

INTEGRATED LABORATORY FOR TEACHING

ELECTRICAL ENGINEERING: AUTOMATION:

low-voltage power consuming electric installations, electric installations for buildings
electric and electro-pneumatic installations for industry

ELECTRONICS and TELECOMMUNICATIONS:

basic electronics, analog circuits, digital circuits, microprocessors and microcontrollers, industrial electronics and process control



GENERAL INTRODUCTION

3

WHEELED STRUCTURE	Mod. LII-S/EV	4
FLOOR STANDING DISPLAY RACK	Mod. LII-T/EV	5
VERTICAL BENCH WITH FOUR WORKSTATIONS	Mod. 397-4/EV	7

DISTRIBUTION SYSTEMS AND PROTECTION DEVICES	Mod. LII-SD1/EV	9
---	-----------------	---

PANEL OF LIGHTING INSTALLATIONS AND SOCKETS	Mod. LII-CB1/EV	11
PANEL OF ELECTRIC SIGNALLING SYSTEMS	Mod. LII-CB2/EV	13
PANEL OF ELECTRONICALLY CONTROLLED INSTALLATIONS	Mod. LII-CB3/EV	15

PANEL OF INNOVATIVE KNX BUS SYSTEMS	Mod. LII-CD1/EV	17
PANEL OF BUS TELEPHONE AND VIDEO INTERPHONE SYSTEMS	Mod. LII-CD3/EV	19
PANEL OF ANTI THEFT SYSTEMS	Mod. LII-CD5/EV	21
PANEL OF FIRE DETECTING SYSTEMS	Mod. LII-CD6/EV	23

PANEL FOR AUTOMATION OF WIRED INDUSTRIAL INSTALLATIONS	Mod. LII-AI1/EV	25
PANEL OF ELECTRONICALLY CONTROLLED INDUSTRIAL INSTALLATIONS	Mod. LII-AI2/EV	27
PANEL OF AUTOMATIC POWER FACTOR CORRECTION SYSTEMS	Mod. LII-AI3/EV	29
PANEL OF ELECTRO-PNEUMATIC AUTOMATION SYSTEMS	Mod. LII-AI4/EV	31
PANEL OF DC MOTOR STARTING AND CONTROL SYSTEMS	Mod. LII-AI5/EV	33

PANEL OF PIERCED METAL SHEET	Mod. 397-PLF/EV	35
KIT FOR INDUSTRIAL INSTALLATIONS	Mod. MI-P/EV	35
KIT FOR ELECTRO-PNEUMATIC SYSTEMS	Mod. ME/EV	36

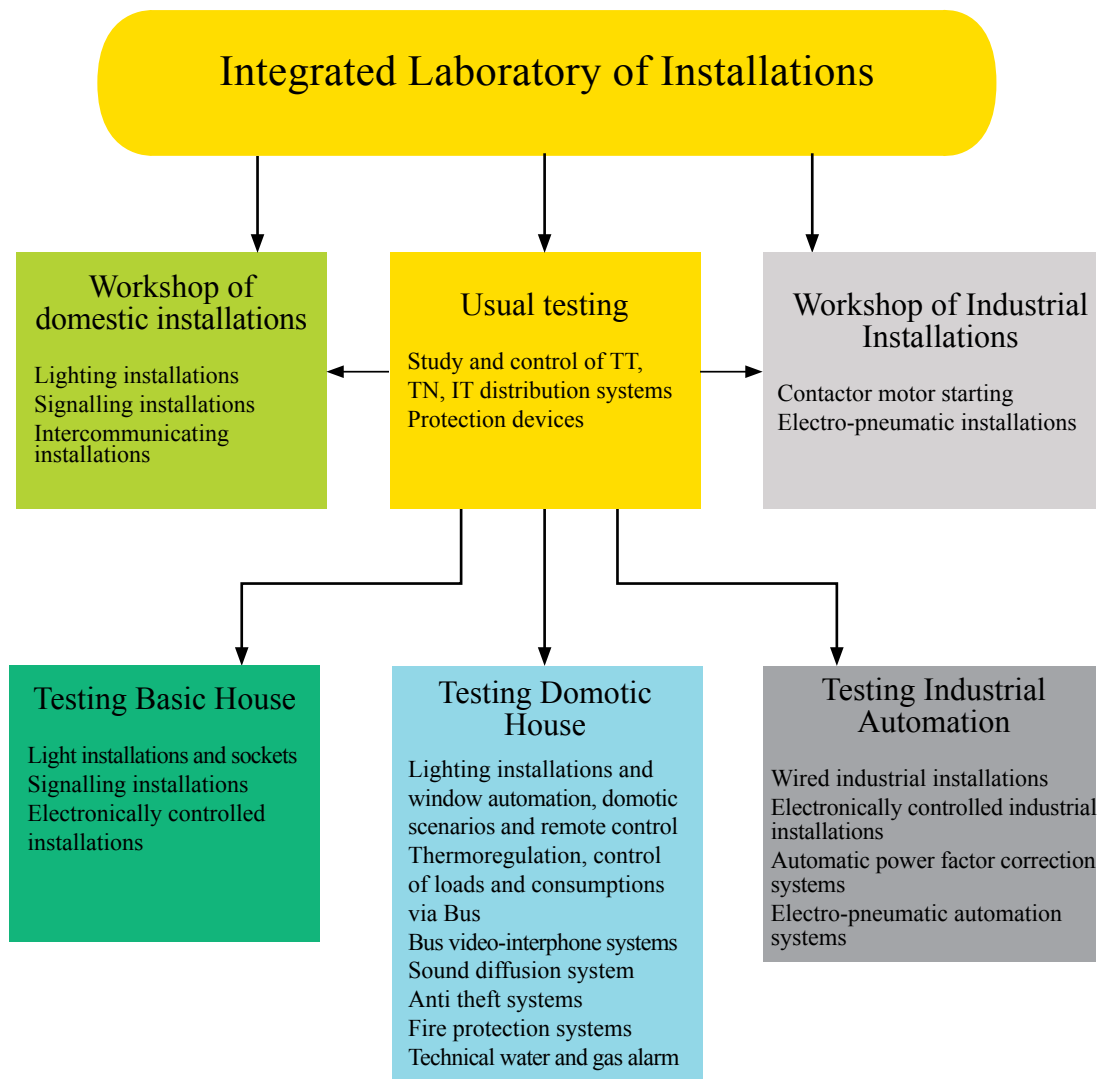
PANEL WITH FLUSH-MOUNTED BRANCH EXCHANGE AND BOXES	Mod. LII-PSC/EV	38
PANEL WITH FLUSH-MOUNTED BOXES	Mod. LII-PSI/EV	38
KIT FOR SWITCHBOARDS OF LIVING UNIT	Mod. MIS-Q/EV	39
KITS FOR LIGHTING INSTALLATIONS	Mod. MIS-I/EV	40
KIT FOR SIGNALLING SYSTEMS	Mod. MIS-S/EV	41
KIT FOR INTERPHONE SYSTEMS	Mod. MIS-C/EV	41

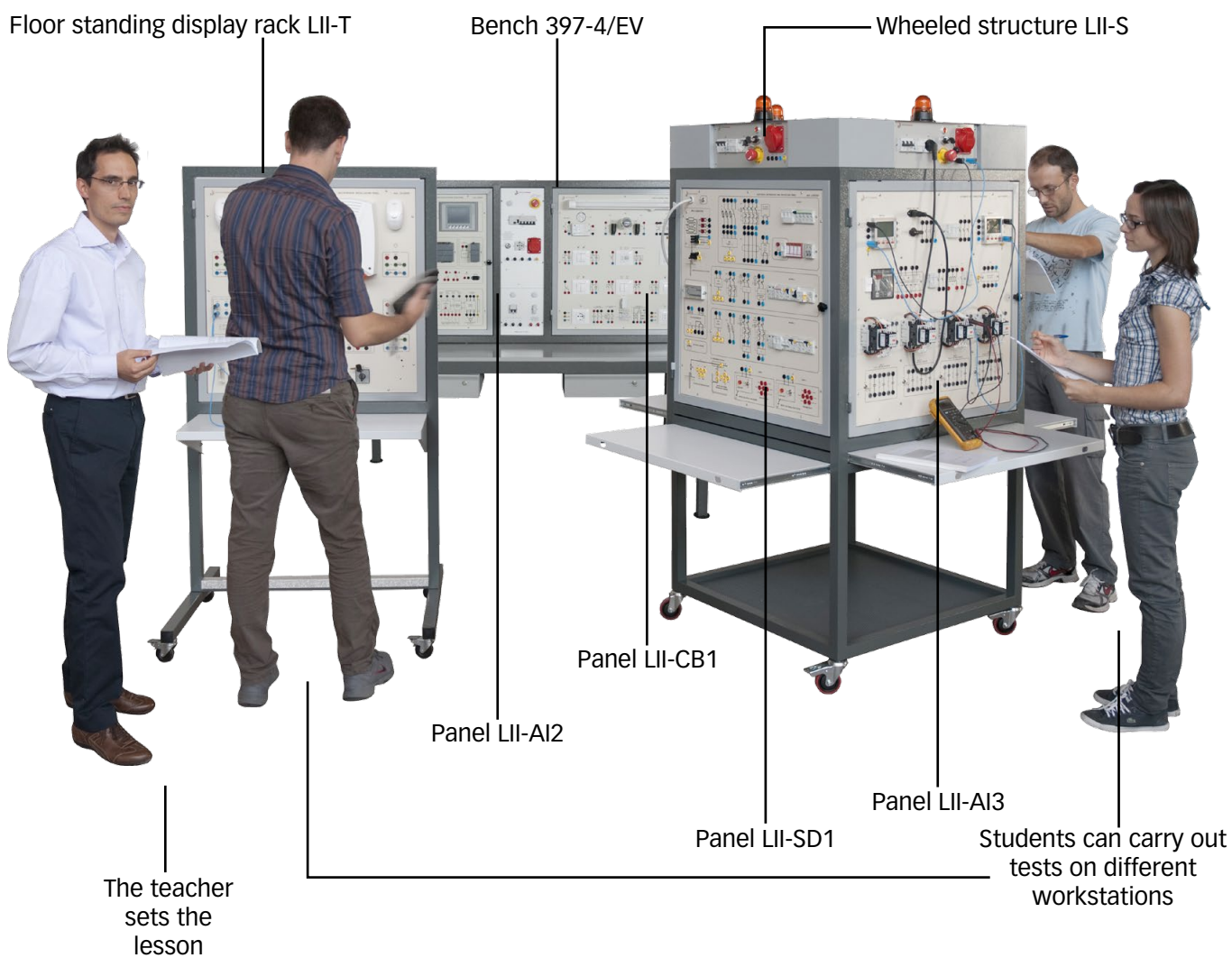
PANEL OF TESTING IN ELECTRONICS AND TELECOMMUNICATIONS	Mod. LII-SET/EV	43
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ELECTRICAL ENGINEERING AND AUTOMATION: LOW-VOLTAGE POWER-CONSUMING ELECTRIC INSTALLATIONS, ELECTRIC INSTALLATIONS FOR BUILDINGS AND INDUSTRY

INTEGRATED LABORATORY OF INSTALLATIONS WITH WHEELED STRUCTURE FOR ASSEMBLING AND TESTING THE INSTALLATIONS OF "BASIC HOUSE", OF "DOMOTIC HOUSE" AND OF "INDUSTRIAL AUTOMATION", WITH DIFFERENT PANELS AND METHODS.





WHEELED STRUCTURE

mod. LII-S/EV

INTRODUCTION

This wheeled structure has been designed specifically for works in workshops and for testing of electric installations. This framework includes 4 workstations with interchangeable hinged panels, wholly independent, that can also be used for group exercises. Each workstation has a sliding top where tools and/or instruments can be placed, the upper part of each workstation is provided with a single-phase and 3-ph power supply panel with high-sensitivity magneto-thermal differential circuit breaker, universal single-phase and 3-ph EEC 3/N/ Ground socket, terminals for safety plugs (Ø 4 mm), key control, emergency button and warning light signalling unit powered.

LII-S/EV

Framework has been made with structural and sheet steel, chemically treated and painted with epoxy varnish.

This structure is provided with wheels to make its handling easier; two wheels can be braked to stop any movement during the use.

The panels for the different educational activities are inserted in the framework so that they can turn on hinges for the preparation and configuration. The workstations are completely independent thanks to four sliding worktops for placing tools and/or instruments, and to four power supply panels.

Four universal single-phase sockets of 230 V – 10-16 A / UNEL, included in the structure and controlled by switch, are available to power the accessories such as a PC and an external 32" screen for displaying the software programs, a compressor for electro-pneumatics, etc...

TECHNICAL CHARACTERISTICS:

Electrical characteristics of EACH power supply panel mod. LII PEE/EV:

- thermomagnetic ELCB 3/N; In 10 A; Pdi 6 kA; I_{dn} 30 mA – class A
- universal single-phase socket of 230 V – 10-16 A / UNEL
- 3-ph socket 3/N/Ground – 400 V – 16 A – standard IEC 309
- 5 safety terminals – Ø 4 mm – for supplying 3-ph and single-phase lines L1, L2, L3, N and PE
- start control with removable key
- Red emergency push button, manual lock and half-Turne release
- four-pole contactor of 400 V – 24 A, with coil of 230 Vac
- panel powered warning light
- 4-230 V top lamps for signaling power supplies ON mounted over the console to signal that workstation is enabled, even from a distance

Dimensions: 880 x 880 x 1800 mm

Suitable for 4 panels: 790 x 790 mm with hinges on the left

Weight: 94 kg



POWER SUPPLY:

3 x 400 V / N / PE 50-60 Hz
Max. absorption: 6 kVA

FLOOR STANDING DISPLAY RACK

mod. LII-T/EV mod. LII-T1/EV

INTRODUCTION

This wheeled rack can be used in workshop and also for testing electric installations. This structure gives availability to use interchangeable hinged panels, and it may be additional or complementary of the wheeled structure mod. LII-S/EV.

Available in two models, without power supply (mod. LII-T/EV) and with power supply (mod. LII-T1/EV)

Mod. LII-T/EV

TECHNICAL CHARACTERISTICS:

The structure has been made with structural and sheet steel, chemically treated and painted with epoxy varnish.

