The PLC-IN is an Industrial Control PLC System designed by EDIBON. The PLC-IN is based on an industrial PLC from Allen-Bradley* (see Note). The PLC-IN targets the ControlLogic system which offers flexibility in programming, network and I/O. The PLC-IN integrates the commonly used elements in an industrial PLC system such as, CPU, I/O elements (I/O cables, terminals, push-buttons, indicators, etc.), Ethernet modules, HMI interface (HUMAN-MACHINE-INTERFACE), etc.

* Note: This PLC-IN system can work with any other PLC, as: Siemens, Omron, Panasonic, etc.
The PLC-IN is also designed to work with some PLC-IN applications from EDIBON. These applications represent real applications or systems such as traffic light control, elevator system, control process, etc. These applications can be controlled using the PLC-IN to obtain the required functionality. The PLC-IN features different control methods such as manual, PID control, ON/OFF, etc. to adjust the functionality to the process or system to be controlled.

The unit is provided with a set of practices, through which will familiarize students with the architecture of an industrial PLC. Students will also understand how an industrial PLC works and how to program an industrial PLC for controlling real applications. The practices are divided into two major sections. The first group is PLC oriented and the objective is to familiarize students with PLC programming. The second set of practical exercises is application-oriented and the objective is to develop control applications (see PLC-IN applications). Students can develop programs to perform tasks related with process control and instrumentation such as data acquiring, measurement calibration, servo drive motors control, conveyors control, pneumatic cylinders and electo-valves control, etc.

### Technical Data:
- Allen-Bradley ControlLogix system:
  - 32 Digital Inputs to 24Vdc (36 pins).
  - 32 Digital Outputs to 24 Vdc (36 pins).
  - 8 Analogue Inputs of current or voltage (36 pins).
  - 4 Analogue Outputs of current or voltage (20 pins).
  - Logix Processor 5561 with memory 2 Mbytes.
  - Bridge EtherNet Module 10/100.
  - Power supply 110/220 Vac for PLC.
  - Software.

- Allen-Bradley Versa View 1200P. Integrated Display and Workstation (HMI):
  - Touchscreen Option: Resistive anti-glare.
  - Display Type & Size: 12.1” color TFT.
  - Resolution: 800 x 600.
  - Bezel Type: Aluminum.
  - Processor Type: Celeron M 1.06 GHz.
  - RAM: 512 MB DDR2.
  - I/O: 4 USB 2.0, 2 10/100/1000 EtherNet, 1 serial port, audio in/out and microphone.
  - Operating System: Windows XP.
  - Electrical and Environmental Power Requirements: 90-264V AC, autoranging; 47-63 Hz.
  - Software.

- Stratix 2000 Unmanaged EtherNet Switch:
  - For network, and all devices communication (included some devices from the applications).
  - Very easy to apply it does not required any configuration.
  - 5 ports for RJ 45 EtherNet/IP standard cables.

### Additional elements:
- Free terminal connections to control the PLC:
  - 32 Digital terminal inputs.
  - 32 Digital terminal outputs.
  - 8 analog terminal inputs.
  - 4 analog terminal outputs.
- I/O Cable to connect different PLC-IN applications.
- 8 Pushbuttons (different colours) with NO/NC contacts.
- 2 Start/Stop push buttons.
- 3 ON/OFF switches.
- 1 Cylinder lock operator.
- 2 End switches.
- 2 Power relays.
- 4 Contactors.
- 1 Timer.
- 2 Emergency pushbutton.
- 8 lights (different colours).
- 2 Buzzers.

Different programming languages:
- Relay Ladder programming language.
- Function block diagram.
- Sequential function chart.
- Structured text.

Cables and Accessories, for normal operation.

Manuals: This unit is supplied with following manuals: Required Services, Assembly and Installation, Software, Starting-up, Safety, Maintenance and Practices Manuals.

Available several Industrial PLC Applications for working with PLC-IN. (See from page 4 to page 10).

Optional accessory:
- Work Bench.
**EXERCISES AND PRACTICAL POSSIBILITIES**

Some PLC Practical Possibilities:
1. - PLC Programming and Download to the PLC. Running Applications.

PLC Programming with different languages:
2. - Relay Ladder (LD).
3. - Function Block Diagram (FBD).
4. - Sequential Function Chart (SFC).
5. - Structured Text (ST).

Using math and arithmetic instructions:
6. - Addition.
7. - Subtraction.
8. - Multiplication.
9. - Division.
10. - Additional instructions.

Studying Number Systems and Data Types:
11. - Decimal, Binary, Octal, Hexadecimal Systems.
12. - Bool, Integer, Word, Double, etc.

Studying the fundamentals of logic:
13. - AND, OR, and NOT Functions and Bool Algebra.
14. - Developing Circuits from Boolean Expressions.
15. - Producing the Boolean Equation from a Given Circuit.
16. - Hardwired Logic versus Programmed Logic.
17. - Programming Word-Level Logic Instructions.
18. - Use of Functions Blocks and libraries.
19. - Timer/Counter instructions and function blocks.

Creating basic applications to test the analog I/O modules:
20. - Using the analog input to read real analog signals.
21. - Using the analog outputs to generate analog signals and waveforms.

Creating basic applications to test the digital I/O modules:
22. - Connecting hardware inputs (push buttons, timers, etc).
23. - Connecting hardware outputs (lamps, contactor coils, etc.).

Configuration of control loops:
24. - An open loop (start end switch stop).
25. - An analogue input PID with analogue output and alarm.
26. - An analogue input PID with PWM output.
27. - Configuring single and dual loops.

*Some applications related to these practices are included in the supply.

Some HMI (Human Machine Interface) Practical Possibilities:
28. - Connection of the HMI to the PLC.
29. - Ethernet/IP connection and starting.
30. - How to create a simple application for the HMI screen.
31. - How to simulate digital / analog inputs from the HMI
32. - How to operate digital/analog outputs from the HMI.
33. - Industrial type applications simulation.

Some Electrical Applications Practical Possibilities:
34. - Programmable interlocks in control circuits.
35. - Relay operation from control line to power line.
36. - Contactors and power elements control from the PLC.
37. - Timer configuration for on delay, off delay, etc.
38. - Contactors actuated by hardware timers.
39. - Manoeuvre Counters and actuation according to pushbutton pulses.
40. - Alarm actuation caused by end switches detection.
41. - Emergency stop and acoustic and light alarms.

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**REQUIRED SERVICES**

- Electrical supply: single-phase, 230V/50-60Hz.
- Computer (PC).

**OPTIONAL ACCESSORY**

- Work Bench.

**DIMENSIONS & WEIGHT**

PLC-IN:
- Dimensions: 1200 x 300 x 870 mm. approx.
  (47.24 x 11.81 x 34.25 inches approx.).
- Weight: 60 Kg. approx.
  (132 pounds approx.).

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www.edibon.com
Direct Starter:
- Three-pole Magneto-thermal Switch of 2.5..4 A.
- Contactor 4 KW/400 VAC, 1 NA, Voltage 230V 50/60Hz.
- Communication Modules for EtherNet/IP.

Soft Starter:
- Static Starter SMC-FLEX, 1..5A, Three-phase, 200..480V AC, Voltage 100..240V AC.
- Communication Module 7, for EtherNet/IP.

Frequency Drive:
- Powerflex Frequency Drive 40, 480V , 3PH, 4.0A, 1.5KW, Ip20.
- Communication Module 4, for EtherNet/IP.

Squirrel Cage AC Motor:
- Power: 370W.
- Speed: 2730 r.p.m. (50/60Hz).
- Connections: Star/triangle.
- V.Armature: 230/400V (50Hz), 250/440V (60Hz).
- I.Armature nominal: 1.67/0.97A.

EXERCISES AND PRACTICAL POSSIBILITIES

Some PLC-IN-1 Practical Possibilities:
1. Connecting devices to the Ethernet / IP.
2. Squirrel cage Delta/Star connection and parameters measurement.
3. Electrical protections wiring associated to the electrical machine installation.
5. Direct/Inverse rotation of motor.
6. Connecting a Direct Starter. Local Mode start and setting adjustment.
7. Connecting a Direct Starter. Remote Mode start and setting adjustment.
8. Connecting a Soft Starter. Local Mode start and setting adjustment.
10. Connecting a Frequency Drive. Local Mode start and setting adjustment.
11. Connecting a Frequency Drive. Remote Mode start and setting adjustment.
12. Ramps up and slow down program of the Frequency converter.
13. Programming steps in motor control devices, according to external signals.
The Process Control Application (PLC-IN-2) is designed for working with PLC Industrial Control System (PLC-IN).

