INDUSTRIAL ELECTRICAL ENGINEERING

Ver: 03

A: ETEK solution

ETEK solution

ETEK TOTAL AUTOMATION SOLUTIONS

12 classrooms from basic to advanced

PH01. Basic Electricity training room	• Basic knowledge of electrical engineering
PH02. Basic electronic training room	• Knowledge of basic electronics, electronic components and applied circuits
PH03. Sensor training room	• Sensor types, working principles and industrial applications
PH04. Electric machine and power electronics training room	• Knowledge of Electric machine , power electronic components and power control circuits
PH05. Electrical equipment in training room	• Knowledge of electrical tools and electrical equipment in industrial machines and equipment

ETEK solution

ETEK
TOTAL AUTOMATION SOLUTIONS

12 classrooms from basic to advanced

PH06. Electrical installation training room	• Practice installing electrical circuits in industry and civil use
PH07. Substation operation and power transmission training room	• Knowledge of practical power transmission and supply systems. Practice operating the system
PH08. Equipment renewable energy training room	• Experiment on types of renewable energy, practice installation and operation, and identify errors in wind and solar power systems
PH09. Basic PLC training room	• Basic PLC programming using simulators: Logo, S7-1200, S7-1500, FX5U

ETEK solution

ETEK
TOTAL AUTOMATION SOLUTIONS

12 classrooms from basic to advanced

| **PH10. Advanced PLC training room**	• PLC programming communicates through industrial communication standards: Profinet/Ethernet IP, Profibus, CC-Link, Device Net... Programming control systems
PH11. Automation training room	• Building a smart factory operation monitoring system via the Internet
PH12.Pneumatic - hydraulic training room	• Knowledge of pneumatic and hydraulic components and applied circuits

B: Details of training rooms

ETEK
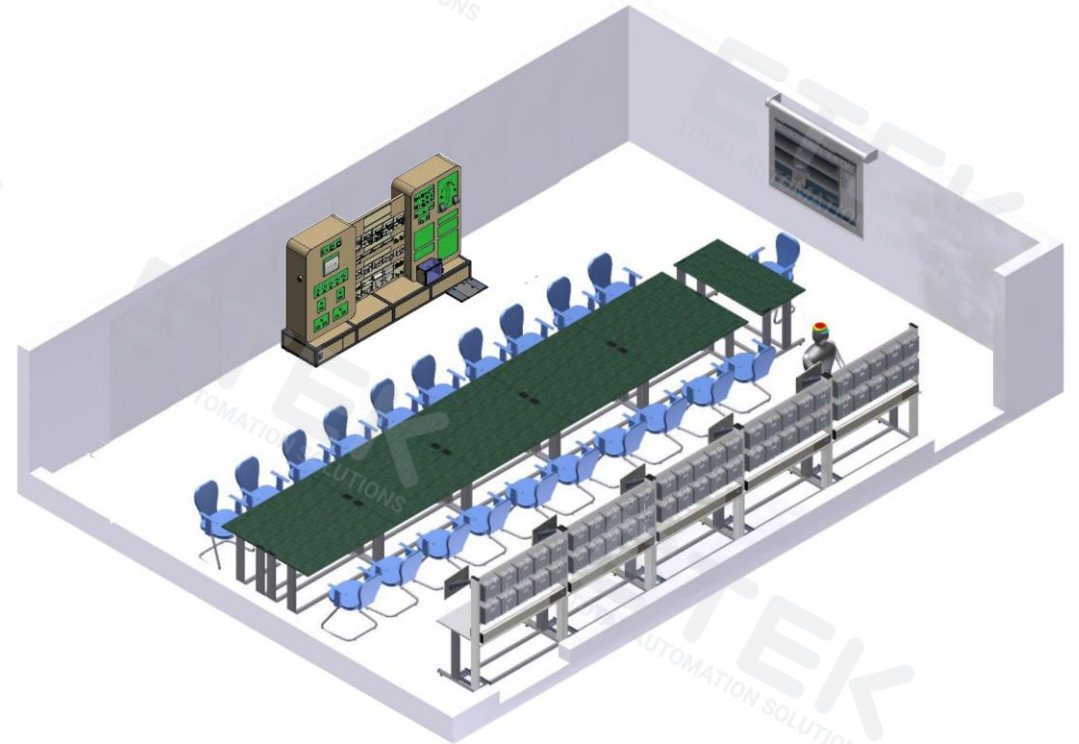TOTAL AUTOMATION SOLUTIONS
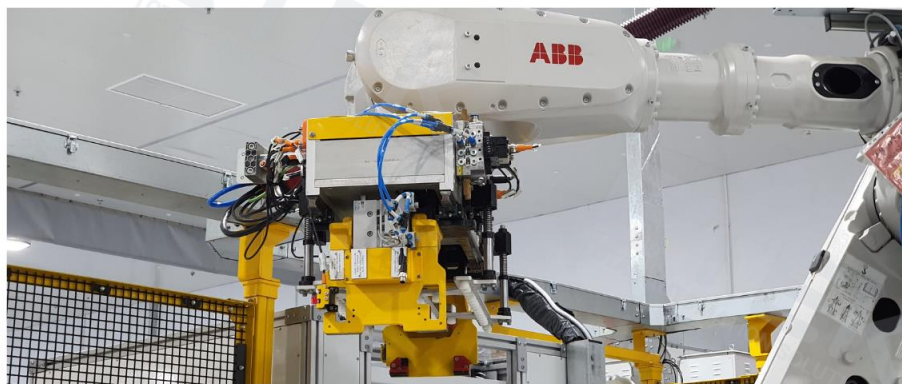
PH01
BASIC ELECTRICITY
TRAINING ROOM

PH01. BASIC ELECTRICITY TRAINING ROOM

FUNCTION

- Practice measuring voltage and direct current
- Practice resistive circuits, parallel resistors, series resistors, voltage divider circuits
- Experiment on Ohm's law, Kirchooff 1 and 2 - Current characteristics electricity, voltage of alternating current
- Characteristics of purely resistive, purely inductive, and purely capacitive loads in AC circuits
- Practicing electrical safety

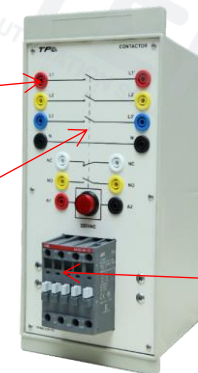| DC electric training bench | AC electricity training bench | Electrical safety practice model | Model of safe practices when working with vertical ladders | Table with Chair | Table with Chair | Magnetic White Board | Interactive Screen |

PH01. BASIC ELECTRICITY TRAINING ROOM

Structure of practice module

M4 safety jack

The key surface is printed with instructions

Plastic box

Main equipment

Solution for mounting A4 modules during practice:

Equipment

Table frame

Training set

PH01. BASIC ELECTRICITY TRAINING ROOM

1. DC electric training bench

Training content
- Practice measuring DC voltage
- Practice measuring direct current
- Practice resistive circuits
- Practice with resistor circuits connected in parallel
- Practice with resistor circuits connected in series
- Experiment on voltage divider circuit
- Experiment on Ohm's law
- Experiment on Kirchooff's 1st and 2nd laws

2. AC electricity training bench

Training content
- Current and voltage characteristics of alternating current
- Characteristics of purely resistive, purely inductive, and purely capacitive loads in AC circuits
- Calculate the capacity of 1-phase and 3-phase AC circuits
- Inductance and RL circuit
Inductors connected in series and parallel
- Capacitance and RC circuit
- LC circuit and resonance phenomenon

PH01. BASIC ELECTRICITY TRAINING ROOM

3. Electrical measurement training bench

Training content
- Practice measuring 1-way voltage
- Practice measuring DC current
- Practice measuring AC voltage
- Practice measuring alternating current
- Practice resistive circuits
- Practice with variable voltage circuits
- Practice single-phase power measurement circuit
- Practice three-phase power measurement circuit
- Practice frequency measurement circuit
- Practice power factor circuits
- Practice single-phase power consumption measurement circuit
- Practice 3-phase power consumption measurement circuit
- Practice using a Multimeter

Structure of practice model

Sample panel cluster

Indoor electrical safety practice cluster

Electric shock and leakage current simulation practice cluster

Electrical safety practice model

4. Equipment for training labor safety

4.1. Model of electrical safety training

Training content
- Analyze types of electrical safety incidents and train on how to prevent them depending on each type.
- Training on preventing electric shock accidents due to excessive current (excessive current practice)
-     Understand the effects of electric current according to each level of electricity that can impact the body
-     Experiment on overcurrent and overload incidents

General specifications
+ Dimensions: 3596 x 1042 x 1902 mm (LxWxH)+/- 10%
+ Mechanical structure made from welded box steel frame and powder-coated CT3 steel plate, ensuring durability and aesthetics

ETEK
TOTAL AUTOMATION SOLUTIONS

4.2. Model of training seat belts when working and moving

Training content:
Training on safety principles when working with steel frames and working at height
- Training on the dangers of falling when working with steel frames and working at height
- Training on the importance of using seat belts
- Training on examples of fall accidents due to not using seat belts and lifelines

4.3. Model of safe training with tools and hand tools

Training content:
Training on safety principles when working with hand tools
- Training on frequently occurring accidents
- Training on the structure and features of hand-held machine parts (hand cutters, high-speed cutters, circular saws

4.4. Practical model of seat belts to prevent falling accidents

Training content:
- Practice using seat belts and practice falling after using the belt
Training on the importance of using seat belts
- Training on how to properly use seat belts
- Training on the differences between types of seat belts: full body type, upper body type, hip type
- Training to prevent falls due to working at unsafe heights
- Training on incidents caused by not using seat belts

PH01. BASIC ELECTRICITY TRAINING ROOM

4.5. Model of safe training with mobile scaffolding

Training content:
Training on safety principles when working with steel frames and working at height
- Training on the dangers of falling when working with steel frames and working at height
- Training on the importance of using seat belts
- Training on examples of fall accidents due to not using seat belts and lifelines

4.6. Model of safe training when using protective shoes

Training content:
Training on safety principles when working with hand tools
- Training on frequently occurring accidents
- Training on the structure and features of hand-held machine parts (hand cutters, high-speed cutters, circular saws

4.7. Model for safe training in enclosed spaces

Training content:
- Practice using seat belts and practice falling after using the belt
Training on the importance of using seat belts
- Training on how to properly use seat belts
- Training on the differences between types of seat belts: full body type, upper body type, hip type
- Training to prevent falls due to working at unsafe heights
- Training on incidents caused by not using seat belts

PH01. BASIC ELECTRICITY TRAINING ROOM

4.8. Model of safe training when using protective helmets

Training content:
Training on safety principles when working with steel frames and working at height
- Training on the dangers of falling when working with steel frames and working at height
- Training on the importance of using seat belts
- Training on examples of fall accidents due to not using seat belts and lifelines

4.9. Model of safe training when working with A-shaped ladders

Training content:
Training on safety principles when working with hand tools
- Training on frequently occurring accidents
- Training on the structure and features of hand-held machine parts (hand cutters, high-speed cutters, circular saws

4.10. Model of safe training when working with vertical ladders

Training content:
- Practice using seat belts and practice falling after using the belt
Training on the importance of using seat belts
- Training on how to properly use seat belts
- Training on the differences between types of seat belts: full body type, upper body type, hip type
- Training to prevent falls due to working at unsafe heights
- Training on incidents caused by not using seat belts

PH01. BASIC ELECTRICITY TRAINING ROOM

5. Mechanical joint model

Purpose of use: to present to students an understanding of mechanical joints
- 01 aluminum suitcase
- 01 threaded joint model
- 01 key joint model
- 01 dowel joint model
- 01 riveted joint model
- 01 weld joint model
- 01 key joint model

6. Model of basic geometric blocks

Purpose of use: to present to students the understanding of basic geometric shapes in mechanics
* List of equipment
- 01 aluminum suitcase
- 01 Prism block
01 Sphere
- 01 Cylinder block
- 01 Cone block

7. Sample model of cable connections

- Dimensions: 1080x610x1515 mm
- Thick anodized aluminum frame ensures scratch resistance and aesthetics, specialized assembly structure.
- Specimens included in the model:
 + Multi-fiber cable connections: straight connections, branch connections, welded connections, screw connections...
 + 1-fiber cable connection: straight connection, branch connection, welded connection, screw connection...

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PH02.
BASIC ELECTRONIC
TRAINING ROOM
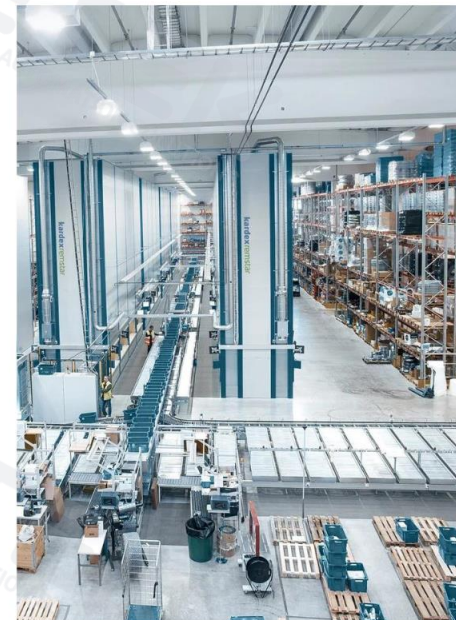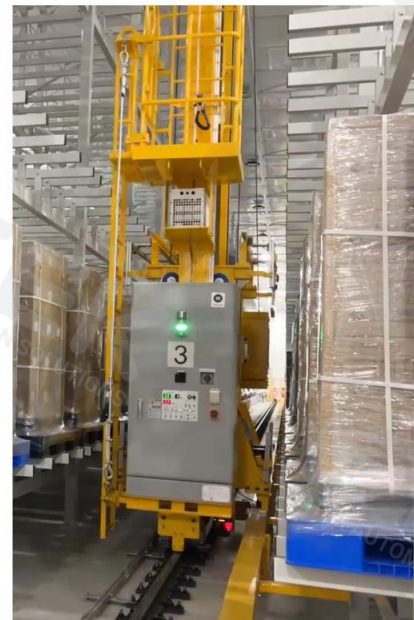
PH02. BASIC ELECTRONIC TRAINING ROOM

FUNCTION

- Practice identifying different types of electronic components
- Practice DC and AC circuits
- Practice applied circuits of semiconductor devices
- Practice applications of operational amplification
- Pulse practice
- Digital practice

Main module for practicing basic electronics

Basic experiment module for DC circuits

Theorems of DC circuits training module

AC - 1 Basic circuit training module

AC - 2 Basic circuit training module

Semiconductor training module

Electronic practice table

PH02. BASIC ELECTRONIC TRAINING ROOM

Solution for mounting modules during practice:

Position for function module

Main module   Function modules   Practice set

PH02. BASIC ELECTRONIC TRAINING ROOM

1. Main module for practicing basic electronics

Specifications:
- Input power supply for module: 220VAC/50Hz
- Output source block:
 + Adjustable power source: 0 ~ ± 15V/500mA adjustable by rheostat
 + Fixed source: ±5V/500mA, ±12V/500mA
- Fixed AC output: 12V/1A/50Hz
- Fixed AC output: 6V/1A/50Hz
- Pulse generator block
 (A) Frequency range
 + 10 Hz ~ 100 Hz
 + 100 Hz ~ 1 kHz
 + 1 kHz ~ 10 kHz
 + 10 kHz ~ 100 kHz
 (B) Output sine wave amplitude: 0 – 8 Vpp variable
 + Output triangle wave: 0 - 6 Vpp variable
 + Square wave output: 0 – 8 Vpp variable
 + TTL level: 0 - +5 V

PH02. BASIC ELECTRONIC TRAINING ROOM

2. Main module for practicing basic electronics with computer connection

Specifications:
• Box size: 330 x 264 x 109 (WxDxH)
• Quality Management Standard ISO 9001:2015
• Input power supply for module: 220VAC/50Hz
• DC output power block: ±5V/500mA, ±12V/500mA
• Module design uses standard plastic box
• Standard M2 type pin
• The printing pattern guides the printing of the film on the module surface, ensuring aesthetics and the longevity of the device

PH02. BASIC ELECTRONIC TRAINING ROOM

3. Basic experiment module for DC circuits

Training contents:
- DC power source in series and parallel
- Dual DC source
- Determine the type of switching
- Concept of circuit reversal
- Ohm's Law: Resistance, current, circuit voltage
- Resistance, current, voltage in series resistor circuits
- Resistance, current, voltage in a parallel resistor circuit
- Resistance, current, voltage in mixed resistor circuits
- Power in series, parallel and mixed resistor circuits

4. Theorems of DC circuits training module

Training contents:
- Current in a 2-element branch circuit
- Nodal current in a 2-element branch circuit
- Voltage in a 3-element series circuit
- Add voltage in series circuit
- Circular equation
- Node equation
- Kirchhoff's voltage law for circuits with 2 sources
- Kirchhoff's current law with 2-source circuits
- Network method with 2-source circuit
- Stacking method with 2-source circuit
- Millman's theorem with 2-source circuit
- Thevenin method with one-source network
- Thevenin method with dual source network
- Thevenin bridge circuit resistor
- Thevenin bridge circuit voltage
- Convert Thevenin to Norton
- Convert Norton to Thevenin
- Tee, Wye, Pi and Delta networks
- Switch Delta and Wye Networks networks

5. AC - 1 Basic circuit training module

Training contents:
- AC waveform generator
- Measure AC amplification
- Measure AC voltage, current and impedance with an oscilloscope
- Measure and set frequency
- Inductance
- Phase angle
- Inductance in series and parallel
Basics of resistance
- Inductance and impedance
- Serial RL circuit
- Parallel RL circuit
- Electromagnetic fields

- Transformer coil
- Symptoms
- Turns ratio and voltage of the transformer
- Secondary load of transformer
- Capacitor
- Capacitors in series and parallel circuits
- Basic effects of capacitors
- Series RC circuit
- Parallel RC circuit
- RC time coefficient
- RC/RL waveform
- Basics of troubleshooting

6. AC - 2 Basic circuit training module

Training contents:
- Serial RLC circuit
- Parallel RLC circuit
- Series resonant circuit
- Q and series RLC circuit frequency range
- Resonant frequency in parallel LC circuit
- Q and frequency range
- Power division
- Power factor
- Low pass filter
- High pass filter
- Band filter
- Stop band filter
- Basics of troubleshooting

PH02. BASIC ELECTRONIC TRAINING ROOM

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7. Semiconductor training module

Training contents:
- Identify semiconductor devices
- Semiconductor switching control
- Diode and DC characteristics
- Half-cycle rectification
- Full cycle bridge rectifier using Diode
- Filter the power source
- Voltage doubler
- Waveform using Diode
- Zener diode
- Adjust Zener Diode voltage
- Check Transistor function
- Current control circuit uses PNP Transistor
- Emitter-Base bias voltage
- Collector upstream bias
- DC circuit voltage using Transistor
- Load line uses Transistor
- Optical isolation IC
- Optical resistance
- Basics of troubleshooting

8. Transistor amplifier circuit training module

Training contents:
- Recognize, become familiar with and locate components in the circuit
- Introducing multi-stage amplification
- DC/AC operation of common Base circuit
- DC/AC operation of common Emitter circuit
- DC/AC operation of common Collector circuit
- Temperature influence on fixed polarity circuits
- Temperature influence on voltage divider bias circuit
- Transistor parameter range
- Use the Transistor parameter table
- RC coupled amplifier DC operation
- RC coupling gain and phase angle relationship
- RC coupled amplifier frequency response
- DC/AC operation of transformer coupled amplifier
- Transformer coupled amplifier frequency response
- DC/DC operation of direct coupled amplifier
- Direct coupled amplifier frequency response
- Basics of handling and troubleshooting circuit problems

Member of

PH02. BASIC ELECTRONIC TRAINING ROOM

9. Transistor power amplifier training module

Training contents:
- Recognize, become familiar with and locate components in the circuit
- Introduction to Transistor power amplification
- DC single output power amplifier operation
- Single AC output voltage and power amplification
- Phase-separated DC operation
- Voltage amplification and input/output signal phase relationship
- DC operation symmetrical power amplifier
- AC symmetrical voltage and power amplification
- DC operation power compensation amplifier
- AC compensation voltage and power amplification
- Amplify push-pull power
- Darlington pair current amplification characteristics
- Darlington pair input and output impedance
- Basics of handling and troubleshooting circuit problems

10. Transistor feedback circuit experiment module

Training contents:
- Recognize, become familiar with and locate components in the circuit
- Series feedback amplification operation
- Effect of feedback on AC amplification
- Effect of negative series feedback on frequency range
- Effect of series feedback on input and output impedance
- Effect of parallel feedback on AC amplification
- Effect of parallel amplification on frequency range
- Effect of parallel amplification on input and output impedance
- Multi-stage current amplification in series and parallel
- Multi-stage output amplification in series - parallel
- Multi-stage voltage amplification in series - parallel
- Multi-stage output impedance connected in series - parallel
- Differential amplifier operation
- Differential and unipolar gain characteristics
- Differential gain coefficient
- Basic concepts of handling and troubleshooting feedback amplifier circuits.

11. Power source regulation circuit training module

Training contents:
- Recognize, become familiar with and locate components in the circuit
- Introducing power supply adjustment
- Parallel adjustment operation
- Line adjustment
- Adjust load
- Serial adjustment operation
- Pressure feedback adjustment operation
- Load regulation using voltage feedback
- Reverse current limit protection circuit
- Line adjustment operation
- Adjust the line using a line regulator
- Adjust load using current regulator
- 3-pin IC adjustment and voltage adjustment activities
- Adjust 3-pin IC current and performance
- DC to DC conversion characteristics
- Regulates DC to DC conversion voltage and performance
- Basic concepts of handling and troubleshooting power source regulation circuits.

12. Thyristor and power control training module

Training contents:
- Learn the principles and practice of half-wave SCR DC Gate circuits
- Learn the principles and practice of full-wave SCR DC Gate circuits
- Learn the principles and practice of AC power control circuits using Triac
Learn the principles and practice of controlled rectifier circuits
- Learn the principles and practice of half-wave SCR AC Gate circuits
- Learn the principles and practice of full-wave SCR AC Gate circuits

PH02. BASIC ELECTRONIC TRAINING ROOM

13. Basic experimental module of operational amplification

Training contents:
- Basic characteristics and parameters of operational amplifiers.
- Learn the principles and practice of inverting amplifier circuits
- Learn principles and practice with non-inverting amplifier circuits
- Learn principles and practice with inverter amplifier circuits Learn the principles and practice with non-inverting additive amplifier circuits.
- Learn principles and practice with voltage repeater circuits
- Learn the principles and practice with sine wave to square wave conversion circuit
- Learn principles and practice with differential amplifier circuits
- Learn principles and practice with open loop circuits
- Learn principles and practice with gate amplifier circuits
 - Learn principles and practice with exponential amplifier circuits
- Learn principles and practice with subtractive amplifier circuits

14. Experimental module of applications of operational amplification

Training contents:
- Basic characteristics and parameters of operational amplifiers.
- Learn the principles and practice with full-wave bridge diode control circuits
- Learn principles and practice with integrator circuits
Learn principles and practice with differential circuits
- Learn the principles and practice with low-pass filter circuits
- Learn principles and practice with high-pass filter circuits
- Learn the principles and practice with bandpass filters
 - Learn principles and practice with limited circuits
- Learn principles and practice with latching and sampling circuits
 - Learn the principles and practice with window comparator circuits

15. Basic training module for FET transistors

Training contents:
- Learn the principles and operating characteristics of JFET
- Learn principles and practice with JFET amplifier circuits
- Learn principles and practice with JFET CURRENT circuit practice DC source current operation/load voltage variation with JFET
- Learn principles and practice with Colpitts oscillator circuit
- Learn the principles and practice the operation of the HARTLEY oscillator
- Learn principles and practice with thermistor circuits
- Learn the principles and practice of waveform generation and control characteristics using UJT
- Learn principles and practice with photoresistor circuits
- Learn principles and practice with fiber optic transceiver conversion circuits
- Learn the principles and practice of operating modes and dual gate MOSFET adder
- Basic troubleshooting and troubleshooting in circuits.

16. Analog electronics basic experiment module
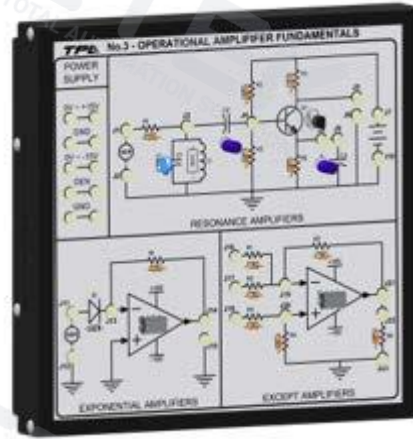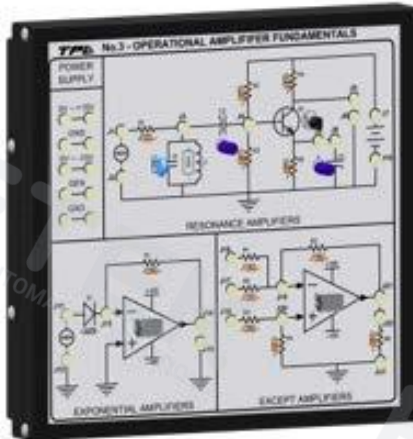
Training contents:
- Learn the principles and practice of analog switching circuits using 4051, 4066
- Learn the principles and practice of signal amplifier circuits using LM358, BJT2N3904
- Learn the principles and practice of the PNP transistor amplifier circuit using the 2N3906 transistor
- Learn the principles and practice of logarithmic amplification using IC LM358
- Learn the principles and practice of the transformer coupled Armstrong oscillator, LC resonance

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17. Digital practice module

Training contents:
- Learn circuit principles and practice with MULTIPLEXER multiplexing and DEMULTIPLEXER multiplexing circuits
- Learn the principles and practice with BCD/DECIMAL, BCD PRIORITY circuits
- Learn the principles and practice with ADC/DAC conversion circuits
- Learn the principles and practice with the 7-SEGMENT DRIVER/DISPLAY circuit
- Learn the principles and practice with the ASYNCHRONOUS RIPPLE COUNTER circuit

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TOTAL AUTOMATION SOLUTIONS

18. Pulse technique practice module

Training contents:
- Practice stable multivibrator circuits using transistors
Learn principles and practice with monostable oscillator circuits using OP-AMP
- Learn the principles and practice with unstable oscillator circuits using OP-AMP
- Learn principles and practice with bistable oscillator circuits using OP-AMP
- Learn principles and practice basic applications of IC555
- Learn principles and practice with IC555 - PWM circuit
- Practice creating pulses with the IC555 chip
- Learn principles and practice with Wien bridge circuits
- Learn principles and practice with IC555 linear circuits
- Learn principles and practice with trimmer circuits
- Learn principles and practice with pin circuits
- Learn principles and practice with differential circuits
- Learn principles and practice with integrator circuits
- Learn the principles and practice with frequency to voltage conversion circuits
- Learn the principles and practice with voltage to frequency conversion circuits
- Practice pulse generator circuit using UJT
- Practice pulse shortening circuit
- Practice pulse circuit using IC 74122
- Practice multivibrator circuits

19. Analog electronic circuit assembly practice kit

Training contents:
- Semiconductor, light-emitting diode in 1-way circuit
- Semiconductor diodes in AC circuits, half-cycle and full cycle rectifiers
- Use bridge diodes in DC and AC circuits
- Filter circuit, adjusting one-way pulse source
- The power circuit uses a PI filter
- Voltage multiplier circuit uses diode and capacitor
- Common E current amplifier circuit, stage amplifier, Single-End type audio amplifier
- Pull-push type audio amplifier circuit, pull-push symmetric compensation amplifier
- Zero-Phase oscillator circuit, phase shift
- Oscillator circuits ARMSTRONG, Hartley, Colpitts
- Digital circuits of AND, OR, OR– AND gates
- NAND and NOR digital circuits
- Inverting circuit, adding circuit

20. Digital electronic circuit assembly practice kit

Training contents:
- Basic logic functions, Demoorgan theorems 1, 2, 3, 4
- Boolean algebra and simplifying logical expressions 1, 2 ,3, 4, 5, 6
- Definition and operation of TTL NAND/NOR gate 1, 2
- XOR logic function and its applications 1 - 7
- Full adder and full subtractor 1, 2, 3, 4, 5
- Binary counter and binary number system 1, 2
- Divide by -n counter and decimal counter 1 - 5
- Random access memory working memory area
- Digital-to-digital (D/A) and digital-to-digital (A/D) converters 1-2

