

**EMMS6**  
**3kW**  
**ELECTRICAL MACHINES**  
**MODULAR SYSTEM**



All available EMMS series:

- 300watts = EMMS3 MOD.3XXX
- 1.000watts = EMMS4 MOD.4XXX
- 2.000watts = EMMS5 MOD.5XXX
- 3.000watts = EMMS6 MOD.6XXX
- 6.000watts = EMMS7 MOD.7XXX
- 8.000watts = EMMS8 MOD.8XXX
- 10.000watts = EMMS9 MOD.9XXX

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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.

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 also used in a frame system
- 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 Dc. and Ac. 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



Example of coupling

EMMS are available with 300W power or for 0,5kW, 1kW, 3kW, 6kW etc.

### EMMS is available with different operative voltages as:

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

### EMMS is available with 1500 rpm or 3000 rpm (4 poles or 2 poles)

All speed values are shown with an operating frequency of 50Hz. For 60Hz operation, speed values will be higher (around +20%).

## 2.1 - EXPERIMENT MANUALS

### D.C. Motors & Generators

- Connection and study of industrial type of Dc. 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
- Load characteristics with mechanical or magnetic brake
- Characteristic with variable R-load
- 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.



The machines of this system can be supplied with a suitable base that allows an easy and safe coupling with other machines. It is fast and easy to realise groups of machines.

Special didactic solutions have been introduced in order to simplify the approach of the student to the study.

### Mod.6030B

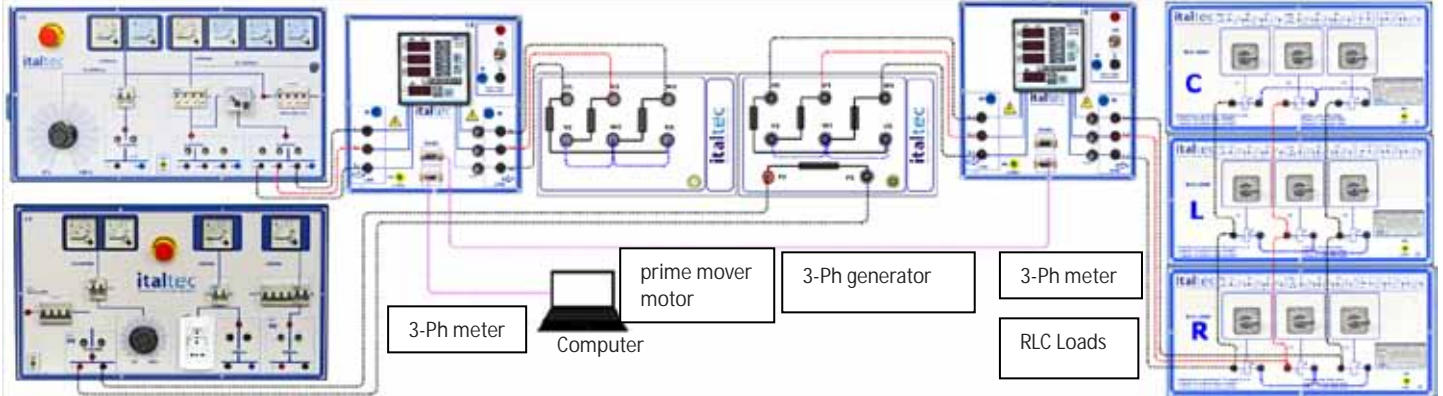
Rail bed for all electrical machines, tabletop



### 2.2 - Connection example

#### Connection example 1

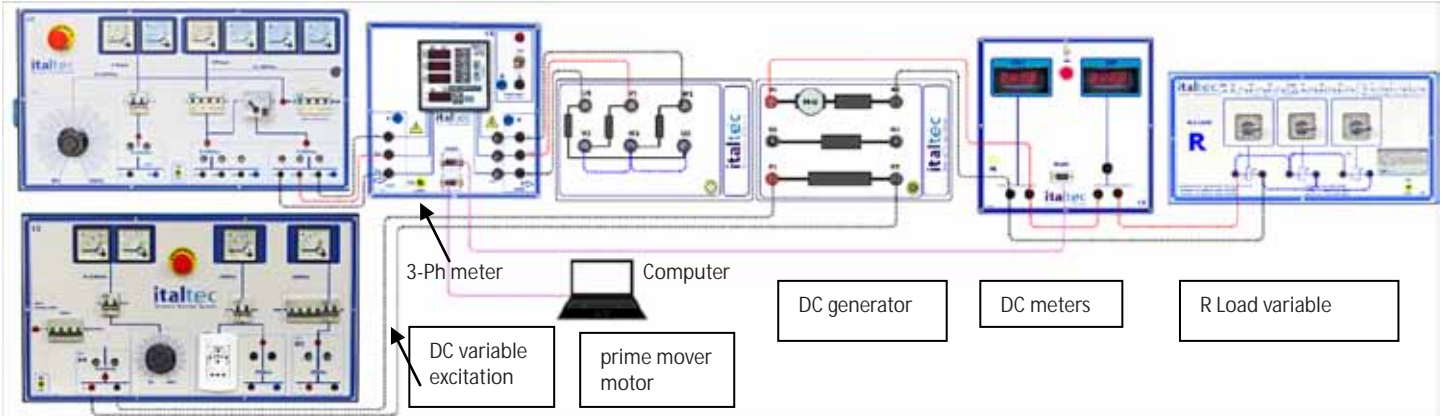
Mod.6002/Mod.6004-----Mod.6209-----Mod.6040/50/60-----Mod.6070 ----- Mod.6209 -Mod.6020R/L/C



Variable power supply - | -Meter for motor | - -motor | generator-- | -Meter for generator | -RLC Loads

#### Connection example 2

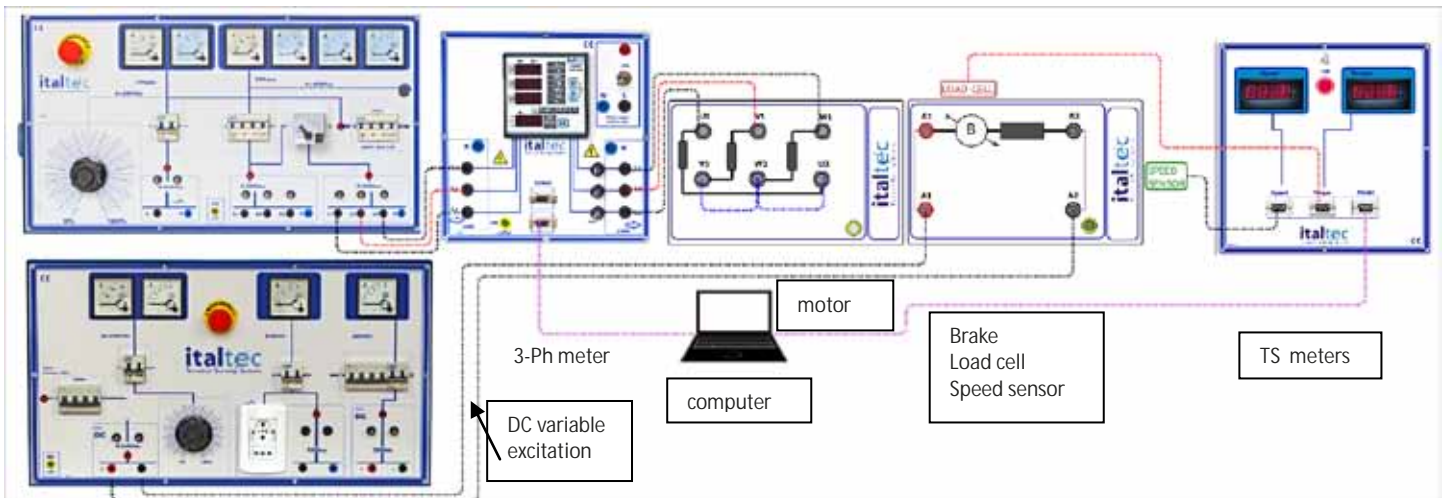
Mod.6002/Mod.6004-----Mod.6209-----Mod.6040/50/60---Mod.6140/50/60 ---- Mod.6203-02 -Mod.6020-10R



Variable power supply - | -Meter for motor | - -motor | generator-- | -Meter for generator | -RLC Loads

#### Connection example 3

Mod.6002/Mod.6004----- -Mod.6209-- ----- --Mod.6040/50/60----- -Mod.6180 ----- -- Mod.6203-07



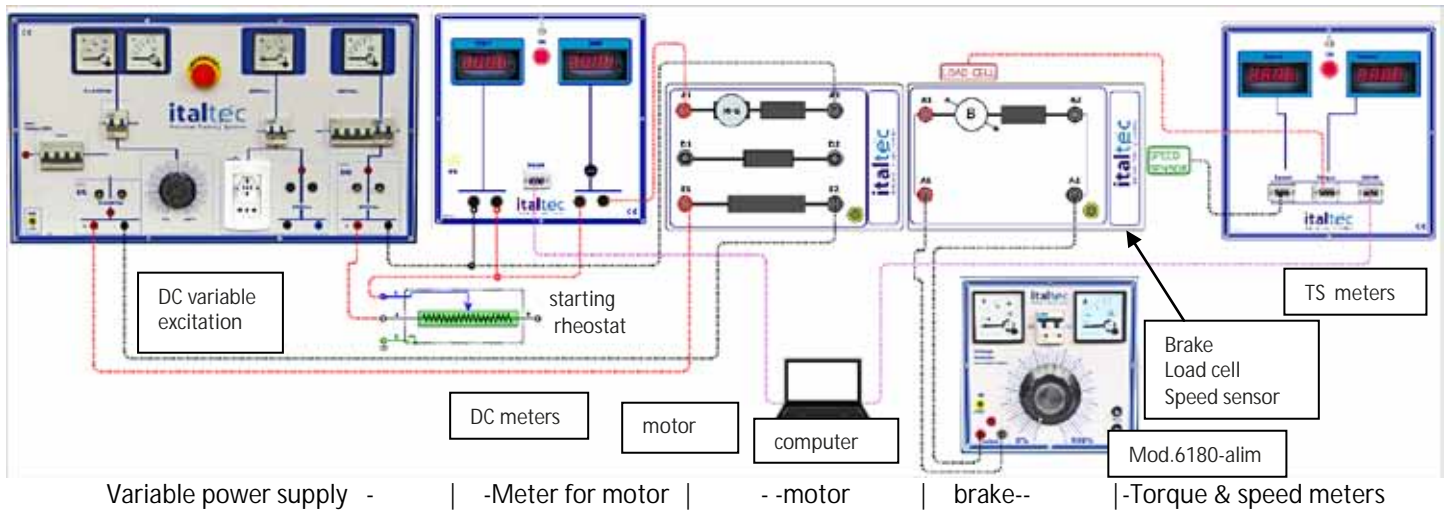
Variable power supply - | -Meter for motor | - -motor | brake-- | - Torque & speed meter

**2.3- Connection example**



**Connection example 4**

Mod.6002/Mod.6004-----Mod.6203-02-- --Mod.6140/50/60----- -Mod.6180 ----- Mod.6203-07



### 3.1 - POWER SUPPLY MODULE

Mod.6000 Universal power supply. (6002+6004) (also available 220V 60Hz version).  
- Power requirements: 380/400V, 3PH+N+G, 50Hz



Mod.6002 3-Ph/1Ph AC power supply 10+10A

Mod.6004 DC power supply 3+10A

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÷450V, 10A with  
- 1 x A.C. voltmeter - 3 x A.C. ammeters  
adjustable motor overload protection  
Single phase adjustable output: 0÷240V 10A with  
- 1 x A.C. voltmeter - 1 x A.C. ammeter

DC variable output: 0÷230V, 3A with  
- 1 x D.C. voltmeter - 1 x D.C. ammeter  
D.C. fixed output: 220V, 10A  
- with 1 x D.C. ammeter  
Single phase triple output: fixed 230Vac 16A  
- 1 x A.C. ammeter



Mod.6002D 3-Ph/1Ph AC power supply(Digital)



Mod.6004D -DC power supply (Digital)



Mod.6002-10-15 -3-Ph AC power supply 10+15A

3 phase adjustable output: 0÷450V, 10A with  
- 1 x A.C. voltmeter - 3 x A.C. ammeters  
Single phase adjustable output: 0÷240V 15A with  
- 1 x A.C. voltmeter - 1 x A.C. ammeter



Mod.6004-03-15 -DC power supply

DC variable output: 0÷230V, 3A with  
- 1 x D.C. voltmeter - 1 x D.C. ammeter  
DC fixed output: 220Vdc 15A  
- 1 x A.C. ammeter

### 4.1 - D.C. MACHINES

- Design: with typical industrial characteristics.
- Input/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 base and shaft joints available for fast and easy coupling.
- Optional double shaft ends

*Accessories:*

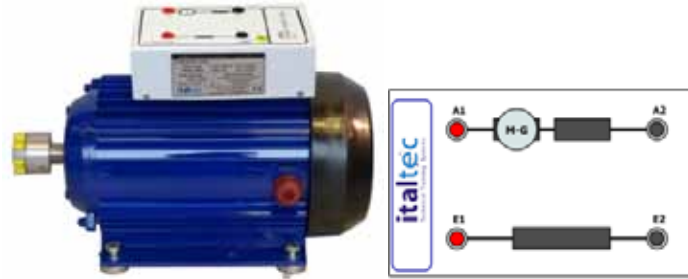
- STARTING RHEOSTAT
- EXCITATION RHEOSTAT
- POWER AND EXCITATION SUPPLY

**Mod.6140 Shunt Wound Machine 3000rpm**

**Mod.6140-4 Shunt Wound Machine 1500rpm**

Modes: self and externally excited Motor/Generator

- Nominal voltage: 220Vdc
- Excitation voltage: 90÷210Vdc
- Nominal speed: 3000/1500rpm
- Nominal power: 3Kw (mot.) 2,5kW(gen.)



**Mod.6150 Series Wound Machine 3000rpm**

**Mod.6150 Series Wound Machine 1500rpm**

Modes: series Motor/Generator.

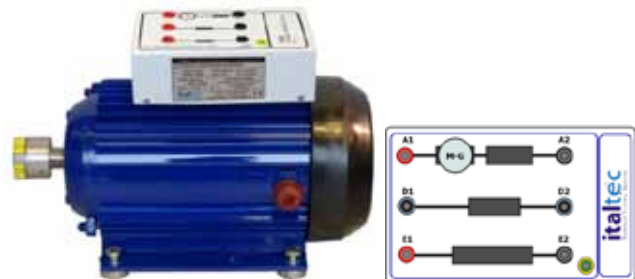
- Nominal voltage: 220Vdc
- Nominal speed: 3000/1500rpm
- Nominal power: 3Kw (mot.) 2,5kW(gen.)

**Mod.6160 Compound Wound Machine 3000rpm**

**Mod.6160-4 Compound Wound Machine 1500rpm**

Modes: self and externally excited Motor/Generator.

- Nominal voltage: 220Vdc
- Excitation voltage: 90÷210Vdc
- Nominal speed: 3000/1500rpm
- Nominal power: 3Kw (mot.) 2,5kW (gen.)



**Mod.6165 Multi circuit Wound Machine 3000rpm**

**Mod.6165-4 Multi circuit Wound Machine 1500rpm**

Modes: Shunt wound, compound wound, series wound Motor/Generator.

- Nominal voltage: 220Vdc
- Excitation voltage: 90÷210Vdc
- Nominal speed: 3000/1500rpm
- Nominal power: 3Kw (mot.) 2,5kW (gen.)



## 5.1 - A.C. MACHINES

- Design: with typical industrial characteristics.
- Input/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 base and shaft joints available for fast and easy coupling.
- Optional double shaft ends
- Also available: other voltage like 127/220V 60Hz version (speed is 20% higher)

*Accessories:*

- POWER AND EXCITATION SUPPLY

**Mod.6040 -3Phase Squirrel Cage Motor 2Poles 2850rpm**

**Mod.6040-4 -3Ph Squirrel Cage Motor 4Poles 1420rpm**

- Nominal power: 3kW;
- Voltage: 230/400V delta/star (D/Y)
- 2P Speed: 50Hz/2850rpm (60Hz: 3400) 6,3/11Amp.
- 4P Speed: 50Hz/1420rpm (60Hz: 1700rpm) 7/12Amp
- Weight: 24Kg; -Shaft H: 112mm



**Mod.6050 -3Ph Slip ring asynchronous motor 2Poles 2850rpm**

**Mod.6050-4 -3Ph Slip ring asynchronous motor 4Poles 1420rpm**

- Nominal power: 3kW;
- Voltage: 230/400V delta/star
- Optional Voltage: 127/220V delta/star 60Hz
- 2P Speed: 50Hz/2850rpm (60Hz: 3400rpm)
- 4P Speed: 50Hz/1420rpm (60Hz: 1700rpm)
- Weight: 25Kg; - Shaft H: 112mm

*Accessories:*

- STARTING RHEOSTAT
- POWER SUPPLY



**Mod.6060 3Phase Dahlander Motor 2&4 Poles**  
**- 2Poles 2800rpm - 4poles 1400RPM**

- Nominal power: 2,2/3kW;
- Voltage: 400V star/star 50Hz
- Optional Voltage: 230/400V delta/star (D/Y)
- 2P Speed connection: 50Hz/2800rpm (60Hz: 3400)
- 4P Speed connection: 50Hz/1400rpm (60Hz: 1700rpm)
- Weight: 24Kg; - Shaft H: 112mm
- Optional Voltage: 127/220V delta/star 60Hz





## 5.2 - A.C. MACHINES

- Design: with typical industrial characteristics.
- Input/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 base and shaft joints available for fast and easy coupling.
- Optional double shaft ends
- Other voltage available like 127/220V 60Hz (speed is 20% higher)

*Accessories:*

- POWER AND EXCITATION SUPPLY

### Mod.6070 3Ph salient poles Synchronous Generator 3000rpm

### Mod.6070-4 3Ph salient poles Synchronous Generator 1500rpm

With salient pole rotor. Modes: motor, generator.

- Nominal power: 3kW(gen.)/2,4kW(mot.)
- Voltage: 230/400V (delta/star)
- Optional Voltage: 127/220V delta/star 60Hz
- Excitation voltage: 100÷210Vdc
- Current : (max) 9/6A
- 2P Speed: 50Hz/3000rpm (60Hz: 3600rpm)
- 4P Speed: 50Hz/1500rpm (60Hz: 1800rpm)
- Weight: 25Kg; - Shaft H: 112mm

*Accessories:*

- STARTING RHEOSTAT
- POWER SUPPLY



### Mod.6074 3Phase Synchronous Generator 2P

### Mod.6074-4 3Phase Synchronous Generator 4P

Non-salient (smooth) pole rotor. Modes: motor, generator.

- Nominal power: 3kW(gen.)/2,4kW(mot.)
- Voltage: 230/400V (delta/star)
- Optional Voltage: 127/220V delta/star 60Hz
- Excitation voltage: 100÷210Vdc
- Current : (max) 9/6A
- Speed(2P): 50Hz/3000rpm (60Hz: 3600rpm)
- Speed(4P): 50Hz/1500rpm (60Hz: 1800rpm)
- Weight: 25Kg; - Shaft H: 112mm

*Accessories:*

- STARTING RHEOSTAT
- POWER SUPPLY



### Mod.6072 Single Phase Synchronous Generator 2P 3kRpm

### Mod.6072-4 Single Phase Synchronous Generator 4P

With salient pole rotor.

- Nominal voltage: 220/230V
- Excitation voltage: 100÷210V DC
- Nominal power: 1,5 kW
- Speed(2P): 50Hz/3000rpm (60Hz: 3600rpm)
- Speed(4P): 50Hz/1500rpm (60Hz: 1800rpm)
- Weight: 25Kg; - Shaft H: 112mm



**5.3 - A.C. MACHINES**

- Design: with typical industrial characteristics.
  - Input/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 base and shaft joints available for fast and easy coupling.
  - Optional double shaft ends
  - Other voltage available like 127/220V 60Hz (speed is 20% higher)
- Accessories:*
- POWER AND EXCITATION SUPPLY



- Mod.6080 3Ph Reluctance synchronized motor 2P 3kRpm**  
**Mod.6080-4 3Ph Reluctance synchronized motor 4P 1,5kRpm**
- Nominal power: 1,1kW;
  - Voltage: 230/400V delta/star (D/Y)
  - Speed(2P): 50Hz/3000rpm (60Hz: 3600)
  - Speed(4P): 50Hz/1400rpm (60Hz: 1800rpm)
  - Weight: 22Kg; - Shaft H: 112mm
  - Optional Voltage: 127/220V delta/star 60Hz

**Mod.6130 Universal Motor**  
Modes: AC motor DC series motor

- Nominal voltage: 220V DC/AC
- Nominal speed: 3000rpm
- Nominal power: 3kW (DC) / 2kW (AC)
- Weight: 22Kg; -Shaft H: 112mm



- Mod.6090 Single Phase Ac Capacitor Run Motor Squirrel cage Motor**  
**Mod.6090-4 Single Phase Ac Capacitor Run Motor Squirrel cage Motor**
- Nominal power: 3kW
  - Nominal voltage: 220/230Vac 50Hz
  - Optional Voltage: 127/220V delta/star 60Hz
  - Speed(2P): 50Hz/2800rpm (60Hz: 3400)
  - Speed(4P): 50Hz/1400rpm (60Hz: 1800rpm)
  - Cap.=36uF
  - Weight: 22Kg; - Shaft H: 112mm

**Mod.6095 Split phase motor 2P 220/230V 2800rpm**  
**Mod.6095-4 Split phase motor 4P 220/230V 1400rpm**  
Single-phase motor with starting auxiliary phase, complete with centrifugal starting switch and starting and running capacitor

- Starting capacitor and run capacitor
- Nominal power: 3kW
- Nominal voltage: 220/230V AC 1Ph 50Hz
- Optional Voltage: 127/220V delta/star 60Hz
- Speed(2P): 50Hz/2800rpm (60Hz: 3400)
- Speed(4P): 50Hz/1400rpm (60Hz: 1800rpm)
- Weight: 22Kg; - Shaft H: 112mm



**5.4 - A.C. MACHINES**

- Design: with typical industrial characteristics.
- Input/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 base and shaft joints available for fast and easy coupling.
  - Optional double shaft ends
  - Other voltage available (ie 127/220V 60Hz speed is 20% higher)
- Accessories:*
- POWER AND EXCITATION SUPPLY



**Mod.6120 Single Phase Ac Capacitor Start Motor 2800rpm**  
**Mod.6120-4 Single Phase Ac Capacitor Start Motor 1400rpm**  
Single-phase motor with starting auxiliary phase, complete with starting switch and starting capacitor

- Nominal power: 3kW
- Nominal voltage: 220/230V AC 1Ph 50Hz
- Optional Voltage: 127/220V delta/star 60Hz
- Speed(2P): 50Hz/2800rpm (60Hz: 3400)
- Speed(4P): 50Hz/1400rpm (60Hz: 1800rpm)
- Weight: 22Kg; - Shaft H: 112mm

**Mod.6122 Single Phase AC Capacitor Start/Cap. Run Motor 2800rpm**  
**Mod.6122-4 Single Phase AC Capacitor Start/Cap. Run Motor 1400rpm**  
Single-phase motor with starting auxiliary phase, complete with starting switch and starting and running capacitor

- Starting capacitor and run capacitor
- Nominal power: 3kW
- Nominal voltage: 220/230V AC 1Ph 50Hz
- Optional Voltage: 127/220V delta/star 60Hz
- Speed(2P): 50Hz/2800rpm (60Hz: 3400)
- Speed(4P): 50Hz/1400rpm (60Hz: 1800rpm)
- Weight: 22Kg; -
- Shaft H: 112m



**Mod.6030B**



**Mod.6030B**  
Rail bed for all electrical machines, tabletop

**Mod.6030W**



**Mod.6030B**



## 6.1 - SEC MACHINES

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

**Mod.3040**  
Three Phase Squirrel Cage Motor



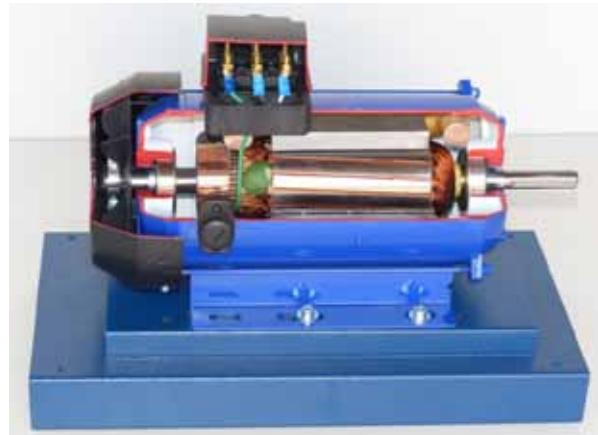
**Mod.3070**  
Three Phase Synchronous Generator



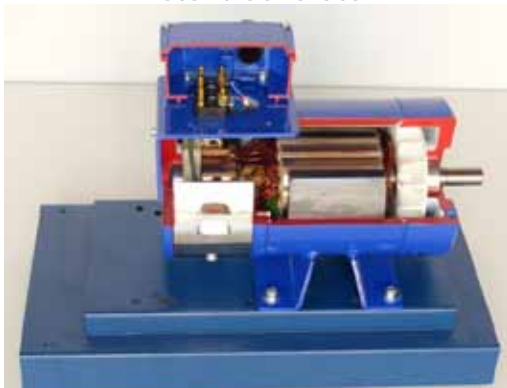
**Mod.3122**  
Single Phase AC Motor  
Capacitor Start/Run with centrifugal switch



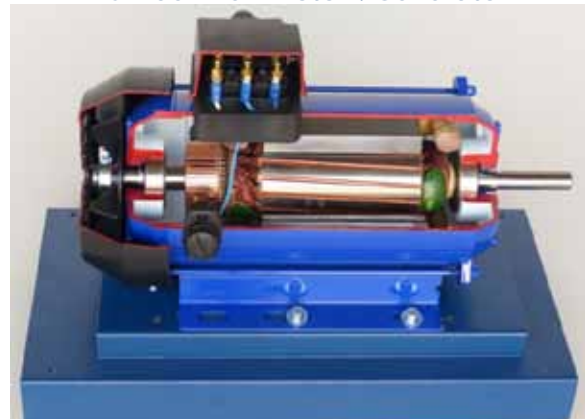
**Mod.3130**  
Universal Motor AC/DC



**Mod.3142**  
Permanent Magnet DC Machine  
Motor /Generator



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



**7.1 - TRANSFORMERS**

**Mod.6190**

**Single Phase Transformer**

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

- 230/115V primary/secondary.
- Primary: 2x115V Ac
- Secondary: 2x57,5V Ac
- Power: 3kVA
- Frequency 50/60 Hz
- also available: other power, other primary/secondary ratio



**Mod.6195**

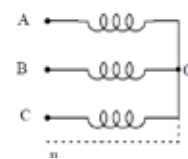
**Three-phase Transformer**

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

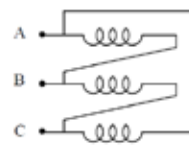
- Primary: 3x400 (3 x 2 x 115V)
- Secondary: 3x230 (3 x 2 x 66,5V)
- Power: 3kVA
- Frequency 50/60Hz
- also available: other power, other primary/secondary ratio

**Primary/secondary connection**

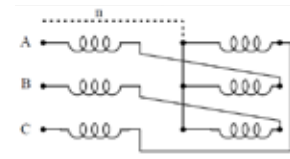
- STAR - STAR Yy
- DELTA - STAR Dy
- DELTA - DELTA Dd
- STAR - Zig-zag Yz
- DELTA - Zig-zag Dz



STAR (Y)



DELTA (D)



ZIG-ZAG (Z)

**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 base plate and coupling cog for easy engagement with other machine
- Input/output with standard 4 mm safety sockets
- Protection against thermal overload
- Imprinted terminal boards with the synoptic
- Two shaft ends on request
- Manual explaining theory and practice

### Mod.6170 Electrodynamicometer (brake/generator)

Brake and generator with separate excitation, mounted on oscillating frame in order to operate as a brake. The electrodynamicometer is complete with arms, weights, and counterweights, for usage with the classic mechanical scale method, with the graduated measuring rod and 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 Mod.4203-07.

- Nominal voltage: 220V d.c.;
- Excitation voltage: 0÷ 210V d.c.
- Speed: 1000/3600 rpm;
- Power: up to 3,5kW at 3000 rpm;
- Coupling type: cog coupling
- Weight: 30kg

#### Optional accessories:

- Load adjustable with steps.
- Excitation power supply.
- Encoder for detecting the speed in rpm.
- Load cell or torque meter for detecting the couple.
- Digital meter for displaying the speed and couple in Kgm or Nm.



### Mod.6174 Magnetic powder brake

Magnetic powder brake for test and measurement of the torque and power of electrical motors. 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 electrical motors 3kW, 1000/3000 Rpm.

- Couple: 0,3 - 12Nm. •Coupling type: cog coupling; •Weight: 20 kg

#### Optional accessories:

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



### Mod.6180 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.6203-07.

For direct test of electric motors up to 3kW and 3000 Rpm.

- Excitation voltage: 0÷ 210V d.c.
- Speed: 1000/3600 rpm; •Weight: 30 kg

#### Optional accessories:

- Excitation power supply.
- Encoder for detecting the speed.
- Load cell or torque meter for detecting the couple.
- Digital instrument (Mod.6203-07) for displaying the speed (rpm) and couple automatically, both in Kgm or Nm.



### 8.2 - BRAKES & TORQUE METERS

#### Mod.6203-07

##### Torque & Speed Meter with Load Cell

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. Both measurements can be shown on the digital display.

It can be calibrated both in kgm or Nm. The meter can be used with all brakes.

*Optional accessories:*

- RS485 interface.
- Management software

#### Mod.6203-07-TT

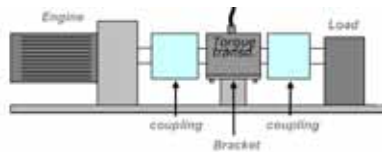
##### Torque Transducer



Torque Transducer



Load cell



#### Mod.6203-08

##### 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.6186 Inertia wheel

For simulating heavy starting and energy storage.

Design: built into an electrical motor housing with base.

- Flywheel mass: approx 10kg



#### Mod.6180-ALIM

For excitation of brake Mod.6180.

Input: 220/230Vac  
Output: 0÷220Vdc

### 9.1 - STARTERS, VARIABLE RLC LOADS

- Practice and modular version table top
- Input/output with standard 4 mm safety sockets
- Manual explaining theory and practice
- also available: 0,3kW, 2 kW, 3kW, 6kW



**Mod.6010**  
Starting rheostat  
for Dc motor  
Resistance: 0÷100%, linear



**Mod.6011**  
Starting rheostat  
for slip ring 3-phase motor  
Resistance: 3x0÷100% linear continuously  
variable



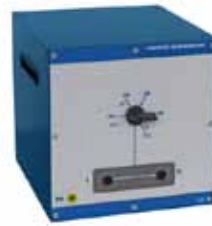
**Mod.6012**  
Field regulator  
for Ac. and Dc. motors  
Resistance: 0÷100% linear,  
continuously variable



**Mod.6013**  
Field regulator  
for Ac. and Dc. generators  
• Resistance: 0-100% linear,  
continuously variable



**Mod.6016-R**  
Load resistor  
for d.c. generators  
• Resistance:  
20÷100% cont. variab.  
• Nominal power: 200÷1000W



**Mod.6010-4R** Starting  
rheostat for dc motor  
Resistance:  
4 steps+0W



**Mod.6011-4R**  
Starting rheostat  
for slip ring & squirrel cage 3-ph  
motor  
• Resistance:  
3 x 4 steps+0



**Mod.6020T-20R**  
Load resistive for dynamo  
and alternator;  
Starter for DC motor; Speed  
control for slip-rings motor;  
• Variable load 3x5÷100%;  
• Power: 150W÷3000W  
3-phase/ single-phase;



**Mod.6020T-20LC**  
Load for 3-phase  
alternator  
Load inductives &  
capacitives;  
Variable with 20 steps :  
5% ÷100%;  
Power: 150VA÷3000VA  
Triphase / monophase;  
(monophasé with 60  
steps);



**Mod.6020T-110R**  
Load resistive for dynamo &  
alternator; Starter for DC motor. ;  
• Variable 3x 1%÷110%;  
• 3Ph: variable with 110 steps  
from 1% to 110%  
• Power: 30÷3000VA;  
Triphase / monophasé;  
(monophasé with 330 steps);



**Mod.6020T-110LC**  
Charge for triphase alternator  
• Inductive & capacitive load  
variable with 3x 1%÷110%;  
• 3Ph: variable with 110 steps  
from 1% to 110%  
• Power: 30÷3000VA;  
Triphase / monophase;  
(monophasé with 330 steps);



**9.2 - R.L.C. VARIABLE LOADS**

- Practice and modular version table top
- Input/output with standard 4 mm safety sockets

- Manual explaining theory and practice
- also available: 0,3kW, 2kW, 3kW, 6kW



**Mod.6020-10R Resistive Load Module 3kW (wheeled)**

With 12 resistors in three identical groups to realise balanced or unbalanced 3-phase loads (star & delta) and single-phase loads. Each phase can be independently varied in 10 uniform steps from 0 to max current value for full power. Single-phase connection provides 30 regulation steps.

- Power variation: 0-100%

**Mod.6020T-10R Resistive Load Module 3kW (tabletop)**

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

**Mod.6020T-20R Resistive Load Module 3kW (tabletop)**

**Mod.6020T-10L Inductive Load Module 3kVA (tabletop)**

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 0 to max current value of full load. Single-phase connection provides 30 regulation steps.

- Power variation: 0-100%



**Mod.6020T-20L Inductive Load Module 3kVA (tabletop)**

Provides -60 steps Monophase or -20 steps Three-phase

**Mod.6020T-10C Capacitive Load Module 3kVA (tabletop)**

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 107 uniform steps from 0 to max current value of full load. Single-phase connection provides 30 regulation steps.

- Power variation: 0-100%

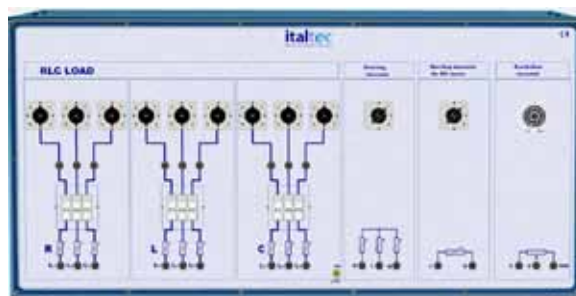
**Mod.6020T-20C Capacitive Load Module 3kVA (tabletop)**

Provides -60 steps Monophase or -20 steps Three-phase



**Mod.6020-RLC-02 (3kVA)**

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 : 0,3kW, 1kW, 6kW**

**Mod.6200-VA**

**- DC VoltAmmeter**

- with eight separate meters for Dc
- DC voltmeters: 10-50-150-300V DC
- DC Ammeters: 2,5A -5A -10A -20A



**Mod.6201-VA**

**- AC VoltAmmeter**

- with eight separate meters for Ac
- AC voltmeters: 30-100-250-500V AC
- AC Ammeters: 2,5A -5A -10A -20A ;



**Mod.6206**

**- DC Power meter**

- for measurements of power dc
- Max Voltage: 300V
- Max current: 10A



**Mod.6200-V**

**- DC Voltmeter**

- with three separate meters for Dc
- DC C: -50-150-300V DC



**Mod.6201-V**

**- AC Voltmeter**

- with three separate meters for Ac
- AC Voltmeter: - 500V



**Mod.6207**

**- Power factor meter**

- for measurements of power factor
- -0,5 ind.-1-0,5 cap.
- Voltage max: 500V;
- Current: 5A;



**Mod.6200-A**

**- DC Ammeter**

- with three separate ammeters for DC
- DC Ammeters: 5A - 10A - 20A



**Mod.6201-A**

**- AC Ammeter**

- with three separate meters for Ac
- AC ammeters: - 10A



**Mod.6208**

**- Power Meters AC**

- Max Voltage: 500V
- Max current: 10A - 10A



**Mod.6211**

**- Frequency Meter**

- Range: 45-65Hz
- Max Voltage : 500V c.a.



**Mod.6209B**

**- 1&3ph Multimeter**

- 3 input Voltage L-L & L-N; 30÷400V
- 3 Current I1, I2, I3 ; range:0,1÷30A
- Active, reactive, apparent power,
- Frequency,
- Power factor meter



### 10.2 - AC/DC MEASUREMENT

#### 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 : 0,3kW, 3kW, 6kW

#### Mod.6200-VAD

##### -DC VoltAmmeter

- Digital voltmeter 0,1V÷300V DC
- Digital milliAmmeter 0,1mA÷3A DC
- Digital Ammeter 0,1A÷20A DC



#### Mod.6201-AD

##### -AC Ammeter

- with three separate meters for Ac
- AC ammeters: 0,02÷ 20A



#### Mod.6201-VD

##### - AC Voltmeter

- with three separate meters for Ac
- AC voltmeters: 2÷500V AC



#### Mod.6209M

##### -1-Ph Multimeter

- input voltage: 10÷ 290V AC
- input current: 0,08÷30A AC
- Active, reactive, apparent power, Frequency, Power factor meter.
- Accuracy: 0,5%
- Optional RS485/USB for PC



#### Mod.6209

##### -3-Ph Multimeter

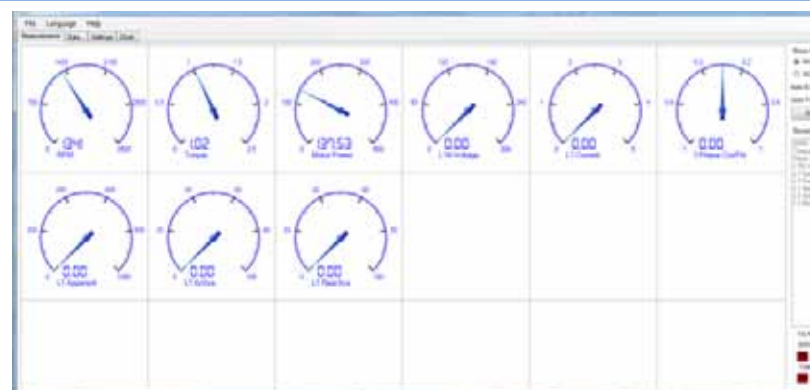
- 3 inputs for voltage 15÷ 500V AC
- 3 input for current 0,08÷20A AC
- Active, reactive, apparent power, Frequency, Power factor meter.
- Optional RS485/USB for PC
- Optional software for PC Windows



#### Mod.6203-01

##### -3-Ph Multimeter with graphic display

- 3 inputs for voltage 20÷ 600V AC
- 3 input for current 0,08÷20A AC
- Active, reactive, apparent power, Frequency, Power factor meter.
- Optional RS485/USB for PC
- Optional software for PC Windows



#### 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.).

### 10.3 - AC/DC & MECHANICAL MEASUREMENT

#### Digital instruments:

- also available for : 1kW, 3kW, 6kW
- Compact table top version or for vertical frame
- Accuracy: 0,5%
- Optional software for PC Windows with data recording and export
- Optional wired/wireless PC Usb connection

#### Mod.6203-02

##### -DC digital VA

- Voltmeter: 0,1÷300V DC
- Ammeter: 0,05÷20A DC
- Optional software for PC Win.



#### Mod.6203-03

##### -AC digital VA

- Voltmeter: 0,1÷300V AC
- Ammeter: 0,05÷20A AC
- Optional software for PC Win.



#### Mod.6203-04DC

##### -Digital VAW Meter DC

- input voltage: 1÷ 220V DC
- input current: 0,08÷20A DC
- VAW (Volt, Ampere, Watt)
- Accuracy: 0,5%



#### Mod.6203-07

##### -TS digital meter

- Torque meter
- Speed meter
- with speed sensor and a load-cell
- Optional software for PC Win.



#### Mod.6203-07ALR

##### -TS digital meter

- Torque meter with alarm
- Speed meter with alarm
- with speed sensor and a load-cell
- Optional software for PC Win.



#### Mod.6203/09-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's video) of all parameters (voltage, current, power, speed, torque, mechanical power).



**11.1 - E.M. CONTROL AND REGULATION SYSTEMS**

**Mod.6230 DC Speed Regulator Module**

For experiment on open and closed loop regulation on 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.6240 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

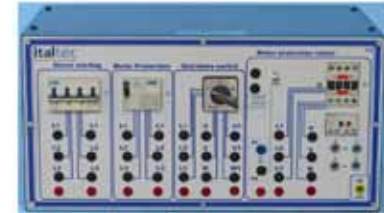
**Mod.6301-B Soft-Starter**

Soft starter for motors slip-ring and squirrel cage

Star-delta starter

Motor protection adjustable current

Direct-starting



**Mod.6301-A Starter**

Starter for motors slip-ring and squirrel cage

Star-delta starter

Motor protection adjustable current 1÷1,6A

Direct-starting

**Mod.6183S Starting and Synchronizing module for synchronous motor**

- With dc power supply 0÷220volt up to 3A
- Input/Outputs: 4 mm CE safety sockets
- Unit type: Table top



**MOD.6184-S Synchronizing indicator**

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

**11.2 - E.M. 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 : 0,3kW, 1kW, 6Kw

**MOD.6302-01**  
With Star/Delta starter



**MOD.6302-02**  
With MT and Y/D



**MOD.6302-03**  
With Fuses and Y/D



**MOD.6302-04**  
With soft starter and Y/D



**MOD.6302-05**  
With MT



**MOD.6302-06**  
with Fuses



**Mod.6210 Tacho generator**

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

- Output: 60mV/rpm

**MOD.6210.C**

To read the speed of tachogenerator.



**12.1 -ACCESSORIES**



**Mod.6185**  
**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.6182**  
**Digital Precision Tachometer**

Digital Photo tachometer, for safe and accurate RPM measuring both with and without contact with shaft. It has a wide measuring range and high resolution.

- Test Range: 5 ~ 99999 RPM±0.05%



**Mod.6196**  
**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.6196M-50**  
Cable Holder.

**Mod.6215**  
**Gear block**

Device for block the rotor of the three-phase asynchronous motor cage and slip ring.

- Dimensions: LxWxH: 16 x 14 x 15cm



**Mod.6212**  
**Shaft end guard**

- Dimensions: LxWxH: 3 x 9 x 11,5cm



**Mod.6213**  
**Coupling guard**

- Dimensions: LxWxH: 6 x 9 x 11,5cm



**Mod.6214**  
**Coupling gear**

**Mod.6214A**  
Rubber coupling sleeve



### 12.2 -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.6070 with Mod.6050 as prime mover motor

with a variable RLC Load applied to the generator

with a variable dc excitation applied to the generator

Mod.6002/Mod.6004-----Mod.6209-----Mod.6050-----Mod.6070 ----- Mod.6209 -Mod.6020R/L/C