The Process Control Application (PLC-IN-2) allows students to carry out different control processes using a PLC. It allows different control methods such as manual, PID control, ON/OFF, etc., to adjust the functionality and performance of the process to be controlled. The students can develop applications to acquire the data provided by sensors, to calibrate measures, and to carry out any type of control over any of the measured variables.

**SPECIFICATIONS**

- **Bench-top unit.**
- **Anodized aluminum structure and panels of painted steel.**
- **Main metallic elements in stainless steel.**
- **Diagram in the front panel with similar distribution to the elements in the real unit.**
- **A transparent main tank and collector with an orifice in the central dividing wall (2x25 dm³), and drainage in both compartments.**
- **A transparent dual process tank (2x10 dm³), interconnected through an orifice and a ball valve and an overflow in the dividing wall; a graduate scale and a threaded drain of adjustable level with bypass.**
- **2 Centrifugal pumps, range: 0-10 l./min.**
- **2 Variable area flow meters (0.2-2 l./min, and 0.2-10 l./min), and with a manual valve.**
- **Line of on/off regulation valves (solenoid). Usually one is normally opened, and the other two are normally closed, and manual drainage valves of the upper tank.**
- **Proportional valve: a motorized control valve:**
  - Brass valve G ½”:
  - Pmax. 4 bar. 24 volts. Control 12-24 V. 200-1000 mA. Temperature :-10 to 60ºC.
- *(PLC-IN) required.*

**EXERCISES AND PRACTICAL POSSIBILITIES**

**Some PLC-IN-2 Practical Possibilities:**

- **Temperature Process Control using a PLC:**
  1. - Temperature control loops (Manual).
  2. - Temperature control loops (On/Off).
  3. - Temperature control loops (Proportional).
  4. - Temperature control loops (Proportional + Integral).
  5. - Temperature control loops (Proportional + Derivative).
  6. - Temperature control loops (Proportional + Derivative + Integral).
  7. - Adjustment of the constant of a controller of temperature (Ziegler-Nichols).
  8. - Adjustment of the constant of a controller of temperature (Reaction Curves).
  9. - Temperature sensor calibration.

- **Level Process Control using a PLC:**
  19. - Level control loops (Manual).
  20. - Level control loops (On/Off).
  21. - Level control loops (Proportional).
  22. - Level control loops (Proportional + Integral).
  23. - Level control loops (Proportional + Derivative).
  24. - Level control loops (Proportional + Derivative + Integral).
  25. - Adjustment of the constants of a flow controller (Ziegler-Nichols).
  26. - Adjustment of the constants of a flow controller (Reaction Curves).
  27. - Level sensor calibration.

- **Flow Process Control using a PLC:**
  11. - Flow control loops (On/Off).
  12. - Flow control loops (Proportional).
  13. - Flow control loops (Proportional + Integral).
  14. - Flow control loops (Proportional + Derivative).
  15. - Flow control loops (Proportional + Derivative + Integral).
  16. - Adjustment of the flow controller constants (Ziegler-Nichols).
  17. - Adjustment of the flow controller constants (Reaction Curves).
  18. - Flow sensor calibration.

- **Pressure Process Control using a PLC:**
  28. - Pressure control loops (Manual).
  29. - Pressure control loops (On/Off).
  30. - Pressure control loops (Proportional).
  31. - Pressure control loops (Proportional + Integral).
  32. - Pressure control loops (Proportional + Derivative).
  33. - Pressure control loops (Proportional + Derivative + Integral).
  34. - Adjustment of the constant of a Pressure controller (Ziegler-Nichols).
  35. - Adjustment of the constant of a Pressure controller (Reaction Curves).
  36. - Pressure sensor calibration.
Bench-top unit.
Anodized aluminum structure.
Main metallic elements in stainless steel.
Diagram in the front panel with similar distribution to the elements in the real unit.

2 Pressure regulators, one for controlling the pneumatically operated control valve and the second for supplying the necessary flow and/or pressure to the circuit that is to be adjusted.
Pressure regulators range:
- Input of control air through the filter and the regulator “1”: 0.5-8.5 bar.
- Input of process air through regulator “2”: 0.5-8.5 bar.

I/P Converter, range: 4-20 mA; 0.2-1 bar.
On/off valves.
Inlet/outlet valves.
Pneumatically operated control valve, range: CV=0.25; 0.2-1 bar.
Storage (air) tank, capacity: 2 l.
Absolute pressure sensor, range: 0-2 bar.
Differential pressure sensor, range: 0-0.066 bar.

Flow meter, range: 0.8-9.5 m³/h.
1 pressure manometer, range 0-4 bar.
2 pressure manometers, range (each one): 0-2.5 bar.

* PLC Industrial Control System (PLC-IN) is required.

EXERCISES AND PRACTICAL POSSIBILITIES

Some PLC-IN-3 Practical Possibilities:
1.-Calculating the fluid flow in function of different pressure sensor.
2.-Calibration processes.
3.-Pressure sensor calibration. Study of the hysteresis curve.
4.-I/P converter calibration.
5.-Identification of the pneumatic valve type.
6.-Determination of the influence of the flow rate of the conduction.
7.-Pressure control in conduction using a PID controller.
8.-Proportional control (P) characteristics.
9.- Characteristics of a proportional and integral control (P+I).
10.- Characteristics of a proportional and derivative control (P+D).
11.-Optimization of the variables of a PID controller.
12.-Optimization of the variables of the PID controller, flow control.
13.-Flow rate control in conduction with a PID controller.
PLC-IN-4. **Traffic Light Control Application**

![Traffic Light Control Application](image)

### DESCRIPTION

The Traffic Light Control Application (PLC-IN-4) is designed for working with PLC Industrial Control System (PLC-IN).

The Traffic Light Control Application (PLC-IN-4) represents a two-road traffic light system including the most common elements in this system such as traffic lights, car detectors, pedestrian buttons, etc.

The application is designed to demonstrate the use of a PLC in a real-life application.

This application allows students to learn how to manage a sequence of events to safely control the flow of traffic at crossroads.

### SPECIFICATIONS

- Anodized aluminum structure and panels of painted steel.
- Dimensions: 500 x 400 x 500 mm. approx.
- Lights (Green, Yellow, Red).
- Push – Buttons.
- **PLC Industrial Control System (PLC-IN)** is required.

### EXERCISES AND PRACTICAL POSSIBILITIES

Some PLC-IN-4 Practical Possibilities:

1. Developing a program that responds to a push button request.
2. Developing a program that controls a pedestrian traffic light.
3. Developing a program that controls a vehicle traffic light.
4. Developing a program that synchronizes the pedestrian and vehicles traffic lights.
5. Developing a program that counts the number of vehicles crossing each road.
6. Developing a program that considers different operation modes for day and night.
7. Developing a program that adapts automatically the timing of each traffic light depending on the usage.
8. Developing a program that handles emergency situations.
The Industrial Elevator Control Application (PLC-IN-5) is designed for working with PLC Industrial Control System (PLC-IN).

The Industrial Elevator Control Application (PLC-IN-5) represents a three-level elevator system including the most common elements in this system such as motor, request buttons, lights, limit switches, etc.

The application is designed to demonstrate the use of a PLC in a real-life application. This application allows students to learn how to develop different PLC programs to manage the requests generated by the users of the elevator system.

**SPECIFICATIONS**

- Anodized aluminum structure and panels of painted steel.
- Dimensions: 1020 x 400 x 500 mm. approx.
- Lights (Green, Red).
- Limit Switches.
- Emergency Stop.
- DC motor: Medium Power, Analog Command Input.
- Encoder.
- Push – Buttons.

* PLC Industrial Control System (PLC-IN) is required.

