Image For Ref. Only

Overview

- This is a **computerized, SCADA-based Measurement Instrument Trainer** designed for advanced electrical engineering laboratories. It combines traditional circuit experiments with modern data acquisition, real-time monitoring, and SCADA-based control.
- The trainer allows students to perform **AC/DC circuit experiments, transformer tests, motor-generator analysis, and verification of fundamental electrical theorems**, while logging all experimental data in real time. Developed in compliance with **latest European Union safety and EMC directives (CE, EMC, LVD, RoHS)**, this is modular, safe, and highly interactive.

Key Features

- SCADA-supervised operation with **real-time voltage, current, power, frequency, and power factor acquisition**.
- Graphical user interface for **circuit diagrams, measurement trends, event logging, and alarms**.
- Built-in **short-circuit, overload, and overcurrent protection**.
- Integrated **dynamometer** interface for DC motor and generator testing.
- Real-time visualization of **AC/DC load behavior, series/parallel/mixed circuits, and transformer performance**.
- Modular setup with **color-coded safety banana sockets, cooling fans, and external AC connection facility**.
- Data logging and export capability to **CSV, Excel, or SQL database** for further analysis.

Learning Outcomes

- Students will be able to:
- Verify **Ohm's Law**, **Kirchhoff's Current Law**, and **Kirchhoff's Voltage Law**.
- Test **series, parallel, and mixed circuits** under AC and DC conditions.
- Measure **active, reactive, apparent power**, and **energy consumption**.
- Verify network theorems: **Thevenin, Norton, Superposition, Maxwell, Maximum Power Transfer**.
- Conduct **transformer tests**: Open Circuit, Short Circuit, Parallel Operation, and Regulation Tests.

Note: Specifications are subject to change, Photos shown above are Indicative, Actual Product can Vary.

- Analyze **DC motor and generator performance** and efficiency.
- Operate and log data for **resistive, inductive, capacitive, and dynamic loads**.
- Use **SCADA software for fault simulation, data acquisition, real-time monitoring, and analysis**.

System Specifications
Power Supply Units

- **AC Supply:** 0–250 V AC, 50 Hz, variable, SCADA-monitored.
- **DC Supply:** 0, 6, 12, 18, 24, 30, 36 V ±10%, 3 A, digitally controlled and SCADA-integrated.
- Built-in overload and short-circuit protection for all outputs.

Measurement Instruments

- **Digital Wattmeter's:** 2 units, SCADA-monitored.
- **Digital AC Ammeters:** 2 units, SCADA-integrated.
- **Digital DC Ammeter:** 1 unit, SCADA-monitored.
- **Analog AC Voltmeters:** 3 units, interfaced with SCADA for logging.
- **Digital DC Voltmeter:** 1 unit, SCADA-acquisition enabled.
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Load Units

- **Resistive Loads:** 3 units (550 Ω, 1100 Ω, 1600 Ω ±10%, 200 W each).
- **Inductive Loads:** 3 units (1 H, 2 H, 3 H ±10%).
- **Capacitive Loads:** 3 units (1.5 µF, 3 µF, 4.5 µF ±10%).
- **Fan Cooling System:** 6 units, monitored via SCADA for operational status.

Motors & Generators

- **Permanent Magnet DC Motor/Generator:** SCADA-monitored voltage, current, speed, torque, and power.
- **DC Generator Prime Mover:** Integrated with SCADA for real-time performance analysis.
- **Dynamometer:** Measures torque, mechanical power, and efficiency; SCADA interface displays data in real-time charts.
- **Connectors & Safety**
- 4 mm **safety banana sockets** for AC/DC connections.
- **Built-in short-circuit and overload protection**.
- External AC connection facility for interfacing additional lab devices.

SCADA Integration (Advanced Software Suite)

- The trainer includes a **dedicated SCADA PC workstation** with the following configuration:
- **SCADA PC Workstation**
- **Processor:** Intel Core i7-11700 / i7-11700K, 8 cores / 16 threads, up to 5.0 GHz turbo.
- **Motherboard:** Intel 500-series or compatible 400-series with PCIe 4.0, dual LAN, M.2 NVMe.
- **RAM:** 32 GB DDR4-3200 (expandable to 64 GB).
- **Storage:** 1 TB NVMe PCIe SSD (for SCADA software, data logs, and replay files).
- **Monitor:** 27" IPS, Full HD (1920 × 1080) or higher; supports dual-monitor setup for mimic diagrams and event logging.
- **Keyboard & Mouse:** Standard, USB-connected.
- **Offline SCADA Operation:** Advanced graphical interface for measurement acquisition, trend plotting, fault simulation, and experiment logging.

SCADA Software Features

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- Real-time monitoring of **voltage, current, power, frequency, power factor** for all circuits.
- Logging and visualization of **series, parallel, and mixed circuit experiments**.
- Fault simulation with automatic alarm and event logging.
- Transformer test monitoring: open-circuit, short-circuit, regulation, and parallel operation.
- DC motor and generator testing interface with **torque-speed-power plots via dynamometer**.
- Export of experimental results to CSV, Excel, or SQL databases.
- User management with roles for students, instructors, and administrators.

Experiments / Exercises

- Verification of **Ohm's Law** (AC/DC).
- Series, Parallel, and Mixed Circuit Verification.
- Power Measurement and Efficiency Analysis (AC/DC).
- Verification of **Kirchhoff's Current and Voltage Laws**.
- Verification of **Thevenin, Norton, Superposition, Maxwell, and Maximum Power Transfer Theorems**.
- Transformer Open Circuit Test.
- Transformer Short Circuit Test.
- Transformer Parallel Operation Test.
- Transformer Voltage Regulation Test.
- Performance Analysis of **DC Motor & Generator** (with dynamometer).
- Performance Analysis of **Permanent Magnet DC Motor/Generator**.
- Load Testing with **resistive, inductive, and capacitive loads**.
- Synchronous operation analysis of **DC and PM generators**.
- SCADA-based **fault simulation and event logging**.
- Energy consumption and power factor analysis for various loads.

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