Automatic Control Operations with Contactors and Sensors IV

AEL-CM4

INTRODUCTION

Nowadays it is essential to implement process automation systems using different types of sensors.

In the absence of process automation, plant operators have to physically monitor performance values and the quality of outputs to determine the best settings on which to run the production equipment.

As manufacturing processes become increasingly complex, industry must rely on advanced sensor technology and process control to improve efficiency and product quality. Processes now need a variety of on-line measurements, such as film thickness, particle size, solids concentrations, and contamination detection.

This comprehensive application offers concise explanations and demonstrations of how industrial process sensors work, starting with a review of the basic principles and finishing with real examples of automation processes. In addition, this application provides different real cases and details from actual industrial installations that demonstrate authentic sensor applications.

The AEL-CM4 Automatic Control Operations with Contactors and Sensors application has been designed by EDIBON for the study of automatic control operations with contactors and sensors connected to a load (induction motors, conveyor belts, lighting, etc).

This application allows the students to acquire the most important knowledge about the working mode of industrial installations equipped with circuit breakers, sensors and induction motors. Through this application can be studied the most significant sensors used in the industry such as limit switches, pulse counters, inductive proximity sensors, capacitive proximity sensors, barrier photo-electric sensors, level magnetic sensors and level controller devices. All these elements will be wired with basic and complex control logic circuits explained step by step from basic level to advanced level.

The AEL-CM4 includes the following modules:

- N-ALI01.   Industrial Power Supply.
- N-ALI03.   AC Auxiliary Power Supply.
- N-PUL48.   Three Double Chamber Push-Buttons Module.
- N-LAM02.   Three Auxiliary Lamps Module.
- N-CON01.   Three-Pole Contactor Module. (4 units).
- N-REL47.   Thermal Relay Module.
- N-SFC.   Limit Switch Module.
- N-MED47.   Pulse Counter Module.
- N-SEN05.   Cylindrical Inductive Proximity Sensor Module.
- N-SEN013.   DC Cylindrical Capacitive Proximity Sensor Module.
- N-SEN21.   Barrier Photoelectric Sensor (Emitter) Module.
- N-SEN22.   Barrier Photoelectric Sensor (Receptor) Module.
- N-SEN23.   Reflecting Photoelectric Sensor (Emitter) Module.
- N-SEN24.   Reflecting Photoelectric Sensor (Receptor) Module.
- N-SEN25.   Level Magnetic Sensor Module.
- N-DPP.   Water Tank Module.
- N-CNV.   Level Controller Module.
- EMT7.   Asynchronous Three-Phase Motor of Squirrel Cage.

Optional learning software:

  In addition, Edibon provides optional software (AEL-CM4/ICAI) to reinforce knowledge about this field. This software is formed by:

- ECM-SOF.   EDIBON Classroom Manager (Instructor Software).
- ESL-SOF.   EDIBON Student Labsoft (Student Software).

The application AEL-CM4 can be mounted on rack (option A) or on rail (option B):

Option A:

  This application needs the following racks.

- N-RACK-A. (2 units).

  Optionally the AEL-WBR. Electrical Workbench (Rack) can be supplied to place the rack/s.

Option B:

  This application can be mounted on rail.

  Optionally the AEL-WBC. Electrical Workbench (Rail) can be supplied to mount the modules.

The trainer includes the following modules:

• **N-ALI01. Industrial Power Supply.**
  Supply voltage: 400 VAC, 3PH+N+G.
  ON-OFF removable key.
  Output voltage connections:
    Three-Phase + Neutral: 400 VAC.
    Single-Phase: 230 VAC.
  Three-Phase supply hose with IP44 3PN+E 32A 400V connecting plug.
  Differential magnetothermal, 4 poles, 25A, 300mA AC 6KA.

N-ALI01

• **N-ALI03. AC Auxiliary Power Supply.**
  Supply voltage (Single-Phase): 230VAC PH+N+G.
  Output voltage:
  Single-Phase 24VAC/12VAC.
    24 VDC.
  0-24VDC through potentiometer.

N-ALI03

• **N-PUL48. Three Double Chamber Push-Buttons Module.**
  Two independent chambers.
  Nominal voltage: 24 VAC.
  Three double chamber push-buttons (green and red).
  Contacts:
    Three Normally Open Contacts (NO) for green switch.
    Three Normally Close Contacts (NC) for red switch.
  Ground terminal.

N-PUL48

• **N-LAM02. Three Auxiliary Lamps Module.**
  Nominal voltage: 24 VAC.
  Three lamps (red, yellow and green).
  Ground terminal.

N-LAM02

• **N-CON01. Three-Pole Contactor Module. (4 units).**
  Nominal voltage for power contacts: 400 VAC.
  Nominal voltage for control contacts: 24 VAC.
  Nominal voltage for the control coil: 24 VAC.
   Contacts:
    One three-phase Normally Open Contact (NO) for power circuit.
    Three Normally Open Contacts (NO) for control circuit.
    Two Normally Close Contacts (NC) for control circuit.
   Ground terminal.

N-CON01

• **N-REL47. Thermal Relay Module.**
  Nominal voltage for power contacts: 400 VAC.
  Nominal voltage for the control coil: 24 VAC.
  Contacts:
    One three-phase Normally Open Contact (NO) for power circuit.
  Ground terminal.

• **N-SFC. Limit Switch Module.**
  Nominal voltage: 24 VAC.
  Nominal current: 3 A.
  Contacts:
    One Normally Open Contact (NO).
    One Normally Close Contact (NC).
  Fuses: 2x3 A.
  Ground terminal.

N-SFC

- N-MED47. **Pulse Counter Module.**
  Supply voltage (Single-Phase): 230VAC PH+N+G.
  Power switch.
  Digital display.
  Terminals (24 VDC):
    Output:
      Two output terminals.
    Input:
      One input terminal.
      One counter digital input.
  Contacts (24 VAC):
    One Normally Open Contact (NO).
    One Normally Close Contact (NC).
    Common point of normally close/open contacts.
  Fuses: 2x1 A.

N-MED47

- N-SEN05. **Cylindrical Inductive Proximity Sensor Module.**
  DC Circuit: 24 VDC.
  Detection surface.
  Light detection.
  Inductive sensor:
    Supply voltage: 0-58 VDC.
    Two digital outputs.
  Relay contact (24 VAC):
    One Normally Open Contact (NO).
    One Normally Close Contact (NC).
    Common point of normally close/open contacts.
  Fuse: 250 mA.
  Ground terminal.

N-SEN05

- N-SEN013. **DC Cylindrical Capacitive Proximity Sensor Module.**
  DC Circuit: 24 VDC.
  Capacitive sensor:
    Supply voltage: 10-55 VDC.
    Two digital outputs.
  Relay contact (24 VAC):
    One Normally Open Contact (NO).
    One Normally Close Contact (NC).
    Common point of normally close/open contacts.
  Fuse: 500 mA.
  Ground terminal.

N-SEN13

- N-SEN21. **Barrier Photoelectric Sensor (Emitter) Module.**
  Nominal voltage: 12-24 VDC.
  Emitter sensor.
  Fuse: 250 mA.
  Ground terminal.

N-SEN21

- N-SEN22. **Barrier Photoelectric Sensor (Receptor) Module.**
  Nominal voltage: 12-24 VDC.
  Receptor sensor.
  Digital output signal
  Relay contact (24 VAC):
    One Normally Open Contact (NO).
    One Normally Close Contact (NC).
    Common point of normally close/open contacts..
  Fuse: 2 A.
  Ground terminal.

N-SEN22

- N-SEN23. **Reflecting Photoelectric Sensor (Emitter) Module.**
  Emitter:
    Nominal voltage: 24 VDC
    Digital output signal
  Relay contact (24 VAC):
    One Normally Open Contact (NO).
    One Normally Close Contact (NC).
    Common point of normally close/open contacts.
  Fuse: 250 mA.
  Ground terminal.

N-SEN23

- N-SEN24. **Reflecting Photoelectric Sensor (Receptor) Module.**
  Receptor sensor.
  Ground terminal.

N-SEN24

- N-SEN25. **Level Magnetic Sensor Module.**
  Nominal voltage: 24 VAC.
  Magnetic level sensor.
  Contact:
    Normally open Contact (NO).
  Fuse: 500 mA.
  Ground terminal.

N-SEN25

- N-DPP. **Water Tank Module.**
  Three sounders connections.
  Two switches ON/OFF:
    Max water level simulator switch.
    Min water level simulator switch.
  Lineal potentiometer 0-50 kOhms.
  Three water resistor measurement terminals.
  Ground terminal.

N-DPP

- N-CNV. **Level Controller Module.**
  Level controller:
    Nominal voltage: 24 VDC.
    Signal calibration wheel.
  Three sounders connections.
    Lamp 24 VDC.
  Contacts:
    One Normally Open Contact (NO).
  Fuse: 5A.
  Ground terminal.

