



① Unit: AEL-TPT-06. Parallel Transmission Lines Protection

Key features:

- **Advanced Real-Time SCADA.**
- **Open Control + Multicontrol + Real-Time Control.**
- **Specialized EDIBON Control Software based on LabVIEW.**
- **Projector and/or electronic whiteboard compatibility allows the unit to be explained and demonstrated to an entire class at one time.**
- **Capable of doing applied research, real industrial simulation, training courses, etc.**
- **Remote operation and control by the user and remote control for EDIBON technical support, are always included.**
- **Totally safe, utilizing 4 safety systems (Mechanical, Electrical, Electronic & Software).**
- **Designed and manufactured under several quality standards.**
- **Optional ICAI software to create, edit and carry out practical exercises, tests, exams, calculations, etc.**  
**Apart from monitoring user's knowledge and progress reached.**
- **This unit has been designed for future expansion and integration. A common expansion is the EDIBON Scada-Net (ESN) System which enables multiple students to simultaneously operate many units in a network.**



For more information about Key Features, click here



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)



Certificate and Worlddidac Member

## GENERAL DESCRIPTION

Transmission and distribution lines require efficient protection systems to provide safety, reliability and quality to the power. In the event of meshed grids are necessary some types of protections. The overcurrent protection can be given directional feature by adding directional element in the protection system. Directional overcurrent protection responds to overcurrents for a particular flow direction. If power flow is in the opposite direction, the directional overcurrent protection remains un-operative.

The AEL-TPT-06 trainer has been developed as a complement to AEL-TPT-01 in order to study how protect a system with parallel transmission lines.

The AEL-TPT-06 offers to students a wide knowledge about selectivity on transmission lines. The student can configure and parametrize the protection relays in order to see how they protect the system when there are parallel transmission lines.

Required basic equipment:

- AEL-TPT-01. Overcurrent Time Protection Relay for Lines.

The AEL-TPT-04 includes the following modules:

- N-TOPR. Time Overcurrent Protection Relay.
- N-TDOPR. Time Directional Overcurrent Protection relay.
- N-AE1/1K. 1 KVA Transmission Line Simulator Module.
- N-PSM. Power Switch Module. (2 units)

Optional SCADA software:

- AEL-TPT-06/CCSOF. Computer Control + Data Acquisition + Data Management Software.

Optional learning software:

In addition, Edibon provides optional software (AEL-TPT-06/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-TPT-06 can be mounted on rack (option A) or on rail (option B):

Option A:

This application needs the following racks.

- N-RACK-B. (4 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.

Optionally This Computer Controlled Unit is supplied with the EDIBON Computer Control System (SCADA), and includes: The unit itself + Computer Control, Data Acquisition and Data Management Software Packages, for controlling the process and all parameters involved in the process.

With this unit there are several options and possibilities:

- Main items: 1, 3 and 4.
- Optional items: 2, 5, 6 and 7.

Let us describe first the main items (1 to 4):

① **AEL-TPT-06. Unit.**

Required basic equipment of AEL-TPT-01:

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

- ON-OFF removable key.
- Input Voltage: 400 VAC, 3PH+N.
- Output Voltage:
  - 0...450 VAC.
  - 0...240 VDC.
- Maximum current: 2 A.
- Frequency: 50/60 Hz.
- Wheel to regulate the voltage.
- Three lamps.
- Measurement commutators:
  - One commutator to measure the voltage:
    - 6 positions: L1-N ; L2-N ; L3-N ; L1-L2 ; L1-L3 ; L2-L3.
  - One commutator to measure the current:
    - 3 positions: I1, I2, I3.
- Three-Phase supply hose with IP44 3PN+E 32A 400V connecting plug.
- Differential magnetothermal, 4 poles, 25A, 300mA AC 6KA.



N-VPS01

- **N-MED65. Digital Multimeter.**

- This module has a digital multimeter of about 3 1/2 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-REVT/1K. 1kW Three-Phase Resistors Module.**

- Parallel, series, star and delta connection.
- Resistance: 3 x 750 Ohm.
- Current: 3 x 2 A.



N-REVT/1K

- **N-EALD. Network Analyzer Unit with Computer Data Acquisition.**

- ON-OFF switch.
- Supply voltage: 400 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.
- RS-485 Communication port.
- 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-EALD

- **N-AE1/1K. 1KVA Transmission Line Simulator Module.**

- Phase Resistance: 4 Ohm; 8 Ohm.
- Phase Inductance: 125mH 250mH.
- Phase Capacity:
  - Line-to-line: 2 x 100nF; 175nF
  - Line-to-ground: 2 x 0,4μF; 0,8μF
- Maximum power: 1kVA
- Nominal Voltage: 3x 400V; 50/60Hz
- Maximum Current: 2 A



N-AE1/1K

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

- The voltage can be switch on and off manually or automatically.
- Nominal voltage: 230/400VAC
- Frequency: 50/60Hz
- Control voltage: 24V
- Nominal operating current: 15A
- Functions: 2 pushbutton switches and remote control for switch-off relay.
- Contacts:
  - Three normally open contact.
  - One auxiliary normally open contact.



N-PSM

• **N-TOPR. Time Overcurrent Protection Relay.**

Nominal frequency: 50 to 60 Hz.  
 Thermal load capacity of current circuit:  
 Surge current (half-wave)  $250 \times I_N$   
 For 1s  $100 \times I_N$   
 For 10s  $30 \times I_N$   
 Continuous  $4 \times I_N$

Output relay:

Switch-on current: 20A  
 Nominal current: 5A  
 Max. contact rating:  
 1250 VA/DC; 120W/DC, ohmic.  
 500VA/AC; 75W/DC, inductive.

Trip parameters:

$I > 0.5-2 \times I_N$   
 $I > 1-15 \times I_N$   
 $tI > 0-100s$   
 $tI > 0-2.5s$

RS 485.



N-TOPR

• **N-RELT. Relay test module.**

Power supply: 110-230V AC  
 Frequency: 50/60Hz  
 Start/stop pushbutton.  
 Display.

Operation pushbuttons:

Switch-on (it can be remote controlled).  
 Switch-off (it can be remote controlled).  
 Timer ON (relay test).

Contacts:

Voltage: 0...400 VAC/VDC.  
 Current: 0...20 A AC/DC.  
 3 operating contacts.  
 2 auxiliary contacts.



N-RELT

• **N-CON02. 3-Pole Contactor.**

The technical specifications of the N-CON02 are:

Supply Voltage Coil: 240 VAC

Power terminals:

3 input power terminals.  
 3 output power terminals.

Auxiliary contacts:

3 normally open contacts (black).  
 3 normally closed contacts (red).



N-CON02

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

Electronic thermal relay.

Overload protection.

Range 1.2 - 7 A.

Reset and test function.

1 NONC contact.

Temporization.



N-RELO9

The trainer AEL-TPT-06 includes the following modules:

• **N-TOPR. Time Overcurrent Protection Relay.**

Nominal frequency: 50 to 60 Hz.  
 Thermal load capacity of current circuit:  
 Surge current (half-wave)  $250 \times I_N$   
 For 1s  $100 \times I_N$   
 For 10s  $30 \times I_N$   
 Continuous  $4 \times I_N$

Output relay:

Switch-on current: 20A  
 Nominal current: 5A  
 Max. contact rating:  
 1250 VA/DC; 120W/DC, ohmic.  
 500VA/AC; 75W/DC, inductive.

Trip parameters:

$I > 0.5-2 \times I_N$   
 $I > 1-15 \times I_N$   
 $tI > 0-100s$   
 $tI > 0-2.5s$

RS 485.



N-TOPR

• **N-TDOPR. Time Directional Overcurrent Protection relay.**

Nominal current: 1A  
 Nominal voltage: 400V  
 Nominal frequency: 50-60Hz  
 Setting ranges:  
 $I > : 0.5-2.0 \times I_N/t > : 0-100s$   
 $I > > : 1-15 \times I_N/t > > : 0-2.5s$   
 Tripping characteristics:  
 Normal inverse.  
 Very inverse.  
 Extremely inverse.  
 Independent.  
 The integrated interface RS 485.



N-TDOPR

• **N-AE1/1K. 1KVA Transmission Line Simulator Module.**

Phase Resistance: 4 Ohm; 8 Ohm.  
 Phase Inductance: 125mH 250mH.  
 Phase Capacity:  
 Line-to-line: 2 x 100nF; 175nF  
 Line-to-ground: 2 x 0,4μF; 0,8μF  
 Maximum power: 1kVA  
 Nominal Voltage: 3x 400V; 50/60Hz  
 Maximum Current: 2 A



N-AE1/1K

• **N-PSM. Power Switch Module (2 units).**

The voltage can be switch on and off manually or automatically.  
 Nominal voltage: 230/400VAC  
 Frequency: 50/60Hz  
 Control voltage: 24V  
 Nominal operating current: 15A  
 Functions: 2 pushbutton switches and remote control for switch-off relay.  
 Contacts:  
 Three normally open contact.  
 One auxiliary normally open contact.



N-PSM

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

The complete unit includes as well:

**Advanced Real-Time SCADA.**

**Open Control + Multicontrol + Real-Time Control.**

**Specialized EDIBON Control Software based on LabVIEW.**

**Projector and/or electronic whiteboard compatibility allows the unit to be explained and demonstrated to an entire class at one time.**

**Capable of doing applied research, real industrial simulation, training courses, etc.**

**Remote operation and control by the user and remote control for EDIBON technical support, are always included.**

**Totally safe, utilizing 4 safety systems (Mechanical, Electrical, Electronic & Software).**

**Designed and manufactured under several quality standards.**

**Optional ICAI software to create, edit and carry out practical exercises, tests, exams, calculations, etc.**

**Apart from monitoring user's knowledge and progress reached.**

**This unit has been designed for future expansion and integration. A common expansion is the EDIBON Scada-Net (ESN) System which enables multiple students to simultaneously operate many units in a network.**

② **AEL-TPT-06/CCSOF. Computer Control + Data Acquisition + Data Management Software:**

The three softwares are part of the SCADA system.

Compatible with actual Windows operating systems. Graphic and intuitive simulation of the process in screen. **Compatible with the industry standards.**

Registration and visualization of all process variables in an automatic and simultaneous way.

**Flexible, open and multicontrol software**, developed with actual windows graphic systems, acting simultaneously on all process parameters.

**Management, processing, comparison and storage of data.**

**It allows the registration of the alarms state and the graphic representation in real time.**

Comparative analysis of the obtained data, after the process and modification of the conditions during the process.

**Open software, allowing the teacher to modify texts, instructions. Teacher's and student's passwords** to facilitate the teacher's control on the student, and allowing the access to different work levels.

**This unit allows the 30 students of the classroom to visualize simultaneously all the results and the manipulation of the unit, during the process, by using a projector or an electronic whiteboard.**

③ **Cables and Accessories**, for normal operation.

④ **Manuals:**

This unit is **supplied with 7 manuals:** Required Services, Assembly and Installation, Control Software, Starting-up, Safety, Maintenance & Practices Manuals.

\*References 1 to 4 are the main items: AEL-TPT-06 + AEL-TPT-06/CCSOF + Cables and Accessories + Manuals are included in the minimum supply for enabling normal and full operation.



AEL-TPT-06/CCSOF

## EXERCISES AND PRACTICAL POSSIBILITIES TO BE DONE WITH THE MAIN ITEMS

Some practical exercises possibilities of basic equipment (AEL-TPT-01):

- 1.- Configuration of overcurrent time protection relay.
- 2.- Parameterization of overcurrent time protection relay.
- 3.- Commissioning of overcurrent time protection relay.
- 4.- Configuration of different protection thresholds.
- 5.- Generation of different current levels for tripping operations.
- 6.- Analysis of different wave forms in real time.
- 7.- Determining rise and fall time.
- 8.- Determining the reset ratio.
- 9.- Setting and testing various characteristics.
- 10.- Checking circuit breaker's release behavior in the event of a failure.

Some practical exercises possibilities with the specific modules of AEL-TPT-06:

- 11.- Configuration of directional protection relay.
- 12.- Parameterization of directional protection relay.
- 13.- Commissioning of directional protection relay.
- 14.- Configuration of directional protection relay thresholds.

15.- Combining of directional protection relay and overcurrent protection relay for selectivity studies.

Other possibilities to be done with this Unit:

- 16.- Many students view results simultaneously.  
To view all results in real time in the classroom by means of a projector or an electronic whiteboard.
  - 17.- The Computer Control System with SCADA allows a real industrial simulation.
  - 18.- This unit is totally safe as uses mechanical, electrical and electronic, and software safety devices.
  - 19.- This unit can be used for doing applied research.
  - 20.- This unit can be used for giving training 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, 380V./50 Hz. or 208V./60 Hz., 20 Kw.
- Computer.

## DIMENSIONS AND WEIGHTS

AEL-TPT-06:

- Dimensions: 2000 x 400 x 2000 mm. approx.  
(78.74 x 15.75 x 78.74 inches approx.)
- Weight: 100 Kg. approx.  
(220 pounds approx.)

## AVAILABLE VERSIONS

Offered in this catalogue:

- AEL-TPT-06. Parallel Transmission Lines Protection Relay.

Offered in other catalogues:

- AEL-TPT-01. Overcurrent Time Protection Relay for Lines.
- AEL-TPT-02. Directional Overcurrent Protection Relay for Transmission Lines.
- AEL-TPT-03. Overvoltage and Undervoltage Protection Relay.
- AEL-TPT-04. Directional Power Protection Relay.
- AEL-TPT-05. Earth-Fault Voltage Protection Relay.
- AEL-TPT-07. High Speed Distance Protection Relay.

Additionally to the main items (1, 3, 4) described, we can offer, as optional, other items 2 and from 5 to 7.

All these items try to give more possibilities for:

- a) Technical and Vocational Education configuration. (ICAI)
- b) Multipost Expansions options. (Mini ESN and ESN)

a) Technical and Vocational Education configuration

**⑤ AEL-TPT-06/ICAI. Interactive Computer Aided Instruction Software System.**

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.

This software is optional and can be used additionally to items (1 to 4).

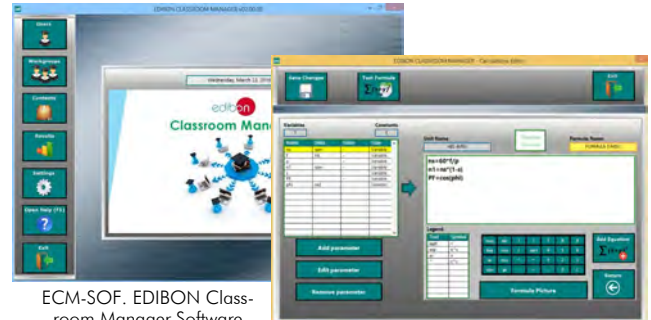
**-ECM-SOF. EDIBON Classroom Manager (Instructor Software).**

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:

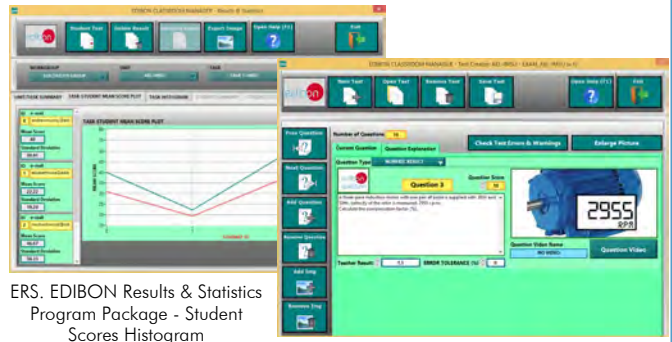
- User Data Base Management.**
- Administration and assignment of Workgroups, Tasks and Training sessions.**
- Creation and Integration of Practical Exercises and Multimedia Resources.**
- Custom Design of Evaluation Methods.**
- Creation and assignment of Formulas & Equations.**
- Equation System Solver Engine.**
- Updatable Contents.**
- Report generation, User Progression Monitoring and Statistics.**

EDIBON Classroom Manager



ECM-SOF. EDIBON Classroom Manager Software Application main screen

ECAL. EDIBON Calculations Program Package - Formula Editor Screen



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

ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question

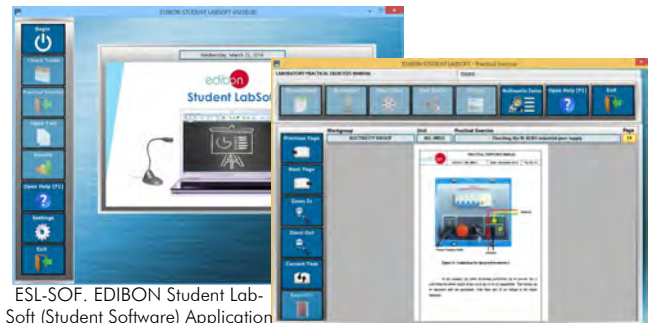
**-ESL-SOF. EDIBON Student Labsoft (Student Software).**

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:

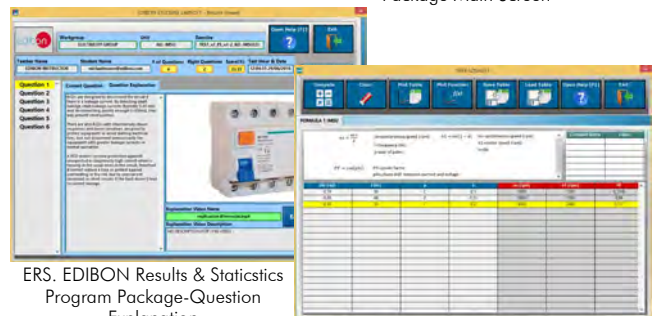
- Student Log-In & Self-Registration.**
- Existing Tasks checking & Monitoring.**
- Default contents & scheduled tasks available to be used from the first session.**
- Practical Exercises accomplishment by following the Manual provided by EDIBON.**
- Evaluation Methods to prove your knowledge and progression.**
- Test self-correction.**
- Calculations computing and plotting.**
- Equation System Solver Engine.**
- User Monitoring Learning & Printable Reports.**
- Multimedia-Supported auxiliary resources.**

EDIBON Student LabSoft



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

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

[www.edibon.com/products/catalogues/en/units/electricity/ICAI-Electricity/ICAI-Electricity.pdf](http://www.edibon.com/products/catalogues/en/units/electricity/ICAI-Electricity/ICAI-Electricity.pdf)

⑥ **Mini ESN. EDIBON Mini Scada-Net System.**

Mini ESN. EDIBON Mini Scada-Net System allows up to 30 students to work with a Teaching Unit in any laboratory, simultaneously.

It is useful for both, Higher Education and/or Technical and Vocational Education.

The Mini ESN system consists of the adaptation of any EDIBON computer controlled unit with SCADA integrated in a local network.

This system allows to view/control the unit remotely, from any computer integrated in the local net (in the classroom), through the main computer connected to the unit. Then, the number of possible users who can work with the same unit is higher than in an usual way of working (usually only one).

Main characteristics:

- It allows up to 30 students to work simultaneously with the EDIBON Computer Controlled Unit with SCADA, connected in a local net.
- Open Control + Multicontrol + Real Time Control + Multi Student Post.
- Instructor controls and explains to all students at the same time.
- Any user/student can work doing "real time" control/multicontrol and visualisation.
- Instructor can see in the computer what any user/student is doing in the unit.
- Continuous communication between the instructor and all the users/students connected.

Main advantages:

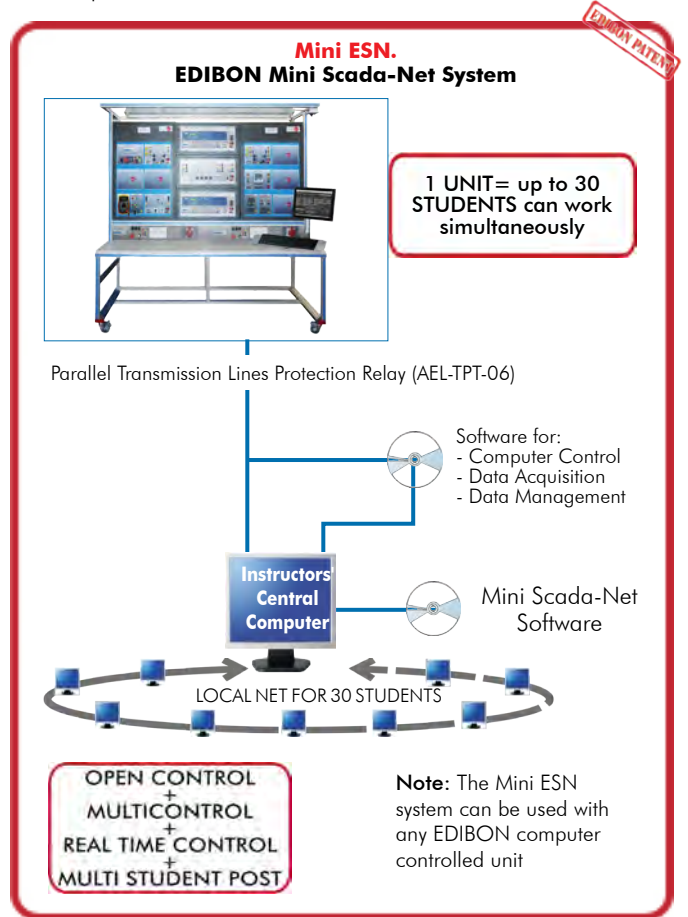
- It allows an easier and quicker understanding.
- This system allows you can save time and cost.
- Future expansions with more EDIBON Units.