PH03
SENSOR TRAINING
ROOM

PH03. SENSOR TRAINING ROOM

FUNCTION

- Classification of industrial sensors
- Structural principles and measuring principles of industrial sensors
- Experiment with the working spectrum of different types of sensors
- Experiment with sensors with a variety of receivers
- Connect various types of sensors
- Adjust sensor sensitivity
- Experiment with sensor response frequency
- Understand the benefits of smart sensors in Industry 4.0
- Establish IO-Link® communication
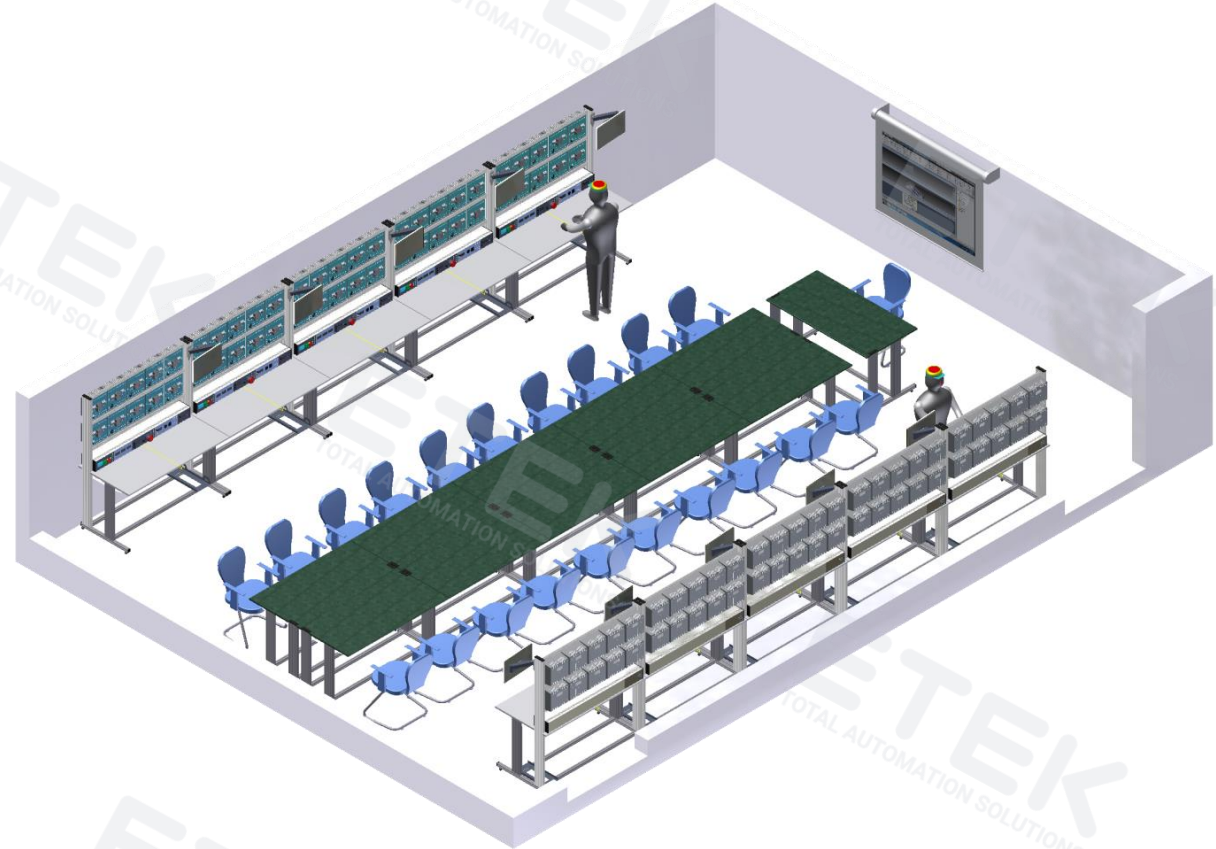
Sensors principles training set

Distance and displacement sensor experiment training bench

Force and pressure sensor experiment training bench

Smart sensor training bench for industry 4.0

Industrial electrical practice table with chair

Product structure

1. Quick fix mounting structure:

- Quickly mounts onto standard DIN rails

- High precision, sharp mold

2. Anode aluminum box + plastic lid:

 - Hard anode, sandblasted,

 - Does not leave fingerprints or stains

3. Push-in quick match:

- German equipment, industrial standards,

- Standard according to German program

4. Electronic circuit

- FR04 circuit, latest technology, fireproof
- Matte surface treatment to avoid dirt
- Quickly scan QRcode

5. Main equipment:

- Easy to remove and replace.

- Mounting according to equipment standards
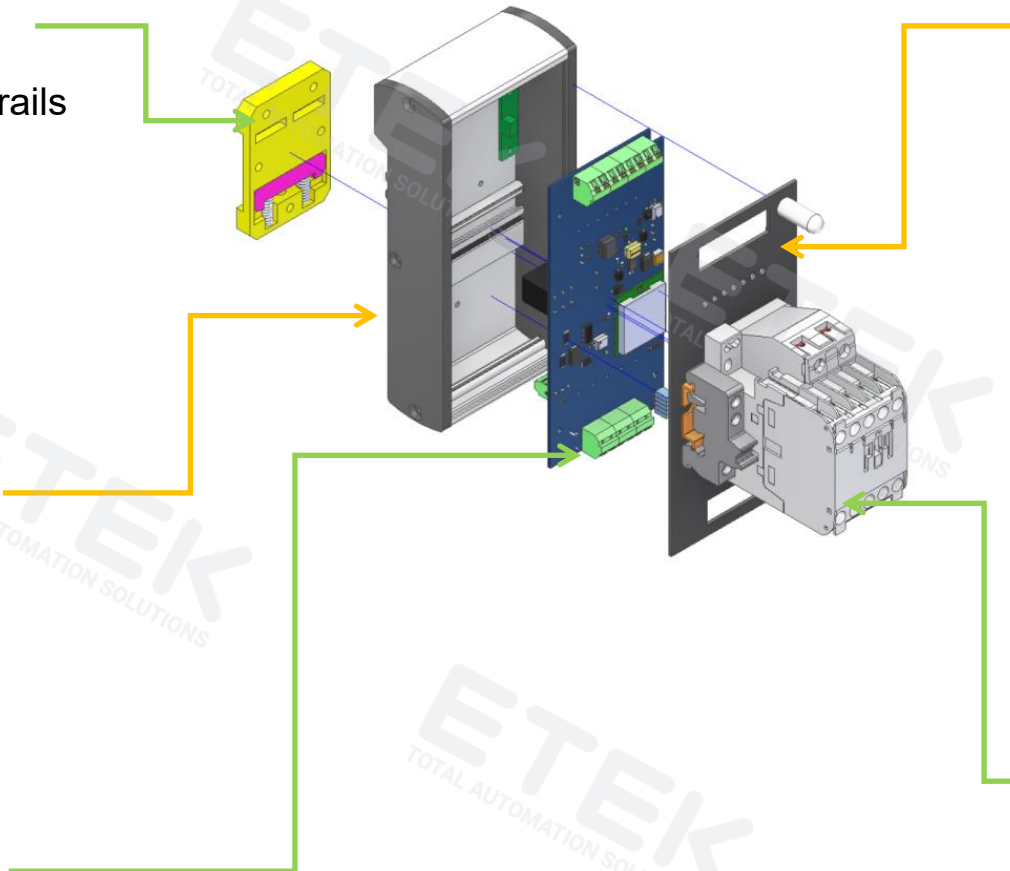
PH03. SENSOR TRAINING ROOM

Electrical Student Work Bench Solutions
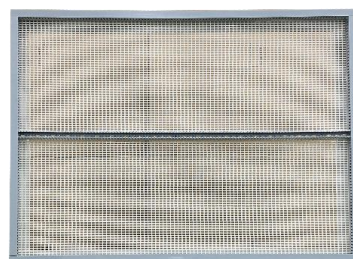
Sensor module

Assembly panel

Table frame

PH03. SENSOR TRAINING ROOM

1. Sensors principles training set

Training Contents:
- Operating principles of sensors in the training set
- Collect data from sensors through the control training and signal collection module
- Draw a graph of the sensor's characteristic curves during practice and export it to an image file
- Store results after each experiment
- Export collected data to excel file

2. Distance and displacement sensor training bench

Training Contents:
- Learn the structure and operating principles of various types of sensors
- Practice measuring distance with ultrasonic sensors
- Practice measuring distance with sensors from analog output
- Practice measuring speed and displacement distance with encoder

PH03. SENSOR TRAINING ROOM

3. Force and pressure sensor training bench

Training Contents:
- Learn the structure and operating principles of sensors
- Practice measuring mass with loadcell
- Practice measuring compression pressure

PH03. SENSOR TRAINING ROOM

4. Smart sensor training bench for industry 4.0

Training Contents:
- Understand the benefits of smart sensors in Industry 4.0
- Selected, parameterized, monitored and adjusted sensors
- Establish IO-Link® communication
- Integrate sensors into different production communication layers
- Perform maintenance
- Automatic replacement of sensors and upload settings
- Troubleshooting sensor problems

PH04
ELECTRIC MACHINE AND POWER ELECTRONICS TRAINING ROOM

PH04. ELECTRIC MACHINE AND POWER ELECTRONICS TRAINING ROOM

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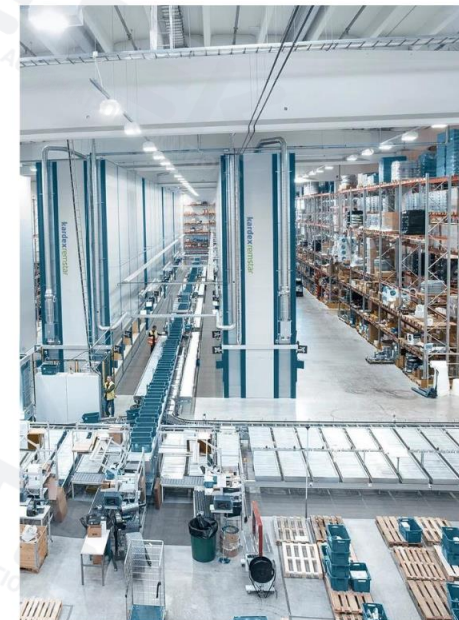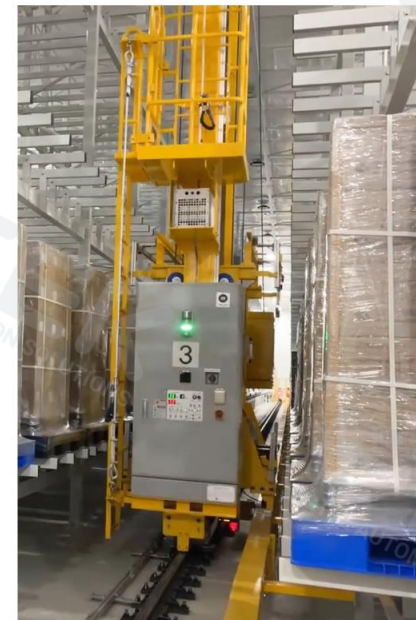
FUNCTION

- Experiment with UJT
- Experiment with SCR
- Experiment with DIAC and TRIAC
- Experiment with automatic voltage regulation using SCR
- Experiment with MOSFET
- Set up electrical circuits for AC control, including 3-phase motor circuits
- Control and simulate motors and other electrical components
- Perform single-phase and three-phase power control experiments
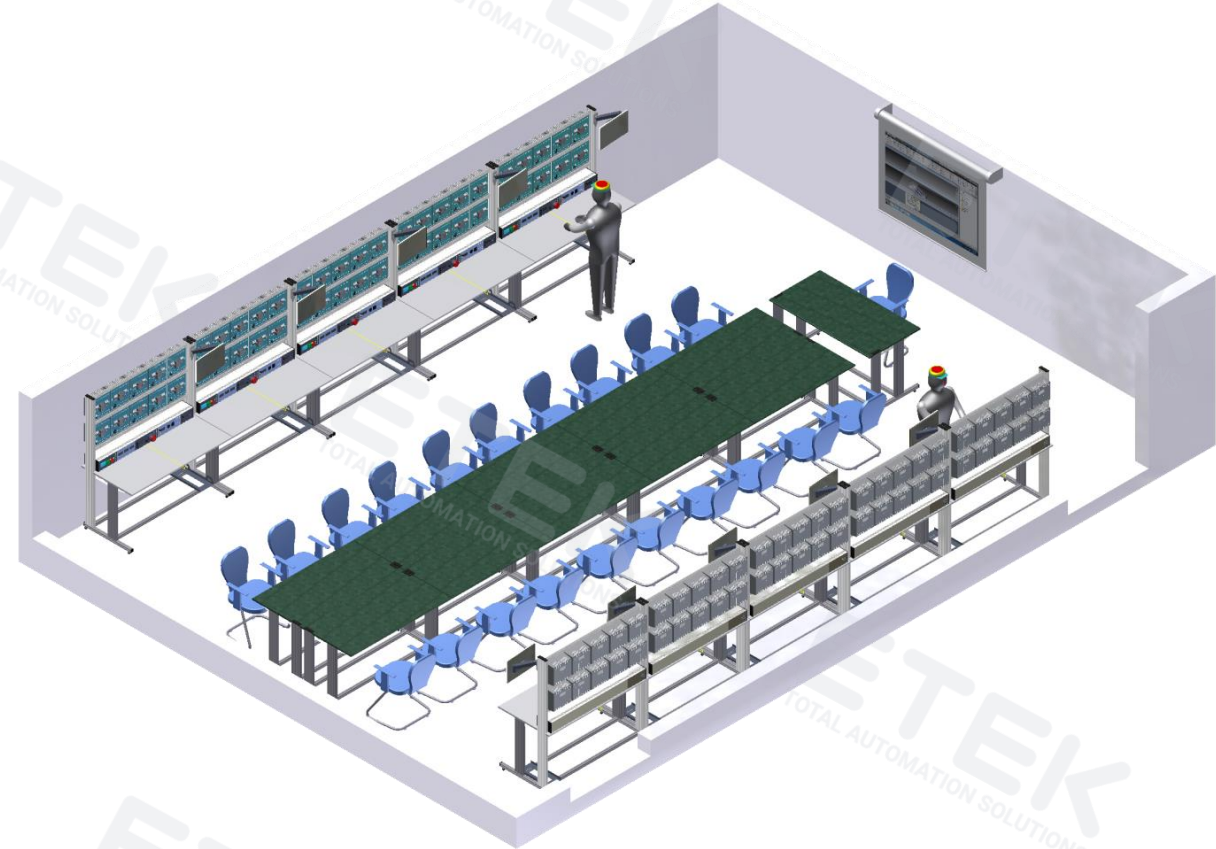
| Power Electronics Control Circuit Practice Kit | Uncontrolled Power Supply Practice Kit | Controlled Power Supply Practice Kit | Inverter Practice Kit | Single-phase Voltage Control Practice Kit | Three-phase Voltage Control Practice Kit | Industrial Power Supply Practice Bench |
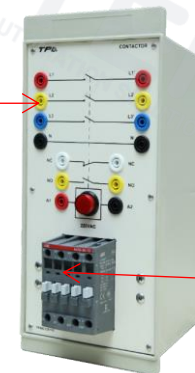
PH04. ELECTRIC MACHINE AND POWER ELECTRONICS TRAINING ROOM

Structure of practice module

M4 safety jack

Plastic box

Main equipment

Solution for mounting A4 modules during practice:

Equipment

Table frame

Training set

Solution for mounting A4 modules during practice:

Equipment

Table frame

Training set

1. Power electronic components training bench

Training Contents:
- Laboratory test on UJT
- Experiment on SCR
- Laboratory test on DIAC and TRIAC
- Experiment on automatically adjusting light bulbs and adjusting AC motor speed using TRIAC
- Experiment on rectifier circuits using SCR
- Experiments on JFET and MOSFET

2. Uncontrolled rectifier training bench

Training Contents:
- Half-cycle single-phase power rectification
- Power rectification in two half cycles
- Single phase bridge rectifier
- 3-phase beam rectifier
- 3-phase bridge rectifier

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3. Controlled rectifier training bench

Training Contents:
- Overview of power rectifier control circuit
- Single-phase half-cycle uncontrolled rectifier (Half-wave rectifier)
- Single-phase uncontrolled rectifier for the whole cycle (Full-wave rectifier)
- Rectifier with 1-phase half-cycle control (rectifier with half-cycle control)
- The rectifier has single phase control for the entire cycle
 - 1-phase full-cycle symmetrical semi-controlled rectifier
- 1-phase full-cycle asymmetric semi-controlled rectifier
- 3-phase ray-shaped uncontrolled rectifier
- The rectifier does not control 3 phases throughout the cycle
- Rectifier with 3-phase beam control
- Full-cycle 3-phase semi-controlled rectifier
- The rectifier has 3-phase control for the whole cycle

4. Inverter training bench

Training Contents:
- Basic characteristics of inverters and frequency conversion principles
- Practice 1-phase PWM control circuit
- Practice 3-phase PWM control circuit

PH04. ELECTRIC MACHINE AND POWER ELECTRONICS TRAINING ROOM

5. AC voltage regulation training bench

Training Contents:
- General concept of AC pressure regulation
- Single-phase AC voltage control
- Three-phase AC voltage control

6. DC voltage regulation training bench

Training Contents:
- Learn the principles of controlling the speed of a DC motor using a DC-DC converter
Connect the DC motor speed control circuit using a DC-DC converter
- Measure and check voltage and current values in the circuit
- Step-down DC voltage converter (Buck)
- Booster type DC voltage converter (Boost)
- Push-pull DC voltage converter (Buck - Boost)

7. AC voltage regulation training bench

Training Contents:
- Understand the principles of AC voltage regulation circuits using thyristors.
- Generation of control pulses for AC and signal waveform analysis.
- Techniques for measuring and analyzing circuits.
- Understand the impact of inductive loads on AC voltage regulation circuits.
- Signal conversion and isolation methods in high-voltage measurement.
- Use of electrical measurement tools.
- Electrical safety skills.

8. Controlled inverter training bench

Training Contents:
- Understand the principles of SinPWM and 6-step inverters.
- Identify and differentiate the advantages and disadvantages of each type.
- Familiarize with control pulse waveform and motor output waveform.

9. DC Voltage Regulation Training bench

Training Contents:
- Study the principle of DC motor speed control using a DC-DC converter
- Wire the DC motor speed control circuit using a DC-DC converter
- Measure and check voltage and current values in the circuit
- Buck-type DC-DC converter
- Boost-type DC-DC converter
- Buck-Boost-type DC-DC converter

10. Electrical machine characteristics laboratory

Training Contents:
- Experiment on investigating the mechanical characteristics of a single-phase squirrel-cage induction motor
- Experiment on investigating the mechanical characteristics of a three-phase squirrel-cage induction motor
- Experiment on investigating the mechanical characteristics of a three-phase synchronous motor
- Experiment on investigating a three-phase synchronous motor in generator mode
- Experiment on investigating the mechanical characteristics of a separately excited DC motor
- Investigation of no-load and load characteristics of the motor

11. Single phase transformer training bench

Training Contents:
- No-load state test of single-phase transformer
- Short-circuit state test of single-phase transformer.
- Resistive load characteristic test.
- Inductive load characteristic test.
- Capacitive load characteristic test.

PH04. ELECTRIC MACHINE AND POWER ELECTRONICS TRAINING ROOM

12. 3 - Phase Transformer training bench
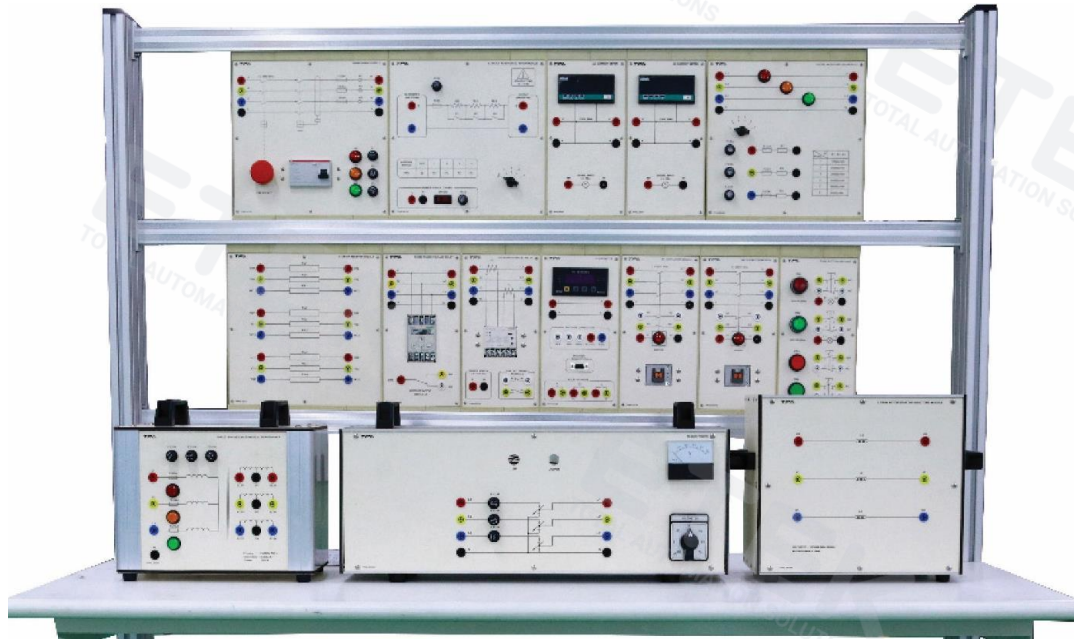
Training Contents:
- Transformer wiring experiment: star-star, star-delta, delta-star, delta-delta.
- Transformer polarity determination experiment.
- 3-phase transformer no-load state experiment.
- 3-phase transformer short-circuit state experiment.
- Resistive load characteristic experiment.
- Inductive load characteristic experiment.
- Capacitive load characteristic experiment.

ETEK
TOTAL AUTOMATION SOLUTIONS

13. 1-phase 3-phase motor control training bench with Automation Studio software and interaction

Specifications:

The equipment set is designed in standardized modules with uniform dimensions and connection standards, allowing flexible integration during practice and easy product upgrades. The training kit is manufactured following processes that comply with the following standards:

- ISO 9001:2015 – Quality Management System
- ISO 14001:2015 – Environmental Management System
- ISO 45001:2018 – Occupational Health and Safety Management System
- ISO/IEC 27001:2013 – Information Security Management System
- ISO 50001:2011 – Energy Management System
- Specifications for power, current, leakage current, and dielectric strength are in accordance with TCVN 5699-1:2010 and IEC 60335-1:2010

On-site training on system operation is provided by manufacturer-certified experts or personnel trained and certified by the manufacturer in Vietnam.

Product information is published on the official website of the manufacturer, including full technical specifications and features that meet the requirements.

14. Three - phase AC generator test kit

Training Contents:
- Theory:
- Learn the operating principles of electrical instruments in the model
- Learn the methods of controlling the output voltage of the generator
- Current and voltage characteristics of the generator with R, L, C loads
- Practice:
- Connect the inverter to the motor-generator and Excitation
- Set parameters on the inverter suitable for the motor
- Practice controlling the excitation for the generator manually or automatically
- Practice controlling the speed stability of the electric drive system
- Practice controlling and measuring the generator voltage
- Practice controlling and measuring the generator frequency
- Practice surveying the characteristics of resistive loads
- Practice surveying the characteristics of inductive loads
- Practice surveying the characteristics of capacitive loads
- Practice surveying the characteristics of R-L-C loads

15. Three-phase generator synchronization model

Training Contents:
- Practice adjusting and measuring generator voltage
- Practice adjusting and measuring generator frequency
- Practice synchronizing the generator with the grid manually using the rotating lamp method
- Practice semi-automatic synchronization
- Practice adjusting reactive power
- Practice adjusting active power.
- Generator overcurrent protection.

16. 3-phase motor control training bench with wound rotor

Training Contents:
- Control circuit to start a 3-phase motor with wound rotor through 3 levels of manual auxiliary resistance.
- Practice adjusting the speed of a 3-phase motor with wound rotor by controlling the armature resistance
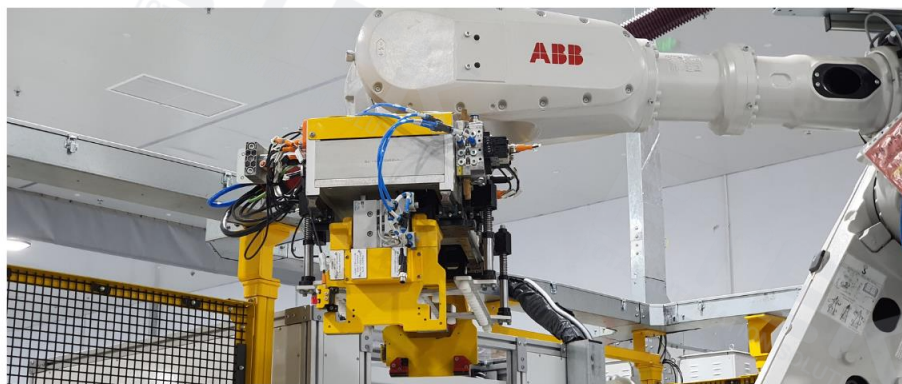
PH05
ELECTRICAL EQUIPMENT TRAINING ROOM

