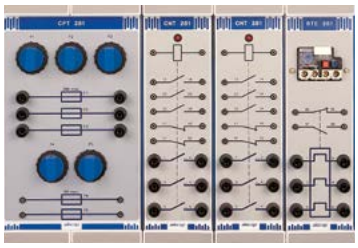
4 electrical machines

Alecop

Educational resources for the study of electrical, static and rotary machines. Ranging from the operating principles to the construction of automatic devices and the maintenance operations of the machines.



AUTOMATION

WORKSHOP

Electrical machines





TESTING



PRINCIPLES

CLASSROOM-WORKSHOP



Documentation

Each resource has a set of supporting documents to facilitate the teacher's work:

- User Manual: contains instructions for the implementation and operation of equipment, its technical features and information about precautions to be taken into account for proper operation.
- Workbook: Defines the objectives, sequence of implementation and an answer key for each of the practice sessions.

Safety

The resources presented in this catalogue have been designed to meet European directives on the safety of machinery, low voltage and electromagnetic compatibility.

Economics

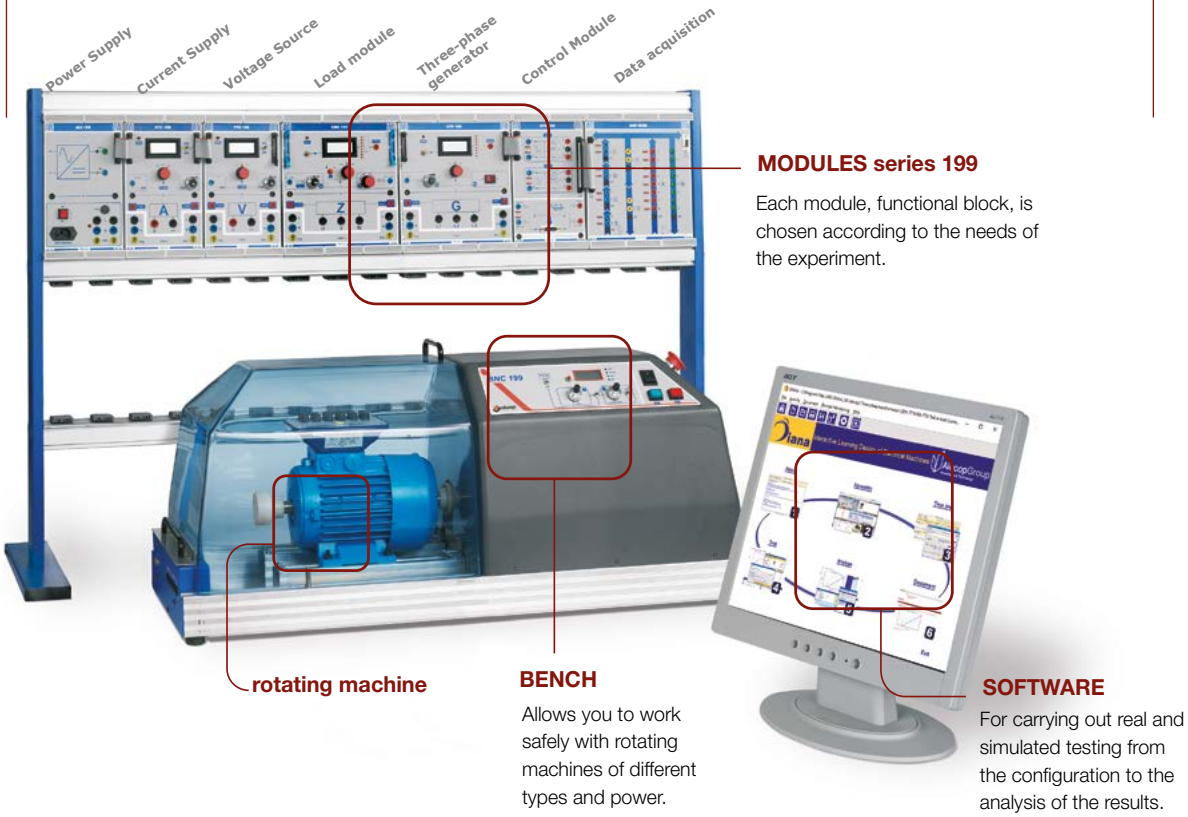
The scalability of the teaching resources and the potential for use in the classroom, allows a considerable reduction in the investment to be made for a specific program of electrical machines.

Modularity

The equipment allows a modular configuration according to the available equipment and the training needs of the user.

ProLAB

Modular test bench



Alecop's ProLAB is the most advanced system for teaching Electrical Machines. It allows students to study, both theoretically and practically, the operation and performance of static and rotating electrical machines from a fundamental level to the most advanced tests.

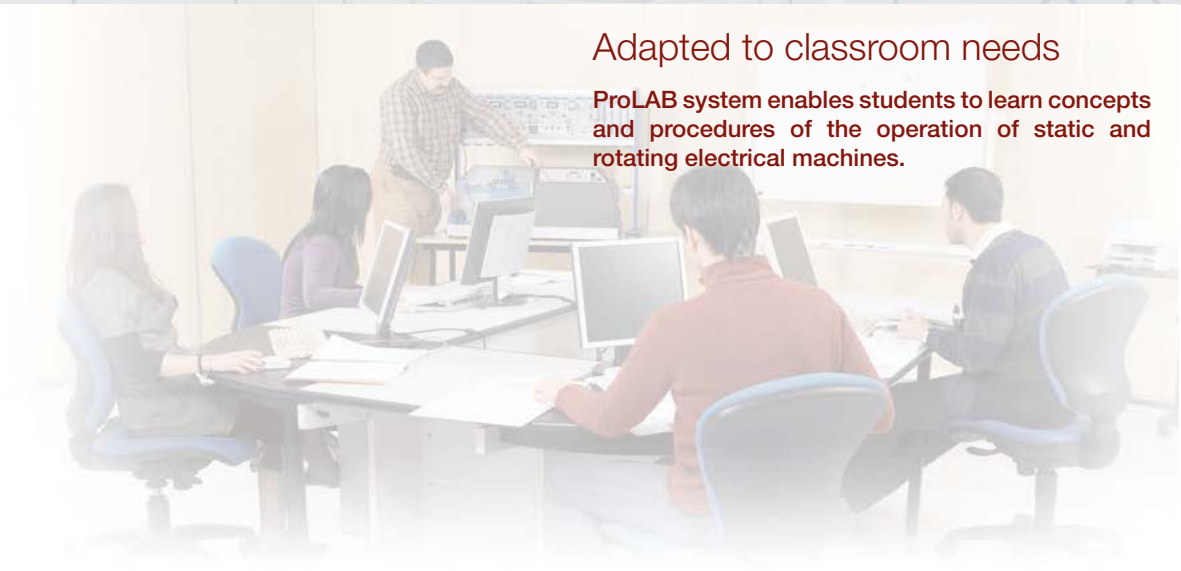
ProLAB is a modular system, comprising a test bench, power supplies, instruments and various dc, single and 3-phase ac machines and transformers. It can be configured traditionally as single workstations, using either conventional or PC based instruments, or networked when only one set of hardware is necessary for each classroom providing a cost effective solution, and a simple upgrade path when student numbers increase.

