CIM

COMPUTER INTEGRATED MANUFACTURING TRAINER

DL CIM-A

CIM (computer integrated manufacturing) is a manufacturing method, in which the entire production process is controlled by computer. This manufacturing method includes transversal applications in several didactic areas such as automation, pneumatics, electronics, mechatronics and process control.
De Lorenzo has developed station-based training systems, which allow the student to view a specific manufacturing process of an industrial production line.

The trainer is a closed- loop control system based on PLC that exchanges information collected from sensors.

The version **DL CIM-A** integrates Belt conveyer, Linear Transfer, and Pick and Place units.

TRAINING OBJECTIVES

DL CIM-A focuses on the study of the integration of the industrial sensors in process inspection as a support for manufacturing processing line.
The trainer integrates the typical actuators (electric, pneumatic) into process executions. The performances of the actuators influence the quality of industrial automation functions. Together with the sensors, they ensure and multiply the value of manufacturing processes.

To study the components substations functionalities: linear transfer unit, horizontal transfer unit, pick and place unit.

Ideal for 4 students to work simultaneously.

Vocational and technical schools.

And applicable to courses in:

- **Automation**
- **Electronics**
- **Mechatronics**
- **Electro pneumatics and Process Control**

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TECHNICAL SPECIFICATIONS

- Power supply: single phase by the mains.
- Total power: 450W, 2A fuse on socket for overload and short circuit protections.

The DL CIM-A trainer is available in two versions depending on the PLC integrated in the system:

- **DL CIM-A_1200** with Siemens PLC (S7-1200 series, CPU 1214C)
- **DL CIM-A_AB** with Allen Bradley PLC CPU 2080-LC30-16QWB Expansion module 2080-IQ4OB4

A third version is also available which adds an HMI and SCADA software to the DL CIM-A with PLC Siemens:

- **DL CIM-AS_7INCH** with 7 inch HMI
- **DL CIM-AS_10INCH** with 10 inch HMI

HIGHLIGHTS

The trainer is a real application of industrial sensors and actuators, programmable logic control (PLC), and dedicated information and computer technologies (ICT-s).

All training topics are designed for CIM applications understanding. The sensors are a support for inspections and manipulation, the actuators run process and the PLC monitors and controls manufacturing algorithms adjusting the processes variables.

It is the basic study of Flexible Manufacturing Systems, with benefits in increasing the machines utilization, reducing the manufacturing leading time, and ensuring high flexibility scheduling.

The following table shows the details of the models available with ordering code.

	PLC SIMENS	PLC ALLEN BRADLEY	TOUCH PANEL 7INCH	TOUCH PANEL 10INCH	SCADA SOFTWARE
DL CIM-A_1200	✓				
DL CIM-A_AB		✓			
DL CIM-AS_7INCH	✓		✓		✓
DL CIM-AS_10INCH	✓			✓	✓

Note: A compressor is needed (no less than 0.6Mpa). Module suggested: **DL 8110SLZ**

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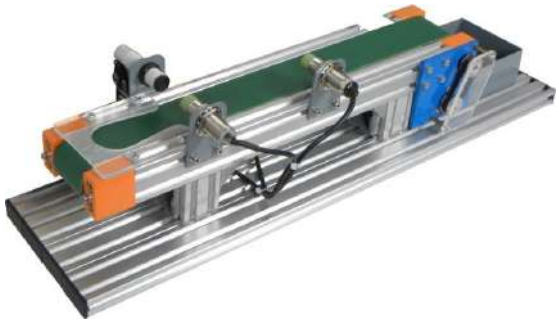
SUBSTATIONS DETAILS



CONVEYER UNIT

This is a miniature model of a real time industrial conveyor system, driven by a DC motor.

The operation of the conveyor is limited to single direction according to the usage.

The conveyor belt rolls over two pulleys fixed on either end. The pulleys roll freely and maintain a free movement for the belt.

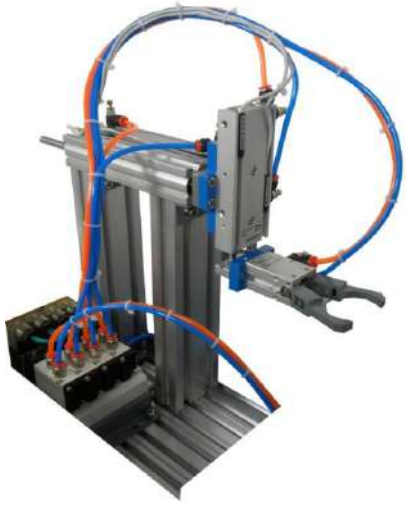
- Length: 480 mm.
- Width: 50 mm.

LINEAR TRANSFER UNIT

The Linear Transfer Unit is an electro-pneumatic controlled linear actuator. Magnetic switches are fixed to sense the retracted and extended position of the transfer unit.