PH05. ELECTRICAL EQUIPMENT TRAINING ROOM

FUNCTION

- Calculate the capacity of 1-phase and 3-phase AC circuits
- Learn the uses, configurations, and operating principles of low-voltage electrical apparatus
- Calculate some common low-voltage electrical apparatus according to specific technical requirements (breakers, fuses, circuit breakers, contactors, etc.) in simple cases.
- Learn and practice the skill of finding common errors in low-voltage electrical apparatus in electrical circuits by creating electronic errors
- Learn the uses, configuration, and operating principles of the electrical circuit of the machining machine
- Identify errors and troubleshoot problems the electrical circuit of the machining machine
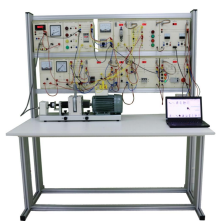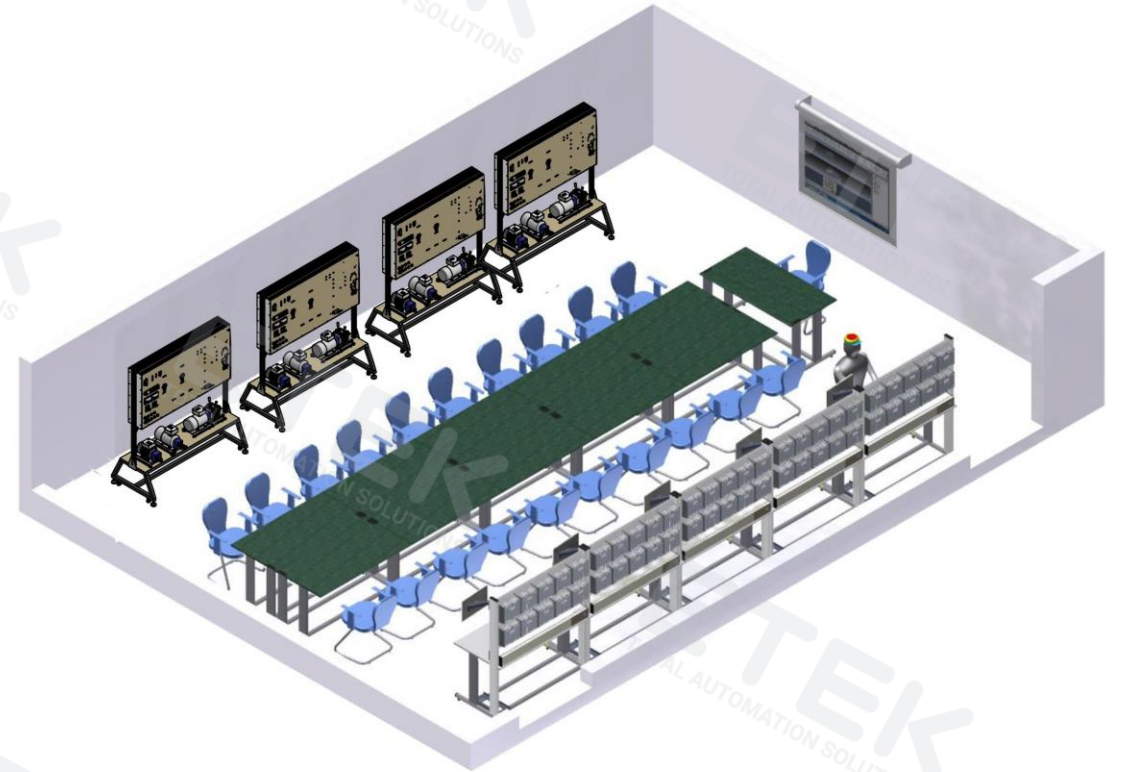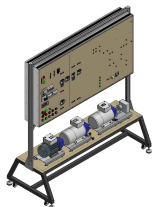
Electric instrument training bench	Model equipped with electric machine tools (Drilling machine)	Model equipped with electric machine tools (Grinding machine)	Model equipped with electric machine tools (Boring machine)	Model equipped with electric machine tools (Lathe machine)	Electric machine tool equipment model (Milling machine)	Crane training model
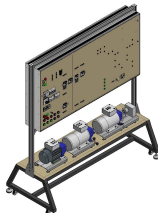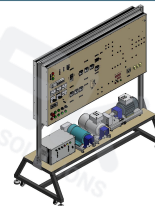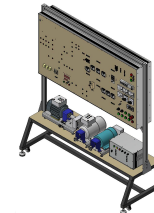
Model Structure electrical of machine tools
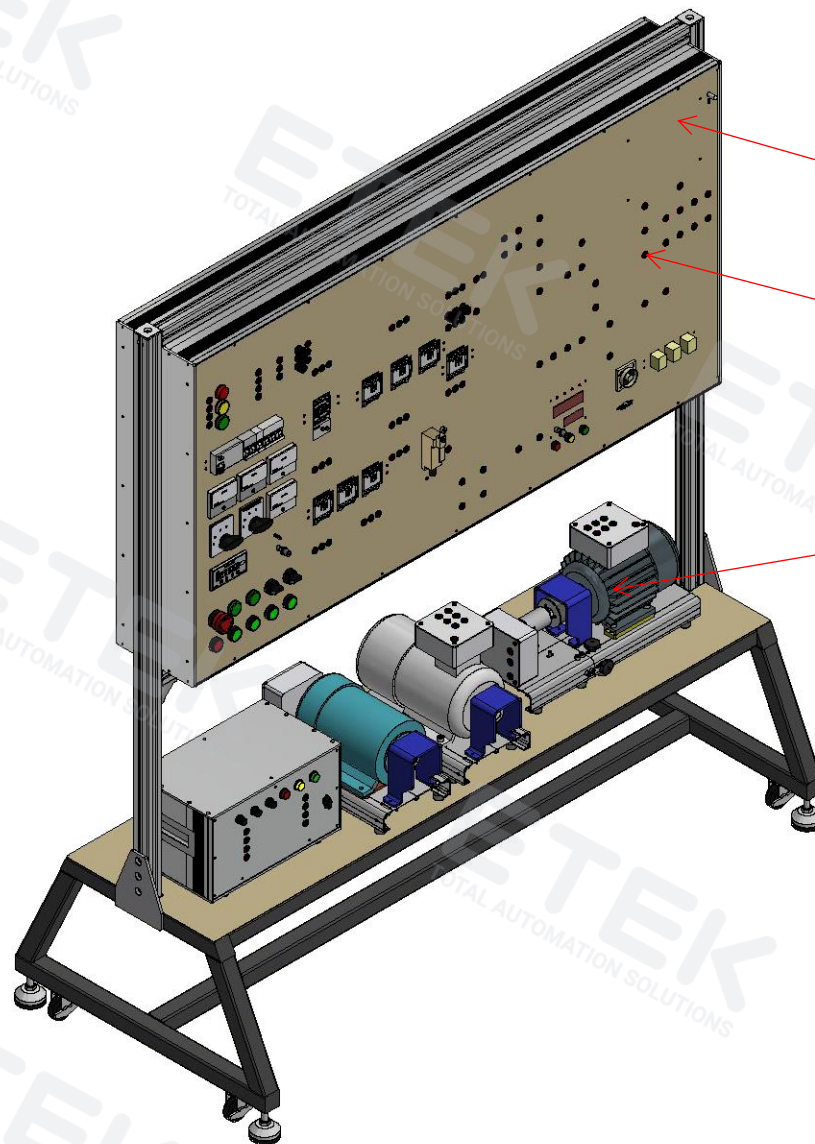
The panel shows the machine tool circuit

M4 safety jack

Simulate motors on machine tools

PH05. ELECTRICAL EQUIPMENT TRAINING ROOM

1. Model equipped with electric machine tools (Drilling machine)
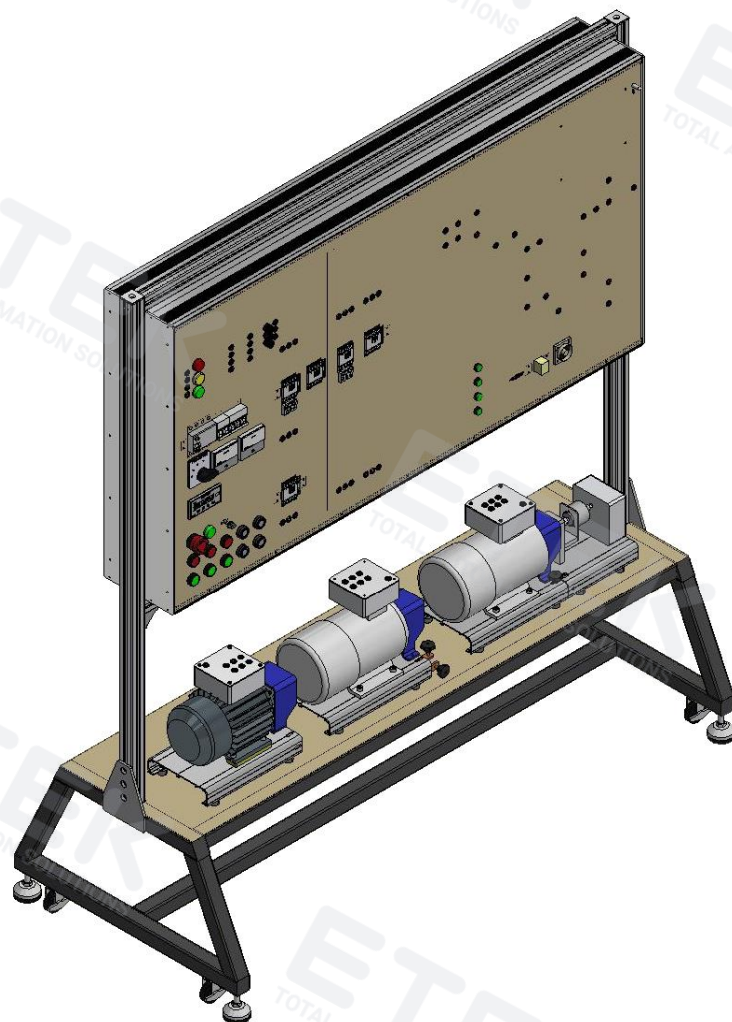
Training content
- Helps students learn about the structure and operating principles of the electrical equipment in the 2A55 drill
Learn the practical principles of controlling the 2A55 drilling machine and learn how to test, detect errors, and troubleshoot problems in the control circuit.

Skills acquired
1. Distinguish between types of electrical equipment such as atomat, fuse, contactor, magnetic starter, relay, push button
2. Understand the function of each electrical device in the circuit
3. Grasp knowledge of the structure and operating principles of electrical equipment
4. Understand measurement methods to detect errors and troubleshoot problems in control circuits.

2. Model equipped with electric machine tools (Grinding machine)

Training content
- Helps students learn about the structure and operating principles of the electrical equipment in the 3A161 grinding machine
- Learn the practical principles of controlling the 3A161 drilling machine and learn how to test, detect errors, and troubleshoot problems in the control circuit.

Skills acquired
1. Distinguish between types of electrical equipment such as aptomat, fuse, contactor, magnetic starter, relay, push button
2. Understand the function of each electrical device in the circuit
3. Grasp knowledge of the structure and operating principles of electrical equipment
4. Understand measurement methods to detect errors and troubleshoot problems in control circuits.

3. Model equipped with electric machine tools (Boring Machine)

Training content
- Helps students learn about the structure and operating principles of electrical equipment in the 2620 boring machine
- Learn the practical principles of controlling the 2620 boring machine and learn how to test, detect errors, and troubleshoot problems in the control circuit.

Skills acquired
1. Distinguish between types of electrical equipment such as atomat, fuse, contactor, magnetic starter, relay, push button
2. Understand the function of each electrical device in the circuit
3. Grasp knowledge of the structure and operating principles of electrical equipment
4. Understand measurement methods to detect errors and troubleshoot problems in control circuits.

PH05. ELECTRICAL EQUIPMENT TRAINING ROOM

4. Model equipped with electric machine tools (Lathe Machine)
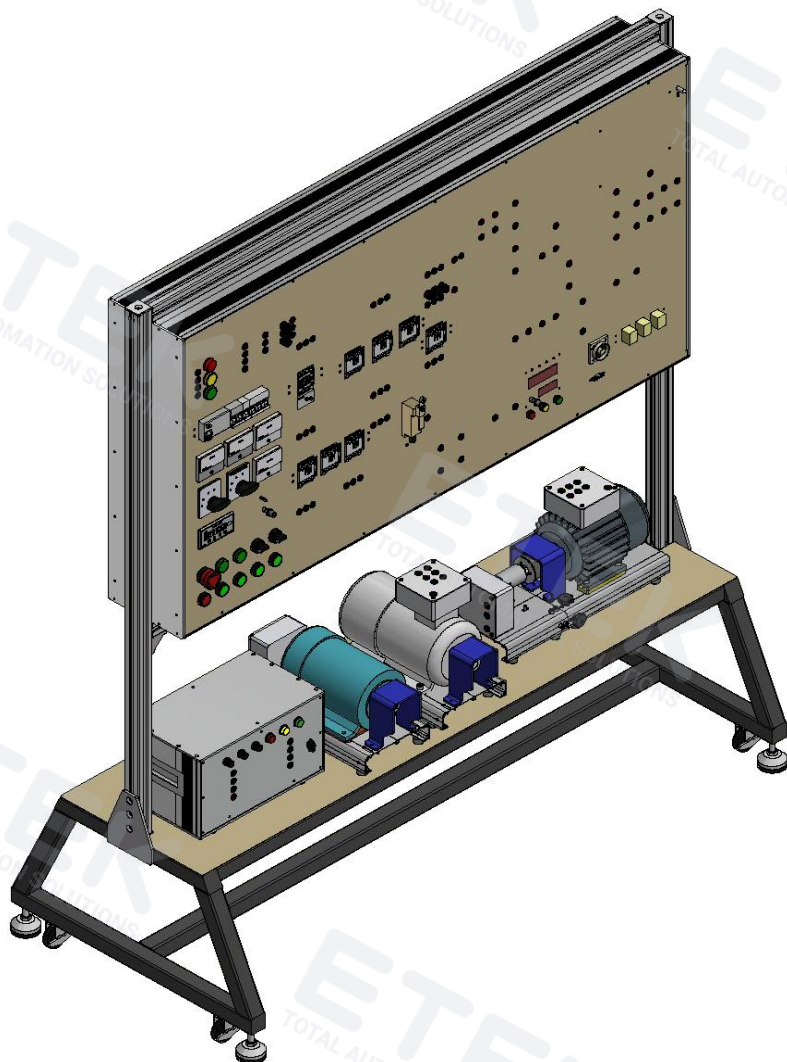
Training content
- Helps students learn about the structure and operating principles of electrical equipment in the 1A64 lathe
- Learn the practical principles of controlling the 1A64 lathe and learn how to test, detect errors, and troubleshoot problems in the control circuit.

Skills acquired
1. Distinguish between types of electrical equipment such as atomat, fuse, contactor, magnetic starter, relay, push button
2. Understand the function of each electrical device in the circuit
3. Grasp knowledge of the structure and operating principles of electrical equipment
4. Understand measurement methods to detect errors and troubleshoot problems in control circuits.

5. Electric machine tool equipment model (Milling machine)
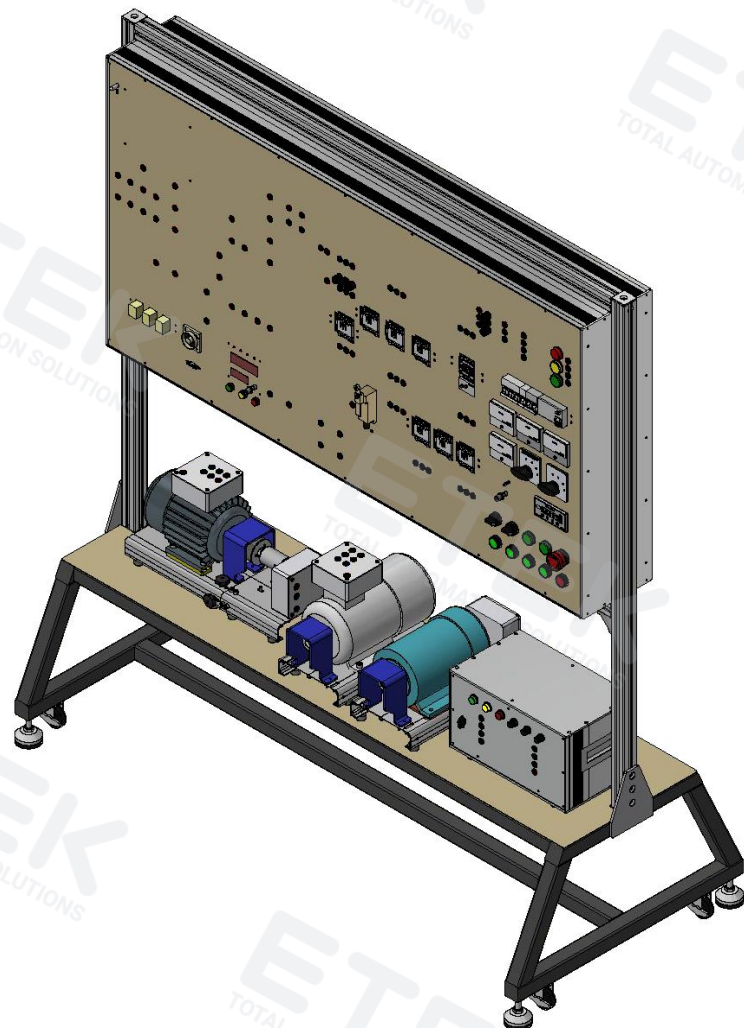
Training content
- Helps students learn about the structure and operating principles of electrical equipment in the 6H81 milling machine
- Learn the practical principles of controlling the 6H81 milling machine and learn how to test, detect errors, and troubleshoot problems in the control circuit.

Skills acquired
1. Distinguish between types of electrical equipment such as atomat, fuse, contactor, magnetic starter, relay, push button
2. Understand the function of each electrical device in the circuit
3. Grasp knowledge of the structure and operating principles of electrical equipment
4. Understand measurement methods to detect errors and troubleshoot problems in control circuits.

6. Crane training model

Training content
- Practice understanding the structure of the crane system.
- Practice operating and controlling the crane manually.
- Practice surveying PLC S7-1200
- Practice surveying sensors (limit switches)
- Practice crane control with PLC S7-1200

Skills acquired
Operate crane equipment as in reality.
- Detect and resolve common damages and maintain the system.
- Know the hardware structure of the PLC programmer.
- Know how to connect the power supply, digital input and output, and analog input and output of the PLC.
- Know how to write programs for PLC with functions: logic, Timer, Counter, arithmetic calculations.

PH05. ELECTRICAL EQUIPMENT TRAINING ROOM

Structure of practice module

M4 safety jack

Plastic box

Main equipment

The key surface is printed with instructions
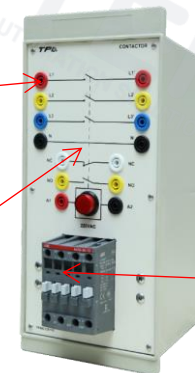
Solution for mounting A4 modules during practice:

Equipment

Table frame

Training set

7. Electric instrument training bench

Training content
- Learn the uses, structures and operating principles of low – voltage electrical apparatus
- Calculate and select some common low – voltage electrical apparatus according to specific technical requirements (breakers, fuses, circuit breakers, contactors, ...) in simple cases.
- Install and operate common low – voltage electrical apparatus
- Learn and practice the skill of finding common errors of electrical devices in electrical circuits by creating electronic errors for the devices through software installed on teachers' computers.

PH06
ELECTRICAL INSTALLATION
TRAINING ROOM

PH06. ELECTRICAL INSTALLATION TRAINING ROOM

FUNCTION

- Install electrical equipment on specialized panels
- Wiring and electrical connection
- Testing without electricity
- Operate and test the equipment
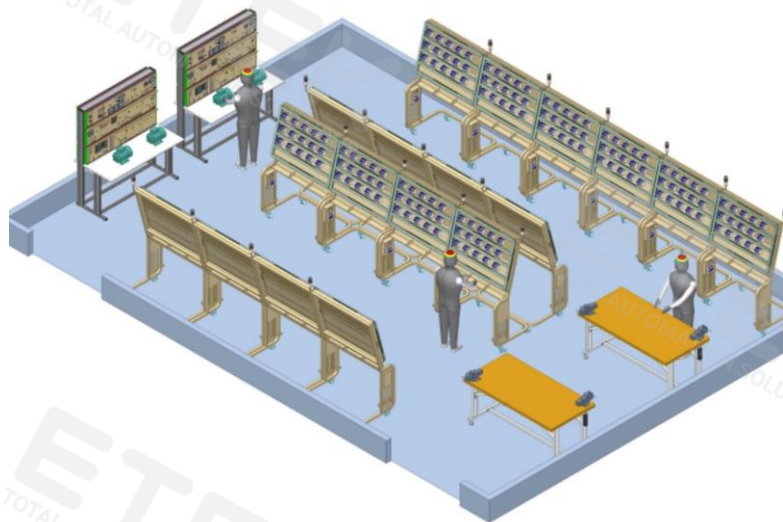
| Single assembly station | Practice set for installing basic industrial electrical circuits | Practice set for installing advanced industrial electrical circuits | Practice set for installing civil electrical circuits | Practice set for installing home electricity Smart | Table with vice |

PH06. ELECTRICAL INSTALLATION TRAINING ROOM

Frame solution

Assembly panel   **Single mounting frame**   **Single assembly station**
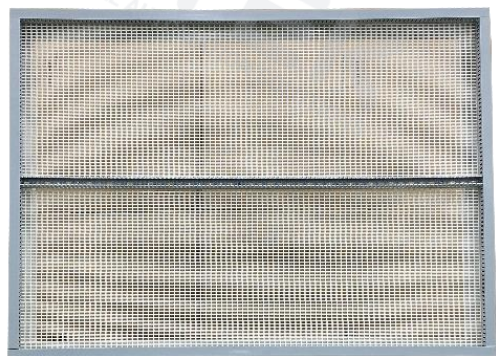
Wiring training solution

Electrical equipment

Single assembly station

PH06. ELECTRICAL EQUIPMENT TRAINING ROOM

1. Panel for practicing industrial and civil electrical installation

- Overall dimensions: 1180x740x1716 ±1% (mm) (LxWxH)
- Frame:
 + Use 40x40 mm box iron for bending and milky white powder coating.
 Edge panels made of powder-coated corrugated iron, size 690x285 mm (LxW), supplied R150
 + Each edge panel has 14 bean grooves measuring 80x20 mm
 + The installation panel frame is designed at a 100 degree angle for easy installation and connection
 + 04 moving wheels with height-adjustable feet when practicing
 + Base size: 1180x740 mm (LxW), R110 board

PH06. ELECTRICAL EQUIPMENT TRAINING ROOM

2. Industrial electricity installation skill practice kit

a.   Experiments with electrical instruments
- Controlling the motor at 2 positions
- Changing the direction of the motor rotation
- Starting circuit of the Y/D asynchronous motor with 3-phase squirrel cage rotor controlled by time relay
- Starting circuit of the Y/D asynchronous motor with 3-phase squirrel cage rotor controlled by manual control
- Double starter circuit with push button
- Dual starter circuit controlling 2 places of 4-wire push button set
- Dual starter circuit controlling 1 place of 5-wire push button set with end of stroke control
- Dual starter circuit controlling 2 places of 5-wire push button set with end of stroke control
- Star-delta starter circuit

b. Experiments with LOGO programmable device
- Controlling the motor on_off
- Controlling the motor in cycles.
- Circuit with forward and reverse control.
- Star-delta starter circuit
- Star-delta starter circuit with push button- Controlling two motors in cycles.

PH06. ELECTRICAL EQUIPMENT TRAINING ROOM

3. Domestic electricity installation skill practice kit

The provided equipment will be used to practice the following exercises:
- Simple light circuit (on/off light circuit)
- Light circuit with double switch
- Light circuit with changing brightness level
- Sequential circuit (light circuit set up in wine cellar)
- Reversing circuit (staircase light circuit)
- High voltage light circuit- Automatic on/off light circuit
- Circuit with call device
- Circuit with digital timer
- Circuit with 4-button remote control switch
- Single-phase electric meter circuit, single-phase circuit breaker
- Single-phase voltage circuit, light control, socket
- Circuit with a single switch controlling an LED bulb, a socket and a protective fuse
- Single-phase voltage circuit branching to floors

4. Smart home electrical installation kit (KNX)
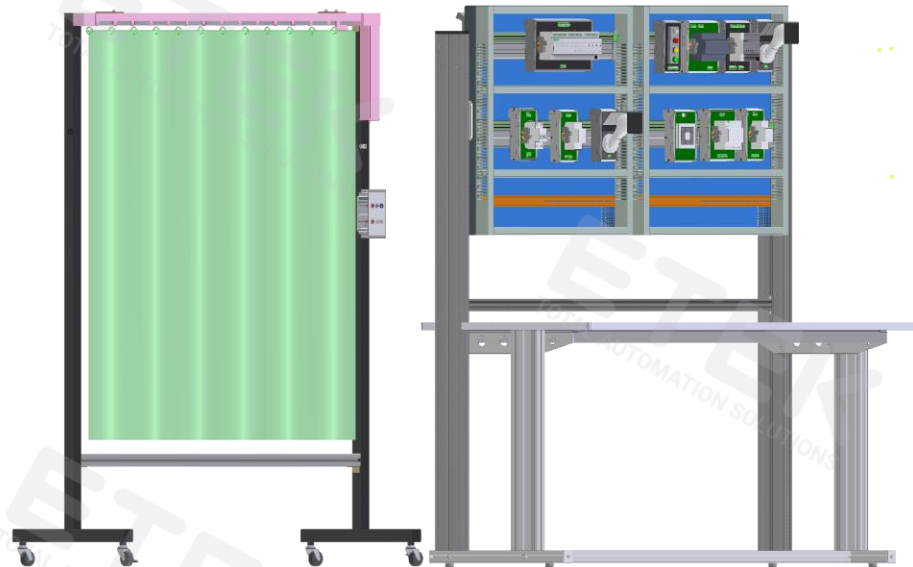
The provided equipment will be used to practice the following exercises:
- Practice to learn about the structure and function of the motor single phase AC with only starting capacitor
- Practice configuring infrared sensors in smart home systems
- Practice controlling curtains with KNX digital inputs
- Controlling curtains with KNX regular push buttons
- Practice configuring and connecting KNX devices with software
- Practice linking devices between 2 rooms
- Practice controlling fluorescent light intensity with KNX light sensors
- Practice controlling incandescent bulbs with KNX smart push buttons
- Practice controlling curtains with KNX smart push buttons
- Practice configuring KNX ip routers
- Practice controlling fluorescent bulbs with KNX digital inputs
- Practice configuring motion sensors in smart home systems
- Practice installing circuits and controlling automatic on/off lights when detecting human presence or movement.
- Practice installing circuits and controlling automatic opening and closing of curtains when human presence is present.
- Practice installing circuits and automatically turning on and off other electrical devices when there is human presence.
- Practice programming KNX servers and monitoring the system over the network

5. Wireless smart home electrical installation training system
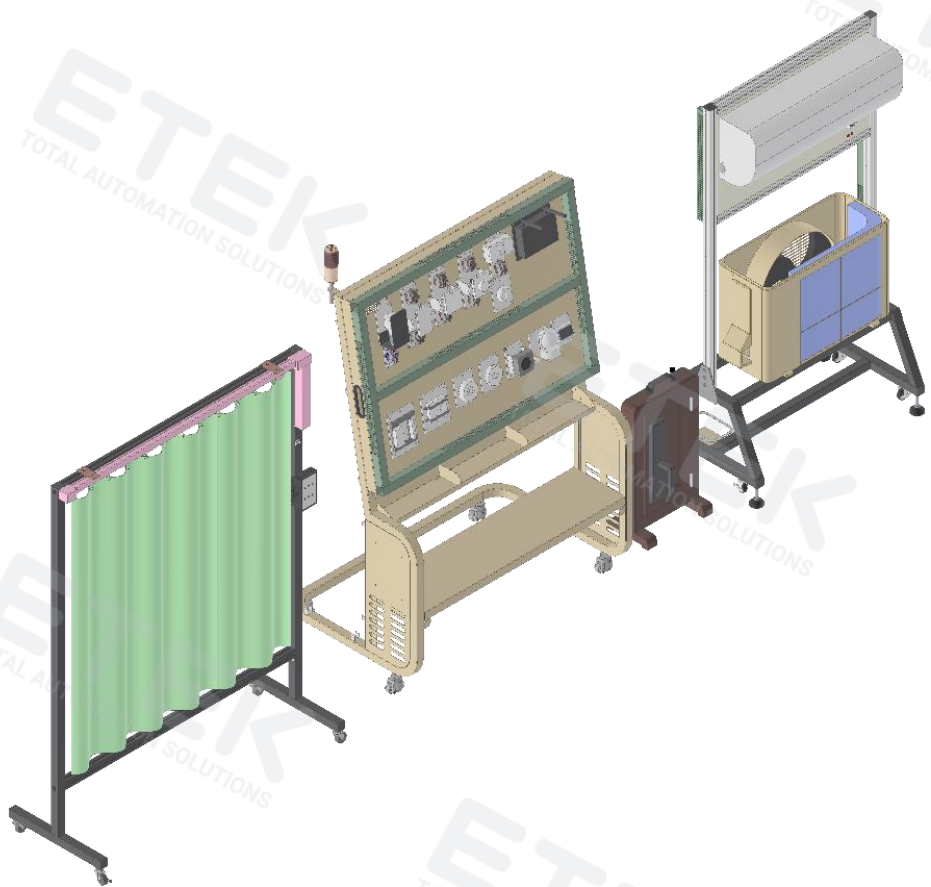
Training content:
- General concept of smart home devices using 2 standards zigbee and wifi (Definition, advantages, disadvantages) to create a basis for choosing devices
- Learn the system structure and the function of each hardware and software component of the smart home system according to 2 standards zigbee and wifi
- Learn the operating principles and how to connect Tuya smart home devices
- Operate and use Tuya devices according to specific problems in practice

6. Lightning protection system installation training system
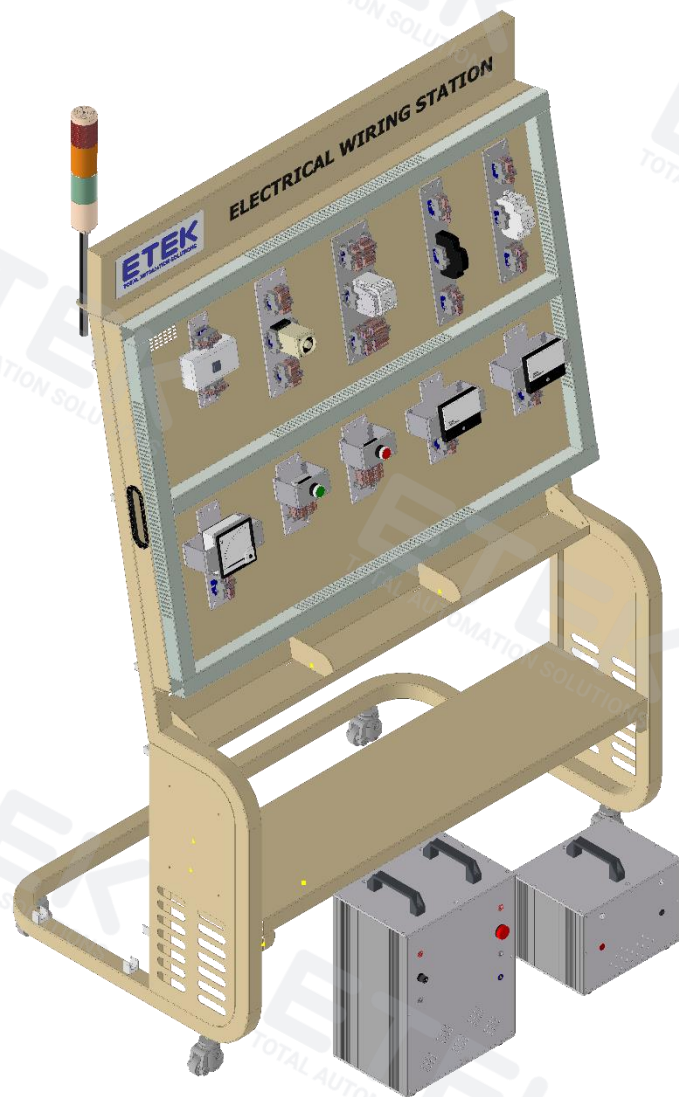
I. General specifications
- The equipment set is designed into separate modules with standard sizes and the same connection standards, helping to flexibly connect devices during practice and easily upgrade products.
- Intermediate terminals for all input and output of power circuits as well as control circuits. Connecting via terminals will prevent students from directly operating on the device, helping to increase the life of the device.

II. Training content:
- Identify devices in the lightning protection system
- Connect devices, practice lightning protection

7. Mobile material rack for electrical installation
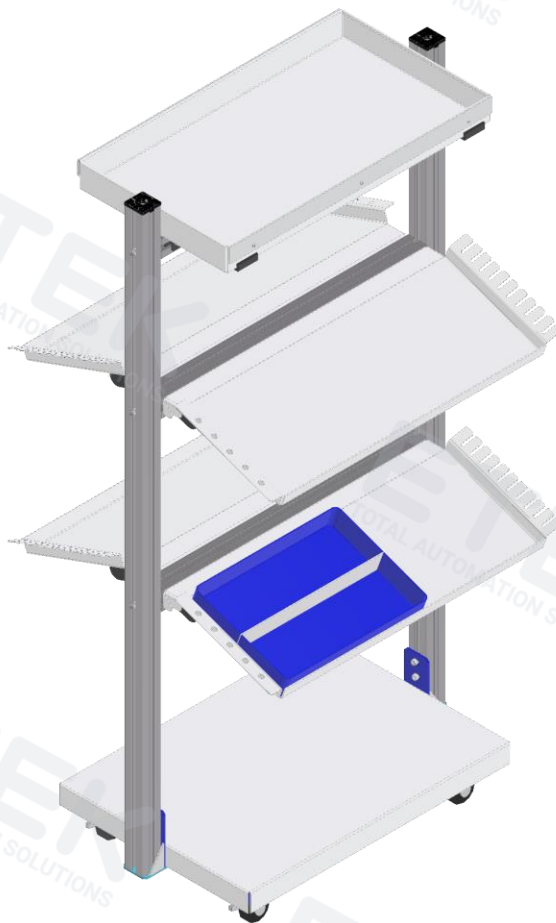
- Dimensions: 636 x 531 x 1275 mm (L x W x H)
- Frame material: Assembled from aluminum profiles with anodized surface for durability, strength, and aesthetic appearance
- Trays for components: Made from powder-coated CT3 steel sheets, ensuring durability and aesthetics
- Structure: The rack is divided into 4 levels, each designed to hold different types of equipment
- Mobility: The aluminum frame is mounted on 4 caster wheels with brakes, providing easy mobility and stability during use

8. Single phase distribution cabinet model
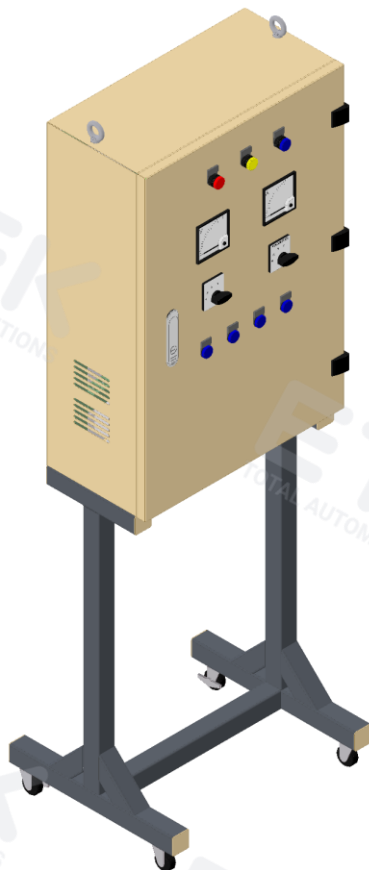
Dimensions: 800 x 400 x 1803 mm (W x D x H)
Cabinet material: Made of CT3 steel with powder-coated finish; aesthetically designed and highly durable
Standards:
- ISO 9001:2015 – Quality Management System
- Conforms to TCVN 5699-1:2010 and IEC 60335-1:2010 standards on power ratings, current, leakage current, and dielectric strength
Input power supply: 380V / 50Hz, protected by 3-phase 100A circuit breaker (MCB)
Output power supply:
.04 single-phase outputs (220V / 50Hz) protected by 25A single-phase circuit breakers
Measurement and display unit:
.01 analog voltmeter (500VAC)
.01 analog ammeter (50/5 AAC)
.03 current transformers (ratio 50/5) as input for ammeter
.03 power indicator lights
Cabinet is mounted on a CT3 powder-coated steel frame
Equipped with four wheels for mobility: 2 with brakes and 2 without

9. Three phase distribution cabinet model
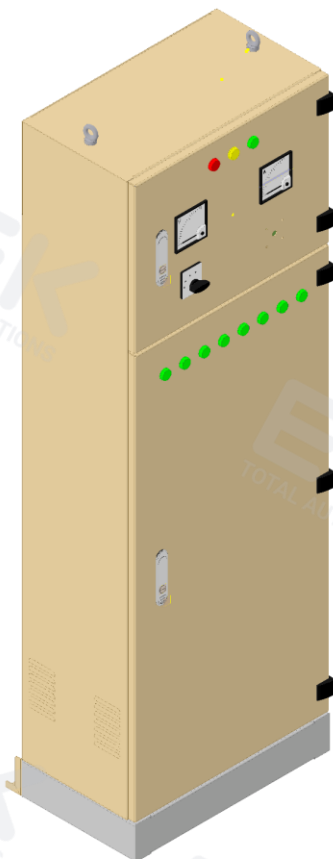
Dimensions: 600 x 350 x 1800 mm (L x W x H)

Standards:
- ISO 9001:2015 – Quality Management System
- Compliant with TCVN 5699-1:2010 and IEC 60335-1:2010 standards for power ratings, current, leakage current, and dielectric strength

Input power supply:
- Three-phase AC 380V / 50Hz
- Input power is switched and protected against overcurrent and short circuit by a 200A circuit breaker (MCB)

Output power supply:
- 01 output line rated at 50A
- 03 output lines rated at 40A
- 04 output lines rated at 30A

All output lines are switched and protected by corresponding circuit breakers

PH07
SUBSTATION OPERATION AND POWER TRANSMISSION TRAINING ROOM

PH07. SUBSTATION OPERATION AND POWER TRANSMISSION TRAINING ROOM

FUNCTION

Training content
- Practice understanding the operation of elements in the electrical system.
- Practice operating the electrical system locally - remotely
- Practice operating the electrical system on Scada software.
- Practice controlling generator voltage and frequency
- Practice synchronizing the generator with the grid manually and automatically on Scada software
- Practice controlling reactive power and active power of the generator.
- Practice controlling the ATS automatic power transfer system.
- Practice relay protection for distance, ground fault, differential, directional and scalar overcurrent
- Practice operating the system with LRC loads

Power Operation, Protection, and Transmission Training System

Low Voltage Power Supply and Protection Transformer System Model

Transmission and Power Supply Simulation System with SCADA Monitoring

1. Training system for operation, protection and transmission of power

System equipment includes:

AC generator training module	Circuit breaker cabinet model (synchronous)	Power supply cabinet model	Circuit breaker cabinet model (input low voltage circuit breaker cabinet)	Step-up transformer model	Isolator cabinet model	Measurement cabinet model (medium voltage)

Circuit breaker cabinet model (Medium voltage circuit breaker cabinet)

Control SCADA system and monitoring and measuring electricity	Practice table for protective relay experiment	Central control practice table for power supply system	Training module for adjustable capacity loader (R - L - C)	Cabinet model Low voltage capacitor	Low voltage distribution cabinet model

Low voltage transformer model

2. Simulation model of power transmission and supply system using Scada Monitoring

❖ **Training content:**

- Practice simulating power supply diagrams: Diagram of a busbar with segments using circuit breakers; diagram of 2 busbars; diagram of 2 busbars with ring busbar; quadrilateral diagram.
- Practice the functions of line protection relays
- Practice the features of transformer differential protection relays
- Practice automatic or manual low voltage power factor compensation
- SCADA system control, monitor and measure electricity
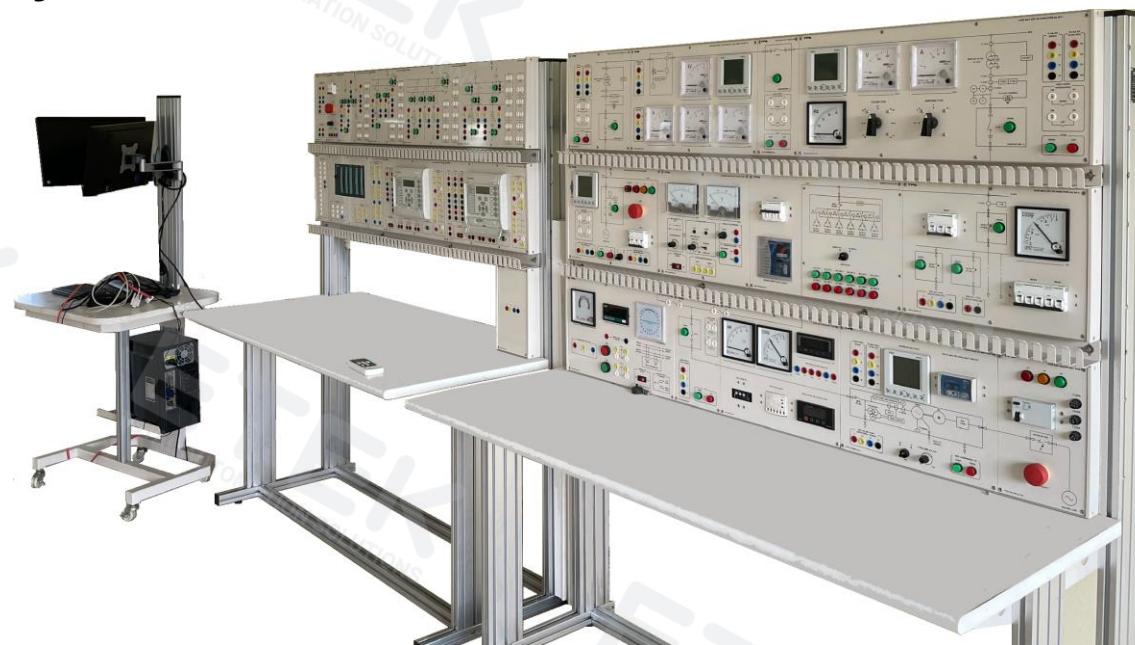
| Central control practice table for power supply system | Power grid simulation equipment set for relay protection practice | Transformer training module | Load module | SCADA system for control and monitoring and measurement Electrical Powe |
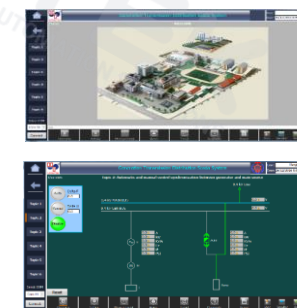
2. Simulation model of power transmission and supply system using Scada Monitoring

The system includes:

1. Input power supply system
2. Generator (simulated by stepless transformer)
3. ACB1: Input low voltage circuit breaker
4. 0.4/22kV step-up transformer (simulated)
5. Medium voltage measurement system
6. VCB1: Medium voltage circuit breaker
7. Low voltage transformer 22kV/0.4kV (simulated)
8. ACB2: Output low voltage circuit breaker
9. Low voltage distribution system
10. Reactive power compensation system
11. Load system: Including inductive load and resistive load
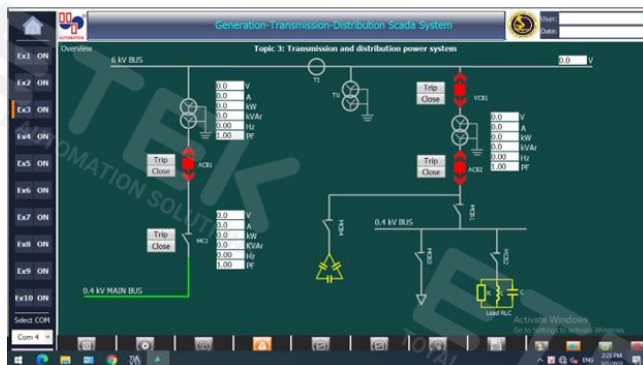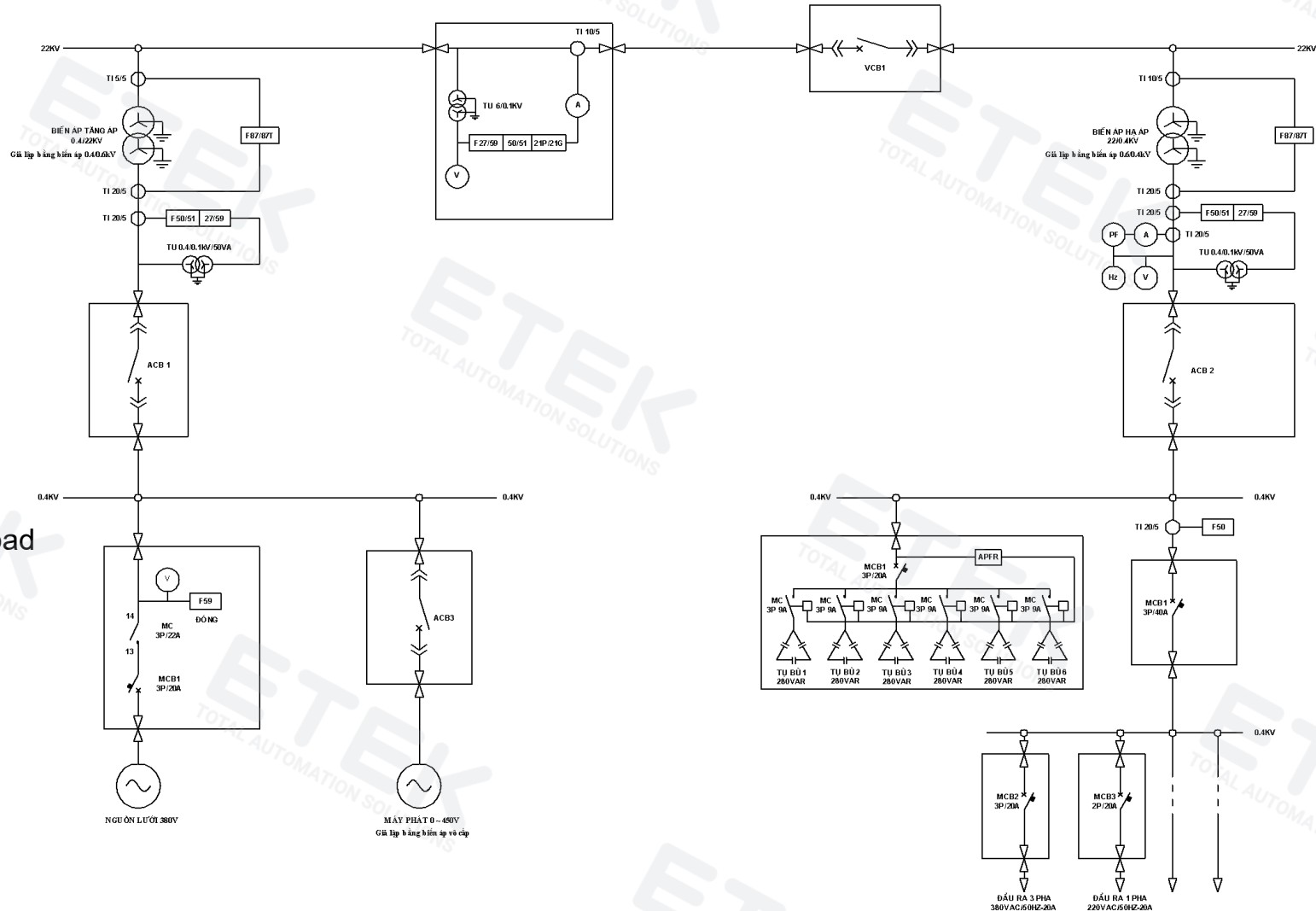
Scada interface controls and monitors the electrical system

3. Model of low voltage power supply and protection transformer system

Training content:
- ❖ Lesson 1: Practice simulating power supply diagrams: Diagram of a busbar with segments by circuit breakers; diagram of 2 busbars; diagram of 2 busbars with ring busbar; quadrilateral diagram.
- ❖ Lesson 2: Experiment to practice the functions of line protection relay
- ❖ Lesson 3: Practice the features of transformer differential protection relay
- ❖ Lesson 4: Practice low voltage power factor compensation automatically or manually

Model of low-voltage power supply system

Model of low-voltage power supply system

Model of low-voltage transformer station (hanging station)

Elevator system and dynamic electric cables

![ETEK - Total Automation Solutions logo]

PH08.
EQUIPMENT
RENEWABLE ENERGY
TRAINING ROOM

PH08. EQUIPMENT RENEWABLE ENERGY TRAINING ROOM

ETEK
TOTAL AUTOMATION SOLUTIONS
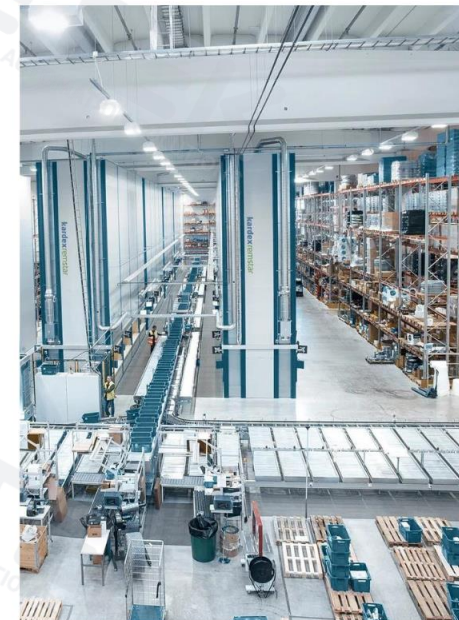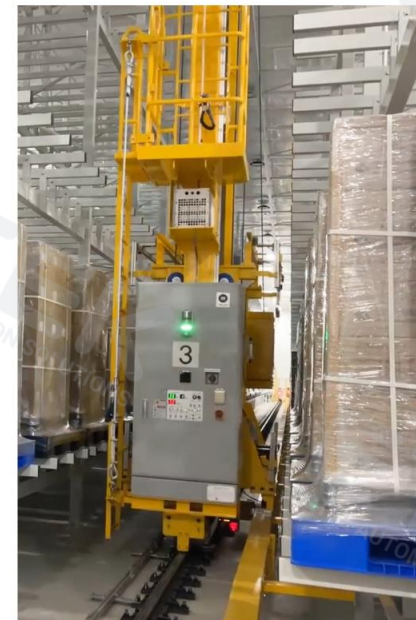
FUNCTION

- Practice connecting and operating off-grid solar/wind energy circuits (Offline) / grid-connected (Online)

- Practice measuring, checking and calculating power consumption and power output to the grid.

- Practice installing a power switch circuit for the house when a grid failure occurs (offline power grid)

- Practice finding errors and repairing common damages.

- Practice periodic maintenance of equipment.

Wind energy training model

On grid solar training model

Off grid solar training model

Solar Energy Training Kit (with Automation Studio simulation and interactive software)

Wind Energy Training Kit (with Automation Studio simulation and interactive software)

Frame solution

Assembly panel

Single mounting frame

Single assembly station

Wiring training solution

Electrical equipment

Single assembly station

1. Panel for practicing industrial and civil electrical installation

- Overall dimensions: 1180x740x1716 ±1% (mm) (LxWxH)
- Frame:
 + Use 40x40 mm box iron for bending and milky white powder coating.
 Edge panels made of powder-coated corrugated iron, size 690x285 mm (LxW), supplied R150
 + Each edge panel has 14 bean grooves measuring 80x20 mm
 + The installation panel frame is designed at a 100 degree angle for easy installation and connection
 + 04 moving wheels with height-adjustable feet when practicing
 + Base size: 1180x740 mm (LxW), R110 board

2. Wind energy training model

- Study the construction principles of wind turbine systems and the various types available on the market
- Learn about installation methods, optimal orientation, and power calculation of wind turbines
- Practice wiring and operating an off-grid (offline) wind energy circuit
- Practice wiring and operating an on-grid (online) wind energy circuit
- Practice troubleshooting and repairing common faults
- Practice periodic maintenance of the equipment

PH08. EQUIPMENT RENEWABLE ENERGY TRAINING ROOM

3. On grid solar training model

- Study the construction principles of solar panels and the various types available on the market
- Learn about installation methods, panel orientation, and solar power output calculation
- Practice wiring and operating an on-grid (online) solar energy circuit
- Practice wiring a backup power switch-over circuit for a house using solar energy in case of grid failure (off-grid mode)
- Practice connecting the solar power system to the household electrical network
- Practice troubleshooting and repairing common faults
- Practice routine maintenance of the equipment

4. Off grid solar training model

- Study the construction principles of solar panels and the various types available on the market
- Learn about installation methods, panel orientation, and calculation of solar panel power output
- Practice wiring and operating an off-grid (offline) solar energy circuit
- Practice installing a circuit to switch the home's power supply to solar energy in case of grid power failure (offline mode)
- Practice connecting the solar power system to the household electrical network
- Practice troubleshooting and repairing common faults
- Practice periodic maintenance of the equipment

5. Solar Energy Training Kit (with Automation Studio simulation and interactive software)

- Calculate and select equipment, design and simulate solar power circuits using Automation Studio software
- Connect hardware devices and interactively collect real-time hardware status data synchronized with the software
- Study the construction principles of solar panels and the various types available on the market
- Learn about installation methods, panel orientation, and calculation of solar panel power output
- Practice wiring and operating an off-grid (offline) solar energy circuit
- Practice wiring and operating an on-grid (online) solar energy circuit
- Practice measuring, testing, and calculating power output
- Practice periodic maintenance of the equipment

6. Wind Energy Training Kit (with Automation Studio simulation and interactive software)
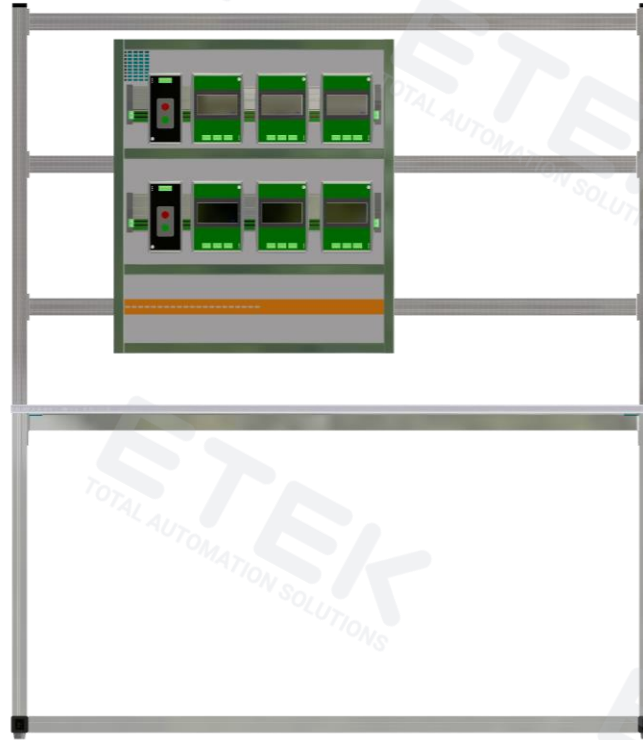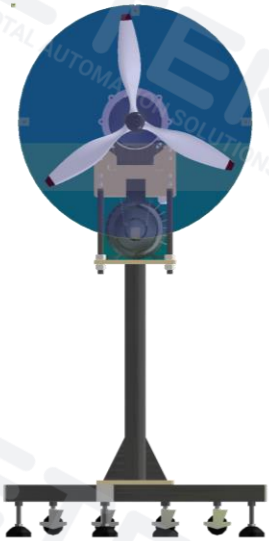
- Calculate and select equipment, design and simulate wind turbine electrical circuits using Automation Studio software
- Connect hardware devices and interactively collect real-time hardware status data synchronized with the software
- Study the construction principles of wind turbine systems and the various types available on the market
- Learn about installation methods, turbine orientation, and calculation of wind turbine power output
- Practice wiring and operating an off-grid (offline) wind energy circuit
- Practice wiring and operating an on-grid (online) wind energy circuit
- Practice troubleshooting and repairing common faults
- Practice periodic maintenance of the equipment

PH09
BASIC PLC TRAINING ROOM

PH09. BASIC PLC TRAINING ROOM

FUNCTION

PLC programming training S7-1200, FX5U, Logo

- Learn the hardware structure
- Hardware declaration and PLC configurationprogramming basic logic commands
- Programming commands using Timer and Counter
- Programming comparison commands
- Programming basic mathematical commands
- Programming using subroutines
- Programming interrupt handler programmingreal-time programming
- Analog signal processing programming
- Analog signal processing programming
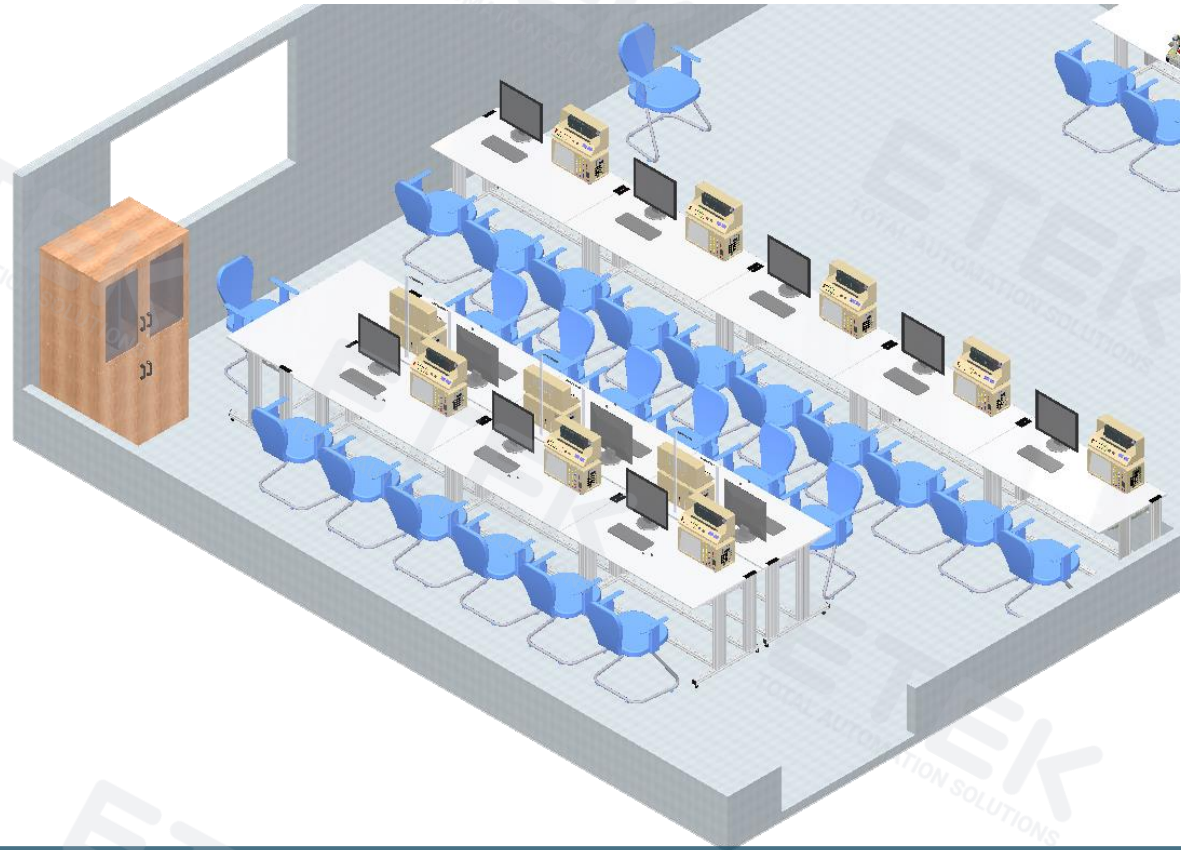
PLC Siemens LOGO Training set