This rack is provided with wheels to make its handling in laboratory easier; two wheels can be braked to stop any movement during its use.

The panels for the different educational activities are inserted in the rack so that they can turn on hinges for the preparation and configuration.

Dimensions of the rack: 880 x 700 x 1650 mm

Suitable for 1 panel: 790 x 790 mm
with hinges on the left

Weight: 19 kg



Mod. LII-T/EV

Mod. LII-T1/EV

Mod. LII-T1/EV

TECHNICAL CHARACTERISTICS:

Structurally similar to model LII-T/EV, this model includes a power supply with the following features:

Dimensions of the rack: 880 x 700 x 1650 mm

Suitable for 1 panel: 790 x 790 mm
with hinges on the left

Weight: 25 kg

POWER SUPPLY:

- High-sensitivity thermomagnetic ELCB 3/N; In 10 A; Pdi 6 kA; Idn 30 mA – class A
- 2 universal single-ph socket 230 V - 10-16 A / UNEL, one in the front panel and the second in the rear
- one 3-ph-socket 3/N/G 400 V - 16 A standard IEC 309, placed in the back
- 5 safety terminals – Ø 4 mm – for supplying 3-ph and single-phase lines L1, L2, L3, N and PE
- start main switch with removable key
- Red emergency pushbutton, manual lock and half-turn release
- four-poles contactor, 400 V – 24 A, coil 230 Vac
- spy lamp for signaling panel power ON



Example with one panel (not included)

VERTICAL BENCH WITH FOUR WORKSTATIONS

Mod. 397-4/EV

INTRODUCTION

This bench has been designed to enable students to develop a complete program of practical assembling, wiring and testing exercises of lighting installations, signalling systems, industrial electric and electro-pneumatic installations.

In fact five different types of interchangeable panels, described in the following pages, are provided for a practical and realistic work based on the most common employed wiring techniques.

This bench has been designed for four students ensuring four comfortable workstations of proper size. Panels are fixed on the vertical frame by hinges for an easy assembling and removal; thus the realized circuit must not be disassembled. Consequently the same available interchangeable panels are used.



TECHNICAL SPECIFICATIONS:

This bench is made of welded sheet steel and section, chemically treated and painted with several coats of epoxy varnish; the working top of chipboard coated with bonded laminate, includes two drawers on each side (a drawer for each workstation).

Panels are fixed on the vertical frame by hinges for an easy assembling and removal; thus the realized circuit must not be disassembled.

Each front of the bench (two workstations) is provided with the following power supply:

- 1 three-phase (230 or 400 V) and single-phase (230 V – 16 A) line, protected by high-sensitivity magneto-thermal differential circuit breaker, safety terminals, emergency button with mechanical holding, minimum voltage release device
- Four-pole switch with key control that can be extracted only in zero position to enable three-phase line
- 1 single-phase line of 12-24 Vac – 4 A (safety extra-low voltage) protected against overloads and short-circuits by fuses and by magneto-thermal circuit breaker
- 1 circuit tester with light-acoustic signalling (powered with extra-low voltage)

Dimensions: 2.000 x 1.000 x 850 + 850 mm

Net weight: 98 kg

POWER SUPPLY:

400 V / N / PE 50-60 Hz

Max. absorption: 6 kVA

Example of configuration of an integrated laboratory of installations with 4-station wheeled structure mod. LII-S/EV

Panel	Installation typology				
	Testing Basic House	Testing Domestic House	Testing Industrial Install.	Workshop of domestic install.	Workshop of Industrial install.
Panel of electric systems and switchboards mod. LII-SD1/EV	1 (*)				
Panel of lighting installations mod. LII-CB1/EV	1				
Panel of signalling systems mod. LII-CB2/EV	1				
Panel of electronically controlled systems mod. LII-CB3/EV	1				
Panel for automation of lamps and blinds mod. LII-CD1/EV		1			
Panel of thermoregulation and load control mod. LII-CD2/EV		1			
Panel of bus video-interphone systems mod. LII-CD3/EV		1			
Panel of sound diffusion systems mod. LII-CD4/EV		1			
Panel of anti theft systems mod. LII-CD5/EV		1			
Panel of fire protection systems mod. LII-CD6/EV		1			
Panel of wired industrial installations mod. LII-AI1/EV			1		
Panel of electronically controlled industrial installations mod. LII-AI2/EV			1		
Panel of industrial automatic power factor correction systems mod. LII-AI3/EV			1		
Panel of electro-pneumatic automation systems mod. LII-AI4/EV			1		
Panel of boxes and branch exchange mod. LII-PSC/EV				1	
Kit of materials for switchboards mod. MIS-Q/EV				1	
Panel of wall boxes mod. LII-PSI/EV				3	
Kit of materials for domestic installations mod. MIS-I/EV				1 to 3	
Kit of materials for signalling installations mod. MIS-S/EV				1 to 3	
Kit of materials for interphone systems mod. MIS-C/EV				1 to 3	
Panel of pierced metal sheet mod. 397-PLF/EV					1 to 4
Kit of materials for industrial installations mod. MI-P/EV					1 to 4
Kit of materials for electro-pneumatic installations mod. ME/EV					1 to 4
Silent compressor of 20 litres for Kit mod. ME/EV					1

(*) Panel mod. LII-SD/EV, used for study and check of distribution systems and protection devices, enables to assemble the switchboard/s of living units of levels 1, 2 and 3 according to standard CEI 64-8; V3

DISTRIBUTION SYSTEMS AND PROTECTION DEVICES

mod. LII-SD1/EV

INTRODUCTION

Panel for the implementation and check (even by instruments) of TN (C, S, C-S), TT, IT distribution systems, and for the study of protection devices and of switchboards. This panel can be used by teachers for their lessons and by students for an easy learning and testing on the connection position of neutral conductor in low-voltage distribution systems. The actual electrical components of the equipment connected with educational terminals of high protection level against accidental contacts allow to assemble the various configurations and to make a visual check of the operation, besides carrying out the tests with traditional instruments.

The used apparatuses are represented on the panel with their standardized international symbols. The field of application of these devices includes both civil installations and those of business and/or production (craft-industrial and service) sectors.

TRAINING PROGRAM:

Indication to the testing of distribution systems:

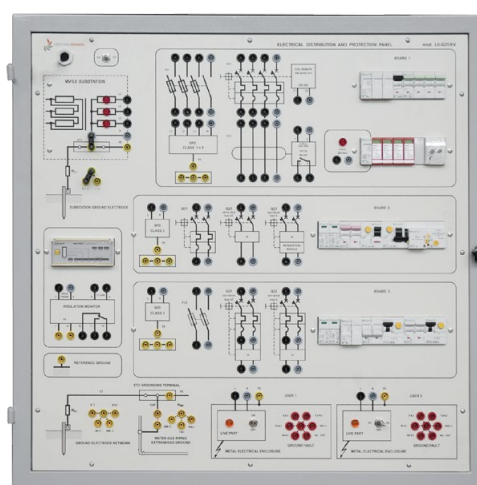
- TN (TNC, TNS, TNC-S) systems
- TT systems
- IT systems
- protections against direct contacts
- protections against indirect contacts by earthing
- substation earthing system
- user earthing system
- extraneous conductive parts
- protections against indirect contacts by electric separation
- protections against indirect contacts by differential circuit breaker
- protection against overcurrents, selectivity in protection devices
- Supervision of insulation resistance in systems isolated from earth

Indication to testing and measurements with instruments:

- measurement of insulation resistance
- measurement of earth resistance
- continuity tests of protection conductors
- analyzing the functionality of ELCB
- checking the protection devices with automatic circuit breakers
- measurement of resistance/impedance of fault loop
- measurement of first earth fault current in isolated systems

Indication to the applications of protection devices onto power distribution boards:

- Study and application of AC-type differential circuit breaker
- Study and application of A-type differential circuit breaker
- Study and application of selective differential circuit breaker
- Study and application of differential circuit breaker with automatic reset
- Magneto-thermal automatic circuit breakers for lighting systems and socket circuits
- Fuses for protection of power and auxiliary circuits
- Surge Protection Devices (SPD) against overvoltages



TECHNICAL CHARACTERISTICS:

The framework has been made with structural and sheet steel, chemically treated and painted with epoxy varnish; its left side is provided with hinges for a quick insertion/removal in/from the wheeled structure or work bench.

All the necessary electric components for the correct power supply of circuits are included in the panel.

Tests can be carried out via safety cables and terminals for plugs with diameter of 4 mm

Main components installed:

- 1 3-ph insulation transformer – 230-400 V / 230-400 V; 1500 VA
- 1 set of three fuse holders, with breakable neutral conductor and cylindrical fuses 10.3 x 38 of 4 A
- 1 Surge Protection Device (SPD) 3+1, combined protector of class 1+2 with $I(10/350 \mu s) = 32 \text{ kA}$ / $I_n(8/20 \mu s) = 100 \text{ kA}$
- 1 magneto-thermal automatic circuit breaker – 4 x 3 A; curve C with current start-up coil
- 1 differential relay of class A coupled to a toroidal transformer with adjustable I_{dn} and tripping time
- 1 monitor for checking the isolation in IT systems with adjustment of the value of tripping sensitivity, and scale for monitoring the instantaneous value of insulation resistance in the installation
- 1 output of 230 Vac -1 A for powering auxiliary devices

- 1 three-pole lever selector for inserting two different values of capacitance to earth in IT line
- 1 substation earthing system with resistances of 0.3 Ω , 1 Ω
- 1 user earthing system with resistances of 2 Ω , 20 Ω , 200 Ω , 2 k Ω
- 1 extraneous conductive part with resistances of 200 Ω , 1 k Ω , 5 k Ω
- 1 Surge Protection Device (SPD) against overvoltages 1+1, protector of class 2, with I_{max} (8/20 μ s) = 40 kA / I_n (8/20 μ s) = 20 kA
- 1 thermomagnetic automatic circuit breaker – 2 x 2 A; curve C
- 1 two-pole pure automatic differential circuit breaker of 25 A / 0.3 A, class AC, "S" selective
- 1 two-pole differential circuit breaker – I_{dn} = 30 mA, of A-type, with automatic reset
- 1 Surge Protection Device (SPD) against overvoltages 1+1 - protector of class 3, with I_{max} (8/20 μ s) = 10 kA / I_n (8/20 μ s) = 2.5 kA
- 1 breakable pair of fuse-holders with cylindrical fuses 10.3 x 38 of 2 A
- 1 thermomagnetic ELCB switch 2 x 1 A, curve C, I_{dn} = 0.03 A, class AC, with possibility of using the only magneto-thermal switch without the differential part
- 1 magneto-thermal automatic differential switch 2 x 1 A, curve C, I_{dn} = 0.03 A, class A, with possibility of using the only magneto-thermal switch without the differential part
- 1 simulator of power consuming device with sinusoidal earth fault current; fault resistance of 50 k Ω , 15 k Ω , 5 k Ω , 1.5 k Ω , 500 Ω , bolted fault
- 1 simulator of power consuming device with sinusoidal or unidirectional earth fault current; fault resistance of 50 k Ω , 15 k Ω , 5 k Ω , 1.5 k Ω , 500 Ω , bolted fault

Dimensions of working area:	730 x 730 mm
Dimensions of the panel:	790 x 790 x 200 mm
Weight:	38 kg

This panel can be used in different ways:

- it can be inserted in the wheeled structure of the integrated laboratory of installations mod. LII-S/EV from which it is powered;
- it can be inserted in the bench for exercises on installations mod. 397-4/EV from which it is powered;
- it can be applied onto a wall like a blackboard; in this case, it is powered via the nearest 3-ph socket.

ACCESSORIES OF THE EQUIPMENT:

- 3-ph power cord (of 2.5 m) with EEC socket and plug
- 20 jumpers with safety plugs (\varnothing 4 mm) for assembling the various installation configurations
- Mixed set of 20 cables with safety plugs with diameter of 4 mm

RECOMMENDED ACCESSORIES AND SOFTWARE:

- Multi-function microprocessor instrument for electric testing
- Digital current probe for measuring rated and stray currents with peak memory
- Digital autoranging multimeter
- Design, simulation and animation software for the study of electrical engineering mod. SW-ELT/EV

POWER SUPPLY:

3 x 400 V / N / PE 50-60 Hz
Max. absorption: 1500 VA

THEORETICAL-EXPERIMENTAL HANDBOOKS

Practical handbook of industrial installations.

PANEL OF LIGHTING INSTALLATIONS AND SOCKETS

mod. LII-CB1/EV

TRAINING PROGRAM:

Indication to the testing of lighting installations and sockets:

- controlling a lamp from one point with switch
- controlling two lamps from one point with switch (lamps in series)
- controlling two or more lamps from one point with switch (lamps in parallel)
- controlling a lamp from one point with switch, with position or state warning light
- controlling a lamp from one point with switch, and a lighting socket
- controlling two lamps from one point with changeover switch
- controlling two lamps from one point with changeover switch, with position or state warning lights
- controlling a lamp and a lighting socket from one point with changeover switch
- controlling a lamp from two points by two deviation switches
- controlling a lamp from two points by two deviation switches, with two sockets for electric household appliances
- controlling two or more lamps from two points by two deviation switches
- controlling a lamp from three/four points by two deviation switches and one/two inverter/s
- controlling a lamp from one or more points by a switching relay
- controlling a lamp from one or more points by a switching relay, with state warning light
- controlling two lamps from one or more points by a relay acting as changeover switch
- controlling a fluorescent lamp from a point
- controlling a lamp from one point with timing relay (bathroom lighting)
- controlling several lamps from various points by a timing relay (stairwell lighting)
- luminosity control system by dimmer with push button control
- lighting installation controlled by presence sensor
- lighting installation controlled by twilight switch
- lighting installation with LED lamps of fixed light and with luminosity control
- simple alarm system with presence sensor and bell

INTRODUCTION

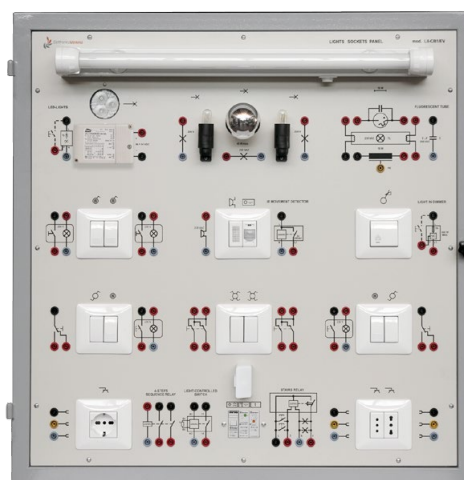
This panel includes actual devices to test electric lighting systems and sockets in civil and/or service sectors. It enables to define the minimal characteristics of an electric installation for residential environments of level 1: "basic house", level 2: "properties of greater usability", as stated in the general standard CEI 64-8; V3, for installations.

When used together with the panel of "distribution systems and protection devices mod. LII-SD1/EV", this panel enables to assemble the switchboards of the housing units (levels 1, 2 and 3) and combining these two panels creates a very important unit for the study of people's safety and of the coordination of electric protection devices.

All the devices are included in the fore panel and are represented with their standardized international symbols.

The field of application of these devices includes both civil installations and those of business and/or production (craft-industrial and service) sectors.

Test and installations are realized rapidly with cables of the equipment provided with safety plugs in the standard of 4 mm, without any other tool.



TECHNICAL CHARACTERISTICS:

The framework has been made with structural and sheet steel, chemically treated and painted with epoxy varnish; its left side is provided with hinges for a quick insertion/removal in/from the wheeled structure or work bench.

All the necessary electric components for the correct power supply of circuits are included in the panel.

Tests can be carried out via safety cables and terminals for plugs with diameter of 4 mm

Main components installed:

- 2 single-pole switches of 250 V – 10 A, with warning neon lamp of 230 V
- 2 single-pole two-way switches of 250 V – 10 A
- 2 single-pole inverters of 250 V – 10 A
- 2 single-pole pushbuttons of 250 V – 10 A, with warning neon lamp of 230 V
- 1 universal socket (2p + earth) 10-16 A and Unel (socket for S30 plugs)
- 1 universal socket (2p + earth) 10-16 A
- 1 socket (2p + earth) 10 A
- 2 lamp sockets with lamps E14 of 230 V – 3 W
- 1 lamp socket with lamp E27 of 230 V – 40 W

- 1 ceiling lighting fixture with linear fluorescent lamp of 230 V – 18 W (one tube in white light and one tube in coloured light)
- 1 ballast for fluorescent lamp of 18 W, 1 universal starter 4-80 W and 1 power factor correction capacitor of 5 μ F – 250 V
- 1 buzzer of 230 V
- 1 cyclic (switch/changeover switch) relay, excitation of 230 Vac, contacts of 250 V – 10 A
- 1 timing relay for staircase lighting, excitation of 230 Vac, contact of 250 V – 10 A
- 1 switch with IR movement sensor, adjustable twilight threshold and delayed switching off, powered with 230 V, output relay contact 230 V – 2 A with inductive loads
- 1 twilight switch with outdoor sensor, luminosity control, power supply of 230 V, output of relay contact 230 V – 3 A with inductive loads
- 1 button dimmer for resistive load and ferromagnetic transformers of 230 V 60-500 W/VA

Dimensions of working area: 730 x 730 mm
Dimensions of the panel: 790 x 790 x 150 mm
Weight: 14 kg

This panel can be used in different ways:

- it can be inserted in the wheeled structure of the integrated laboratory of installations mod. LII-S/EV from which it is powered;
- it can be inserted in the bench for exercises on installations mod. 397-4/EV from which it is powered;
- it can be inserted in one of the mobile floor-standing display rack with work top for instruments:
 - mod. LII-T/EV; in this case, it is powered via the nearest 3-ph socket;
 - mod. LII-T1/EV, from which it is powered;
- it can be applied onto a wall like a blackboard; in this case, it is powered via the nearest 3-ph socket.

ACCESSORIES OF THE EQUIPMENT:

- Set of 40 cables with safety plugs (\varnothing 4 mm)

POWER SUPPLY:

Single-phase 230 V - 50-60 Hz - 1000 VA

THEORETICAL-EXPERIMENTAL HANDBOOKS

Practical handbook of industrial installations.

PANEL OF ELECTRIC SIGNALLING SYSTEMS

mod. LII-CB2/EV

TRAINING PROGRAM:

Indication to the testing of signalling systems:

- system with a ringer controlled from one point
- system with a ringer controlled from two or more points
- system with one or more ringers controlled from one point (ringers in parallel)
- system with two ringers controlled from one point (deviated ringers)
- ringer system with call and answer
- bell system with pushbutton on nameplate
- bell system with pull-cord button for calls from bathroom
- acoustic signalling system for a flat (outdoor bell, buzzer for calls from bathroom and ringer for calls from bedrooms)
- light-acoustic signalling system with lighting labels for offices, hospitals and schools
- interphone system with an outdoor unit and an indoor unit (single-family system)
- interphone system with an outdoor unit and two indoor units (two-family system)
- intercommunication system between two interphones

TECHNICAL CHARACTERISTICS:

The framework has been made with structural and sheet steel, chemically treated and painted with epoxy varnish; its left side is provided with hinges for a quick insertion/removal in/from the wheeled structure or work bench.

All the necessary electric components for the correct power supply of circuits are included in the panel.

Tests can be carried out via safety cables and terminals for plugs with diameter of 4 mm.

Main components installed:

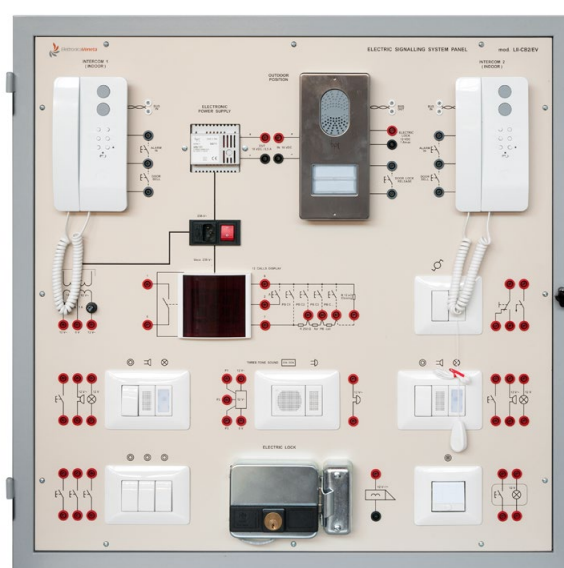
- 1 single-phase safety transformer with output of 12-24 Vac- 1 A
- 2 fuse holders with quick-break fuses 5 x 20 – 1 A
- 1 light indication panel with display, powered with 230 Vac, control circuits
- 5 single-pole pushbuttons of 250 V – 10 A
- 1 NO pushbutton with lighted door-plate – 12 V
- 1 single-pole pull-cord button of 250 V – 10 A
- 2 buzzers of 12 Vac
- 1 bronze ringer bell of 12 Vac
- 1 electronic three-tone ringer of 12 Vac
- 2 lamp sockets with warning lights of 12 V – 1.5/2 W
- 1 single-pole two-way switch of 250 V – 10 A

INTRODUCTION

This panel is wholly independent and it includes actual devices for testing electric optical-acoustic signalling systems in civil and/or service sectors. This panel also includes a single-phase transformer of safety extra-low voltage of 12 V ensuring the highest operation safety; this transformer is always present in actual installations for powering signalling circuits.

When used together with the panel of "electric lighting installations and sockets mod. LII-CB1/EV", this panel enables to complete the installations for residential environments of level 1: "basic house", level 2: "properties of greater usability", as stated in the general standard CEI 64-8; V3, for installations. All the devices are available in the fore panel and are represented by international electric symbols. The field of application of these devices includes both civil installations and those of service sector, offices, etc...

Tests and installations are carried out quickly via leads with safety plugs of 4 mm supplied with the equipment, and without the use of any working tool.



- 1 electric lock with excitation of 12 Vac and support for showing the door opening
- 1 outdoor unit of interphone system with two-button door plate
- 2 interphones provided with intercommunication and door opening button
- 1 power supply unit for interphones with output of 230 Vac
- 1 power plug of board-type, 2P + Ground
- 1 cable of 0.5 mm² with German/French plug

Dimensions of working area: 730 x 730 mm
Dimensions of the panel: 790 x 790 x 150 mm
Weight: 16 kg

REMARK:

Testing is carried out at safety extra-low voltage of 12 Vac output by the transformer included in the panel.

This panel can be used in different ways:

- it can be inserted in the wheeled structure of the integrated laboratory of installations mod. LII-S/EV from which it is powered;
- it can be inserted in the bench for exercises on installations mod. 397-4/EV from which it is powered;
- it can be inserted in one of the mobile floor-standing display rack with work top for instruments:
 - mod. LII-T/EV; in this case, it is powered via the nearest socket;
 - mod. LII-T1/EV, from which it is powered;
- it can be applied onto a wall like a blackboard; in this case, it is powered via the nearest single-phase socket.

ACCESSORIES OF THE EQUIPMENT:

- Set of 27 cables with safety plugs (Ø 4 mm)
- Set of 2 cables with safety plugs (Ø 2 mm)

POWER SUPPLY:

Single-phase 230 V - 50-60 Hz - 100 VA

THEORETICAL-EXPERIMENTAL HANDBOOKS

Practical handbook of industrial installations.

PANEL OF ELECTRONICALLY CONTROLLED INSTALLATIONS

mod. LII-CB3/EV

TRAINING PROGRAM:

Indication to the testing of systems for improving comfort and safety in houses:

- Lighting installations with LED lamps of adjustable coloured light for accent lighting
- Luminosity control systems with dimmer for fluorescent lamps
- Luminosity control systems with dimmer for traditional lamps and selection of different operating modes
- Installations with power consuming devices (lamps, electric loads, actuators) controlled by hour programmer
- Installations with power consuming devices (lamps, electric loads, actuators) controlled by telephone interface
- Lighting installations with emergency lamp; automatic switching on; manual switching off
- Room temperature control system by electromechanical thermostat
- Room temperature control system by programmable chronothermostat
- Alarm system with gas leak detector and normally open solenoid valve – manual reset
- Alarm system with CO detector

TECHNICAL CHARACTERISTICS:

The framework has been made with structural and sheet steel, chemically treated and painted with epoxy varnish; its left side is provided with hinges for a quick insertion/removal in/from the wheeled structure or work bench.

All the necessary electric components for the correct power supply of circuits are included in the panel.

Tests can be carried out via safety cables and terminals for plugs with diameter of 4 mm.

Main components installed:

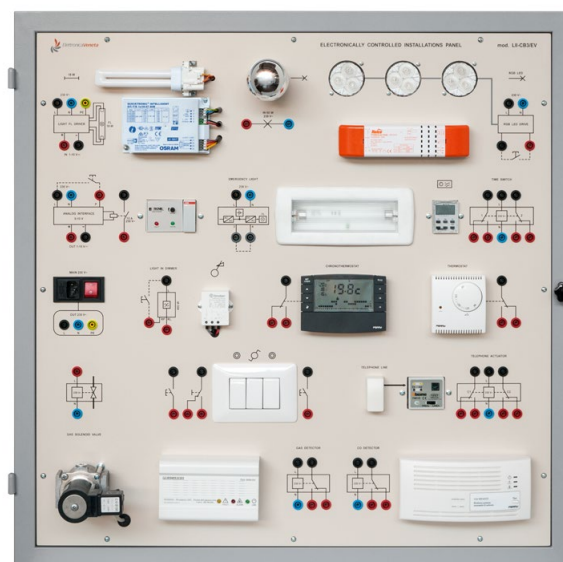
- 3 RGB LED lamps of 3 W – 350 mA
- 1 electronic dimmable power supply for LED lamp of 350 mA; input of 220-240 Vac 50-60 Hz
- 1 electronic dimmable ballast QT-T/E of 18 W
- 1 lamp socket G24Q-2 and compact fluorescent lamp DULUX D/E 18 W/830
- 1 controller of 1-10 Vdc for electronic dimmable ballasts
- 1 double (hour/week) digital switch, with automatic change of summer time, power supply of 230 V 50-60 Hz, 2 outputs relay contacts 230 V – 2 A with inductive loads

INTRODUCTION

This independent panel is designed to assemble installations with electronic devices for improving the building safety and comfort (home automation). The systems that can be assembled on this panel include dimmers for luminosity control of fluorescent lamps, hour programmers, emergency lighting with self-powered lamps, accent lighting with RGB-coloured LED lamps, CO and gas leak detectors, thermostat and chronothermostat for room temperature control, remote enabling device via telephone line.

When used together with the panel of "electric lighting installations and sockets mod. LII-CB1/EV", this panel enables to complete the installations for residential environments of level 1: "basic house", level 2: "properties of greater usability", as stated in the general standard CEI 64-8; V3, for installations. All the devices are available in the fore panel and are represented by international electric symbols. The field of application of these devices includes both civil installations and those of service sector, offices, etc...

Tests and installations are carried out quickly via leads with safety plugs of 4 mm supplied with the equipment, and without the use of any working tool.



- 1 multifunction dimmer with selector of different operating modes, 230 V – 5...400 W/VA, controlled by pushbuttons
- 1 lamp socket E27 and lamp of 230 V – 40 W, with silver-plated dome
- 1 single-pole two-way switch of 250 V – 10 A
- 2 single-pole pushbuttons of 250 V – 10 A
- 1 self-powered emergency light of 230 V 50-60 Hz, with fluorescent lamp of 4 W
- 1 gas leak detector
- 1 solenoid valve for gas positive safety
- 1 CO detector
- 1 telephone actuator with 2 separate outputs, exchange relay contacts, 250 V – 6 A
- 1 electromechanical room thermostat
- 1 room chronothermostat

Dimensions of working area: 730 x 730 mm
Dimensions of the panel: 790 x 790 x 150 mm
Weight: 16 kg

This panel can be used in different ways:

- it can be inserted in the wheeled structure of the integrated laboratory of installations mod. LII-S/EV from which it is powered;
- it can be inserted in the bench for exercises on installations mod. 397-4/EV from which it is powered;
- it can be inserted in one of the mobile floor-standing display rack with work top for instruments:
 - mod. LII-T/EV; in this case, it is powered via the nearest socket;
 - mod. LII-T1/EV, from which it is powered;
- it can be applied onto a wall like a blackboard; in this case, it is powered via the nearest single-phase socket.

ACCESSORIES OF THE EQUIPMENT:

- Set of 25 cables with safety plugs (Ø 4 mm)

POWER SUPPLY:

Single-phase 230 V - 50-60 Hz - 100 VA

THEORETICAL-EXPERIMENTAL HANDBOOKS

Practical handbook of industrial installations.

PANEL OF INNOVATIVE KNX BUS SYSTEMS

mod. LII-CD1/EV

INTRODUCTION

Panel for testing electric automation installations for lights and blinds, provided with KONNEX Bus systems: wide and innovative systems that can be applied in residential or service buildings of level 3 as stated in the general standard CEI 64-8; V3, for installations. This panel can be used in stand-alone mode and together with the panels of "basic house" and with the panel of innovative "domotic house" systems mod. LII-CD2/EV to extend automation to thermoregulation systems, access control and to the control of electric loads.

These panels of wide and innovative systems can be used together with the panel of "distribution systems and protection devices mod. LII-SD1/EV" to assemble the switchboards of housing units (of level 1, 2 and 3); this combination of panels is very important for the study of users' safety and the coordination of electric protection devices.

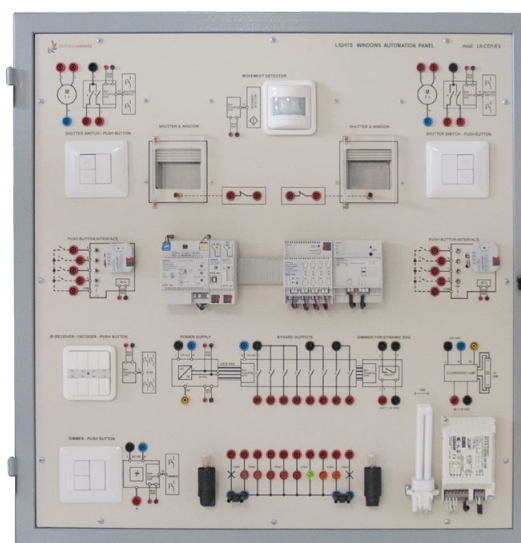
The distinctive feature of an installation applying Bus technology consists of the separation between power circuit (line of 230 V and actuators for electric loads) and Bus circuit (sensors and control and testing devices); the link between commands and load actuators is carried out by the "logic wiring". This logic wiring consists of a set of digital information, transmitted-received and carried out by the devices according to the instruction stated at the programming stage.

Several control devices, sensors, actuators, identified by their international electric symbols, are available on the fore panel. The application field of these devices includes both civil installations and those of business and/or production (craft-industrial and service) sectors. Testing is carried out quickly by leads with safety plugs of the equipment in the standard of 4 mm, for power circuits, and in the standard of 2 mm, for Bus circuits. Software ETS3 Professional with mobile dongle license can be used to program and set the devices at work, as well as for their diagnosis (software ETS3 must be supplied separately on demand).

TRAINING PROGRAM:

Indication to the testing of innovative systems of domotic house:

- electric connections of (power and Bus) devices
- addressing BUS devices
- programming BUS devices
- dimmer-ON/OFF control devices



- ON/OFF actuators and dimmer for traditional and fluorescent lamps
- wireless control (infrared transmitter/receiver)
- presence detection devices
- blinds handling devices

TECHNICAL CHARACTERISTICS:

The framework has been made with structural and sheet steel, chemically treated and painted with epoxy varnish; its left side is provided with hinges for a quick insertion/removal in/from the wheeled structure or work bench.

All the necessary electric components for the correct power supply of circuits are included in the panel.

Tests can be carried out via safety terminals and cables for plugs with diameter of 4 and 2 mm.

Main components installed:

- 1 power supply unit of 640 mA including noise-filtre coil; modular assembly on omega-shaped guide outputting and controlling the voltage for Bus system of 24 Vdc (SELV: Safety Extra-Low Voltage), provided with overvoltage suppressor for Bus line of 24 V. Input power supply: 120...230 Vac, 50/60 Hz
- 1 USB interface for PC connection, of modular assembly on omega-shaped guide including Bus coupler

- 1 8-channel binary output for controlling power consuming devices or groups of power consuming devices separately, with rated load of 230 V – 8 A; modular assembly on omega-shaped guide including Bus coupler
- 2 actuator for motors of blinds including Bus coupler suitable to be inserted in control boxes. Blind actuators are equipped with a pair of buttons for activations
- 2 miniaturized blinds with 230 Vac motors for up-down motion controlled by limit switches and two windows with shutters that interact with the corresponding magnetic contacts of anti theft system
- 1 scenario module: modular equipment suitable to store up to 4 "scenarios". Each scenario can contain up to 8 address groups (particular operating situations) and it can be retrieved by external commands
- 1 dimmer actuator of 230 V – 20-250 VA for incandescent or halogen lamps, including bus coupler. This dimmer actuator is equipped with pair of buttons for various activations
- 1 flush-mounted passive infrared motion sensor including coupler for the connection with Bus line
- 2 sets of 4 pushbuttons connected with two 4-channel Bus couplers suitable to be inserted in control boxes. Channels can also be used with external contacts to interface various devices
- 1 flush-mounted IR decoder-receiver including Bus coupler. This IR receiver is equipped with four pairs of buttons for various activations, and with four LEDs of state indications
- 1 portable infrared (IR) transmitter of 4+4 channels
- 2 lamp sockets E10 with lamps of 230 V – 5-10 W for dimmer activation
- 1 electronic dimmable ballast with compact fluorescent lamp of 230 V – 18 W for dimmer activation

All modular devices are inserted on DIN guide provided with data strip for Bus links. A part of this data strip is available for the insertion of additional modular devices.

Dimensions of working area:	730 x 730 mm
Dimensions of the panel:	790 x 790 x 150 mm
Weight:	16 kg

REMARK:

This panel is "open" to be integrated with new devices of home automation of KONNEX standard. Refer to panel mod. LIC-CD2/EV.

This panel can be used in different ways:

- it can be inserted in the wheeled structure of the integrated laboratory of installations mod. LII-S/EV from which it is powered;
- it can be inserted in the bench for exercises on installations mod. 397-4/EV from which it is powered;
- it can be inserted in one of the mobile floor-standing display rack with work top for instruments:
 - mod. LII-T/EV; in this case, it is powered via the nearest 3-ph socket;
 - mod. LII-T1/EV, from which it is powered;
- it can be applied onto a wall like a blackboard; in this case, it is powered via the nearest 3-ph socket.

ACCESSORIES OF THE EQUIPMENT:

- Set of : 30 cables with safety plugs (Ø 4 mm), 20 cables with safety plugs (Ø 2 mm)

RECOMMENDED ACCESSORIES AND SOFTWARE:

Original multi-language **Design EIB Tool Software** mod. ETS4 Professional edited by consortium Konnex.

This software enables to assign the specific functionality to the installation, as well as the starting and diagnosis of BUS devices; it is used with a personal computer (not included in the equipment) connected with the BUS system via USB interface.

POWER SUPPLY:

- Single-phase 230 V - 50-60 Hz - 100 VA

THEORETICAL-EXPERIMENTAL HANDBOOKS

Practical handbook of industrial installations.

PANEL OF BUS TELEPHONE AND VIDEO INTERPHONE SYSTEMS

mod. LII-CD3/EV

INTRODUCTION

This panel is totally independent and it includes actual devices for testing Bus telephone, video interphone and video surveillance systems that can be applied in buildings of residential and/or service sectors, of level 3, as stated in the general standard CEI 64-8; V3, for installations.. Tests and installations are carried out on the panel quickly via leads with safety plugs of 2 mm supplied with the equipment, and without the use of any working tool.

All the devices are available in the fore panel of insulating material and are represented by international electric symbols. The distinctive feature of a video interphone installation applying Bus technology consists in using only two wires to carry both interphone and video signal, suitably compressed, in digital format.

TRAINING PROGRAM:

Indication to the testing of bus telephone and video interphone systems:

- electric connections of (power and Bus) devices
- 2-wire video interphone system with an outdoor audio-video unit and an indoor video-interphone unit (single-family system)
- 2-wire video interphone system with an outdoor audio-video unit and two indoor video-interphone units (two-family system)
- 2-wire video interphone system with a further camera for video surveillance
- telephone indoor system with electronic branch exchange for managing up to 8 extension telephones
- interaction between indoor video-interphone and telephone systems

TECHNICAL CHARACTERISTICS:

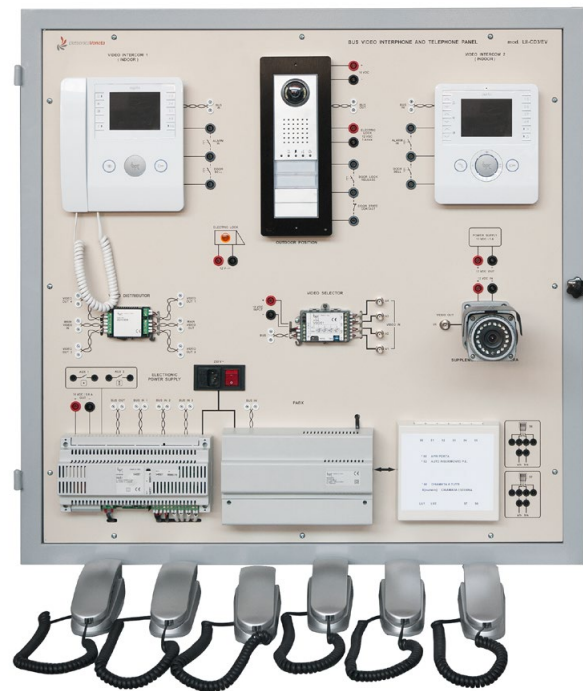
The framework has been made with structural and sheet steel, chemically treated and painted with epoxy varnish; its left side is provided with hinges for a quick insertion/removal in/from the wheeled structure or work bench.

All the necessary electric components for the correct power supply of circuits are included in the panel.

Tests can be carried out via safety terminals and cables for plugs with diameter of 2 mm and 4 mm.

Main components installed:

- 1 self-protected electronic power supply unit for 2-wire digital video interphone systems; power supply: 230 Vac
- 1 outdoor two-wire digital unit with 1/4"-sensor colours CCD camera, infrared lighting, two calling buttons and lighting plate
- 1 warning light of 12 V for simulating electric lock
- 1 wall-type video interphone with colours screen for 2-wire digital systems, including a lock opening button and button for switching the screen on in automatic mode
- 1 video display: wall-type video interphone terminal with colour screen of 3.5", for two-wire digital systems, including a lock opening button and button for switching the screen on in automatic mode
- 1 distributor 4 outputs video for 2-wire digital systems
- 1 colour 1/3"-sensor CCD camera for interiors, for 2-wire digital systems



- 1 selector video for 4 input sources and 1 output
- 1 Private Automatic Branch eXchange (PABX) with 2 inputs of exchange line and 8 outputs for extension telephones
- 1 interface between branch exchange (PABX) and 2-wire video-interphone systems
- 1 network terminator with 10 jacks RJ 11 for quick connections with/from the branch exchange
- 6 tabletop impulse/multi-frequency telephone sets including lead RJ 11
- 1 panel-type, 2P power plug and cable 2 x 0.5 mm²
- 1 two-pole ON-OFF control lever switch

Dimensions of working area: 730 x 730 mm
Dimensions of the panel: 790 x 790 x 150 mm
Weight: 15 kg

This panel can be used in different ways:

- it can be inserted in the wheeled structure of the integrated laboratory of installations mod. LII-S/EV from which it is powered;
- it can be inserted in the bench for exercises on installations mod. 397-4/EV from which it is powered;
- it can be inserted in one of the mobile floor-standing display rack with work top for instruments:
 - mod. LII-T/EV; in this case, it is powered via the nearest socket;
 - mod. LII-T1/EV, from which it is powered;
- it can be applied onto a wall like a blackboard; in this case, it is powered via the nearest single-phase socket.

ACCESSORIES OF THE EQUIPMENT:

- Set of 6 two-pole cables for video-interphone systems with safety plugs (Ø 2 mm)
- Set of 8 cables with safety plugs (Ø 4 mm)

POWER SUPPLY:

Single-phase 230 V - 50-60 Hz - 100 VA

THEORETICAL-EXPERIMENTAL HANDBOOKS

Practical handbook of industrial installations.

PANEL OF ANTI THEFT SYSTEMS

mod. LII-CD5/EV

INTRODUCTION

This panel is totally independent and it includes actual apparatuses for testing anti theft systems that can be applied in residential, business and production sectors. This panel is powered with safety extra-low voltage of 12 Vdc to ensure the highest operation safety; it also includes buffer batteries that power the circuits even when the line voltage is missing (like in actual installations).

All the devices are available in the panel and are represented by international electric symbols.

Tests and installations are carried out on the fore panel quickly via leads with safety plugs of 4 mm supplied with the equipment, and without the use of any working tool.

TRAINING PROGRAM:

Indication to the testing of anti theft systems:

- Functions carried out by the electronic anti theft control unit
- System performance levels, NC lines, single-balanced and double-balanced lines
- Detection sensors, perimeter sensors, volumetric sensors, keys and keyboard for system control and chocking
- Anti theft alarm system of one zone, with electronic control unit, presence sensor of double (IR + microwave) technology, keyboard for system control and programming, and additional siren
- Anti theft alarm system of one zone, with electronic control unit, passive infrared presence sensor, electronic key for remote control of control unit, and additional siren
- Anti theft alarm system of two zones, with electronic control unit, magnetic detector, vibration detector, keyboard for system control and programming, and additional siren
- Anti theft alarm system of three zones, with electronic control unit, passive infrared presence sensor, magnetic micro-contact, vibration detector, keyboard for system control and programming, additional siren and self-powered outdoor siren
- Anti theft alarm system of four zones, with electronic control unit, passive infrared presence sensor, presence sensor of double (IR + microwave) technology, magnetic micro-contact, vibration detector, keyboard for system control and programming, electronic key for remote control of control unit, additional siren and self-powered outdoor siren

TECHNICAL CHARACTERISTICS:

The framework has been made with structural and sheet steel, chemically treated and painted with epoxy varnish; its left side is provided with hinges for a quick insertion/removal in/from the wheeled structure or work bench.

All the necessary electric components for the correct power supply of circuits are included in the panel.

Tests can be carried out via safety terminals and cables for plugs with diameter of 4 mm.

Main components installed:

- 1 electronic control unit for anti theft systems of 2nd level performance with programmable functions, including:
 - 4 alarm lines programmable between NC – NO – single or double balancing, that can also be extended up to 8, and one 24h alarm circuit



- access via integrated programming keyboard
- inlet and outlet times programmable from 0 to 255 s, alarm time programmable from 0 to 20 min.
- alarm relay with contacts of 5 A
- protection fuses
- specific outputs for powering detectors, charging external batteries and controlling self-powered sirens
- LEDs for signalling the operation state / anomalies in the control unit
- 8 resistors for single-balanced and double-balanced links of alarm lines and 24h circuit
- power supply of 230 Vac – 50-60 Hz
- power supply unit for charging internal battery and lead battery of 12 Vdc – 2 Ah
- 1 volumetric sensor of double (infrared and microwave) technology, protected against masking, power supply of 9-15 Vdc, horizontal covering of ~80°, operating range up to 15 m, transmission frequency of 10 GHz, max. transmitted power of 10 mW, NC contact for 24h line
- 1 volumetric passive infrared sensor, of pyroelectric type with two lenses, power supply of 9-15 Vdc, horizontal covering of ~90°, operating range up to 15 m, NC contact for 24h line
- 1 vibration detector with NC contact and 24h line, screw for adjusting sensitivity

- 1 magnetic detector with NC contact 24h line
- 1 self-protected and self-powered outdoor electronic siren; power supply of 13.8-14.1 Vdc; protection against tampering (24h line); max. sound power at 1 m: 117 dB; frequency of 1600-2700 Hz; flashing frequency of 1 Hz; including lead battery of 12 Vdc – 2 Ah
- 1 indoor two-tone siren, powered with 9-14 Vdc; max. sound power at 1 m adjustable from 80 dB to 113 dB; frequency of 1600-2900 Hz; modulation frequency: 2-3 Hz
- 1 remote electronic key; functions: on / off / choking of control unit; power supply of 12 Vdc; 3 state LEDs; reading of keys without contact near the socket
- Remote keyboard for controlling and programming the control unit, powered with 12 Vdc, with backlit Liquid-Crystal Display (LCD), 3 state LEDs and 4 programmable LEDs for other controls, input for 2 NC anti theft lines for connection of local alarm devices
- 1 board-type power plug (2P + earth)
- 1 cable of 0.75 mm² with German/French plug
- 1 key switch for excluding batteries at the end of the class to prevent them from running down completely

Dimensions of working area:	730 x 730 mm
Dimensions of the panel:	790 x 790 x 220 mm
Weight:	18 kg

REMARK:

Testing is carried out at safety extra-low voltage of 12 Vdc output by power supply unit and by batteries included in the control unit and in the self-powered siren.

This panel can be used in different ways:

- it can be inserted in the wheeled structure of the integrated laboratory of installations mod. LII-S/EV from which it is powered;
- it can be inserted in the bench for exercises on installations mod. 397-4/EV from which it is powered;
- it can be inserted in one of the mobile floor-standing display rack with work top for instruments:
 - mod. LII-T/EV; in this case, it is powered via the nearest 3-ph socket;
 - mod. LII-T1/EV, from which it is powered;
- it can be applied onto a wall like a blackboard; in this case, it is powered via the nearest 3-ph socket.

ACCESSORIES OF THE EQUIPMENT:

- Set of 35 cables with safety plugs (Ø 4 mm)

POWER SUPPLY:

Single-phase 230 V - 50-60 Hz - 50 VA

THEORETICAL-EXPERIMENTAL HANDBOOKS

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PANEL OF FIRE FIGHTING SYSTEMS

mod. LII-CD6/EV

INTRODUCTION

This panel is totally independent and it includes actual devices for testing fire detecting systems that can be applied in business, production and service sectors. This panel is powered with safety extra-low voltage of 24 Vdc to ensure the highest operation safety; it also includes some buffer batteries (being available also in actual installations) that power the circuits even when the line voltage is missing.

All the devices are available in the panel and are represented by international electric symbols.

Tests and installations are carried out on the fore panel quickly via leads with safety plugs of 4 mm supplied with the equipment, and without the use of any working tool.

TRAINING PROGRAM:

Indication to the testing of fire detecting systems:

- functions carried out by the electronic fire control unit
- fire fighting system with manual ON button, fire control unit and optical-acoustic alarm device
- fire fighting system with optical smoke sensor, fire control unit and optical-acoustic alarm device
- fire fighting system with (rate-of-rise) temperature sensor, fire control unit and optical-acoustic alarm device
- fire fighting system with optical smoke and temperature sensor, manual ON button, fire control unit, pre-alarm device, optical-acoustic alarm device for evacuation and device for releasing fire-stopping doors

TECHNICAL CHARACTERISTICS:

The framework has been made with structural and sheet steel, chemically treated and painted with epoxy varnish; its left side is provided with hinges for a quick insertion/removal in/from the wheeled structure or work bench.

All the necessary electric components for the correct power supply of circuits are included in the panel.

Tests can be carried out via safety terminals and cables for plugs with diameter of 4 mm.

Main components installed:

- 1 electronic control unit with 2 fire alarm lines and manual alarms, self-powered by buffer batteries (2 x 12 Vdc). Power supply: 230 Vac. Output: 24 Vdc
- 1 manual pushbutton of fire warning with micro-switch enabled by the breaking of glass; it also includes a device for simulating the ON state without breaking the glass
- 1 optical smoke sensor, powered with 24 Vdc
- 1 electronic temperature sensor, powered with 24 Vdc
- 4 resistors representing the balanced lines entering the control unit
- 1 sound alarm device with electronic two-tone siren; sound power at 1 metre: 93-95 dB; power supply of 24 Vdc
- 2 alarms device of 3 W, powered with 24 Vdc
- 1 electromagnet, powered with 24 Vdc, for releasing fire-wall doors
- 1 contact device for extinguishers surveillance
- 1 board-type power plug (2P + earth)



- 1 cable of 0.75 mm² with German/French plug
- 1 key switch for excluding batteries when not used to prevent them from running down completely

Dimensions of working area: 730 x 730 mm
Dimensions of the panel: 790 x 790 x 220 mm
Weight: 19 kg

REMARK:

Testing is carried out at safety extra-low voltage of 24 Vdc output by power supply unit and by batteries included in the control unit.

This panel can be used in different ways:

- it can be inserted in the wheeled structure of the integrated laboratory of installations mod. LII-S/EV from which it is powered;
- it can be inserted in the bench for exercises on installations mod. 397-4/EV from which it is powered;
- it can be inserted in one of the mobile floor-standing display rack with work top for instruments:
 - mod. LII-T/EV; in this case, it is powered via the nearest 3-ph socket;
 - mod. LII-T1/EV, from which it is powered;
- it can be applied onto a wall like a blackboard; in this case, it is powered via the nearest 3-ph socket.

ACCESSORIES OF THE EQUIPMENT:

- Set of 20 cables with safety plugs (Ø 4 mm)

POWER SUPPLY:

Single-phase 230 V - 50-60 Hz - 50 VA

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Practical handbook of industrial installations.

PANEL FOR WIRED INDUSTRIAL INSTALLATIONS

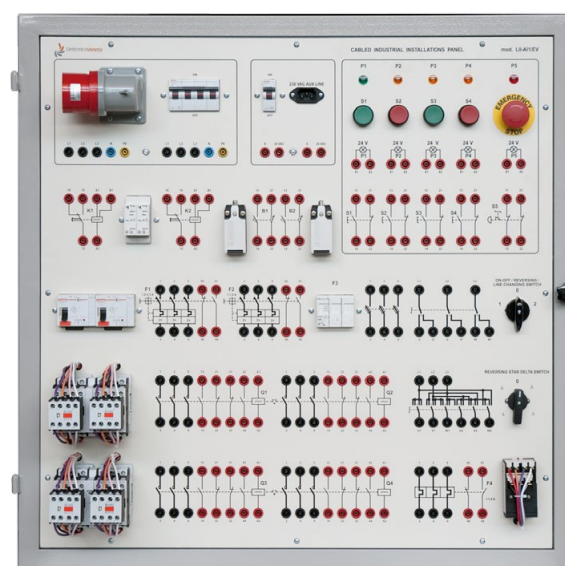
Mod. LII-AI1/EV

INTRODUCTION

This panel is totally independent and includes real electromagnetic devices for testing direct and sequence starting systems of motors in industrial and service sectors. The control section is powered with safety extra-low voltage of 24 Vdc; whereas the power section is powered with the line voltage of 230...400 V (as it occurs in real installations); these two supply voltages can be applied separately: thus the control section can be tested, first, and then also the power section will be tested.

Tests and installations are carried out on the panel quickly via leads with safety plugs of 4 mm supplied with the equipment, and without the use of any working tool. All devices are available in a panel of insulating material and are represented by international electric symbols. This panel also includes the protection devices against short-circuits that can be provoked by wrong connections during the tests. Some electric rotating machines (AC motors) with power up to 1.5 kW – 400 V, and their relevant starting accessories can be used with this panel to make the exercise more “actual”.

This panel is used for testing in wired logic and it can directly be applied to a PLC for programmable logic systems. The field of application of these devices concerns the automation systems of craft-industrial and service sectors.



TRAINING PROGRAM:

Indication to the testing of industrial automation systems:

- Direct starting and reverse of single-phase and 3-phase asynchronous motors
- Star-delta starters reversers
- Controlling a contactor from one point
- Impulse control of a contactor
- Separate control of two contactors
- Remote control starter for 3-phase asynchronous cage motor with thermal relay and fuses or with magneto-thermal overload cut-out breaker
- Remote control reverser for 3-phase asynchronous cage motor
- Remote control reverser for 3-phase asynchronous cage motor with block on the pushbuttons
- Remote control reverser for 3-phase asynchronous cage motor with limit switches
- Remote control reverser for 3-phase asynchronous cage motor with delay

- Star-delta starter for 3-phase asynchronous cage motor
- Remote control reverser, star-delta starter for 3-phase asynchronous cage motor
- Starting with rotor resistances for 3-phase asynchronous cage motor
- Starting with autotransformer for 3-phase asynchronous cage motor
- Starting with rotor resistances for 3-phase asynchronous wound-rotor motor
- Remote controlled pole-change switch for 2-winding 3-phase asynchronous cage motor
- Remote controlled pole-change switch for 3-phase asynchronous Dahlander motor
- Reverse current braking for 3-phase asynchronous cage motor
- Sequence starting of 3-3-phase asynchronous motors
- Contactor starter for single-phase asynchronous motor
- Remote control reverser for single-phase asynchronous motor

TECHNICAL CHARACTERISTICS:

The framework has been made with structural and sheet steel, chemically treated and painted with epoxy varnish; its left side is provided with hinges for a quick insertion/removal in/from the wheeled structure or work bench.

All the necessary electric components for the correct power supply of circuits are included in the panel.

Tests can be carried out via safety terminals and cables for plugs with diameter of 4 mm.

Main components installed:

- 1 three-pole rotary switch of 400 V – 16 A for functions of ON-OFF direct control, reversal of rotation, line switching
- 1 three-pole rotary switch of 400 V – 16 A for functions of star-delta starting and reverse
- 1 four-pole thermomagnetic automatic circuit breaker; In of 6 A; Curve C, for control, protection and breaking of power line
- 1 single-pole thermomagnetic automatic circuit breaker; In of 2 A; Curve C, for control and protection of line of 24 Vac
- 1 single-phase transformer 115-230 / 24 V – 100 VA
- 1 three-pole overload cut-out breaker with auxiliary NO and NC contact; In adjustable from 1.6 A to 2.4 A
- 1 three-pole overload cut-out breaker with auxiliary NO and NC contact; In adjustable from 1 A to 1.6 A
- 4 three-pole contactors of 25 A; excitation of 24 Vac; with 2 NO contacts and 2 NC contacts, 2 mechanical interlocks that can be inserted/removed according to needs
- 1 set of three fuse holders with breakable neutral conductor and cylindrical fuses 10.3 x 38 of 4 A
- 1 three-pole thermal relay with NO-NC auxiliary contact, sensitive to phase lack, with automatic/manual reset, In adjustable from 1 to 1.6 A
- 1 red emergency push button with 2 auxiliary NC contacts
- 2 flush-mounted green start buttons with auxiliary NO and NC contact
- 2 surface-mounted red stop buttons with auxiliary NO and NC contact
- 5 light indicators of 24 V of various colours
- 2 multi-voltage, multi-function (TON, TOFF, PULSE) and multi-range (from 0.1 s to 10 days) timers
- 2 position limit switches with 1 NO contact and 1 NC contact
- 1 board-type power plug (2P + earth) with 1 cable 3x0.75 mm²
- 1 power cord 3/N/PE (2.5 m) with socket and plug of IEC 309 type – 5 poles

Dimensions of working area:	730 x 730 mm
Dimensions of the panel:	790 x 790 x 200 mm
Weight:	20 kg

REMARK:

Control circuits are powered by Protection Extra-Low Voltage (PELV) of 24 Vac output by a transformer included in the panel.

This panel can be used in different ways:

- it can be inserted in the wheeled structure of the integrated laboratory of installations mod. LII-S/EV from which it is powered;
- it can be inserted in the bench for exercises on installations mod. 397-4/EV from which it is powered;
- it can be inserted in one of the mobile floor-standing display rack with work top for instruments:
 - mod. LII-T/EV; in this case, it is powered via the nearest 3-ph socket;
 - mod. LII-T1/EV, from which it is powered;
- it can be applied onto a wall like a blackboard; in this case, it is powered via the nearest 3-ph socket.

ACCESSORIES OF THE EQUIPMENT:

- Set of 70 cables with safety plugs (Ø 4 mm)

POWER SUPPLY:

Single-phase 230 V - 50-60 Hz - 100 VA
Three-phase 3 x 230 o 400 V 2 kVA

THEORETICAL-EXPERIMENTAL HANDBOOKS

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PANEL OF ELECTRONICALLY CONTROLLED INDUSTRIAL INSTALLATIONS

mod. LII-AI2/EV

INTRODUCTION

This panel must be used together with panel mod. LII-AI1/EV to extend the traditional testing on direct and sequence starting systems of motors to typical electronic devices of modern industrial automation processes.

Integrating the PLC and the operator touch panel, the soft starter, the PWM drive and the release of a symmetry and phase sequence relay will lead to assemble the starting circuits of single-phase and 3-ph asynchronous motors.

The **PLC Siemens series 1200** is equipped with analog output and it communicates in LAN with PROFINET protocol, it includes a 4-port SWITCH for the connection of PC – PLC – TOUCH PANEL via UTP connectors (RJ 45 connectors). The programming software SIMATIC STEP 7 Basic of the equipment enables to programme the assembly.

The **soft starter** enables gradual starts and stops of 3-ph asynchronous motors, 400 V, up to 2.2 kW.

The **PWM inverter** controls 3-ph asynchronous motors of 400 V up to 0.75 kW (1 kW, without load): it can easily be programmed via its own keys and display and it can be controlled by external electric signals.

The **symmetry and phase sequence relay** tests the quality of the power of 3-ph power line.

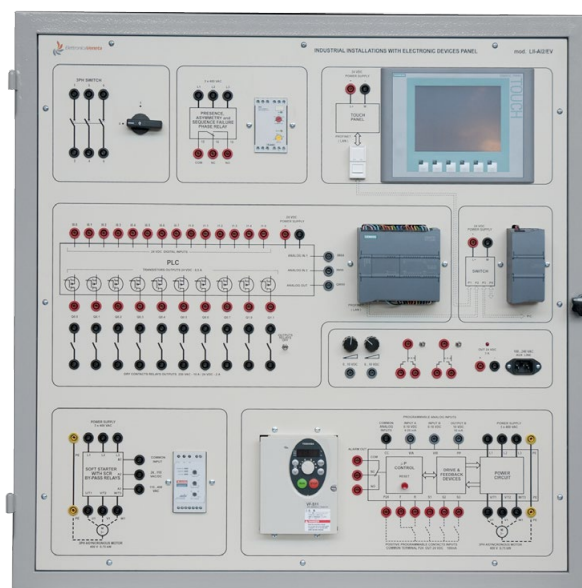
The application field of these devices concerns the automation systems of industry and service sectors.

The panel components can be identified by their international electric symbols; electrical connections are carried out via leads with safety plugs of 4 mm, included in the panel; no working tool is necessary.

TRAINING PROGRAM:

Indication to the testing of electronically controlled industrial installations:

- Implementing gradual starting and stop systems of 3-ph asynchronous motors by soft starter
- Implementing starting and stop systems with ramps, various speeds, V/f or vector mode, for a 3-ph asynchronous motor by PWM electronic drive
- Implementing systems for powering 3-ph power consuming devices with phase presence and sequence relay
- Implementing programmable logic automation systems by PLC and operator panel to supervise the state of installation; examples of motor starting that can be carried out:
 - control of a contactor for start, stop, pulses



- contactor starter for 3-ph asynchronous cage motor
- remote control reverser for 3-ph asynchronous cage motor, with block on the pushbuttons, with limit switches, with delay
- remote control reverser, star-delta starter for 3-ph asynchronous cage motor
- starting with stator resistances, with autotransformer for 3-ph asynchronous motor
- starting with rotor resistances for 3-ph asynchronous wound-rotor motor
- remote controlled pole-change switch for Dahlander and 2-winding 3-ph asynchronous motors
- reverse current braking for 3-ph asynchronous cage motor
- contactor starter, remote control reverser for single-phase asynchronous motor
- sequence starting of 2, 3, 4 asynchronous motors
- control of 3-ph inverter for forward-backward sequences with ramps at different speeds
- interconnection between EIB/KNX BUS systems (home automation) and PLC automation systems (electronically controlled industrial installations)

TECHNICAL CHARACTERISTICS:

The framework has been made with structural and sheet steel, chemically treated and painted with epoxy varnish; its left side is provided with hinges for a quick insertion/removal in/from the wheeled structure or work bench.

All the necessary electric components for the correct power supply of circuits are included in the panel.

Tests can be carried out via safety terminals and cables for plugs with diameter of 4 mm.

Main components installed:

- 1 **static starter** of gradual start and stop for 3-ph asynchronous motors of 400 V up to 2.2 kW, with bypass relay for exclusion of semiconductors at the end of the starting phase and possibility of setting the initial torque value, input 3 x 400 Vac, control with external voltage of 24...110 Vac/dc or of 110...400 Vac
- 1 **PWM inverter** for 3-ph asynchronous motors 400 V up to 0.75 kW (1 kW, without load); input 3 x 400 V; V/f, constant-torque or vector output; it includes programming keys and display, 6 programmable digital inputs, 2 programmable analog inputs 0-10 Vdc / 0-4-20 mAdc, 1 relay for alarm outputs
- 1 **presence, symmetry and sequence phase relay** – 3 x 400 Vac
- 1 **three-pole switch** 400 V – 16 A for power circuits
- 1 **PLC S71200 CPU 1214C**, 24 I/O, with 14 digital inputs of 24 Vdc, 10 digital transistor outputs of 24 Vdc – 0.5 A with clean-contact relay interfaces of 24 Vdc / 230 Vac – 10 A max., 2 inputs and 1 analog output of 0-10 Vdc; it also includes a PROFINET interface for the communication with a PC or from CPU to CPU
- 1 **colour operator Touch panel 6"** with 6 programmable function keys
- 1 **software SIMATIC STEP 7 Basic** that includes WinCC Basic for programming controllers S7-1200 and configuring operator Panels
- 1 **four-port Switch module** ETHERNET RJ45 for PROFINET/ ETHERNET networks
- 3 **UTP connectors for connections of PC** – PLC – Operator panel (2 of 0.5 m and 1 of 2 m)
- 1 **power supply** unit of 24 Vdc – 3 A, with input of 100-240 Vac, for powering PLC and operator panel
- 2 **variable analog outputs** of 0...10 Vdc that can be used as reference and control signals
- 2 **lever switches** for inserting digital logic states
- 1 **board-type power plug** (2P + earth) with 1 cable 3 x 0.75 mm²

Dimensions of working area:	730 x 730 mm
Dimensions of the panel:	790 x 790 x 200 mm
Weight:	18 kg

This panel can be used in different ways:

- it can be inserted in the wheeled structure of the integrated laboratory of installations mod. LII-S/EV from which it is powered;
- it can be inserted in the bench for exercises on installations mod. 397-4/EV from which it is powered;
- it can be inserted in one of the mobile floor-standing display rack with work top for instruments:
 - mod. LII-T/EV; in this case, it is powered via the nearest 3-ph socket;
 - mod. LII-T1/EV, from which it is powered;
- it can be applied onto a wall like a blackboard; in this case, it is powered via the nearest 3-ph socket.

ACCESSORIES OF THE EQUIPMENT:

- Set of 20 cables with safety plugs (Ø 4 mm)

POWER SUPPLY:

Single-phase 230 V - 50-60 Hz - 100 VA
Three-phase 3 x 400 V - 3 kVA

THEORETICAL-EXPERIMENTAL HANDBOOKS

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PANEL OF AUTOMATIC POWER FACTOR CORRECTION

mod. LII-AI3/EV

INTRODUCTION

This panel is designed to test industrial systems with electronic devices for control of power factor correction in low-voltage power consuming devices (voltage of 400 V).

The panel is used to assemble automatic power correction circuits with different capacitive steps and managed by an electronic control unit. Two energy analyzers measure voltages, currents, active, reactive and apparent powers and the power factor.

These instruments are configured in single-phase or 3-ph systems with or without neutral conductor; their use is free in circuits such as power supply line, electric power consumer device, capacitive battery, etc...

Components can be identified in the panel by their international electric symbols; electrical connections are carried out easily via leads and jumpers with safety plugs of 4 mm, included in the panel; no working tool is necessary.

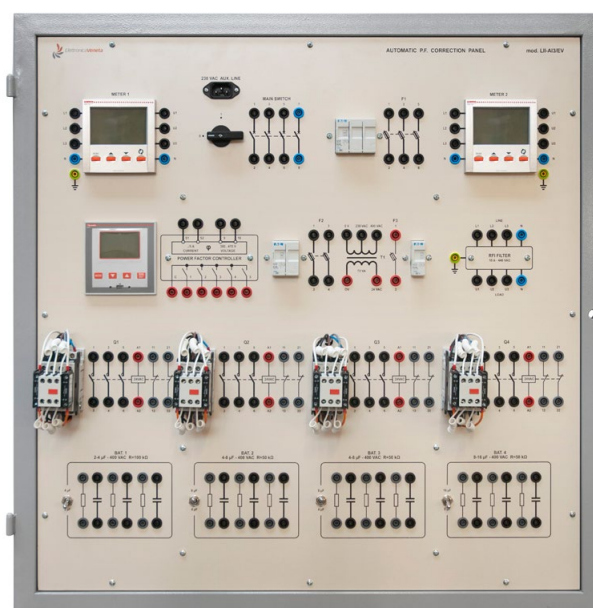
The electric power consuming devices with different values of (active-inductive) apparent power can easily be reproduced in laboratory with the combined use of variable resistive and inductive loads.

The complete test set require a inductive active-reactive power loads ranging between 1300 and 19000 W + 1300-1900 VAR, with adjustment in 5...7 steps. We suggest over variable loads mod. RL-2/EV + IL-2/EV or mod. RL-3/EV + IL-3/EV or mod. RL-2K/EV.

TRAINING PROGRAM:

Indication to the testing of automatic power factor correction systems:

- Measurements of Apparent, Active and Reactive powers and relations among them
- Local power factor correction system of single-phase power consuming devices
- Local power factor correction system of 3-ph power consuming devices
- Discharging the capacitors
- Centralized power factor correction systems with automatic electronic board, with 1-2-3 equal steps
- Centralized power factor correction systems with automatic electronic board, with 1-2-3-4 steps (one double of the other)
- Filtering harmonic currents in capacitors



TECHNICAL CHARACTERISTICS:

The framework has been made with structural and sheet steel, chemically treated and painted with epoxy varnish; its left side is provided with hinges for a quick insertion/removal in/from the wheeled structure or work bench.

All the necessary electric components for the correct power supply of circuits are included in the panel.

Tests can be carried out via safety terminals and cables for plugs with diameter of 4 mm.

Main components installed:

- 1 automatic power factor microprocessor controller, with rated voltage 380..415 V - 50-60 Hz - ammeter input with forward current up to 5 A (sensitivity range 0, 125 ... 6 A) - setting power factor: 0.8 ind ... 0.8 cap., reconnection time: 5 ... 240 s - sensitivity range: 5...600 s/step - 5 relay outputs with contacts of 5 A - 250 Vac - setting parameters manually from display-assisted keyboard

- 2 multi-function instruments; auxiliary power supply: 115-230 V; graphic LCD of 128x80 pixels - measurement of voltages, currents, active, reactive and apparent powers, and power factor in single-phase and 3-ph systems - accuracy rating for currents and voltages: $\pm 0.5\%$ - measuring range: 5 A – 830 V max.
- 1 four-pole rotary switch of operation – 16 A – 400 V
- 1 set of three fuse holders with gl-type fuses 10.3x38 of 6 A
- 1 pair of fuse holders with gl-type fuses 10.3x38 of 2 A
- 1 fuse holder with gl-type fuse 10.3x38 of 4 A
- 1 noise suppression filter for 3-ph line with neutral – Un 440 V; In 10 A; inductance of 0.4 mH, current-carrying capacity of 0.1 μ F
- 4 three-pole contactors for power factor correction – Ith (AC1) 25 A (7.5 kVAR at 400 V) with transient limiting devices at the connection, excitation of 24 Vac – 50-60 Hz, 2 auxiliary NC contacts
- 1 single-phase transformer with primary winding of 230-400 V and secondary winding of 24 V, power of 72 VA
- 1 battery of 3-ph capacitors, 450 Vac, with selector between 2 and 4 μ F and discharging resistors 100 k Ω - 5 W
- 2 batteries of 3-ph capacitors, 450 Vac, with selector between 4 and 8 μ F and discharging resistors 50 k Ω - 10 W
- 1 battery of 3-ph capacitors, 450 Vac, with selector between 8 and 16 μ F and discharging resistors 50 k Ω - 10 W

All capacitor batteries can be connected in single-phase or 3-ph (star-delta configuration). They enable to assemble automatic power factor correction systems with up to 3 equal steps (4+4+4 μ F, 8+8+8 μ F), or with up to 3 steps (one double of the other, of 2, 4, 8 μ F, or of 4, 8, 16 μ F); connecting the various batteries in parallel will lead to further combinations.

Dimensions of working area:	730 x 730 mm
Dimensions of the panel:	790 x 790 x 200 mm
Weight:	22 kg

OPTION:

Programming software and cable (accessories available on demand, separately). Applying the programming software via RS232 port (or USB port, with a converter) will enable to carry out setting and simultaneous display of all measures (current power factor, set power factor, weekly average power factor, voltage, current, reactive power of system) in the automatic power factor controller to obtain a whole view of power factor correction system. Furthermore, the elapsed time and the number of tripping operations from the setting at work of the system are indicated for each step, for preliminary service of contactors.

This panel can be used in different ways:

- it can be inserted in the wheeled structure of the integrated laboratory of installations mod. LII-S/EV from which it is powered;
- it can be inserted in the bench for exercises on installations mod. 397-4/EV from which it is powered;
- it can be inserted in one of the mobile floor-standing display rack with work top for instruments:
 - mod. LII-T/EV; in this case, it is powered via the nearest 3-ph socket;
 - mod. LII-T1/EV, from which it is powered;
- it can be applied onto a wall like a blackboard; in this case, it is powered via the nearest 3-ph socket.

ACCESSORIES OF THE EQUIPMENT:

- Set of 67 cables and of 20 jumpers with safety plugs (\varnothing 4 mm)

POWER SUPPLY:

Single-phase 230 V - 50-60 Hz - 50 VA
Three-phase 3 x 400 V - 50-60 Hz - 3 kVA

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PANEL OF ELECTRO-PNEUMATIC AUTOMATION SYSTEMS

mod. LII-AI4/EV

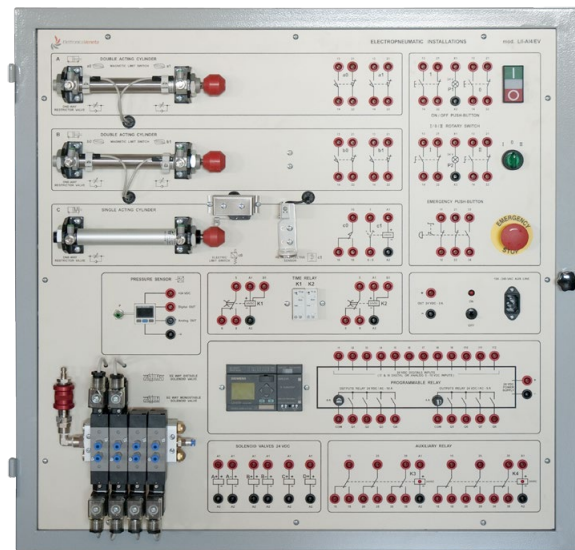
TRAINING PROGRAM:

Indication to the testing of electro-pneumatic automation systems:

- controlling a single-acting cylinder by monostable solenoid valve
- controlling a double-acting cylinder by bistable solenoid valve
- controlling a single-acting cylinder by monostable solenoid valve and self-holding circuit
- semi-automatic control of a double-acting cylinder by monostable solenoid valve
- semi-automatic control of a double-acting cylinder by bistable solenoid valve
- electric control of a cylinder by monostable solenoid valve (anti-repetitiveness)
- electric control of a cylinder by bistable solenoid valve (anti-repetitiveness)
- electric control of a cylinder by monostable solenoid valve and impulse relay (anti-repetitiveness)
- electric control of a cylinder by bistable solenoid valve and impulse relay (anti-repetitiveness)
- automatic control by monostable solenoid valve and stop pushbutton with return to a0 at the end of the cycle
- automatic control by bistable solenoid valve and stop pushbutton with return to a0 at the end of the cycle
- automatic control by bistable solenoid valve and stop pushbutton with immediate return to a0
- automatic control by bistable solenoid valve and stop and emergency pushbutton with different returns
- automatic control by bistable solenoid valve and stop and emergency pushbutton with immediate return to a0
- controlling a cylinder by bistable solenoid valve and delayed-excitation timer
- semi-automatic movement with limit switch, timer and monostable distributor
- semi-automatic movement with limit switch, timer and bistable distributor
- safety two-hand control
- pick-and-place cycle with bistable solenoid valves
- pick-and-place cycle with monostable solenoid valves
- pick-and-place cycle with monostable solenoid valves and safety and emergency circuits
- pick-and-place cycle with bistable solenoid valves and safety and emergency circuits
- "L" cycle with bistable solenoid valves

INTRODUCTION

This panel has been designed to test electro-pneumatic automation systems including the pneumatic circuits and electric slave devices of different solenoid valves and pneumatic cylinders. This panel can be used in stand-alone mode to assemble circuits in both wired and programmable logics because it includes a micro PLC (like in modern processes of industrial automation). When coupled to the panel for automation of industrial installations mod. LII-AI1/EV, this micro PLC can also be used for sequence starting of motors. This panel consists of actual components identified by their international electric and pneumatic symbols; the electrical connections are carried out via leads with safety plugs of 4 mm, whereas the pneumatic connections are carried out with quick-connection Rilsan® pipe (Ø 4 mm), included in the panel; no working tool is necessary.



- "L" cycle with bistable solenoid valves, automatic and semiautomatic control circuits, and anti-repetitiveness condition
- "L" cycle with monostable solenoid valves, automatic and semiautomatic control circuits, and anti-repetitiveness condition
- All sequences and circuits mentioned above can be carried out as applications of PLC; in this case, the training program must also include the programming of programmable logic controllers

TECHNICAL CHARACTERISTICS:

The framework has been made with structural and sheet steel, chemically treated and painted with epoxy varnish; its left side is provided with hinges for a quick insertion/removal in/from the wheeled structure or work bench.

All the necessary electric components for the correct power supply of circuits are included in the panel.

Tests can be carried out via safety terminals and cables for plugs with diameter of 4 mm. Electric controls at extra-low voltage of 24 Vdc and micro PLC.

Electric controls at extra-low voltage of 24 Vdc and micro PLC

- 1 micro PLC LOGO Siemens, with 20 I/O, 12 digital inputs of 24 Vdc of which 4 are also analog 0-10 Vdc and 4 fast inputs up to 5 kHz, 4 digital relay outputs of 24 Vdc / 230 Vac – 10 A max. + 4 digital relay outputs of 24 Vdc / 230 Vac – 5 A max.; programming via its own keys and via PC (software and USB cable for PC connection included)
- 1 regulated power supply unit, with input of 100...240 V 50-60 Hz, output of 24 Vdc – 3 A
- 22 multi-voltage, multi-function (TON, TOFF, PULSE) and multi-range (from 0.1 s to 10 days) timers
- 2 auxiliary relays for industrial uses, with 3 exchange contacts (250 Vac – 10 A / 24 Vdc - 2 A) and coil of 24 Vdc
- 1 one-piece button including start key with NO and NC contact, stop key with NO and NC contact and warning light of 24 V
- 1 red mushroom-head emergency button with 1 NO contact and 2 NC contacts
- 1 butterfly selector switch of three positions, with two NO and NC contacts and warning light of 24 V

Pneumatic actuators

- 1 single-acting cylinder (Ø 20 mm; l = 100 mm), with magnetic piston, quick-connection unions for pipe Ø 4 mm and unidirectional flow control valve mounted onto the cylinder
- 2 double-acting cylinders (Ø 20 mm; l = 100 mm), with magnetic pistons, quick-connection unions for pipe Ø 4 mm and 2 unidirectional flow control valves mounted onto the cylinders

Sensors and limit switches

- 4 magnetic reed sensors with LEDs, fixed onto the double-acting cylinders (Ø 20 mm), provided with interface to obtain separated NO and NC contacts
- 1 electric limit switch enabled by the negative stroke of single-acting cylinder, with 1 exchange contact
- 1 optical proximity sensor with reflector, enabled by the positive stroke of single-acting cylinder, NO/NC programmable contact
- 1 pressure sensor with display (analog and digital output)
- group of solenoid valves
- two 5/2 bistable solenoid valves, powered with 24 Vdc, with enabling LED, quick-connection unions for pipe Ø 4 mm provided with check valves
- two 5/2 monostable solenoid valves, powered with 24 Vdc, with enabling LED (they also act as 3/2 solenoid valves) and quick-connection unions for pipe Ø 4 mm provided with check valves

Dimensions of working area:	730 x 730 mm
Dimensions of the panel:	790 x 790 x 200 mm
Weight:	23 kg

OPTION:

- Design, simulation and animation software for electric, pneumatic and electro-pneumatic circuits mod. SW-AIR/EV
- Interface card mod. C2-IO/EV

This panel can be used in different ways:

- it can be inserted in the wheeled structure of the integrated laboratory of installations mod. LII-S/EV from which it is powered;
- it can be inserted in the bench for exercises on installations mod. 397-4/EV from which it is powered;
- it can be inserted in one of the mobile floor-standing display rack with work top for instruments:
 - mod. LII-T/EV; in this case, it is powered via the nearest 3-ph socket;
 - mod. LII-T1/EV, from which it is powered;
- it can be applied onto a wall like a blackboard; in this case, it is powered via the nearest 3-ph socket.

ACCESSORIES OF THE EQUIPMENT:

- 1 board-type power plug (2P + earth) with 1 cable 3 x 0.75 mm²
- 1 slider valve for pneumatic feeding
- 10 m of spiral pipe (Ø 8) and airtight quick connect unions for compressed air feeding
- set of 40 cables with safety plugs (Ø 4 mm)
- 10 + 10 m of pipe Rilsan® (Ø 4 mm) of different colours
- 1 extractor for unthreading Rilsan® pipe from quick connections
- 1 cutter for Rilsan® pipe

ACCESSORY RECOMMENDED IF COMPRESSED AIR IS NOT AVAILABLE:

Silent compressor provided with tank, overpressure valve, pressure reducer (0.2...8 bars), pressure gauge of 0...10 bars, filter with dehumidifier of automatic discharge, M.12 MINI 1/4" connection fitting.

Further technical characteristics:

- capacity: 20 l
- flow rate: 55 l/min
- pressure: 7 bars
- power supply: single-phase, 230 V – 50-60 Hz
- motor power: 0.5 kW
- number of revolutions per minute: 1400 r.p.m.
- noise level: < 57 dB+
- automatic thermal protection
- dimensions: 650 x 350 x 750 mm
- weight: 30 kg

POWER SUPPLY:

Single-phase 100...240 V - 50-60 Hz - 72 VA

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DC MOTOR STARTING AND CONTROL SYSTEMS

mod. LII-AI5/EV

INTRODUCTION

This panel has been designed to help students carry out separately excited or permanent magnet DC motor starting circuits such as those with stepped resistors and manual override or automated sequences, or those with sliding adjustable rheostats and electronic speed control.

It can be used as a stand-alone unit or together with industrial automation panels mod. LII-AI1/EV and LII-AI2/EV to perform advanced group work.

The components are pre-wired on the panel; circuits and configurations are carried out quickly by means of cables with safety plugs.

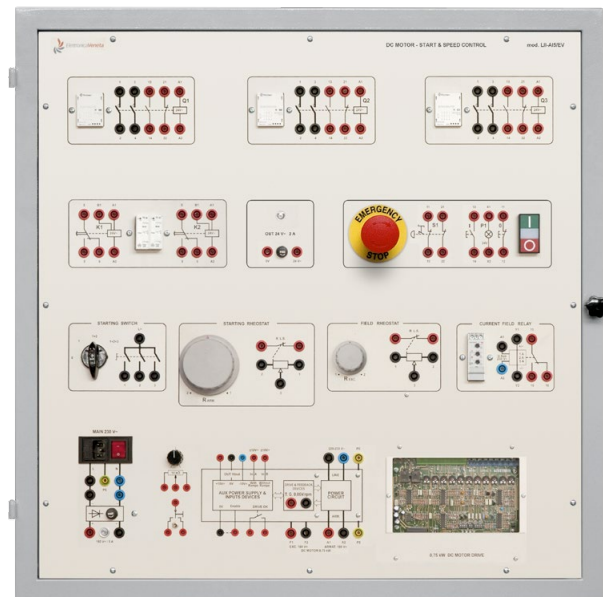
EXPERIMENTS PROGRAM:

- DC motor starting circuit: constant field and step rheostat armature, manual exclusion with rotative commutator.
- DC motor starting circuit: constant field and linear rheostat armature.
- DC motor starting circuit: partially controllable field, field excitation relay and armature with step rheostat with timed automatic exclusion.
- DC motor speed control circuit with electronic drive at constant field. Speed closed loop with armature voltage or tachogenerator feedback.
- DC motor inversion and speed control with 4-Q electronic drive, with constant field and armature voltage or tachogenerator feedback. With programmable starting and braking ramps.

TECHNICAL CHARACTERISTICS:

The framework has been made with structural and sheet steel, chemically treated and painted with epoxy varnish; its left side is provided with hinges for a quick insertion/removal in/from the wheeled structure or work bench.

Tests can be carried out via safety terminals and cables for plugs with diameter of 4 mm.



Main components installed:

- 1 4-Q bidirectional electronic drive for DC motors up to 500 W, with separated excitation. Input power 230 VAC, armature and field output: 170 VDC. It works with armature voltage or tachogenerator (0,06 V/turn) feedback. Analog input ± 10 VDC for external potentiometer control with ramps, 4 on-board trimmers for programming the ramps. Analog input ± 10 VDC for external control with no ramps. Digital input for drive enabling. Tachogenerator input: 60VDC/1000RPM. Relay with NO contact for alarm output
- 1 Potentiometer 10 k Ω A for the drive speed control
- 1 Lever selector 6 A- 250 VAC for the drive STAND-BY and RUN modes
- 1 180 VDC - 5 A power supply, input 230 VAC, protected against overload and short circuit with fast fuses, bipolar switch and spy lamp
- 1 R120 linear toroidal rheostat for the field circuit 0-300 Ω , In 0,65 A with microswitch at Rmin position
- 1 R175 linear toroidal rheostat for the armature circuit 0-40 Ω , In 2,1 A with microswitch at Rmax position
- 3 Relays, 2 poles, 25 A, 24 VAC coil, with 1 NO + 1 NC auxiliary contacts

- 1 3-step 1 way adder-type switch, 25 A, for manual starting of the DC motor
- 1 programmable electronic relay for min/max AC/DC current, auxiliary input 230 VDC, selectable current ranges 1, 2, 5 A, NO-COM-C auxiliary contact
- 1 monoblock pushbutton, RUN key with NO contact, STOP key with NC contact, spy lamp 24 V
- 1 red emergency pushbutton, manual unlocking, with 2 NC contacts
- 2 multifunction multivoltage timers, TON, TOFF, PULSE, multiscale 0,1 s to 10 days
- 1 24 VAC PELV output with single-ph transformer, 115/230 V / 24 V - 50 VA, 50-60 Hz. Protected with 2 A fast fuse
- 1 panel feeding socket 2P + G and 5 x 20 10 A fuse
- 1 single-ph feeding cable with French-German plug

Dimensions of working area: 730 x 730 mm
Dimensions of the panel: 790 x 790 x 200 mm
Weight netto: 19 kg

This panel can be used in different ways:

- it can be inserted in the wheeled structure of the integrated laboratory of installations mod. LII-S/EV from which it is powered;
- it can be inserted in the bench for exercises on installations mod. 397-4/EV from which it is powered;
- it can be inserted in one of the mobile floor-standing display rack with work top for instruments:
 - mod. LII-T/EV; in this case, it is powered via the nearest 3-ph socket;
 - mod. LII-T1/EV, from which it is powered;
- it can be applied onto a wall like a blackboard; in this case, it is powered via the nearest 3-ph socket.