N-CNV

- EMT7. **Asynchronous Three-Phase Motor of Squirrel Cage.**
  Nominal power: 370 W.
  Nominal voltage: 3x 230/400 VAC Δ/Y.
  Frequency: 50/60 Hz.
  Number of poles: 2.
  RPM: 2730 r.p.m.
  Nominal current: 1,67/ 0,97 A.

EMT7

- **All necessary cables to realize the practical exercises are included.**

Cables and accessories, for normal operation.
Manuals:
This unit **is supplied with the following manuals:** Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.

EXERCISES AND PRACTICAL POSSIBILITIES

1.- Checking the industrial power supply.

2.- Checking the AC auxiliary power supply.

3.- Checking the lamps.

4.- Checking and wiring demonstration of the limit switch.

5.- Checking, wiring and programming demonstration of the pulse counter.

6.- Checking and wiring demonstration of the cylindrical inductive proximity sensor.

7.- Checking and wiring demonstration of the DC cylindrical capacitive proximity sensor.

8.- Checking and wiring demonstration of the barrier photoelectric emitter and receptor sensor.

9.- Checking and wiring demonstration of the reflecting photoelectric emitter and receptor sensor.

10.- Checking and wiring demonstration of the level magnetic sensor.

11.- Checking and wiring demonstration of the level controller.

12.- Study of the basic control elements of the three-phase induction motor.

13.- Study of the control of the squirrel cage three-phase induction motor with the limit switch.

14.- Starting and reversing operation of the induction motor.

15.- Starting and reversing operation of motor with induction motor, capacitive, inductive and barrier photoelectric sensors.

16.- Starting and reversing operation of the induction motor using capacitive, inductive and barrier photoelectric sensors and pulse counter.

17.- Reflecting photoelectric sensor, inductive sensor and pulse counter.

18.- Level magnetic sensor and level controller.

19.- Simulation of a water tank filling.

REQUIRED SERVICES

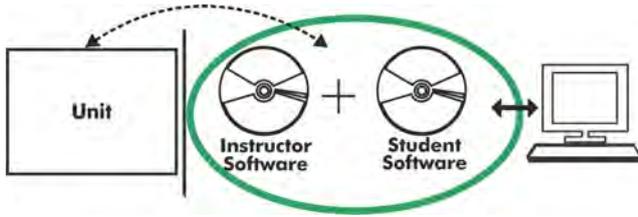- Electrical supply: single phase, 220 V./50 Hz. or 110 V./60 Hz.

DIMENSIONS AND WEIGHTS

AEL-CM4:

-Dimensions: 1380 x 840 x 2010 mm. approx.

(54.33 x 33.07 x 79.13 inches approx.).

-Weight: 75 Kg. approx.

(165 pounds approx.).

AEL-CM4/ICAI. Interactive Computer Aided Instruction Software System.

Whit no physical connection between unit and computer (PC), **this complete software package consists of an Instructor Software (EDIBON Classroom Manager-ECM-SOF) totally integrated with the Student Software (EDIBON Student Labsoft-ESL-SOF).** Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students.
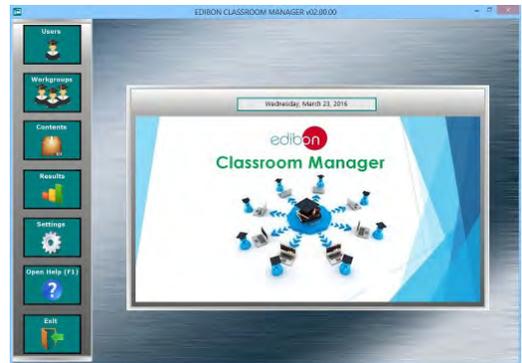
Instructor Software

**-ECM-SOF. EDIBON Classroom Manager (Instructor Software).**

ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual students, workgroups, units, etc… so the teacher can know in real time the level of understanding of any student in the classroom.

Innovative features:

    User Data Base Management.

    Administration and assignment of Workgroup, Task and Training sessions.

    Creation and Integration of Practical Exercises and Multimedia Resources.

    Custom Design of Evaluation Methods.

    Creation and assignment of Formulas & Equations.

    Equation System Solver Engine.

    Updatable Contents.

    Report generation, User Progression Monitoring and Statistics.