PLC S7-1200 Training set

PLC S7-1500 Training set

PLC FX5U Training set

Table with Chair

PH09. BASIC PLC TRAINING ROOM

PLC Training set Solution

PLC

Digital input simulation

HMI

Digital output

I/O interface

Analog input simulation

Analog input

HMI (option)
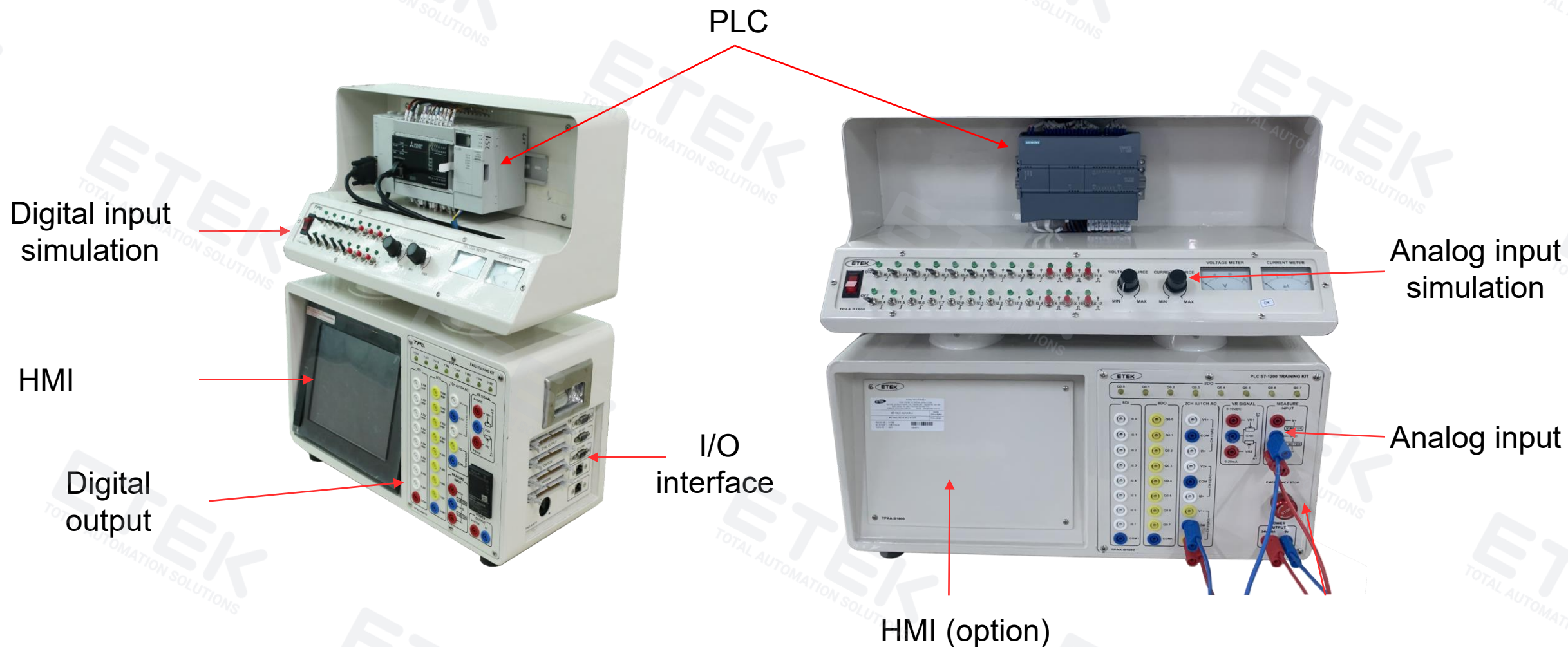
PH09. BASIC PLC TRAINING ROOM

1. PLC LOGO training set

Training Contents:
- Connect the power cord and signal cord to the PLC LOGO
- Practice programming basic logic commands Practice programming commands using Timer and Counter
- Practice programming to process analog input signals

PH09. BASIC PLC TRAINING ROOM

2. PLC S7-1200 Training set

PLC S7-1200

Digital input
simulation

Digital
output

Training Contents:
- Learn the hardware structure of PLC S7 1200
- Learn how to declare hardware and configure PLC
- Practice programming basic logic commands
Practice programming commands using Timer and Counter
- Practice programming comparison commands
- Practice programming basic mathematical commands
 - Practice programming using subprograms
- Practice interrupt handling programming
- Practice real-time programming
- Practice programming to process analog input signals
- Practice programming to process analog output signals

PH09. BASIC PLC TRAINING ROOM

3. PLC S7-1500 Training set

PLC S7-1500

Digital input simulation

Digital output
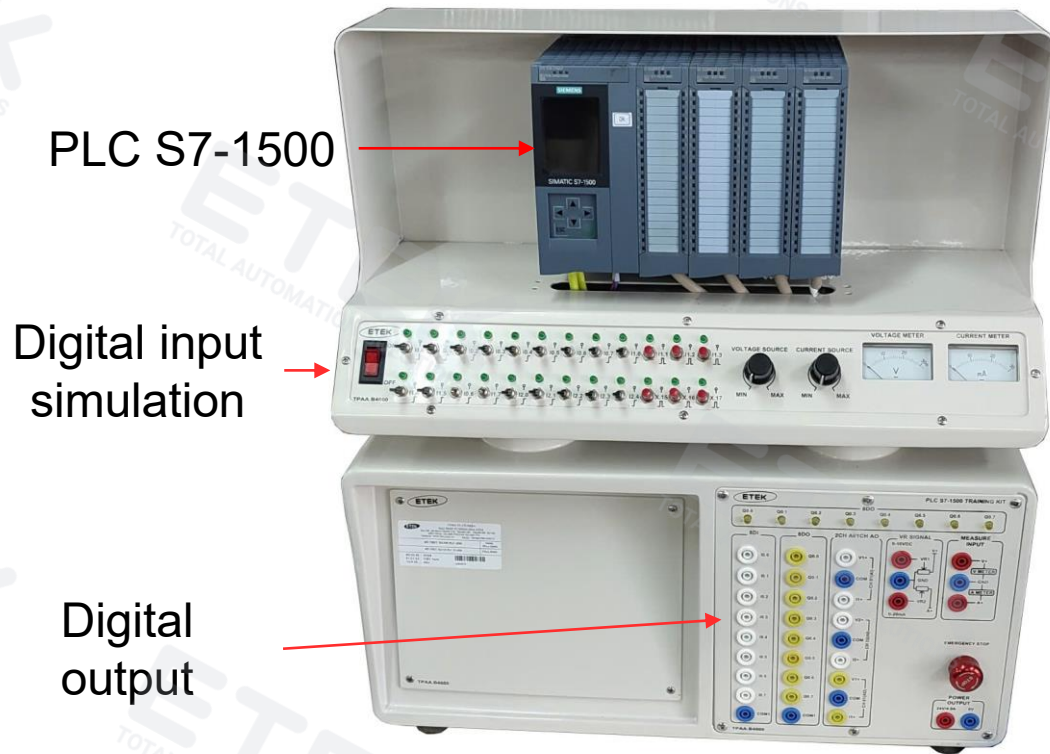
Training Contents:
Pair the CPU with the power module and connect the power and signal wires to the PLC
- Install and declare PLC hardware
- Practice programming basic logic commands
Practice programming commands using Timer and Counter
- Practice programming comparison commands
- Practice programming basic mathematical commands
 - Practice programming using subprograms
- Practice interrupt handling programming
- Practice real-time programming
- Practice programming to process analog input signals
- Practice programming to process analog output signals
- Practice programming using subprograms FB and FC

4. PLC FX5U Training set

PLC

Digital input
simulation

HMI
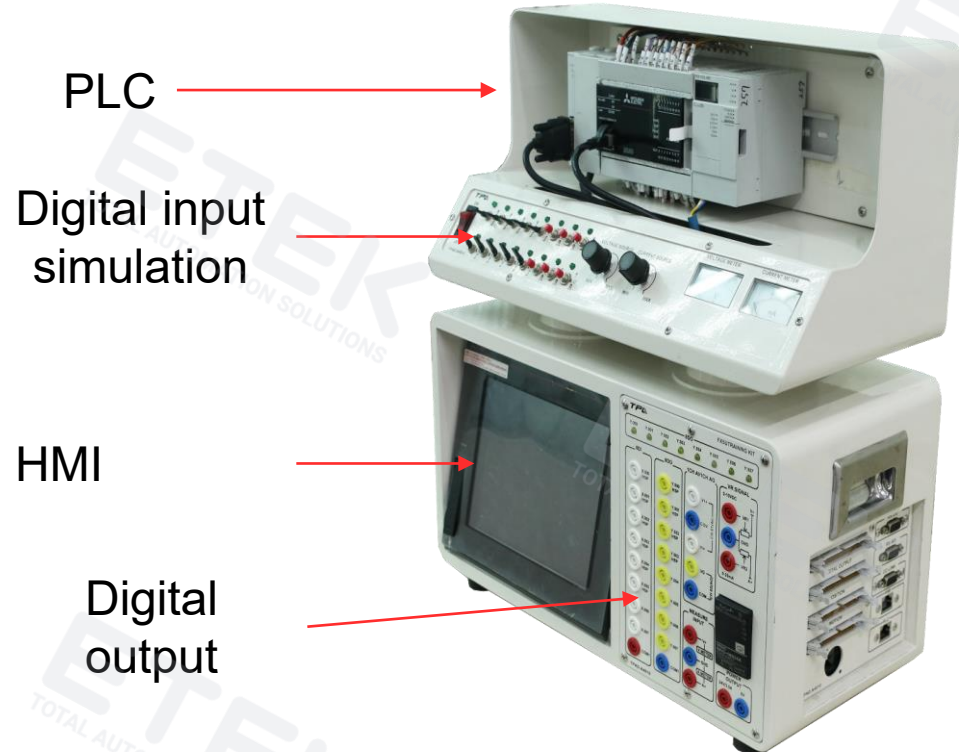
Digital
output

Training Contents:
- Know the hardware structure of the FX5U PLC programmer
- Know how to connect the power supply, digital input and output, and analog input and output of PLC FX5U
- Know how to write programs for PLC FX5U with functions: logic, Timer, Counter, mathematics
- Know how to create interfaces on HMI GS2107-WTBD
- Know how to program controls. Monitoring between HMI and PLC

PH10
ADVANCED PLC TRAINING ROOM

PH10. ADVANCED PLC TRAINING ROOM

FUNCTION

PLC programming training S7-1200

- Learn the hardware structure
- Hardware declaration and PLC configurationprogramming basic logic commands
- Programming commands using Timer and Counter
- Programming comparison commands
- Programming basic mathematical commands
- Programming using subroutines
- Programming interrupt handler programmingreal-time programming
- Analog signal processing programming
- Analog signal processing programming
- Programming control conveyor, 4-floor elevator, process control, motor control

PLC wiring training set

Conveyor control station
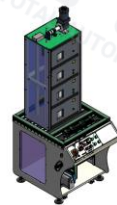
4-floor elevator

Process control station

Motor control station

Electrical Student WorkBench with chair

PH10. ADVANCED PLC TRAINING ROOM

1. PLC wiring training set
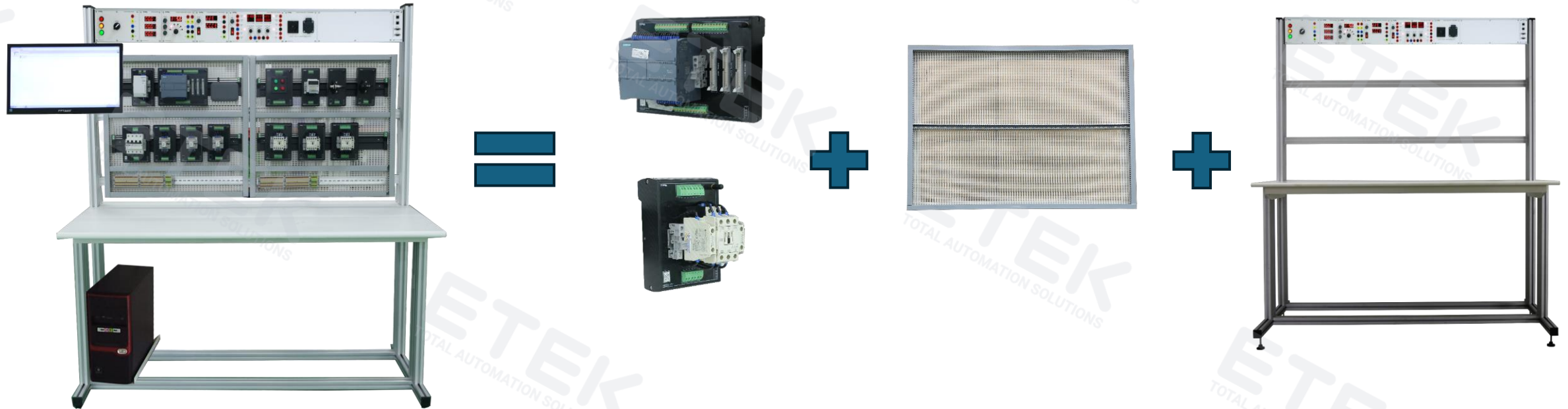
Equipment + **Assembly panel** + **Table frame**

Training Contents
- Learn the hardware structure of PLC S7 1200
- Learn how to declare hardware and configure PLC
- Practice programming basic logic commands
- Practice programming commands using Timer and Counter
- Practice programming comparison commands

- Practice programming basic mathematical commands
- Practice programming using subprograms
- Practice interrupt handling programming
- Practice real-time programming
- Practice programming to process analog input signals

PH10. ADVANCED PLC TRAINING ROOM

2. Model of product sorting conveyor belt actuator

Connector

Conveyor

Cable

Pushbutton panel

Trough
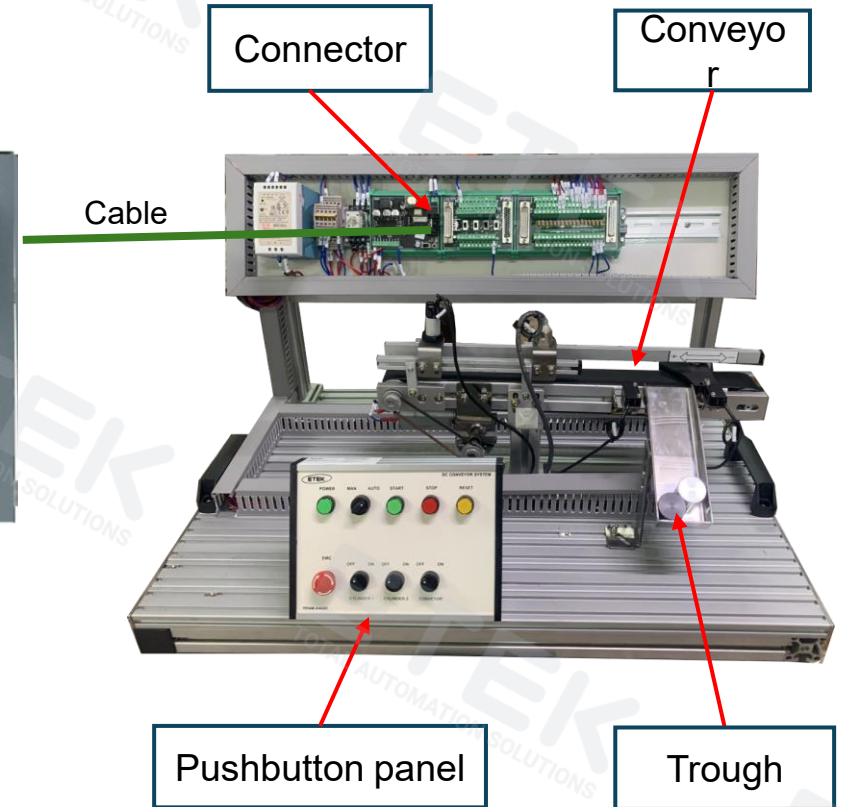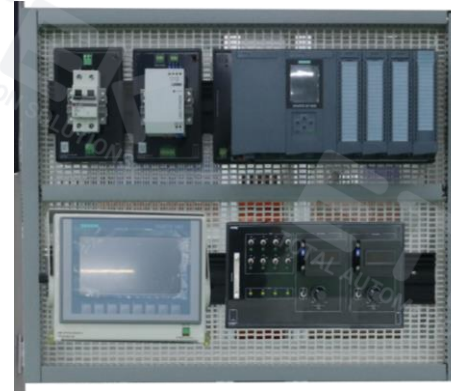
Training Contents
- Install and align mechanical details
- Align industrial sensors included in the model
- Compressed air connection
- Connect the conveyor control cabinet circuit, Check I/O signal
- PLC programming to control the conveyor belt, control the system to run in cycles
- Weighing, checking weight and classifying products

3. Model of 4-floor elevator actuator

Cable

Training Contents

- Practice learning the operating principles of the devices in the model

- Practice learning the operating principles of elevator systems in practice

Practice installing electrical equipment on the panel, connecting the elevator control cabinet

- Practice surveying the power supply for the device

- Practice surveying elevator I/Os

- Practice connecting elevator I/O to the controller

- Practice writing elevator cabin control programs

- Practice writing programs to control the opening and closing of elevator doors

- Practice writing a program to display the elevator's floor number

- Practice writing a program to call the elevator cabin

- Practice writing complete elevator control programs

PH10. ADVANCED PLC TRAINING ROOM

4. Process control actuator model (flow, level, temperature)

Electrical cabinet

Cable

Mixing Tank

Flow Sensor

Liquid Tank 2

Liquid Tank 1

Pump

Flow sensor
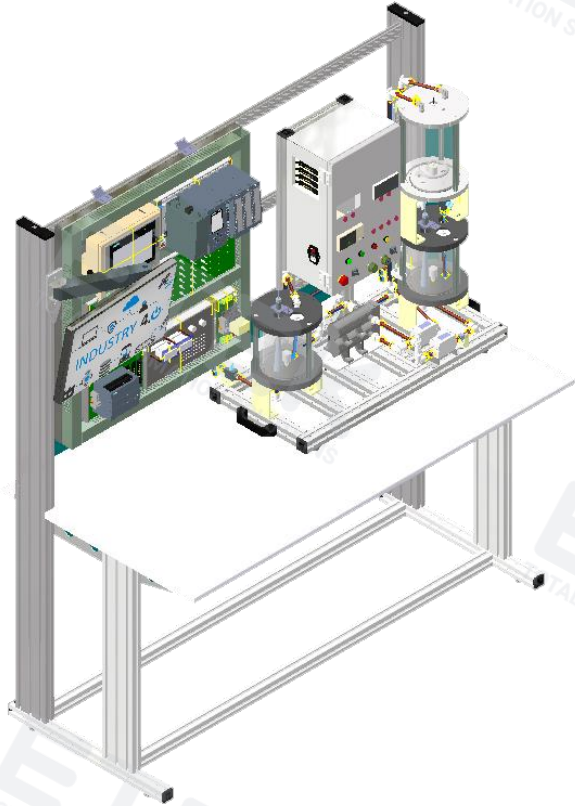
Training Contents
- Practice PLC
- Practice Level PID programming
- Practice PID Flow programming
- Practice programming and mixing product materials
- Heating control
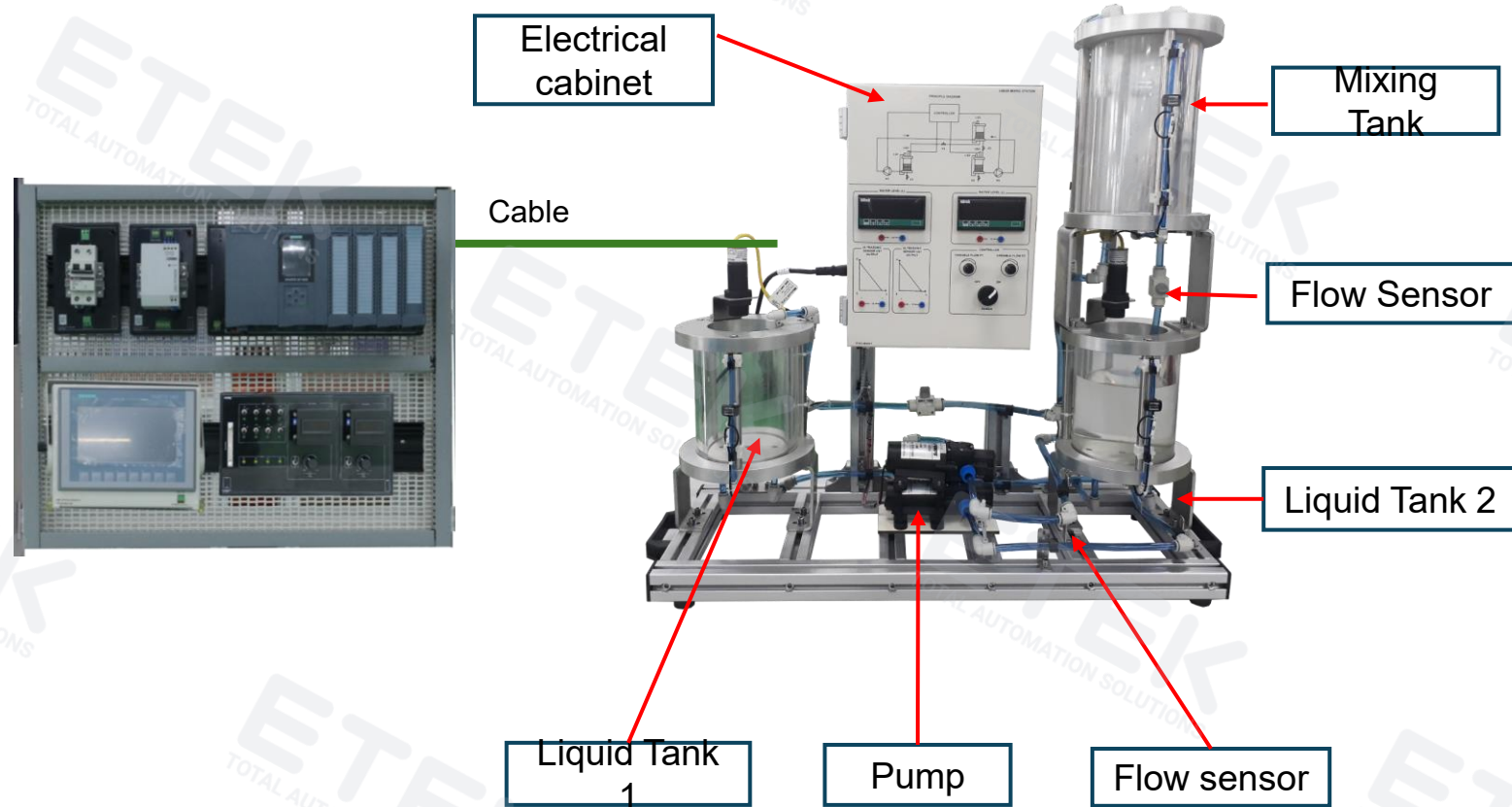
5. Model of 1-axis position control actuator

Cable
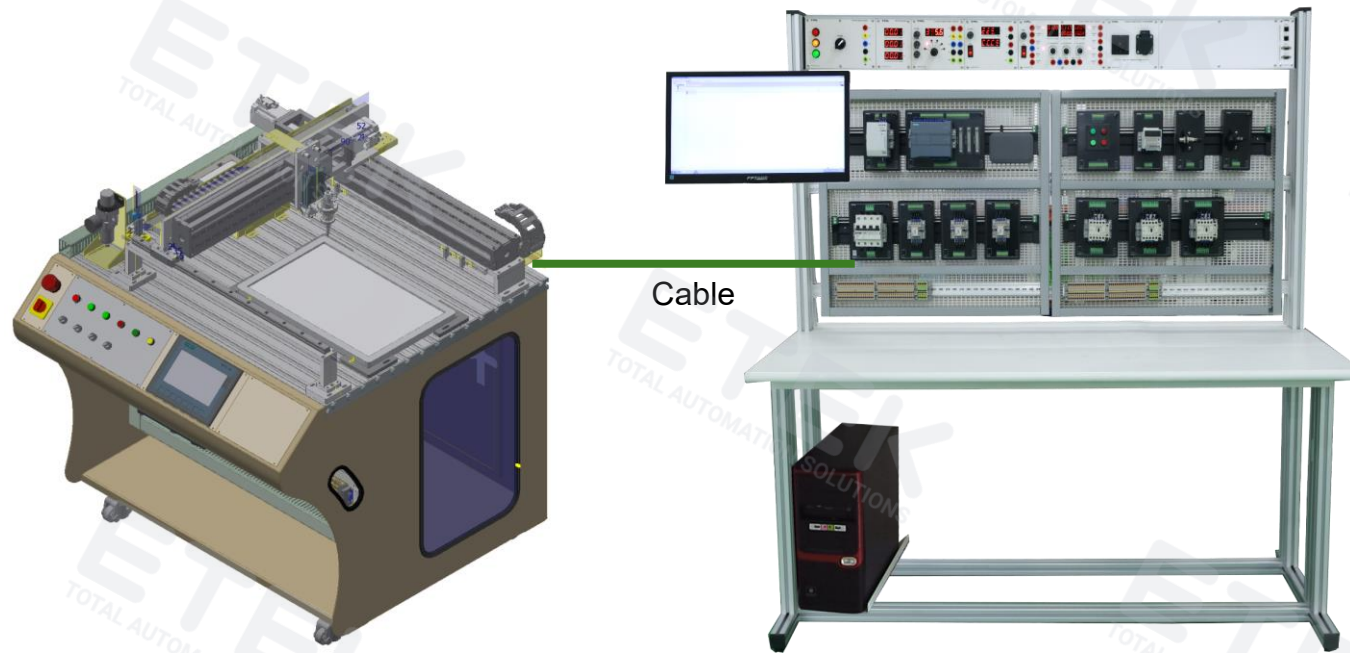
Training Contents
- Install and mechanically align equipment clusters in the module
- Wiring, connecting and checking the electrical control system
- Operate and test the system
- Practice PLC programming to control stepper motors
- Practice PLC programming to control DC motors
- Practice PLC programming to control AC servo motors
- Practice PLC programming to control and coordinate different types of motors in the L. INDUSTRIAL ROBOT PRACTICE ROOM

PH11
AUTOMATION TRAINING ROOM

PH11. AUTOMATION TRAINING ROOM

FUNCTION

- Learn the structure of a mechatronic system
- Practice mechanical alignment, installation and alignment of sensors
- Practice installation and troubleshooting of each station
- Practice writing PLC control programs for the station
- Practice connecting, programming industrial robots
- Connect the I/O inputs and outputs of the PLC to the system
- Expanded training content:
+ Collect remote station management data via web server
+ Collect and update the positions of workpieces on different stations
+ Simulate and collect system signals using a remote management interface connected via the internet
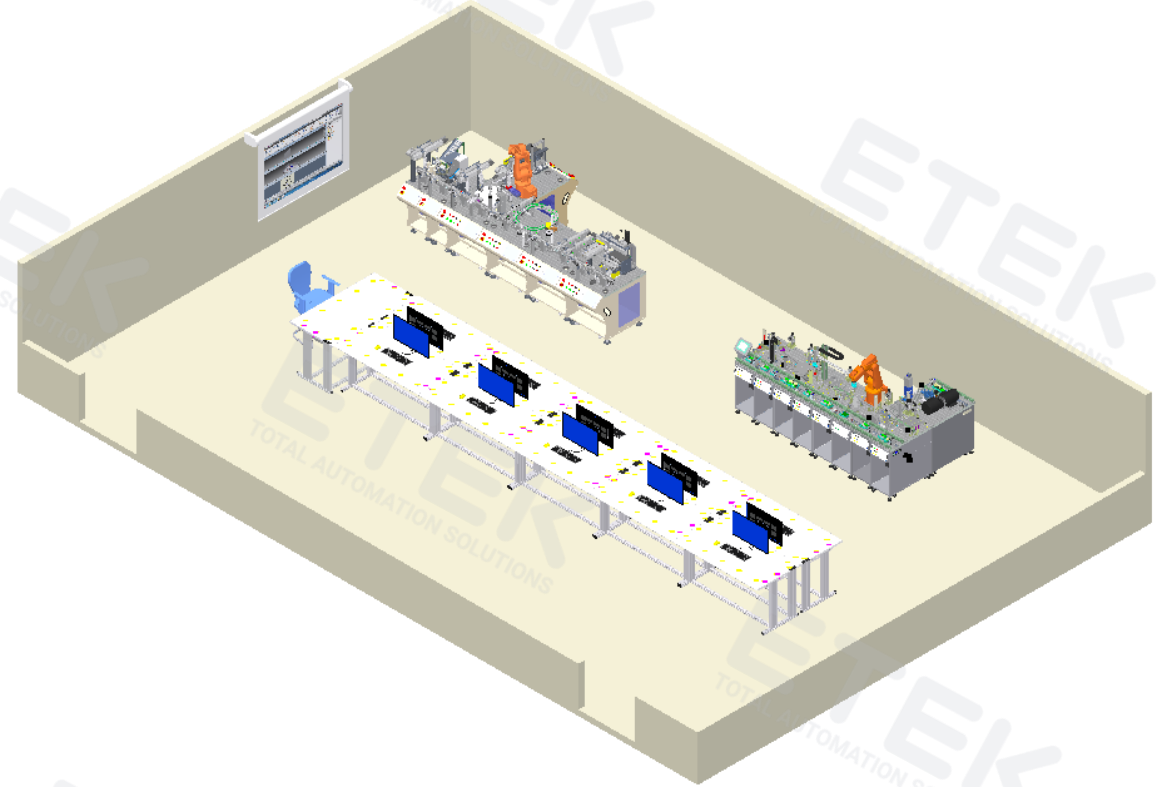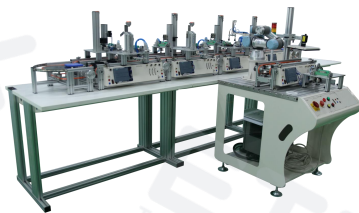
Basic robot programming model	Mechatronics 4.0 desktop training system	Mechatronic installation and maintenance practice system - MPS	Digital-twin and Smart Factory practice system	Theoretical desk
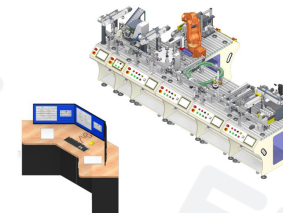
PH11. AUTOMATION TRAINING ROOM

1. Basic robot programming model

Training content:

- Learn the structure of Robot
- Safe use of robots Robot coordinate system, Robot Calib
- Setting robot parameters
- Programming basic movement commands
- Program advanced movement commands (follow lines, draw, simulate glue ..)
- Change the work plane
- Programming conditional commands
- Simple subroutine
- Write, pick and place robot programs using IO robot

1. Robot 2. Basic training 3. Pick& plate 4. Writing and drawing 5. Conveying 6. Pen holder 7. Table

2. Mechatronics 4.0 desktop training system

Training content:

- Learn the structures of a flexible production line

- Practice surveying, installing, and aligning hardware devices

- Practice configuring devices and linking stations on software

- Practice PLC programming

- Practice programming SCADA monitoring interface

ETEK
TOTAL AUTOMATION SOLUTIONS

3. Mechatronic installation and maintenance practice system - MPS

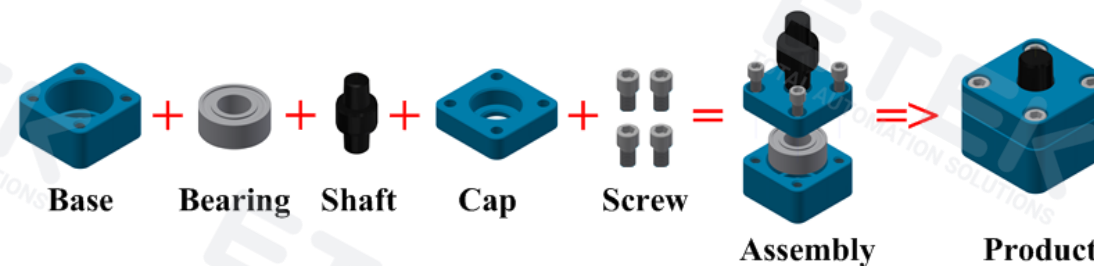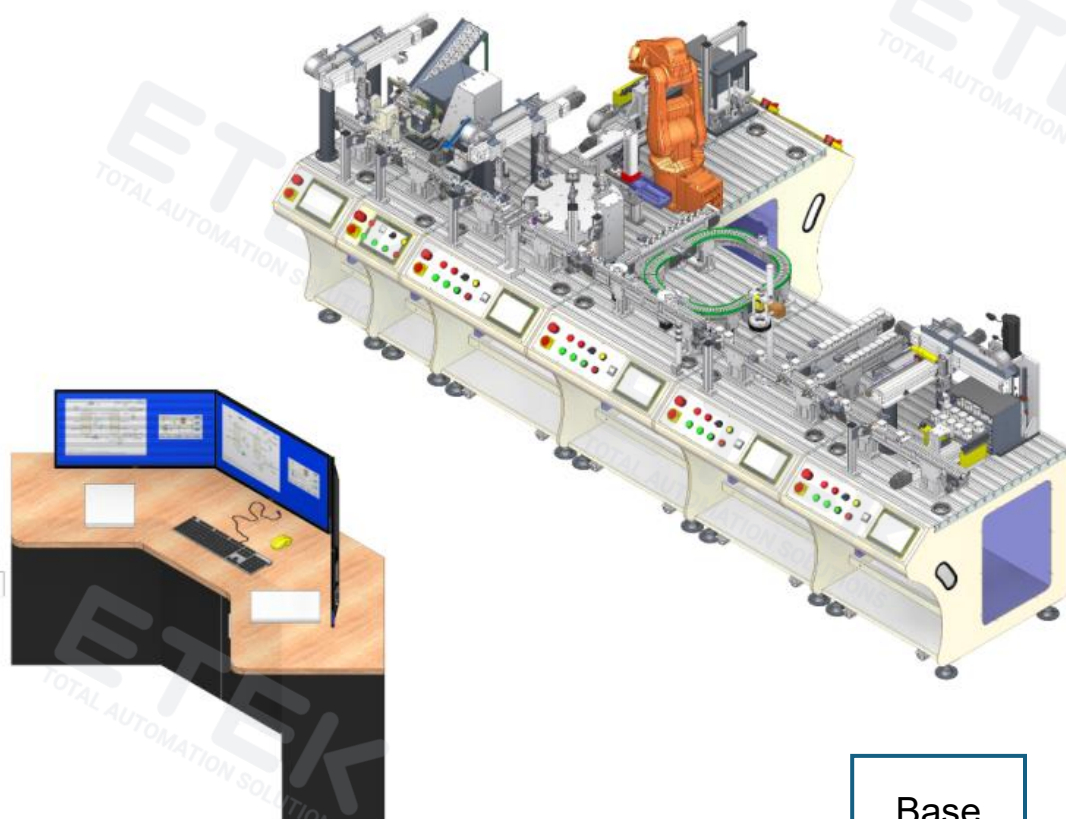**Training content:**

- Overall knowledge of mechatronics: Sensors, pneumatics, hydraulics, PLC, industrial communication networks, IOT.
- Disassembly, installation and connection of mechatronic modules (according to the national and international skills competition program)
- PLC programming to control independent stations
- Programming inter-station communication, complete system control
- Control and monitor the system via Cloud server
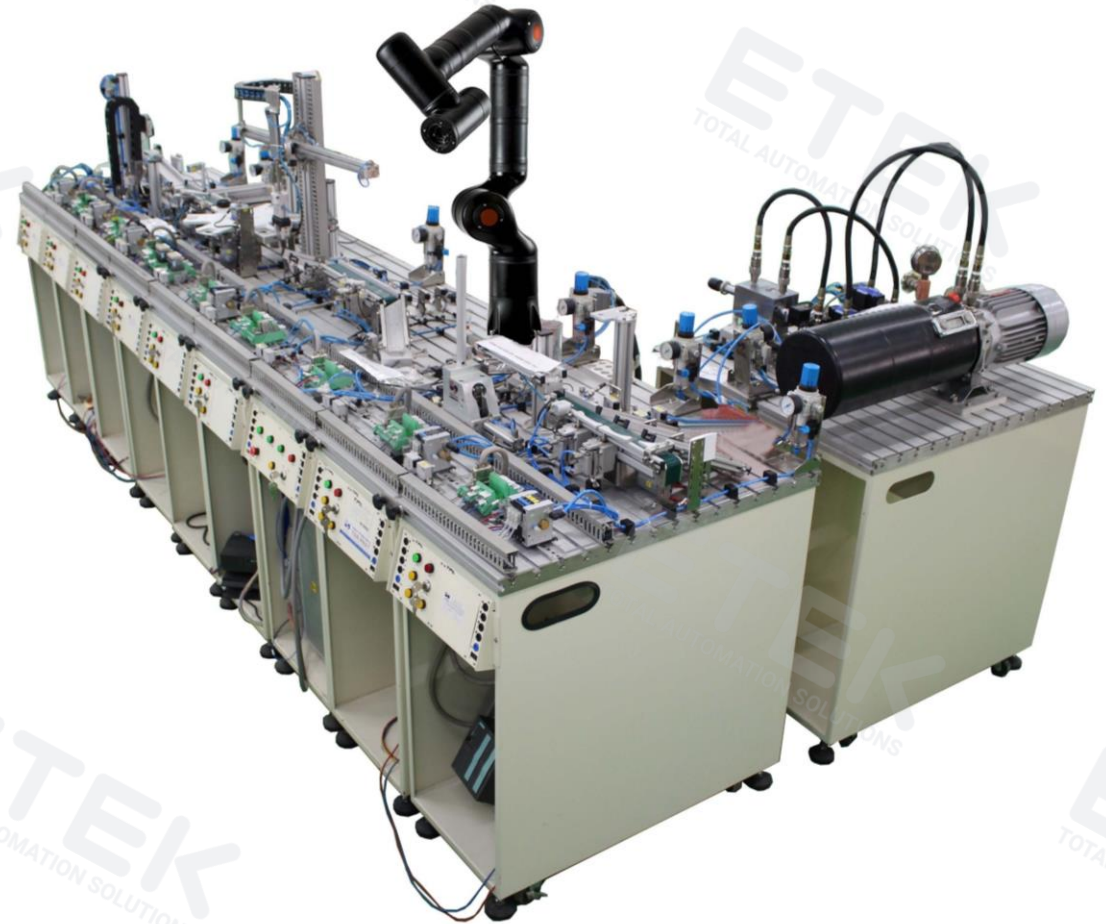
PH11. AUTOMATION TRAINING ROOM

3. Mechatronic installation and maintenance practice system - MPS

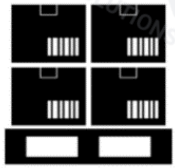### 2.1. SUPPLY TRAINING STATION
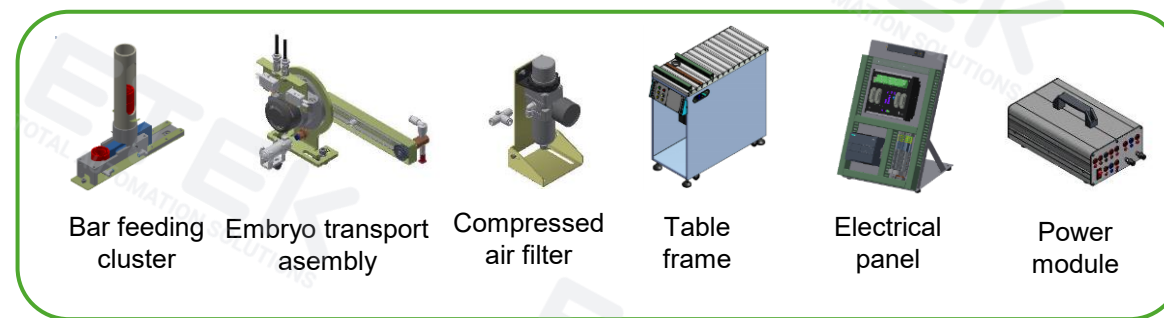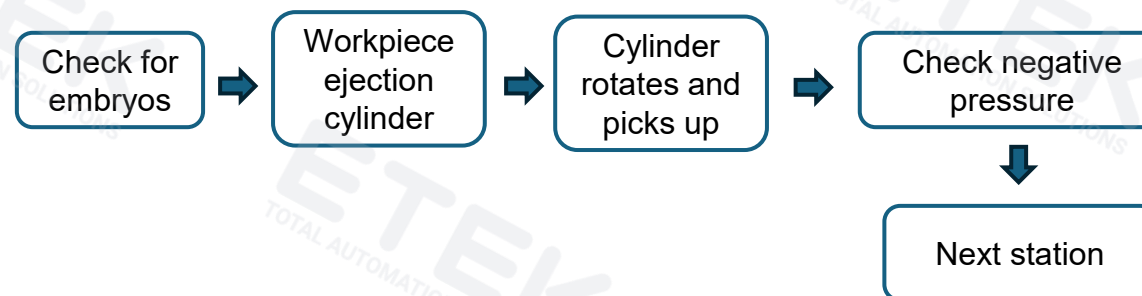
Process:

Check for embryos → Workpiece ejection cylinder → Cylinder rotates and picks up → Check negative pressure → Next station

| Bar feeding cluster | Embryo transport asembly | Compressed air filter | Table frame | Electrical panel | Power module |

3. Mechatronic installation and maintenance practice system - MPS

2.2. TESTING TRAINING STATION
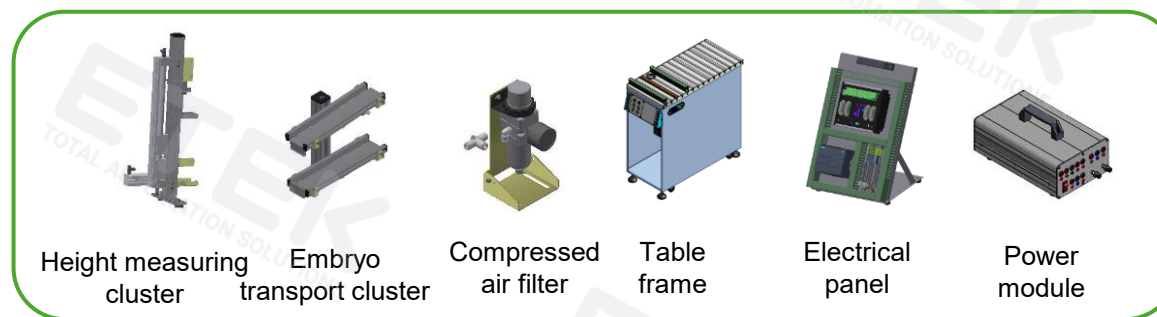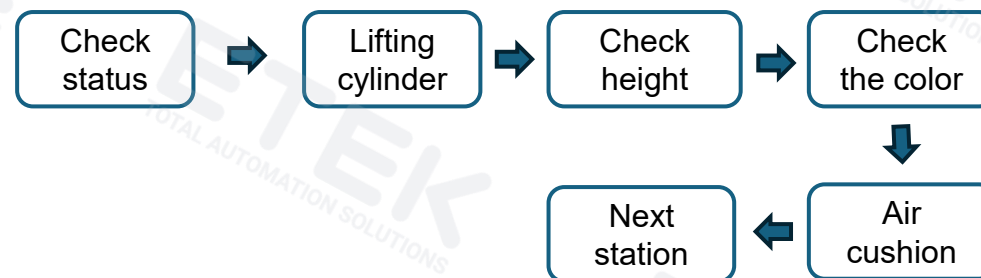
Process:

```
Check        →    Lifting      →    Check       →    Check
status            cylinder          height           the color
                                                        ↓
Next         ←    Air cushion
station
```


Height measuring cluster | Embryo transport cluster | Compressed air filter | Table frame | Electrical panel | Power module

PH11. AUTOMATION TRAINING ROOM

3. Mechatronic installation and maintenance practice system - MPS

2.3. PROCESSING TRAINING STATION
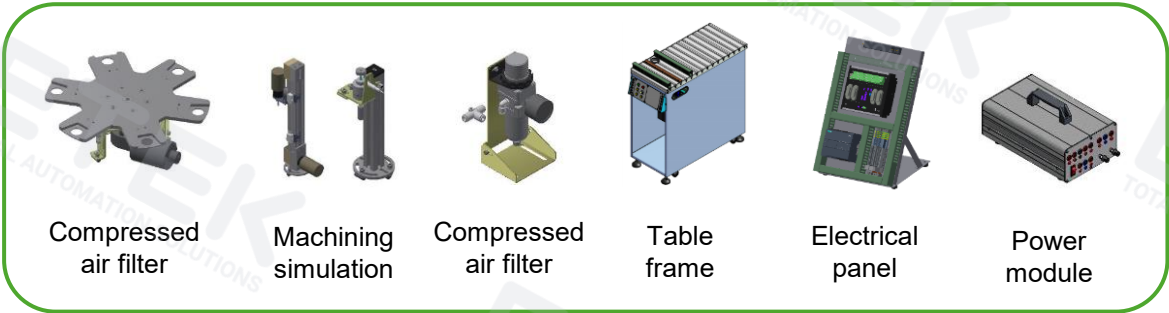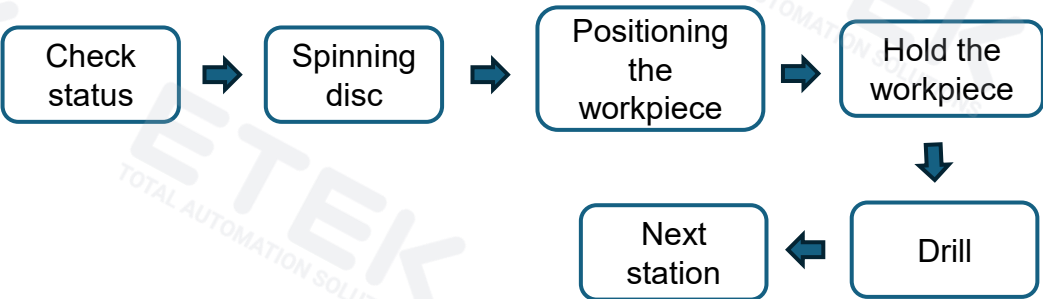
Process:

Check status → Spinning disc → Positioning the workpiece → Hold the workpiece → Drill → Next station

Compressed air filter	Machining simulation	Compressed air filter	Table frame	Electrical panel	Power module

PH11. AUTOMATION TRAINING ROOM

3. Mechatronic installation and maintenance practice system - MPS

2.4. PICKING TRAINING STATION

Process:

Check status → Move the X Axis → Raising and lowering the Z Axis → Check the color

↓

Next station ← Slider
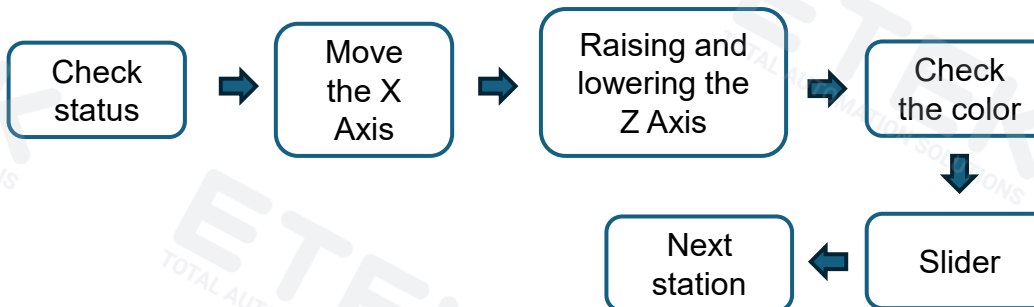
Picking arm | Slider | Compressed air filter | Table frame | Electrical panel | Power module
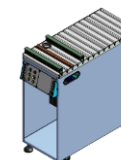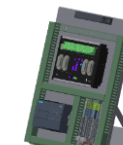
ETEK
TOTAL AUTOMATION SOLUTIONS

3. Mechatronic installation and maintenance practice system - MPS

2.5. BUFFERING TRAINING STATION
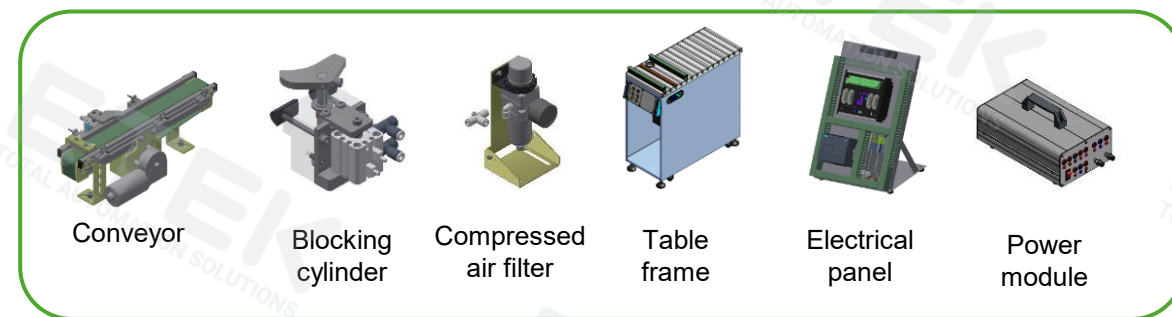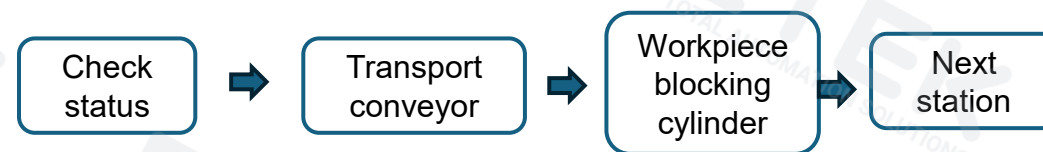
Process:

Check status → Transport conveyor → Workpiece blocking cylinder → Next station

Conveyor | Blocking cylinder | Compressed air filter | Table frame | Electrical panel | Power module

3. Mechatronic installation and maintenance practice system - MPS

2.6. ROBOT TRAINING STATION
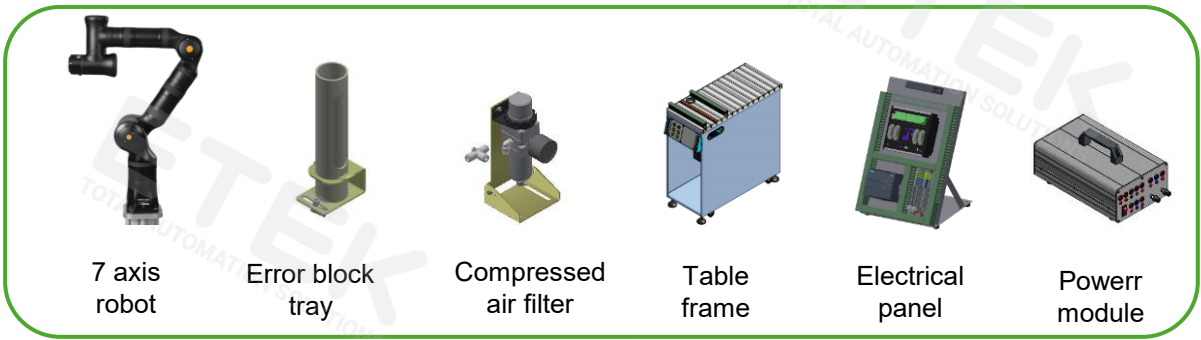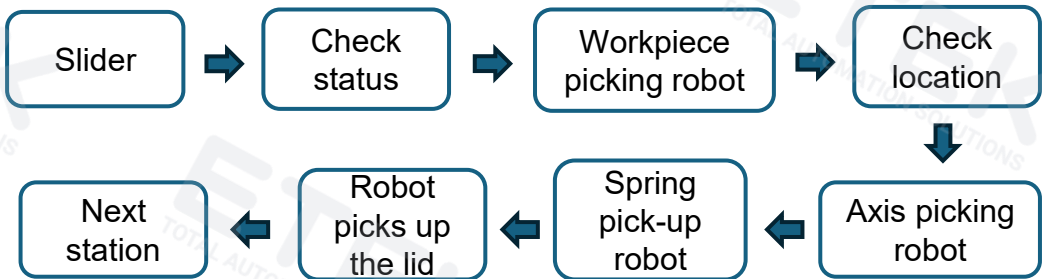
Process:

Slider → Check status → Workpiece picking robot → Check location

Check location → Axis picking robot → Spring pick-up robot → Robot picks up the lid → Next station

| 7 axis robot | Error block tray | Compressed air filter | Table frame | Electrical panel | Powerr module |

PH11. AUTOMATION TRAINING ROOM

3. Mechatronic installation and maintenance practice system - MPS

2.7. ASSEMBLY TRAINING STATION

Process:

Check status → Spring level silane → Lid supply cylinder → Shaft level

Spring level assembly | Lid level assembly | Compressed air filter | Table frame | Electrical panel | Power module
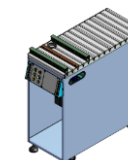
3. Mechatronic installation and maintenance practice system - MPS

2.8. HYDRAULIC PUNCHING TRAINING STATION
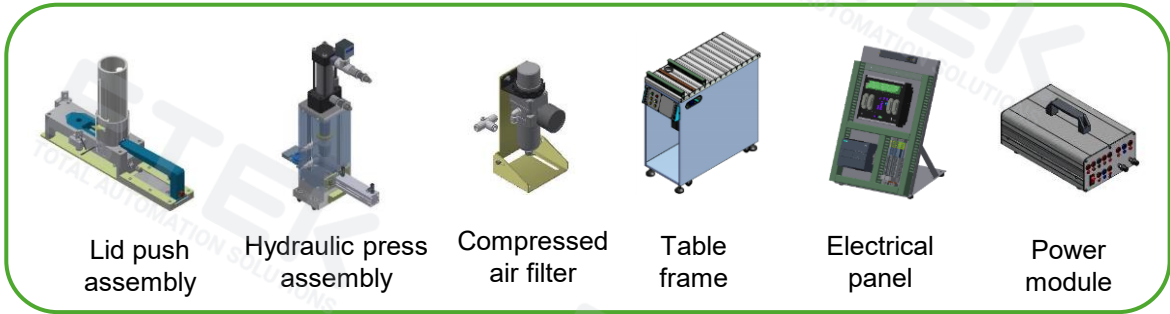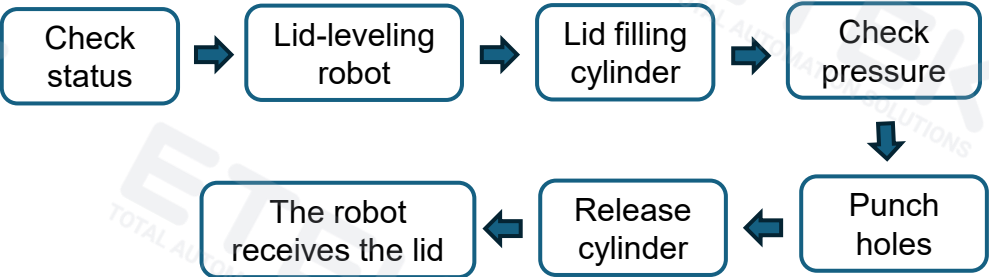
Process:

Check status → Lid-leveling robot → Lid filling cylinder → Check pressure

The robot receives the lid ← Release cylinder ← Punch holes

Lid push assembly | Hydraulic press assembly | Compressed air filter | Table frame | Electrical panel | Power module

3. Mechatronic installation and maintenance practice system - MPS

2.9. SORTING TRAINING STATION
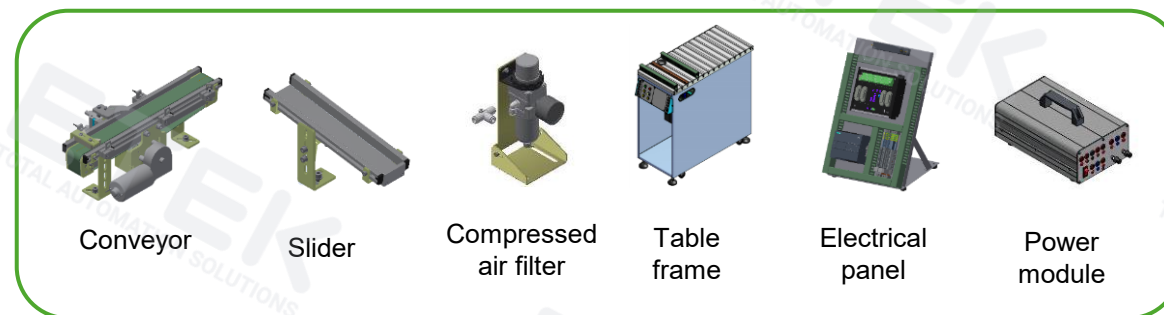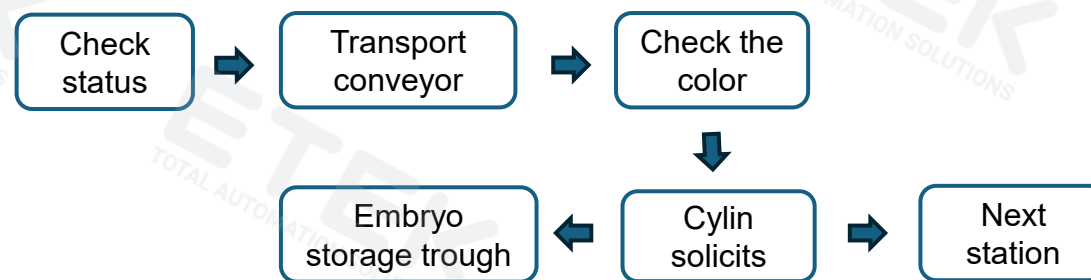
Process:

Check status → Transport conveyor → Check the color

Check the color → Cylin solicits

Embryo storage trough ← Cylin solicits → Next station

Conveyor — Slider — Compressed air filter — Table frame — Electrical panel — Power module

