



Configuration example of AEL-TI with AEL-TI-02 application included

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↳ 40.- ELECTRICITY

INTRODUCTION

Electric utilities aim to provide service to customers at a specific voltage level, for example, 220V or 240V. However, due to Kirchhoff's Laws, the voltage magnitude and thus the service voltage to customers will in fact vary along the length of a transmission line.

Depending on the amount of demanded power the voltage drops along the lines may be more or less. The goal of the utilities is to maintain constant the voltages. In order to maintain voltage within a tolerance under changing load conditions, voltage regulators are used in the distribution transformers.

The distribution transformers have elements called "tap changers", that allow to select the number of the turns of the secondary winding, thus the voltage of the final user can be regulated when the voltage varies due to demand changes.



ISO 9001: Quality Management (for Design, Manufacturing, Commercialization and After-sales service)



European Union Certificate (total safety)



Certificates ISO 14001 and ECO-Management and Audit Scheme (environmental management)



"Worlddidac Quality Charter" and Platinum Member of Worlddidac

GENERAL DESCRIPTION

The Distribution Transformer with Motor Regulation Application, "AEL-TI-02", has been designed to study the distribution transformers and its importance in voltage regulation of the medium and low voltage stage of the electrical system. For that, this application includes a transformer with motorized voltage regulator to keep the voltage constant against the demand changes.

In addition, this application has been designed to be combined with the rest of AEL-TI- and AEL-SST- applications in order to form a system in which the user can study concepts about generation, transmission, distribution and power consumption.

Additionally, this application can work remotely through SCADA software AEL-TI-07/CCSOF included in the application of Transmission Application with Synchronous Generator, "AEL-TI-07".

The AEL-TI-02 application includes the following element:

- N-TRANS3R/1K. Three-phase Transformer with Motor Voltage Regulator.

Required elements:

- AEL-TI-01. Analysis of Three-phase Power Lines Application.
- N-VPS01. AC 3PH Variable Power Supply.

Recommended elements:

- AEL-TI-03. Arc Suppression Coil Application.
<http://www.edibon.com/en/files/equipment/AEL-TI-03/catalog>
- AEL-TI-04. Underground Transmission Lines Application.
<http://www.edibon.com/en/files/equipment/AEL-TI-04/catalog>
- AEL-TI-05. Parallel and Series Transmission Lines Application.
<http://www.edibon.com/en/files/equipment/AEL-TI-05/catalog>
- AEL-TI-06. Analysis of Power Flows in Transmission Lines Application.
<http://www.edibon.com/en/files/equipment/AEL-TI-06/catalog>
- AEL-TI-07. Power Transmission Application with Synchronous Generator + AEL-TI-07/CCSOF. Computer Control + Data Acquisition + Data Management Software.
<http://www.edibon.com/en/files/equipment/AEL-TI-07/catalog>
- AEL-SST-01. Switching in Transmission and Distribution Substations Application.
<http://www.edibon.com/en/files/equipment/AEL-SST-01/catalog>
- AEL-SST-02. Switching Substation Protection Application.
<http://www.edibon.com/en/files/equipment/AEL-SST-02/catalog>

The application AEL-TI-02 can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs the following racks.

- N-RACK-B.

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.

SPECIFICATIONS

The AEL-TI-02 application includes the following element:

- **N-TRANS3R/1K. Three-phase Transformer with Motor Voltage Regulator.**

Primary: 3x400V AC.

Secondary: 3x 0 ... 450 V.

Nominal power: 1 Kva.

Frequency: 50/60 HZ.

25 V input/"Increase voltage" button.

25 V input/"Decrease voltage" button.



N-TRANS3R/1K

Required elements:

AEL-TI-01. Analysis of Three-phase Power Lines Application.

- **N-AE1. Transmission Line Simulation Module.**

Four capacitors banks of 1uF by capacitor to simulate capacitance between lines.

Two capacitors of 1 and 2uF by phase to simulate capacitances between the line and earth.

Two resistors of 15 and 30 Ohm by phase.

One inductance by phase with 33, 78, 140, 193 and 236 mH terminals.

One neutral resistor of 10 Ohm.



