Dimensions: 910x917x1600mm (LxWxH).
- Power supply: 220VAC/50HZ.
- The electric drive system uses a PLC to control the motor.
- All components mounted on a CT3 steel frame with powder coating and casters for mobility.
- Motors are controlled by an accompanying driver.
- Loads utilize motors to simulate load.
- Integrated HMI for monitoring and control

## TPAM.A0100 PRODUCT SORTING CONVEYOR MODEL
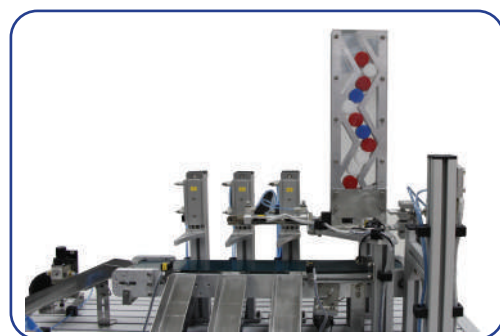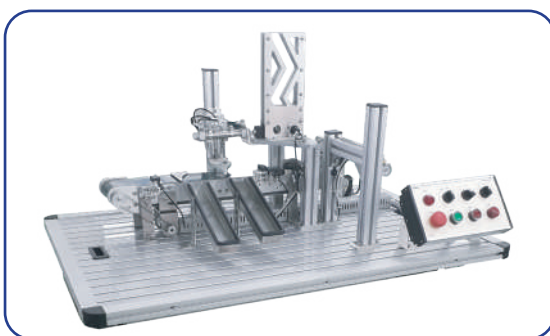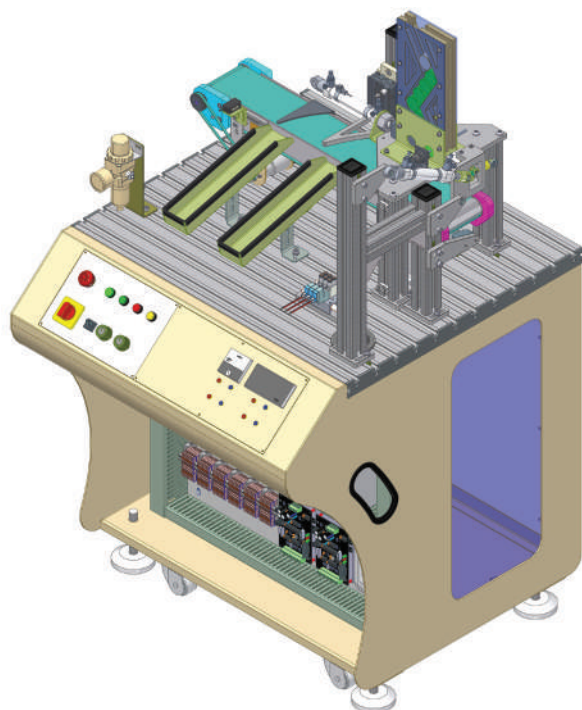
TRAINING CONTENT

- PLC programming.
- Pneumatic and electrical control.
- Sensor technology, sensor calibration.
- DC motor control.
- Practice connecting equipment.
- Practice mechanical alignment and system operation.

OPERATIONAL PROCESS

1. Feeding Blanks → 2. Dividing Blanks

↓

4. Product Sorting ← 3. Color Inspection

GENERAL SPECIFICATIONS

- Dimensions: 910x917x1580mm (LxWxH).
- Power supply: 220VAC/50HZ.
- Air source: 5bar.
- Blank feeding mechanism with pneumatic cylinder weight
- Rotating clamp mechanism actuated by a pneumatic cylinder.
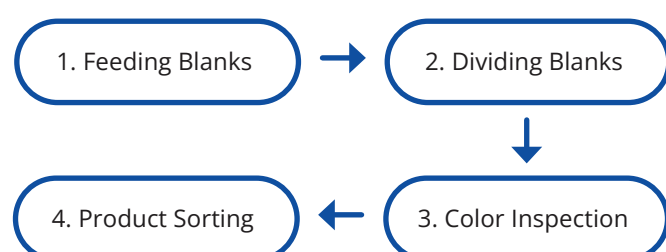
- Color, proximity, and photoelectric sensors
- DC motor conveyor.
- Inclined chute and sorting cylinder.
- Configurable PLC.

## ST.ME.A6050 FOUR-STORY ELEVATOR ACTUATOR MODEL

TRAINING CONTENT

- Practice learning the operating principles of the devices in the model
- Practice learning the operating principles of the elevator system in reality
- Practice installing electrical equipment on the panel, connecting the elevator control cabinet
- Practice surveying the power supply for the equipment
- Practice surveying the input/output I/O of the elevator
- Practice connecting the I/O of the elevator to the controller
- Practice writing the elevator Cabin control program
- Practice writing the elevator door opening and closing control program
- Practice writing the elevator Cabin calling program
- Practice writing the complete elevator control program

GENERAL SPECIFICATIONS

- Simulation of elevator mechanism and operating principle in real applications.
- Dimensions: 905 × 700 × 2092 mm (L × W × H).
- Power supply: 220 VAC, 50 Hz.
- 4-stop elevator type.
- Three-phase motor for cabin lifting/lowering.
- Cabin door driven by DC motor.
- Proximity sensors and limit switches.
- Inverter (VFD) for motor control.
- Optional control via Microcontroller or PLC.

SOFTWARE APPLICATION
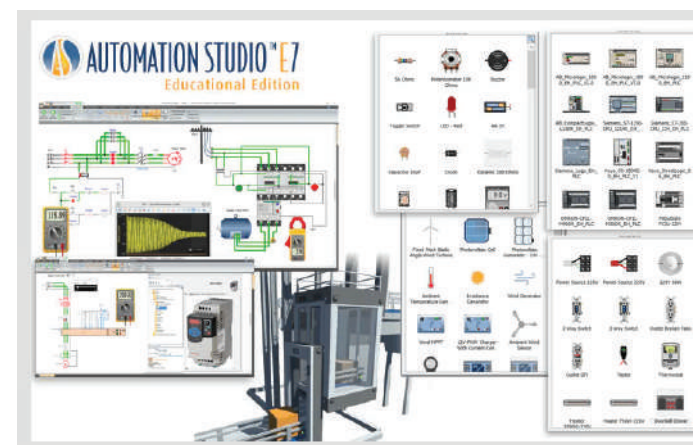
- Connect and collect data from the Gateway.
- Allocate devices to practice sets.
- Manage all devices in the classroom.
- Add, edit, and delete devices flexibly.
- Connect hardware devices with Automation Studio software.
- Scan devices into the system using QR codes.
- Connect devices to students' practice tables.
- Manage the entire status of DIO, AIO of devices.
- Set parameters and configure devices.
- Manage the pin layout, images, and datasheets of devices.

ST.IE.A0770 — MODEL FOR CONTROLLING MIXING, HEATING, AND PRESSURE PROCESSES
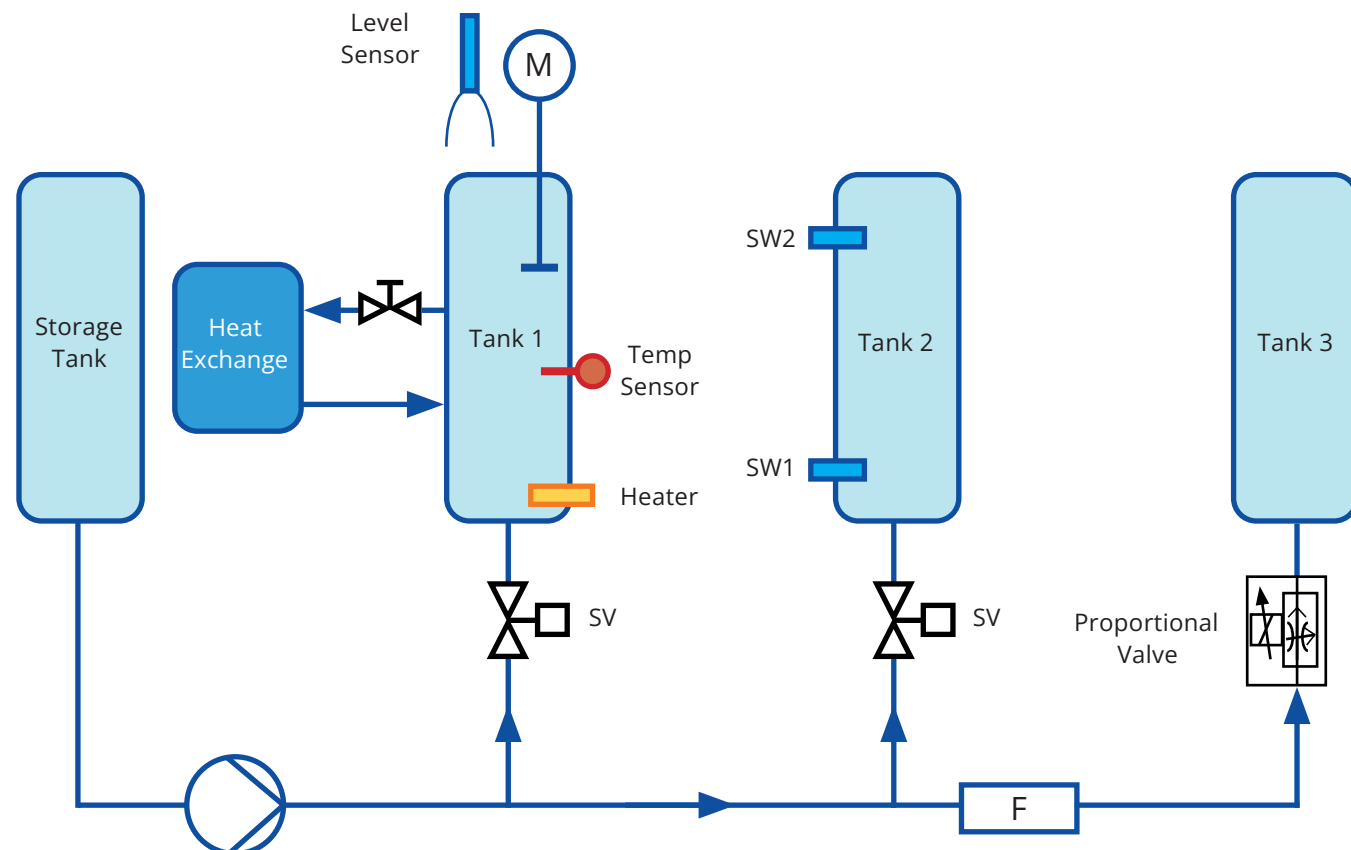

TRAINING CONTENT

- Learn the structure and operating principles of process control devices
- PLC programming for closed-loop PID control, open-loop control
- Analog signal processing
- Calibration of various types of sensors
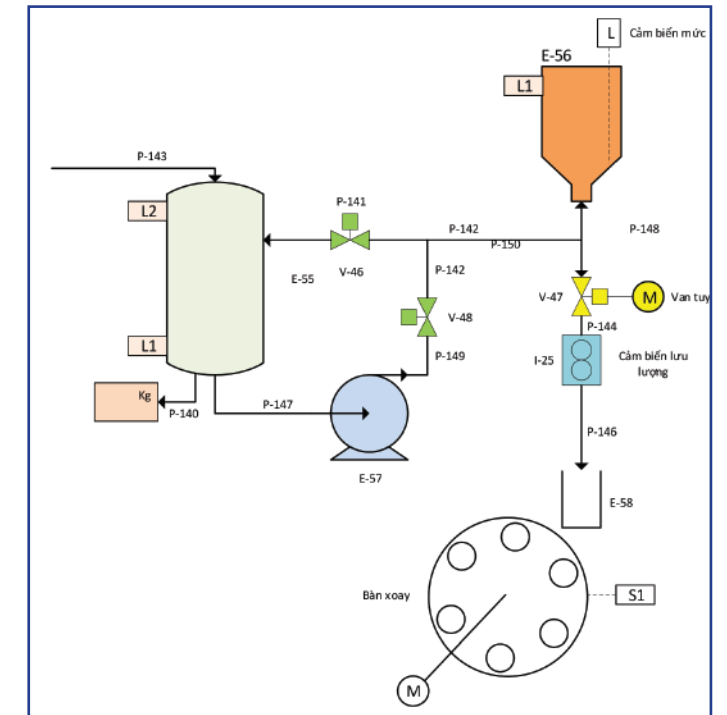- Scada programming for system monitoring

GENERAL SPECIFICATIONS

- Dimensions: 910 x 917 x 1062 (LxWxH).
- Input voltage 220VAC.
- Model used to practice basic process control exercises.
- 02 supply tanks, 1 storage tank, transparent material.
- DC water pump.
- Flow and temperature sensors.
- Ultrasonic sensor, level sensor.
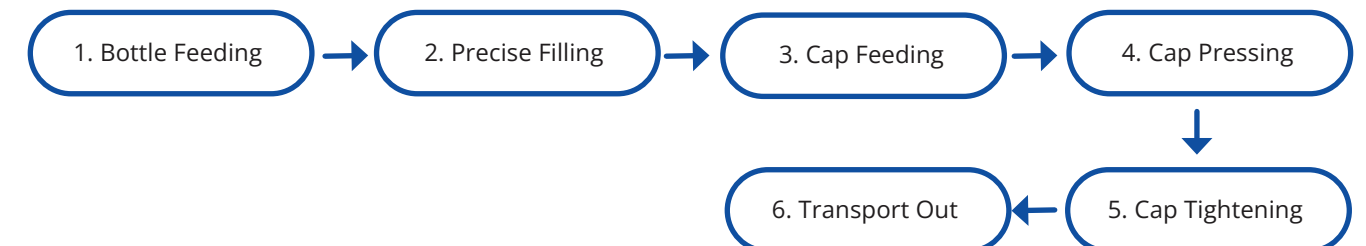- PLC S7-1200 with analog inputs.
- SCADA monitoring software.

