

# M21-1000 Training System

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# SAFETY RULES

Carefully follow the instructions contained in this handbook as they supply important indications on the safety of the installation, use and maintenance.

Keep this handbook at hand for any further help.

Refer to the present handbook for the characteristics of the machine.

## UNPACKING

After the packaging has been removed, set all accessories in order so that they are not lost and check the equipment integrity. In particular, check that the equipment is integral and shows no visible damage.

Before connecting to power supply to the equipment, be sure wires are connect correctly with the power supply unit.

The power supply cables must be set so that they cannot be trodden upon or squeezed by objects.

On the equipment, there are some slots or opening for the ventilation; to ensure a reliable operation and to protect the equipment from overheating, they must not be blocked or covered. This equipment must be in such a position to enable a proper aeration.

Do never set the equipment on trolleys, supports, tripods, stirrups o unstable tables. The equipment could fall causing damages to the collided persons or it can damage itself any installation of the equipment must follow the instructions of the manufacturer and must be carried out using recommended accessories.

This equipment must be employed only for the use it has been conceived, i.e. as educational equipment, and must be used under the direct survey of expert personnel. Any other use is unproven and so dangerous. The manufacturer cannot be considered responsible far eventual damages due to unproven, wrong or unreasonable uses.

## PRECAUTIONS!

In order to safeguard the user's safety and the equipment operation, when using electrical equipment some fundamental rules must be followed. In particular the following regulation for use must be followed:

Ambient temperature: from 0 to 45°C.

Relative humidity: from 20 to 80 %.

Avoid any quick shift of temperature and humidity.

The system included the power supply cable, must be used in a place without or distant from: dust, humidity, high heat, objects radiating heat, liquids or corrosive substances.

Power supply: those reported on the label

Fuses: only those indicated in the related electrical diagram.

In case of fault and/or bad operation, turn off the equipment and do not tamper it. In case of reparation, ask the center far technical assistance or ask exclusively original spare parts. If these conditions are

not respected, the equipment can be compromised.

In case of penetration of objects or liquids inside the equipment, disconnect the power supply cable and make it checked by qualified personnel before using again.

### **CLEANING THE EQUIPMENT**

Use a soft and dry cloth to clean the container and the silk screen panel. Do never use insecticide or chemical products or solvents far cleaning.

### **VIBRATIONS OR COLLISIONS**

Be careful not to cause vibrations or collisions.

M21-1000 is practical and efficient equipment for introducing and explaining the branch of electricity. By the help of this kit you can carry out base circuits with electric components, connected by means of flexible cables and terminals set on the upper panel of the kit.

## INTRODUCTIONS

### TRANSFORMER

This is an electric device being able to transform the value or an electric alternating voltage.

A voltage which changes its own polarity alternately is called electric alternating voltage.

When you apply an alternating voltage to the primary, the voltage you get in the secondary is proportional to the first one, according to a constant coefficient being equal to the ratio between the turns of the secondary winding and those of the primary.

### FUSE

It is an electric protective device of circuits and intervenes by melting, and opening the circuit where it is connected.

It is a properly calibrated resistive element; when current intensity reaches the stated value in the circuit, such element melts.

### AMMETER

The instruments, which measure current intensity and are used in industrial measurements, are called ammeters. Sometimes they are also indicated with the name of submultiples or of multiples or ampere; so, there are milli ammeters, micro ammeters, or kilo ammeters, etc...

Since the ammeter must measure the current crossing a circuit, it must be connected in series to the circuit. In order that such connection does not vary the resistance (or impedance, if you are in presence of alternating voltage) of the circuit and, consequently, the current intensity crossing it, considerably, the ammeter must have a very low internal resistance (impedance) of about some fractions of ohm.

### VOLTMETER

The instruments, which indicate the potential difference existing between two points of a circuit and are used in industrial measurements, are called voltmeters.

Sometimes they take their names from the submultiples or multiples or volt: so there are milli voltmeters, kilo voltmeters, etc.

Voltmeter must be shunted between the two points you choose for measuring the potential difference between them; in order that such shunting does not alter the characteristics of the circuit considerably, the internal resistance of voltmeter must be very high.

### RESISTOR

This is an element with two poles of passive nature. In fact, there are active elements and passive elements.

We define active element a device being able to deliver electric energy, or to cause an amplification (of current, or of voltage, or of both of them).

On the contrary, a passive element is a device which has not such characteristics

### POTENTIOMETER

Besides the resistor having a fixed resistance value (actually, there are no similar resistors, because the value of resistance varies, more or less, according to the material forming the resistor, together with temperature: resistance increases with temperature), there are also some elements, for which it is possible to vary the value of their own resistance, according to certain laws. Such elements are called potentiometers

In order to vary the value of their resistance, normally it is necessary to act on the length of the element.

In fact, there is a relation of direct proportion between resistance and length of the resistive element. Moving this slider along the potentiometer, you get a variable resistance.

## DIODE

It is necessary to exceed a certain voltage, before obtaining current flow, but, when it is conducting; voltage is practically constant on diode, even if current increases considerably;

There is not any relation of direct proportion between voltage and current (as it happens in resistors); When you apply a voltage, positive on N-side there is such a value, in correspondence of which the device destroys itself, i.e. it is not able to block the current any more: such phenomenon is called "avalanche breakdown".

Diodes have several characteristic quantities:

Here are the main ones:

The maximum current it can conduct;

The maximum power it can lose.

## CAPACITOR

This is a device being able to store electric energy. Consider two metal plates (conductors), separated each other. Suppose to subtract some electrons from one of these plates and to transfer them to the other one: in this way, you provoke a voltage potential difference.

Unit of capacitance Farad (F), but this value is too high, so people commonly use its submultiples, i.e. pf (Picofarad= $10^{-12}$ F), nF (nanofarad= $10^{-9}$ F),  $\mu$ F (microfarad= $10^{-6}$ F), mf (millifarad= $10^{-3}$ F).

## INDUCTOR

An inductor consists of a coil of conducting wire. When current crosses it, a magnetic field is generated and it tries to obstruct the current itself. When current flow stops or its direction of propagation is reserved, magnetic field is reduced, thus generating an electromotive force which tends to maintain the current flow. Inductor is used to regulate current.

The unit of inductance is Henry (H).

The low values are expressed in mH (millihenry) and in  $\mu$ H (microhenry). Also in this case, there are fixed inductors and variable inductors. The inductors, which show a constant nominal inductance at their terminals, are called fixed inductors.

## LAMP

It is composed by: the base: threaded part allowing the connection of the lamp to the lamp holder. The base or cap can have different sizes: E10, E14, E27, etc...; usually the types, used in lamps for lighting installations, are E14 and E27; the glass bulb, within which vacuum is created or an inert gas is placed; it contains the filament. Bulb is necessary because, if the filament were in air, it would burn; it can be transparent, frosted, or colored; the tungsten filament: when it is crossed by electric current, filament becomes incandescent and emits light.

Generally, lamps are classified according to supply voltage and to the power they absorb.

As power increases, lamp increases its light efficiency.

## RINGER

Ringling is produced by an electromagnet (power supplied with unified voltages): in fact, when it is power supplied, the electromagnet overcoming the contrasting action of a spring attracts a rather flexible metal rod, on which the hammer is placed. Since the electric quantity, which generates the attracting force of electromagnet, is alternating and sinusoidal, whereas the mechanical action of spring is constant in time, there are some moments on which the mechanical force of spring prevails over the electromagnetic force consequently hammer strikes a metal (aluminum-brass) "bell", emitting a high-pitched and bright sound.

In the case of a ringer supplied with direct current, its electromagnet has an intensity being constant in time, so the sound would be limited to one stroke on the bell when the coil of electromagnet is reenergized.

## PUSHBUTTON

This is an electric device being able to close an electric circuit, only temporarily.

Kit CBE-1/EV is equipped with two double pushbuttons. They have a contact which closes, and another contact which opens again simultaneously: the circuit, where such a component is connected is kept closed or open, according to the used contact, until you intervene on the device manually.

## TWO-WAY SWITCH AND SWITCH

A device, which is able to deviate the electric current from a branch of a circuit to another branch of the same circuit, is called two-way switch.

As regards switches, it is necessary to state the electric voltage at which they have to operate: in fact, a too high voltage can provoke the phenomenon of field discharge between the two terminals (or poles) of the switch.

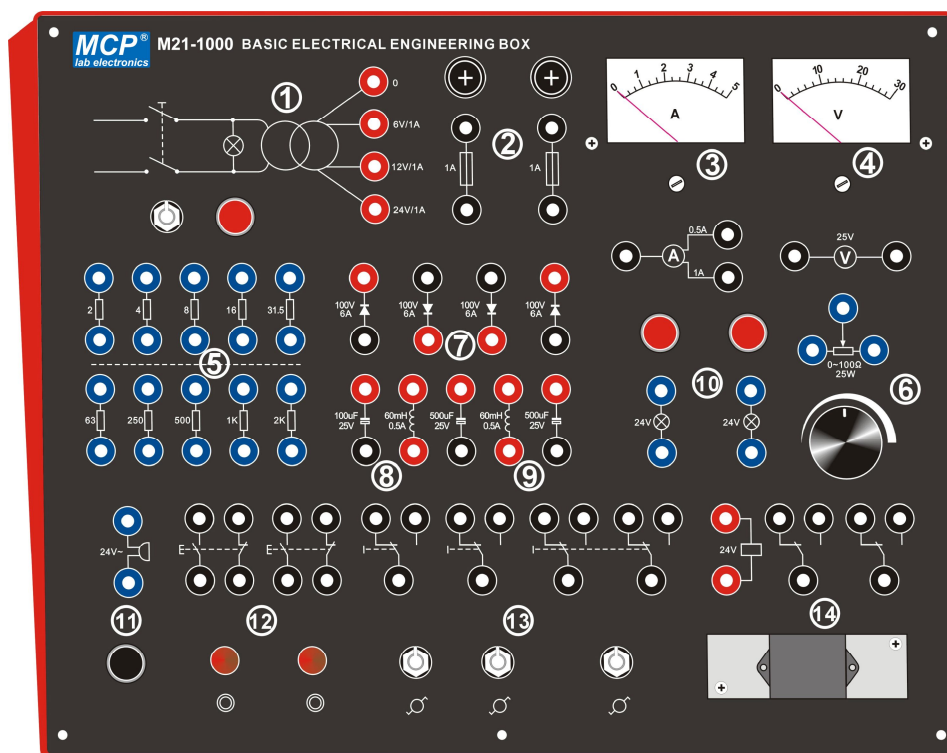
## ELECTROMAGNETIC RELAY

This device is used for the control (even remote control), check and safety of electric systems.

When the intensity of the excitation current crossing the coil reaches a certain value, the moving part is attracted with a force which is proportional to the square of current. Usually when excitation stops, the armature is released due to the action of a spring. Also this device is based on the principle of electromagnetic induction.

In this case, polarities, contrary to those present in the fixed part, are induced in the soft iron of armature, thus causing the attraction of the two components.

# OPERATING CONTROLS



- 1 Transformer (6-12-24VAC/1A)
- 2 Fuse (1A)
- 3 Ammeter (0~0.5/0~1A, AC & DC)
- 4 Voltmeter (0~25V, AC & DC)
- 5 Resistor (2Ω, 4Ω, 8Ω, 16Ω, 31.5Ω, 63Ω, 250Ω, 500Ω, 1000Ω, 2000Ω)
- 6 Potentiometer (0~100Ω, 25W)
- 7 Diode (6A, 100V)
- 8 Capacitor (100uF/25VDC, 500uF/25VDC)
- 9 Inductor (60mH/0.5A)
- 10 Lamp (24V)
- 11 Ringer (24VAC)
- 12 Pushbutton
- 13 Two-way switch and switch
- 14 Electromagnetic relay (24V)

**DIMENSIONS (W×H×D):** 335×100×260mm

**WEIGHT:** 2.5kg

**ACCESSORY:** 20pcs lead