3. Mechatronic installation and maintenance practice system - MPS

2.10. STORING TRAINING STATION
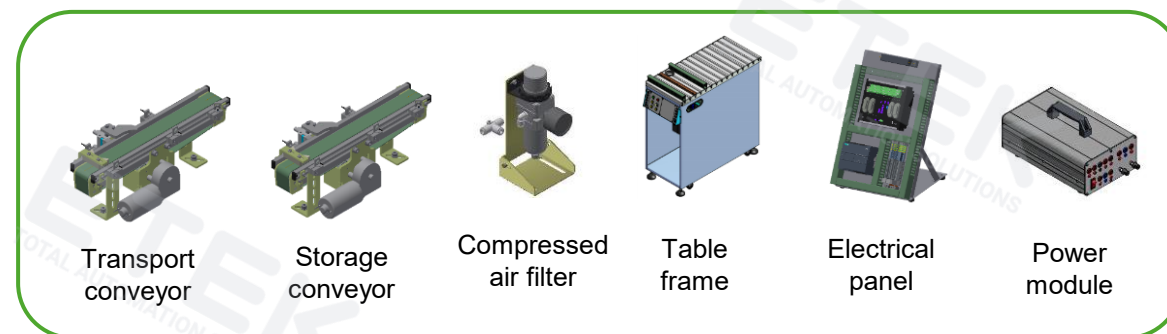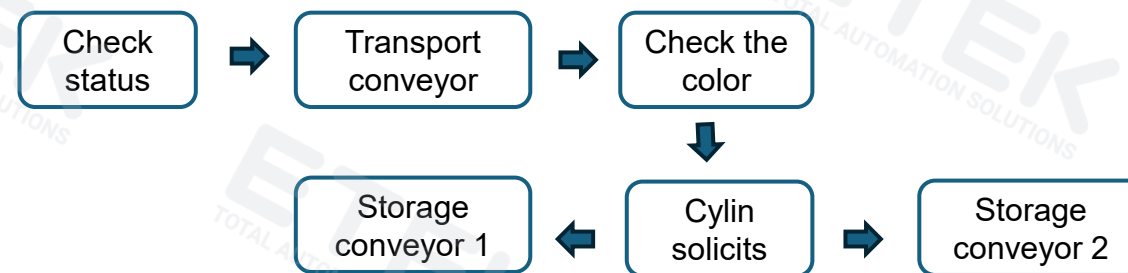
Process:

```
Check status → Transport conveyor → Check the color
                                            ↓
Storage conveyor 1 ← Cylin solicits → Storage conveyor 2
```


| Transport conveyor | Storage conveyor | Compressed air filter | Table frame | Electrical panel | Power module |

PH11. AUTOMATION TRAINING ROOM
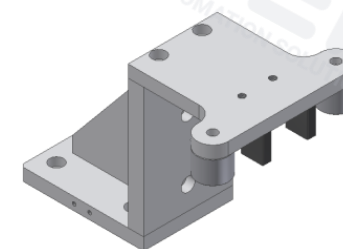
4. Digital-twin and Smart Factory practice system

Base + Bearing + Shaft + Cap + Screw = Assembly => Product

| Cap supply |
| Robot |

| Base supply | → | Shaft supply | → | Assem bly | → | Buffer | → | Checking | → | Storing |
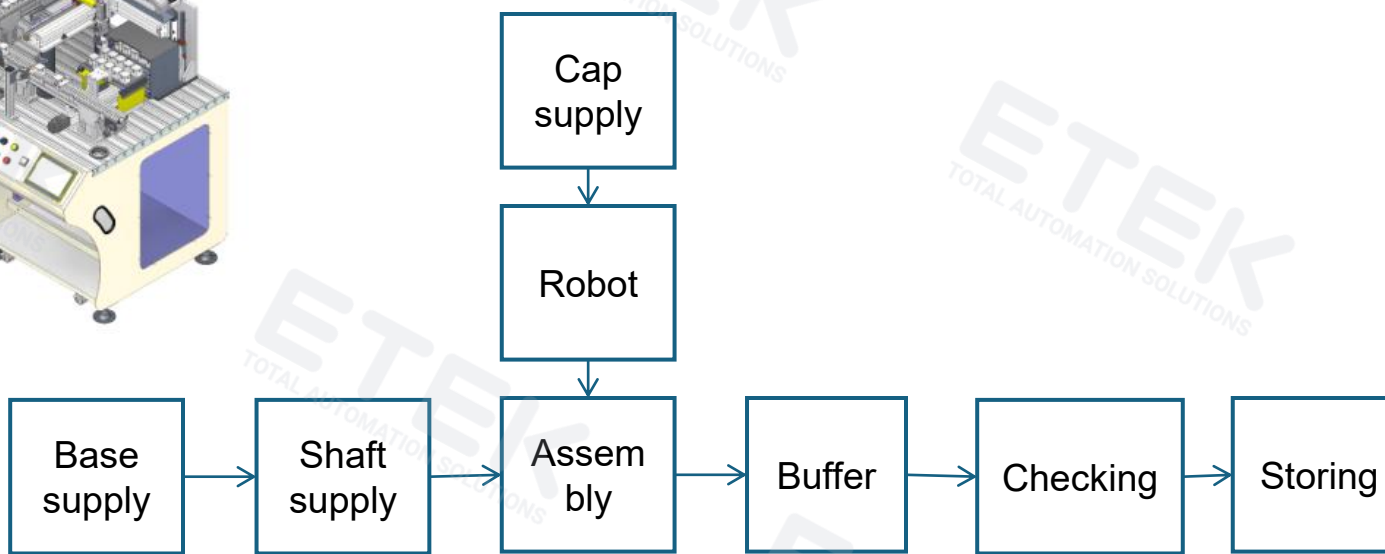
PH11. AUTOMATION TRAINING ROOM

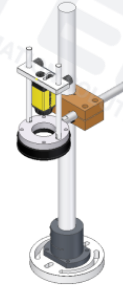## 4. Digital-twin and Smart Factory practice system

☑ ***Assemble over 40 configurations***

☑ ***Practice grouping***

☑ ***Diverse problems***

8 Packing configuration

11 Checking configuration

20 Assemble configuration
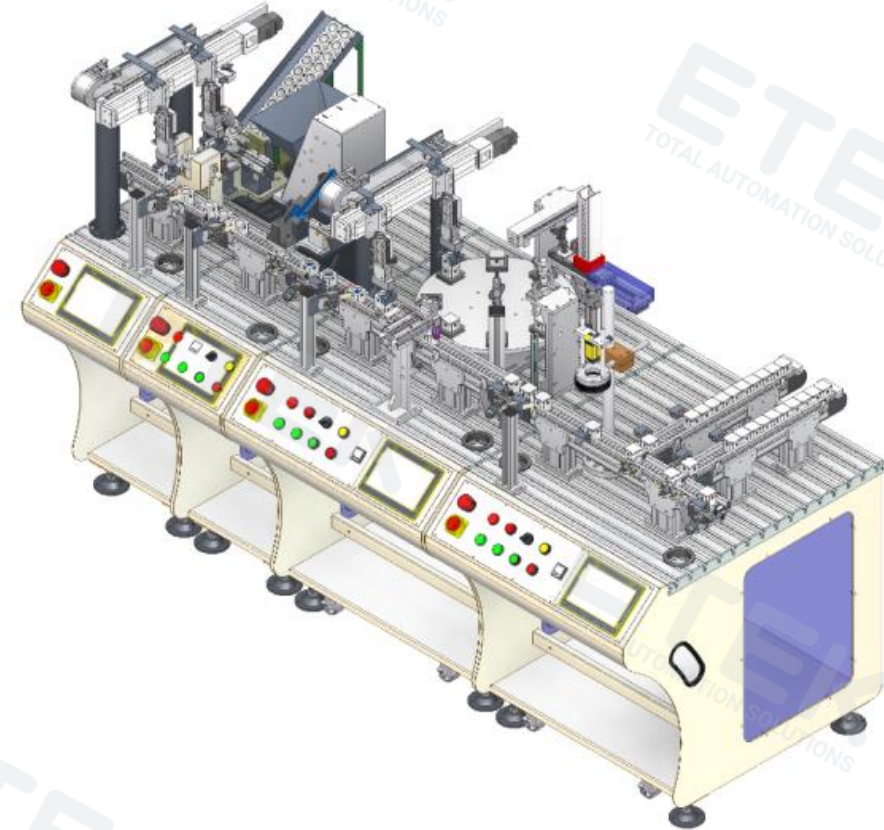
Example: Test assembly

configuration, stations 1-2-3-6

4. Digital-twin and Smart Factory practice system

a. Base supply training station
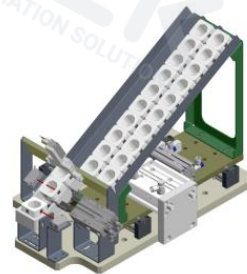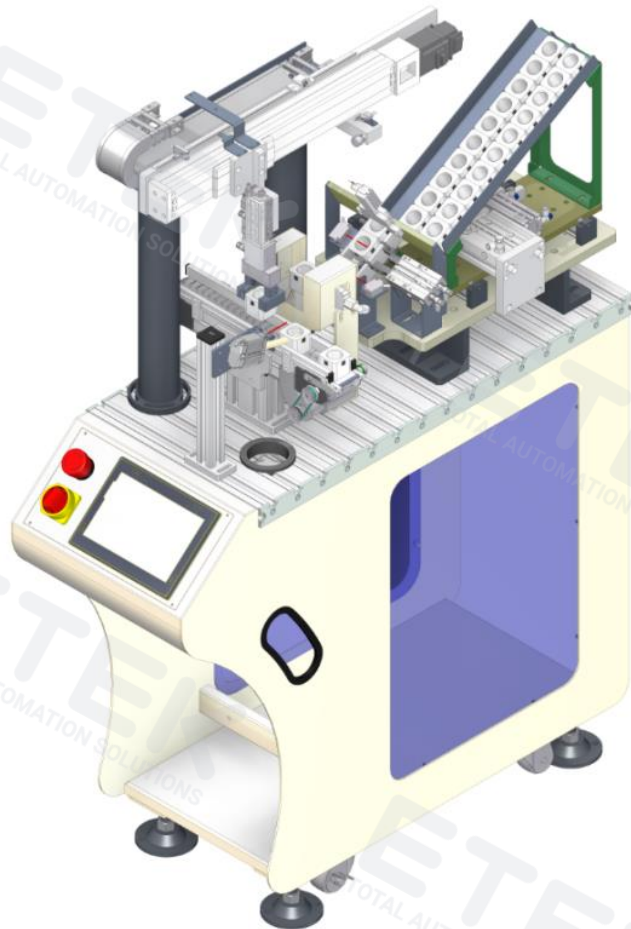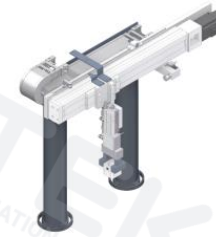
Base supply	1 axis robot	Split cylinder
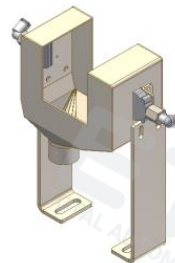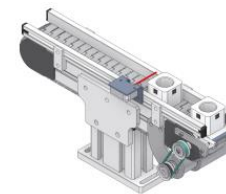
air cleaning	Conveyor	Frame

PH11. AUTOMATION TRAINING ROOM
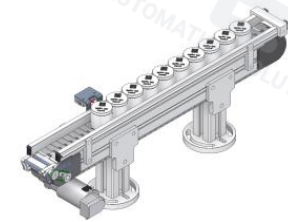
4. Digital-twin and Smart Factory practice system

b. Shaft supply training station
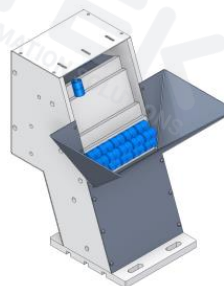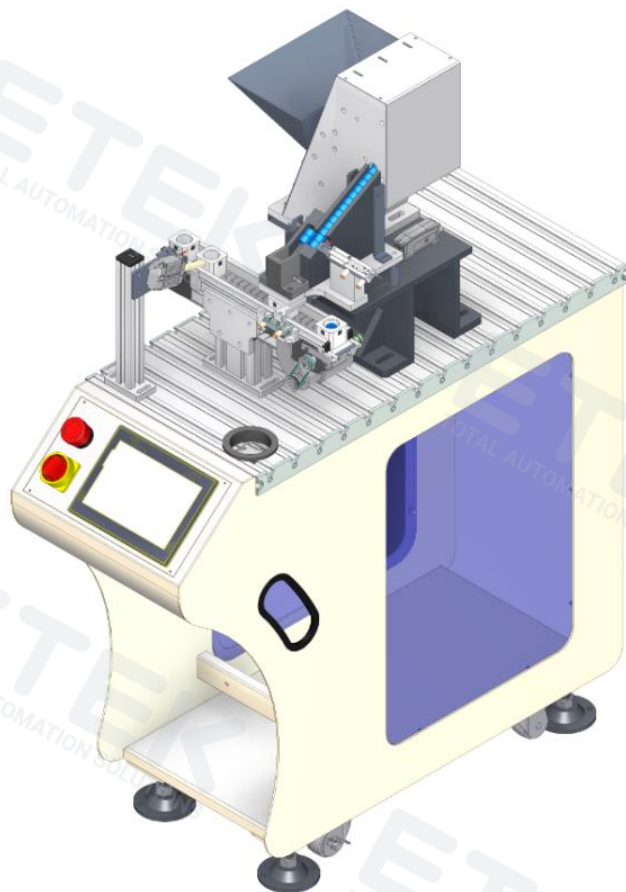
Shaft supply
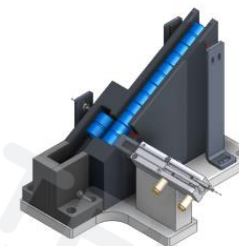
Product guide

Split cylinder
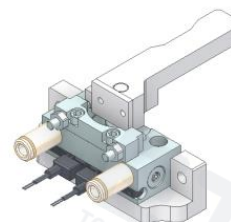
Holding cylinder

Conveyor
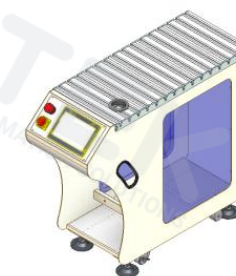
Frame

4. Digital-twin and Smart Factory practice system

c. Assembly training station
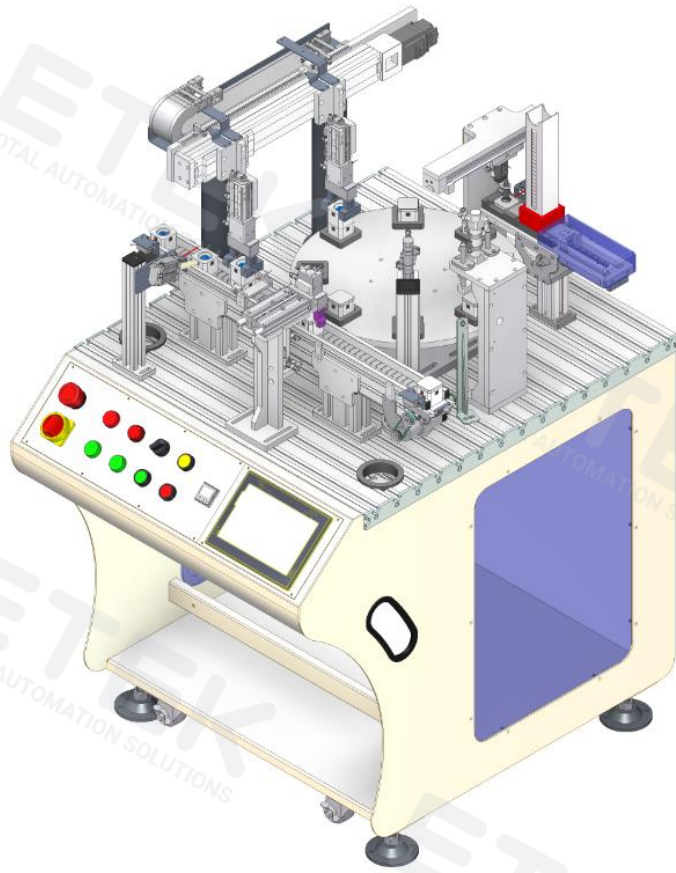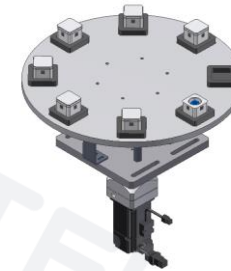
1 axis robot	Turntable	Cap supply
Cap pressor	Conveyor	Frame
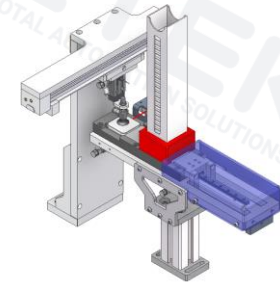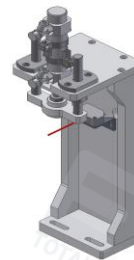
4. Digital-twin and Smart Factory practice system

d. robot station
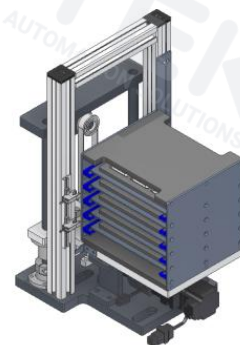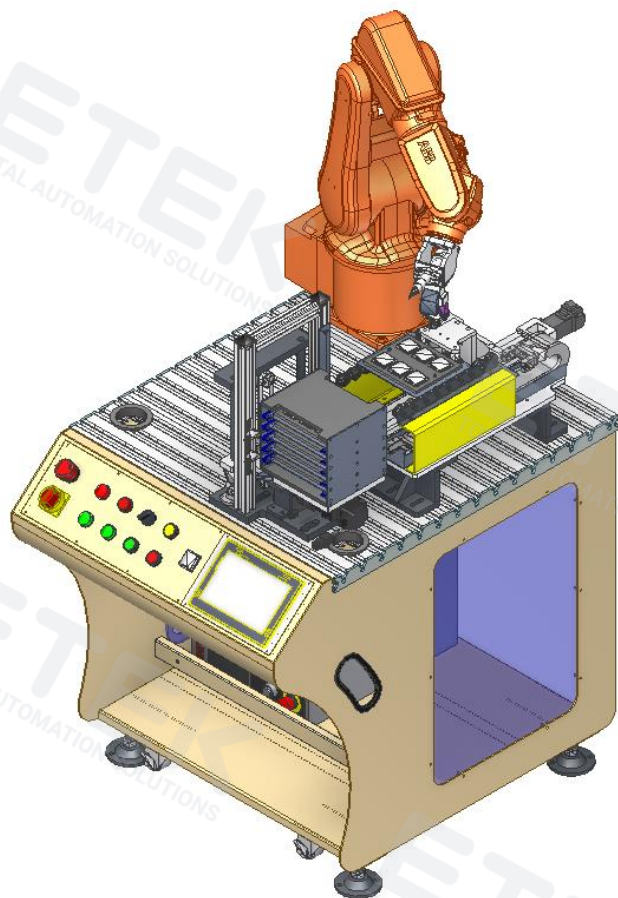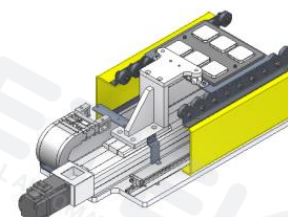
Tray lift	Tray transporter	Tray holder
Robot	Gripper	Frame
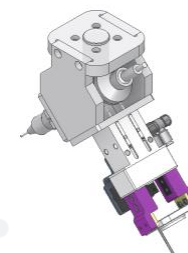
4. Digital-twin and Smart Factory practice system

e. Buffer training station
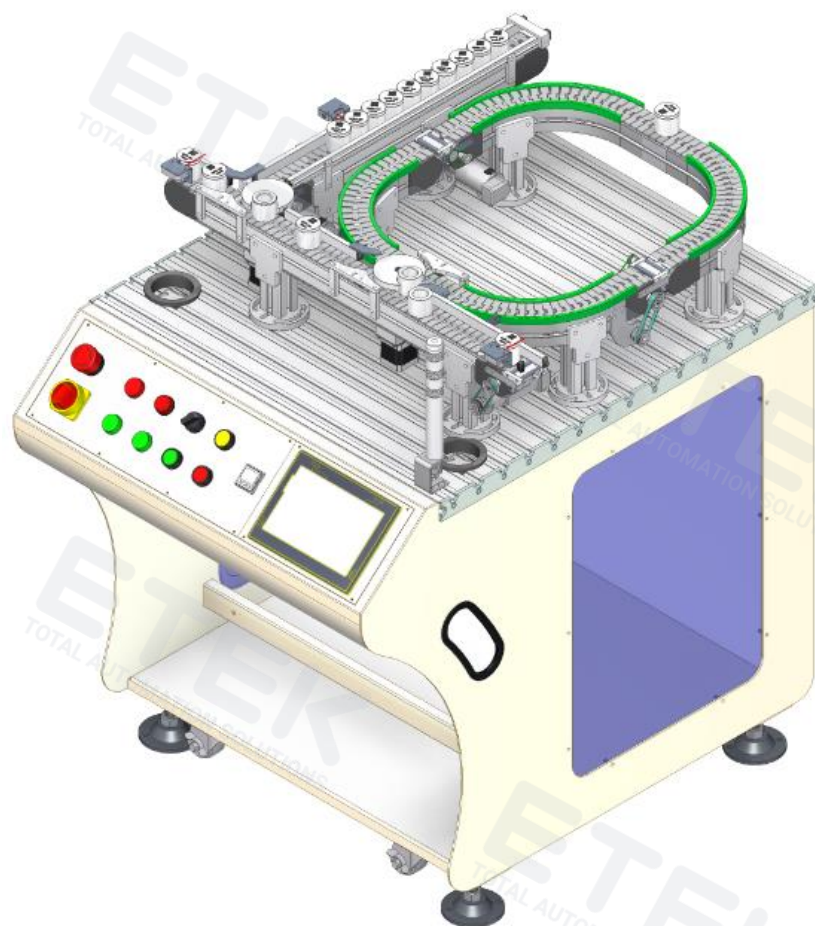
Closed loop conveyor
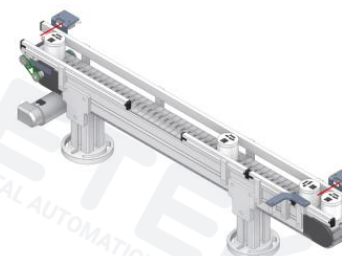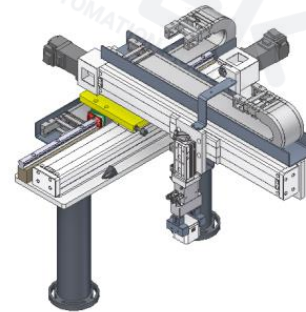
Input conveyor
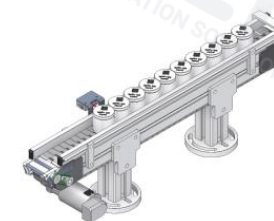
Error conveyor
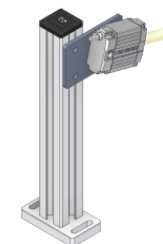
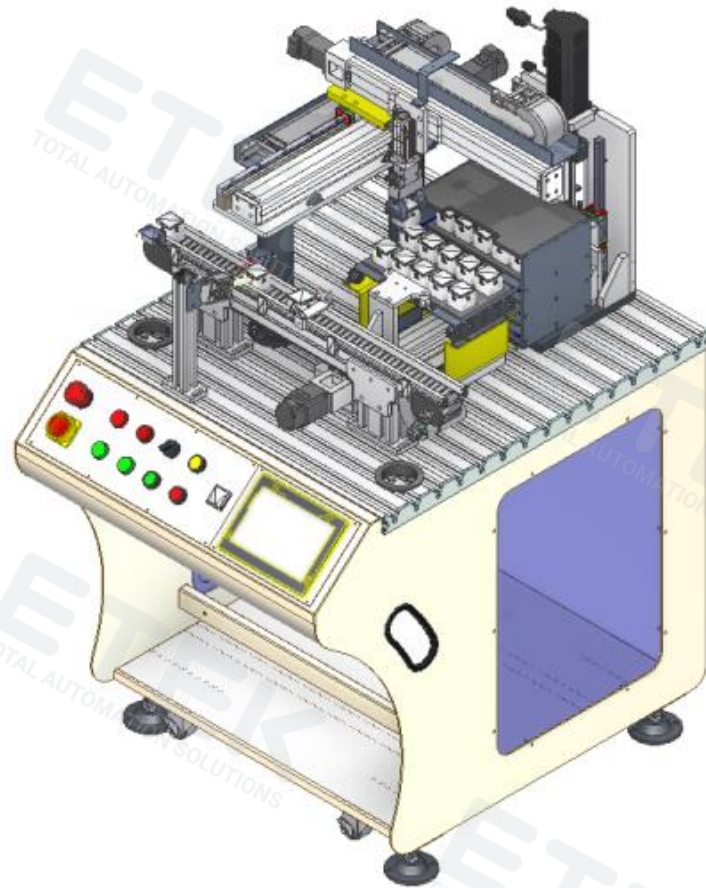Navigation

Barcode reader

Frame

PH11. AUTOMATION TRAINING ROOM

4. Digital-twin and Smart Factory practice system

f. Vision training station
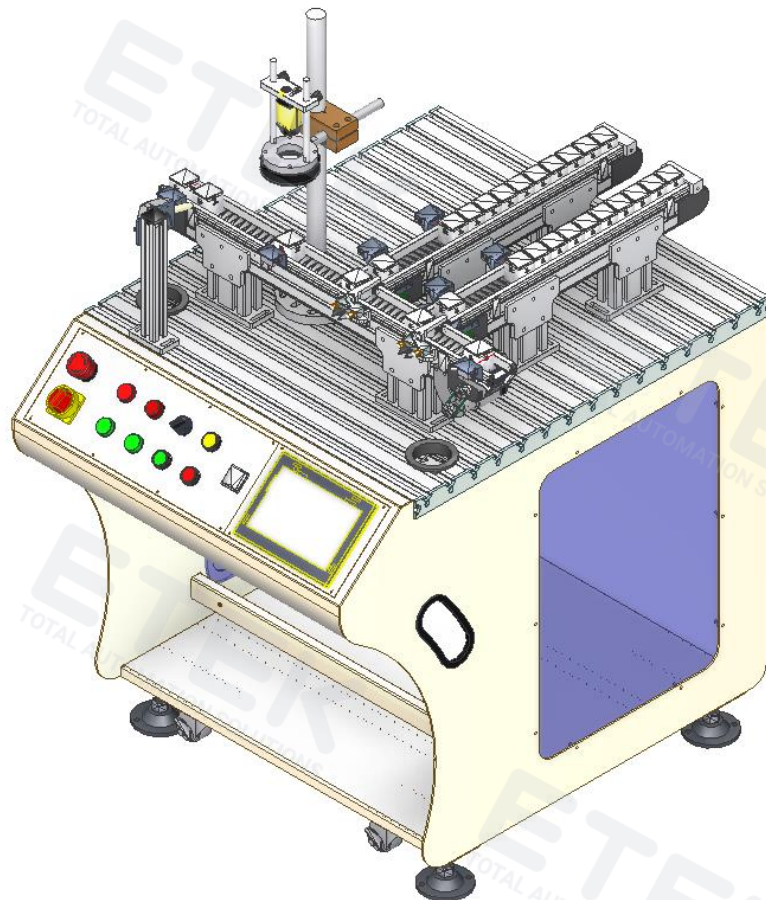
| Camera | Input conveyor | Error conveyor |

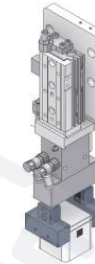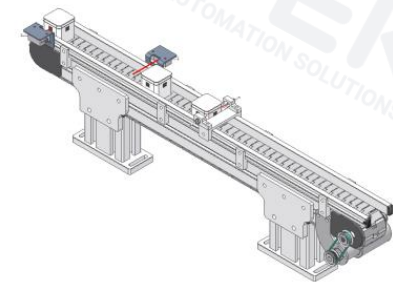| navigation | Barcode reader | Frame |
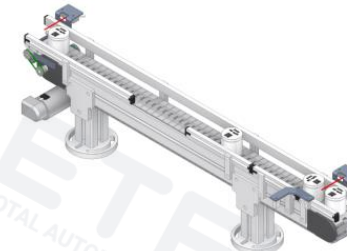
PH11. AUTOMATION TRAINING ROOM

4. Digital-twin and Smart Factory practice system

g. Storage training station

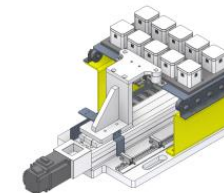| 2 axes robot	Gripper	Conveyor
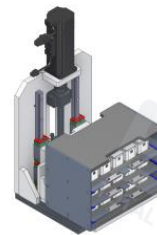
Tray lift	Tray transport robot	Frame

4. Digital-twin and Smart Factory practice system

Digital factory simulation software suite

Visual Components simulation software

- Visual Compoments Premium 4.5: Simple Intuitive, Powerful software. Verify automation solutions accurately
- Design: There are 3D design models available for use (available libraries) and you can also build your own 3D models according to CAD (import into
- Model and program: Visually define operating processes with easy-to-use tools or program robots with Teaching right in the software
- Simulation: Experience a simulation line and watch the simulated behavior of components and processes in action
- Evaluation: Perform simulation modeling studies to evaluate factors such as collisions, blockages, and design unknowns
- Optimization: When detecting abnormalities, you can quickly change the simulation design and repeat testing to optimize the production line.
- Share: Can export simulation activity and share results for multiple users to access
- The software connects to the Siemens S7 PLC to visualize the simulation model

4. Digital-twin and Smart Factory practice system

Software toolkit to build smart factory functions

a. Manage and monitor OEE & Andon performance

**1. OEE machine performance monitoring software**
Calculated on the following indicators:
▪ Index A: Represents machine availability
▪ P index: Shows production efficiency
▪ Q index: Product quality indicator
Based on the indicators, users can evaluate and Flexible system optimization to meet requirements production demand
2. Andon software
▪ Visually display the error and the machine location where the error occurred
▪ Statistics on error frequency
▪ Calculate losses based on time and frequency
▪ Provide events and notifications about the machine
▪ Document service requests and monitor the process
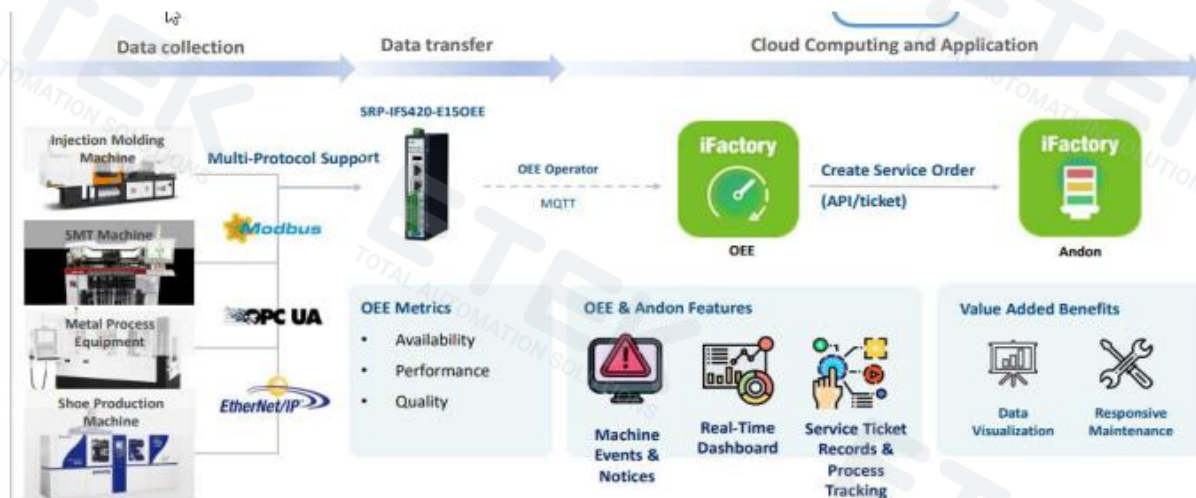
4. Digital-twin and Smart Factory practice system

Software toolkit to build smart factory functions

b. FMS energy monitoring management

▪ Real-time display of energy used in machines, lines, and areas: Electricity, compressed air
▪ Energy usage chart during periods of time: Peak, off-peak
▪ Manage total energy usage
▪ Energy distribution assessment
▪ Optimize system costs
▪ Detect signs of abnormal energy usage, early warnings of possible errors
▪ Monitor the energy area in the factory
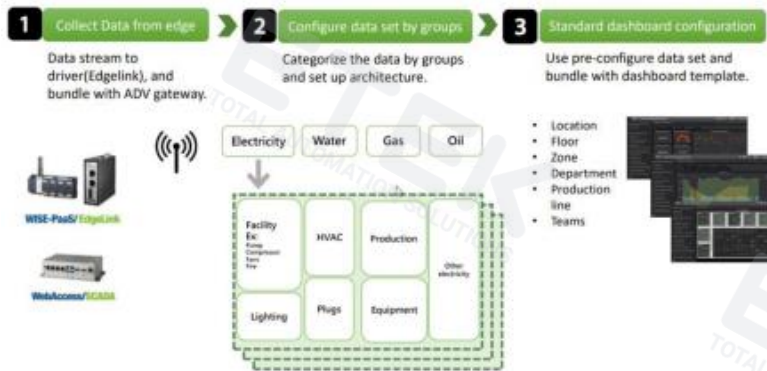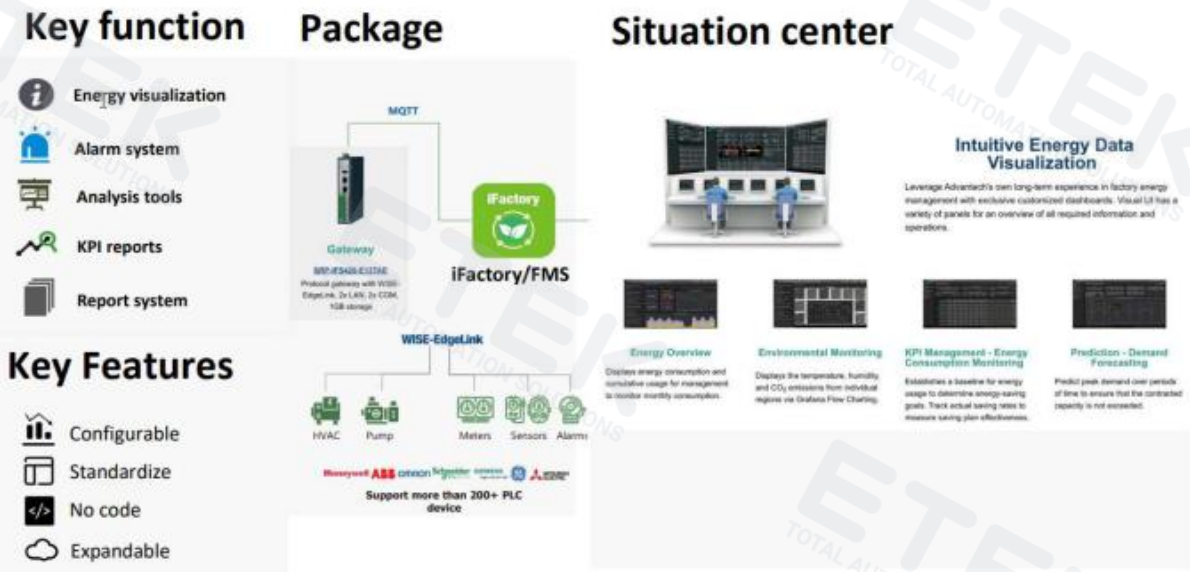
PH11. AUTOMATION TRAINING ROOM

4. Digital-twin and Smart Factory practice system

Software toolkit to build smart factory functions

c. Maintenance and prediction

▪ Real-time display of machine information: Temperature, vibration, energy consumption
▪ Visualize abnormal signs and mutation states that can cause errors
▪ Assess the current health of the machine
▪ Predict machine condition in the future
▪ Root cause analysis
▪ Develop a detailed maintenance plan and schedule system maintenance

PH12
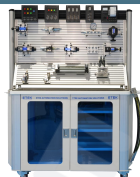# PNEUMATIC - HYDRAULIC TRAINING ROOM

PH12. PNEUMATIC - HYDRAULIC TRAINING ROOM

FUNCTION

- Identify pneumatic and hydraulic elements in practice
- Learn the operating principles and control principles of pneumatic and hydraulic elements
- Practice connecting and operating pneumatic and hydraulic control circuits

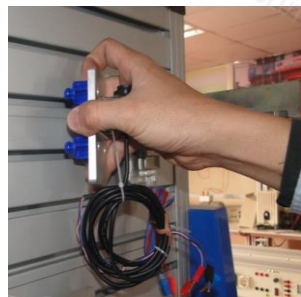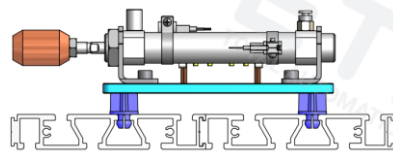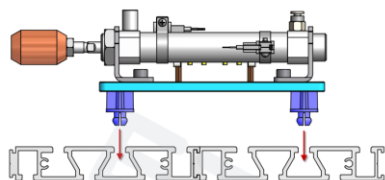| Basic /Advanced Hydraulic training set | Basic /Advanced Electro-hydraulic training set | Basic /Advanced level pneumatics training set | Basic /Advanced electro-pneumatics training set | Hydraulic Servo Training Set (Linear Hydraulic Control) | Table with Chair |

Solution for mounting pneumatic modules in practice:

PH12. PNEUMATIC - HYDRAULIC TRAINING ROOM

Solution for mounting hydraulic modules in practice:
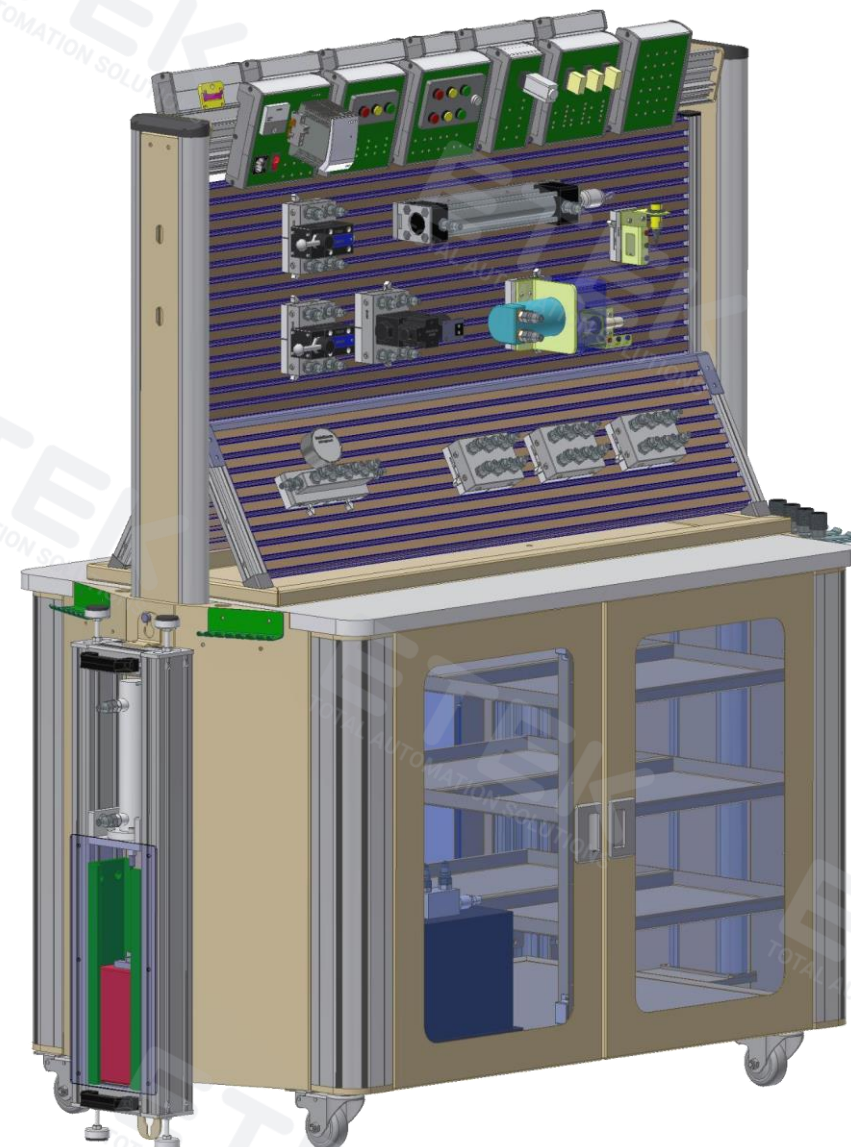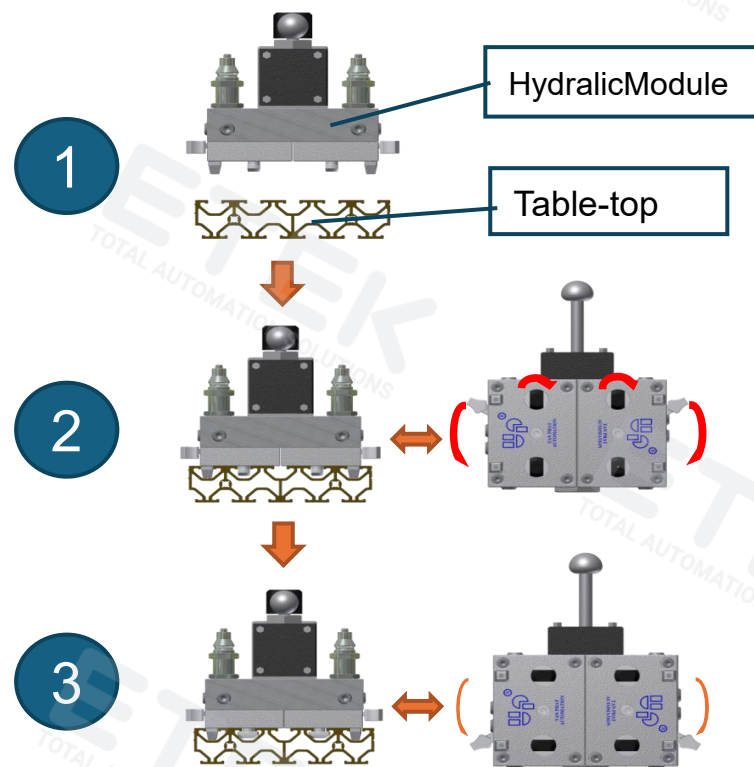
PH12. PNEUMATIC - HYDRAULIC TRAINING ROOM

1. Basic level pneumatics training set

- **Training content:**
- Cylinder delay control
- Practice connecting compressed air circuits:
+ Bar feeding equipment
+ Product classification
+ Parcel parcel division
+ Station for classifying pieces of material vertically
+ Metal edge folding machine
+ Stamp machine
+ Feeding the measuring machine
+ Redirection station for working objects
+ Paint box vibrator
+ Supply and divide materials
+ Heat plastic welding machine
+ Stone screening machine
+ Camera case clamping mechanism
+ Feeding station for Laser cutting machines
+ Semi-automatic internal grinding machine

2. Basic electro-pneumatics training set

- **Training content:**
- Connecting compressed air circuits:
 + Theory of compressed air
 + Sorting equipment
 + Switching device
 + Object rotation mechanism on conveyor belt
 + Lid closing mechanism
 + Assembly station
 + Cutting machine structure
 + Barrel tilt control
 + Tilting mechanism
 Product redirection device
 + Impeller valve control structure
 + The bar feeder uses gravity
 + Gravity feeder has many grooves
 + Conveyor control device

 + Product labeling rotary table
  + Sliding table
  + Clamping device
  + Direction reversing device
  + Pressing equipment
  + Heat sealing equipment
  + Moving station
  + Product classification (throttle valve practice)
  + Classification equipment (OR valve practice)
  + Stamping equipment (AND valve practice)
  + Bar feeding device (time relay practice)

PH12. PNEUMATIC - HYDRAULIC TRAINING ROOM

3. Advanced pneumatic training set

- **Training content:**
- *Connecting compressed air circuits:*
  + *Theory of compressed air*
  + *Control the oven door*
  + *Rotate step by step*
  + *Embryo separation structure*
  + *Wood block drilling set*
  + *Drill bit with 4 drill bits*
  + *Drill bit with weight-based feeding mechanism*
  + *Design of compressed air counter*
  + *Door opening and closing mechanism*
  + *Transporting embryos*
  + *Calculate cylinder force*

PH12. PNEUMATIC - HYDRAULIC TRAINING ROOM

4. Advanced electro-pneumatic training set

- **Training content:**
- *Practice connecting and operating compressed air circuits:*
  + *Bench drilling machine*
  + *Punch holes for metal strips*
  + *Filling equipment*
  + *Stamping equipment*
  + *Stamping equipment*
  + *Embossing equipment*
  + *Hole drilling and boring equipment*
  + *Loading station*
  + *Vaati clamping mechanism (vise)*
  + *Embryo separation structure*
  + *Calculate cylinder force*
  + *Cutting machine structure - PLC programming*
  + *Gravity-based feeding structure with many compartments - PLC programming*
  + *Product labeling rotary table – PLC programming*
  + *Sliding table – PLC programming*
  + *Vest clamping mechanism – PLC programming*
  + *Pressing equipment – PLC programming*
 + *Moving equipment – PLC programmingz*

5. Basic Hydraulic training set
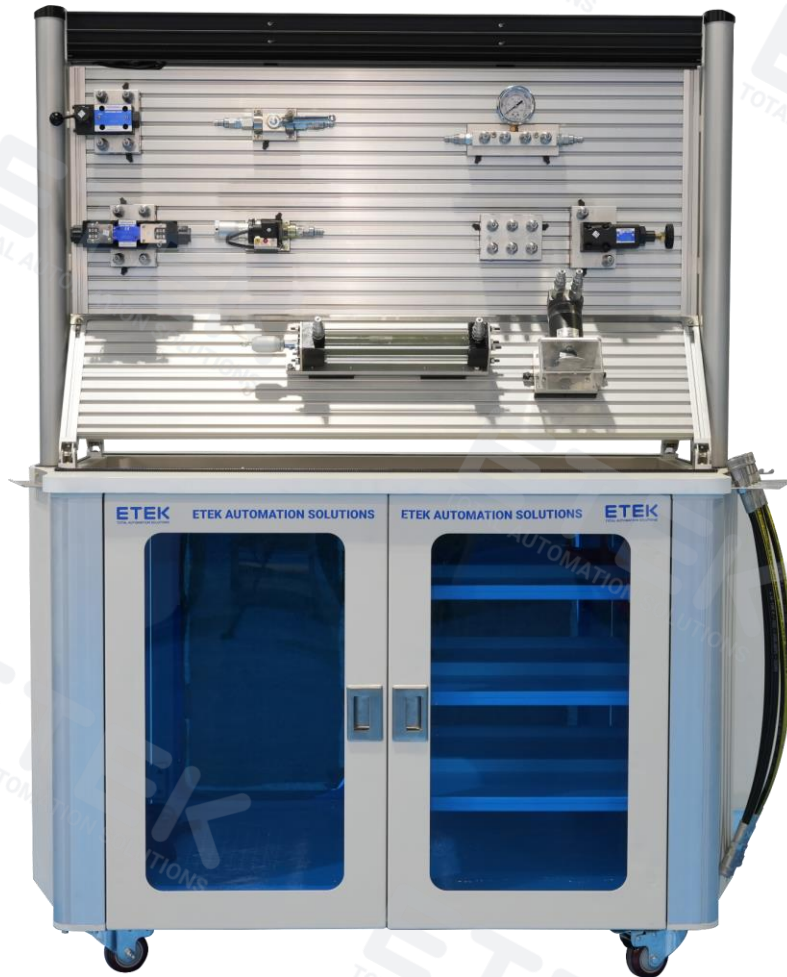
- **Training content:**
 + Lesson 1: Automatic lathe
 + Lesson 2: Package lifting equipment
 + Lesson 3: Detailed punching machine
 + Lesson 4: Equipment for loading blanks for rolling machines
 + Lesson 5: Equipment for lifting the heat treatment furnace lid
 + Lesson 6: Controlling the kiln door
 + Lesson 7: Equipment to increase conveyor belt tension
 + Lesson 8: Equipment for opening and closing frozen warehouse doors
 + Lesson 9: Machining station with turntable
 + Lesson 10: Paint booth
 + Lesson 11: Embossing machine
 + Lesson 12: Surface grinder
 + Lesson 13: Drilling machine
 + Lesson 14: Combustion chamber door opening and closing device
 + Lesson 15: Equipment for lifting and lowering ferry bridges
 + Lesson 16: Operating containers
 + Lesson 17: Pressing machine
 + Lesson 18: Assembly equipment
 + Lesson 19: Calculation for assembled equipment

6. Electro-hydraulic training set
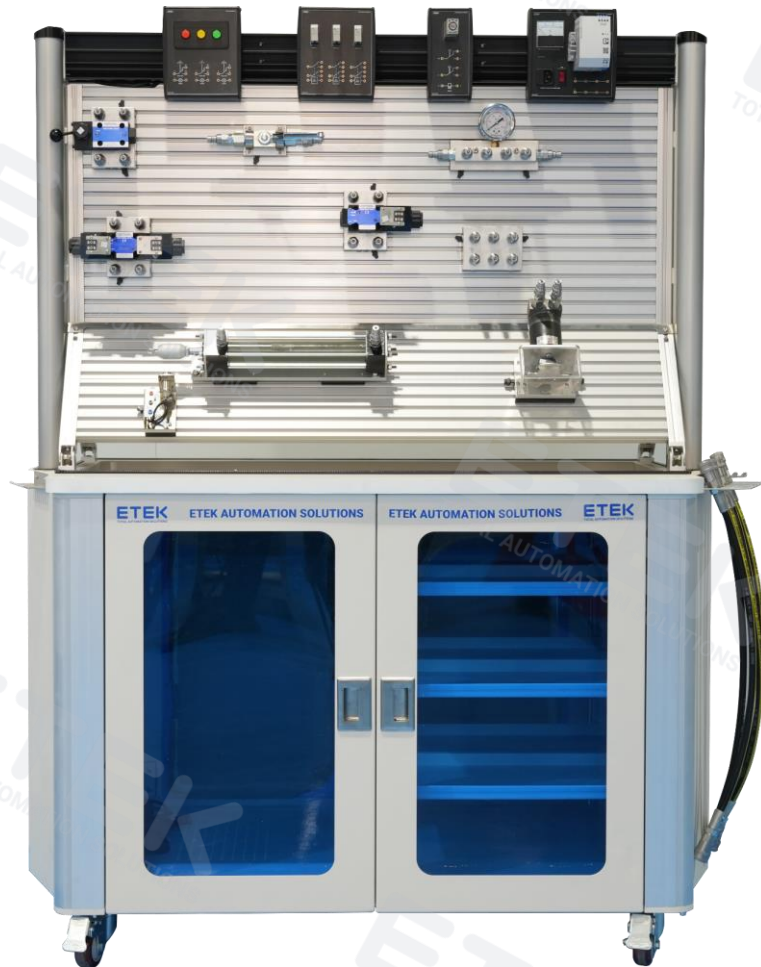
- **Training content:**
  + *Lesson 1: Arranging equipment*
  + *Lesson 2: Classifying products on the conveyor belt*
  + *Lesson 3: Lift station*
  + *Lesson 4: Corrugated iron bending equipment*
  + *Lesson 5: Detailed pressing and assembling equipment*
  + *Lesson 6: Pressing machine*
  + *Lesson 7: Door control*
  + *Lesson 8: Cutting equipment*
  + *Lesson 9: Feeding equipment for drilling machines*
  + *Lesson 10: Pressing machine*
  + *Lesson 11: Loading equipment*
  + *Lesson 12: Assembly equipment*

7. Advanced hydraulics training set

- **Training content:**
 + *Lesson 1: Pipe winding roller control system for tank trucks*
 + *Lesson 2: Rough grinding machine table control device*
 + *Lesson 3: Lifting equipment with two cylinders*
 + *Lesson 4: Fast running equipment for drilling machines*
 + *Lesson 5: Control system for deburring press machine*
 + *Lesson 6: Gearbox casing clamping device*
 + *Lesson 7: Plastic injection molding machine*
 + *Lesson 8: Steel pipe bending machine*
 Lesson 9: Single cylinder press
 + *Lesson 10: Machining center*
 + *Lesson 11: Magnetic crane*
 + *Lesson 12: Edge bending machine*
 + *Lesson 13: Earth drilling machine*

8. Advanced electrohydraulic training set

- **Training content:**
  + *Lesson 1: Van Shut-off*
  + *Lesson 2: Clamp set*
  + *Lesson 3: Milling machine*
  + *Lesson 4: Pressing machine*
  + *Lesson 5: Bending machine*
  + *Lesson 6: Broaching machine*
  + *Lesson 7: The drying oven operates continuously*
  + *Lesson 8: Polishing machine*
  + *Lesson 9: Equipment to increase conveyor belt tension*
  + *Lesson 10: Equipment for lifting and lowering bridges onto ferries*

9. Hydraulic Servo Trainer (linear hydraulic control)
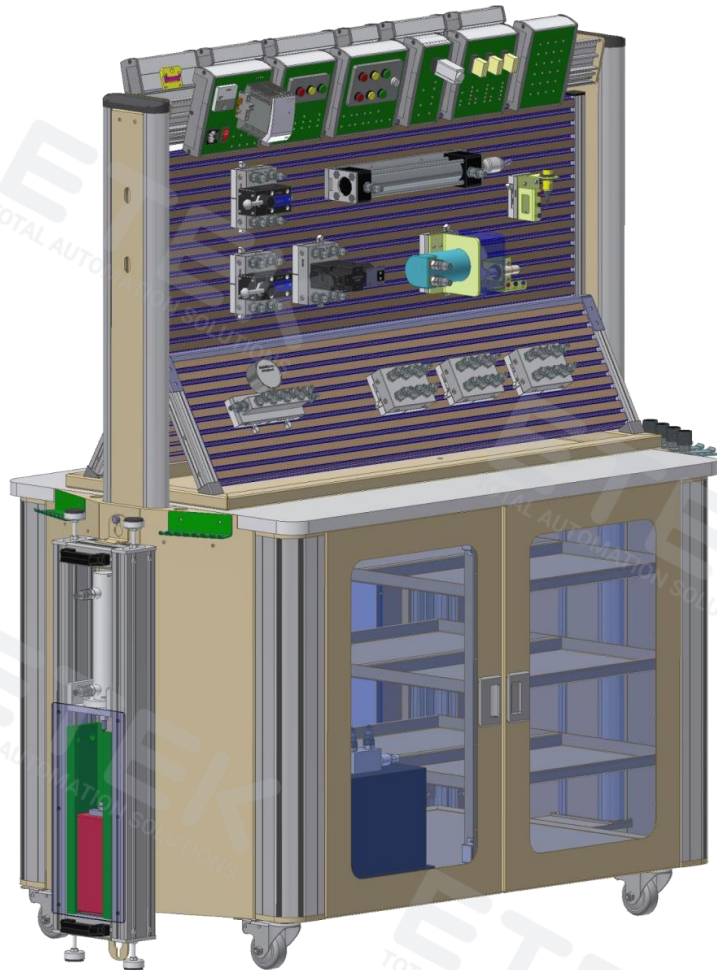
Training content:
- Adjust and observe parameter values of the hydraulic Servo unit
- Build a PID model for hydraulic speed and position control
- Adjust PID parameters
- Controls and mechanical structures are electrically coupled
- Application of sensors and hydraulic components on automatic systems
- Dashboard applications
- Pairing/installation application
- Diagnose, detect and repair

10. Magnetic pneumatic and hydraulic element symbols

Basic Practice

Purpose of use:

• Used to practice pneumatic and hydraulic diagrams.

• Magnetic symbols of pneumatic and hydraulic elements are mounted on iron boards to serve lectures or to assemble into complete pneumatic and hydraulic diagrams.

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