TECHNOLOGY DIAGRAM

ME.A8024 — BOTTLING AND FILLING MODEL

TECHNOLOGY DIAGRAM

OPERATIONAL PROCESS

1. Bottle Feeding → 2. Precise Filling → 3. Cap Feeding → 4. Cap Pressing → 5. Cap Tightening → 6. Transport Out
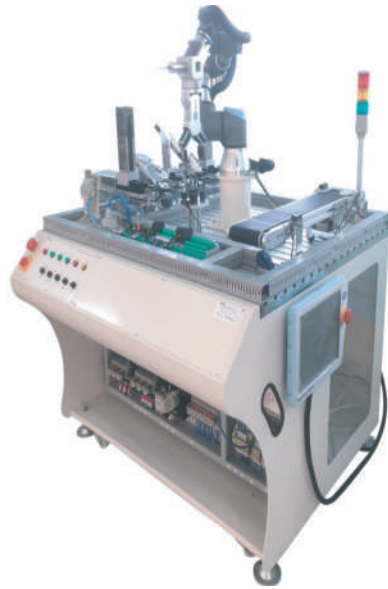
TRAINING CONTENT

- Practice PLC programming, logic, timers, and counters
- Practice controlling the rotary table Index motor
- Control DC motors
- Pneumatic electrical control
- Sensor alignment and mechanical mechanism adjustment
- Familiarize with industrial mechanisms
- Connect and operate the system
- HMI programming system monitoring

GENERAL SPECIFICATIONS

Simulation of the Automatic Bottling and Capping Process in a Production Line
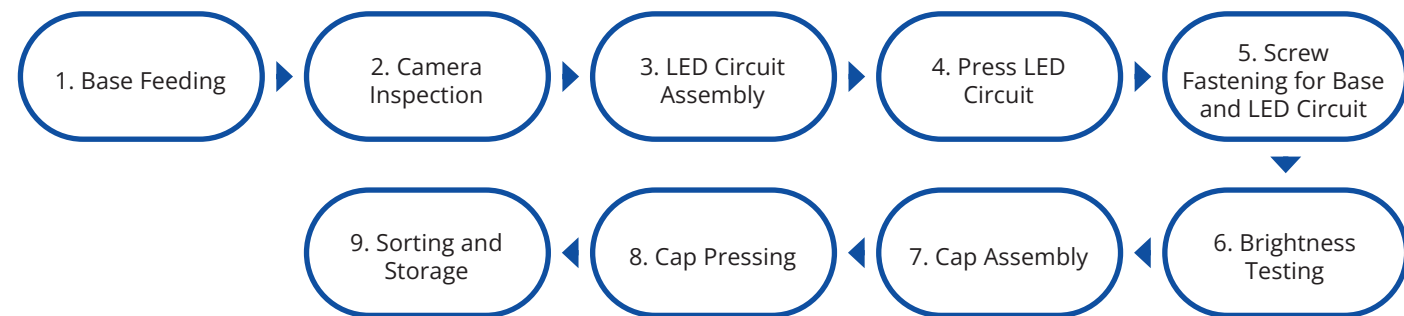- Dimensions: 905 × 1075 × 1440 mm (L × W × H).
- Input voltage: 220 VAC, compressed air supply: 5 bar.
- Conveyor for bottle feeding and finished bottle transport.
- 10-position indexing rotary table.
- Filling unit.
- Cap feeding unit.
- Cap tightening (capping) unit.
- PLC configuration optional.
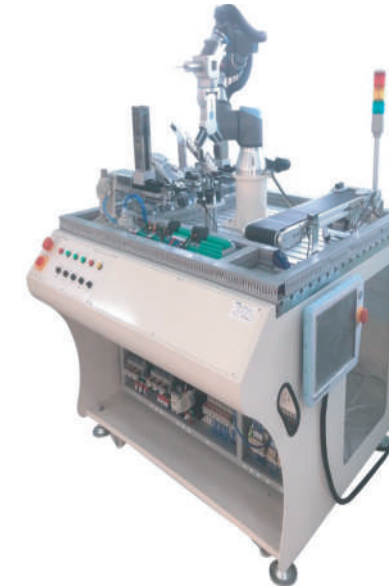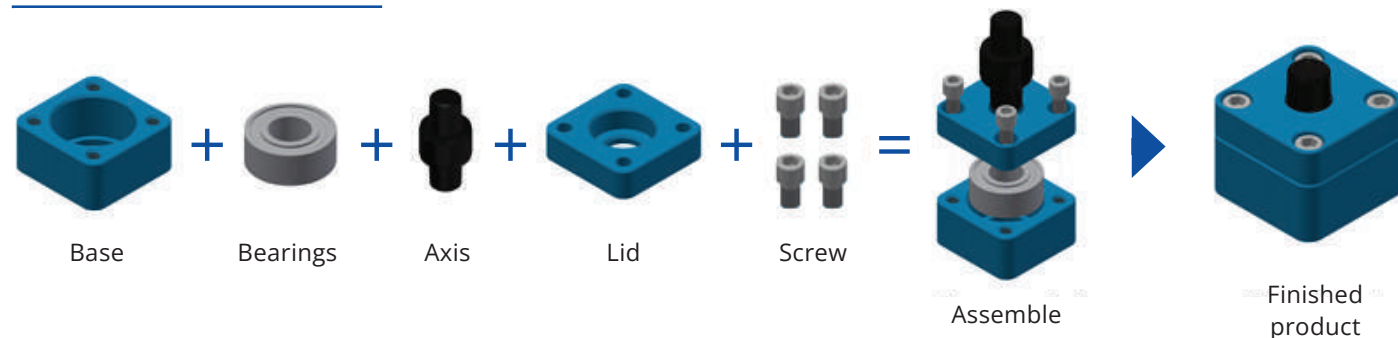
ST.ME.A1008 ROBOT TRAINING MODEL

TRAINING CONTENT

- Practice point-to-point robot programming
- Practice programming robots integrating sensor signals and actuating cylinders
- Practice combined Robot-PLC programming
- Practice programming complete product assembly cycles
- Practice monitoring production systems using IoT technology
- Analyze the structure and operating principles of electrical and pneumatic device clusters in the field of mechatronics
- Operate devices within an automated production line
- Identify and repair common faults in mechatronic systems

OPERATIONAL PROCESS

1. Base Feeding → 2. Camera Inspection → 3. LED Circuit Assembly → 4. Press LED Circuit → 5. Screw Fastening for Base and LED Circuit

9. Sorting and Storage ← 8. Cap Pressing ← 7. Cap Assembly ← 6. Brightness Testing

ASSEMBLED PRODUCT

Base + Bearings + Axis + Lid + Screw = Assemble ▶ Finished product

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SIX-AXIS COLLABORATIVE

Product assembly of 5 parts including: Base, bearing, bearing, cover, screw
- Dimensions: 910 × 917 × 1600 mm (L × W × H).
- Power supply: 220 VAC / 50 Hz.
- Air supply: 5 bar.
- Collaborative robot UR3 or ABB.
- Pneumatic gripper, multifunctional tool gripper capable of handling various types of workpieces.
- Workpiece feeding by inclined chute motor.
- Workpiece feeding by gravity tube.
- DC motor conveyor.
- DC motor screwdriving tool.
- PLC configuration optional
- Configurable PLC
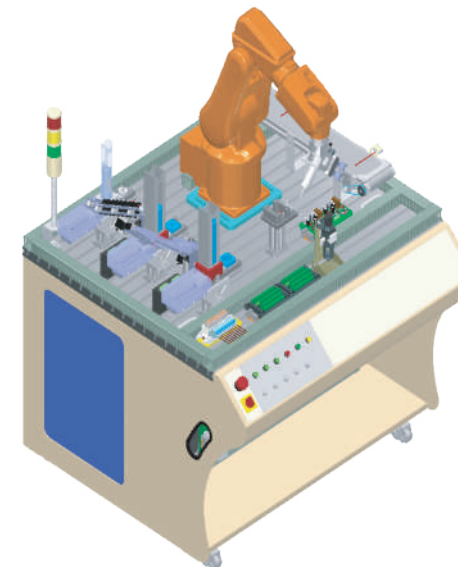
SIX-AXIS INDUSTRIAL

Assemble the product with 5 parts including: Base, bearing, bearing, cover, screw
- Dimensions: 910 × 917 × 1700 mm (L × W × H).
- Power supply: 220 VAC / 50 Hz.
- Air supply: 5 bar.
- ABB Industrial robot.
- Pneumatic gripper, multifunctional tool gripper capable of handling various types of workpieces.
- Workpiece feeding by inclined chute motor.
- Workpiece feeding by gravity tube.
- DC motor conveyor.
- DC motor screwdriving tool.
- PLC configuration optional.

SEVEN-AXIS

Provide students with basic knowledge of industrial robots, PLC programming, pneumatic devices, sensors, switching and protection devices, etc
- Dimensions: 910 × 917 × 1700 mm (L × W × H).
- Power supply: 220 VAC / 50 Hz.
- Air supply: 5 bar.
- 7-axis Kassow robot.
- Pneumatic gripper, multifunctional tool gripper capable of handling various types of workpieces.
- Workpiece feeding by inclined chute motor.
- Workpiece feeding by gravity tube.
- DC motor conveyor.
- DC motor screwdriving tool.
- PLC configuration optional.
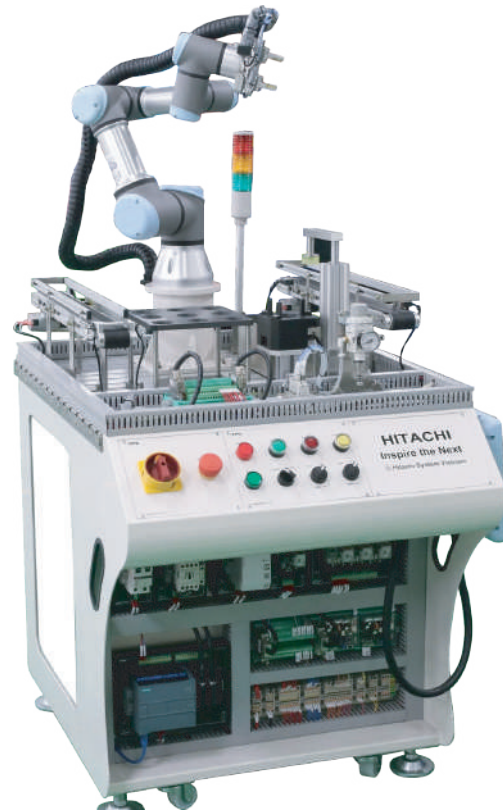
TRAINING CONTENT

- Explore the structure, functions, and connections of the collaborative robot
- Program the collaborative robot, both basic and advanced levels
- PLC programming and robot-PLC communication
- Pneumatic electrical control
- DC motor control
- Stepper motor control
- Practice alignment and operation of the system

GENERAL SPECIFICATIONS

- Dimensions: 910 × 917 × 1600 mm (L × W × H).
- Power supply: 220 VAC / 50 Hz.
- Air supply: 5 bar.
- Collaborative robot UR3 or ABB.
- Pneumatic gripper, multifunctional tool gripper capable of handling various types of workpieces.
- Workpiece feeding by inclined chute motor.
- Workpiece feeding by gravity tube.
- DC motor conveyor.
- DC motor screwdriving tool.
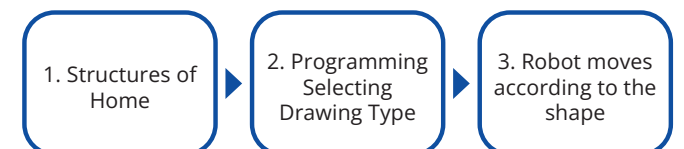- PLC configuration optional
- Configurable PLC
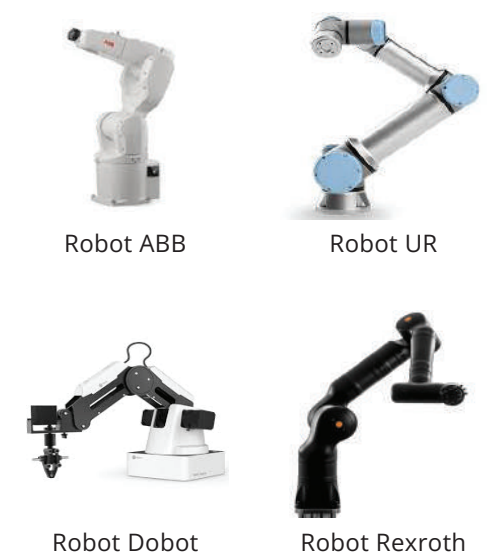
ASSEMBLED PRODUCT
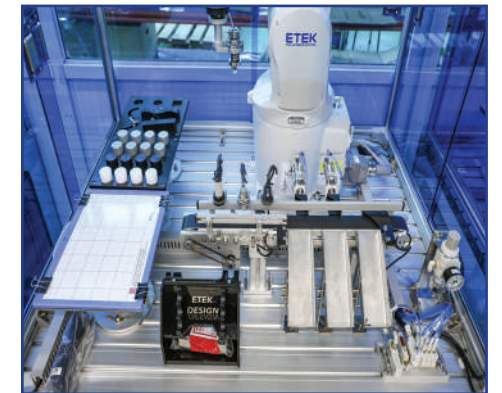
TRAINING CONTENT

- Learn how to configure and program industrial robots.
- Understand and become familiar with controlling robots via a user interface.
- Learn how to integrate robots into production systems.
- Optimize operational processes, improving the speed, accuracy, and efficiency of robot performance.
- Acquire skills for regular inspection, maintenance, and troubleshooting of common issues.
- Understand and adhere to safety procedures when working with robots.
- Be able to create and execute precise paths and movements for robots in 3D space

OPERATIONAL PROCESS

1. Structures of Home → 2. Programming Selecting Drawing Type → 3. Robot moves according to the shape

ROBOT OPTION

Robot ABB   Robot UR

Robot Dobot   Robot Rexroth
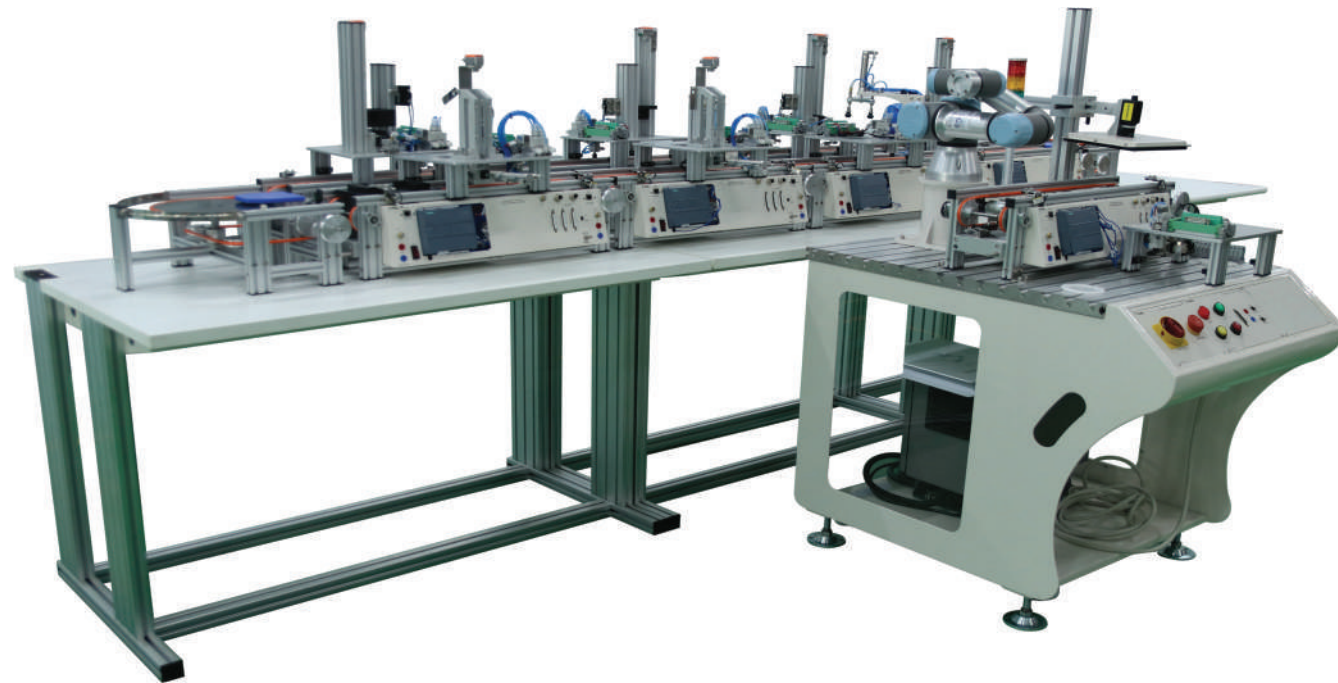
GENERAL SPECIFICATIONS

- Dimensions: 910x917x2200mm (LxWxH).
- Power supply: 220VAC/50HZ.
- Air source: 5bar.
- Main equipment components are imported and assembled in Vietnam.
- PLC control block: allows control and operation of individual clusters.
- Air control by pneumatic solenoid valves.
- All equipment is mounted on a CT3 electrostatically painted frame with moving wheels

ST.ME.A6001 | SMALL-SCALE FLEXIBLE PRODUCTION STATION

ASSEMBLED PRODUCT

Base + Cap + Shaft ▶ Product

OPERATIONAL PROCESS

1. Select Product ▶ 2. Manufacture Assembly ▶ 3. Inspect ▶ 4. Stack Items

TRAINING CONTENT

- PLC programming for controlling peripheral devices
- Configuration and use of Profinet communication network for control and operation via HMI screen
- Common industrial sensors: proximity sensors, magnetic sensors, optical sensors, I/O link sensors
- Assembly, setup, and testing of pneumatic cylinders and valves
- Programming and practice with industrial problems using robots, cameras
- Industry 4.0 connectivity and wireless control
- MES/ERP systems for management in organizations and businesses, particularly in production management

GENERAL SPECIFICATIONS

- Power supply: 220VAC/50HZ.
- Air source: 5bar.
- Closed loop 2-wire conveyor system using aluminum profile frame.
- Divided into small stations with different functions, linked together into a complete system.
- Easy to expand and upgrade.
- PLC S7 1200 and sensor with IO-link communication expansion
- Using Profinet, IO-link communication network to communicate between PLC and PLC and PLC with field devices.
- Collaborative robot and image processing camera
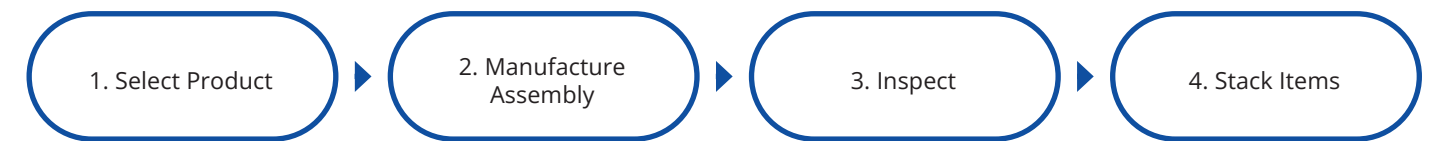- Application of Industry 4.0 technology to serve organizations and businesses

ADVANCED TRAINING CONTENT

- Industry 4.0 technology
- Connectivity and wireless control technology
- MES/ERP systems
- Management systems for organizations and businesses, especially in managing production, addressing issues such as inventory, production processes, etc
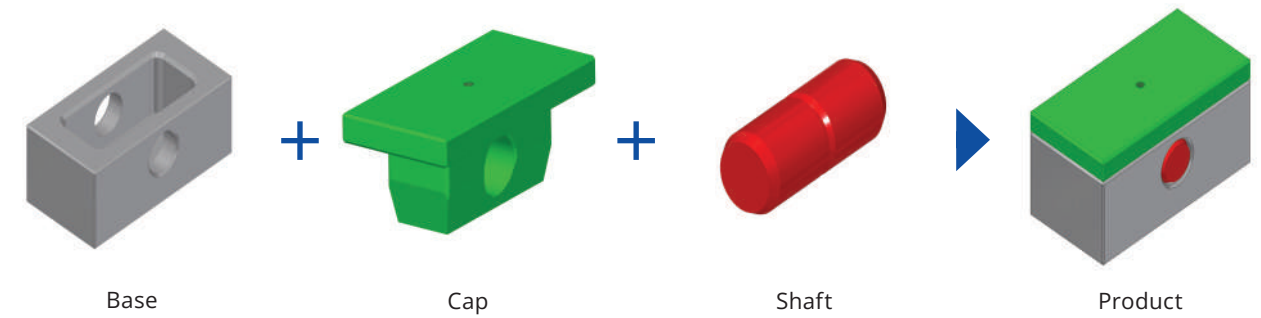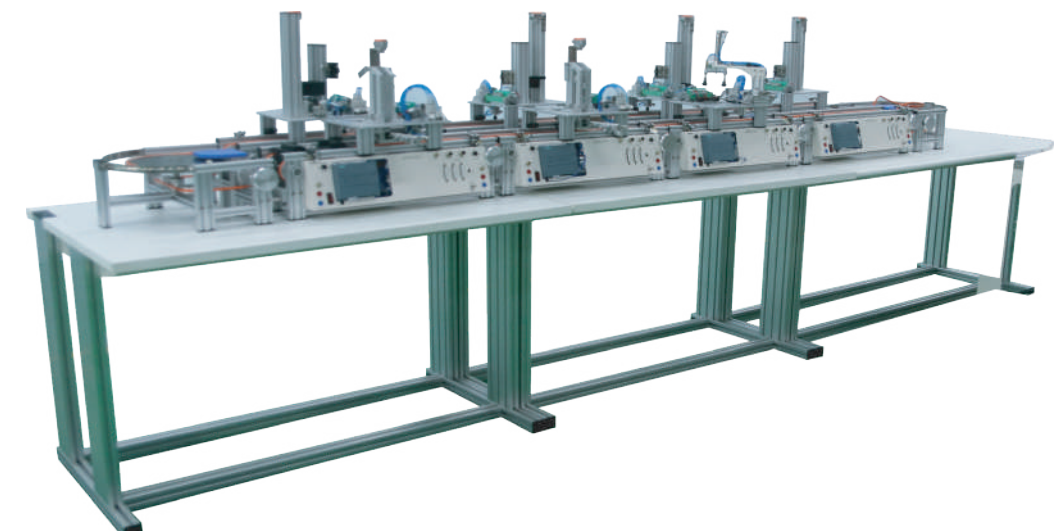
EQUIPMENT LIST

Small Flexible Production Station

Inspection Station

SMALL FLEXIBLE PRODUCTION STATION

OPERATIONAL PROCESS

Pick product → Assembly

Sort ◄ Checking

Base Level

Lid Supply
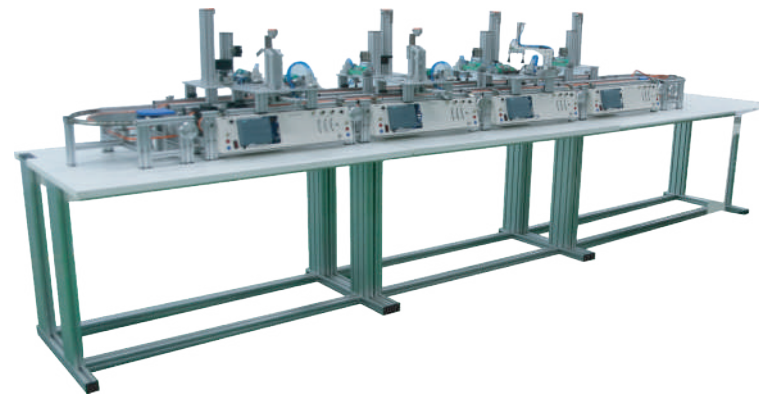
Visual inspection, product code reading, and defective product sorting

- Product line start conveyor
- Defective product conveyor
- Product inspection camera
- Product redirection unit
- Product barcode reading
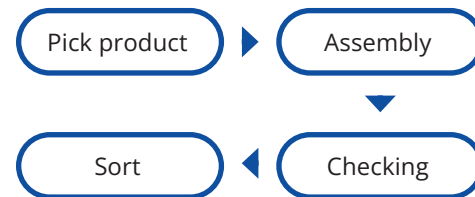
Shaft Supply

Grip Station

INSPECTION STATION

OPERATIONAL PROCESS

Get product ▶ Check

Check ◄ Get product
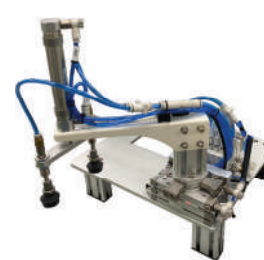
Robot

Camera

- Robot Programming
- Image Processing
- PLC Programming
- PLC, Robot and Camera Communication
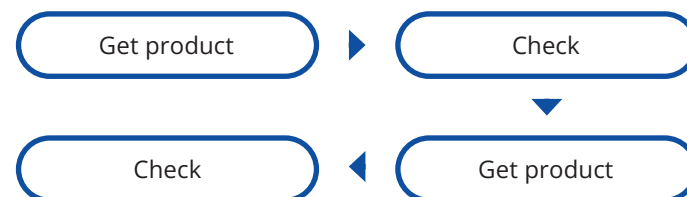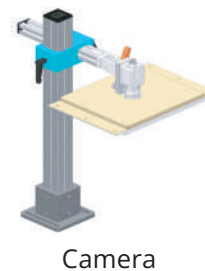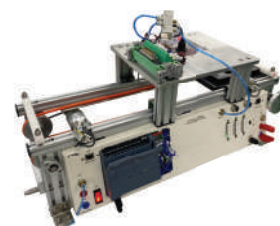
Testing Station

ERP SYSTEM

Enter and process orders, purchase and warehouse supplies, release product

MES SYSTEM

Creating the production instruction & goods delivery note
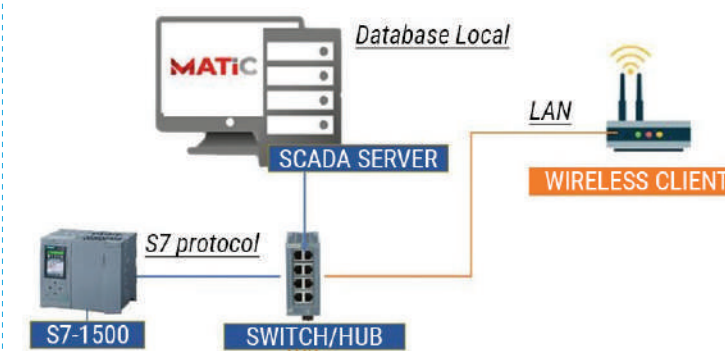
SCADA

