



PLC 4.0 SIEMENS environment

Environment for implementing the industry of the future

Description of the teaching aid

The **EAxx Automated Environment** is a **teaching system** that **implements** a range of **current and future industrial technologies** around an **adapted PLC board**. It consists of a cabinet integrating the PLC board, plus independent technological options (acting as the system's sensors and actuators) and a modular operating section.

This training system is designed primarily for advanced development/programming and design activities, but also offers a wide range of activities for implementing the latest industry techniques.

The EAxx Fully Automated Environment implements a product **conformity control** application on a production line, and is supplied with a demonstration program.

The EA10 PLC board is a **Siemens S7-1200** (or S7-1500 code EA20) PLC cabinet. This board is designed for studying **PLC programming** and creating programs in specific languages.

The front panel of this ergonomic case features the PLC rack, with an interface for quick connection of PLC inputs/outputs to double-well plugs (banana plugs), and the rear panel provides access to the case components and terminal blocks for real-life wiring. An **optional touch screen (HMI)** can be used to simulate actuators or provide a visual aspect of operation.

Independent technology options :

- ✓ Vision sensor,
- ✓ Weight control,
- ✓ IO-Link RFID traceability,
- ✓ Profinet communicating drive,
- ✓ Conveyor operating part and pneumatic assembly integrating IO-Link components.



Each element of the environment offers the latest technical solutions from the industry in terms of connectivity, choice of components and communication.

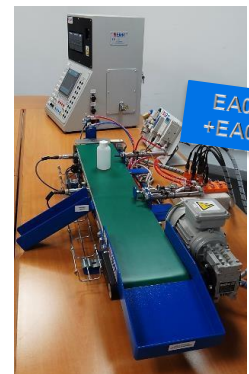
Highlights

- ✓ **Industrial system with modern technologies** (vision control, checkweighing, traceability, digital factory...)
- ✓ Selection of equipment for a **comprehensive approach to different types of technologies, configurations and tools**
- ✓ **Improvement activities**
- ✓ A system that can be used in the **electrical engineering, industrial automation, industrial maintenance, and the operation and piloting of automated systems**
- ✓ Includes TIA Portal and WinCC programming software for PLC and terminal programming
- ✓ Possibility of upgrading to a mini-production line with a tablet for **remote control** and supervision
- ✓ Connection via **plug-in terminals** on rear of box
- ✓ **Implementation** of adapted operating parts
- ✓ Reservation for freedom of development and wiring
- ✓ Simple interface for quick connection to focus on programming
- ✓ **Educational file** with procedure sheets and tutorials provided

Bac Pro MELEC, Bac Pro MEI, Bac Pro PLP,
BTS Electrotechnique, BTS CRSA, BTS MI

THEMES ADDRESSED

Industrial Maintenance, Production Control, Multi-technology Systems Design, Electrical Engineering and Automation, Automation & Control, Pneumatics, Identification, Design and Development.



References

- EA10 : PLC / Web Server Siemens S7-1200 EA20 : PLC / Web Server Siemens S7-1500
 EA11: Additional ANA I/O card option for S7-1200 PLC
 EA12: Option: Siemens KTP700 control panel
 EA13: Option: RFID traceability (IO-Link)
 EA14: Digital weighing option for S7-1200 PLC EA50 : Communicating Profinet drive option
 EA00+EA03: Conveyor operating section+Pneumatic assembly
 EA02: Machine vision option
 UC41 : Supervision tablet option for Siemens console (HMI)
Compatible auxiliary system :
 EA09: Operating part Lift for PLC boards



General

The Automated Environment consists mainly of :

- ✓ A plastics processing PLC cabinet with a PLC rack and a man-machine interface (MMI) on the front panel (optional). The enclosure integrates protections and power supplies, and is designed to accommodate optional modules.
- ✓ Technological options with connectors and support adapted to for stand-alone use or integration into the operating part:
 - Vision sensor,
 - Digital scale,
 - RFID traceability,
 - Profinet communicating drive,
- ✓ A "Conveyor" operating part with fixing rails for the technology options, as well as a pneumatic package

These products are accompanied by a technical and educational dossier in digital format including :

- ✓ HTML site with activities, projects, answers and resources
- ✓ Programs, diagrams: functional, electrical, pneumatic...
- ✓ Data sheet, operating instructions, parameterization procedures
- ✓ Component manufacturer documentation