N-AE1

- **N-REFT/3C. 3x300 W Three-Phase Configurable Resistors Module.**

Configurable Star and Delta connections.

Three banks with three three-phase resistors of 1600 Ω.

Nominal voltage: 400V AC.

Nominal power: 3 x (3 x 300) W.



N-REFT/3C

- **N-INDT/3C. 3x300 VAR Three-Phase Configurable Inductances Module.**

Configurable Star and Delta connection.

Three banks with three three-phase inductances of 5 H.

Nominal voltage: 400V AC.

Nominal power: 3 x (3x300) VAR.



N-INDT/3C

- **N-CAR19T/3C. 3x300 VAR Three-Phase Configurable Capacitors Module.**

Configurable Star and Delta connection.

Three banks with three three-phase capacitors of 2 μF.

Nominal voltage: 400V AC.

Nominal power: 3 x (3 x 300) VAR.



N-CAR19T/3C

- **N-EALD. Network Analyzer Unit with Data Acquisition (2 units).**

ON-OFF switch.

Supply voltage: 400V AC.

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.

RS-485 Communication port.

Fuses: 3 x 10 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-EALD

Specifications

- **N-PSM. Power Switch Module.**

Supply voltage: single-phase 230V AC.

Power terminals:

Four power input terminals (3PH+N).

Four power output terminals (3PH+N).

Auxiliary contacts:

One "NO" contact.

One "NC" contact.

Two push-buttons to open / close the power terminals and auxiliary contacts.

Two control contacts of 24V DC.

Two voltage supply outputs of 24V DC.



N-PSM

- **N-RELO9. Time Electronic Relay against Overcurrents (1.2 - 7 A).**

Electronic thermal relay.

Overload protection.

Range 1.2 – 7A.

Reset and test function.

1 NONC contact.

Temporization.



N-RELO9

- **N-VPS01. AC 3PH Variable Power Supply.**

3PH+N+GND male connector with cable.

200V DC fixed output terminals.

0-200V DC variable output terminals.

230/400V AC fixed output terminals.

0-230/400V AC variable output terminals.

Three positions voltage regulation commutator: this commutator allows to control the AC and DC output voltage terminals with a motorized autotransformer. Central position keep actual voltage. Right position increase slowly the output voltage. Left position reduce slowly the output voltage up to zero volts. By releasing the commutator, it will return to its initial position.

ON/OFF switch.

DC Ammeter.

DC Voltmeter.

AC Ammeter.

AC Voltmeter.

Adjustable three phase thermal protection.

Fuses.

GND terminal.



N-VPS01

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

Cables and Accessories, for normal operation.

Manuals:

This application **is supplied with the following manuals**: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.

EXERCISES AND PRACTICAL POSSIBILITIES

- 1.- Drop voltage correction with three-phase transformer with motor regulation.
 - 2.- Study of increasing voltages with step up transformer.
 - 3.- Study of decreasing voltages with step down transformer.
- Other possibilities to be done with this application:
- 4.- Many students view results simultaneously.
To view all results in real time in the classroom it can be used a projector or an electronic whiteboard.
 - 5- This application is totally safe as uses mechanical, electric and electronic, and software safety devices.
 - 6- This application can be used for doing applied research.
 - 7- This application can be used for giving learning courses to industries even to other Technical Education Institutions.
- Several other exercises can be done and designed by the user.

REQUIRED SERVICES

- Electrical supply: three-phase, 380 V/50 Hz or 208 V/60 Hz, 3 kW.

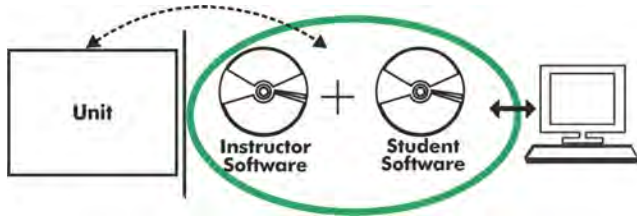
DIMENSIONS AND WEIGHTS

- AEL-TI-02:
- Dimensions: 1000 x 450 x 1000 mm approx.
(39.37 x 17.71 x 39.37 inches approx.)
 - Weight: 30 Kg approx.
(66 pounds approx.)