Management and supervision; Use profinet, profibus communication, PLC S7-1500 S7-1200 HMI, PC scada and wireless line monitoring in internet network.
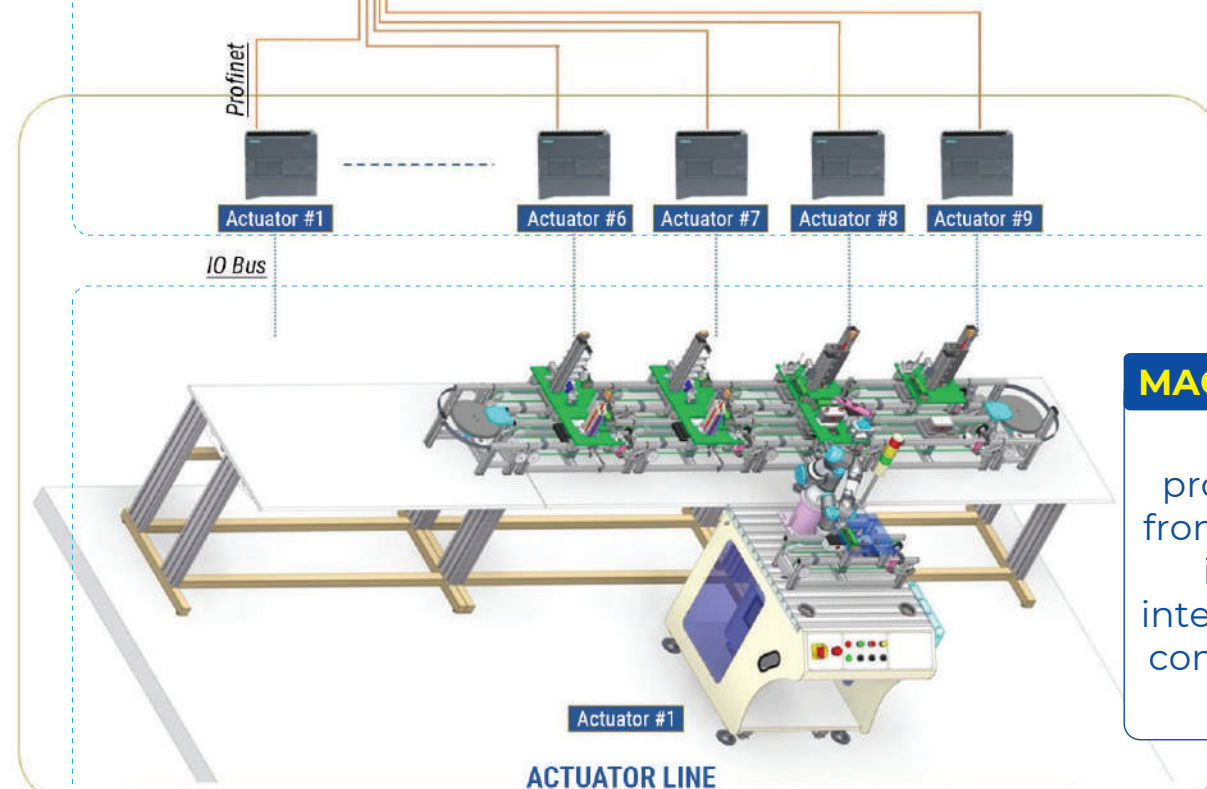
MACHINE SYSTEM

Closed production line from assembly to inspection, integrated IO link communication-profinet.

ACTUATOR LINE

ST.ME.A8030 FACTORY AUTOMATION TRAINING SOLUTIONS

ASSEMBLED PRODUCT

Base feeding → Pin insertion → Cap feeding → Screw insertion → Storage

TRAINING MODULE

TRAINING MODULE

- PRODUCTION MANAGEMENT
- PRODUCTION ENGINEERING
- AUTOMATION ENGINEERING

OEE
MES   SOPs
PLC   ROBOTS   SENSORS

ENGINEERING AND TECHNOLOGY

PRODUCTION MANAGEMENT SOFTWARE	SCADA–HMI MONITORING
▶ **OEE, Andon** (Realtime Dashboard, Downtime Analysis, Energy Monitoring…)	▶ HMI & SCADA
	▶ Industrial Communication Network
▶ **MES** (Manufacturing Execution System)	▶ IoT connection
	▶ AGV Traffic Management
▶ Service, PHM, Predictive Maintenance (PdM)	▶ Digtal Twin

TRAINEES

LEADER	Plan and manage projects, train and mentor staff, integrate MES-ERP systems, manage quality control and focus on process improvements (Lean 4.0) (ATTS-5).
TECHNICIAN	Oversee and manage the process, provide technical support, and work with SPC/SCADA (ATTS2-3).
OPERATOR	Standardize the process, perform 5S checks, and ensure quality control at each step (ATTS-2).

DESIGN THINKING

▶ Safety Machine Design
  • *Electrial Safety: EN/IEC 60204/NFPA 79*
  • *Machinery Safety: ISO 13849*
▶ Mechatronic Machine Design
▶ Mechatronic Design
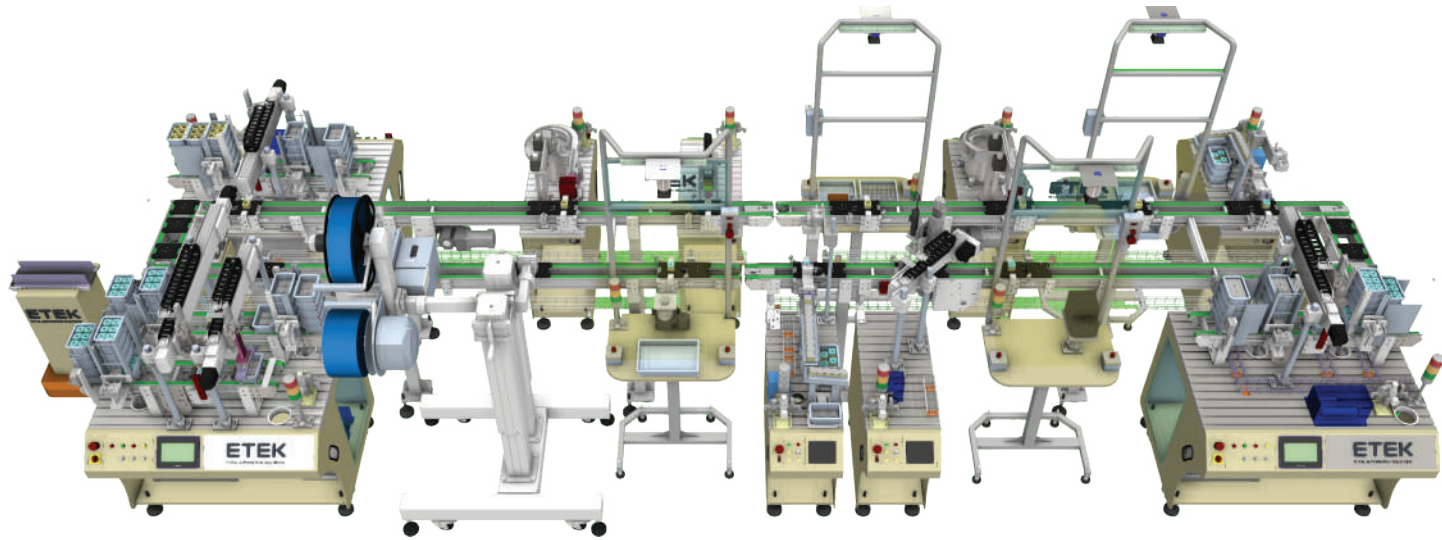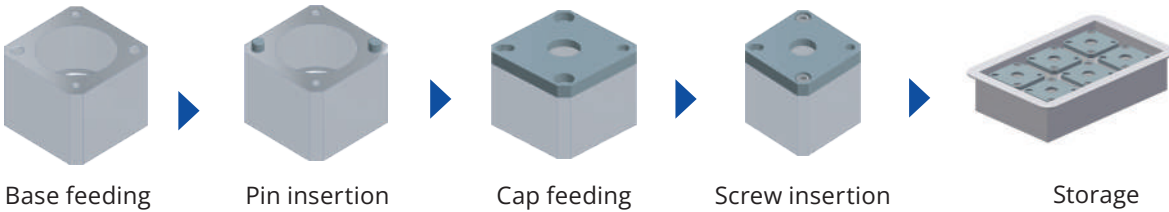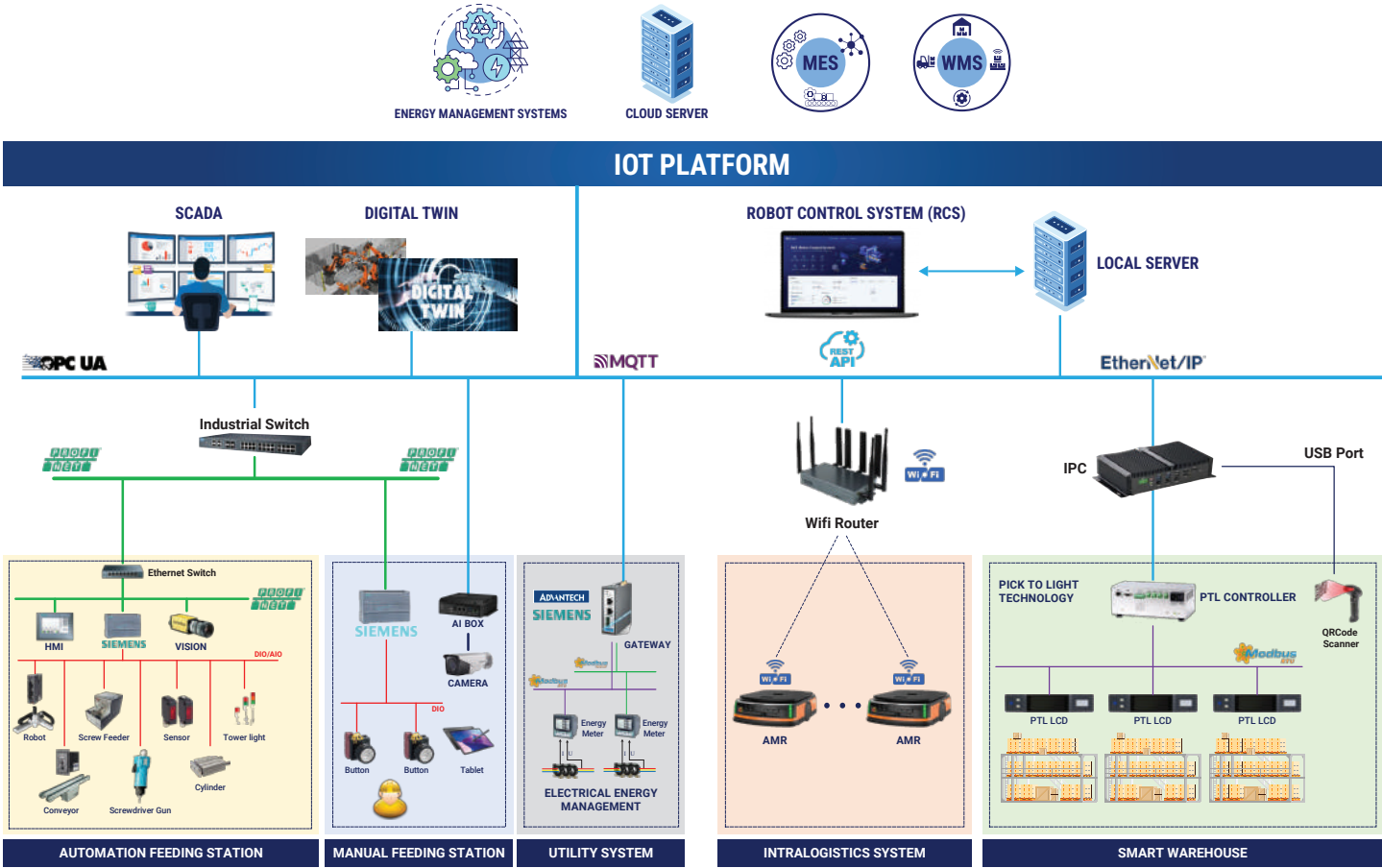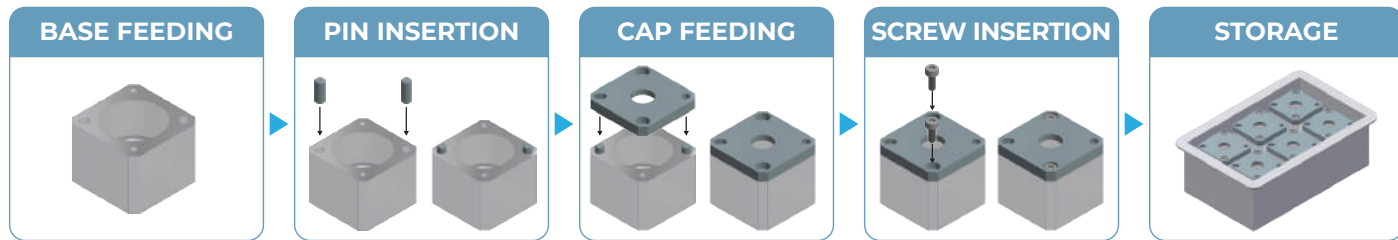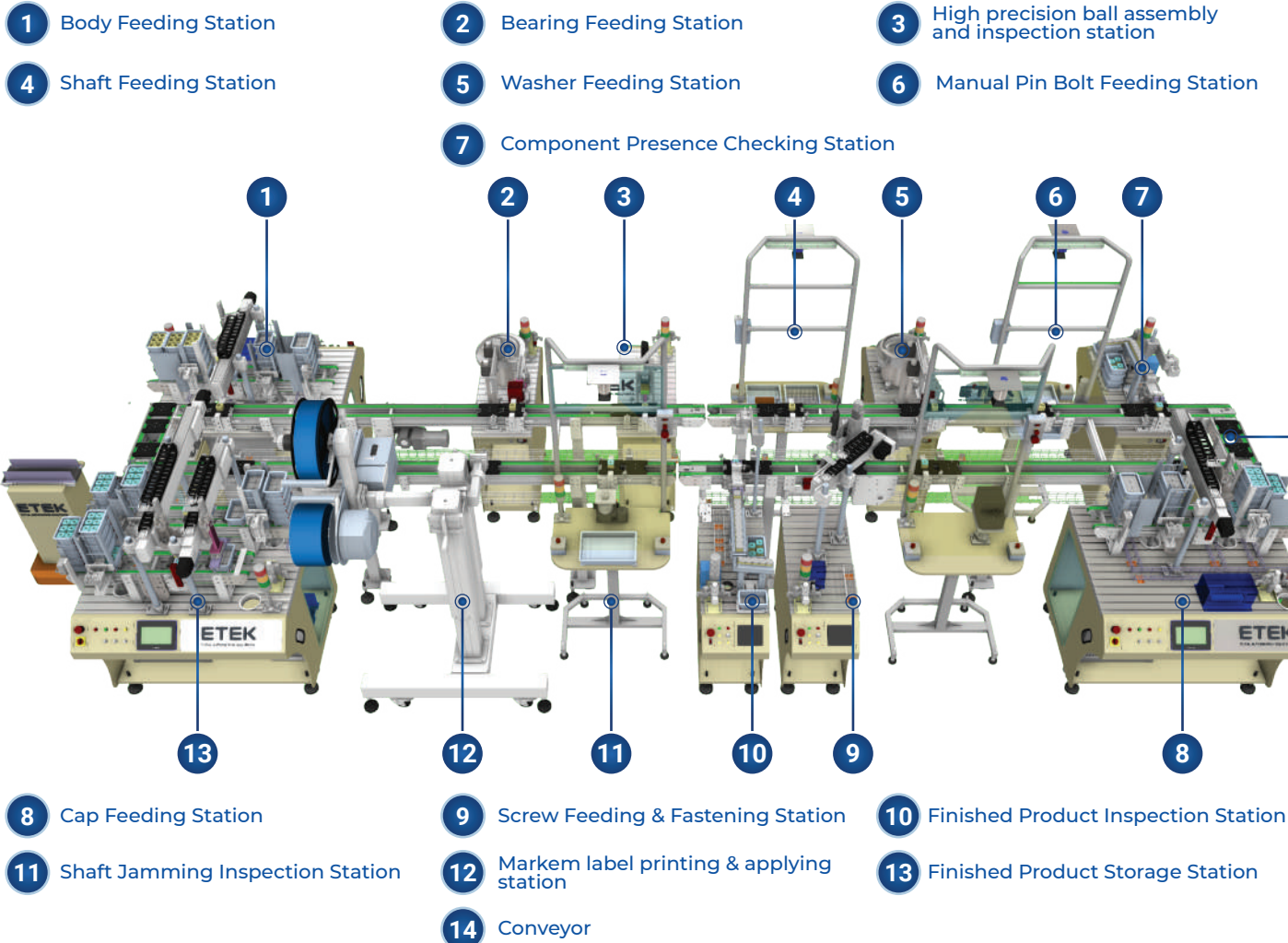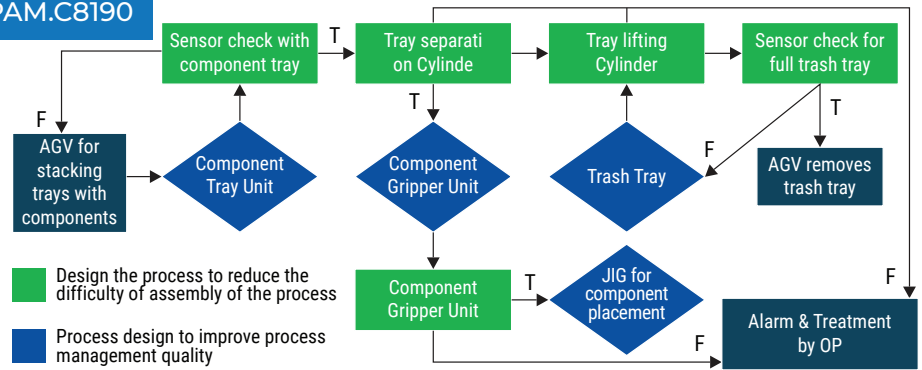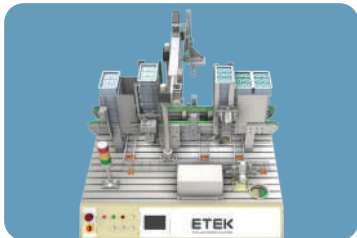▶ Electrical Design
▶ Mechanical Assembly and Alignment Skills

MECHATRONIC SYSTEM

▶ Electrical Control Cabinet
▶ PLC
▶ Smart Sensor
▶ Industrial Robot
▶ AGV, AMR
▶ Pneumatics
▶ AI Vision
▶ Servo
▶ Single-axis Robot
▶ Fault Simulation I/O
▶ IoT

GENERAL SPECIFICATIONS

05 LEVELS OF TRAINING

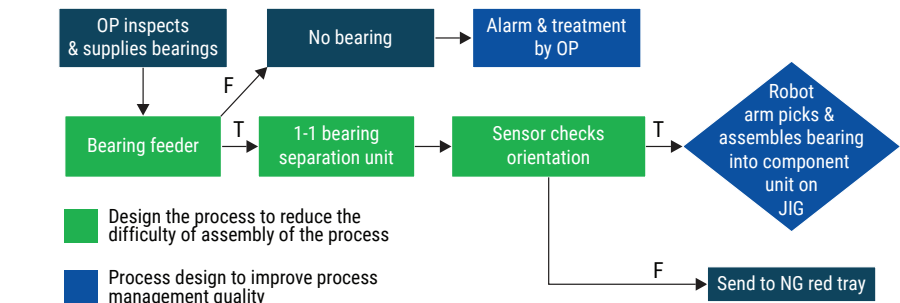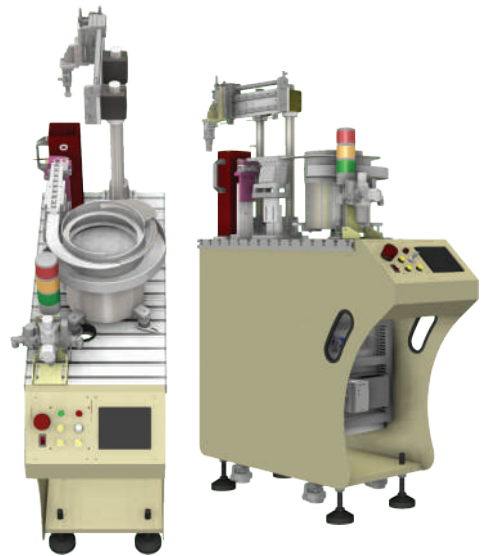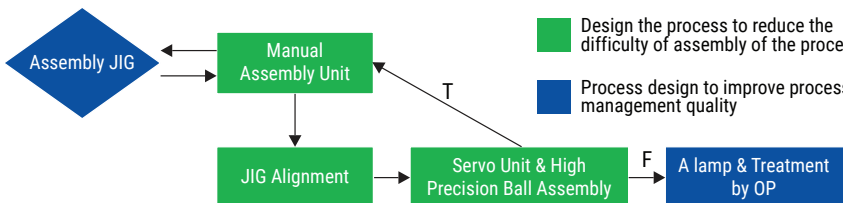|		Major Topics (IEM)					Tools, competencies	Core Knowledge	Target
		Work Study & Ergonomics	Operations and production system	Quality management	Lean and productivity	Supply chain			
FATS 5 Smart Factory	CPS, AI/ML, predictive maintenance, blockchain supply chain.	• Human-AI interaction, AR/VR supporting training, and cognitive ergonomics. • Design of intelligent, user-friendly monitoring systems.	• CPS system for automatic scheduling and optimization. • Digital Twin simulates the entire factory. • Strategic management instead of detailed scheduling.	• AI analyzes big data, predicts faults.	• AI automatically detects waste, suggests Kaizen improvements. • Predictive maintenance using AI.	• Blockchain & AI logistics. • Digital supply network management.	AI/ML for fault prediction, AR/VR training, Digital Twin, Autonomous Decision Making.	Lean 4.0 (AI for waste detection), Predictive maintenance, managing the innovation ecosystem.	Train senior managers and IE/IEM engineers with the ability to operate and design Smart Factories.
FATS 4 Digital Integration	e-Kanban, IoT, MES-ERP integration, BI dashboard.	• Monitoring via HMI/dashboard; transition to "cognitive ergonomics" • Design intuitive interfaces, reduce cognitive load, ensure data safety.	• Integrated management via MES-ERP • Automatic scheduling • Real-time production monitoring	• Build integrated quality data. • Analyze big data for early detection of deviations. • Develop automatic warning systems and predictive quality control.	• e-Kanban, e-VSM, automated OEE • Predictive maintenance. Learners analyze data for improvement.	• IoT, RFID, WMS integration for warehouse – production – logistics. • Real-time supply chain management via MES/ERP.	IoT, RFID, WMS, BI dashboard, Predictive Analytics.	Integrated data management, automatic OEE, BI-based quality analysis, Smart scheduling.	Train digital production management capabilities, connecting the entire supply chain – production – logistics.
FATS 3 Automation Line	Fully automated lines with online SPC, sensors for quality control, barcode tracking	• Direct observation and monitoring at the production floor. • Reset/maintenance tasks • Safety when interacting with automated systems	• Synchronize workstations, identify bottlenecks. • Product flow simulation within the factory (Flexsim) • Basic ERP/MES.	• Quality measurement and control with sensors & online SPC • Read SPC charts and intervene if limits are exceeded. • Detailed traceability through each step in the production process.	• TPM • SMED • Improve systems to reduce Six Big Losses.	• JIT • Simulation of material flow within the factory (Flexsim)	SPC Online, OEE, Basic TPM, ANDON System	Material synchronization with production lines, Lean Six Sigma projects, Real-time data quality analysis from sensors.	Operate automated production lines, manage productivity and quality at the system level.
FATS 2 Semi-Automation	Integration of semi-automatic lines with SPC online, data view from PLC/SCADA.	• Task allocation between humans and machines. • AI vision analysis OP's actions. • Safety monitoring • Optimize human-machine coordination. Reduce repetitive tasks.	• Design U-line, Routing, Branching layouts.	• Measure quality with semi-automatic devices. • Manage quality data • Basic SPC to monitor process stability. • Traceability by production phase	• Machine downtime. • Basic JIT. • Basic TPM. • OEE calculations for equipment.	• Barcode and WMS software. • Calculate material flow and finished goods (Material Flow).	Balance chart, line layout, Kanban board, Barcode/RFID	Conveyor balancing, Machine downtime, Semi-automatic quality control.	Standardize operations, understand the human-machine relationship, and start learning electronic supply chain management.
FATS 1 Manual	Manual production, basic quality control, checklists, and standard inspection.	• Observation, analysis • Standardize movements, improve posture	• Small batch production management • Manual scheduling with Excel • Optimize production layout	• Manual inspection, checklists, and comparison to standard samples • Maintain quality through 5S	• 5S, eliminate wasteful actions • PDCA and Kaizen • Identify 7 types of waste.	• Manual material and inventory management • FIFO card	Stopwatch, Process Chart, SIPOC, Layout, Check sheet, 5S, Spaghetti Diagram	Standard time, Takt vs. Cycle, 7 types of waste, FIFO, Manual inventory management.	Establish a foundation for Lean thinking and basic management.

1 Body Feeding Station
2 Bearing Feeding Station
3 High precision ball assembly and inspection station
4 Shaft Feeding Station
5 Washer Feeding Station
6 Manual Pin Bolt Feeding Station
7 Component Presence Checking Station

8 Cap Feeding Station
9 Screw Feeding & Fastening Station
10 Finished Product Inspection Station
11 Shaft Jamming Inspection Station
12 Markem label printing & applying station
13 Finished Product Storage Station
14 Conveyor

| BASE FEEDING | PIN INSERTION | CAP FEEDING | SCREW INSERTION | STORAGE |

BODY FEEDING STATION — TPAM.C8190

Sensor check with component tray
AGV for stacking trays with components
Tray separation Cylinde
Tray lifting Cylinder
Sensor check for full trash tray
Component Tray Unit
Component Gripper Unit
Trash Tray
AGV removes trash tray
Component Gripper Unit
JIG for component placement
Alarm & Treatment by OP

- Design the process to reduce the difficulty of assembly of the process
- Process design to improve process management quality

STATION 1 – BODY FEEDING

Cycle time 10s	**Number of products per tray** 6/1
Number of trays per stack 5/1	**Waiting for material supply by AGV** Yes
Tray transfer time 6~8s	**Time to supply a new stack of trays** 6~8s

BEARING FEEDING STATION — TPAM.C8130

OP inspects & supplies bearings
No bearing → Alarm & treatment by OP
Bearing feeder
1-1 bearing separation unit
Sensor checks orientation
Robot arm picks & assembles bearing into component unit on JIG
Send to NG red tray

- Design the process to reduce the difficulty of assembly of the process
- Process design to improve process management quality

STATION 2 – BEARING FEEDING

Cycle time 6s	**Number of products per tray** 1/1
Feeding method Bowl Feeder	**Waiting for material supply by AGV** No

Vibratory feeder for bearing classification & supply (Bowl Feeder)
30 - 40 bearings/min, bearings classified and supplied in one assembly orientation

TPAM.C8140 — HIGH PRECISION BALL ASSEMBLY AND INSPECTION STATION

Assembly JIG
Manual Assembly Unit
JIG Alignment
Servo Unit & High Precision Ball Assembly
A lamp & Treatment by OP

- Design the process to reduce the difficulty of assembly of the process
- Process design to improve process management quality

STATION 3 – BEARING ASSEMBLY

Cycle time 6s	**Number of products per Tray** 1/1

Waiting for material supply by AGV
No

Servo pressing force (compared to bearing's rated load)
Less than 1350N

SHAFT FEEDING STATION — TPAM.C8150

OP loads shaft into shaft tray
Shaft inspection: pass through JIG
Assemble shaft into component body on JIG
Press 2 buttons to confirm assembly completion
Transfer defective shaft (NG) to NG tray

- Design the process to reduce the difficulty of assembly of the process
- Process design to improve process management quality

AI vision technology analyzes user operations

STATION 4 – SHAFT ASSEMBLY

Cycle time 6s	**Number of products per Tray** 1/1
Feeding method Manual	**Waiting for material supply by AGV** No

![ETEK - TOTAL AUTOMATION SOLUTIONS]

WASHER FEEDING STATION — TPAM.C8160

Flowchart:
- OP inspects & supplies washers → Washer feeder
- No washer → Alarm & treatment by OP
- Washer feeder → (T) 1-1 washer separation unit → Sensor checks orientation
- Sensor checks orientation → (T) Robot arm picks & assembles washer into component unit on JIG
- (F) → Transfer to red NG tray