For more information see Mini ESN catalogue. Click on the following link:

[www.edibon.com/products/catalogues/en/Mini-ESN.pdf](http://www.edibon.com/products/catalogues/en/Mini-ESN.pdf)

⑦ **ESN. EDIBON Scada-Net System.**

This unit can be integrated, in the future, into a Complete Laboratory with many Units and many Students.





## ORDER INFORMATION

### **Main items** (always included in the supply)

Minimum supply always includes:

- ① **Unit: AEL-TPT-06. Parallel Transmission Lines Protection.**
- ③ **Cables and Accessories**, for normal operation.
- ④ **Manuals.**

\*IMPORTANT: Under AEL-TPT-06 we always supply all the elements for immediate running as 1, 3 and 4.

### **Optional items** (supplied under specific order)

- ② AEL-TPT-06/CCSOF. Computer Control + Data Acquisition + Data Management Software.
  - a) Technical and Vocational configuration
- ⑤ AEL-TPT-06/ICAI. Interactive Computer Aided Instruction Software System.
  - b) Multipost Expansions options
- ⑥ Mini ESN. EDIBON Mini Scada-Net System.
- ⑦ ESN. EDIBON Scada-Net System.

**① AEL-TPT-06. Unit.**

Required basic equipment of AEL-TPT-01:

- N-VPS01. AC 3PH Variable Power Supply.
  - ON-OFF removable key.
  - Input Voltage: 400 VAC, 3PH+N
  - Output Voltage:
    - 0...450 VAC
    - 0...240 VDC
  - Maximum current: 2 A
  - Frequency: 50/60 Hz
  - Wheel to regulate the voltage.
  - Three lamps.
  - Measurement commutators:
    - One commutator to measure the voltage:
      - 6 positions: L1-N ; L2-N ; L3-N ; L1-L2 ; L1-L3 ; L2-L3
    - One commutator to measure the current:
      - 3 positions: I1, I2, I3
  - Three-Phase supply hose with IP44 3PN+E 32A 400V connecting plug.
  - Differential magnetothermal, 4 poles, 25A, 300mA AC 6KA
- 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-REVT/1K. 1kW Three-Phase Resistors Module.
  - Parallel, series, star and delta connection.
  - Resistance: 3 x 750 Ohm
  - Current: 3 x 2 A
- N-EALD. Network Analyzer Unit with Computer Data Acquisition.
  - ON-OFF switch.
  - Supply voltage: 400 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.
  - RS-485 Communication port.
  - 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-AE1/1K. 1KVA Transmission Line Simulator Module.
  - Phase Resistance: 4 Ohm; 8 Ohm.
  - Phase Inductance: 125mH 250mH
  - Phase Capacity:
    - Line-to-line: 2 x 100nF; 175nF
    - Line-to-ground: 2 x 0,4µF; 0,8µF
  - Maximum power: 1kVA
  - Nominal Voltage: 3x 400V; 50/60Hz
  - Maximum Current: 2 A
- N-PSM. Power Switch Module.
  - The voltage can be switch on and off manually or automatically.
  - Nominal voltage: 230/400VAC
  - Frequency: 50/60Hz
  - Control voltage: 24V
  - Nominal operating current: 15A
  - Functions: 2 pushbutton switches and remote control for switch-off relay.
  - Contacts:
    - Three normally open contact.
    - One auxiliary normally open contact.
- N-TOPR. Time Overcurrent Protection Relay.
  - Nominal frequency: 50 to 60 Hz
  - Thermal load capacity of current circuit:
    - Surge current (half-wave) 250x I<sub>N</sub>
      - For 1s 100x I<sub>N</sub>
      - For 10s 30x I<sub>N</sub>
      - Continuous 4x I<sub>N</sub>
  - Output relay:
    - Switch-on current: 20A
    - Nominal current: 5A
    - Max. contact rating:
      - 1250 VA/DC; 120W/DC, ohmic.
      - 500VA/AC; 75W/DC, inductive.
    - Trip parameters:
      - I > 0.5-2x I<sub>N</sub>
      - I > 1-15x I<sub>N</sub>
      - tI > 0-100s
      - tI > 0-2.5s

RS 485.

