ML300

Electrical Machines & Transformer Lab 300 Watts

Overview

The Electrical Machines & Transformer Lab 300 Watts is a complete modular training system designed as two integrated units that work together to provide both theoretical understanding and practical performance testing of electrical machines and transformers. The first unit is the main modules unit, which serves as the control, supply, measurement, and monitoring platform of the trainer. This unit includes the measuring and operating modules required to build and study different machine and transformer circuits, such as electrical measuring devices, switching , transformer modules, synchronization functions, and software-based monitoring, allowing trainees to configure experiments, observe electrical variables, & understand circuit operation in a clear and structured way. The second unit is the DC Brake Test bench unit, where the actual electrical machines are mounted and tested under real operating and loading conditions. This unit is used to connect different AC and DC machines, apply mechanical or electrical load, measure speed and torque-related behavior, and evaluate machine performance characteristics during operation. The interchangeable machine units allow trainees to study different machine types, operating modes, and response under load. By combining the modular experiment unit with the practical machine testing unit, the trainer provides a comprehensive educational environment for studying machine operation, transformer behavior, and fault investigation in a direct hands-on manner.



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Specifications

Main Modules Kit (ML300.01)

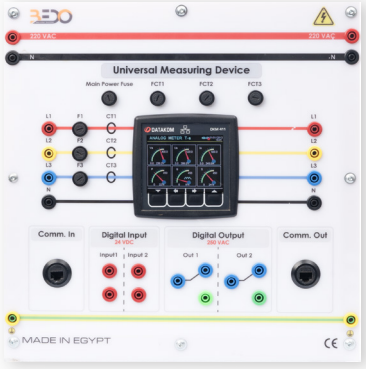
AC digital multimeter (ML300.01.01)



Technical Data:

- Input:
  - » 220 V
  - » 50Hz via 4 mm safety banana socket
- Measurement inputs:
  - » 10 - 300 V AC
  - » 0.2 – 5.50 A AC
  - » 30 - 100 Hz
- Accuracy: volts-amps-hz: 0.5% digits
- Fuse Protection

Universal Measuring Device (ML300.01.02)



Technical Data

- True RMS measurements, 0.2% accuracy
- Harmonic distortion display (31 harmonics)
- Max demand display
- User configurable display screen
- Sealed front panel (IP54)
- RS-485 interface
- Measurements:
  - » Phase to phase voltages: U_{12}-U_{23}- U_{31}-U_{avg}
  - » Phase to neutral voltages: V_1-V_2-V_3-V_{avg}
  - » Phase currents: I_1-I_2-I_3-I_N-I_{AVG}-I_{TOT}
  - » Active power: P_1-P_2-P_3-ΣP
  - » Reactive power: Q_1-Q_2-Q_3-ΣQ
  - » Apparent power: S_1-S_2-S_3-ΣS
  - » Power factor: COS_1-COS_2-COS_3-ΣCOS
  - » Active power counters: PC_1-PC_2
  - » Reactive power counters: QC_1-QC_2
  - » User counters: USR_1-USR_2-USR_3-USR_4
  - » 2...31 harmonics of any voltage or current
  - » Input voltage: 0-300VAC PH-N

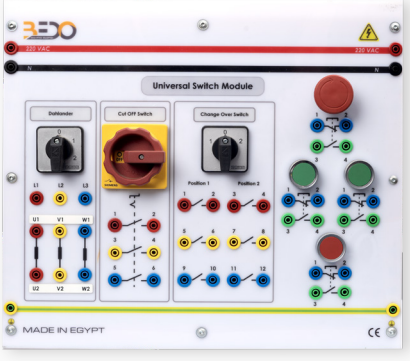
Variable Frequency Drive (VFD (ML300.01.03)



Technical Data:

- 3 phase 380V Input
- 3 phase 380V Output
- Control Speed of three phase induction motor squirrel cage and slip ring
- Input and outputs from 4 mm banana sockets
- 3.5 HP

Universal Switch Unit (ML300.01.04)



Overview

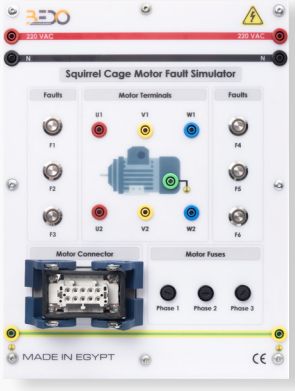
- Universal switch unit with all necessary switches and push-buttons for switching various motors with a power rating up to 1kW.

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Switch elements:

- 1x Emergency stop push-button
- 2X Push-button 1 NO/1 NC, green
- 1X Push-button 1 NO/1 NC, red
- 1X Cut off switch, 3-pole
- 1X Pole change-over switch, Dahlander
- 1X Pole change-over switch for separate windings
- Nominal voltage: 230/400V, max 500V
- Nominal current: 16A
- Frequency: 50/60Hz
- Inputs & outputs: 4 mm safety sockets

Squirrel cage motor fault simulator (ML300.01.05)



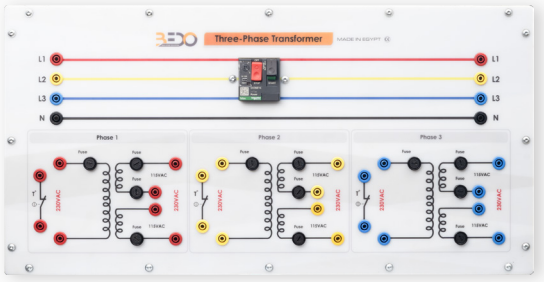
Overview

- The ends of the stator windings are connected to a series of switchesthat, when activated, simulate common faults on the motor.
- The instructor activates the switches to simulate faults and assigns to the student the task of analyzing and explaining them.
- When all switches are in their normal position, the motor behaves as a typical cage motor.

Technical Data:

- Nominal power approx.: 0,25 kW
- Input voltage volts (Δ/y) 230/400 V
- Frequency: 50 Hz

Three-phase Transformer (ML300.01.06)



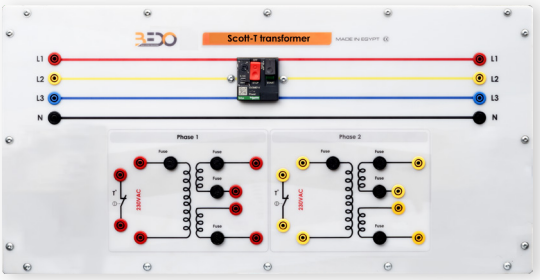
Overview

- Can be used as single phase, Step up or down, Autotransformer and three-phase transformer

Technical Data:

- Input voltage: 3x 230, 50/60Hz,
- Output voltage: 6x 115V
- Power: 3000VA
- Protection via motor protection switch
- Inputs & Outputs Via 4mm Safety Sockets

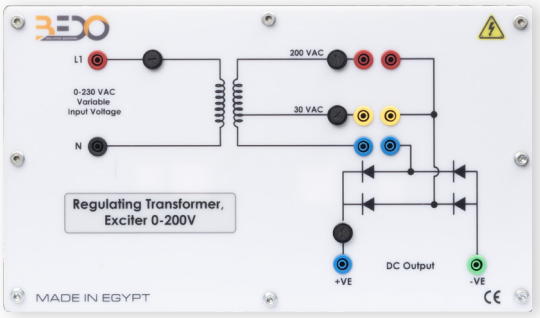
Scott-T Transformer (ML300.01.07)



Overview

- The Scott-T transformer is a special transformer connection used to convert three-phase power into two-phase power.
- It consists of two single-phase transformers:
  - » Main Transformer Teaser Transformer.
  - » Input voltage: 2x 230, 50/60Hz,
  - » Output voltage: 2x 115V
  - » Power: 1000 VA
  - » Protection via fuse set

Regulating transformer, exciter 0-200V (ML300.01.08)



Overview

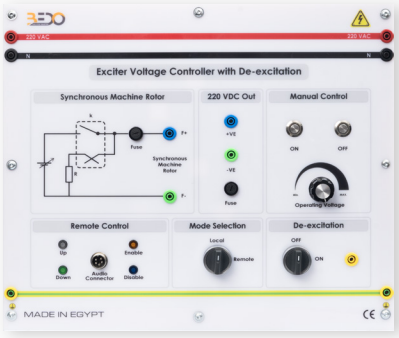
- Variable isolating transformer as exciter 0 - 200 V for field excitation of DC, synchronous and multi-function machines.
- Output voltage:
  - » 0...200 V
  - » 2 A AC/DC

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» 0...30 V
» 10 A AC/DC

- Voltage supply: 230 V, 50 Hz via 2mm mains cable or 4mm sockets.

Exciter voltage controller with de-excitation (ML300.01.09)



Overview

- The exciter voltage controller is used in experiments involving synchronization.
- The de-excitation switch is used in generator protection measures and is responsible for the disconnection of the generator from the grid and its de-excitation in the event of a fault.

Technical Data:

- Output: DC 200 V/2 A
- Output: DC 24 V/2.731 A
- 2X Push-buttons for switching the DC voltage on and off
- Inputs and outputs: 4-mm safety sockets
- Power supply: 230 V, 50/60 Hz

Synchronization unit (ML300.01.10)



Overview

- The Synchronization Unit consist of:
  » Three Pilot indicators operating voltage (Lamps): 500 VAC
- Zero voltmeter: 0….400V
- Frequency, voltage & current measuring devices for the generator bus & the mains to maintain the manual synchronization conditions to function
  » Double frequency measurement: from 47 to 53 hz
  » Double voltmeter measurement: 0 to 500 v
- Synchronizer (Digital synchronoscope) display is used to display voltage and phase angles between generator and power supply

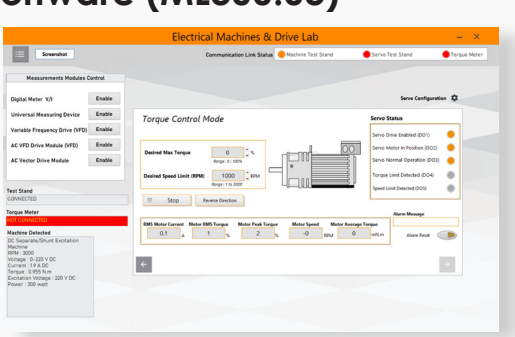
Technical Data:

- Generator voltage: 300 V-AC max.(Ph-N)
- Generator frequency: 0-100 Hz.
- Busbar voltage: 300 V-AC max. (Ph-N)
- Busbar frequency: 50/60 Hz.
- Digital inputs: 0 - 30 V-DC DC
- Supply Range: 9.0 to 33.0 V-DC
- Synchronization switch
- Operating voltage: 400V

Regulated high DC voltage power supply (ML300.02)

- Technical Data
  » Power: 1400W
  » Voltage: 0~500VDC
  » Current: 0~4ADC
  » Over voltage, over current, over temperature and over power protections
  » Constant voltage (CV) and constant current (CC) operations
  » Adjustable OVP & OCP range, OPP fixed 110%.
  » Accuracy: ±(3% FS+1 digit)

Software (ML300.03)



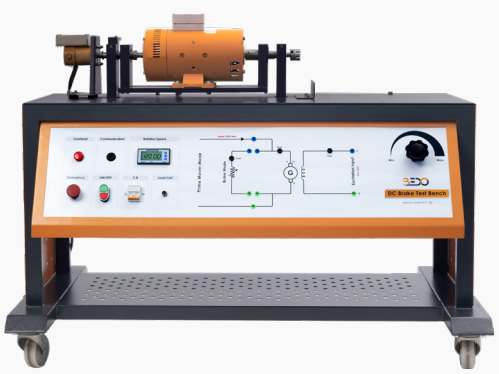
- Electrical machines & transformers trainer interactive software with remote learning facility.
- Measurements and graphics can be saved within the experiment instructions by means of drag and drop. The software can detect the machine under test, and display its name plate.

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300 Watts Machines 3000 RPM (ML300.04) (Not included)

- The windings ends are connected to 4 mm safety sockets in a metal housing on top of which a clear electrical drawing shows the internal Logic of the machine.
- The students can therefore easily understand operation & windings connections.
- Include electronic name plate for machine parameters for automatic machine identification.
- Relevant machine data is automatically uploaded
- Pre-setting of scaling in the software

DC. Brake Test Bench (ML300.04.01)



Overview

- A full test bench used to perform experiments of loading on different machines to determine characteristics of any motor like torque-speed characteristics.
- The test bench is powered from the main trainer through power cable and protected with on/off, emergency switches.
- The trainer is connected to the main software through a RS-485 Connection via 4mm safety bananas
- The trainer is capable of automatically identify the machine under test via audio socket cable.
- The Test Bench consists of :
  - » Resistive potentiometer to apply electrical load on the machine under test
  - » Digital meter to show the speed of the shaft

Braking DC Generator:



- Nominal shaft speed: 3000 rpm
- Rated braking power: 300W
- Rated generated output voltage: 220VDC
- Nominal excitation voltage: 220VDC

Tacho-Generator :

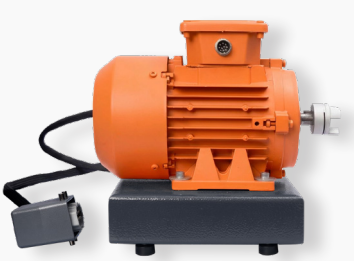


- 26V/1000rpm
- Rated Speed: 3000rpm

Load Cell:

- 10Kg, 2mV/V

Three-Phase Asynchronous Squirrel Cage Motor (ML300.43.02)



- Nominal shaft speed: 3000rpm
- Rated output power: 100W
- Rated input voltage: 220VAC /380VAC
- Rated operating frequency: 50Hz

Three-Phase Slip Ring Motor (ML300.04.03)

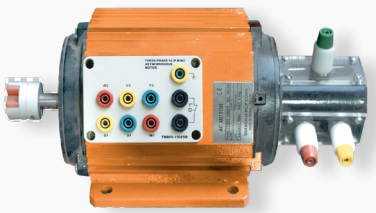


- Nominal shaft speed: 3000rpm
- Rated output power: 300W

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- Rated input voltage: 220VAC / 380VAC
- Rated o perating frequency: 50Hz

Three-Phase Synchronous Machine (ML300.04.04)



- Nominal shaft speed: 3000rpm
- Rated output power: 200W
- Rated input voltage: 75VAC / 140VAC
- Rated operating frequency: 50Hz

Three-Phase Double Speed Induction Motor (ML300.04.05)



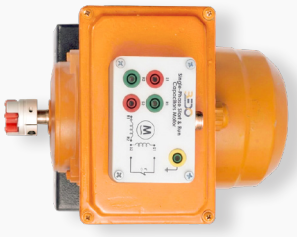
- Nominal shaft speed: 3000/1500rpm
- Rated input voltage: 380VAC
- Rated operating frequency: 50Hz

Single-Phase Universal Motor (ML300.04.06)



- Nominal shaft speed: 3000rpm
- Rated output power: 300W
- Rated input voltage: 220VAC/VDC
- Rated operating frequency: 50Hz

Single-Phase Capacitor-Start Motor (ML300.04.07)



- Nominal shaft speed: 3000rpm
- Rated output power: 300W
- Rated input voltage: 220VAC
- Rated operating frequency: 50Hz

DC Compound Machine (ML300.04.08)



- Nominal shaft speed: 3000rpm
- Rated output power: 300W
- Rated armature voltage: 220VDC
- Rated field voltage: 220VDC

DC Series Machine (ML300.04.09)



- Nominal shaft speed: 3000rpm
- Rated output power: 300W
- Rated Input Voltage: 220VDC

DC Shunt/Separately Excited Machine (ML300.04.10)



- Nominal shaft speed: 3000rpm
- Rated output power: 300W
- Rated armature voltage: 220VDC
- Rated field voltage: 220VDC

DC Permanent Magnet Machine (ML300.04.11)



- Nominal shaft speed: 3000rpm
- Rated output power: 300W
- Rated Input Voltage: 220VDC

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Braking DC Generator (ML300.04.12)



- Nominal shaft speed: 3000rpm
- Rated braking power: 300W
- Rated generated output voltage: 220VDC
- Nominal excitation voltage: 220VDC

Magnetic Powder Brake (ML300.04.13)



- Rated braking power: 800W
- Nominal input voltage: 0 - 24VDC

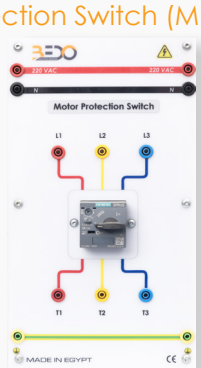
Three-Phase Squirrel Cage Induction Motor Cutaway (ML300.04.14)



- Nominal power approx.: 0,25 kW
- Nominal speed approx: 1400 rpm
- Nominal input voltage volts (Δ/y): 230/400V
- Frequency: 50 Hz

Additional modules for 300 watt 3000 rpm machines (ML300.04.15)

- Motor Protection Switch (ML300.04.15.01)

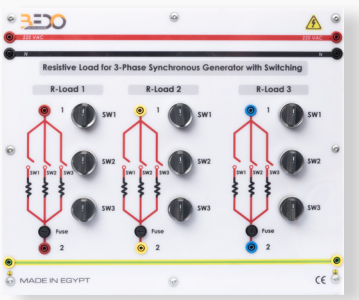


Overview

- Power circuit breaker including thermal overload trip and overcurrent trip
- 1X Motor protection switch, 0.7...1A
- Contact rating: 500V, 10A

- Resistive Loads

» Universal Resistor Bank (ML300.04.15.02)



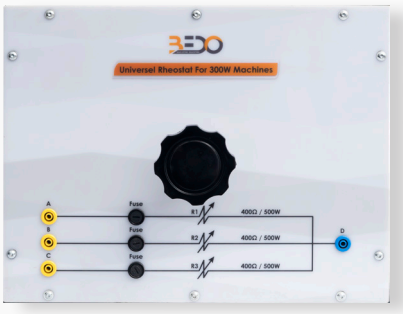
Overview

- Contains nine power resistors arranged in three banks (Three resistors in each bank)
- Resistors of each bank are arranged in parallel connection by toggle switch for each resistor to obtain multiple values.
- Three resistor banks can be used separately in 3-phase circuits or can be connected together in single phase circuits

Specifications:

- Three Banks (Three Resistors for each bank)
- Resistor Values: 0.8K / 1.6K / 3.2K Ohms

» Universal Rheostat (ML300.03.15.03)



Overview

- Contains three rheostats in series with three fixed power resistors arranged in three branches.
- Three branches can be used separately in 3-phase circuits or can be connected together in single phase circuits.

Specifications:

- Branch Values : 500 to 900 Ohms

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- Maximum Voltage : 220 V AC/DC

» Rheostat for field regulation (ML300.03.15.04)



- Range of resistance value: 0 - 2.2Kohm
- Power capacity: 25W

• Inductive Load (ML300.03.15.05)



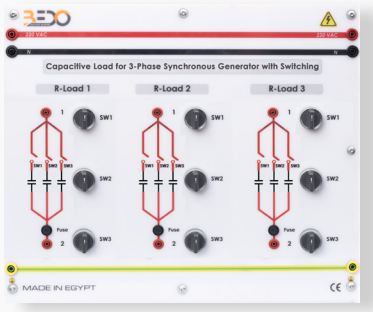
Overview

- Contains nine iron core power inductors arranged in three banks (Three inductors in each bank)
- Inductors of each bank are arranged in parallel connection by toggle switch for each inductor to obtain multiple values.
- The Three inductor banks can be used separately in 3 phase circuits or can be connected together in single phase circuits

Specifications:

- Three Banks (Three Inductors for each bank)
- Inductor Values : 2.5 / 5 / 10 H
- Maximum Voltage : 220 V AC

• Capacitive Load (ML300.03.15.06)



Overview:

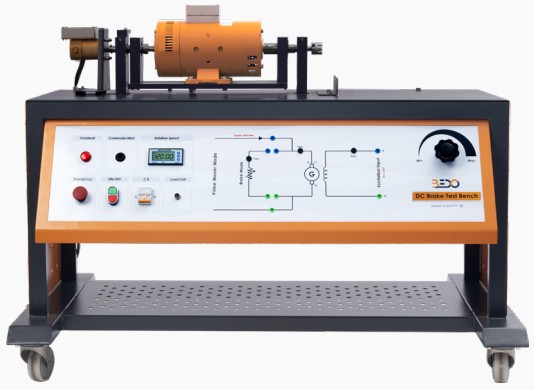
- Contains nine capacitors arranged in three banks (Three capacitors in each bank)
- Capacitors of each bank are arranged in parallel connection by toggle switch for each capacitor to obtain multiple values
- Three capacitive banks can be used separately in 3 phase circuits or can be connected together in single phase circuits

Specifications:

- Three Banks (Three Capacitors for each bank)
- Capacitor Values : 1 / 2 / 4 uF
- Maximum Voltage : 450 V AC/DC

300 Watts Machines 1500 RPM (ML300.05) (Not included)

- The windings ends are connected to 4 mm safety sockets in a metal housing on top of which a clear electrical drawing shows the internal Logic of the machine.
- The students can therefore easily understand operation and windings connections.
- An electronic nameplate displays machine parameters for automatic identification & real-time monitoring.
- Relevant machine data is automatically uploaded
- Pre-setting of scaling in the software



DC. Brake Test Bench (ML300.05.01)

- A full test bench performs experiments to load different machines & determine motor characteristics, such as torque-speed curves.
- The test bench is powered from the main trainer through power cable and

protected with on/off, emergency switches.
- The trainer is connected to the main software through a RS-485 Connection via 4mm safety bananas
- The trainer is capable of automatically identify the machine under test via audio socket cable.
- The Test Bench consists of :
  - » Resistive potentiometer to apply electrical load on the machine under test
  - » Digital meter to show the speed of the shaft



Braking DC Generator :

- Nominal shaft speed: 1500 rpm
- Rated braking power: 300W
- Rated generated output voltage: 220VDC
- Nominal excitation voltage: 220VDC



Tacho-Generator :

- 26V/1000rpm
- rated Speed: 3000rpm

Load Cell:

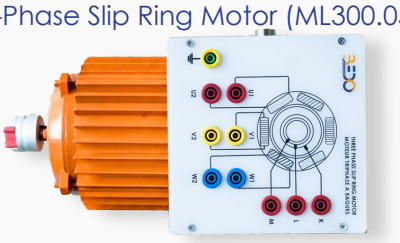
- 10Kg, 2mV/V

Three-Phase Asynchronous Squirrel Cage Motor (ML300.05.02)



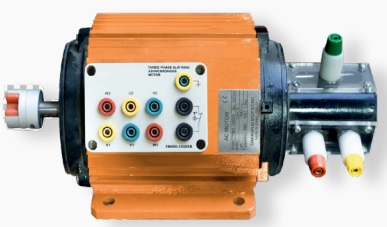
- Nominal shaft speed: 1500rpm
- Rated output power: 300W
- Rated input voltage: 220VAC / 380VAC
- Rated operating frequency: 50Hz

Three-Phase Slip Ring Motor (ML300.05.03)



- Nominal shaft speed: 1500rpm
- Rated output power: 300W
- Rated input voltage: 220VAC / 380VAC
- Rated operating frequency: 50Hz

Three-Phase Synchronous Machine



(ML300.05.04)

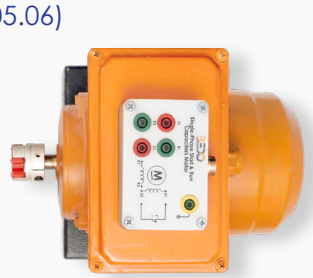
- Nominal shaft speed: 1500rpm
- Rated output power: 220W
- Rated input voltage: 83/145VAC
- Rated operating frequency: 50Hz

Three-Phase Double Speed Induction Motor (ML300.05.05)



- Nominal shaft speed: 3000/1500rpm
- Rated input voltage: 380VAC
- Rated operating frequency: 50Hz

Single-Phase Capacitor-Start Motor (ML300.05.06)



- Nominal shaft speed: 1500 rpm
- Rated output power: 300W
- Rated input voltage: 220VAC
- Rated operating frequency: 50Hz

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DC Compound Machine (ML300.05.07)



- Nominal shaft speed: 1500rpm
- Rated output power: 300W
- Rated armature voltage: 220VDC
- Rated field voltage: 220VDC

DC Series Machine (ML300.05.08)



- Nominal shaft speed: 1500rpm
- Rated output power: 300W
- Rated Input voltage: 220VDC

DC Shunt/Separately Excited Machine (ML300.05.09)



- Nominal shaft speed: 1500rpm
- Rated output power: 300W
- Rated armature voltage: 220VDC
- Rated field voltage: 220VDC

Permanent Magnet DC Machine (ML300.05.10)



- Nominal shaft speed: 1500rpm
- Rated output power: 300W
- Rated Input voltage: 220VDC

Braking DC Generator (ML300.04.11)



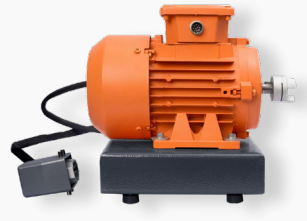
- Nominal shaft speed: 1500rpm
- Rated braking power: 300W
- Rated generated output voltage: 220VDC
- Nominal excitation voltage: 220VDC

Magnetic Powder Brake (ML300.04.12)



- Nominal shaft speed: 1500rpm
- Rated braking power: 300W
- Nominal Input voltage: 0- 24VDC

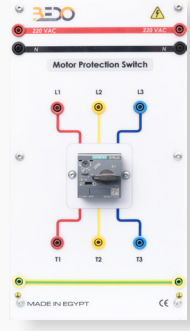
Three-Phase Squirrel Cage Induction Motor Cutaway (ML300.04.13)



- Nominal power approx.: 0,25 kW
- Nominal speed approx. 1400 rpm
- Nominal input voltage volts (Δ/y) 230/400V
- Frequency: 50 Hz

Additional modules for 300 watt 1500 rpm machines (ML300.04.14)

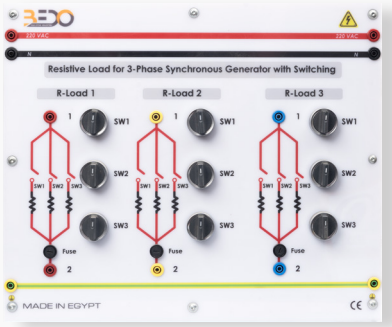
- **Motor Protection Switch (ML300.04.14.01)**



- Power circuit breaker including thermal

overload trip and overcurrent trip
  - » 1X Motor protection switch, 0.7...1A
  - » Contact rating: 500V, 10A

- **Resistive Loads (ML300.04.14.02)**



- **Universal Resistor Bank (ML300.04.14.03)**

Overview

- Contains nine power resistors arranged in three banks (Three resistors in each bank)
- Resistors of each bank are arranged in parallel connection by toggle switch for each resistor to obtain multiple values.
- The Three resistor banks can be used separately in 3-phase circuits or can be connected together in single phase circuits

Specifications:

- Three Banks (Three Resistors for each bank)
- Resistor Values : 0.8K / 1.6K / 3.2K Ohms
- Maximum Voltage : 220 V AC/DC

- **Universal Rheostat (ML300.04.14.04)**



Overview

- Contains three rheostats in series with three fixed power resistors arranged in three branches.
- Three branches can be used separately in 3-phase circuits or can be connected together in single phase circuits.

Specifications:

- Branch Values : 500 to 900 Ohms
- Maximum Voltage : 220 V AC/DC

- **Rheostat for field regulation (ML300.04.14.05)**



- Range of resistance value: 0 - 2.2Kohm
- Power capacity: 25W

- **Inductive Load (ML300.04.14.06)**



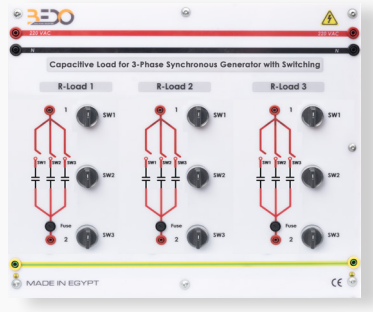
Overview:

- Contains nine iron core power inductors arranged in three banks (Three inductors in each bank)
- Inductors of each bank are arranged in parallel connection by toggle switch for each inductor to obtain multiple values.
- Three inductor banks can be used separately in 3 phase circuits or can be connected together in single phase circuits

Specifications:

- Three Banks (Three Inductors for each bank)
- Inductor Values : 2.5 / 5 / 10 H
- Maximum Voltage : 220 V AC

- **Capacitive Load (ML300.04.14.07)**



Overview:

- Contains nine capacitors arranged in

three banks (Three capacitors in each bank)

- Capacitors of each bank are arranged in parallel connection by toggle switch for each capacitor to obtain multiple values
- Three capacitive banks can be used separately in 3 phase circuits or can be connected together in single phase circuits

Specifications:

- Three Banks (Three Capacitors for each bank)
- Capacitor Values : 1 / 2 / 4 uF
- Maximum Voltage : 450 V AC/DC

Servo machine test Stand (Not Included)

Code: (ML300.05)

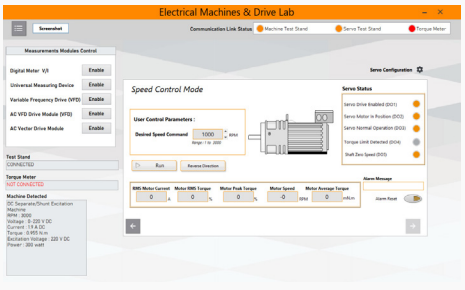


- The servo-machine test bench is a complete testing system for examining electrical machines and drives. It consists of a digital controller, a brake and the software.
- The system combines state-of-the-art technology with ease of operation.
- The system also allows manual and automated synchronization to be carried out.
- The controller has the following features:
  - » Dynamic and static four-quadrant
  - » Selectable operating modes/ machine models (torque control, speed control.
  - » Interface for reading electronic nameplates EDD of the machines under test
  - » An integrated galvanically isolated amplifier measures voltage & current while preventing electrical interference between the measured signal and the system.
  - » Colour display
  - » Four-quadrant monitor
  - » Isolated USB interface
  - » Connection voltage: 400V, 45...65Hz
- The motor and sensor leads are connected via polarity-safe plugs. The machine has thermal monitoring and, in conjunction with the controller, it constitutes a driving and braking system that is free of drift and requires no calibration.

Technical Data:

- Maximum speed: 3000 RPM
- Maximum Voltage: 3~, 220V
- Maximum Motor Current: 9.5A
- Motor Maximum Capacity : 2.2 kw

Software features



- Measurement, calculation & display of mechanical & electrical variables (Speed, torque, mechanical power output, current, voltage, active, apparent and reactive power, efficiency, power factor).
- Reading Electronic nameplates of the machines under test.
- Simultaneous display of measured and calculated values (e.g. instant display of efficiency)
- Measurement of voltage and current (including RMS values even for non-sinusoidal waveforms)
- Speed or torque-controlled operation
- Recording of variables over time
- Programming of limiting values of speed or torque to prevent inappropriate loading of the machine under test.
- Operation in all four quadrants (display of generated torque)
- Export of graphics & measurements

Special Machines (ML300.06)

- Upon customer request

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Experiments

Chapter 1: DC Machines Experiments

- Basic Operation (Connection) of DC Motors
- Direction control of DC Motor by changing Polarity
- Open-Loop Armature voltage control for DC machines
- Open-Loop Field Control for DC machines
- Torque vs Speed Characteristics of DC Motors
- Torque vs Current Characteristics of DC Motors
- Torque vs Field Characteristics of DC Motors
- Armature Current vs Field Current Characteristics of DC Motors
- Basic Operation (Connection) of DC Generators
- Self-Excited vs Separately-Excited operation of DC Generators
- Effect of regulating field current
- Voltage vs Speed Characteristics of DC Generator
- Voltage vs Field Characteristics of DC Generator
- Voltage vs Load Current Characteristics of DC Generator
- Load Current vs Speed Characteristics of DC Generator
- Retardation Test

Chapter 2: Transformer (1ph & 3ph) Experiments

- Excitation of Single-Phase Transformer
- Study the effect of Transformer ratio
- Study the operation of Isolating Transformers
- OCC & SCC of Single-Phase Transformers
- Load test of Single-Phase Transformers
- Parallel Operation of Single-Phase Transformers
- Back-to-Back Test of Single-Phase Transformers
- Calculating Eddy Current Losses & Hysteresis Losses
- Three-Phase Transformer Multi-Winding Test
- Three-Phase Transformers Vector Group Experiment
- 3-ph to 2-ph Transformer and open-delta connection

Chapter 3: AC Machines (1ph & 3ph) Experiments

- Study Operation (Connection) of Single-Phase an AC Motor
- Reverse Direction of Rotation for Single-Phase AC Motor

Chapter 4: Universal Special Machines (Synchronization/Universal) Experiments

- Speed Control of 3-ph Induction motor by Rotor Resistance (External Resistance)
- Speed Control of 3-ph Induction motor by Rotor Resistance (Slip Ring)
- Speed Control of 3-ph Induction motor by Changing Supply Frequency
- Starting of Slip-Ring Induction Motor by Rotor Resistance
- Torque vs Speed Characteristics of 3-ph Induction Motor
- No-Load Test for Three-Phase a Single-Phase Induction Motors
- Locked-Rotor Test for Three-Phase a Single-Phase Induction Motors
- Grid and Stand-Alone Connection of 3-Phase Induction Motor
- Load Sharing of Three-Phase Induction Machine in Parallel Operation
- 3-ph Induction Motor Winding breaks in coils fault
- 3-ph Induction Motor Winding to Winding fault
- 3-ph Induction Motor Winding to Frame fault
- 3-Ph Induction Motor Combination of Different Faults

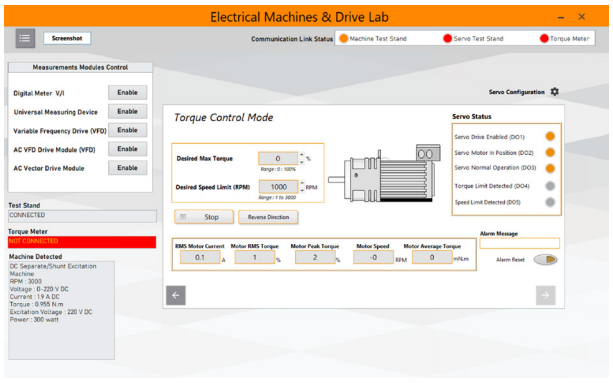
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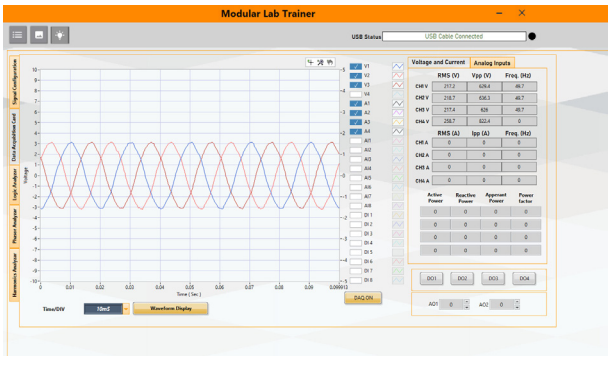
- Automatic and Manual Star-Delta Starting for 3-ph Induction Motor
- Dahlander Switch for Double speed Induction Motor
- AC vs DC Operation of Universal Motor

Chapter 5: Switching, Fault Simulation & Synchronization Experiments

- Starting of Three-Phase Synchronous Motor
- Study Operation (Connection) of Three-Phase Synchronous Motor
- Reverse Direction of Rotation for Three-Phase Synchronous Motor
- V and I Curves of Three-Phase Synchronous Machine
- V and I Curves of Three-Phase Synchronous Generator (No Load)
- V and I Curves of Three-Phase Synchronous Generator (Load)
- Effect of Excitation on Three-Phase Synchronous Generator
- Open Circuit, Short-Circuit and Zero Power factor test of Three-Phase Synchronous Generator
- Study Stability Limits and Power Angle Curve for Three-Phase Synchronous Generator
- Determine Xd and Xq for Three-Phase Synchronous Generator
- Synchronization of Three-Phase Synchronous Generator
- Study Different Switching and Protection Circuits
- Design & connecting of synchronization unit.
- Comparison of bright, dark and three lamp synchronizing circuit
- On/Off Switch for different motors
- Star/delta and star/delta reversing
- Automatic star/delta and star/delta
- Motor protection circuit breaker
- Contactor circuit with Latching relay
- Contactor circuit with Relay and fault indication
- Contactor circuit with Latching fault indication
- Contactor circuit with Time delay relay (On-Delay)
- Pulsed contactor circuit
- Reversing contactor with Contactor interlock
- Reversing contactor with Contactor & button interlock
- Star-delta three phase induction motor squirrel cages
- Insulation faults winding to winding
- Insulation faults winding to frame
- Combination of different fault

Software Screenshots





Modules Required

NO.	Modules	Ch.1	Ch.2	Ch.3	Ch.4	Ch.5
		DC MACHINES EXPERIMENTS	TRANSFORMER (1PH & 3PH) EXPERIMENTS	AC MACHINES (1PH & 3PH) EXPERIMENTS	UNIVERSAL SPECIAL MACHINES (SYNCHRONIZATION/ UNIVERSAL..) EXPERIMENTS	UNIVERSAL SPECIAL MACHINES (SYNCHRONIZATION/ UNIVERSAL..) EXPERIMENTS
1	AC Digital Multi-Meter			Yes	Yes	Yes
2	VFD			Yes	Yes	Optional
3	Universal Switch Unit	Yes	Yes	Yes	Yes	Yes
4	Universal Measuring device		Yes	Yes	Yes	Yes
5	Fault Simulator		Yes			
6	3-Phase Transformer				Yes	
7	Exciter 0-200				Yes	Yes
8	Exciter with De-Excitation	Yes	Yes	Yes	Yes	Yes
9	Synchronization Unit				Yes	Yes
10	DC Brake Test Bench	Yes	Yes	Yes	Yes	Optional
11	3-ph Squirrel Cage Induction Motor			Yes		Yes
12	3-ph Slip-ring Induction Motor			Yes		Optional
13	3-ph Synchronous Machine			Yes	Yes	Optional
14	3-ph Double-Speed Induction Motor			Yes		Yes
15	Universal Motor				Yes	Optional
16	Capacitor Start Motor			Yes		Yes
17	DC Compound Machine	Yes				Optional
18	DC Series Machine	Yes				Optional
19	DC Shunt Machine	Yes				Optional
20	DC PM Machine	Yes				Optional
21	Braking DC Generator	Yes				Optional
22	Magnetic Brake	Optional			Optional	Optional
23	Induction Motor Cut-away					
24	Induction Motor Cut-away			Yes	Yes	Optional
25	Motor Protection Switch					
26	Universal Resistor Bank	Optional				
27	Universal Rheostat	Optional				Optional
28	Rheostat for Field Regulation	Yes				Yes
29	Inductive Load					
30	Capacitive Load					
31	Servo Machine Test Stand	Optional	Optional	Optional	Optional	Optional
32	Torque Meter	Yes			Yes	Yes
33	Insulation Tester					Yes

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Scope of Delivery

- Electrical Machines & Transformer 300 Watts (ML300)
  - » Main Modules Kit (ML300.01)
  - » Software (ML300.03)
- Hard Copy User Manual

Options

- Servo machine test Stand (ML300.05)
- Special Machines (ML300.06)
- 300W AC Drives kit (AD300)
- 300W DC Drives kit (DD300)
- Digital content (BI01)
- Storage Unit (BI03)

Required for Operation

- Machine & Drive Lab Supply Unit (ML100)
- To Perform the trainer experiments you must choose one of the following Machine sets:
  - » 300 Watts Machines 3000 RPM (ML300.03)
  - » 300 Watts Machines 1500 RPM (ML300.04)
- Laboratery PC

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