🟩 Design the process to reduce the difficulty of assembly of the process
🟦 Process design to improve process management quality
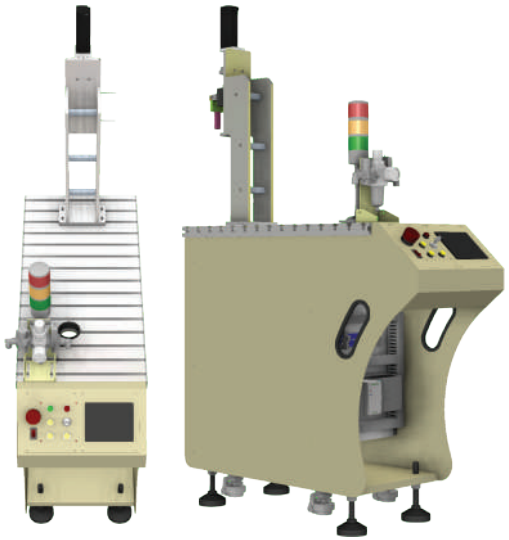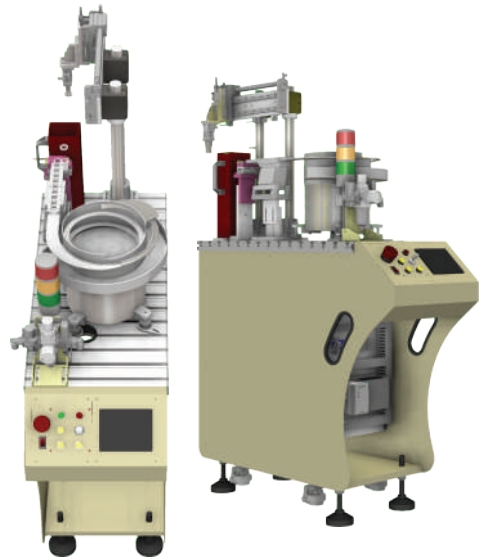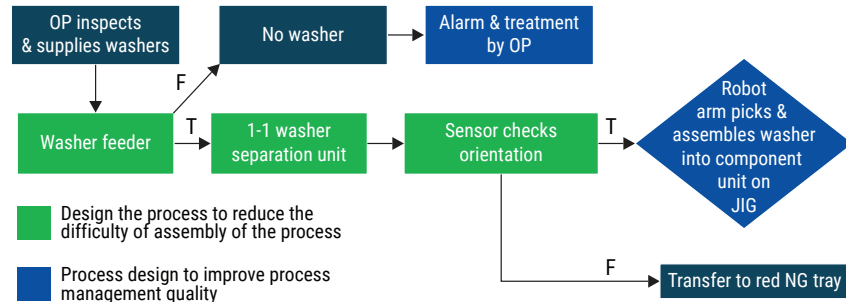
STATION 5 – WASHER FEEDING

Cycle time
6s

Number of products per tray
1/1

Feeding method
Bowl Feeder

Waiting for material supply by AGV
No

Vibratory feeder for bearing classification & supply (Bowl Feeder)
30 - 40 washers/min, classified and supplied in one assembly orientation

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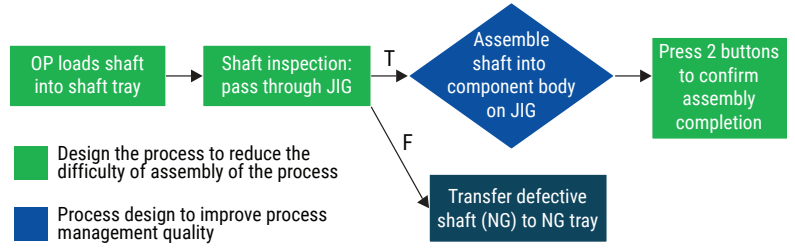## MANUAL PIN BOLT FEEDING STATION — TPAM.C8170

Flowchart:
- OP loads the pin into the pin tray → PIN inspection: pass through JIG Go–No Go
- (T) Assemble PIN into component body on JIG → Press 2 buttons to confirm assembly completion
- (F) Transfer defective PIN (NG) to NG tray

🟩 Design the process to reduce the difficulty of assembly of the process
🟦 Process design to improve process management quality

AI vision technology analyzes user operations

STATION 6 – PIN BOLT FEEDING

Cycle time
6s

Number of products per component body
2/1

Feeding method
Manual

Waiting for material supply by AGV
No

Tray to prevent PINs from falling during assembly
Yes

COMPONENT PRESENCE INSPECTION STATION — TPAM.C8180

Flowchart:
- Assembled component unit on JIG → Vision camera
- (T) Transfer JIG to next station
- (F) NG component pick-up unit → Alarm & treatment by OP
- NG component pick-up unit → NG product chute → Chute full sensor

🟩 Design the process to reduce the difficulty of assembly of the process
🟦 Process design to improve process management quality

STATION 7 – COMPONENT PRESENCE CHECKING

Cycle time
6s

Number of products per Tray
1/1

Vision camera specifications
- Check number of components on product (base, bearing, shaft, pin)
- Detect abnormal/foreign objects (appearance check)

CAP FEEDING STATION — TPAM.C8190

Flowchart:
- AGV for stacking trays with components → Sensor check with component tray
- (T) Tray separation Cylinder → Tray lifting Cylinder → Sensor check for full trash tray
- (T) AGV removes trash tray; Trash Tray
- Component Tray Unit → Component Gripper Unit → Component Gripper Unit → JIG for component placement
- JIG for component placement → (F) Alarm & Treatment by OP

🟩 Design the process to reduce the difficulty of assembly of the process
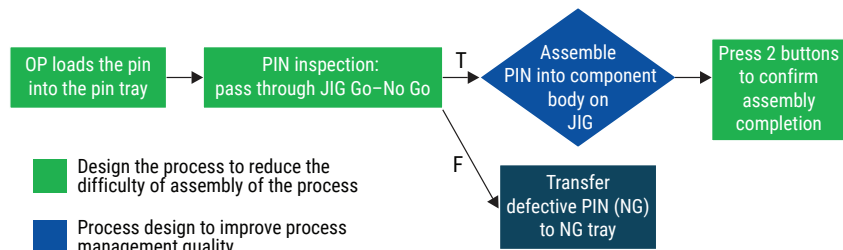🟦 Process design to improve process management quality

STATION 8 – CAP FEEDING

Cycle time
6s

Number of products per tray
6/1

Number of trays per stack
5/1

Waiting for material supply by AGV
Yes

Tray transfer time
5s

Time to supply a new stack of trays
8~10s

SCREW FEEDING & FASTENING STATION — TPAM.C8210

Flowchart:
- OP supplies screws → Screw feeder
- No screw → Alarm & treatment by OP
- Screw feeder → (T) Screw vacuum valve unit → (T) Screw from feeder is fastened into component unit on JIG
- (F) Transfer to red NG tray

🟩 Design the process to reduce the difficulty of assembly of the process
🟦 Process design to improve process management quality

STATION 9 – SCREW FEEDING & FASTENING

Cycle time
12s

Number of products per component unit
2/1

Feeding method
Screw Feeder

Waiting for material supply by AGV
No

Screwdriver (Kilews SKD-BN830PF)
Adjustable torque from 0.98 ~ 2.94 Nm
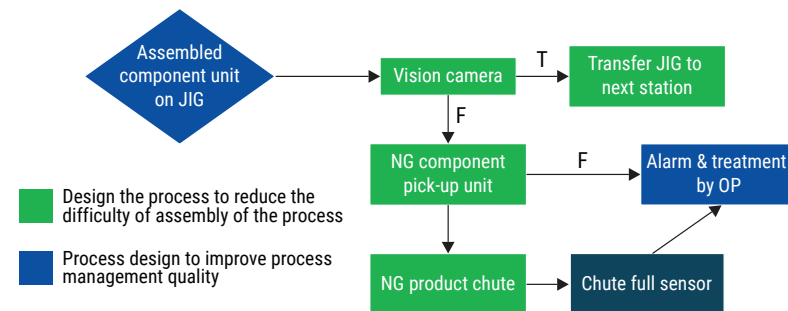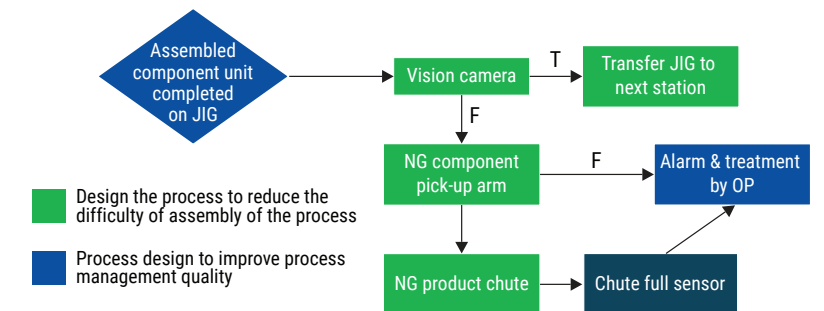(select torque according to M3 screw fastening)

FINISHED PRODUCT INSPECTION STATION — TPAM.C8220

Flowchart:
- Assembled component unit completed on JIG → Vision camera
- (T) Transfer JIG to next station
- (F) NG component pick-up arm → Alarm & treatment by OP
- NG component pick-up arm → NG product chute → Chute full sensor

🟩 Design the process to reduce the difficulty of assembly of the process
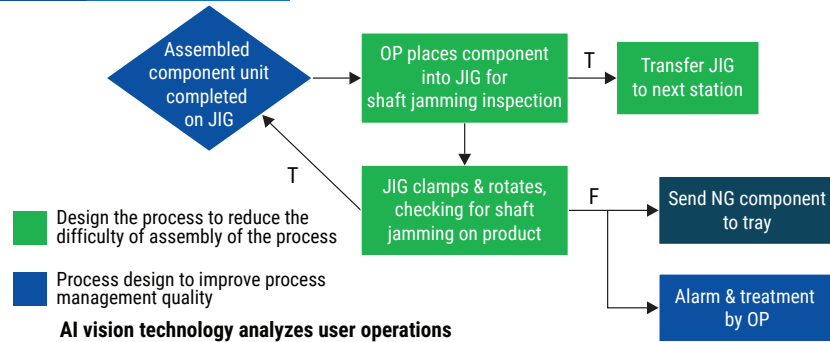🟦 Process design to improve process management quality

STATION 10 – COMPONENT PRESENCE CHECKING

Cycle time
6s

Number of products
1/1

Vision camera specifications
- Dimensional measurement
- Foreign object/appearance abnormality detection
- Character / QR code reading
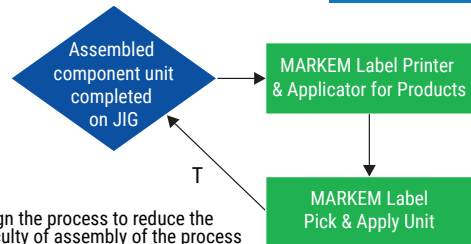
SHAFT JAMMING INSPECTION STATION — TPAM.C8230

Assembled component unit completed on JIG

OP places component into JIG for shaft jamming inspection — T → Transfer JIG to next station

JIG clamps & rotates, checking for shaft jamming on product
- F → Send NG component to tray
- Alarm & treatment by OP

- (green) Design the process to reduce the difficulty of assembly of the process
- (blue) Process design to improve process management quality

AI vision technology analyzes user operations

STATION 11 – SHAFT JAMMING INSPECTION

Cycle time	Number of products per Unit
6s	1/1
Feeding method	**Waiting for material supply by AGV**
Manual	No

TPAM.C8240 — MARKEM LABEL PRINTING & APPLYING STATION

Assembled component unit completed on JIG

MARKEM Label Printer & Applicator for Products

MARKEM Label Pick & Apply Unit — F → Alarm & treatment by OP

- (green) Design the process to reduce the difficulty of assembly of the process
- (blue) Process design to improve process management quality

STATION 12 – MARKEM LABEL PRINTING & APPLYING

Cycle time	Number of Products per component body
6s	1/1
Feeding method	**Waiting for material supply by AGV**
Manual	No

FINISHED PRODUCT STORAGE STATION — TPAM.C8250

Sensor check for component tray — T → Cylinder tray separation — T → Cylinder tray lifting → Sensor check for scrap tray

AGV tray loading — F

Component Tray Stack → Tray Picking Unit → Component Picking Unit → Tray Picking Unit → AGV scrap tray unloading

Component Picking Unit — T → JIG for placing component — F → Alarm & Treatment by OP

- (green) Design the process to reduce the difficulty of assembly of the process
- (blue) Process design to improve process management quality

STATION 13 – FINISHED PRODUCT STORAGE

Cycle time	Number of products per tray
10s	6/1
Number of trays per stack	**Waiting for material supply by AGV**
5/1	Yes
Tray transfer time	**Time to supply a new stack of trays**
5s	8~10s