## Tender Specifications (for main items)

- N-RELT. Relay test module.  
Power supply: 110-230V AC  
Frequency: 50/60Hz  
Start/stop pushbutton.  
Display.  
Operation pushbuttons:  
Switch-on (it can be remote controlled).  
Switch-off (it can be remote controlled).  
Timer ON (relay test).  
Contacts:  
Voltage: 0...400 VAC/VDC.  
Current: 0...20 A AC/DC.  
3 operating contacts.  
2 auxiliary contacts.
- N-CON02. 3-Pole Contactor.  
The technical specifications of the N-CON02 are:  
Supply Voltage Coil: 240 VAC  
Power terminals:  
3 input power terminals.  
3 output power terminals.  
Auxiliary contacts:  
3 normally open contacts (black).  
3 normally closed contacts (red).
- N-RELO9. Time Electronic Relay against Overcurrents (1.2 - 7 A).  
Electronic thermal relay.  
Overload protection.  
Range 1.2 - 7 A.  
Reset and test function.  
1 NONC contact.  
Temporization.

The trainer AEL-TPT-06 includes the following modules:

- N-TOPR. Time Overcurrent Protection Relay.  
Nominal frequency: 50 to 60 Hz.  
Thermal load capacity of current circuit:  
Surge current (half-wave)  $250 \times I_N$   
For 1s  $100 \times I_N$   
For 10s  $30 \times I_N$   
Continuous  $4 \times I_N$   
Output relay:  
Switch-on current: 20A  
Nominal current: 5A  
Max. contact rating:  
1250 VA/DC; 120W/DC, ohmic.  
500VA/AC; 75W/DC, inductive.  
Trip parameters:  
 $I > 0.5-2 \times I_N$   
 $I > 1-1.5 \times I_N$   
 $tI > 0-100s$   
 $tI > 0-2.5s$   
RS 485.
- N-TDOPR. Time Directional Overcurrent Protection relay.  
Nominal current: 1A  
Nominal voltage: 400V  
Nominal frequency: 50-60Hz  
Setting ranges:  
 $I >: 0.5-2.0 \times I_N / tI >: 0-100s$   
 $I > >: 1-1.5 \times I_N / tI > >: 0-2.5s$   
Tripping characteristics:  
Normal inverse.  
Very inverse.  
Extremely inverse.  
Independent.  
The integrated interface RS 485.
- N-AE1/1K. 1KVA Transmission Line Simulator Module.  
Phase Resistance: 4 Ohm; 8 Ohm.  
Phase Inductance: 125mH 250mH.  
Phase Capacity:  
Line-to-line: 2 x 100nF; 175nF  
Line-to-ground: 2 x 0,4 $\mu$ F; 0,8 $\mu$ F  
Maximum power: 1kVA  
Nominal Voltage: 3x 400V; 50/60Hz  
Maximum Current: 2 A

- N-PSM. Power Switch Module (2 units).  
 The voltage can be switch on and off manually or automatically.  
 Nominal voltage: 230/400VAC  
 Frequency: 50/60Hz  
 Control voltage: 24V  
 Nominal operating current: 15A  
 Functions: 2 pushbutton switches and remote control for switch-off relay.  
 Contacts:  
 Three normally open contact.  
 One auxiliary normally open contact.
  - All necessary cables to realize the practical exercises are included.
- The complete unit includes as well:
- Advanced Real-Time SCADA.
  - Open Control + Multicontrol + Real-Time Control.
  - Specialized EDIBON Control Software based on LabVIEW.
  - Projector and/or electronic whiteboard compatibility allows the unit to be explained and demonstrated to an entire class at one time.
  - Capable of doing applied research, real industrial simulation, training courses, etc.
  - Remote operation and control by the user and remote control for EDIBON technical support, are always included.
  - Totally safe, utilizing 4 safety systems (Mechanical, Electrical, Electronic & Software).
  - Designed and manufactured under several quality standards.
  - Optional ICAI software to create, edit and carry out practical exercises, tests, exams, calculations, etc.
  - Apart from monitoring user's knowledge and progress reached.
  - This unit has been designed for future expansion and integration. A common expansion is the EDIBON Scada-Net (ESN) System which enables multiple students to simultaneously operate many units in a network.

**② AEL-TPT-06/CCSOF. Computer Control + Data Acquisition + Data Management Software: .**

- The three softwares are part of the SCADA system.
- Compatible with the industry standards.
- Flexible, open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters.
- Management, processing, comparison and storage of data.
- It allows the registration of the alarms state and the graphic representation in real time.
- Open software, allowing the teacher to modify texts, instructions. Teacher's and student's passwords to facilitate the teacher's control on the student, and allowing the access to different work levels.
- This unit allows the 30 students of the classroom to visualize simultaneously all the results and the manipulation of the unit, during the process, by using a projector or an electronic whiteboard.

**③ Cables and Accessories, for normal operation.**

**④ Manuals:**

- This unit is supplied with 7 manuals: Required Services, Assembly and Installation, Control Software, Starting-up, Safety, Maintenance & Practices Manuals.

**Exercises and Practical Possibilities to be done with the Main Items**

Some practical exercises possibilities of basic equipment (AEL-TPT-01):

- 1.- Configuration of overcurrent time protection relay.
- 2.- Parameterization of overcurrent time protection relay.
- 3.- Commissioning of overcurrent time protection relay.
- 4.- Configuration of different protection thresholds.
- 5.- Generation of different current levels for tripping operations.
- 6.- Analysis of different wave forms in real time.
- 7.- Determining rise and fall time.
- 8.- Determining the reset ratio.
- 9.- Setting and testing various characteristics.
- 10.- Checking circuit breaker's release behavior in the event of a failure.

Some practical exercises possibilities with the specific modules of AEL-TPT-06:

- 11.- Configuration of directional protection relay.
- 12.- Parameterization of directional protection relay.
- 13.- Commissioning of directional protection relay.
- 14.- Configuration of directional protection relay thresholds.
- 15.- Combining of directional protection relay and overcurrent protection relay for selectivity studies.

Other possibilities to be done with this Unit:

- 16.- Many students view results simultaneously.  
 To view all results in real time in the classroom by means of a projector or an electronic whiteboard.
  - 17.- The Computer Control System with SCADA allows a real industrial simulation.
  - 18.- This unit is totally safe as uses mechanical, electrical and electronic, and software safety devices.
  - 19.- This unit can be used for doing applied research.
  - 20.- This unit can be used for giving training courses to Industries even to other Technical Education Institutions.
- Several other exercises can be done and designed by the user.

a) Technical and Vocational Education configuration

**⑤ AEL-TPT-06/ICAI. Interactive Computer Aided Instruction Software System.**

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.

-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.

-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.

b) Multipost Expansions options

**⑥ Mini ESN. EDIBON Mini SCADA-Net System.**

EDIBON Mini SCADA-Net System allows up to 30 students to work with a Teaching Unit in any laboratory, simultaneously.

The Mini ESN system consists of the adaptation of any EDIBON Computer Controlled Unit with SCADA integrated in a local network.

This system allows to view/control the unit remotely, from any computer integrated in the local net (in the classroom), through the main computer connected to the unit.

Main characteristics:

- It allows up to 30 students to work simultaneously with the EDIBON Computer Controlled Unit with SCADA, connected in a local net.
- Open Control + Multicontrol + Real Time Control + Multi Student Post.
- Instructor controls and explains to all students at the same time.
- Any user/student can work doing "real time" control/multicontrol and visualisation.
- Instructor can see in the computer what any user/student is doing in the unit.
- Continuous communication between the instructor and all the users/students connected.

Main advantages:

- It allows an easier and quicker understanding.
- This system allows you can save time and cost.
- Future expansions with more EDIBON Units.

The system basically will consist of:

This system is used with a Computer Controlled Unit.

- Instructor's computer.
- Students' computers.
- Local Network.
- Unit-Control Interface adaptation.
- Unit Software adaptation.
- Webcam.
- Mini ESN Software to control the whole system.
- Cables and accessories required for a normal operation.

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

REPRESENTATIVE



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