EA10 PLC board

It consists mainly of :

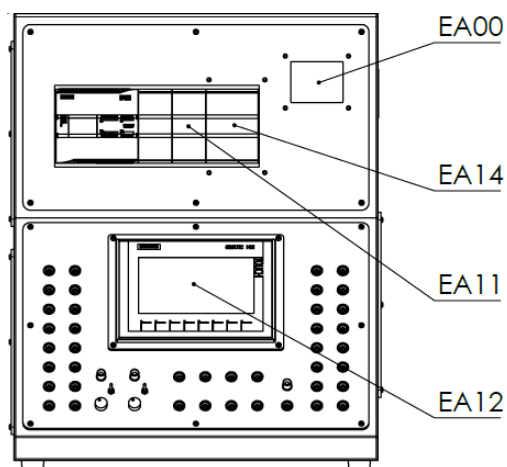
- ✓ 1 plastic box equipped with electrical protections
- ✓ 1 Siemens S7-1200 PLC communicating with Profinet 14E/10S TOR + 2E/1S ANA
- ✓ 1 Additional 8E/8S digital I/O module
- ✓ 1 power supply 24 VDC/ 10 A
- ✓ 1 Switch
- ✓ Siemens KTP700 operator interface touch screen (optional)
- ✓ Fast connection interface with double-well plugs (plugs) and BNC connectors for analog values
- ✓ 2 selectable potentiometers
- ✓ Classic terminal blocks
- ✓ Plug-in terminal blocks



KTP 700 human-machine interface (option EA 12)



S7-1200 Programmable Logic Controller



Modular EA10 PLC board for optional codes



Connection interface with double-well plugs (barana plugs) and BNC connectors. And optional touch screen.

Supervision tablet option for Siemens UC41 console

This option enables remote control of the EAx mini line of the Automated Environment when combined with the optional EA 12 Siemens KTP700 HMI.

It consists mainly of :

- ✓ A Wi-Fi router
- ✓ An iPad-type tablet
- ✓ Siemens application and license



SIMATIC HMI SmartClient



RFID Traceability and Logistics Option (EA13)

This option enables you to load traceability information (batch number, production date, etc.) onto RFID tags associated with bottles or trays. It enables you to get to grips with traceability and logistics tracking procedures.

It consists mainly of :

- ✓ RFID read/write system
- ✓ An IO-Link master communicating with the PLC



IO-Link master and RFID read-write head

Checkweighing option (EA14)

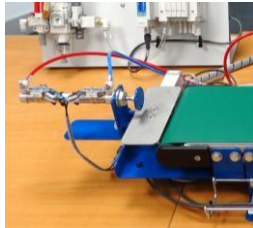
This option enables weight control of vials before packaging, with ejection of non-conforming vials (EAxx system with all options).

It consists mainly of :

- ✓ An independent weighing station or one installed on the operating part, with strain gauge and plug-in terminal connector
- ✓ A Siemens Siwarex weighing card (Siwatool software for the configuration supplied) connecting the weighing system to the PLC.



Strain gauge on the weighing station



Weighing station integrated into the operating part



Weighing card

Strain gauge

Machine vision control option (EA02)

This option enables vision-based product and closure quality control prior to packaging, with ejection of non-compliant vials (EAxx system with all options).

It consists mainly of :

- ✓ An independent vision analysis station with sensor with integrated lighting



Machine vision sensor and programming software



Vision sensor with integrated LED lighting

Conveyor operating section (EA00)

This option is combined with the EA03 pneumatic assembly, to convey products and accommodate technical options.

It consists mainly of :

- ✓ Conveyor belt with geared motor for moving vials
- ✓ Frequency inverter (installed in EA10 cabinet)
- ✓ 2 photoelectric presence sensors
- ✓ Storage bin
- ✓ Scrap chute



Frequency inverter for conveyor gear motor

Pneumatic assembly (EA03)

This option is associated with the EA00 operating part, and allows you to control pneumatic actuators independently.

