

TRANSMISSION LINE SIMULATOR

PSL30

Investigates short, medium and long transmission line performance in single-phase and three-phase systems.



KEY FEATURES

- Fault application switch and earth fault resistors allow studies of earth fault currents and the operation of relays of varying sensitivity
- Enables 'Pi' or 'Tee' methods of loss profiling
- Single and three-phase lines for separate tests
- Built-in industrial-standard digital protection relay gives wide range of functions – module includes extra socket for additional relay to give more experiments
- Includes supplies, circuit protection, internal load banks, instruments and controls

KEY SPECIFICATIONS

- Single-phase and three-phase lines
- Six-section three-phase line
- Resistive, inductive and capacitive loads
- Overcurrent protection relay

LEARNING OUTCOMES

SINGLE-PHASE LINE:

- Short-line investigation
- Medium or long-line investigation (nominal 'Tee' and 'Pi' methods)
- Effect of power and reactive power flow on voltage drop and transmission angle
- Medium/long-line investigation of a natural load of a line
- Voltage regulation at constant load and power factor

THREE-PHASE LINES:

- Per-unit values
- Unbalanced loads and the neutral connection
- Fault simulation and line protection studies
- Parallel feeders and multi-section lines

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DESCRIPTION

The Transmission Line Simulator investigates single-phase and three-phase transmission lines.

The configurable simulated transmission lines allow realistic studies of short, medium and long-distance transmission lines under variable load and power factor conditions, as well as with inserted faults.

The console is divided into two control panels, each with detailed mimic diagrams. The upper panel has a single-phase transmission line equivalent circuit, and the lower panel a three-phase transmission line. The lines may be loaded by the resistive, capacitive and inductive loads included. The effects can be monitored by instruments at the send and receive ends of the transmission lines.

The single-phase transmission line includes a set of inductive impedances connected in series. Tapping points allow the user to:

- change the length of the simulated line;
- set up 'Pi' or 'Tee' methods of loss profiling using different values of capacitance; and
- monitor the voltage, current and power at any point along the line.

The three-phase transmission line is in six sections represented in 'per-unit' values. Facilities include:

- Operating under variable balanced or unbalanced RLC (resistive, inductive and capacitive) loads
- Selectable neutral
- Provision to vary the length parameters

A fault application switch and earth fault resistors allow studies of earth fault currents and the operation of relays of varying sensitivity.

For protection tests, current transformers (CTs) in the test circuits connect to the protection relay fitted to the control panel.

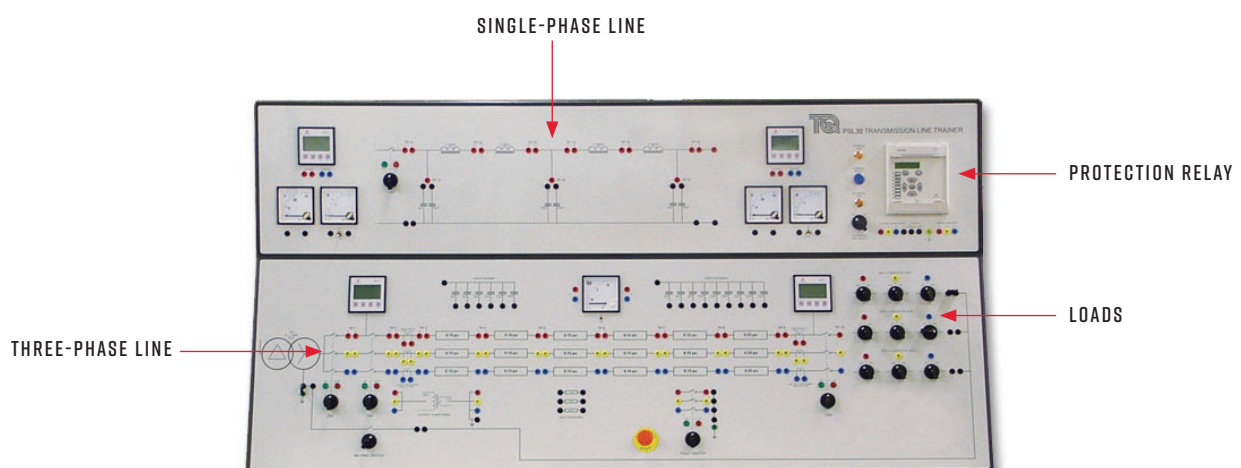
The user connects and sets the protection relay to detect line and earth currents. The relay also monitors and measures fault events and disturbances for fault analysis. The user sets the relay from its local control panel or by a cable link to a suitable computer (computer not included) and software (included). When a circuit fault happens, the relay opens circuit-breakers in the test circuits. The circuit-breakers also include hand-operated switches, and lamps. The lamps show whether the circuit-breakers are open or closed.

Supplied with the equipment is a set of shrouded leads for the user to connect the test circuits together. The unit includes an emergency switch, a mains supply isolator and protection fuses.

Supplied with a comprehensive user guide which includes equipment descriptions, theory and experiments. Also, the open and flexible structure of the equipment makes it ideal for student projects and for lecturers to create their own experiments.

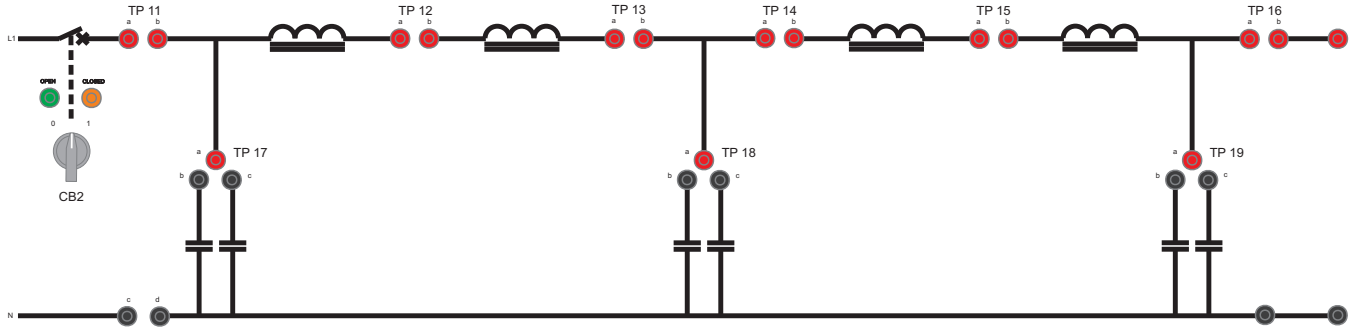
STANDARD FEATURES

- Supplied with comprehensive user guide
- Five-year warranty
- Manufactured in accordance with the latest European Union directives
- ISO9001 certified manufacturer

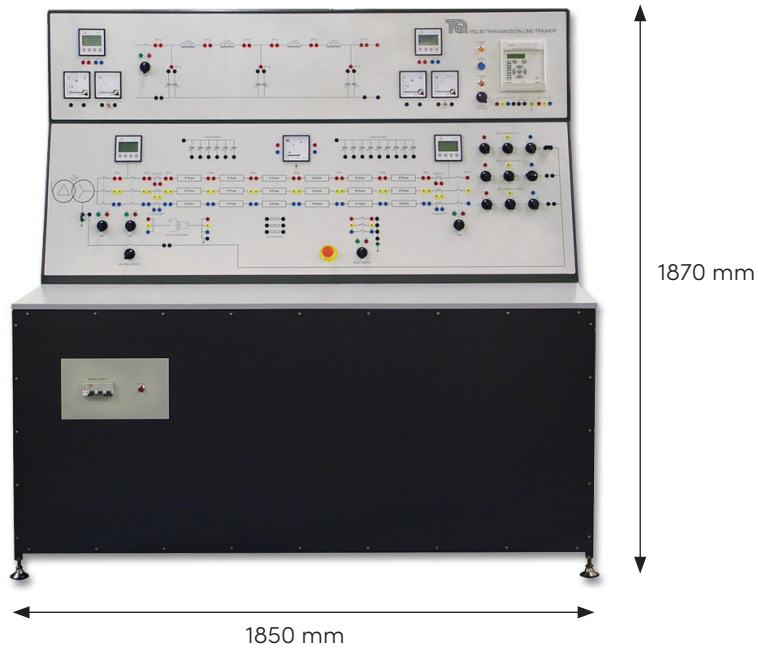


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SINGLE-PHASE LINE [SCHEMATIC]



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RECOMMENDED ANCILLARIES

- PSLHB and at least one cable (PSLSC or PSLMC or PSLLC)
- Power Factor Load Bank (PSA40)

ADDITIONAL RELAYS

- Overcurrent and Earth Fault Relay (PSA10)
- Feeder Management Relay (PSA25)
- Distance Protection Relay (PSA30)



OVERCURRENT AND EARTH FAULT RELAY (PSA10)



POWER FACTOR LOAD BANK (PSA40)



FEEDER MANAGEMENT RELAY (PSA25)



DISTANCE PROTECTION RELAY (PSA30)

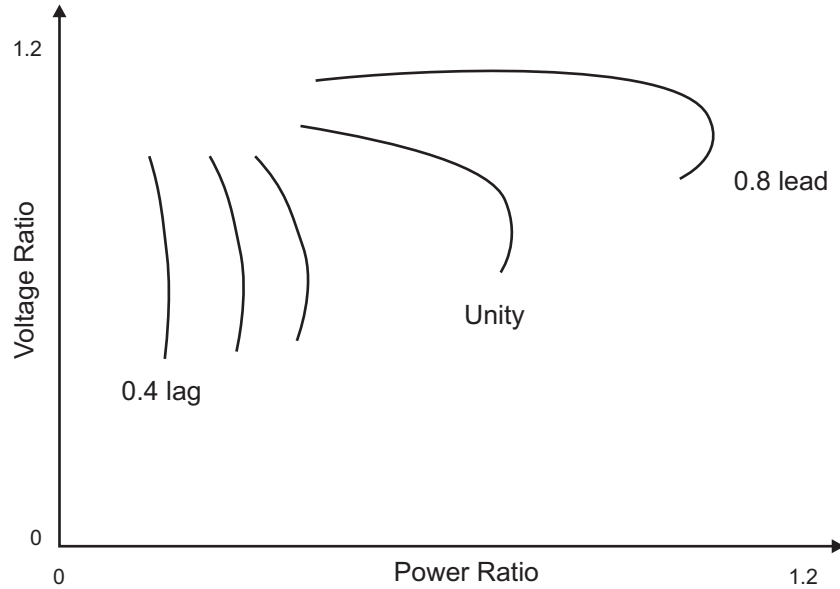
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TYPICAL WORK ASSIGNMENTS

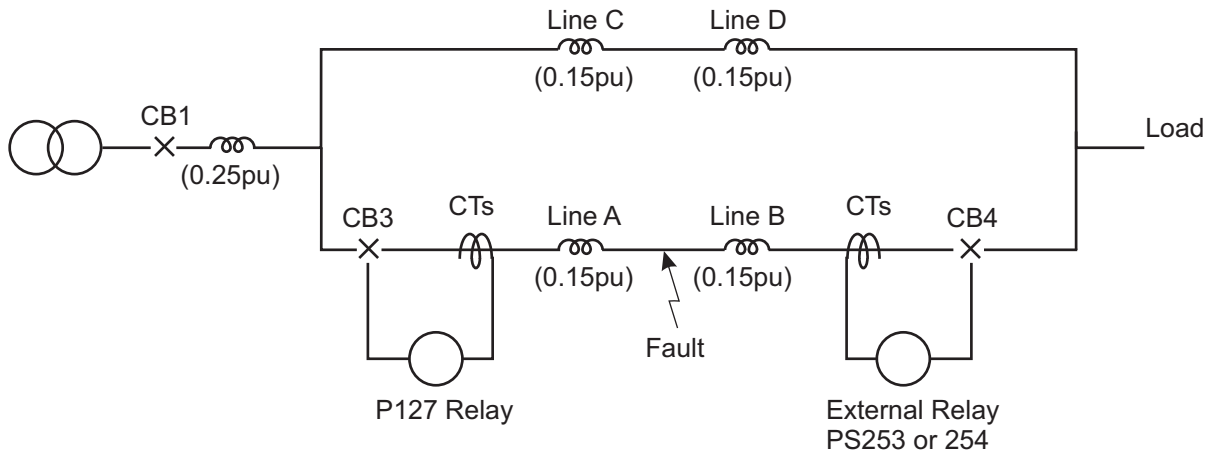
SINGLE-PHASE LINE VOLTAGE REGULATION AT CONSTANT POWER FACTOR

This test measures the voltages at the send and receive ends of the line, and the power at the receiving end compared with the rated power of the line. The curves represent the voltage regulation with five different power factor settings from 0.4 lagging to 0.8 leading.



DIRECTIONAL OVERCURRENT PROTECTION

This test uses the protection relay with an optional relay to show directional overcurrent protection in transmission lines.



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DETAILED SPECIFICATIONS

TecQuipment is committed to a programme of continuous improvement; hence we reserve the right to alter the design and product specification without prior notice.

NETT DIMENSIONS AND WEIGHT:

1850 mm long x 1870 mm high x 960 mm front to back and 750 kg

APPROXIMATE PACKED VOLUME AND WEIGHT:

5 m³ and 950 kg

LINE SIMULATION:

Inductors, with three-phase line represented in per-unit values

THREE-PHASE LINES:

Five sections, each at 0.15 p.u. value: 75 km of 132 kV line on a 100 MVA base

One section at 0.25 p.u. value: 125 km of 132 kV line on a 100 MVA base

THREE-PHASE LOAD BANKS:

Resistive, inductive and capacitive

OTHER CONTROLS AND INSTRUMENTATION:

- Phase angle meter for single-phase and three-phase
- Fault switch
- Single-phase and three-phase selectable capacitor banks for p and T networks
- Switchable neutral from transformer secondary

PROTECTION RELAY:

Overcurrent relay

ESSENTIAL SERVICES

ELECTRICAL SUPPLY:

Three-phase 5 kVA, 50 Hz or 60 Hz (specify on order)

50 Hz needs 380 – 440 VAC

60 Hz needs 200 – 240 VAC

FLOOR SPACE NEEDED:

Approximately 3 m x 2 m of solid, level floor

OPERATING CONDITIONS

OPERATING ENVIRONMENT:

Laboratory environment

STORAGE TEMPERATURE RANGE:

–25°C to +55°C (when packed for transport)

OPERATING TEMPERATURE RANGE:

+5°C to +40°C

OPERATING RELATIVE HUMIDITY RANGE:

80% at temperatures < 31°C decreasing linearly to 50% at 40°C

SOUND LEVELS

Less than 70 dB(A)