**EXERCISES AND PRACTICAL POSSIBILITIES**

Some PLC-IN-5 Practical Possibilities:

1. Developing a program that responds to a push button request.
2. Developing a program that controls the start/stop of the elevator.
3. Developing a program that controls the speed of the elevator.
4. Developing a program that displays the localization of the elevator.
5. Developing a program that controls the maximum number of passengers allowed in the elevator.
6. Developing a program that manages different user requests simultaneously.
7. Developing a program that calculates the most efficient trajectory for different user requests.
8. Developing a program that executes a complete sequence of a user request.
9. Developing a program that handles emergency situations.
The Conveyor Control Application (PLC-IN-6) is designed for working with PLC Industrial Control System (PLC-IN).

The Conveyor Control Application (PLC-IN-6) represents a standard conveyor system widely used in industrial applications with more complex systems like work-cells, CIM systems, etc. The conveyor belt consists of a single conveyor belt that is equipped with an electrical drive and different sensors for detecting when work pieces reaches each point in order to control the flow of the process. The students can develop programs to control all the elements of the system to obtain the required functionality.

**DESCRIPTION**

The Conveyor Control Application (PLC-IN-6) is designed for working with PLC Industrial Control System (PLC-IN).

The Conveyor Control Application (PLC-IN-6) represents a standard conveyor system widely used in industrial applications with more complex systems like work-cells, CIM systems, etc. The conveyor belt consists of a single conveyor belt that is equipped with an electrical drive and different sensors for detecting when work pieces reaches each point in order to control the flow of the process. The students can develop programs to control all the elements of the system to obtain the required functionality.

**SPECIFICATIONS**

Anodized aluminum structure and panels of painted steel.
Dimensions: 1020 x 400 x 500 mm. approx.
Lights (Green, Red).
Limit Switches.
Emergency Stop.
Inductive sensor.
Capacitive sensor.
DC motor: Medium Power, Analog Command Input.
Encoder.
Push–Buttons.
* PLC Industrial Control System (PLC-IN) is required.

**EXERCISES AND PRACTICAL POSSIBILITIES**

Some PLC-IN-6 Practical Possibilities:

1. Developing a program that controls the start/stop of the conveyor.
2. Developing a program that controls the speed of the conveyor.
3. Developing a program that controls the pieces feeding.
4. Developing a program that counts the number of pieces of each material.
5. Developing a program that controls the storage of pieces of each material.
6. Developing a program that considers different operation modes depending on the material of the piece.
7. Developing a program that controls the timing of each stage of the process.
8. Developing a program that displays the status of process.
9. Developing a program that handles emergency situations.
PLC-IN-7. **Electro-Pneumatic Control Application**

The Electro-Pneumatic Control Application (PLC-IN-7) is designed for working with PLC Industrial Control System (PLC-IN).

The Electro-Pneumatic Control Application (PLC-IN-7) pneumatic is designed to demonstrate the use of PLC in pneumatic automation. The objective is to learn how to control the commonly used elements on a pneumatic system like cylinders actuators, valves, etc. and how to check the status of the input elements like position sensors, limit switches, etc.

The students can develop sequential programs to activate the actuators and valves one after another to obtain a required functionality.

**SPECIFICATIONS**

Anodized aluminum structure and panels of apinted steel.
Dimensions: 500 x 400 x 500 mm. approx.
Lights (Green, Red).
Limit Switches.
Position sensors.
Emergency Stop.
Push –Buttons.
Pneumatic cylinders.
Electrical - valves.
* PLC Industrial Control System (PLC-IN) is required.

**EXERCISES AND PRACTICAL POSSIBILITIES**

Some PLC-IN-7 Practical Possibilities:

1. - Study the operation mode of a pneumatic cylinder.
2. - Study the operation mode of an electro-valve.
3. - Study the operation mode of detector sensors.
4. - Developing a program that controls the open/closed status of a pneumatic cylinder.
5. - Developing a program that controls the open/closed status of an electro-valve.
6. - Developing a program that controls sequentially the actuators.
7. - Developing a program that controls the timing of each stage of the process.
8. - Developing a program that handles emergency situations.

*Specifications subject to change without previous notice, due to the convenience of improvements of the product.*