This ensemble is mainly made up of :

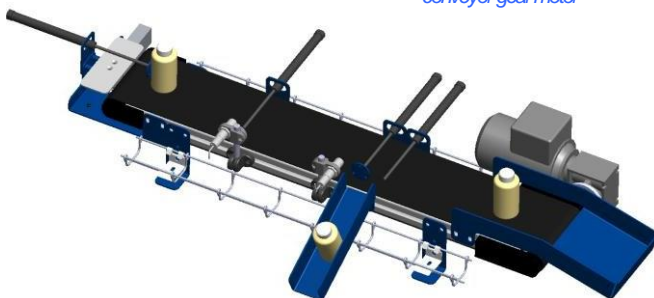
- ✓ Distribution assembly (FR, IO-Link pneumatic island)
- ✓ IO-Link master with Profinet communication
- ✓ 4 Single-acting and double-acting cylinders with quick-release couplings
- ✓ Quick-connect M12 standard connectors



Double-acting pneumatic cylinder



Communicating IO-Link master



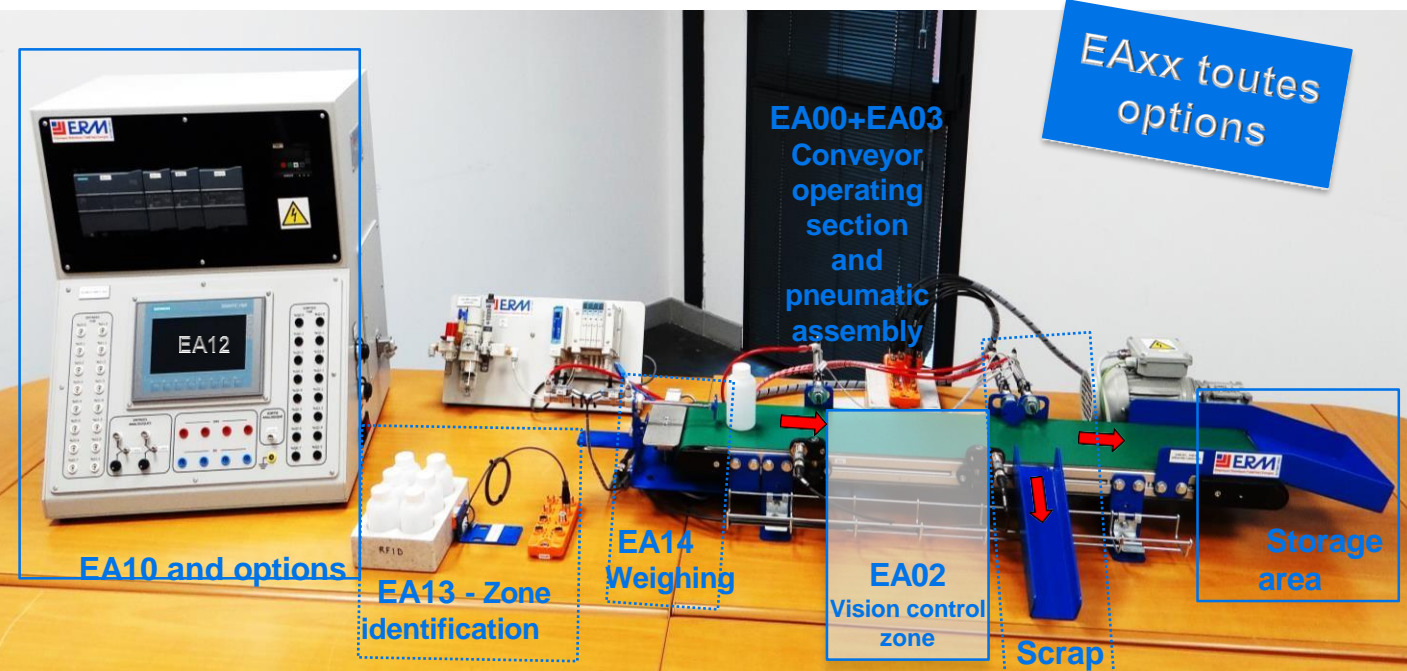
Belt conveyor operating part EA00 and pneumatic cylinders for EA03 assembly



Pneumatic valve assembly with IO-Link communicating pneumatic island and pressure switch



Overview of the PLC Environment



Educational activities

The Automated Environment enables the following pedagogical activities in particular:

- ✓ **Implementing standard & innovative industry technologies**
 - Vision sensor
 - Checkweighing with strain gauge
 - RFID traceability
 - Profinet fieldbus
 - Conventional drive or Profinet communicating drive
 - IO-Link communicating sensors and actuators
 - Sensor configurable via NFC technology
 - Digital factory
- ✓ **Electrical engineering**
 - Discovering and getting to grips with the system (functional analysis and study of system technologies)
 - Adjustment and parameterization of system components
 - I/O wiring, new sensors and actuators
 - Diagnosis of one or more malfunctions
 - Use of digital communication tools
- ✓ **Automation**
 - Production cycle programming (TIA Portal software) with Step7 and WinCC supplied with the system)
 - Human-machine interface programming
 - Programming and configuration of associated peripherals (vision, traceability, IO-Link, etc.)
 - Pneumatic actuator implementation kit
 - LADDER coding methodology based on GRAFCET
- ✓ **Production control**
 - Production control with conveyor running or stopped
 - Setting up a production traceability system
- ✓ **Industrial maintenance**
 - Preventive maintenance (conveyors, actuators, etc.) tires, etc.)
 - Corrective maintenance (fault diagnosis, etc.)
 - Improved maintenance (addition of conveyor sensors, scrap management, vision sensor control, weight control, traceability, etc.).

List of proposed educational activities :

Activity 1: Setting and displaying data from an IO-Link device

- ✓ Read data from a device via the IO-Link network
- ✓ Setting and testing sensors
- ✓ Fill in a statement of work (PV)

Activity 2: Configuring and programming an IO-Link network

- ✓ Setting up an IO-Link master to install a new sensor
- ✓ Test the program and fill out a report

Activity 3: GRAFCET description from several points of view

- ✓ Analyze pneumatic and electrical diagrams
- ✓ Analyze and create GRAFCETS
- ✓ Write the equations for the PLC outputs

Activated #4: Coding an algorithm in LADDER language with an IO-Link pressure switch

- ✓ Code a flowchart in LADDER and test a program
- ✓ Completing a program test report

Activated #5: Coding an algorithm in LADDER language using RFID technology

- ✓ Code a flowchart in LADDER and test a program
- ✓ Completing a program test report

Activated #6: Coding an algorithm in LADDER language with analog inputs

- ✓ Code a flowchart in LADDER and test a program
- ✓ Determine the value of a coefficient
- ✓ Completing a program test report

Activation no. 7: Code a GRAFCET in LADDER language

- ✓ Coding different types of GRAFCET in LADDER
- ✓ Coding automaton output equations and testing a program
- ✓ Completing a program test report

Activated #8: Analysis of Control Unit operation

- ✓ Analyze and complete a document using GRAFCETS

Activated #9: Sensor configuration via NFC

- ✓ Read and modify sensor parameters via NFC
- ✓ Use innovative communication techniques

Resources :

- ✓ Activity-related resource documents
- ✓ TIA Portal software tutorial
- ✓ Siemens training materials



Operating part Lift for PLC boards

Description of the teaching aid

The **Elevator Operating Part for PLCs** is a **training system** representing a three-level elevator with its car and door opening and closing mechanism.

The system comprises an **electrical box** with all electrical protection, safety module, connection terminals, pushbuttons and cabin call indicators.

And an **electro-pneumatic operating part** also equipped with a **Brushless motorization** with control board, belt drive and linear guide with carriage and rail, as well as a double-acting pneumatic cylinder with anti-rotation device. Photoelectric, mechanical and safety sensors, incremental encoders and ILS complete this operating section.

This training system is designed primarily for **advanced development/programming** and design activities, but also offers a wide range of activities for implementing the latest industry techniques.

This operative part is designed to be combined with the study of PLC programming and the creation of programs in specific languages, using Siemens or Schneider PLC boards.

Highlights

- ✓ Ideal for **learning automation**, PLC programming and human-machine **control panels**
- ✓ A system that can be used in the **electrical engineering**, industrial **automation**, **industrial maintenance**
- ✓ **Fast, easy connections** via plug-in terminal blocks in the cabinet, adapted to the associated PLC boards
- ✓ **Implementation** of adapted control parts

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EA09



Electropneumatic operating section



Operating part with safety and interlocking safety switches



Brushless motorization, toothed belt and incremental encoder



Electrical box with standard and plug-in terminal blocks

References

EA09 : Lift operating part for PLC boards
EA10 : PLC board / Siemens S7-1200
Webserver
EA12 : Siemens KTP700 HMI option