italtec
Technical Training Systems

Company with Quality Management System
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SIMULATORS FOR GENERATION, TRANSPORT & DISTRIBUTION OF ELECTRICAL POWER

IT.DI200-KV

1) IT.DI200-KV-SCE
Simulator for control and operation of electrical power plant supplying 300 MVA at 220 KV

2) IT. DI200-KV-SLT
Transport line simulator of three phase power 220V - 80 MVA

3) IT.DI200-KV-SLD
Distribution Threephase line simulator (2 stations, 20 KV each)

CE

In order to meet the requirements coming from many educational Customers, Italtec TTS Srl has designed and carried out a modular educational unit to assist in the teaching and training of generation, transport and distribution of high, medium and low voltage electrical power theory and practice. Our unique realization faces many problems involved with electric power field.
The system consists of three functional units designed for a stand-alone use providing hands on experience in the operation and control of the module itself.

The three units are the following:
1) DI-200/KV-SCE
Simulator for control and operation of electrical power plant supplying 300 MVA at 220 KV
2) DI-200/KV-SLT
Transport line simulator of three phase power 220V - 80 MVA
3) DI-200/KV-SLD
Distribution Threephase line simulator (2 stations, 20 KV each)

Each unit is equipped with the controls and the instrumentation required for the involved measures.
Although the supplying of all the three units is suggested, we point out that each of them can be used as a stand alone unit to study the related matter. It is thus possible a gradual purchase of the system or the employ of the units in different laboratories without limiting the functionality and the planned educational purposes.

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GENERAL TECHNICAL AND FUNCTIONAL DESCRIPTION

a) Mechanical features

- Strong steel tubes bearing structure (electrically welded)
- Synoptical panel with strenghtening border
- Key-lockable sliding drawers
- Four rotating wheels
- Anodized and silk-screened aluminium synoptical panel
- Rear grid for air circulation
- Accurate two colour antiscratch fire enamelled painting

b) Electrical_features

- Wiring and internal execution in compliance with CE rules
- Digital and Analog instrument Panel
- Internal converters (already calibrated)
- Safety devices with electromagnetic locking for mechanical inaccessibility to live terminals
- Magnetothermal resettable protections
- Operation and control system by synoptical panel
- ON-OFF signal lamps.

IT.DI200-KV-SCE
SIMULATOR FOR CONTROL AND OPERATION OF POWER PLANT

Description:
Power: 300 MVA, Voltage 220 KV Built-in generators
The simulator mod. DI200-KV-SCE is the educational version of a modern plant for the generation of electrical power.
On a synoptical panel are located two three-phase generators (A and B) that may operate in series or in parallel depending on the exercises to be performed.
These operations are performed by means of special controls and instrumentation.
The generators are activated by DC motors whose speed can vary by regulating the excitation voltage.
The activation of the threephase A generator allows the speed and the output voltage regulation by externalvcontrols with simultaneously instrument monitoring.
Downstream the generators two transformers are located with max voltage and current automatic circuit breakers.

The A generator can also be used as a motor in order to simulate pumping operation or execute the phasing of the other branch.
Between the first and the second generator there is a beating signal lamp on the translation bars.
Furthermore it is possible to connect the threephase A and B generators in parallel downstream the elevator station transformers through light controls for shunting disconnecting devices on bus bar double system.
For the generators parallel connection (downstream the transformers) the following instrumentation is supplied:

- Double KV meter with linear scale
- Double vibrating-reed frequency meter
- Synchronoscope
- Phasemeter for each branch
- Linear scale ammeter
- Central zero special gauge for the current direction display (on both generator branch)

(The A and B generators are complete of light bus-coupler switches to drive the high voltage to one of the two ouput lines already selected).
On the output of each generator are located:

- 1 Kilovoltmeter
- 1 Digital ammeter
- 1 Megawattmeter

In the lower part of the module plant alarm signals are located. They are joined with a differential breaking on many points of the power circuit.

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The loads are variable and mixed (inductive, capacitive, resistive).
The system can be switched on and off by a key selector and a mushroom shaped emergency button. The power supply is singlephase 220V and the total power absorbed at full load is about 3 KW.
The main branch carries out the simulation with 127V singlephase voltage and the instrument scales are calibrated in compliance with the simulated nominal values.
The auxiliary circuits are supplied with a 24V independent line.

Some exercises that can be executed are:
• Study and display of beating
• Execution of generators shunt connection through zero
voltmeter and voltage and power reading
• Arrangement in the plant for distribution and transport of electrical power to the several
transport lines at unloaded condition
• Correct operations of control switches for loaded
• Lines upstream phasing operations through alternators or under-excited motors
• Test of max voltage and max current relays intervention
• Correct stop of machines

Owing to the completeness of instruments and simulators and the complete compliance with the general problems involved in the management of an electric plant, it is easy to imagine how many practical exercises can be performed with this educational system.

DI200-KV-SLT
THREE PHASE POWER TRANSPORT LINE SIMULATOR

Nominal Power: 80 MVA
Nominal Voltage: 220 KV
Line lenght: 50 - 100 - 150 - 200 Km.
Parametric constants distribuited per phase:
R = 0,12 ohm/Km
Cy = 0,01 F/Km
L = 1,2 mH/Km
Characteristic impedance: Zc = 335 ohm per phase.
The line simulation is performed by means of 4 sections (each of them consists of a "T" quadripole, that is equal to a 50 Km line with the possibility to vary the lenght by a switch which connects in series the other sections).
Since the transport line load is simmetric and equilibrated, only one conductor relevant to a phase is simulated, as this solution is sufficient to solve all the problems related to the whole three phase system.
The value of each quadripole are:
R = 3 + 3 Ohm
Cy = 0,5 uF
L = 28 + 28 mH
The load consists of two ohmic conductor groups, with shunt connection possibilities, and of a multiple phasing system allowing to carry out exercises at constant (or variable) active power with variable phase displacement.
The upstream supply is adjustable (± 30%) through a variac whose (140,5 V) output corresponds to the simulate voltage (243 KV interlinked).
The instrumentation (voltmeters, ammeters and phasemeters, both upstream and downstream of the line) has been realized with calibrated scales for the nominal values and corresponding to the interlinked voltages.

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DI200-KV-SLD
THREE PHASE DISTRIBUTION LINE SIMULATOR

- Supply: from 1 or 2 ends
- Nominal voltage: 20 KV
- Nominal power: 6 MVA max.

The line is divided into five branches, from which four current absorptions are derivated.

Each branch can be changed in lenght and section by a switchable control with the help of a schedule relating to the pointer of the programming knob.

Each load (as a distribution substation) can be regulated in order to set the absorption that can be read on the ammeter calibrated in a simulated scale (50A).

The simulator allows to:
1) Estimate the industrial drops and, with a simple relationship, the line dissipated powers (total ones and corresponding to the several branches in order to test the electrical trend in constant section and density).
2) Obtain the optimal value of the branch (referring to the commercial one with experimental procedure to verify a line design processing).

The instruments are calibrated for the reading of the RMS values of stated interlinked nominal voltages (20 KV). It is however possible to fit the meters to different values as the allowed measurements are independent from the line voltages.

The instructions are supplied together with a table which allows to obtain easily the line parameters and correction factors for branch and phase displacement of each load.

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