ECM-SOF. EDIBON Classroom Manager (Instructor Software)
Application main screen
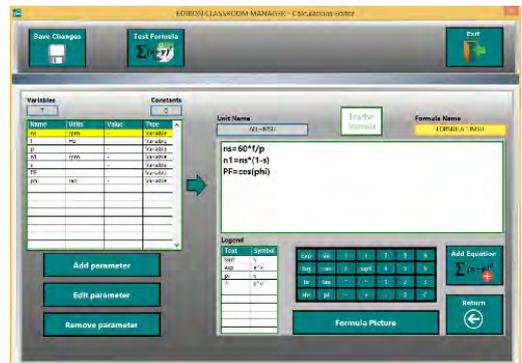
ECAL. EDIBON Calculations Program Package - Formula
Editor Screen
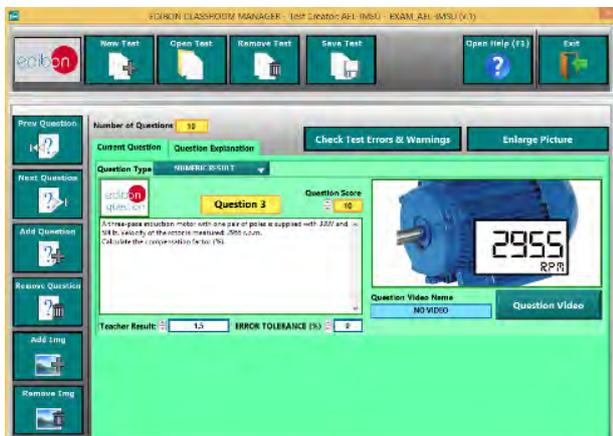
ETTE. EDIBON Training Test & Exam Program Package - Main Screen
with Numeric Result Question

ERS. EDIBON Results & Statistics Program
Package - Student Scores Histogram

Student Software

-ESL-SOF. EDIBON Student Labsoft (Student Software).

ESL-SOF is the application addressed to the Students that helps them to understand theoretical concepts by means of practical exercises and to prove their knowledge and progression by performing tests and calculations in addition to Multimedia Resources. Default planned tasks and an Open workgroup are provided by EDIBON to allow the students start working from the first session. Reports and statistics are available to know their progression at any time, as well as explanations for every exercise to reinforce the theoretically acquired technical knowledge.

Innovative features:

Student Log-In & Self-Registration.

Existing Tasks checking & Monitoring.

Default contents & scheduled tasks available to be used from the first session.

Practical Exercises accomplishment by following the Manual provided by EDIBON.

Evaluation Methods to prove your knowledge and progression.

Test self-correction.

Calculations computing and plotting.

Equation System Solver Engine.

User Monitoring Learning & Printable Reports.

Multimedia-Supported auxiliary resources.

For more information see **ICAI** catalogue. Click on the following link:

www.edibon.com/products/catalogues/en/units/electricity/ICAI-Electricity/ICAI-Electricity.pdf
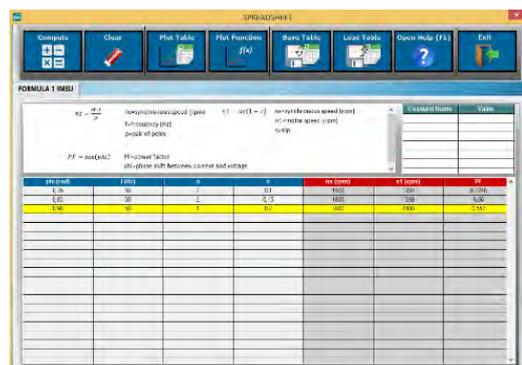

ESL-SOF. EDIBON Student LabSoft (Student Software) Application Main Screen
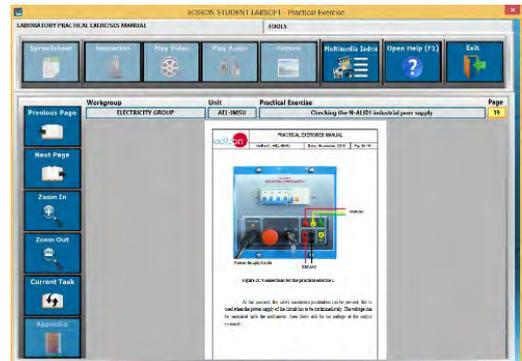
EPE. EDIBON Practical Exercise Program Package Main Screen

ERS. EDIBON Results & Statistics Program Package-Question Explanation

ECAL. EDIBON Calculations Program Package Main Screen

✱ Specifications subject to change without previous notice, due to the convenience of improvement of the product.

INTERNATIONAL

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REPRESENTATIVE: