

EMMS3

ELECTRICAL MACHINES MODULAR SYSTEM 300W



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1.1 - GENERAL DESCRIPTION

System Description

italtec, has designed a new system for the application of electrical machines in experimental lessons.

This system is a complete and compact teaching mean, which can be accommodated on a standard 2 meter laboratory bench.

Thanks to its modularity, flexibility and compactness allows multiple stand-alone center and to manage multiple combinations of the components that means more curricula, and in the same laboratory, with less overall spending.

The machines are industrial-type units in compliance with the construction type B3.

The whole machines range meets the international standards DIN-VDE 0530.

Particular advantages of EMMS system are:

- Clearly arranged and swift set up of complete circuits;
- Safe operating by clear assignment of supply voltage and complete set of security devices:
 - no projections of rotating parts;
 - protection of all rotating parts;
 - low operation power, thereby minimising the risk of accidents;
 - standard 4 mm CE safety sockets for all inputs/outputs connections;
- very small space is required for use and for storage;
- power supply module provides also metering facilities and circuit protections;
- durability by the use of high grade materials;
- a step-by-step course of theory and experiments is described on each book included with each electrical machine;
- machines based on industrial standards, with all real features;
- all table top unit can be used in a frame system also;
- compatible with all other our programs;
- future-oriented thanks to the possibility to adapt to new technologies;
- optional overload protection with temperature sensor;

EMMS consist of:

- universal power supply module used for all models of previous machines;
- set of motors, generators, transformers, brakes etc. which are the equipment for practical execution of experiments and measures;
- set of meter modules designed to cover the complete range of measurements with a small number of meters;
- set of resistive, inductive and capacitive loads housed in separate modules, and designed to provide balanced or unbalanced loads;
- set of accessories as:
 - connection leads;
 - tachometers;
 - dynamometers;
 - starting and excitation rheostat;
 - optional modules for electronic regulation of d.c. and a.c. motors;
 - optional computerised system for data acquisition and data management designed to plot curves and to store the complete test;

Each machine is equipped with its own universal support, which allows a very easy way to match all machines. EMMS's machines are the same machines normally used for industry applications.

Particular solutions has been used to simplify the student's approach and the system philosophy has been designed for educational purposes.



Coupling sample

EMMS are also available with 300W power or for 1kW or 3kW 6kW etc.

EMMS are available with 1500 rpm or 3000 rpm

EMMS are available with different operative voltages as:

- main voltage (127/220V) 50-60Hz
- main voltage (240/415V) 50-60Hz
- main voltage (230/400V) 50-60Hz
- main voltage (24/48V) 50-60Hz

2.1 - Experiments and studies with EMMS

D.C. Motors & Generators

- Connection and study of industrial type of d.c. machines operation, used as motors and generators;
- Operation with starter and field regulator;
- Reversing rotation and speed regulation;
- Measure of armature and excitation voltage and current;
- Speed and torque detection;
- Characteristic with variable R-load;
- Load characteristics with mechanical or magnetic brake;
- Adsorbed power, mechanical losses, iron losses, copper losses, efficiency;
- Comparison between shunt, series and compound connections;
- Shunt connection of two generators;
- Operation with electronic speed control;

A.C. 3-phase Machines

- Operation with connection to power;
- Starting techniques: star-delta circuits, series resistance auto-transformer starter;
- Reversing rotation and speed adjustment;
- Measure of current and voltage values;
- Load characteristics (recording with an electromagnetic brake or magnetic powder brake or DC brake generator);
- Draw of circular diagram and its practical use;
- Real and reactive power, mechanical power;
- Power factor ($\cos \phi$) efficiency and slip;
- Adsorbed power;
- Output power regulation;
- Shunt connection and synchronisation between two three-phase synchronous generators;
- Main synchronisation techniques;
- "V" characteristics: stability – limits;
- Operation as rotating capacitor / inductor;
- Three-phase shifter operation;
- Operation with electronic speed control;
- Fault finding:
 - Winding break in a coil;
 - Winding to winding short;
 - Coil to coil short;
 - Insulation fault.

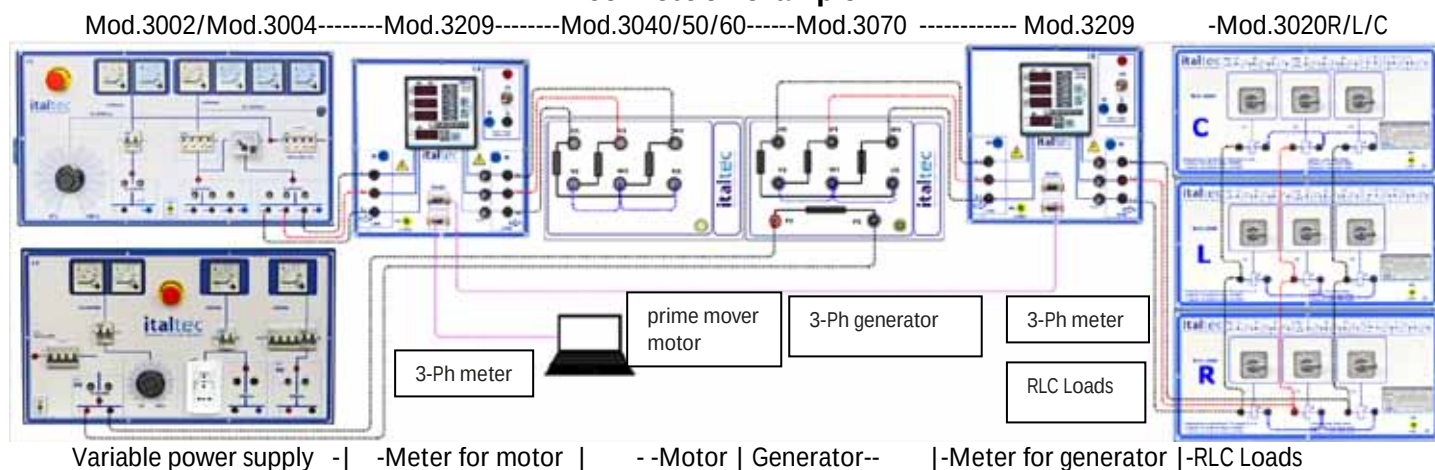
A.C. Single Phase Motors

- Operation with connection to power
- Starting techniques according to the machine type
- Reversing rotation and speed adjustment
- Influence of brush position on the speed;
- Measure of current and voltage values;
- Load characteristics (recording with an electromagnetic brake or magnetic powder brake).

1-PH / 3-PH Transformers

- Operation with connection to power
- Star-Delta, Zig-Zag and Scott connections
- Current and voltage measure at open circuit
- Current and voltage measure at full load and short circuit conditions;
- Shunt connection between two transformers;
- Load distribution.

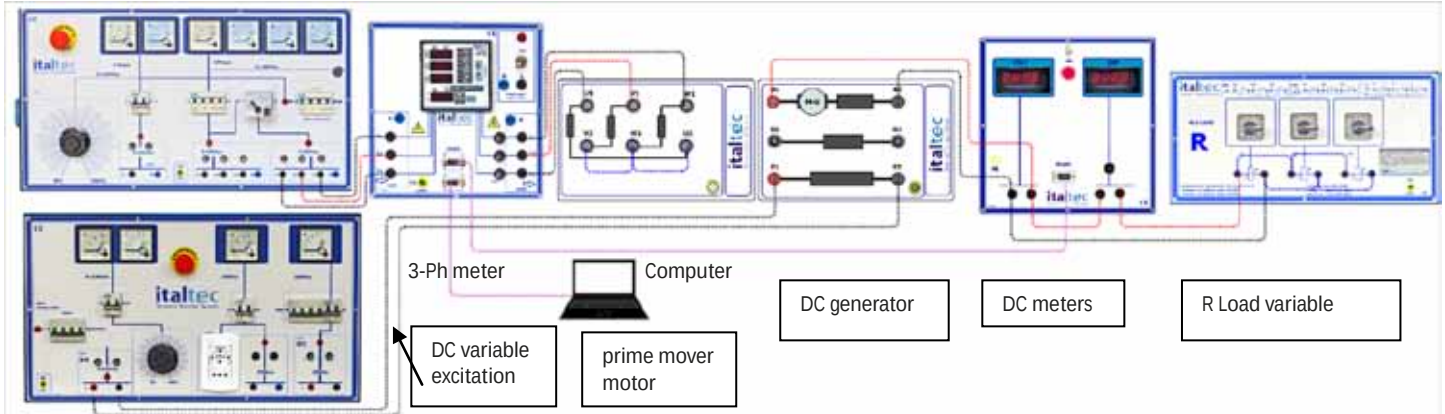
Connection example 1



2.2 - Experiments and studies with EMMS

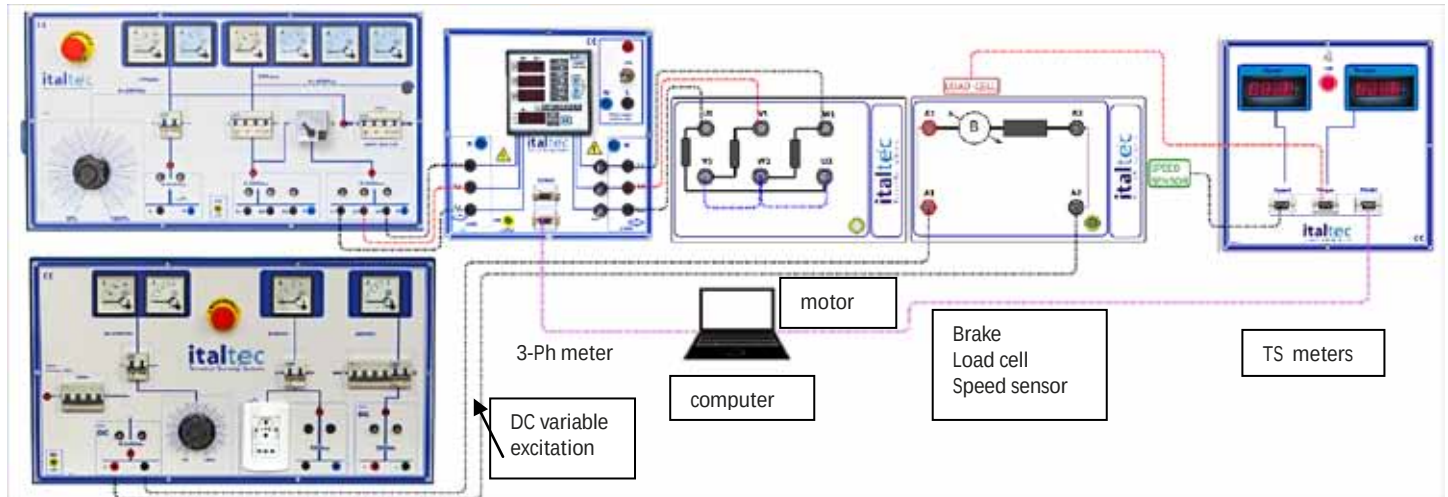
Connection example 2

Mod.3002/Mod.3004-----Mod.3209-----Mod.3040/50/60----- Mod.3140/50/60---- Mod.3203-02 -Mod.3020-10R



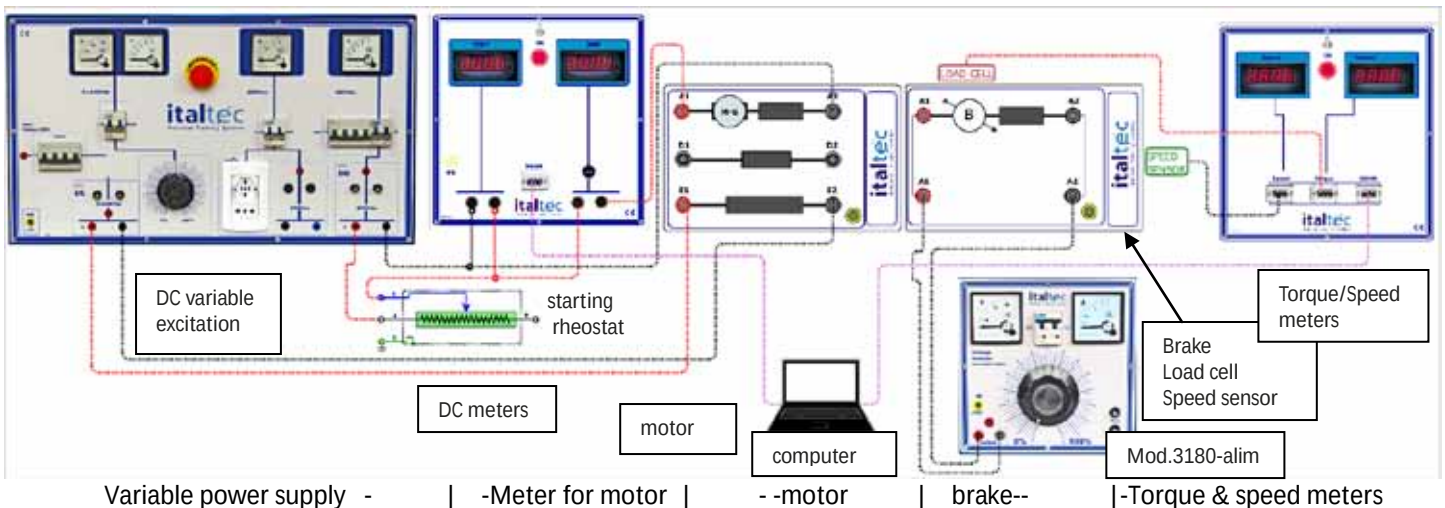
Connection example 3

Mod.3002/Mod.3004----- -Mod.3209-- ----- --Mod.3040/50/60----- -Mod.3180 ----- -- Mod.3203-07



Connection example 4

Mod.3002/Mod.3004----- -Mod.3203-02-- --Mod.3140/50/60----- -Mod.3180 ----- -- Mod.3203-07



3.1 - POWER SUPPLY MODULE

Mod.3000 Universal power supply. (3002+3004) (also available 220V 60Hz version).

- **Power requirements:** 380/400V, 3PH+N+G, 50Hz



- **Mod.3002** 3-Ph/1Ph AC power supply 3+3A



Mod.3004 DC power supply 2+3A

General protection with high sensitivity magneto thermal differential (0,03A) automatic circuit breaker. Mushroom emergency push -button
All outputs are protected by means of an automatic magneto thermal circuit breaker and fuses. Adjustable 3Ph motor overload protection.
Dimensions: 2x 70x40x40h(cm)

3 phase adjustable output: 0-420V, 3A with
- 1 x A.C. voltmeter - 3 x A.C. ammeters
adjustable motor overload protection

Single phase adjustable output: 0-240V 3A with
- 1 x A.C. voltmeter - 1 x A.C. ammeter

Mod.3002D -3-Ph AC digital power supply
with digital instruments



DC variable output: 0-230V, 2A with

- 1 x D.C. voltmeter - 1 x D.C. ammeter

D.C. fixed output: 220V, 3A- with 1 x D.C. ammeter

Single phase output: fixed 230Vac 10A with- 1 x A.C. ammeter

Mod.3004D digital DC power supply
with digital instruments



Mod.3004-02 DC power supply



DC variable output: 0-230V, 2A with
- 1 x D.C. voltmeter - 1 x D.C. ammeter

Mod.3004-02-04 DC power supply



DC variable output: 0-230V, 2A with
- 1 x D.C. voltmeter - 1 x D.C. ammeter
D.C. fixed output: 220V, 4A - with 1 x D.C. ammeter

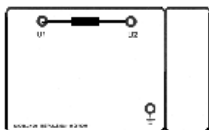
4.1 - D.C. MACHINES

- Design: with typical industrial characteristics.
- In/output with standard 4 mm safety sockets.
- Manual explaining theory and practice
- Other speed available like 3600rpm
- Other supply voltage available
- Protection against thermal overload

- Rail or tabletop base and shaft joints for fast and easy coupling.
- Optional double shaft ends

Accessories:

- STARTING RHEOSTAT
- EXCITATION RHEOSTAT
- POWER AND EXCITATION SUPPLY



MOD.3142 Permanent Magnet DC Motor

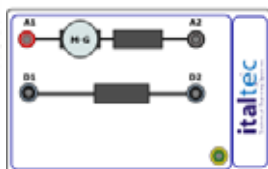
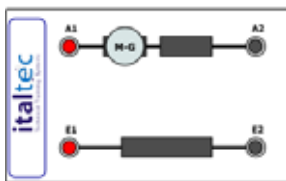
Modes: PM motor/generator

- Nominal voltage: 170V DC
- Nominal speed: 3000rpm
- Nominal power: 0,25Kw (mot) / 0,2kW(gen)

MOD.3140 Shunt Wound Machine

Modes: Motor, self- and externally excited generator;

- Nominal voltage: 220V
- Excitation voltage: 90÷210 V
- Nominal speed: 3000rpm
- Nominal power: 0,25Kw (mot) / 0,2kW(gen)



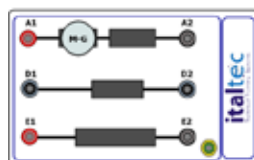
MOD.3150 Series Wound Machine

- Modes: series motor
- Nominal voltage: 220V
- Nominal speed: 3000rpm
- Nominal power: 0,25kW(mot)/0,2kW(gen)

MOD.3160 Compound Wound Machine

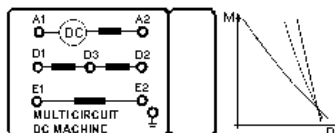
Modes: Shunt wound motor/generator, series wound motor, compound wound motor/generator.

- Nominal voltage: 220V
- Excitation voltage: 90÷210 V
- Nominal speed: 3000rpm
- Nominal power: 0,25kW(mot)/0,2kW(gen)



MOD.3165 Multi circuit Wound Machine

- Nominal voltage: 220V
- Excitation voltage: 90÷210 V
- Nominal speed: 3000rpm
- Nominal power: 0,25kW (mot)/0,15kW (gen)



5.1 - A.C. MACHINES

- Design: with typical industrial characteristics.
- In/output with standard 4 mm safety sockets.
- Manual explaining theory and practice
- available 2 and 4 poles version: 3/1,5Krpm
- Protection against thermal overload

- Rail or tabletop base and shaft joints available for fast and easy coupling.
- Optional double shaft ends
- Other voltage available like 127/220V 60Hz version (speed is 20% higher)

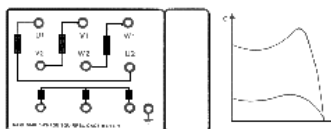
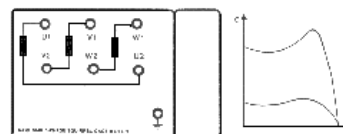
Accessories:

- POWER AND EXCITATION SUPPLY

MOD.3040

3-Phase Squirrel Cage Motor

- Nominal voltage: 230/400V, (delta/star) / 50Hz
- Nominal speed: 2840rpm
- Nominal power: 0,37kW
- $\cos\phi=0,78$ - A: 1,6/0,9 -W: 7kg



MOD.3050

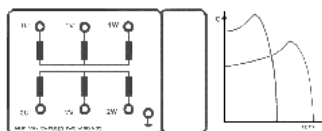
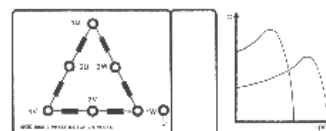
3-phase Slip Ring Asynchronous Motor

- Nominal voltage: 230/400V (delta/star)/ 50Hz
- Nominal speed: 2800rpm
- Nominal power: 0,2kW
- $\cos\phi=0,82$

MOD.3060

3-Phase Dahlander Motor 2/4 Poles

- Nominal voltage: 400V (star-star) / 50Hz
- Nominal speed: 2700/1400 rpm
- Nominal power: 0,4/0,3kW
- $\cos\phi:0,8/0,7$ - A: 1,6/1,2 -W: 8kg



MOD.3065

3-Phase motor 2/4 Poles Two separate windings

- Nominal voltage: 400V (star/star) / 50Hz
- Nominal speed: 2800/1400rpm
- Nominal power: 0,3/0,22kW

MOD.6030AL Universal base

- with rail for easy and fast coupling for test of electrical machines



5.2 - A.C. MACHINES

- Design: with typical industrial characteristics.
- In/output with standard 4mm safety sockets.
- Manual explaining theory and practice
- available 2 and 4 poles version: 3/1,5Krpm
- Protection against thermal overload

- Rail or tabletop base and shaft joints available for fast and easy coupling.
- Optional double shaft ends
- Other voltage available like 127/220V 60Hz n (speed is 20% higher)

Accessories:

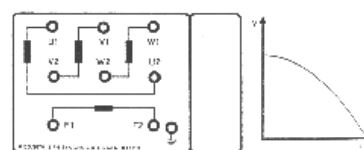
- POWER AND EXCITATION SUPPLY

MOD.3070

Three Phase salient poles Synchronous Generator

Modes: motor, generator.

- Nominal voltage: 220/380V/ 50Hz (delta/star)
- Excitation voltage: 200Vdc
- Nominal speed: 3000rpm
- Nominal power: 0,25kW(gen)/0,2kW(mot)



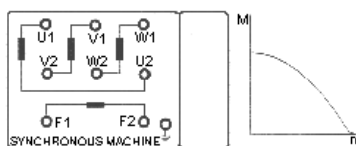
MOD.3074

Three Phase Synchronous Machine

Non-salient pole rotor.

Modes: motor, generator

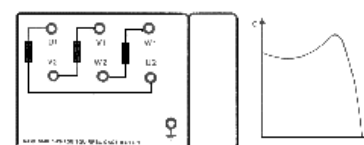
- Nominal voltage: 220/380V/ 50Hz (delta/star)
- Excitation voltage: 90÷210 Vdc
- Nominal speed: 3000rpm
- Nominal power: 0,25kW(gen)/0,2kW(mot)



MOD.3080

3-phase Reluctance Motor

- Nominal voltage: 220V/380V (delta/star)/ 50Hz
- Nominal speed: 3000rpm
- Nominal power: 0,2kW
- Cosφ=0,6

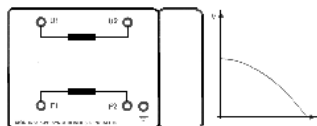


MOD.3072

Single Phase Synchronous Generator

Non-salient pole rotor.

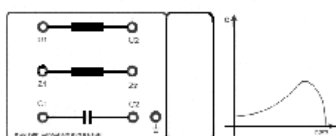
- Nominal voltage: 230V
- Excitation voltage: 90÷210 Vdc
- Nominal power: 0,25 kW
- Speed: 3000rpm



MOD.3090

Single Phase a.c. Capacitor Run Motor

- Nominal voltage: 230Vac/50Hz
- Speed: 2820rpm
- Nominal power: 0,37kW
- Cosφ=0,94- A: 3,3 - W: 9kg - C: 12nF



5.3 - A.C. MACHINES

- Design: with typical industrial characteristics.
- In/output with standard 4mm safety sockets.
- Manual explaining theory and practice
- available 2 and 4 poles version: 3/1,5Krpm
- Protection against thermal overload

- Rail or tabletop base and shaft joints available for fast and easy coupling.
- Optional double shaft ends
- Other voltage available like 127/220V 60Hz n (speed is 20% higher)

Accessories:

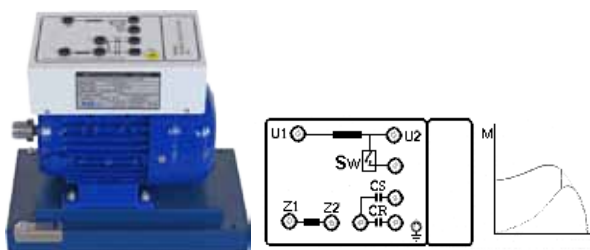
- POWER AND EXCITATION SUPPLY

MOD.3095

Split phase motor 2P 220V

Single-phase motor with starting auxiliary phase, complete with centrifugal starting switch.

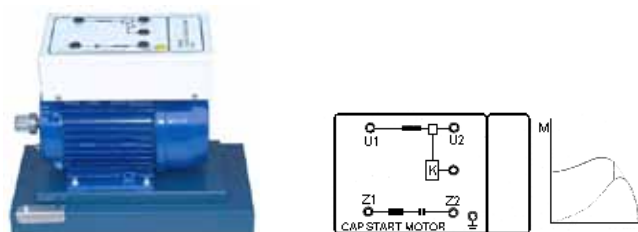
- Nominal voltage: 230V AC 1PH /50Hz
- Speed: 2800 rpm
- Nominal power: 0,3kW
- Starting capacitor and run capacitor



MOD.3120

Single Phase a.c. Capacitor Start Motor

- Nominal voltage: 230V AC / 50Hz
- Speed: 2800 rpm
- Nominal power: 0,3 Kw
- Starting capacitor



MOD.3122

Single Phase a.c. Capacitor Start/Run Motor

Complete with starting relay.

- Nominal voltage: 230V AC single-phase/ 50Hz
- Speed: 2800 rpm
- Nominal power: 0,3 Kw
- Starting capacitor and run capacitor

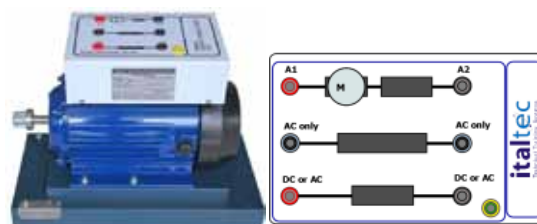


MOD.3130

Universal Motor

Modes: AC motor/ DC series motor.

- Nominal voltage: 220V DC/AC
- Nominal speed: 2800rpm
- Nominal power: 0,3Kw (DC) / 0,2kW (AC)



MOD.3110

Single Phase a.c. shaded pole Motor

- Nominal voltage: 220V DC/AC
- Nominal speed: 2800rpm
- Nominal power: 0,12Kw



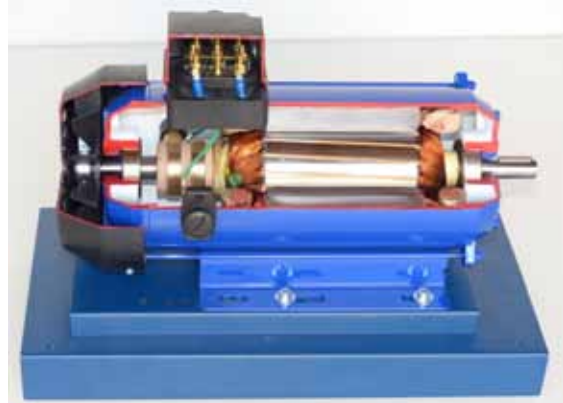
6.1 - SEC MACHINES

- Design: with typical industrial characteristics
- Complete with base plate

MOD.3040
Three Phase Squirrel Cage Motor



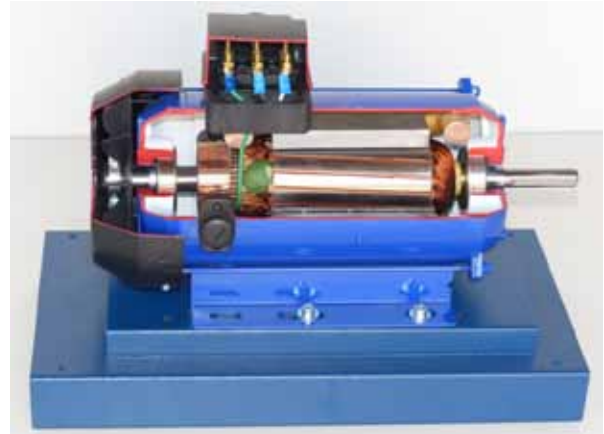
MOD.3070
Three Phase Synchronous Generator



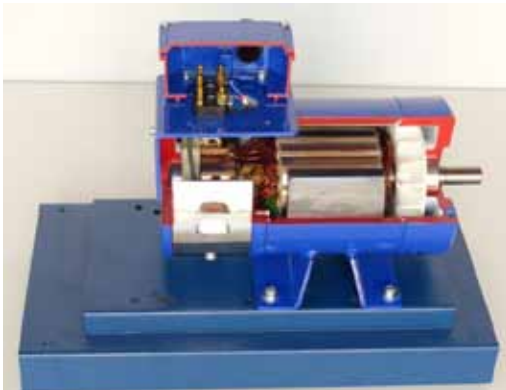
MOD.3122
Single Phase AC Motor
Capacitor Start/Run with centrifugal switch



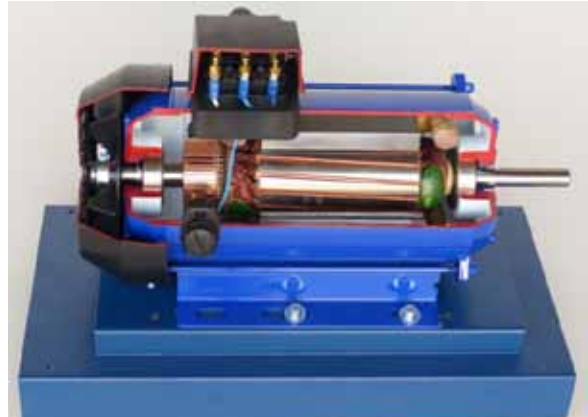
MOD.3130
Universal Motor AC/DC



MOD.3142
Permanent Magnet DC Machine
Motor /Generator



MOD.3160
External/Shunt, Series Compound
DC Machine - Motor /Generator



7.1 - TRANSFORMERS

MOD.3190

Single Phase Transformer

Primary and secondary windings are divided in several sections to allow many connection possibilities.

- 230/115V primary/secondary.
- Primary: 2x115V Ac
- Secondary: 2x57,5V Ac
- Power: 300VA
- Frequency: 50/60 Hz
- also available: 1kW, 3kW



MOD.3195

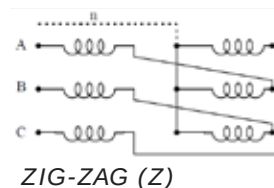
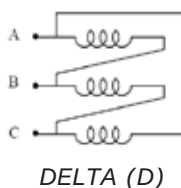
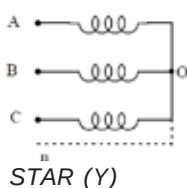
Three-phase Transformer

Primary and secondary windings are divided in several sections to allow many connection possibilities.

- Primary: 3x400 (3 x 2 x 115V)
- Secondary: 3x230 (3 x 2 x 66,5V)
- Power: 300VA
- Frequency: 50/60Hz
- also available: 1kW, 3kW

Primary/secondary connection

- STAR - STAR Yy
- DELTA - STAR Dy
- DELTA - DELTA Dd
- STAR - Zig-zag Yz
- DELTA - Zig-zag Dz



Training topics covered:

- Complete and simplified equivalent circuits
- Measurement of the individual variables
- Transformation of current and voltage
- Measuring the rush current using an oscilloscope
- Measurement and calculation of the no-load values
- Measurement and calculation of the short-circuit values
- Measurements with a variable load R, L & C
- Determining the efficiency
- Evaluating the measured values
- Phase angle between primary and secondary windings and the effect of asymmetric loading in the circuit groups Yy, Yd, Yz, Dy

8.1 - BRAKES & TORQUE METERS

- With rail base or tabletop base plate and coupling cog for easy engagement with other machine
- In/output with standard 4 mm safety sockets
- Protection against thermal overload
- Imprinted terminal boards with the synoptic
- Two shaft ends
- Manual explaining theory and practice

MOD.3170 Electrodynamometer (brake/generator)

Brake and Generator with separate excitation, mounted on oscillating frame in order to operate as a brake.

The electrodynamometer is complete with arms, weights, and counterweights, for usage with the classic mechanical scale method, with the graduated measuring rod and weights.

- Nominal voltage: 220V d.c.;
- Excitation voltage: 0÷210Vdc.
- Speed: 1400/3200 rpm;
- Power: up to 0,6kW at 3000 rpm;
- Coupling type: cog coupling
- Dimensions: LxWxH: 35x18x20cm; Weight: 6,0 kg

Optional accessories:

- Load adjustable Mod.3020-R.
- Excitation power supply.
- Encoder for detecting the speed in rpm.
- Load cell or torque meter for detecting the couple.
- Digital instrument for displaying the speed and couple in Kgm or Nm (Mod.3203-07).



MOD. 3174 Magnetic powder brake

Magnetic powder brake for test and measurement of the torque and power of electrical motors.

The brake is complete with arms, weights, and counterweights, for usage with the classic mechanical scale method, with the graduated measuring rod and weights.

For direct test on the brake of electric motors 0,3/0,6kW, 1000/3000 Rpm.

Couple: 0,2 - 5Nm.

- Excitation voltage: 0÷24Vdc.

Dimensions: LxWxH: 27x18x20cm; Weight: 7 kg

Optional accessories:

- Excitation power supply.
- Encoder for detecting the speed.
- Load cell or torque meter for detecting the couple.
- Digital instrument (Mod.3203-07) for displaying the speed (rpm) and torque automatically, both in Kgm or Nm.



MOD.3180 Electromagnetic Eddy Current Brake

Eddy current brake for test and measurement of the torque and power of electrical motors.

The brake is complete with arms, weights, and counterweights, for usage as the classic mechanical scale with weights.

As with all brakes, the torque measurement can be made with the aid of the arms and weight provided or by using the load cell and the reader and digital display Mod.3203-07.

For direct test on the brake of electric motors up to 0,6kW and 3000 Rpm.

- Excitation voltage: 0÷210Vdc.

Dimensions: LxWxH: 35x18x20cm; Weight: 8,0 kg

Optional accessories:

- Excitation power supply.
- Encoder for detecting the speed.
- Load cell or torque meter for detecting the couple.
- Digital instrument (Mod.3203-07) for displaying the speed (rpm) and couple automatically, both in Kgm or Nm.



8.2 - BRAKES & TORQUE METERS

Mod.3203-07-LC

Torque & Speed Meter with Load Cell & Speed sensor

The meter can be equipped with a load cell or an optional torque transducer for torque detection and with a speed sensor. When used with brakes, it allows to measure the motor torque and speed.

It can be calibrated both in kgm or Nm.

The meter can be used with all brakes.

Optional accessories:

- RS485 interface.
- Management software

Mod.3203-07-TT

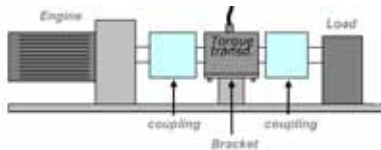
Torque Transducer



Torque Transducer



Load Cell



Mod.3203-08

Torque & Speed Meter with management software

The meter can be equipped with a speed sensor and a load-cell (or a torque-transducer) for torque detection. When used with brakes, it allows to measure the motor torque, speed and power. Values are shown on digital display, it can be calibrated in kgm or Nm.

With optional PC RS485 port, it is possible to read on the PC screen: torque, speed and the instantaneous power, in real time while the motor is running. When a load is applied to the motor, it is possible to observe the increasing of torque and the decreasing of motor speed and get the power variation data.

From the PC it is possible to get all data and create the torque-speed graph for all machines under test.

Data can be printed or stored xls or pdf files.

The meter can be used with all brakes.



Mod.6032P Basis for brakes with height-adjustable base for motors

For direct test and measurement with motors with different sizes and watts up to 12 Kw.

Height-adjustable base allows easy alignment of brake even with motors with different shaft height and different sizes and powers.

Optional cooling fan.



Mod.3186 Inertia wheel

For simulating heavy starting and energy storage.

Design: built into an electrical motor housing with base.

- Flywheel mass: approx 5kg



Mod.3180-ALIM

For excitation of brake Mod.3180.

Input: 220/230Vac

Output: 0÷220Vdc

9.1 - STARTERS, VARIABLE LOADS

- Practice and modular version table top
- Input/output with standard 4 mm safety sockets
- Manual explaining theory and practice
- **also available: 01kW, 2 kW, 3kW, 6kW**



MOD.3010

Starter for Dc motor 0,1-0,3kW

Resistance: 0-100%, linear
Load carrying capacity: suitable for rpm setting of 50% at full torque



MOD.3011

Starter rheostat for slip ring 3-phase motor 0,1-0,3kW

Resistance: 3 x 0-100% linear continuously variable



MOD.3012

Field regulator for d.c. motors 0,1-0,3kW

Resistance: 0-100% linear, continuously variable



MOD.3013

Field regulator for a.c. and d.c. generators 0,1/0,3kW

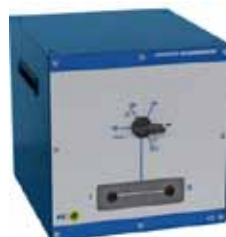
- Resistance: 0-100% linear, continuously variable



Mod.3016-R

Load resistor for 300W d.c. generators

- Resistance: 15% - 100% continuously variable



MOD.3010-4R

Starting rheostat for dc motor

- Resistance: 4 steps + 0W



MOD.3011-4R

Starter rheostat for slip ring 3-Ph motor 0,2÷1kW

- Resistance: 3 x 4 steps+0
- Unit type: table top unit



Mod.3020-20R

Load resistive for dynamo and 3-phase alternator; Starter for DC motor; Speed control for slip-rings motor,

- Variable load 3x5÷100%;
- Power.: 15W ÷ 330W 3-phase and single-phase; (single-phase with regulation 60 steps).



Mod.3020-20LC

Load for 3-phase alternator Load inductives & capacitives; Variable with 20 steps : 5% ÷100%; Triphasé et monophasé; (monophasé with 60 steps)



Mod.3020-110R

Load resistive for dynamo and 3-phase alternator; Starter for DC motor.;

- Variable 3x 1%÷110%;
- 3Ph: variable with 110 steps from 1% to 110%
- Power: 5÷550VA;
- Monophase: with 330 steps 1,6÷550VA



Mod.3020-110LC

Charge for 3-phase alternator

- Inductive & capacitive load variable with 3x1%÷110%;
- 3Ph: variable with 110 steps from 1% to 110%
- Power: 5÷550VA;
- Monophase: with 330 steps 1,6÷550VA

9.2 - R.L.C. VARIABLE LOADS

- Practice and modular version table top
- Input/output with standard 4 mm safety sockets
- Up to 240V(Delta)- Up to 430V(Star)

- Manual explaining theory and practice
- **also available: 1kW, 2kW, 3kW, 6kW**



MOD.3020-10R Resistive Load Module 0,5kW

With 12 resistors in three identical groups to realise balanced or unbalanced 3-phase loads (star and delta) and single-phase loads.

Each phase can be independently varied in 10 uniform steps from 10% to max current value for full power. Single-phase connection provides 30 regulation steps.

- Power variation: 10-100%

MOD.3020-20R

Provides -60 steps Monophase or -20 steps Three-phase. Power variation: 5-100%

MOD.3020-10L Inductive Load Module 0,5kVA

With 12 inductors in three identical groups to realise balanced or unbalanced 3-phase loads (star and delta) and single-phase loads.

Each phase can be independently changed in 10 uniform steps from 10% to max current value of full load. Single-phase connection provides 30 regulation steps.

- Power variation: 10-100%

MOD.3020-20L

Provides -60 steps Monophase or -20 steps Three-phase. Power variation: 5-100%



MOD.3020-10C Capacitive Load Module 0,5kVA

With 12 capacitors in 3 identical groups to realise balanced or unbalanced 3-phase loads (star and delta) and single-phase loads.

Each phase can be independently changed in 10 uniform steps from 10% to max current value of full load. Single-phase connection provides 30 regulation steps.

- Power variation: 10-100%

MOD.3020-20C

Provides -60 steps Monophase or -20 steps Three-phase. Power variation: 5-100%



MOD.3020-10LC

L+C Load Module 0,5+0,5 kVA

With 30 steps Monophase or -10 steps Three-phase.

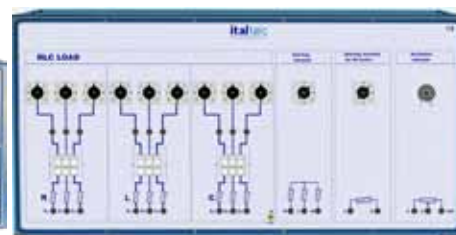
Power variation: 10-100%

Mod.3020-10RLC (0,5kVA)

For single&three phase, Capacitive, resistive and inductive step-variable loads.

Mod.3020-RLC-02 (0,5kVA)

For single&three phase, Capacitive, resistive and inductive step-variable loads. Complete with variable starting rheostats for three-phase and direct current motors and with linear excitation rheostat.



10.1 - AC / DC MEASUREMENT

Analog and digital instruments:

- Input/output with standard 4 mm safety sockets
- Compact table top version or for vertical frame

- User Manual included
- High precision and reliability
- **also available for : 1kW, 3kW, 6Kw**

Mod.3200

- DC VoltAmmeter

- DC voltmeters: 10–50–150–300V DC
- DC Ammeters: 100–500mA -2,5A–5A;



Mod.3201

- AC VoltAmmeter

- AC voltmeters: 30–100–250–500V AC
- AC Ammeters: 100–500mA, 2,5A -5A ;



Mod.3208

- Power Meters AC

- Max Voltage: 500V
- Max current: 2A



Mod.3201-AD

-AC Ammeter Digital

- AC ammeters: 0,02÷ 5A



Mod.3201-VD

- AC Voltmeter Digital

- AC voltmeters: 2÷500V AC



Mod.3201-1PH

- AC Voltmeter/Ammeter Digital

- 5÷ 300Volt / 0÷ 15 Amp.



Mod.3202-AC

- AC Voltmeter 500V
- Ammeter 20A



Mod. 3202-DC

- DC Voltmeter 600V
- Ammeter 20A



Mod.3202-ACDC

- AC-DC Voltmeter
- AC-DC Ammeter



10.2 - AC / DC MEASUREMENT

Digital instruments:

- Input/output with standard 4 mm safety sockets
- High precision and reliability
- also available for : 1kW, 3kW, 6kW
- Optional RS485/USB for PC Win
- Optional software for PC Windows with data recording & export

MOD.3203-01

-3-Ph Multimeter with graphic display

- 3 inputs for voltage 15÷ 600V AC
- 3 input for current 0,02÷5A AC
- Active, reactive, apparent power, Frequency, Power factor meter.



Mod.3203-02

-DC digital VA

- Voltmeter 0,1÷300V DC
- Ammeter 0,01÷5A DC



Mod.3203-03

-AC digital VA

- Voltmeter 0,1÷600V AC
- Ammeter 0,01÷5A AC



Mod.3203-04DC

-DC digital VAW Meter

- input voltage: 1÷ 220V DC
- input current: 0,03÷5A DC
- VAW (Volt, Ampere, Watt)
- Accuracy: 0,5%



MOD.3209

-3-Ph Multimeter

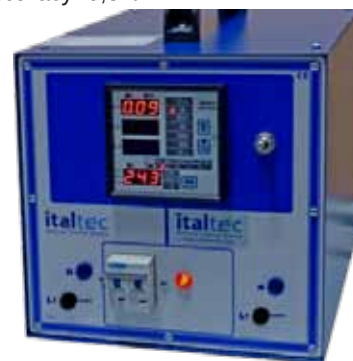
- 3 inputs for voltage 15÷ 500V AC
- 3 input for current 0,02÷10A AC
- Active, reactive, apparent power, Frequency, Power factor meter.



Mod.3209M

-1-Ph Multimeter

- input voltage: 10÷ 290V AC
- input current: 0,02÷10A AC
- Active, reactive, apparent power, Frequency, Power factor meter.
- Accuracy: 0,5%



Mod.3203-09-SW Software for windows

Software for connecting to Windows computers for the visualization, recording and export of all data collected by the instruments. Digital and analog display (on PC video) of all parameters (voltage, current, frequency, power factor, active power, reactive power, apparent power, etc.).

11.1 - EM CONTROL AND REGULATION SYSTEMS

Mod.3230

DC Speed Regulator Module

For open and closed loop regulation with Dc motors used as actuators in automation.

A current limiter with adjustable gain is included, for speed control and variable torque control.

- Input: 230Vac



Mod.3240

3Ph AC Speed Regulator Module

To execute experiment on regulation of Ac motors and as actuators for automation, robotics etc.

Frequency converter for all controls and regulations on three-phase source.

- Input : 208/380/415V 50/60Hz
- Output: 400V, 0÷400Hz

Mod.3301-B

Soft-Starter

Soft starter for motors slip-ring and squirrel cage

Star-delta starter

Motor protection adjustable current

Direct-starting



Mod.3301-A

Starter

Starter for motors slip-ring and squirrel cage

Star-delta starter

Motor protection adjustable current 1÷1,6A

Direct-starting

MOD.3183S

Starting and Synchronizing module

for synchronous motor

- With dc power supply 0-220volt up to 2A
- Input/Outputs: 4 mm CE safety sockets



11.2 - EM CONTROL AND REGULATION SYSTEMS

Protection for electrical machines:

- Motor protection with adjustable max current
- Option: Motor thermal protection
- Compact table top version or for vertical frame
- also available for : 1kW, 3kW, 6Kw

MOD.3302-01

With Star/Delta starter



MOD.3302-02

With MT and Y/D



MOD.3302-03

With Fuses and Y/D



MOD.3302-04

With soft starter and Y/D



MOD.3302-05

With MT



MOD.3302-06

With Fuses



MOD.3184-S Synchronizing indicator

for synchronous generator

It includes three indicator lamps, three line fuses, a three polar switch and 6 security sockets, dual voltmeter, dual frequency meter

- Operative voltage: 208/380/415V

MOD.3210 Tacho generator

Generator for r.p.m. detection, complete with base plate.

- Output: 60mV/rpm

MOD.3210.C

To read the speed of tachogenerator.



12.1 - EM ACCESSORIES



Mod.3185 **Digital Speed Meter**

Digital Tachometer for RPM measurement is safe and accurate without any contact with the machine shaft. It has wide measuring range and high resolution. It includes the speed sensor.

Mod.3182

Digital Photo tachometer, for safe and accurate RPM measuring both with and without contact with shaft.

- Test Range: 5 ~ 99999 RPM $\pm$ 0.05%



MOD.3196 **Connection Leads Set**

Set of 30 leads in 3 different colours and lengths to allow all experiments provided in the manual. Up to 16A.
Terminated with banana-banana plugs.

MOD.3196M-50

Cable Holder.

MOD.3215 **Gear block**

Device for block the rotor of the 3-phase motor.



MOD.3212 **Shaft end guard**



MOD.3213 **Coupling guard**



MOD.3214 **Coupling gear**

MOD.3214A **Rubber coupling sleeve**



12.2 - EM ACCESSORIES

MOD.6030B

Rail bed for all electrical machines



MOD.6030W

Mobile bed for all electrical machines, with 4 wheels



MOD.6031W

Mobile bed for all electrical machines and tabletop modules, with 4 wheels



MOD.3299

Table Top Vertical Frame



MOD.6030AL

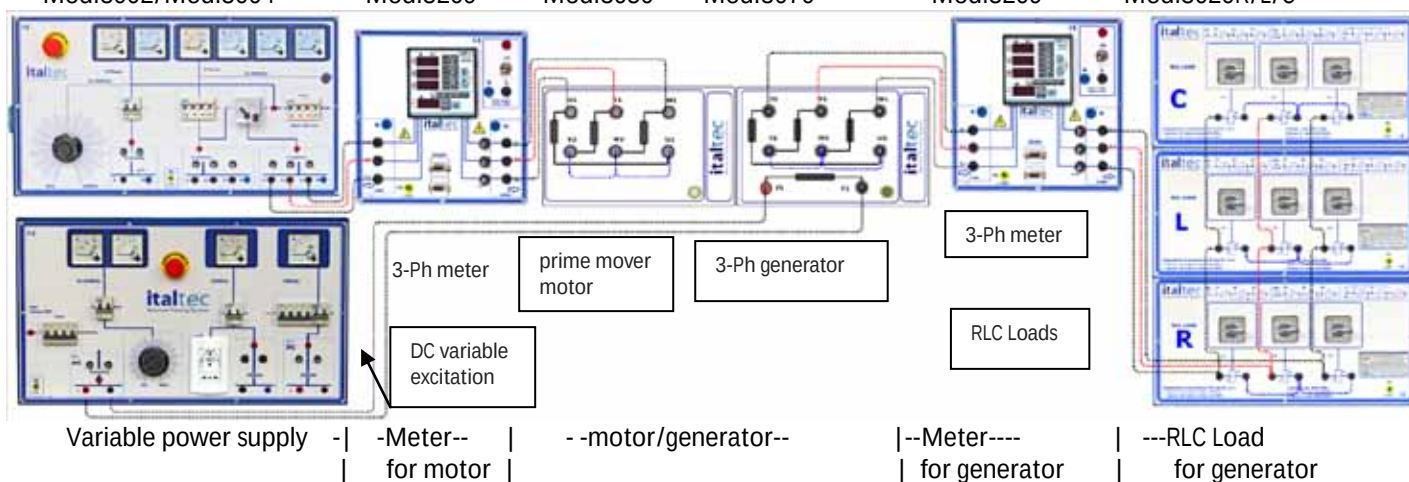
Universal base with rail for test of all electrical machines



Connection example

of 3-Ph generator Mod.3070 with Mod.3050 as prime mover motor
with a variable RLC Load applied to the generator
with a variable dc excitation applied to the generator

Mod.3002/Mod.3004-----Mod.3209-----Mod.3050-----Mod.3070 ----- Mod.3209 -Mod.3020R/L/C



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13.1 - AC/DC ELECTRICAL MACHINES KIT (ELV)

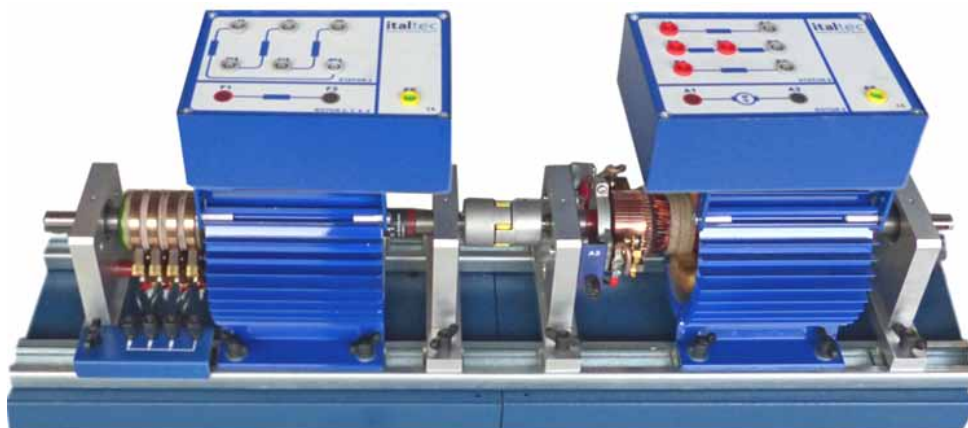
Dissectible System Trainer Kit for Electrical Machines AC/DC - Extra-low voltage (ELV)

The system includes all the equipment required to perform the full range of student assignments.

It provides a hands-on approach to the understanding of electrical machines principles.

Designed for training technician and undergraduate engineers. The interconnection of the windings on to a didactic terminal box provides a visual understanding of the coil of the various electrical machines and their functions.

- Safety connection terminals



- Users can see the position of the brushes and their movement.
- Powered by 48 volt.
- Possibility for studying of different motors & generator

MOD.1002-AC

AC Machines:

- Single-phase motor with capacitors
- 2-pole star connection three-phase motor
- Star-delta three-phase asynchronous motor
- Three-phase slip-ring motor
- Synchronous three-phase motor
- Three-phase alternator
- ST2 Alternating current stator.
- RT2 Two Rings Wound Rotor
- RT3 Two Salient-Pole Rotor
- RT4 Two Pole Permanent Magnet Rotor
- RT5 Slip ring rotor for functioning as motor & alternator.
- Three brushes for the slip-ring motor.
- One rotating brush holder.

- One brush holder mount.
- Half coupling.
- Base with rails for two machines.
- Two bearings for supporting the motor shaft.



- Power supply ca/cc; ca variable 0-50V 10A
cc variable 0-60V 10A

MOD.1002-DC

- Base with rails for two machines.
- A direct current stator.
- Two bearings for supporting the motor shaft.
- DC shunt motor/ motor with commutating poles
- DC series motor/ motor with commutating poles
- Shunt compound generator
- Shunt compound generator with commutating poles
- Separately excited shunt motor

- Series generator with commutating poles.
- Separately excited series source rotor generator
- Separately excited series source stator generator
- Self-excited shunt compound generator
- An armature
- Half coupling.
- Power supply ca/cc; ca variable 0-50V 10A
cc variable 0-60V 10A