It transfers materials from the conveyor with the help of a pneumatically operated rod less double acting cylinder.

- Cylinder: Pneumatic rod less (20 mm diameter, stroke length 200 mm).
- Travel length: 200 mm.



PICK AND PLACE UNIT

It is a totally electro-pneumatic control system. There are three main parts in this unit:

- a vertical arm (double acting cylinder),
- a horizontal arm (double acting cylinder), and
- an angular gripper (double acting angular gripper for holding work pieces).

Magnetic switches are fixed to sense the retracted and extended position of the vertical and horizontal arms; so, the Pick & Place Unit transfers the material from the Linear Transfer Unit end to the next Unit with the help of the vertical arm, the horizontal arm, and the angular gripper.

- Vertical travel: 50 mm.
- Horizontal travel: 125 mm.
- Load Capacity: 0.5Kg.

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CONTROL SYSTEMS: SIEMENS AND ALLEN BRADLEY PLCs

There are programmable controllers that combine high performance and ease of use.
Their main advantages are:

- the flexibility, as they can be reprogrammed,
- the possibility of their use in environments with severe working conditions,
- the reliability and safety, and
- the possibility of processing both digital and analog signals.

With these controllers integrated into the system, the students can perform experiments commonly used in the industrial automation environment.
Each type includes 14 digital inputs, 10 digital outputs, and PLC siemens also has 2 analogue inputs. They can be programmed through the integrated Ethernet port with TIA portal software (for Siemens PLC) and through USB port with CCW (Connected Components Workbench) software (for Allen Bradley PLC).

HUMAN MACHINE INTERFACE (HMI)

It is a computer based DCS and power automation monitoring system, which has a wide application area and can be used for data acquisition, supervisory and process controls, and it is the most widely used in power systems.

With this unit added to the system, the students can perform experiments commonly used in the industrial automation environment.

It has a high resolution and includes I/O interfaces such as Serial interface and Ethernet 10/100 base-T.

it is available in 7-inch or 10-inch

Available only for the following models:
DL CIM-AS_7INCH
DL CIM-AS_10INCH

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Available only for the following models:

DL CIM-AS_7INCH

DL CIM-AS_10INCH

Supervisory Control And Data Acquisition (SCADA) software

The system is supplied with **S**upervisory **C**ontrol **A**nd **D**ata **A**cquisition (SCADA) software and already installed in the HMI unit.

It occupies an important position in remote control systems and can monitor and control on-site operating equipment to achieve functions such as data acquisition, equipment control, measurement, parameter adjustment, and various signal alarms. It interfaces with the CIM's PLC.

EXPERIMENTS DESCRIPTION

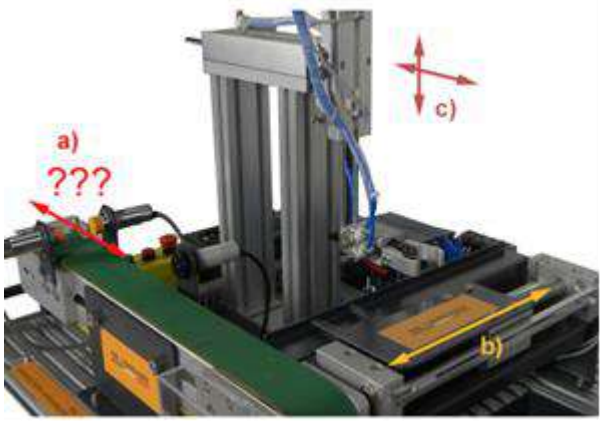
On the inspection area (a), the capacitive sensor detects metals, the inductive sensor distinguishes the difference between metals and plastic, and the photoelectric switch detects reflexivity of the object for correct positioning.

In the transfer area (b), electromagnetic (reed) sensors collect information regarding strokes of the horizontal rod less cylinder.

On the handling area (c), electromagnetic (reed) sensors detect correct positions of the arms during manipulations.

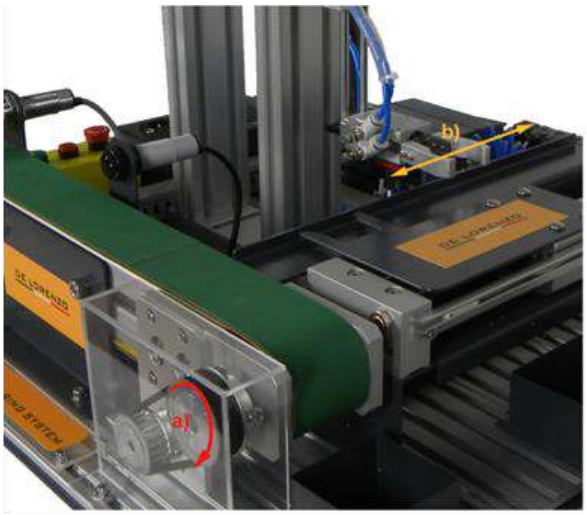
Integration of the sensors in CIM experiments:

- ***Capacitive proximity switch***
- ***Inductive proximity switch***
- ***Photoelectric switch***
- ***Electromagnetic sensors***



Integration and control of dedicated actuators experiments:

- ***DC motor control***
- ***Pneumatic cylinders control***



The **DL CIM-A** trainer offers an excellent possibility to study, understand, and design the most appropriate applications of a DC motor use (a). Simple, easy to control, with some proper gear, the application for belt conveyer is fast integration of this electric machine in manufacturing chain.
The pneumatic actuators, with their elasticity, offer best solutions for alternative linear displacements, and grippers. Together with its electric and pneumatic controlling accessories, and the use of PLC, these execution elements define and describe in an excellent form the mechatronics concept.
Through these experiments, the student/user can compare the possibilities of expansion for these actuators, following the main formulated functions for the manufacturing process design.

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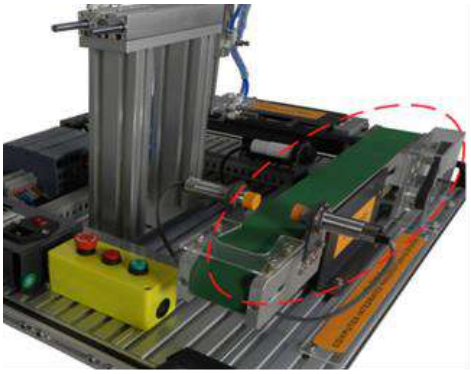
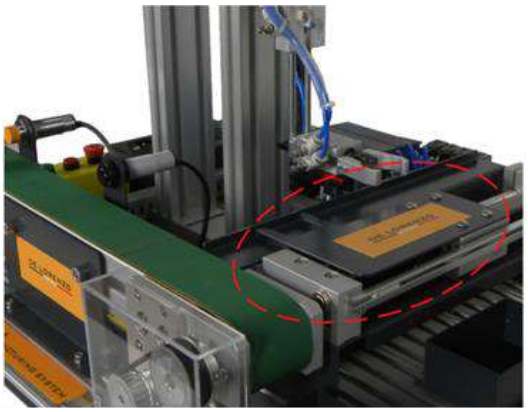
Substation functionality:
Linear transfer unit experiment

Around a PLC program, that integrates different kind of signals (detection whether has work piece, metal work piece detection, detection whether the work piece coming, START/STOP commands), it is built a linear transportation system, as manufacturing function.

Different kinds of working zones are identifiable: process controlling, inspection area, delivering point.



Substation functionality:
Transfer unit experiment

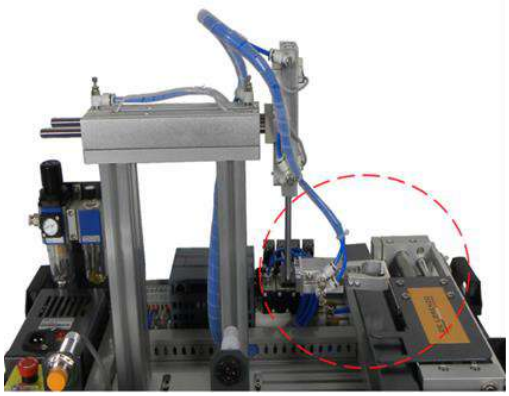


Around a PLC program, that integrates different kind of substation signals (linear transport cylinder stretch out detection, linear transport cylinder retract detection with upstream process signals and type of transported materials), it is built a transfer substation.
Through this experiment, we understand the operations sequence and dependencies of the material transportation and handling up to the moment of materials transferring substation.
These understood and clarified handling constraints allow expanding solutions for many other classes of transported materials.

Around another PLC program, that integrates different kind of substation signals (horizontal cylinder stretch out detection, horizontal cylinder retract detection, vertical cylinder stretch out detection, vertical cylinder retract detection) with upstream process signals (related to availability of the materials), it is built this pick and place substation. The implementation and the control of the gripper is the core idea.

Through this experiment, we understand the operations sequence and dependencies of the material transportation and handling up to the moment of materials transferring substation.
These understood and clarified handling constrains allows expanding solutions for many other classes of transported materials.

Substation functionality:
Pick and place unit experiment



Integration of the substations: CIM experiment

The CIM trainer offers excellent possibility to study, understand, and design the most proper applications where particular substations are implemented to work together.

As we understand the main operations of defined manufacturing system (inspection of the work pieces in the receiving point, the way of transportation of different kind of materials, the transfer point that can be developed according with the process, than managing the re-directing materials based on the process), the success of using this trainer would be the measure of expansion, or customization according with local requirements.

In actual implementation, the PLC sub-programs are working in CIM experiment, like program routines that allow easy understanding of the programming manner.