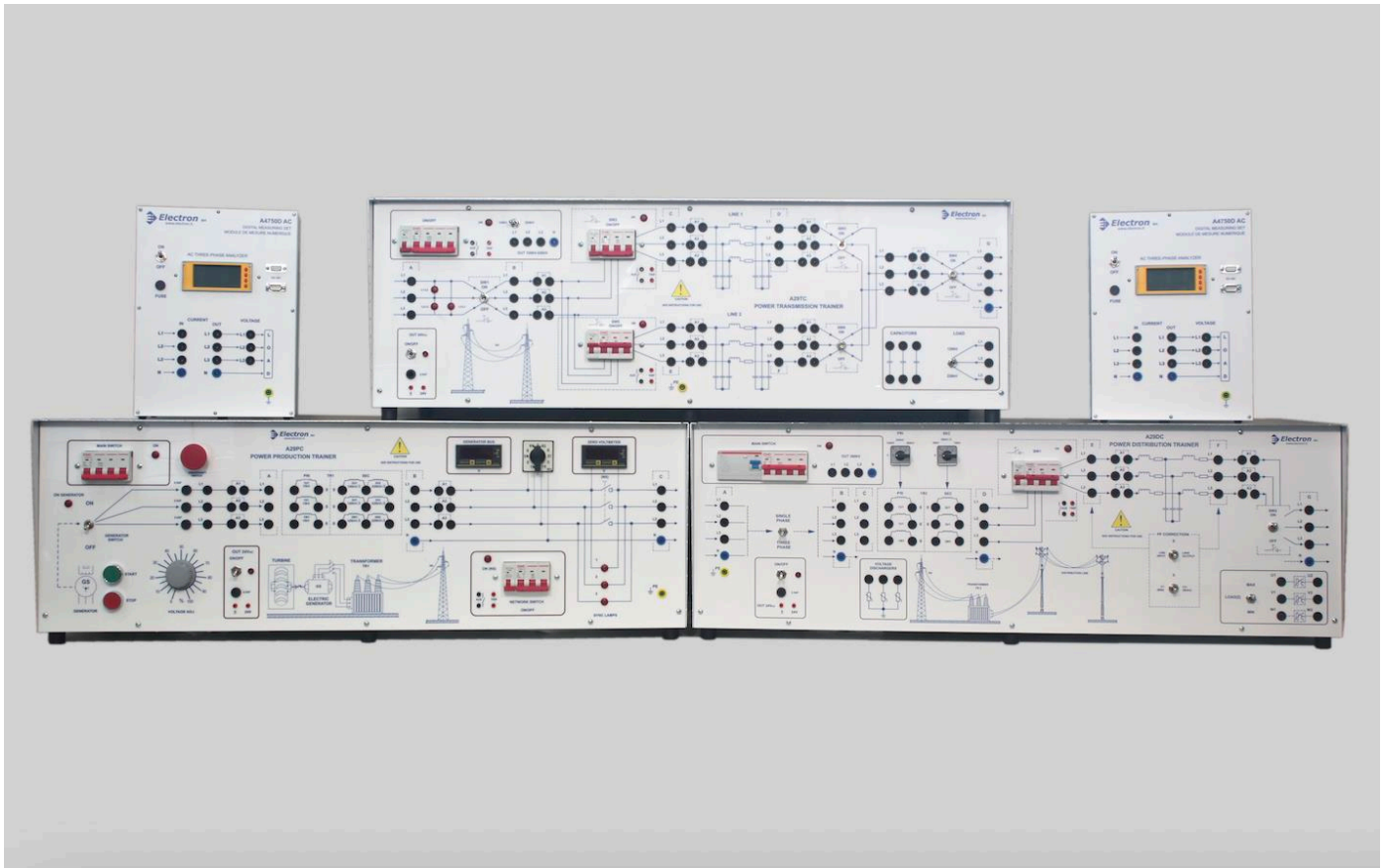




## Lab 4 - ELECTRICAL POWER SYSTEMS



This laboratory simulates a real-life generation, transmission and distribution system based on standard electrical machines, instruments, and a simulated transmission line.

The simulator reproduces the conditions of a 30 kV, 30 Km long overhead line.

The modularity and integration capabilities of this trainer allow maximum flexibility in implementing the desired configuration.

With the proposed mix of products, additional experiments may be designed to reproduce the many different situations that in a power generation, transmission and distribution system may be encountered both in normal and abnormal/failure conditions.

### TRAINING STATIONS LIST

|     |                                |
|-----|--------------------------------|
| 4.1 | POWER PRODUCTION               |
| 4.2 | POWER TRANSMISSION             |
| 4.3 | POWER DISTRIBUTION             |
| 4.4 | SCADA MONITORING SYSTEM        |
| 4.5 | PROGRAMMABLE PROTECTION RELAYS |
| 4.6 | REACTIVE POWER CONTROL         |
| 4.7 | ANALOGUE PROTECTION RELAYS     |
| 4.8 | DIGITAL PROTECTION RELAYS      |

# Equipment List

| LAB N°   | Item N° | TITLE   | CODE           | Tot al Qty | Stud WS 1 | Stud WS 2 | Stud WS 3 | Stud WS 4 | Stud WS 5 | Stud WS 6 | Stud WS 7 | Stud WS 8 | Teach WS | LAB |
|--|---------|---|----------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----|
| <b>4 ELECTRICAL POWER SYSTEM LABORATORY</b><br>Teacher demonstration system. |         |   |                |            |           |           |           |           |           |           |           |           |          |     |
| 4  | 1       | <b>ELECTRICAL POWER SYSTEM TRAINER (BASIC CONFIGURATION)</b>  | <b>A29B</b>    |            |           |           |           |           |           |           |           |           |          |     |
| 4  | 1       | 1 UNIVERSAL POWER SUPPLY                                      | A0245          | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 1       | 2 DC SHUNT EXCITATION MOTOR-GENERATOR                         | A42445         | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 1       | 3 SYNCHRONOUS MACHINE   | A42235         | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 1       | 4 COUPLING BASE   | A48405         | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 1       | 5 PARALLELING BOARD   | A4810 SYNC1    | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 1       | 6 DISTRIBUTION SIMULATOR                                      | A29 IDLE/3     | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 1       | 7 RESISTIVE LOAD  | A45105         | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 1       | 8 CAPACITIVE LOAD   | A45205         | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 1       | 9 INDUCTIVE LOAD  | A45305         | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 1       | 10 SQUIRREL CAGE MOTOR  | A42205         | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 1       | 11 SLIP RING MOTOR  | A42225         | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 1       | 12 CAPACITOR MOTOR  | A42325         | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 1       | 13 3 PHASE SWITCH   | A4852 A21 M021 | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 1       | 14 STAR/DELTA STARTER   | A4820 A21 M216 | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 1       | 15 DIGITAL ELECTRIC POWER MEASURING MODULE                    | A4750D         | 2          |           |           |           |           |           |           |           |           | 2        |     |
| 4  | 1       | 16 ANALOGUE METERS SET  | A29AM          | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 1       | 17 FRAMEWORK FOR PANELS                                       | B4195          | 1          |           |           |           |           |           |           |           |           | 1        |     |
| <b>4</b>   |         |   |                |            |           |           |           |           |           |           |           |           |          |     |
| 4  | 2       | <b>REACTIVE POWER CONTROL</b>                                 | <b>A268</b>    |            |           |           |           |           |           |           |           |           |          |     |
| 4  | 2       | 1 REACTIVE POWER CONTROLLER                                   | A2680          | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 2       | 2 CAPACITOR BANK  | A2685          | 1          |           |           |           |           |           |           |           |           | 1        |     |
| <b>4</b>   |         |   |                |            |           |           |           |           |           |           |           |           |          |     |
| 4  | 3       | <b>DIGITAL RELAYS</b>   | <b>A266</b>    |            |           |           |           |           |           |           |           |           |          |     |
| 4  | 3       | 1 UNDER-OVER CURRENT RELAY (DIGITAL)                          | A2661          | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 3       | 2 UNDER-OVER VOLTAGE RELAY (DIGITAL)                          | A2662          | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 3       | 3 EARTH FAULT RELAY (DIGITAL)                                 | A2663          | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 3       | 4 CABLES SET  | A4890          | 1          |           |           |           |           |           |           |           |           | 1        |     |
| <b>4</b>   |         |   |                |            |           |           |           |           |           |           |           |           |          |     |
| 4  | 4       | <b>ELECTRICAL POWER SYSTEM TRAINER (UPGRADE)</b>              | <b>A29U</b>    |            |           |           |           |           |           |           |           |           |          |     |
| 4  | 4       | 1 PRODUCTION SIMULATOR  | A29 CE-PE      | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 4       | 2 TRANSMISSION SIMULATOR                                      | A29 SLE/2      | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 4       | 3 UNIVERSAL POWER SUPPLY                                      | A0245          | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 4       | 4 DC COMPOUND EXCITATION MOTOR-GENERATOR                      | A42405         | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 4       | 5 SYNCHRONOUS MACHINE   | A42235         | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 4       | 6 COUPLING BASE   | A48405         | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 4       | 7 PHASE SEQUENCE INDICATOR                                    | A12 SFT 3546   | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 4       | 8 SINGLE TAPPING KEY  | A12 ST/1B      | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 4       | 9 REVERSING SWITCH  | A12 CI/2B      | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 4       | 10 SINGLE PHASE TRANSFORMER                                   | A41105         | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 4       | 11 THREE PHASE TRANSFORMER                                    | A41155         | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 4       | 12 THREE PHASE VARIABLE AUTOTRANSFORMER                       | A41215         | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 4       | 13 CABLES SUPPORT   | A4890 CS       | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 4       | 14 DIGITAL ELECTRIC POWER MEASURING MODULE                    | A4750D         | 2          |           |           |           |           |           |           |           |           | 2        |     |
| 4  | 4       | 15 DC MOTOR CONTROL WITH THYRISTORS                           | B3607 C3607    | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 4       | 16 DC MOTOR CONTROL TRAINER (PWM)                             | B3610G         | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 4       | 17 CABLES SET   | A4890          | 1          |           |           |           |           |           |           |           |           | 1        |     |
| <b>4</b>   |         |   |                |            |           |           |           |           |           |           |           |           |          |     |
| 4  | 5       | <b>PROGRAMMABLE RELAYS</b>                                    | <b>A267</b>    |            |           |           |           |           |           |           |           |           |          |     |
| 4  | 5       | 1 OVER CURRENT RELAY (PROGRAMMABLE)                           | A2671          | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 5       | 2 UNDER-OVER VOLTAGE & FREQUENCY RELAY (PROGRAMMABLE)         | A2672          | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 5       | 3 DIRECTIONAL OVER CURRENT & EARTH FAULT RELAY (PROGRAMMABLE) | A2673          | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 5       | 4 3PH TRANSFORMER DIFFERENTIAL PROTECTION RELAY               | A2674          | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 5       | 5 CABLES SET  | A4890          | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 4  | 5       | 6 FRAMEWORK FOR PANELS  | B4195          | 1          |           |           |           |           |           |           |           |           | 1        |     |
| <b>1</b>   |         |   |                |            |           |           |           |           |           |           |           |           |          |     |
| <b>FURNITURE</b>   |         |   |                |            |           |           |           |           |           |           |           |           |          |     |
| 1  | 1       | 1 WORK TABLE  | F1110A         | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 1  | 1       | 2 MOBILE LOWER CABINET  | F11 4146       | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 1  | 1       | 3 STUDENT STOOL   | F11 1718       | 3          |           |           |           |           |           |           |           |           | 3        |     |
| 1  | 1       | 4 TEACHER'S DESK  | F11 2126       | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 1  | 1       | 5 TEACHER'S CHAIR   | F11 5000       | 1          |           |           |           |           |           |           |           |           | 1        |     |
| 1  | 1       | 6 CABINET FOR TOOLS & INSTRUMENTS                             | F11 3310       | 4          |           |           |           |           |           |           |           |           | 4        |     |
| 1  | 1       | 7 TROLLEY   | F1151 R1       | 4          |           |           |           |           |           |           |           |           | 4        |     |
| <b>1</b>   |         |   |                |            |           |           |           |           |           |           |           |           |          |     |
| <b>GENERAL USE MEASURING INSTRUMENTS, POWER SUPPLIES &amp; ACCESSORIES</b>   |         |   |                |            |           |           |           |           |           |           |           |           |          |     |
| 1  | 2       | 1 ANALOGUE MULTIMETER   | AM 7080        | 4          |           |           |           |           |           |           |           |           | 4        |     |
| 1  | 2       | 2 DIGITAL MULTIMETER  | DM Y68         | 4          |           |           |           |           |           |           |           |           | 4        |     |
| 1  | 2       | 3 ANALOGUE ELECTRICAL METERS SET                              | A11 AM         | 1          |           |           |           |           |           |           |           |           | 1        |     |

Other products available for individual needs: please ask for complete price list.