# Electrical Machines Relays Protection Trainer

## AEL-EMRP

Engineering and Technical Teaching Equipment

**Electrical Machines**

EMT7B/1K

## INTRODUCTION

Three-phase squirrel-cage induction motors are widely used in industrial installations because they are rugged, reliable and economical. However, it is very important the utilization of suitable electrical protections to avoid electrical motor´s overheating due to overloads.

# GENERAL DESCRIPTION

The AEL-EMRP Electrical Machines Relays Protection Trainer has been designed by Edibon to study the elementary protections for three phase squirrel cage induction motors.

In order to study the behavior of the electrical machines protections, this trainer consists of a three-phase induction motor of squirrel cage coupled to a servomotor. On this way, the user can control the servo machine and modify the loads condition of the motor to be studied. With the servomotor the user can increase the current consumption by the induction motor and provoke overcurrent and overheating to study the electrical protections performance.

The AEL-EMRP includes the following modules:

- N-ALI01. Industrial Main Power Supply.

- N-REL09. Time Electronic Relay against Overcurrents (1.2 - 7 A).

- N-REL47. Thermal Relay.

- EMT7B/1K. 1kVA Asynchronous Three-Phase Motor of Squirrel Cage.

- N-SERV1K. 1 kW Servomotor Module.

- N-MED65. Digital Multimeter.

- N-EAL. Network Analyzer Unit.

- N-CON01. 3-Pole Contactor (24 VAC)

- N-ALI03. AC Auxiliary Power Supply.

Optional learning software:

In addition, Edibon provides optional software (AEL-EMRP/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-EMRP can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs the following racks.

- N-RACK-M (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 Main 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-REL09. Time Electronic Relay against Overcurrents (1**.2 - 7 A)

  Nominal voltage: 230/24 VAC.

  Time Electronic Relay against Overcurrents.

  Contacts:

    One Normally Open Contact (NO).

    One Normally Close Contact (NC).

    Common point of normally close/open contacts.

N-REL09

- **N-REL47. Thermal Relay**

  Nominal voltage for power contacts: 400 VAC.

  Nominal voltage for the control coil: 24VAC.

  Contacts:

    One three-phase Normally Open Contact (NO) for power circuit.

  Ground terminal.

N-REL47

- **EMT7B/1K. Three-phase Asynchronous Motor of Squirrel Cage**

  Nominal power: 1KW.

  Speed: 1405 r.p.m.

  Nominal torque: 7,48 Nm.

  Performance:

    75,5 % (at 50% of full load).

    77,8 % (at 75% of full load).

    76,7 % (at 100% of full load).

  Power Factor: 0,8.

  Nominal current:

    4,5 A (at 230 VAC).

    2,7 A (at 380 VAC).

    2,6 A (at 400 VAC).

EMT7B/1K

Specifications

- N-SERV1K. **1 kW Servomotor Module**

  Dynamic and static four-quadrant operation.

  Speed and torque displays.

  Four-quadrant monitor.

  Thermal monitoring of the machine under test.

  Testing for the presence of a shaft cover.

  Connection voltage: 400 V.

  Frequency: 50 Hz.

  Maximum power output: 10 kVA.

  Maximum speed: 4000 r.p.m.

  Maximum torque 30 Nm.

  Temperature monitoring.



N-SERV1K

- N-MED65. **Digital Multimeter**

  This module has a digital multimeter of about 3 ½ digits, with double-jack ending cables of about

  4 mm to facilitate interconnections.

  With this digital multimeter we will be able to measure:

  Voltage.

  Current.

  Resistance.

  Capacitors capacity.

  Temperature.



N-MED65

- N-EAL. **Network Analyzer Unit**

  ON-OFF switch.

  Supply voltage: 230 VAC.

  Input terminals: Input connection with the measurement point.

  Output terminals: Output connection with the measurement point.

  Digital outputs: Three digital outputs are used for pulses or alarms, or for combining both.

  Fuses: 3x10 A.

  Network Analyzer Display. It shows:

  Active, reactive and apparent power.

  Active, reactive and apparent energies.

  Lines and phase currents.

  Line and phase voltages.

  Frequencies.

  Power Factor.



N-EAL

• N-CON01. **3-poles Contactor (24 Vac)**

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-ALI03. **AC Auxiliary Power Supply (24 Vac)**

Supply voltage (Single-Phase): 230 VAC PH+N+G.

Output voltage:

Single-Phase 24 VAC/12 VAC.

24 VDC.

N-ALI03

0-24 VDC through potentiometer.

• **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.- Wiring and put into operation of an Asynchronous Three-Phase Motor of Squirrel Cage.

2.- Studying and testing of configuration of overcurrent time electronic relay.

3.- Studying and testing of configuration of thermal protection relay.

4.- Studying in combination of motor protection relays.

5.- Load protection for disconnecting the power supply to the motor.

6.- Studying of servomotor working as load.

7.- Studying of the joint operation of motor with servomotor.

8.- Selectivity and coordination of the protection relays.

9.- Analyze the network parameters with different load conditions.

10.- Configuration of the protection relays for the motor starter.

## REQUIRED SERVICES

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

## DIMENSIONS AND WEIGHTS

AEL-EMRP:

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

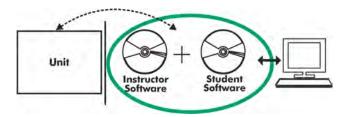                 (54.33 x 33.07 x 79.13 inches approx.).

   -Weight:      80 Kg. approx.

                 (176 pounds approx.).

**AEL-EMRP/ICAI. Interactive Computer Aided Instruction Software System:**



With 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.
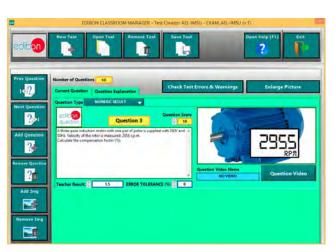
## Instructor Software

### -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
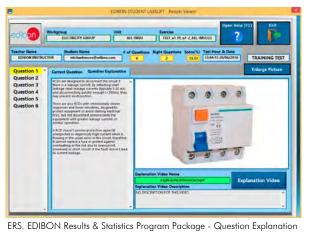
## Student Software

**-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:
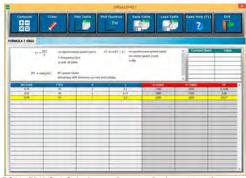
**www.edibon.com/en/files/expansion/ICAI/catalog**



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.

REPRESENTATIVE: