

EL - 111

Power Transmission Simulation Trainer

Overview

The training system is designed to help students to study Electrical Power Engineering systems. The trainer is composed of a set of modules for the simulation of the various components forming a complete electrical power system, from power generation to energy utilization.

Key Features

- Module Based
- Power Supplies Included
- Flexibility to Perform Custom Experiments
- Passive Components Included
- Resistors, Capacitors and Inductors Included
- Control Circuits Included
- P.T. and other Passive Components Included
- Protection Circuits Included



Experiments

Three-Phase Transformer Experiments

- Determination of the vector group of the three-phase transformer.
- Determination of the voltage transformation ratio of the transformer operating at no-load.
- Determination of the current transformation ratio of the transformer operating with short-circuits.
- Determination of the equivalent circuit quantities based on the consumed active and reactive power.
- Measurement of the effect of the load type and magnitude on the performance of the secondary voltage.
- Determination of the efficiency of the transformer.
- Investigation of the zero-impedance of the three-phase transformer with various connection modes.
- Examination of the load capacity of the secondary side using a single-phase load with different connection modes on the primary side.
- Determination of the influence of a delta stabilizing winding.
- Demonstration of the possibility of utilizing a three-phase transformer in economy connection (auto-transformer).

Overhead Line Model Experiments

- Measurement of the voltage in no-load operation.
- Concept of operating capacitance.
- Line model with increased operating capacitance.
- Measurement of current and voltage relationship of an overhead line in matched-load operation, interpretation of the terms: characteristic wave impedance, lagging and leading operation, efficiency and transmission losses.
- Measurement and interpretation of the current and voltage ratios of a transmission line during a three-phase short-circuit.
- Measurement and interpretation of the current and voltage ratios of a transmission line with mixed ohmic-inductive and pure inductive loads.
- Measurement and interpretation of the current and voltage ratios of a transmission line with mixed ohmic-capacitive and pure capacitive loads.
- Investigation on the performance of a transmission line with isolated neutral point connection in the case of a fault to earth.
- Measurement of the earth-fault current and the voltage rise of the fault phases.
- Determination of the inductance of an earth-fault neutralizer for the overhead line model.
- Investigation on the performance of a transmission line with a fault and comparison of the current values with those determined during earth-fault with isolated neutral point system.
- Measurement of the fault currents of the results with those for a three-phase fault.
- Investigation on the effect of parallel compensation on the voltage stability at the load and the transmission losses of the line.

- Investigation on the effect of series compensation on the voltage stability at the load.
- Use of measurement techniques to determine the zero-phase sequence impedance of the overhead line model and comparison of this value with the theoretical one.

Series and Parallel Connections of HV Lines

- Measurement of the voltage distribution in the series connection of two lines without operating capacitance.
- Measurement of the voltage distribution in the series connection of two lines with operating capacitances.
- Measurement of the voltage distribution in the parallel connection of two lines without operating capacitances.
- Measurement of the voltage distribution in the parallel connection of two lines with operating capacitance.

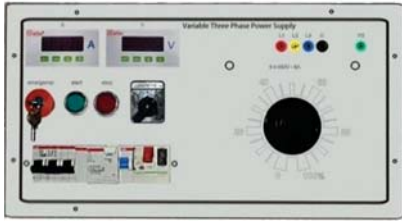
Busbar System Experiments

- Operation of a switching station with two bushars and different voltage.
- Busbar transfer with interruption of the power supply to the consumer.
- Busbar coupling and bus transfer without interruption of the power supply to the consumer.
- Switching sequence for disconnectors and power circuit breakers.

Trainer Modules

1 Variable three-phase power supply

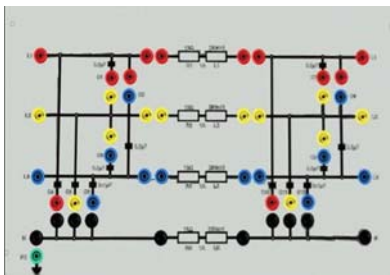
- Power supply unit used for variable 3-phase voltage suitable for supplying AC machines.



- Provided with start stop/stop push bottom EMO
- Three Phase AC Adjustable Output: 3 x 0~380/415V: 6A
- Three Phase AC Fixed Output: 240/415V: 10A

2 Line model

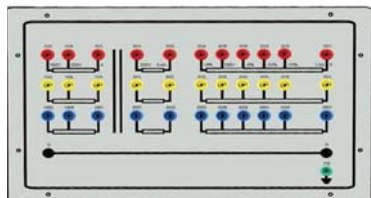
- Three-phase model of an overhead power transmission line 360 km long, voltage 380 kV and current 1000 A.



- Scale factor: 1:1000
- Line resistance: 13 Ω
- Line inductance: 290 mH

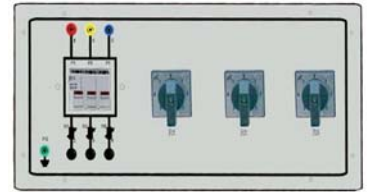
3 Three-phase transformer

- Three-phase transformer for feeding a transmission line model 380 kV with scale factor 1:1000
- Primary: 3 x 380 V windings with tap at 220 V
- star or delta connection
- Secondary: 3 x 220 V windings with taps at +5%, -5%, -10%, -15%



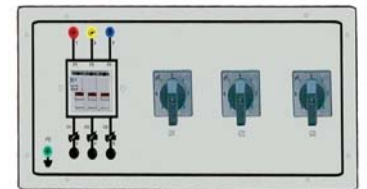
4 Resistive load

- Composed of three resistances, with possibility of star, delta and parallel connection, controlled by three switches with seven steps each.
- Max. power in single or three-phase connection: 1200 W



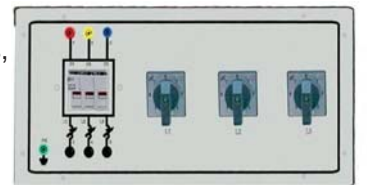
5 Capacitive load

- Composed of three batteries of capacitors, with possibility of star, delta and parallel connection, controlled by three switches with seven steps each.
- Max. reactive power in single or three-phase connection: 825 VAR



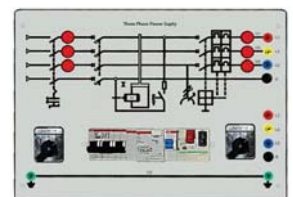
6 Inductive load

- Composed of three inductances, with possibility of star, delta and parallel connection, controlled by three switches with seven steps each.
- Max. reactive power in single or three-phase connection: 900 VAR



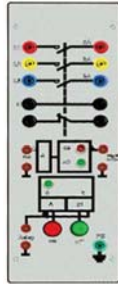
7 Three-phase power supply

- Power supply unit for three-phase connection with 4-pole cam mains switch.
- 25 A current operated earth leakage circuit breaker, sensitivity 30 mA.



8 Power circuit breaker

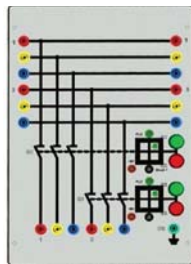
- Three-phase power circuit breaker with normally closed auxiliary contact.



9 Double busbar with two disconnectors

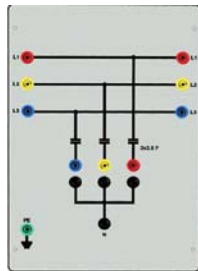
2 Busbars for parallel lines operation

Having 2 outgoing feeders for connection / disconnection



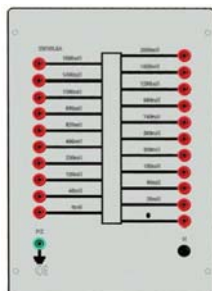
10 Line capacitor

- Three-phase capacitors in star connection with exactly half of the operating capability of the 380 kV transmission line model with a length of 360 km.
- Capacitance: 3 x 2.5 μ F, 450 Vac



11 Petersen coil

- Inductance with 20 taps for earth fault compensation in transmission lines.



Accessories

- User manual in Arabic or English
- Set of safety measurement cables 4mm
- Safety connecting plug 4mm
- Power Cord

12 Digital Voltmeter & Digital Ammeter

- Voltage range: 5V, 50V, 250V, 1000V
- Current ranges: 1A, 5A, 25A.
- AC/DC



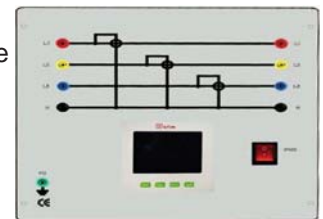
13 Power Factor meter

- Digital Single-phase panel meter for power factor and phase-angle of the connected load.



14 Three Phase Power meter

- Microprocessor controlled three-phase power analyzer. Measurement of voltages, currents, frequencies, active power, reactive power, apparent power.



Options

- Additional power requirements are attainable upon special request.
- E-content of the educational unit.
- Protective coverings.
- Multimeter
- Oscilloscope