When used with a PC or networked, Diana software provides theory and instruction, as well as control, and guides the student through the construction and assembly of different test strategies. Even complex configurations take only minutes to complete. Diana contains standard test routines or allows the student or instructor to set up their own experiments.

Each of the m`odules, whether power supplies, loads or instruments can be set up manually or via the software. The machines and test bench are also compatible with conventional instruments.

Uniquely Diana contains mathematical models of each machines so the 'ideal' simulated test results can be directly compared to those obtained from real machines. Alternatively students can familiarise themselves with test procedures using the simulation before moving on to the actual machine. A document generator helps students produce their laboratory reports. Comprehensive documentation is provided with experimental manuals for both the student and instructor.

ProLAB can be mounted, when required, on a mobile bench for portability. Because it only requires a single phase power supply (three phase for machine operation is generated on-board), it can be used in any classroom so the days of costly dedicated laboratories are past.



Adapted to classroom needs

ProLAB system enables students to learn concepts and procedures of the operation of static and rotating electrical machines.

Scalability

The modular system makes it possible to acquire the components that best meet the needs of its centre, for both curriculum and budget. ProLAB is compatible with conventional elements in your classroom/workshop (resistors, inductors, capacitors, rectifier bridges, etc.).






Time and motion economy

One machine per class is sufficient, reducing acquisition and maintenance costs.

The “199” module series, designed for this system has standard instrumentation built in.

The most complex assembly takes only a few minutes and with few cables.





ENVIRONMENTALLY FRIENDLY PRODUCT

The equipment returns the energy to the grid that is traditional dissipated into heat. In addition to reducing consumption, it implies the reduction of the size of the modules and bench, and the elimination of potentially dangerous hot spots.

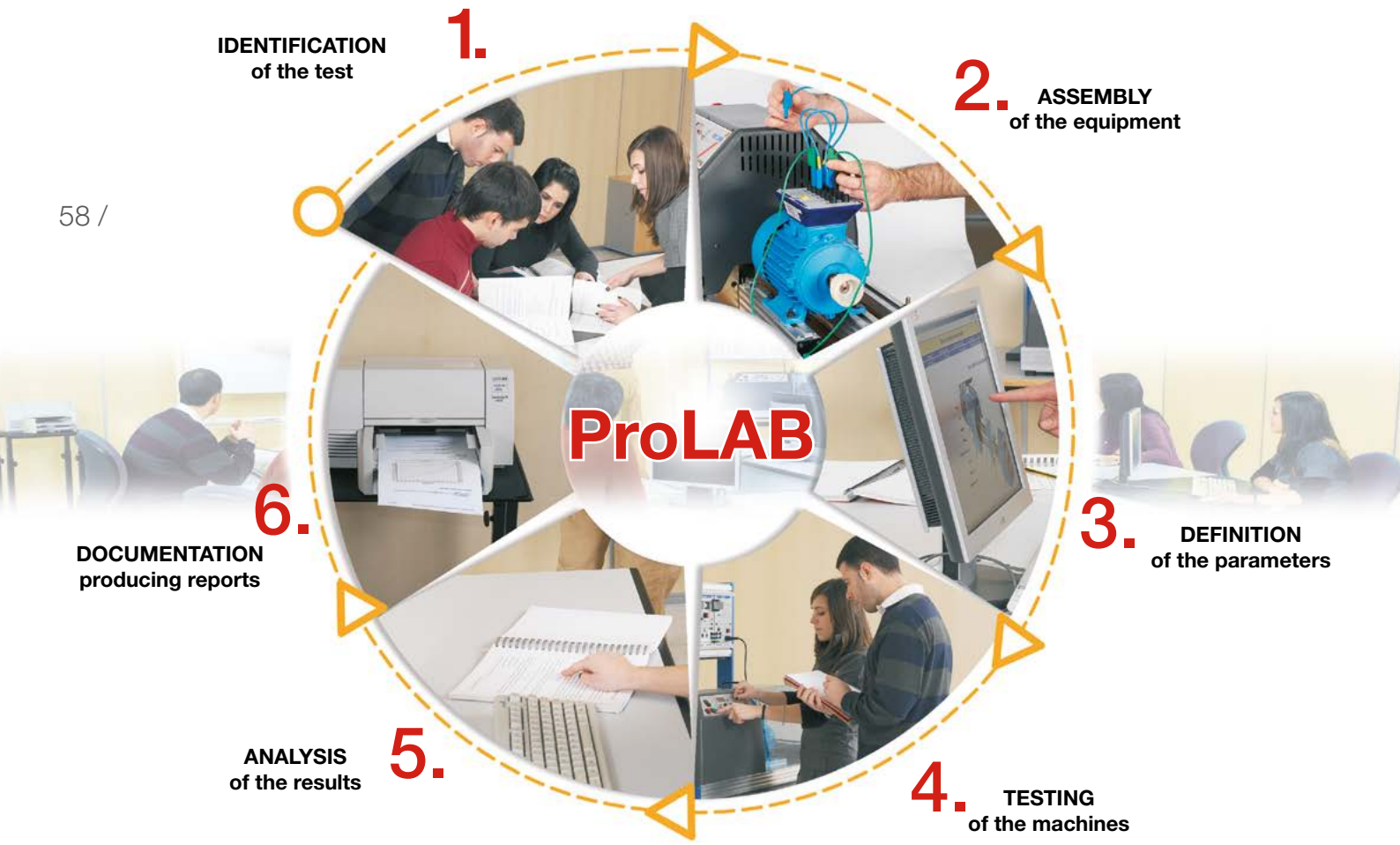


SAFETY

This equipment goes beyond the current regulations relating to safety, implementing a series of added protection to prevent accidents in the field of education.

Work process

ProLAB allows the student to put into practise the basic concepts learnt in the theory related to the operation of electrical machines. The putting into practise is by testing, whether real or simulated. Each test is performed following these 6 steps:



Classroom work

1. Manual



Testing with the modules and the bench. Fieldwork. Manual demonstrations.

2. Mixed



Combines the use computer to prepare exercises and sending the manual application, to the machine bench.

3. Simulation



Enables the entire work process to be carried out through the software. The library has the most significant test activities to achieve global learning.

Configuration

Students in the class are kept active thus avoiding, as far as possible, waiting times.
Classroom connectivity completes the work:

simple — non-networked, students work individually on their computers and run the test manually or from the teacher's computer.

in network — Having a local area network enables tests to be carried out from any computer usin DIANA.

internet — If Internet is added, the users who are not physically in the classroom, may access the test bench thus facilitating distance learning.

Bench

Independent bench for testing rotating electrical machines

Ref: 9EQBNC199A



FUNCTION. Test traction motor and machine brake.



At the heart of the system is the BNC-199 Machine Test Bench into which various motors under test are mounted. This can be manually operated or computer controlled. In Dynamometer mode real time measurements of Speed, Torque and Power are displayed or it can be used as a prime mover for Generator tests. All parameters are also available on the external connector.
Safety is of paramount importance. Interlocks ensure machines cannot be operated unless the robust transparent safety cover is in place. Voltages are isolated and any fault condition, such as over or under voltage, excessive speed or torque etc, are indicated and operate protective relays.

Technical specifications

GENERAL

Dimensions: 950 x 360 x 420 mm
Weight: 41 Kg
Power supply: Single phase network 190 to 250Vac - 5.25 Amp.- 50/60Hz
Machines type to be tested:
- Foot height type 71, 80 and 90 mm.
- 80 and 90 mm height on Alecop profiles.
The testing machine is attached using elastic coupling.

OPERATING AS A TRACTION MOTOR

Speed: 0 to 2,000 rpm
Rated: 800 W
Maximum torque: 9.7 Nm

OPERATING AS A BRAKE

Maximum speed: 2,450 rpm
Torque: 0 to 10 Nm
Rated: 800 W

PROTECTIONS

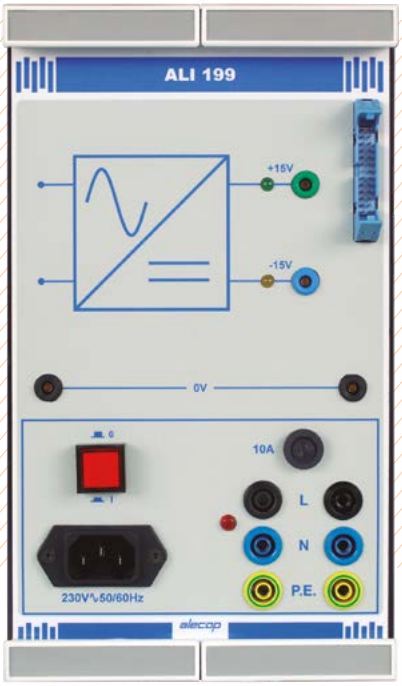
Mobile protection with electric anchor.
Emergency stop button on the bench.
4mm safety terminals for the connection of the machine under testing.
Internal protections: internal temperature, torque, speed, insufficient voltage, excessive over voltage and grid over-current.

Module

ALI-199

Power Supply Module

Provides ±15V power for all the other ProLAB modules fitted to the frame and single phase voltage via 4mm safety terminals.



Ref: MDULALI199

Functional description

The support comprises a double-size training module: 250 x 144 x 130 mm.

The power required for its operation is:

- Voltage: 190 ÷ 250 Vac 50/60Hz.
- Maximum power: 1 kW.

Includes serigraph identifying the functional blocks and components symbols.

Uses 2 mm. in diameter safety sockets which serve as testing points and 4 mm safety sockets diameter for the power supply (red).

Technical specifications

Input supply voltage: Single-phase 190 to 250VAC using a socket.

Mains Frequency: 50Hz / 60Hz.

Output voltage: ±15V c.c.

Maximum current: 2 Amp.

Protections:

Input: using 10amp fuse.

Output: Thermal Protection calculated at 2 Amp.

Outputs from the source: Using the frame chassis and 2mm safety plugs.

Indications: On light to indicate main supply and outputs from the active source.

Module

FTC-199

Adjustable DC Voltage source

DC power supply can be controlled manually, externally or via PC. Includes a switchable display and proportional outputs.



Ref: MDULFTC199

Functional description

The support comprises a double-size training module: 250 x 144 x 130 mm.

The power required for its operation is:

- ± 15 V., 15 V, by plugging into the ALECOP support frame.
- Voltage: 190 ÷ 250 V.
- Maximum power: 1 kW.

Includes serigraph identifying the functional blocks and components symbols.

Uses 2 mm. in diameter safety sockets which serve as testing points and 4 mm safety sockets diameter for the power supply (red).

Technical specifications

The module includes a continuous voltage source whose characteristics are:

Output voltage variation: 0 ÷ 250 V.

Output current: 6.6 A max.

Types of settings:

- Interior: with a dial.
- Exterior: Using a DB26 with a safety socket of 2mm.

Accuracy: 1%.

Physical Measurements:

Magnitude display:

- Magnitudes displayed: Current and voltage output (can be selected using a switch) on the 3½ digit display.
- Voltage Range / Precision: 0 ÷ 250 V c.c. 1% F.E.
- Current Range / Precision: 0 ÷ 6.6 A < 1% F.E.

Magnitude signal capture:

- Analogue signals in the DB26 connector: Output voltage and current.
- Analogue signals in the sockets: output voltage and current.
- Voltage range / precision: 0 ÷ 250 V c.c. (0 ± 10 V) 1% F.E.
- Precision current range: 0 ÷ 6.6 A c.c. (0 ± 10 V) 1% F.E.

Incorporates electronic protection, protecting the module against overloads and short circuits.

Module

FCC-199

Adjustable DC Current source

DC power supply providing controlled current output. Includes a switchable display and proportional outputs.



Ref: MDULFCC199

Functional description

The support comprises a double-size training module: 250 x 144 x 130 mm.

The power required for its operation is:

- ± 15 V., by inserting into the ALECOP support frame.
- Voltage: 190 ÷ 250 V.
- Maximum power: 1 kW.

Includes serigraph identifying the functional blocks and components symbols.

Uses 2 mm. in diameter safety sockets which serve as testing points and 4 mm safety sockets diameter for the power supply (red).

Technical specifications

The module includes a voltage source whose characteristics are:

Output voltage variation: 0 ÷ 310 V.

Output current: 0 ÷ 3.3 A.

Types of settings:

- Interior: with a dial.
- Exterior: Using a DB26 with a safety socket of 2mm.

Accuracy: 1%.

Physical Measurements:

Magnitude display:

- Magnitudes displayed: output voltage and current. (Switch selectable) in a 3½ digit display.
- Voltage range / precision: 0 ÷ 310 V c.c. 1% F.E.
- Current range / Precision: 0 ÷ 3.3 A c.c. < 1% F.E.

Magnitude signal capture:

- Analogue signals in the DB26 connector: Output voltage and current.
- Analogue signals in the sockets: output voltage and current.
- Voltage range / precision: 0 ÷ 350 V c.c. (0 ± 10 V) 1% F.E.
- Precision current range: 0 ÷ 3.5 A c.c. (0 ± 10 V) 1% F.E.

Incorporates electronic protection, protecting the module against overloads and short circuits.

Module

CRG-199

Electronic load

Ref: MDULCRG199

A compact DC, single and three-phase electronic load for rotary machines and transformers. Reactive and resistive loads with a Power Factor between 0 and 1 (inductive or capacitive). Ability to capture and control magnitudes by PC via a data acquisition system and DIANA software. The incorporated controls allow it to operate in accordance with the various types of passive loads:

- Direct current resistive load.
- Inductive load - resistive – single-phase capacitive.
- Inductive load - resistive –three-phase capacitive.
- Power factor variable between 0 and 1 (inductive and capacitive).



Functional description

The support comprises a triple-size training module: 250 x 216 x 130 mm.

It operates installed in a desktop vertical rack from where it gets its ± 15 V power required for operation. Interconnection with other modules in the test bench BNC-199 and DIANA software with a fast 26-pin connector.

2 mm sockets for external measurements and set values. 4 mm safety terminals input power (mains connection). Includes serigraph identifying the functional blocks. Has many advantages over other traditional load types (resistors, capacitor banks, inductances, etc.), Including the following:

- Reduced volume: all possible load types in one module.
- Improved Performance: Incorporates electronic circuitry which returns the energy to the power supply.
- Safety: Incorporates protection against overloads and short circuits, as well as safety terminals for user protection.
- Accuracy and resolution: Electronic control of electrical magnitudes (current amplitude and power factor).
- Instrumentation built into the module itself.
- Interconnection with other elements of the Test Bench BNC-199 tests and control from the PC with DIANA software.
- Possibility of autonomous operation with manual or computer assisted control (general purpose data acquisition system).

Technical specifications

Power supply:

- Control: ± 15 VDC from the ALECOP support frame.
- Power: Single phase 190 to 250 Vac across safety terminals.

Maximum power:

- 1 HP Direct Current.
- 1 HP single phase alternating current.
- 1 kW three-phase alternating current.

Power factor: Variable between 0 and 1 (inductive and capacitive).

Maximum input voltage:

- 250 V Direct Current.
- 280 V AC single and three phase.

Maximum intensity: 10 A.

Short-circuit switch: Current variation between 0 and 100%.

Module with integrated Instrumentation through LCD display and magnitude selector push button:

- Voltmeter.
- Ammeter.
- Wattmeter (active, reactive and apparent).
- Power Factor Meter.
- Phase angle meter to measure the angle between voltage and current.
- Frequency.

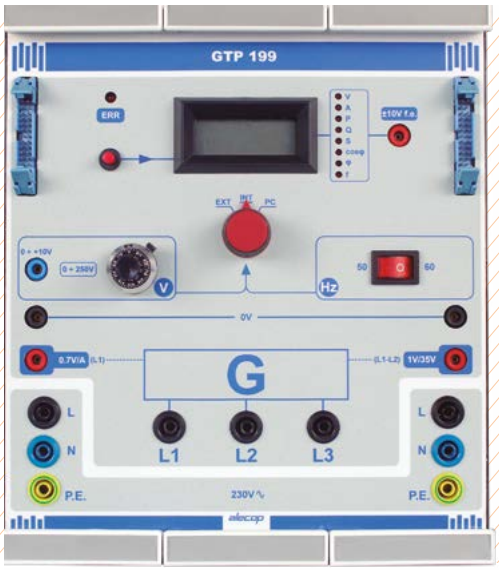
Module

GTP-199

Three-phase Power Generator

Provides adjustable three-phase power for rotary machines and transformers from a single-phase input. Includes adjustable Power Factor and a switchable display.

Works autonomously or is able to capture and control magnitudes by PC via a data acquisition system and DIANA software.



Ref: MDULGTP199

Functional description

The support comprises a triple-size training module: 250 x 216 x 130 mm.

It operates installed in a desktop vertical rack from where it gets its ± 15 V power required for operation.

Interconnection with other modules in the test bench BNC-199 and DIANA software with a fast 26-pin connector. 2 mm sockets for external measurements and set values. 4 mm safety terminals input power (mains connection).

Includes serigraph identifying the functional blocks. Has many advantages over other types of variable voltage (auto-linear drive frequency, etc...), Among which are the following:

- Reduced volume: Single and three-phase generator with its instrumentation in a single module.
- Improved performance: incorporates power electronic circuits returning power to the mains.
- Safety: Incorporates protection against overloads and short circuits, as well as safety terminals for user protection.
- Accuracy and resolution: electronic control of electrical quantities (voltage amplitude).
- Instrumentation built into the module itself.
- Interconnection with other elements of the BNC-199 Test Bench and control from the PC with DIANA software.

Possibility of autonomous operation with manual or computer assisted control (data acquisition system for general use).

Technical specifications

Power supply:

- Control: ± 15 VDC from the ALECOP support frame.
- Power: Single phase 190 to 250 Vac using safety terminals.

Maximum power: 1 kW.

Power factor: Variable between 0 and 1 (inductive and capacitive).

Maximum output voltage: 250 V AC.

Maximum intensity: 10 A.

Module with integrated Instrumentation through LCD display and magnitude selector push button:

- Voltmeter.
- Ammeter.
- Wattmeter (active, reactive and apparent).
- Power Factor Meter.
- Phase angle meter to measure the angle between voltage and current.
- Frequency.

Incorporates electronic protection, protecting the module against overloads and short circuits.

Module

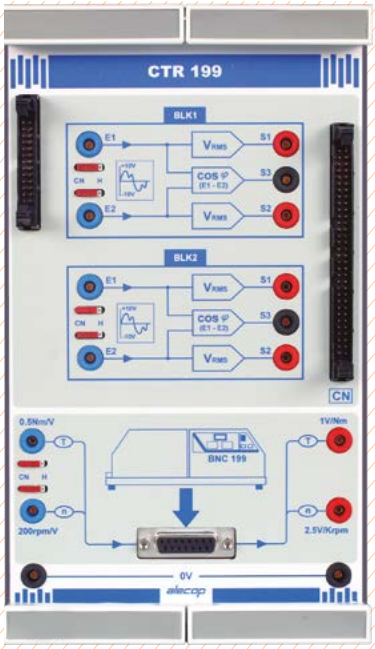
CTR-199

Interface to the Test Bench

Full computer control to configure different tests and mathematical functions to calculate true rms values and power factor.

Union between BNC-199 bench and test bench, allowing set values to be applied to the bench and their signals to be read.

- Two blocks are available to calculate the true efficient values of two signals and the power factor between them.
- Organizes the analogue inputs and outputs of the SAD450 DIANA as needed by the DIANA software for automatic configuration of the test.



Ref: MDULCTR199

Functional description

The support comprises a double-size training module: 250 x 144 x 130 mm. The power required for its operation is:
• ± 15 V, by inserting into the ALECOP support frame.

Includes serigraph identifying the functional blocks and components symbols. Use safety sockets 2 mm. in diameter that serve as test points.

Technical specifications

True effective value block
- Number of inputs: 2 (Two effective values). ± 10V.
- Number of outputs: 3 (Two effective values 0 to +10V, and an out of phase Cosine ± 10V).
- Bandwidth: >500Hz.
- Accuracy: 1% f.e. (RMS), 2% f.e. (power factor).

BNC-199 connection
- Number of active signals: 6.
  - Number of outputs (default value): 2 (Torque and speed).
  - Number of inputs (measurements): 2 (Torque and speed).
  - Number of control signals: 2 (Error and Control).
- 2 mm safety plugs for set point control or testing.

Input-output control
- Number of modules to control: 4 + BNC199 Test benches + 2 RMS blocks.
- Number of combinations: 128.

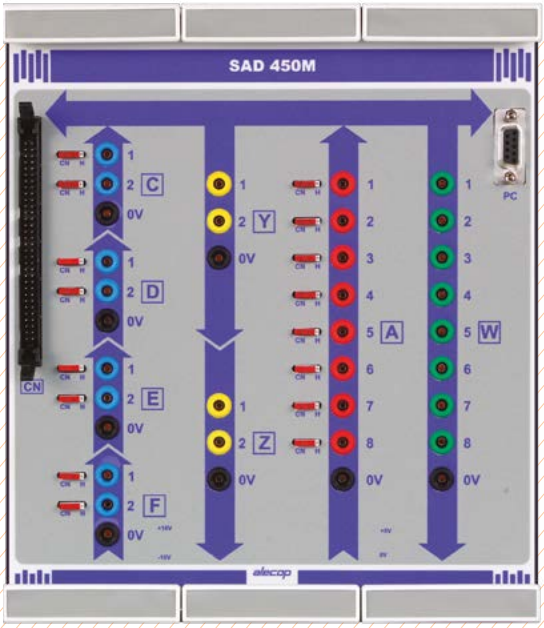
Module

SAD450M

PC Control Module

Full computer control to configure different tests and mathematical functions to calculate true rms values and power factor.

Along with the DIANA software it is part of a test bench governed from a computer which enables tests to be performed on real machines (transformers, DC rotary machines, and AC single and three phase rotary electrical machines. This module requires a desktop chassis with power supply (ALI -700 or ALI-199) for its operation. It has inputs / output connections in 2 mm sockets to connect quickly with the equipment to be analyzed. In addition to the sockets, all connections are available in a 64-way connector.



Ref: MDULSAD450

Functional description

Along with the SAD-450 a module a cable for a line connection to a PC USB is incorporated. The SAD450 module is divided into 8 blocks or channels, each with a determined I / O type and with different nomenclature based on whether they are inputs or outputs.

Each analogue or digital input channel has a switch to select whether the input comes from the socket (position H) or a 64-way connector (CN). Based on this switch the origin of the signal to be acquired by the data acquisition system will be determined.

The outputs have no switch and will be accessible both from the socket and from the connector at all times.

Technical specifications

Communication via ASCII commands

Consumption: +15V – 162mA.

Physical Measurements: 215x250x147 mm. (W x H x D)

External connections:

- PC connection: USB wire.
- Power Supply Connector to the frame.
- I/O Connector: 64-way connector.

Conversion times:

- 1 channel analogue Fmax 200 Khz.
- Fmax 1 digital channel 333 Khz.

60K of RAM for data

8 Analog Inputs: 12 bits of resolution.

Diana software can be used with a stand-alone PC, networked or over the Internet. It not only controls the test bench and machines under test but also includes powerful mathematical models which allow the comparison of real world results with simulation. Students can familiarise themselves with experimental procedures before entering the laboratory.

A truly comprehensive package Diana's features include:

- Theory and experimental procedures.
- Configurable mathematical models of DC and AC machines.
- Assembly instructions and graphics for experiment set-up.
- Definition of all experimental parameters.
- Control of all modules and the test bench parameters.
- Realtime display of experimental results.
- Analysis of experimental results; using both real machines and simulation.
- A report generator for the production of post experiment documentation.

When used over a network Diana allows multiple students to interact with one set of hardware reducing costs and providing a scalable environment for studying machines.

simple

in network

internet

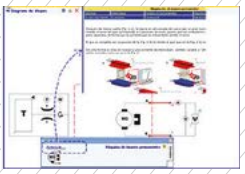


CONDUCTING A TEST

1. 

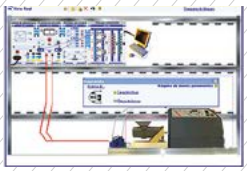
Description of the test

You can enter a title and description that includes images about the practice.

2. 

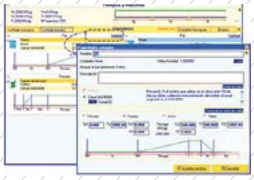
Definition of assembly

The items chosen as part of the test, their interconnection and instrumentation through a block diagram.

3. 

Real elements

The block diagram is translated to real elements DIANA offers various possibilities for each element and shows how to do the actual connection.

4. 

Chronogram

The signals which are sent and received from and to the test elements are configured in this section (units, signal shape and its timer).

5. 

Performing the test

Once the definition of the test is complete it can be launched and the status of the signals of interest can be monitored.

6. 

Test bench Network

The test is applied and transmitted to a ProLAB through the local network or Internet.



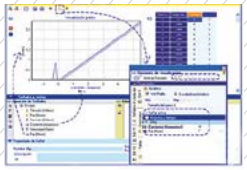
Local test bench

ProLAB is connected to the PC directly.



Simulated test bench

Advanced machine simulators incorporated by DIANA offer a result tightly adjusted to reality without the need for any hardware.

7. 

Analysis of the results

In each test a set of signals are collected a signal that is stored in the results. With DIANA signals can be viewed, compared, operations can be carried out among them and filters can even be applied.

8. 

Document

A DIANA wizard generates personalised reports on the work carried out with graphic and numerical information.

Includes a comprehensive library of activities

It is not necessary to start from scratch to set up the tests. DIANA is distributed with a complete library of activities designed and developed by experts, including:

- Headings.
- Configuration of items.
- Definition of the diagram.
- Results analyzed with comments.

Tests for AC, DC electric machines and transformers.

Licensing system

DIANA licenses can be hardware or Internet licenses:

- Web Licenses
  - Undefined
  - 1 year
  - 4 months

DIANA is full of content on electrical machines!

Automation

Control and testing with electrical machines CM-281

Designed to study the operating principles of electric machines, allows for commissioning, testing on empty and loaded to obtain curves, etc.

It is composed by:

- 1 Set of didactic modules of instrumentation, power, supply, and control.
- 1 Set of rheostats.
- 1 Vertical frame with 36 spaces on two tiers.
- 1 Set of accessories.
- Manual.



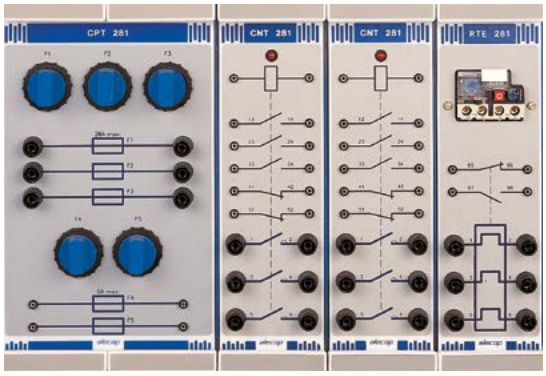


Instrumentation modules

Module “AMMETER 281”: 0.5-2.5-5 A. In AC/DC.
Module “AMMETER 282”: 5-10-25 A. In AC/DC.
Module “VOLTMETER-281”: 100-250-500 V. In AC/DC.
Module “VOLTMETER-281Q: 1kW 220 V./5 A.

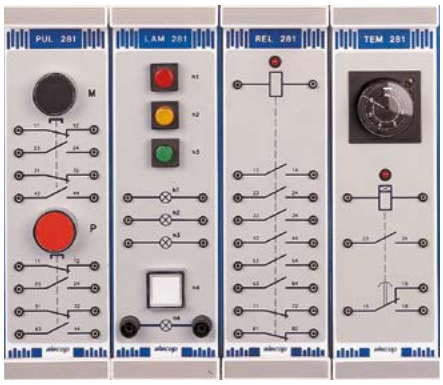
Supply training modules

Module “ALI-24”: 24V power supply.
Module “CNM-281”: 3-way switch/3 positions.
Module “SIN-281”: synchronism light.
Module “REC-281”: 200 Vdc rectifier. / 10 A.
Module “CON-281”: condenser.



Power modules

Module “CPT-281”: fuse protection circuit 6 and 20 A.
Module “CNT-281”: energy meter.
Module “RTE-281”: thermal relay.



Control modules

Module “PUL-281”: 2 buttons.
Module “LAM-281”: 4 different coloured lamps.
Module “REL-281”: manoeuvre relay with auxiliary contacts.
Module “TEM-281”: timed from 0 to 60 sec.

Rheostats

Set of resistive loads equipped with 4 mm safety terminals for a fast connection to electrical machines under study. The electrical parts are protected from shock by electrically insulated metal casing.



RHEOSTATS	DC START-UP	EXCITATION	THREE-PHASE LOAD	THREE-PHASE START-UP
0.5 HP MODELS.	150/500	1500/250	3250	347
References	9EQR150500	9EQR1K5250	9EQR325000	9EQRTR3470
FEATURES	150 ohm.	1,500 ohm.	3 x 470 ohm.	3 x 47 ohm.
	500W.	250W	3 x 250 W.	3 x 300 W.
	1.83 A.	0.41 A.	3 x 1.45 A.	3 x 2.4 A.

Automation

Mains voltage electric automatisms MT-332

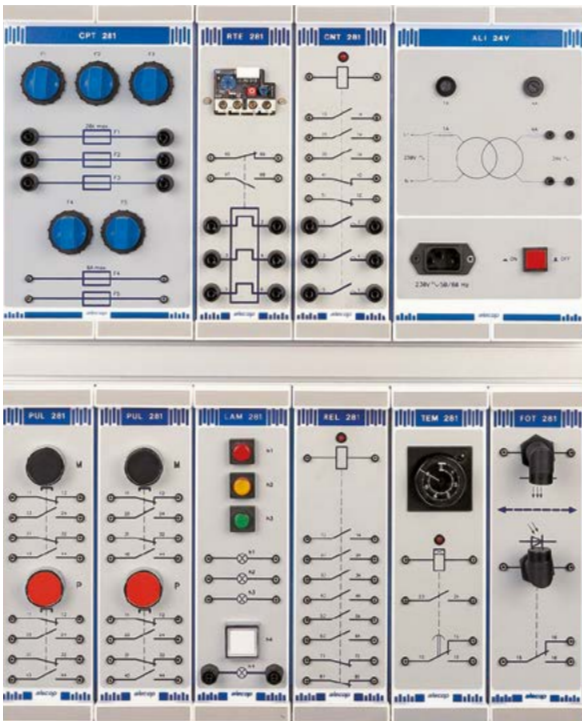
Teaching equipment for the study of different types of operations with single and three phase electric motors. Allows electric automatism practices and exercises to be carried out: commissioning and typical operation, interlocks, rotation inversions, protection, etc. They also allow the simulation and testing of any type of automation.

Electrical automation equipment

The equipment comprises:

- 1 desktop frame.
- 1 modular set of elements: protection modules and control and signalling modules.
- 1 set of accessories: operating practices, safety plugs, fuses, spare parts, etc.

Ref: 9EQMT332SE



Educational Transformers

For the study and interconnection of different types of three-phase and single-phase transformers.

They have the following general characteristics:

- E-shaped or U-shaped oriented grain magnetic core.
- Set of standard coils for the 127/220 V.
- Safety terminals.



REFERENCES	MODEL	NAME-FEATURES
9EQTM1K596	TM-1K5	1.5 KVA single-phase transformer
9EQTT1K496	TT-1K4	1.4 KVA three-phase transformer

Three-phase autotransformer **AT-3822**

Three-phase functional autotransformer 1 KVA 380 - 220 V. Output available in safety terminal and power socket to feed an machines. Pilot lights indicating the presence of phases. Protection of phase using fuse.

Ref: 9EQAT38221



KMQ-120

Kit of rotary electric machines



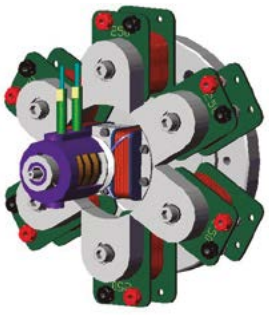
Fast assembly kits and testing of electric machinery at low tension.

This equipment is meant for the study of the constitutive parts and fundamentals of the functioning of the most common rotary electric machines.

In an easy way and with a reduced amount of parts, the following types of machines can be studied:

- Independent excitation generator.
- DC serial generator.
- DC shunt generator.
- Independent excitation motor.
- DC serial motor.
- DC shunt motor.
- Three-phase asynchronous alternator.
- Three-phase synchronous motor.
- Single-phase motor.
- Universal motor.
- Single-phase induction motor.
- Repulsion motor.
- Wound-rotor three-phase motor.
- Squirrel cage three-phase motor.
- Dahlander motor.





This equipment consists in:





Panel

This can be placed on the work surface or on a vertical frame. The support disc is attached to the panel, being used for screwing on the various field poles. The shaft protrudes from the centre of the disc and this is where the different rotors are attached.

An area has been set aside on the upper left-hand corner of the panel for the attachment of a drive motor that will allow experiments to be conducted with generators or provide a braking torque for the motors.

The right-hand side of the panel has the area for electric connections, using interchangeable labels. These allow the quick and clear interconnection of the various windings on the rotary machine subject to the experiment, providing the necessary information for its assembly. The areas the label is subdivided into make it easy to distinguish the electric connections both inside and outside the machine (connection board), without losing the perspective of a real machine.

The panel includes a 0-10 Vdc/2 A adjustable power supply for the excitation of the machines, as well as a tachometer for measuring the motor's velocity during the different types of tests.

Suitcase

It includes a series of parts (rotors, brush holders, windings, polar parts, etc), which allow configuring different rotary machines on a panel in a fast and easy way. The parts are the following:

- 1 Two-pole rotor.
- 1 Three-pole rotor.
- 1 Twelve-pole rotor.
- 1 Squirrel cage rotor.
- 1 Shaft.
- 6 Narrow field poles.
- 3 Wide field poles.
- 6 Windings of 240 turns.
- 4 Windings of 1,400 turns.
- 5 Brushes.
- 1 Brush holder.
- 6 Light poles.
- 1 Drive motor with belts.
- Tools and screws.

Power supply

The machines built are powered by a low voltage supply - 22/38 V AC/DC -, which ensures the students' safety. Hence, there are available (depending on choice) a TRI-120 transformer or a GTT-120 three-phase generator.

Standard accessories included:

- Practical and user's manual.
- Connexion wires.

Necessary accessories not included:

- Three-phase generator GTT-120, or as an alternative:
- Three-phase transformer TRI-120 + power supply 0-15 Vdc/5 A.

KMQ-100

BASIC kit of rotary electric machines

This is a “reduced” version of the dissectible machine, designed as a student work station.



Although it has fewer options than the full kit, it may be a valid option, depending on the nature of the practical activities to be held. Basically, the differences are as follows:

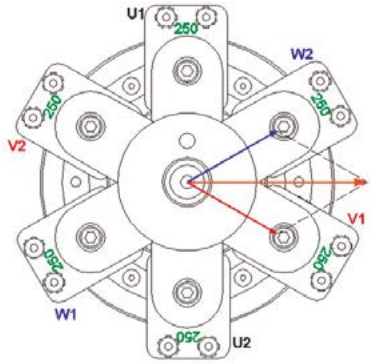
The assembly panel is smaller and can only be placed on the tabletop. It does not include the drive motor, tachometer, power source or connexions area neither. In this way, the result is a compact assembly panel.

The set of machinery construction, which is more reduced, fits in a suitcase that contains the following:

- 6 Windings of 250 turns.
- 2 Windings of 1,400 turns.
- 1 Twelve-pole rotor.
- 1 Squirrel cage rotor.
- 1 Brush holder.
- 5 Brushes.
- 2 Wide field poles.
- 6 Narrow field poles.
- 1 assembly support base.
- 1 assembly shaft.

The following machine models can be built and studied with this version:

- DC shunt motor.
- DC serial motor.
- Universal motor.
- Repulsion motor.
- Three-phase asynchronous elemental motor.
- Squirrel cage three-phase motor.
- Dahlander motor.

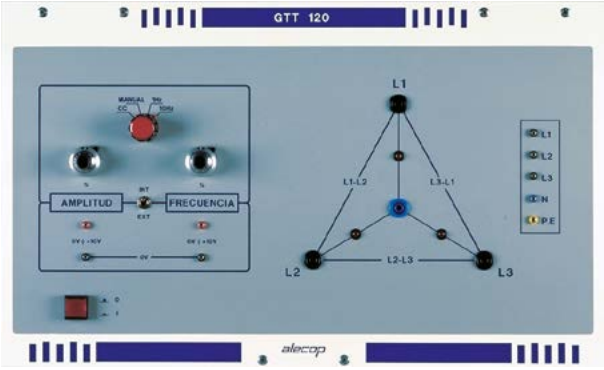


Standard accessories included:

- Practical and user’s manual.
- Connexion wires.

Necessary accessories not included:

- Three-phase generator GTT-120, or as an alternative:
- Three-phase transformer TRI-120 + power supply 0-15 Vdc/5 A.



Three-phase generator **GTT-120**

This panel, which is mounted either on the frame or tabletop, incorporates a low voltage variable frequency three-phase generator with a single-phase mains supply of 110-230 V / 50-60 Hz (depending on the module). It has the following specifications:

- Phase-neutral voltage: 0-22 V variable strength adjusted by a potentiometer control.
- Phase-Phase: 0-38 V strength.
- Maximum current per phase: 5 A.
- Protection against current surges and short circuits.
- Frequency variation: 1-100 Hz in two scales and potentiometer control.
- Instant value output from the three-phase network, variable between 0-360º.
- 3 simultaneously variable 0-30 V / 5 A DC outputs
- Option of independent control of the value of the amplitude and frequency.
- User's manual.



Three-phase transformer **TRI-120**

This is a three-phase transformer which, depending on the model (TRI-122 or TRI-123), has a transformation ratio of either 220V to 22/38V or 380V to 22V-38V.

- Apparent power of 300 VA.
- The output voltage is 22V between phases (12.7V neutral phase) and 4 Amperes or 38V between phases (22V neutral phase) and 3.75 Amperes which can be selected by means of a commutator on the front template.
- 4 and 2 mm simultaneous output sockets.
- Over-current and short-circuit output protection with phase light indicators.
- The outputs are thermally insulated, with the resetting being produced automatically after the protective elements have been cold for a period of time.
- The frontal light display shows the order of phases (L1-L2-L3 or L1-L3-L2).
- The transformer's primary is protected by 2A fuses with a light indication if any should blow (pilot light out).
- User's manual.

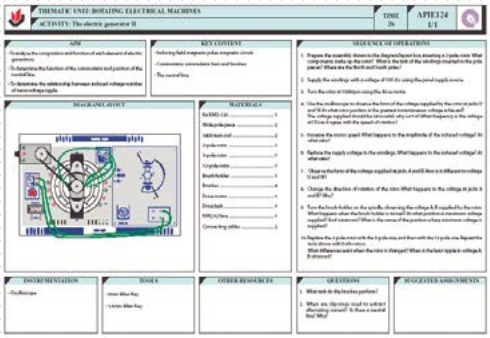
TRAINING SUPPORT MATERIAL

User's manuals.

Their content includes the use, maintenance and safety norms, as well as the description of the parts and characteristics of the equipment.

Practical manuals.

This is a proposal of different activities that can be carried out , with the list of the necessary components, assembly and wiring instructions and the solutions for the teacher.



Machines

AC & DC Electrical machines

The machines are designed to work under safety standards, and can work coupled with other machines or independently.

To prevent user access to moving parts, the machine has built-in protectors in both axis outputs. The handling of the protectors is defined in the manual of each machine. They also incorporate a printed terminal block with safety terminals.

All electric machines are mounted on an aluminium bench with hooks at their ends so they can be quickly and easily fitted together without tools.

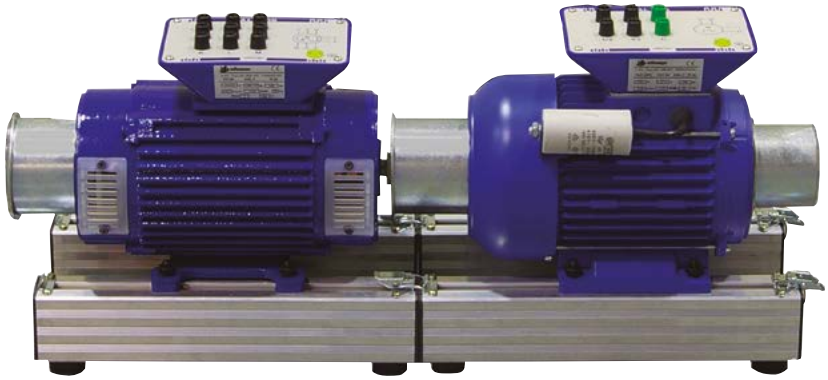
- The system is compatible with BNC-199 bench.
- Machines are available for 50 and 60 Hz.



AC electrical machines

MODEL	NAME-FEATURES	REFERENCE
AL-806	Universal electrical machine 370 W.	(50 Hz) 9MAK08064C (60 Hz) 9MAK08065C
AL-106	Single-phase asynchronous motor. Permanent capacitor 370 W.	(50 Hz) 9MAK01064C (60 Hz) 9MAK01065C
AL-205	Asynchronous three-phase 2-speed didactic motor with separate windings 370 W/0.5 C.V.	(50 Hz) 9MAK0205AC (60 Hz) 9MAK0205BC
AL-306	370 W. Three-phase asynchronous motor rotor winding.	(50 Hz) 9MAK0306GC (60 Hz) 9MAK0306HC
AL-406	Synchronous rotor winding machine 370 W.	(50 Hz) 9MAK0406GC (60 Hz) 9MAK0406HC
AL-1106	Asynchronous three-phase squirrel cage motor 370 W.	(50 Hz) 9MAK1106GC (60 Hz) 9MAK1106HC

DC electrical machines



MODEL	NAME-FEATURES	REFERENCE
AL-506	DC educational independent excitation machine 0.5 HP	9MAK0506ZC
AL-606	DC educational excitation machine series 370W	9MAK0606ZC
AL-1006	DC educational excitation machine series Compound 0.5 HP	9MAK1006ZC