OVERALL FACTORY LAYOUT

MANUAL PRODUCTION LINE

AUTOMATIC PRODUCTION LINE

WAREHOUSE

CUSTOMIZE LIST

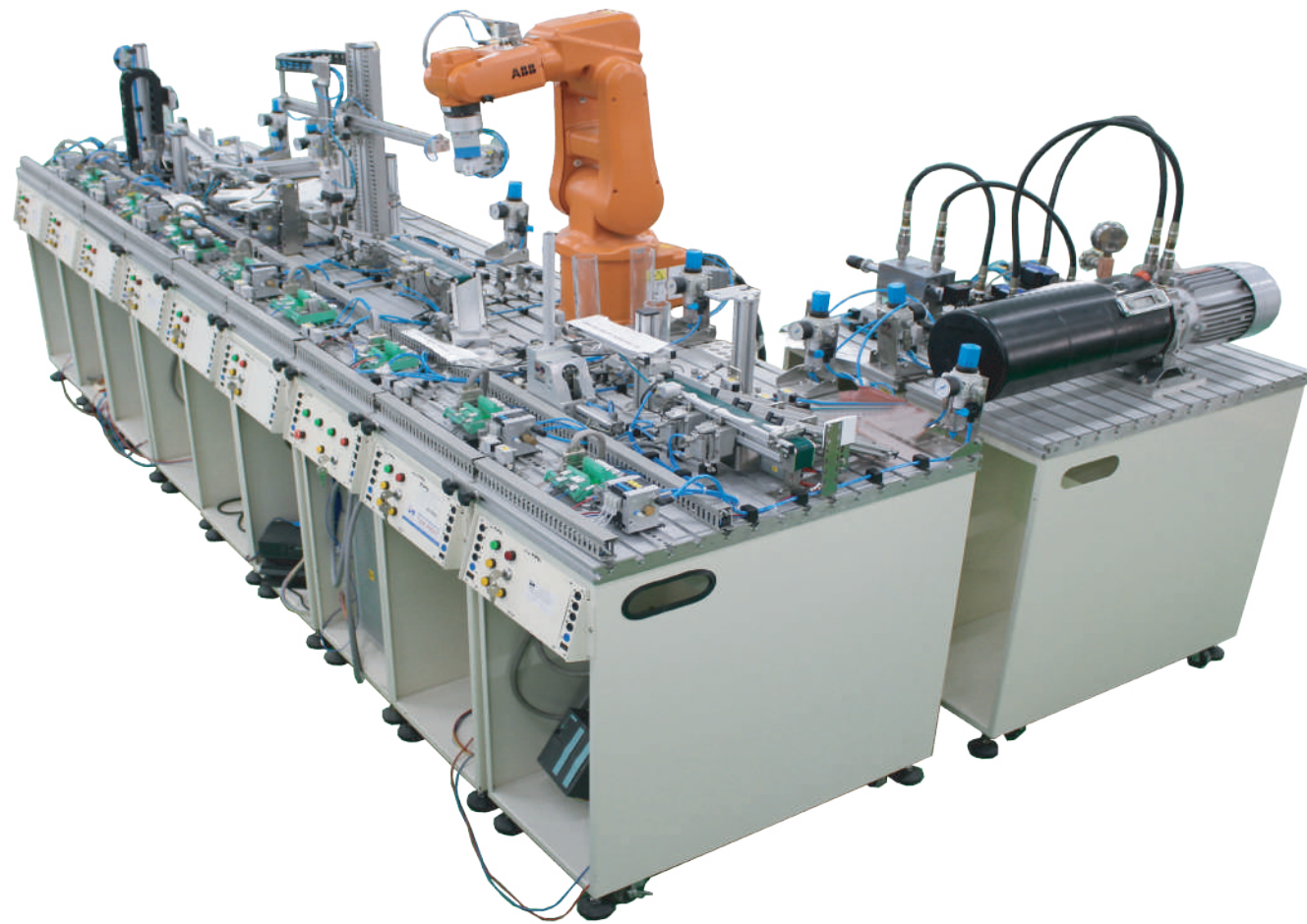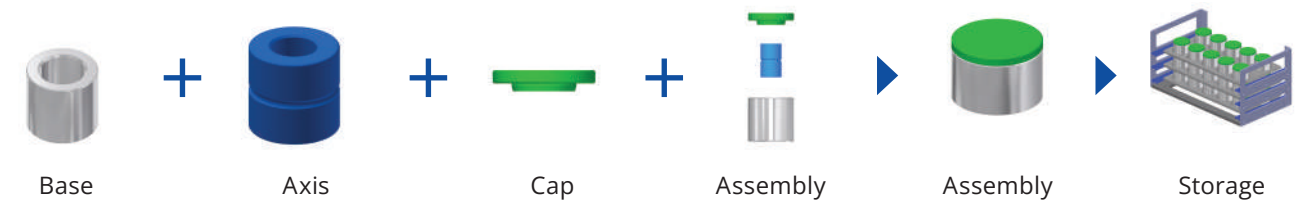| Category	Brands
STANDARD CONTROLLERS	SIEMENS, Schneider Electric, MITSUBISHI ELECTRIC, OMRON, Allen-Bradley, ABB
SMART CONTROLLERS	ctrlX AUTOMATION, BECKHOFF, Schneider Electric
ROBOT	ABB, MITSUBISHI ELECTRIC, rexroth A Bosch Company, UNIVERSAL ROBOTS, YASKAWA, KUKA
PNEUMATIC	SMC, FESTO, CKD, AiRTAC
VISION	COGNEX, HIKVISION, KEYENCE, OMRON, SICK Sensor Intelligence, BASLER
SENSOR	Autonics Sensors & Controllers, OMRON, KEYENCE, Panasonic, SICK Sensor Intelligence, Honeywell
AGV	HIKROBOT, KUKA

ASSEMBLED PRODUCT

| Base | Axis | Cap | Assembly | Assembly | Storage |

OPERATIONAL PROCESS

Base feeding — Spring feeding — Cap pressing — Piston feeding

Inspection ▶ Machining ▶ Transfer ▶ Assembly ▶ Sorting

Storage

EQUIPMENT LIST

Blank feeding   Inspection station   Rotary table   Pneumatic gripper   Conveyor station

Robot assembly   Cap and spring feeding   Hydraulic pressing   Sorting station

GENERAL SPECIFICATIONS

- Various modular stations
- Industrial components and practice in connectivity
- Option to choose between PLC or PC-based controllers

- High compatibility and expandability
- Equipment suitable for training purposes
- Easy connection with robot controllers

TRAINING CONTENT

- Understand the structure of a mechatronics station within a flexible production line
- Survey the electrical power supply, pneumatic power supply, and assembly structure for each unit and the entire system
- Introduction to pneumatic components, sensors, electrical devices, and their operating principles

- Practice mechanical alignment, sensor installation and adjustment, and troubleshooting errors at each station
- Learn how to collect data from a basic industrial model system

BLANK FEEDING

- Function: Supplies blanks for the initial stage of the system using pneumatic cylinders
- Dimensions: 750 x 350 x 1070 mm (L x W x H)
- Working voltage: 24VDC
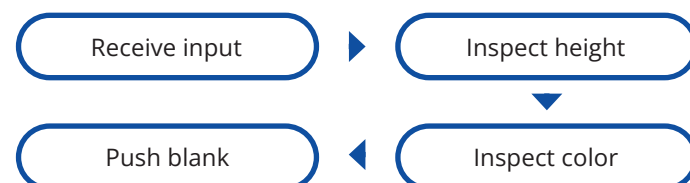- Operating pneumatic pressure: ~ 700 kPa (7 bar)

OPERATIONAL PROCESS

Inspect fed blank ▶ Push blank
▼
Pick blank ◀ Check
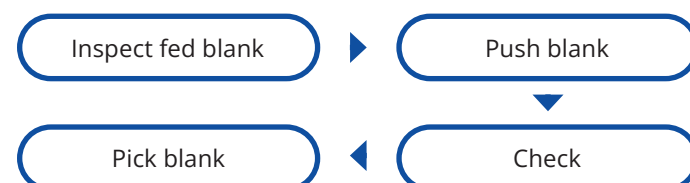
INSPECTION STATION

- Check the workpiece according to height
- Check the workpiece according to color direction
- Dimensions: 750 x 430 x 1253 (LxWxH)
- Working voltage: 24VDC
- Operating pressure pneumatics: ~ 700 kPa (7 bar)

OPERATIONAL PROCESS

Receive input ▶ Inspect height
▼
Push blank ◀ Inspect color

ROTARY TABLE

- Function: Simulates machining processes such as drilling and grinding on aluminum rotary disks
- Dimensions: 750 x 380 x 1138 mm (L x W x H)
- Working voltage: 24VDC
- Operating pneumatic pressure: ~ 700 kPa (7 bar)

OPERATIONAL PROCESS

Check for blank ▶ Simulate pressing
▼
Position and drill ◀ Transfer blank
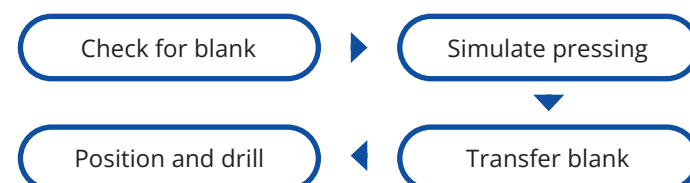
PNEUMATIC GRIPPER

- Function: 2-axis gripper made of reciprocating pneumatic cylinder, running along two X and Y axes to pick and drop products
- Dimensions: 750 x 725 x 1340 (LxWxH)
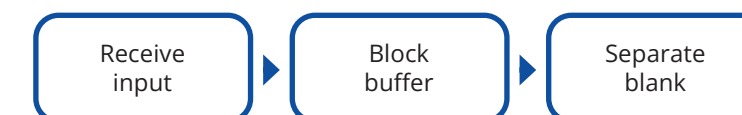- Working voltage: 24VDC
- Operating p

OPERATIONAL PROCESS

Receive input ▶ Pick and transfer blank to the chute

CONVEYOR STATION

- Function: is a buffer station for transportation and store FIFO (first in - first out) workpieces on the conveyor
- Dimensions: 750 x 350 x 990 (LxWxH)
- Working voltage: 24VDC
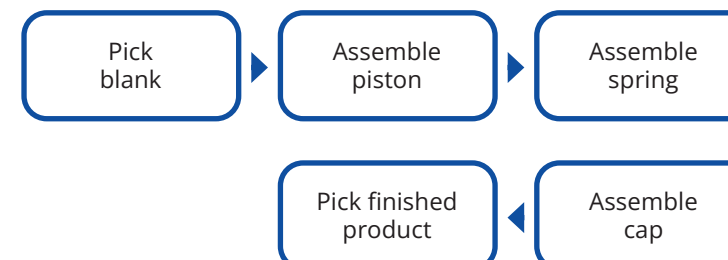- Pneumatic operating pressure: ~ 700 kPa (7 bar)

OPERATIONAL PROCESS

Receive input ▶ Block buffer ▶ Separate blank

ROBOT ASSEMBLY

- Function: Robot picks up the inspection base and rotates the base into the correct assembly position
- Dimensions: 750 x 350 x 1500 mm (LxWxH)
- Working voltage: 24VDC
- Operating pressure pneumatics: ~ 700 kPa (7 bar)

OPERATIONAL PROCESS

Pick blank ▶ Assemble piston ▶ Assemble spring
▼
Pick finished product ◀ Assemble cap

SPRING, CAP, AND PISTON FEEDING

- Function: Supplies shafts, caps, and springs for the robot assembly station
- Dimensions: 750 x 350 x 1040 mm (L x W x H)
- Working voltage: 24VDC
- Operating pneumatic pressure: ~ 700 kPa (7 bar)
- Standard: IEC 60335-1:2010 for power and current, leakage current, and electrical durability
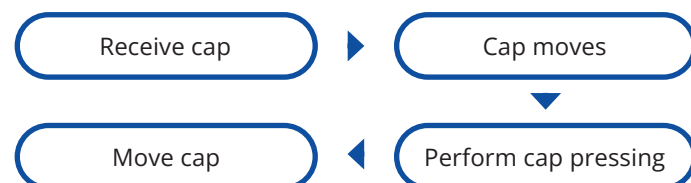

OPERATIONAL PROCESS

Push spring ▶ Push cap ▼ Complete product ◀ Transfer
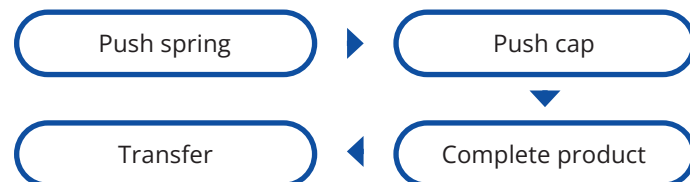
HYDRAULIC PRESSING

- Function: After being supplied, the lid of the product that has not yet been punched will be passed to this station by the robot of the previous station to punch the hole.
- Dimensions: 750 x 370 x 1110 (LxWxH)
- Working voltage: 24VDC
- Operating pressure pneumatics: ~ 700 kPa (7 bar)

OPERATIONAL PROCESS

Receive cap ▶ Cap moves ▼ Perform cap pressing ◀ Move cap

SORTING STATION

- Function: is a buffer station for transportation and store FIFO (first in - first out) workpieces on the conveyor
- Dimensions: 750 x 350 x 990 (LxWxH)
- Working voltage: 24VDC
- Pneumatic operating pressure: ~ 700 kPa (7 bar)

OPERATIONAL PROCESS

Receive assembled ▶ Pick and assemble ▼ Inspect for light ◀ Sort

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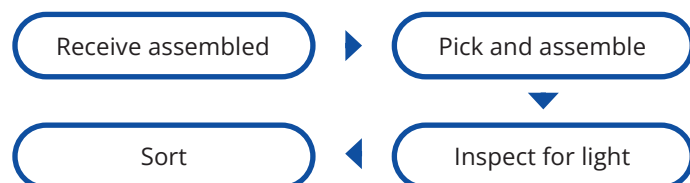
OTHER CONFIGURATIONS

4 stations

6 stations

10 station

ETEK
TOTAL AUTOMATION SOLUTIONS

ST.ME.A5002 — SENSOR AND PROCESS CONTROL TRAINING SYSTEM - DCS

GENERAL SPECIFICATIONS

- DCS and process control training model
- 220 VAC input voltage
- Multiple module stations with different features
- Industrial details and connection practice
- High compatibility and expandability
- Equipment suitable for training

EQUIPMENT LIST

Feeding Station

Filling Station

Heating Station

Mixing Station

TRAINING CONTENT

Basic training on process control systems:

- Configure devices and install sensors
- Design On/Off controllers for pressure, flow, level, and temperature control
- Design PID controllers for pressure control
- Design PID controllers for flow and level control
- Design PID controllers for ratio mixing control
- Design PID controllers for temperature control of heating tanks
- Design PID controllers for mass control
- Interactive control for water level and temperature, multivariable control for level ratio

- Program batch control applications and route control
- Integrate filling processes using level and flow sensors or weight sensors
- Operate and monitor the system
- Advanced training on distributed control systems (DCS):
- Configure hardware and communication for operating stations (OS) and automatic control stations (AS)
- Configure hardware for smart field devices
- Apply CFC, SFC, and PID function blocks to control valves and motors
- Develop programs and control interfaces for flow, level, and temperature management
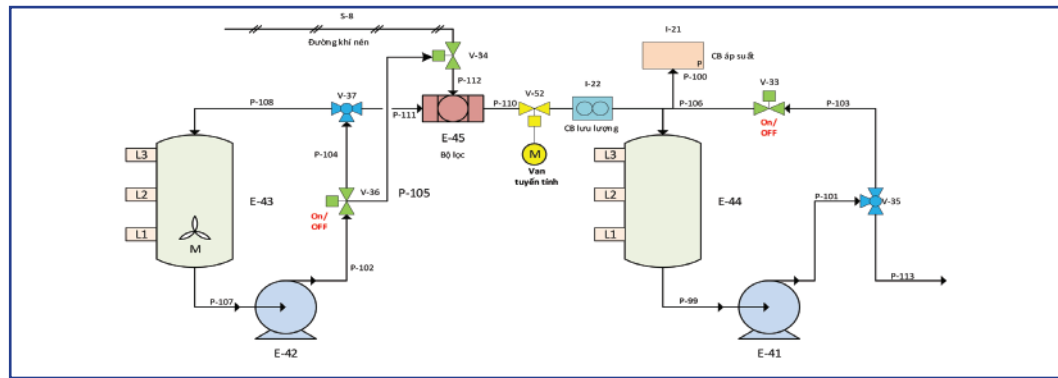
FEEDING STATION

- Survey the system characteristics.
- Configure the equipment and install the sensor.
- Design the On-Off controller: Control pressure, flow.
- Design the PID controller to control pressure.
- Design the PID controller to control flow.
- Operate and monitor the system.
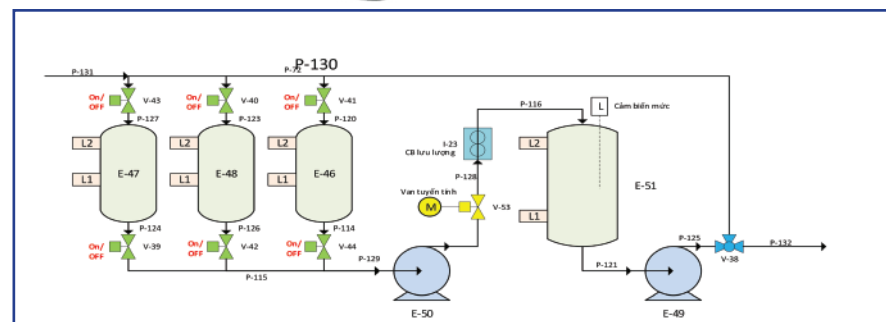- Check, maintain and service the system.
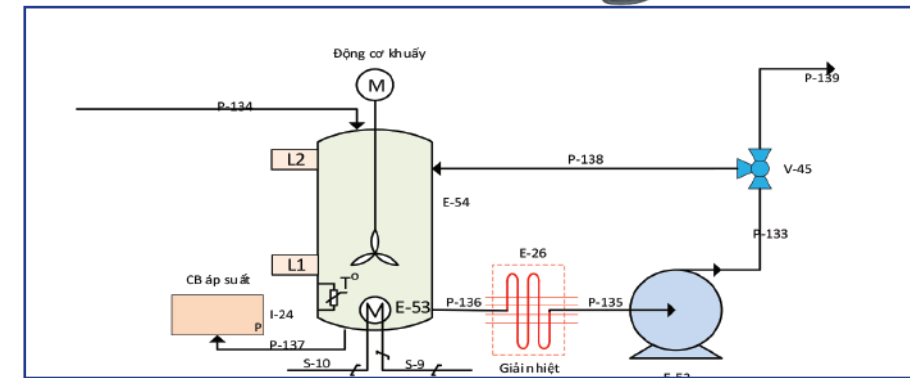
TECHNOLOGY DIAGRAM

HEATING STATION

- Survey the characteristics of the system.
- Design On-Off controller: Pressure, temperature.
- Design PID controller to control tank pressure.
- Design PID controller for water level through the relationship between pressure and water column height.
- Design PID controller for heating tank temperature.
- Interactive control: Temperature - water level.
- Operate and monitor the system.

TECHNOLOGY DIAGRAM

MIXING STATION

- Survey the characteristics of the system.
- Design On-Off controller: Level and flow control.
- Design PID controller to control level.
- Design PID controller to control flow.
- Design PID controller to control mixing ratio.
- Operate and monitor the system.
- Check, maintain and service the system.

TECHNOLOGY DIAGRAM

FILLING STATION

- Survey the characteristics of the system.
- Design On-Off controller: Level, volume, flow.
- Design PID controller to control water level.
- Design PID controller to control volume.
- Design PID controller to control flow.
- Coordinate the filling problem using level and flow sensors.
- Operate and monitor the system.
- Check, maintain and service the system.
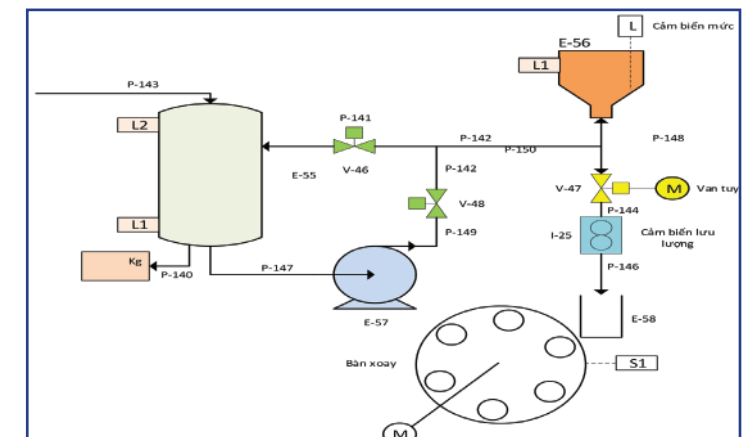
TRAINING CONTENT

- Survey and understand the working principles of the system: Working principles of sensors, Actuators and controllers,...
- Configure devices and install sensors
- Set up control tasks for pressure regulation

- Set up control tasks for temperature regulation
- Set up PID control tasks for level regulation
- Operate and monitor the system
- Inspect, maintain, and service the system

GENERAL SPECIFICATIONS

- Working Voltage: 220VAC/50Hz
- PLC Control Unit: Allows for control and operation of individual stations.
- The system includes two modular stations with different functionalities:
- Feeding Station: Cleans raw materials and supplies them to the system.

- Fuel Mixing Station: Mixes three types of raw materials based on preset ratios.
- Utilizes industrial-standard equipment, ensuring easy connectivity between devices.
- High compatibility and expandability.

ETEK
TOTAL AUTOMATION SOLUTIONS

MIXING STATION

GENERAL SPECIFICATIONS

- CT3 steel frame with powder coating
- 02 transparent raw material tanks allowing liquid level observation
- 01 transparent mixing allowing liquid level observation
- 03 industrial pumps
- 02 flow sensors, 10–6000 m³/h
- 01 ultrasonic sensor, 80–1200 mm
- 01 linear control valve
- 01 control valve unit
- 01 control cabinet
- 01 Siemens S7-1500 PLC
- 01 KTP700 HMI panel

TECHNOLOGY DIAGRAM

FILLING STATION
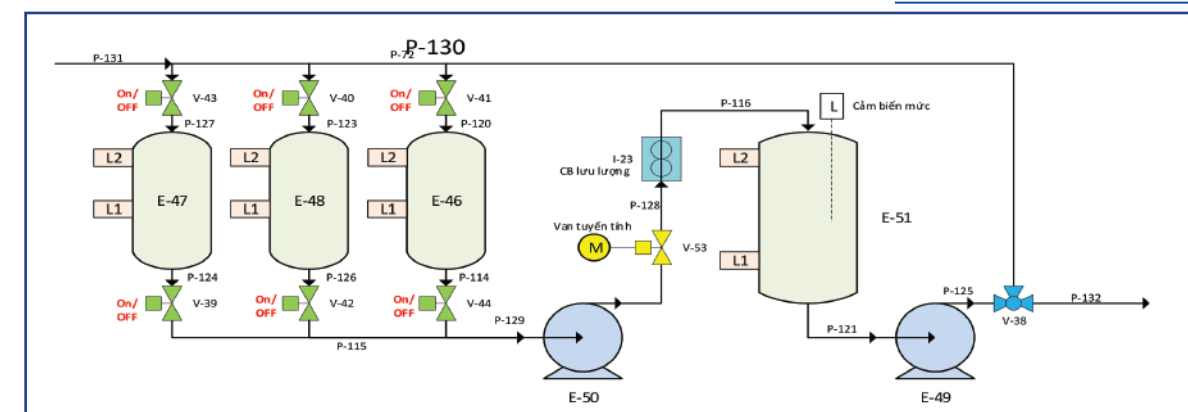
GENERAL SPECIFICATIONS

- CT3 steel frame with powder coating
- 01 transparent raw material tank allowing liquid level observation
- 01 heating resistor (heating element)
- 01 industrial pump
- 01 temperature sensor, 0°C–100°C
- 01 ultrasonic sensor, 80–1200 mm
- 01 linear control valve
- 01 control cabinet
- 01 Siemens S7-1500 PLC
- 01 KTP700 HMI panel

TECHNOLOGY DIAGRAM
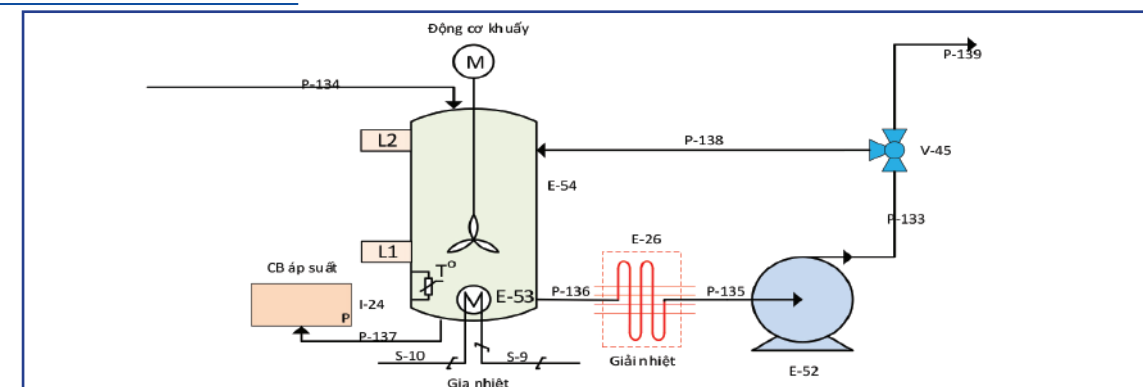
GENERAL SPECIFICATIONS

1. Control panel
- PLC: CPU S7-1200 1214C 14DI/ 10DO/ 2AI.
- IoT Gateway: ECU-1051, TI Cortex A8 CPU, 600MHz, DDR3L 256MB, 512MB NAND Flash, Linux OS.
- IPC industrial computer: Core i7, 16G RAM, 512G SSD.
- Monitor: 27 inches, 1920 x 1080, multi-touch interaction
- Electric energy simulator: Measures V, A, kW, kVAr, kWh, kVAr, 128x64 LCD display, Modbus RTU communication.
- Gas energy simulator: Measuring L/min, m3, 128x64 LCD display, Modbus RTU communication.
- HMI screen: KTP700, 7 inch TFT, 65536 colors, Profinet communication.

2. Sensors and actuators
- Simulated in 3D motion and interaction on the IPC computer system and screen.
- Movement under PLC control.
- Sensor simulation signals are detected and transmitted to the PLC in real time.
- Communication network: Ethernet.
- Control panel: Includes physical buttons, switches, and emergency stops for users to interact with.
- Support interaction on HMI.

TRAINING CONTENT

1. System control programming
- PLC programming to control the system, HMI interface.
- Configure IoT system, MQTT platform.
- Process data on the Cloud.
2. Build monitoring and management software
- Build Dashboards, graphs displaying data.
- Analyze and optimize machine performance with OEE tools.
- Analyze and optimize energy use with FMS tools
- Build a maintenance schedule with the Maintenance

3D SOFTWARE

3d simulation software

SKILLS ACHIEVED

1. Know how
- How to configure hardware and tasks of devices in the system
- Hardware configuration for the PHM engine prediction and maintenance system
- Hardware architecture for data collection, methods to optimize production processes and improve factory capacity

2. Understand
- Design a complete IoT system (hardware, software, Cloud)
- Use visual interface design tools to display data for smart factories
- Programming PLC, HMI to control stations and production lines
- Design a complete Smart Factory system
- Set up data transmission architecture
- Proficient in using software

REALISTIC MONITORING SOFTWARE
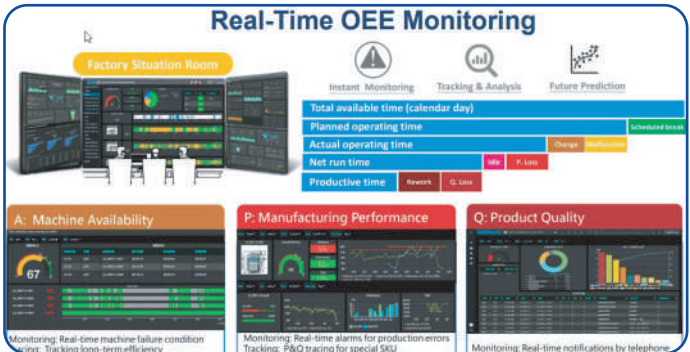
Software toolkit

Software toolkit