AVAILABLE VERSIONS

- Offered in this catalogue:
- AEL-TI-02. Distribution Transformer with Motor Regulation.
- Offered in other catalogue:
- AEL-TI-01. Analysis of Three-phase Power Lines.
 - AEL-TI-03. Arc Suppression Coil.
 - AEL-TI-04. Underground Transmission Lines.
 - AEL-TI-05. Parallel and Series Transmission Lines.
 - AEL-TI-06. Analysis of Power on Transmission Lines.
 - AEL-TI-07. Transmission Systems with Synchronous Generator.
 - AEL-SST-01. Switching and Distribution Power Substations Application.
 - AEL-SST-02. Switching Substation Protection Application.

AEL-TI-02/ICAI. Interactive Computer Aided Instruction Software System:



With no physical connection between unit and computer, 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.

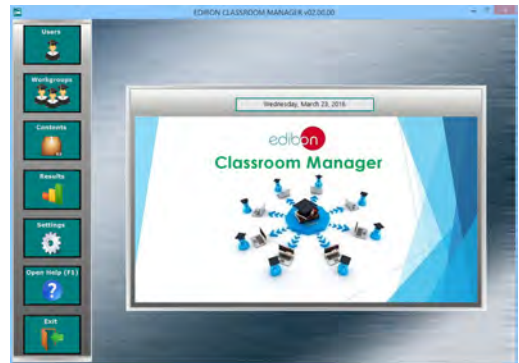
Instructor Software

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

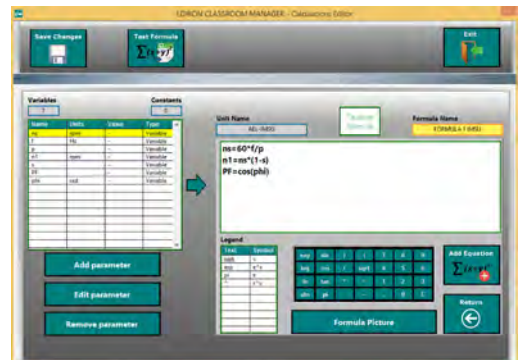
ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual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

Innovative features:

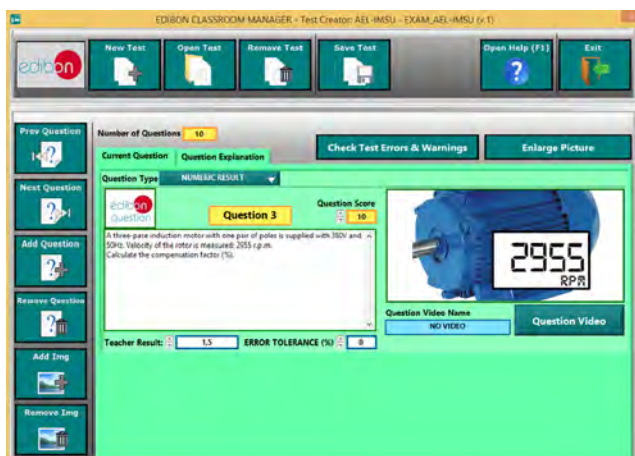
- User Data Base Management.
- Administration and assignment of Workgroup, Task and Training sessions.
- Creation and Integration of Practical Exercises and Multimedia Resources.
- Custom Design of Evaluation Methods.
- Creation and assignment of Formulas & Equations.
- Equation System Solver Engine.
- 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

Optional

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



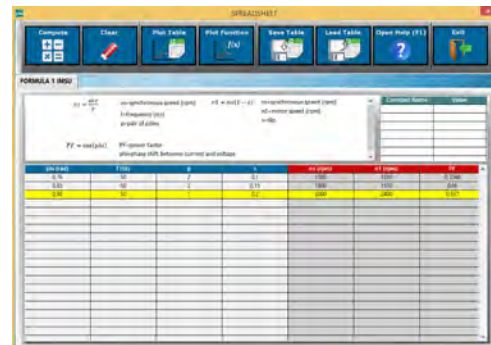
ESL-SOF. EDIBON Student LabSoft (Student Software) Application Main Screen



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.



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REPRESENTATIVE:

