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Product Name : Dissectable Rotating Machines Semi-Automatic System- Didactic Equipment	**Product Code :** LIM-CAT-L0043-00002

Description :

Dissectable Rotating Machines Semi-Automatic System- Didactic Equipment

Technical Specification :

Dissectable rotating machines semi-automatic system- didactic equipment
This equipment is an ?open? structure, where rotor windings, stator windings and brushes are completely exposed to perform didactic experiences such as the analysis of magnetic fluxes and magnetic fields. The students could learn in detail the internal construction and assembly of different types of electrical machines and carry out practical tests for the acquisition of their operating characteristics.
The trainer is a complete set of components for the assembling many rotating electric machines, for DC and AC. With this trainer, it is possible to learn and to assemble at least the following rotating machines:
Shunt, series, and compound excited DC motor
Shunt, series, and compound excited DC motor
Indication motors: three-phase slip ring and squirrel cage, single- phase repulsion and with capacitor
Dahlander motor
Synchronous motor
The power of the machines is of about 200W.
It is possible to perform the following experiments:
Flux produced by the poles

Main magnetic field
Intensity of the magnetic field

Induced voltage
Inter pole effect
No-load magnetic neutral axis
Rotating magnetic field
3-phase squirrel cage motor, 2 poles, 24V?
3-phase squirrel cage motor, 2 poles, 42V?
3-phase squirrel cage motor, 2 poles, 24V??
3-phase squirrel cage motor, 2 poles, 42VYY
3-phase squirrel cage motor, 4 poles, 24V?
3-phase squirrel cage motor, 4 poles, 42V?
3-phase Dahlander motor, 4/2 poles, 42V?/ YY
Split Phase Motor
Capacity Start and run motor
3- phase motor with round rotor, 2poles, 42VYY
Phase shifter
Induction regulator
3-phase synchronous motor, 2 poles, 24V?
3-phase synchronous induction motor, 2 poles, 24 VAA
DC motor with separate excitation
DC motor with shunt excitation
DC motor with series excitation DC motor with compound excitation, long shunt
DC motor with compound excitation, short shunt
Single phase series motor
Repulsion motor Synchronous motor winding resistance
Synchronous motor no-load test
Synchronous motor short-circuit characteristics
Synchronous motor short-circuit test
Synchronous motor Behn - Eschenberg's method
Synchronous motor load test
Synchronous motor conventional efficiency
Parallel connection of the alternator with the mains
Alternator as synchronous motor
DC generator winding resistance
DC generator test of the no-load motor (Swinburne)
DC generator no-load e.m.f.
DC generator excitation characteristics
Separate excitation dynamo
Shunt excitation dynamo
Series excitation dynamo
Compound excitation dynamo
DC motor with permanent magnet
DC generator with permanent magnet
It is composed of the following modules: fully dissectible system, power supply module, electrical and speed measurement module. loads and rheostat module, adapter bracket, locking and rotatable device, pole changing unit, parallel board, electromagnetic brake, star/delta starter and starting and synchronization unit.
Fully dissectible system
It is include the following elements:
Base plate
Supports with bearing
Coupling joints
Flexible coupling
Electronic speed transducer
Assembling screws

Wrenches
DC stator: it is composed of a metal frame supporting the laminated magnetic circuit, with 2 main poles and 2 interpoles,and the electrical
windings. The sheet iron pack is 60 mm long, with internal diameter of 80 mm. On the poles, the coils is wound whose terminals are
shown on a suitable educational terminal board.
AC stator: it is composed of a metal frame supporting the laminated magnetic circuit, because interested by a flux variable in time and the electrical winding. The sheet iron pack is 60 mm long, with internal diameter of 80 mm and external one of 150 mm and it present 24 half-closed slots inside of which there is a double 3-phase winding: the beginnings and the ends of the different phases is shown outside the stator on a suitable educational terminal board. The winding is a double layer one of the long coil lap type, with winding span 6 (1÷7). Every slot contain two coils of 19 turns each of enameled wire of diameter 1.12 mm.
A permanent magnet stator
DC Rotor with commutator: it is composed of a shaft to which the segment commutator is fixed and of a magnetic sheet iron pack where 20 semi-closed slots suitable to contain the electrical winding is set. The sheet iron pack is 60 mm long,with external diameter of about 80 mm. The winding is a double layer one of the long coil lap type, with winding span 9 (1÷10). Every slot contain two coils with two sections of 5+5 turns carried out with enameled wire of diameter 1.12 mm. The winding is subordinate to the 40 segments of the commutator on which two brushes supported by a brush holder graze.

The brushes is subordinate to terminals set on two external boards that show the synoptic of the rotor winding.
Brush holder with 2 brushes.
AC Cage motor: the squirrel cage rotor is composed of a shaft to which a pack of magnetic sheet irons is fixed, where the slots suitable to contain the rotor winding is set. The sheet iron pack is 60 mm long, with external diameter of about 78 mm. To avoid the phenomenon of the motor crawling in starting phase and to reduce the noise, the slots is inclined as regards the stator ones.
The rotor winding is composed of the squirrel cage. The cage is carried out by setting in every rotor slot some conducting bars that are closed in short-circuit at both ends by means of some conducting rings.
The rotor winding can be therefore considered a multiphase winding. with a single conductor for pole-phase, so it does not present its proper pole number, but it assumes one that is equal to the stator winding one.
AC Ring motor:the ring rotor is composed of a shaft to which the collector rings and a magnetic sheet iron pack is fixed:the iron pack has 21 semi-closed slots suitable to contain the winding. The sheet iron pack is 60 mm long, with external diameter of about 78 mm. To avoid a noisy mechanical running the rotor slots is inclined as regards the stator ones.
The rotor winding is composed of coils and it is two-pole three-phase. The winding is a double layer one of the long coil lap type, with winding span 9 (1-10). Every slot contain two coils of 8 turns each of enameled wire of diameter 1.5 mm.
The winding is star connected and it is subordinate to the collector rings while the star center is internal and not accessible. The terminals of the rotor winding is accessible by means of the collector rings on which the bushes supported by a brush holder graze. The brushes is two for each phase and they is subordinateto an external terminal board that shows the synoptic of the rotor winding.
Brush holder with 6 brushes.
A magnetic probe is foreseen to display the magnetic fields and for the operator safety. a transparent covering is provided preventing from the accidental contact with the rotating parts.
A transparent Plexiglas screen for protection.
Power supply module
It has the following features:
AC Outputs:
Three-phase voltage 24V/14A
Three-phase voltage 42V/10A
Variable single-phase voltage 0 ÷48V/5A
Variable single-phase voltage 0+10V/12A
DC Outputs:

Rectified voltage with three-phase bridge 32V/14A
Rectified voltage with three-phase bridge 42V/10A
Rectified voltage with variable single-phase bridge from 0÷40V/5A
Rectified voltage with variable single-phase bridge from 0 ÷ 8V/12A
On the front panel the following elements is included:
Mains supply indicator lamp inserted
Indicator lamps of the voltage.range
Fixed voltage selector
DC fixed voltage output switch
Three-phase fixed voltage output switch
Variable voltage selector
DC/AC voltage variator
Variable voltage output magnetothermic protection.
On the back panel the following elements will be included:
Speed protection connector
General differential magnetothermic switch
Fixed voltage output magnetothermic switch
Supply cable
Three-phase power supply from mains and complete with over-speed protection.
Electrical measurement module
The metering module is designed to carry out all the basic measurements in the electrical machine's laboratory.
The module include three identical multifunction digital instruments to perform electrical measurements.
Each multimeter provide the voltage, current, and power values, in both DC and AC, available in three selectable display modes:
AC and DC voltage and current
AC rms voltage, current and power
DC voltage, current and power.
It has the following technical features:
Power supply: 100÷240 Vac, 50/60 Hz
Vac/Vdc measurement range:0-65V
Iac/Idc measurement range:0+20A
Communication: Modbus RTU Protocol.
This didactic panel is installed on a vertical frame.
Mechanical power digital measuring unit
Suitable for direct measurement of motor output torque through load cell and of rotating speed through optical transducer, with mechanical power display. The module is composed of:

Digital readout by LCD 20x2 of the measured quantities (Torque, speed, and temperature).
Connector for over speed protection of the motors through the connection to the power supply module.
Ambient temperature sensor and probe for measuring the temperature of the motor.
Communication: RS485 with MODBUS RTU protocol.
Power supply:single-phase from mains: 100÷240 Vac,50/60 Hz
Buttons for switching scaling-International System/UK System.
It has the following technical features:
Torque: suitable for measuring the torque of the laboratory through the load cell
Speed: suitable for measuring the speed of the machines of the laboratory
Power: suitable for measuring the power of the machines of the laboratory
Power supply: single-phase from mains
On the front panel the following elements is included:
Connector for speed protection connection
Connector for speed transducer connection
Connector for temperature probe
Load cell connector

1LCD display for mechanical parameters
1 LCD display for thermal parameters
This didactic panel is installed on a vertical frame.
Load cell
Resistance electronic strain gauge with 51N range is mounted on the braking system to measure the mechanical torque.
The load cell consist in a precise bridge transducer using special materials to get the best performances.
It work by flexure, and the outgoing electric signal is proportional to the applied force and to the supply voltage.
It is made up by special steel and is OIMLR60 directive compliant with combined error ? ±0.05% and IP65 compliant.
It has the following technical Features:
Rated output: 3mV/V±5%
CREEP at nominal load in 30 minutes: 0.05%
Max supply voltage without damage: 10 Volt
Input resistance: 410?±40
Output resistance:350?±5
Zero balance:±2%
Insulation resistance:>2000 M?
Safe overload (% of Full Scale):150%

Ultimate overload(% of Full Scale):>200%
Deflection at nominal load:0.5 mm
For temperature:
Temperature effect on zero:0.005%?
Temperature effect on span:0.005%?
Compensated temperature range:-10°?/+40°?
Operating temperature range: -20°?/+60?
Loads and rheostat module
This module is planned to carry out resistive and capacitive loads suitable for the generators of the electrical machine laboratory.
Besides the same loads, it is possible to use it as starting rheostat both for the three-phase asynchronous motors with winded rotor and for the direct current motors and as starting and running capacitors for the induction single phase motor. This module contain both a load rheostat and an excitation rheostat to adjust the field current.
It has the following technical features:
Resistive load R with three fixed resistances: 15?/90W
Capacitive load C with three fixed capacitors: 80?F/150V
Load rheostat: fixed resistance from 1? in series to a variable resistance from 0 to 2?; Current: 8,5A (S0W)
Excitation rheostat: variable resistance from 0 to 80 ?; current: 1A.
Adapter bracket
This module is suitable to connect the locking device, the brake,or the drive motor.
Locking and rotatable device
This module is suitable for locking and for rotating the rotor of slip-ring induction motors to obtain an induction regulator and phase transformer.
Pole changing unit
This module consist in a switch to change the number of poles on Dahlander motors. It has 9 terminals + 1 PE.
A schematic diagram allow an easy operation of the unit.
Parallel board
This module consist in a rotating light synchronoscope to perform the parallel connection between synchronous generators or between the alternatorand the mains.
It has 3 lamps, S terminals, 1 switch and 1 PE.
A schematic diagram allow an easy operation of the unit.
This didactic panel is installed on a vertical frame.

Electromagnetic brake
This module include a smooth roil rotor and a salient pole stator. It is provided with water level, arms, weights, and balance weight form mmeasuring the output torque of the motor.

There is the possibility of assembling a load cell.
It is possible to couple this machine with other electrical machines through a hub and spider elastic gear ring in polyurethane. It is supplied with a hooked module in aluminium and safety terminals for the electrical connection.
A schematic diagram is shown on the hooked module .It is provided with:
A side plate to fix the unit with screws to the universal base through 4 holes where the machine remain suspended
A coupling joint with reflecting strip and with diam.40mm.
Star/delta starter
This module is suitable for three-phase squirrel cage induction motors. It has 9 bushes +1 PE. A schematic diagram allow an easy operation of the unit.
It has 9 terminals, 1 switch and 1 PE.
Starting and synchronization unit
This module consist in a rotor starter for three-phase slip ring motors and excitation device for synchronization with the mains. A schematic diagram allow an easy operation of the unit. Power supply: 220Vac, 50/60 Hz.
Data acquisition and processing software
This software permit to execute, in an automatic or semi-automatic mode, under the control of the computer, all the tests that is normally executed inside the Electrical Machines Laboratory.
It is designed to measure electrical machines parameter in many working conditions, through dedicated instruments; it allow the data export.graphs tracing and the computation of main parameters not directly acquirable.
It is possible to perform the following experiments for asynchronous machines:
No load test of the Three-phase Asynchronous Motor
Short circuit test of the Three-phase Asynchronous Motor
Measurement of the internal resistance of a Three-phase Asynchronous Motor
Measurement of the transformation ratio of the Three-phase Asynchronous Motor
Direct test of the Three-phase Asynchronous Motor
It is possible to perform the following experiments for synchronous machines:
Magnetization Characteristic of a Synchronous Machine
Short-circuit Characteristic of a Synchronous Machine
Measurement of the Winding Resistance of a Synchronous Machine
External Characteristics of the Synchronous Machine
Regulation Characteristic of a Synchronous Machine
No load Test of a Synchronous Machine as a Motor
"V" curve plot of a Synchronous Machine
It is possible to perform the following experiments for direct current machines:
Measurement of the internal resistance of a Direct Current Machine
Computation of the conventional efficiency of a DC Generator
Magnetization characteristic of a DC Generator
External characteristics of the DC Generator
Regulation characteristic of the DC Generator
No load test of the Direct Current Motor
Direct test of the Direct Current Motor
Smart Simulator for Electric Machines Training
This software simulate a real electric motor's workbench so that the student is able to perform the experiments in the virtual environment in a simple and almost real way, in a way very close to what he/she would do on a real equipment.
It is conceived as a complete course in electric machines to make the student able to solve practical and real assembling problems and to work on several experiments in the virtual equipment and then perform them by submitting the electric assembled machine to different working conditions. The software has a 3D environment

composed by a workbench with electric motor components, power modules, sensors, actuators, and instruments, and all the components ishave and look like real ones, with texture and lightening.
It include a frame with base to fix the modules and the machines and has a set of electric machine components, including but not limited to rotors suitable for AC and DC motors, stators suitable for AC and DC motors, electromagnetic brake, brake support with load cell for measuring the torque, coupling joint for mechanically connecting the rotor to the electromagnetic brake or other components, speed transducer for measuring the motor
speed, block with rotation system to lock the motor or turms it manually by means of a crank, brush with brush holder, and supports.
The software also provide the student with the theoretical content that is necessary to perform the experiments, and every experiment has detailed instructions on how to assemble, wire and to perform it.
It also include the typical modules used in electric machines experiments, including but not limited to:
AC three-phase source,
AC single-phase source,
DC source,
Wattmeter's,
Speed Meter,
Torque Meter,
Amperemeters,
Voltmeters,
Starting Rheostat with Resistive Load,
Pole Changing Unit,

Excitation Rheostat with Capacitive Load,
Rotating light synchronoscope,
Pole changing unit,
Star/Delta starter,
Starting rheostat and synchronizer,
Oscilloscope.
Besides the mechanical assembly, the software allow the student to perform the wiring, including the wiring between power supplies and the electric motor, brake, sensors and/or other devices used in each experiment, the connections on the electric motor itself, and the connections between the devices and the measurement modules.
The software has at least 45 different experiments, including but not limited to the following topics:
Basics concepts of an electric machine:
Flux produced by the poles-Main poles
Flux produced by the poles-Interpoles
Main magnetic field - Concurrent series
Intensity of the magnetic field
Induced voltage
Interpole Effect
Rotating magnetic field-three-phase and single-phase rotating fields
Induction motors:
Three-phase squirrel cage motor, 2 poles, 24V ?
Three-phase squirrel cage motor, 2 poles, 42V Y
Three-phase squirrel cage motor, 2 poles, 24V ??
Three-Phase squirrel cage motor, 2 poles, 42V YY
Three-Phase squirrel cage motor, 4 poles,24V ?
Three-Phase squirrel cage motor, 4 poles, 42V Y
Three-Phase Dahlander motor, 4/2 poles,42V ?/YY
Split phase motor
Capacitor start and run motor
Three-phase motor with wound rotor, 2 poles,42V YY

Phase shifter
Induction regulator
Three-Phase synchronous induction motor, 2 poles,42V?
Three-Phase synchronous induction motor, 2 poles, 24V??
Direct current motors:
DC motor with separate excitation
DC motor with shunt excitation
DC motor with series excitation

DC motor with compound excitation, long shunt
DC motor with differential excitation, long shunt
DC motor with compound excitation, short shunt
DC motor with differential excitation, short shunt
Commutator motors for alternating current:
Single-phase series motor
Repulsion motor
Synchronous machines:
Winding resistance
No-load test, mechanical losses of the DC motor
No-load test, mechanical and iron losses of the alternator
Short-circuit characteristic
Short-circuit test
Load test
Parallel connection of the alternator with the mains
Alternator as synchronous motor
Direct current generators:
Winding resistance-Armature winding
Winding resistance-Series and interpole windings
Winding resistance-Inductor winding
Test of the no-load motor (Swinburne)
No-load E.M.F.
Excitation characteristic
Separate excitation dynamo
Shunt excitation dynamo
Series excitation dynamo
Compound excitation dynamo.
The software guide the student through the learning process automatically by providing the above experiment proposals and, for each experiment.it automatically verify if the student hasperformed the mechanical assembly and the wiring correctly,and then if so, it allow to perform thesimulation and measurement by comparing the student's measurements with the expected values for the experiment.
When the student finishes an experiment, the software register the progress locally and in a cloud system so that the student can start the experimentusing one computer, and continue somewhere else, using the same or another computer synchronizing the student's progress.
The software has a detailed online help with text and videos made from screen recordings with the software, so that the instructionson how to useit are clear and easy to understand.The software is delivered always in full version with feature unlock through a cloud system so that any user can download the software from theinternet where the school may provide access to users to the software features.
It is possible to select an interface language between English,French, Spanish,and Portuguese.
Three level work frame
This three-level work metal frame is supplied to assemble the modules of the laboratory.
The trainer is supplied with a set of cables and tools for conducting experiments and tests and manuals in English language.

Dissectable Rotating Machines Semi-Automatic System- Didactic Equipment, Dissectable Rotating Machines Semi-Automatic System- Didactic Equipment Bulk Suppliers, Dissectable Rotating Machines Semi-Automatic System- Didactic Equipment Tools, Dissectable Rotating Machines Semi-Automatic System- Didactic Equipment Dissectable Rotating Machines Semi-Automatic System- Didactic Equipments, Dissectable Rotating Machines Semi-Automatic System- Didactic Equipment Manufacturers, Dissectable Rotating Machines Semi-Automatic System- Didactic Equipment Suppliers from India, China, Kenya.