ACCESSORIES OF THE EQUIPMENT:

- DC motor, 500 W, 170 VDC armature and separated excitation
- mod. M-1G/EV
- Set of 40 cables with safety plugs Ø 4 mm
- Set of 6 cables with safety plugs Ø 2 mm

ACCESSORY RECOMMENDED (NOT INCLUDED)

- Tachogenerator 0,06 V / turn - mod. M-16/EV

POWER SUPPLY:

Single-phase 230 V - 50-60 Hz - 1000 VA

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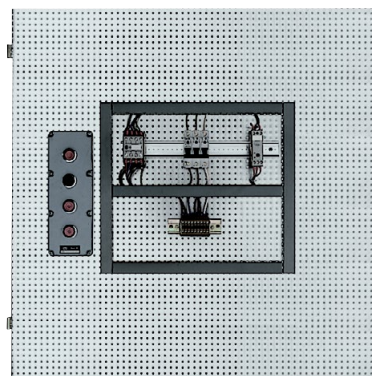
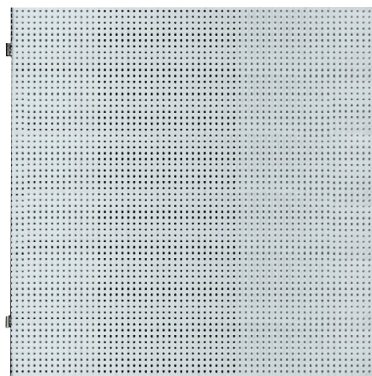
PANEL OF PIERCED METAL SHEET

Mod. 397-PLF/EV

Thickness: 20/10 mm; galvanized steel. Holes of 4 mm are drilled on the whole surface with a spacing of 12 mm. This panel is equipped with hinges for a quick insertion in the bench.
Suitable for industrial electric installations.

Dimensions: 790 x 790 mm

Weight: 7,5 kg



Example with the material of MI-P/EV

KIT FOR INDUSTRIAL INSTALLATIONS

Mod. MI-P/EV

TRAINING PROGRAM:

- Controlling a contactor from a point
- Impulse control of a contactor
- Separate control of two contactors
- Remote control reverser
- Remote control reverser with block on pushbuttons
- Remote control reverser with timer
- Start-delta starter
- Starting by stator resistances
- Starting by autotransformer
- Starting by rotor resistances by steps
- Remote controlled pole-change switch for two-winding motors
- Remote controlled pole-change switch for single-winding (Dahlander) motor
- Reverse current braking
- Remote control reverser, star-delta starter

COMPONENTS INCLUDED IN THE KIT:

- 1 set of three fuse holders with fuses 10.3x38 up to 25 A - 400 Vac
- 6 fuses 10.3 x 38 with current of 6 A
- 1 mushroom-head emergency button with 1 NO contact + 1 NC 10 A - 250 Vac



- 3 pushbuttons of different colours with 1 NO contact + 1 NC 10 A - 250 Vac
- 4 lamp socket for warning lights with diameter of 22 mm, of different colours, including lamps Ba9s - 24 V - 3 W
- 5 three-pole contactors of 25 A - 400 Vac, 2 auxiliary NO contacts + 2 NC 10 A - 250 Vac, coil of 24 Vac
- 1 three-pole thermal relay with rated current of 4.5 - 7.5 A, 1 NO contact + 1 NC 10 A - 250 Vac
- 3 multi-function timers (delayed closing, delayed opening) with NO / NC exchange contact 10 A - 250 Vac, coil of 24 Vac
- 1 auxiliary relay, 2 auxiliary NO contacts + 2 NC 10 A - 250 Vac, coil of 24 Vac
- 1 single-phase transformer 115/230 - 12/24 V 50 VA
- 2 boxes for 4 button operators / lamp socket
- 30 screws M4 x 10-20 mm with nuts and washers
- 2 pieces of 30 cm for fixing modular components

THEORETICAL-EXPERIMENTAL HANDBOOKS
Practical handbook of electric installations.

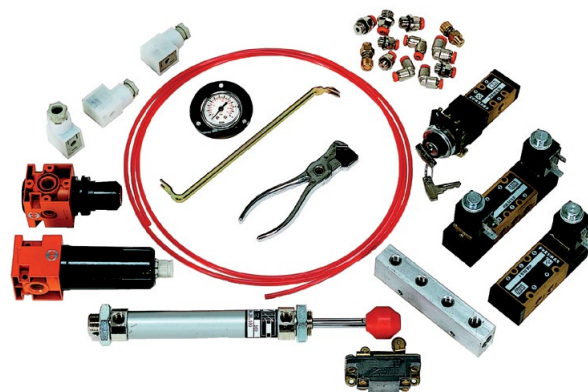
KIT FOR ELECTRO-PNEUMATIC SYSTEMS

Mod. ME/EV

TRAINING PROGRAM:

ELECTRO-PNEUMATIC SYSTEMS

- Controlling a cylinder by monostable solenoid valve
- Controlling a cylinder by bistable solenoid valve
- Controlling a cylinder by monostable solenoid valve and self-holding circuit
- Temporary storage with prevalent insertion
- Temporary storage with prevalent reset
- Temporary binary counter for circuits with bistable solenoid valve
- Temporary binary counter for circuits with monostable solenoid valve
- Permanent binary counter for circuits with bistable solenoid valve
- Permanent binary counter for circuits with monostable solenoid valve
- Control of a sliding door
- Semi-automatic control of a double-acting cylinder by monostable solenoid valve
- Semi-automatic control of a double-acting cylinder by bistable solenoid valve
- Electric control of a cylinder by monostable solenoid valve (anti-repetitiveness)
- Electric control of a cylinder by bistable solenoid valve (anti-repetitiveness)
- Electric control of a cylinder by monostable solenoid valve and impulse relay (anti-repetitiveness)
- Electric control of a cylinder by bistable solenoid valve and impulse relay (anti-repetitiveness)
- Automatic control by monostable solenoid valve and stop pushbutton with return to a0 at the end of the cycle
- Automatic control by bistable solenoid valve and stop pushbutton with return to a0 at the end of the cycle
- Automatic control by bistable solenoid valve and stop pushbutton with immediate return to a0
- Automatic control by bistable solenoid valve and stop and emergency pushbutton with different returns
- Automatic control by bistable solenoid valve and stop and emergency pushbutton with immediate return to a 0
- Controlling a cylinder by bistable solenoid valve and delayed-excitation timer
- Electric diagrams for using delayed-excitation timer, with monostable solenoid valve and instantaneous contact
- Semi-automatic control of a cylinder, with bistable distributor, delayed excitation
- Semi-automatic control of a cylinder, with bistable distributor, delayed excitation and exchange contact



- Semi-automatic movement with limit switch, timer and monostable distributor
- Semi-automatic movement with limit switch, timer and bistable distributor
- Safety two-hand control

LOGICAL FUNCTIONS IMPLEMENTED WITH FUNCTIONAL ELECTRIC DIAGRAMS

- identity function (YES)
- inverse function (NOT)
- sum function (inclusive OR)
- exclusive OR
- product function (AND)
- inhibition function
- examples of logical equations

INDUSTRIAL APPLICATIONS

- pick-and-place cycle with bistable solenoid valves
- pick-and-place cycle with monostable solenoid valves
- pick-and-place cycle with monostable solenoid valves and safety and emergency circuits
- pick-and-place cycle with bistable solenoid valves and safety and emergency circuits
- "L" cycle with bistable solenoid valves
- "L" cycle with bistable solenoid valves, automatic and semiautomatic control circuits, and anti-repetitiveness condition
- "L" cycle with monostable solenoid valves, automatic and semiautomatic control circuits, and anti-repetitiveness condition

COMPONENTS INCLUDED IN THE KIT:

- 1 single-phase transformer 115-230 / 12-24 V – 72 VA
- 2 multifunction multivoltage timers, TON, TOFF, PULSE, multiscale 0,1 s to 10 days
- 2 auxiliary relays 3 exchange contacts 10 A - 250 Vca, excitation of 24 Vac complete with undecal socket
- 2 fuse holders with breakable neutral complete of cylindrical fuses 10,3 x 38 da 4 A
- 3 push-buttons for industrial uses with auxiliary NO and NC contact 10 A - 250 Vca
- 1 impulse relay (two-way switch) with coil of 24 Vca
- 1 nylon spiral pipe Rilsan® (10 m), provided with connections M 12 MINI of ¼"
- 20 m of coloured nylon pipe Rilsan®, 4 x 2.5
- 2 m of neutral nylon pipe Rilsan®, 6 x 4
- 1 filter/reducer/pressure gauge assembly
- 1 bistable directional valve of ¼", controlled by side lever
- 1 distribution frame of 4 connections, ¼"
- Two 5/2 solenoid valves, solenoid-solenoid, 24 Vac 50-60 Hz
- Two 5/2 solenoid valves, solenoid-spring, 24 Vac 50-60 Hz
- 6 light connectors for solenoid valves
- 2 double-acting cylinders provided with 2 magnetic sensors, pins, nuts and cam on rod
- 1 silencer of 1/8"
- 1 malew quick connection of ¼"
- 4 unions R1-6 – ¼"
- 12 unions R6-4 - 1/8"
- 12 L-shaped unions, R4 4
- 4 plastic plugs (Ø 4)
- 8 drain regulators of 1/8"
- 9 unions R1-4 of 1/8"
- 1 union R2-4 of 1/8"
- 1 male plug of ¼"
- 1 union R1-6 of 1/8"

RECOMMENDED ACCESSORIES:

Silent compressor, provided with wheels and tank, overpressure valve and pressure reducer with connection fitting M.12 MINI ¼".

Technical specifications of compressor:

- capacity: 20 l
- flow rate: 55 l/min
- pressure: 7 bars
- motor power: 0.5 kW
- revolutions per minute: 1400
- noise level: < 57 dB
- power supply: 230 V, single-phase – 50-60 Hz
- automatic thermal protection
- Dimensions: 650 x 350 x 750 mm
- Net weight: 30 kg

**THEORETICAL-EXPERIMENTAL
HANDBOOKS**

Practical handbook of industrial installations.

PANEL WITH FLUSH-MOUNTED BRANCH EXCHANGE AND BOXES

Mod. LII-PSC/EV

INTRODUCTION

Thickness: 15/10 mm; painted galvanized steel. It includes 4 flush-mounted rectangular boxes for components; inside dimensions: 100 x 57 x 45 mm, 1 branch exchange for 12 + 12 modular units (branch exchange for flat), 1 branch exchange for 8 modular units (flat riser branch exchange); 2 system switching and distribution boxes interconnected by plastic pipes.

This panel is equipped with hinges for a quick insertion in the structures mod. LII-S/EV and mod. 397-4/EV.

Mostly used to realize the riser, the board of living units, the switching and distribution of wiring in chased domestic installations and conduit systems.

Dimensions: 790 x 790 mm

Weight: 9 kg



PANEL WITH FLUSH-MOUNTED BOXES

Mod. LII-PSI/EV

INTRODUCTION

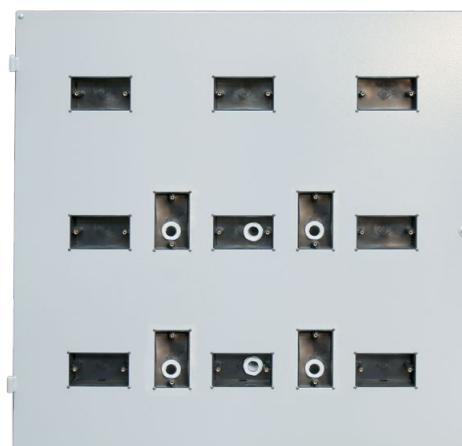
Thickness: 15/10 mm; painted galvanized steel. It includes 13 flush-mounted rectangular boxes for components; inside dimensions: 100 x 57 x 45 mm; boxes are interconnected by plastic pipes.

This panel is equipped with hinges for a quick insertion in the structures mod. LII-S/EV and mod. 397-4/EV.

Mostly used for chased domestic installations and conduit systems.

Dimensions: 790 x 790 mm

Weight: 8,5 kg



KIT FOR SWITCHBOARDS OF LIVING UNIT

Mod. MIS-Q/EV

TRAINING PROGRAM:

- application of AC-type differential circuit breaker
- application of A-type differential circuit breaker
- application of selective differential circuit breaker
- application of differential circuit breaker with automatic reset
- application of magneto-thermal automatic circuit breakers for lighting circuits, sockets and services
- application of fuses for protection of power and auxiliary circuits
- application of Surge Protection Devices (SPD) against overvoltages



COMPONENTS INCLUDED IN THE KIT:

- 1 single-phase energy meter, direct connection, for currents up to 40 A; selectable measurements of total and partial active and reactive power, voltage, current, active and reactive power, power factor, frequency, hour meter, average active power (demand on 15 min.)
- 1 magneto-thermal automatic circuit breaker 2 x 16 A, curve C
- 1 magneto-thermal automatic circuit breaker 2 x 10 A, curve C
- 1 magneto-thermal automatic circuit breaker 2 x 6 A, curve C
- 1 pure selective "S" two-pole automatic differential circuit breaker of 25 A / 0.3 A, AC class
- 1 two-pole A-type differential circuit breaker; $I_{dn} = 30 \text{ mA}$
- 1 two-pole AC-type differential circuit breaker; $I_{dn} = 30 \text{ mA}$
- 1 device for the automatic reset of differential circuit breakers
- 1 pair of breakable fuse holders with cylindrical fuses 10.3 x 38 of 10 A

REMARK:

The ideal application of kit MIS-Q/EV is in panel LII-PSC/EV.

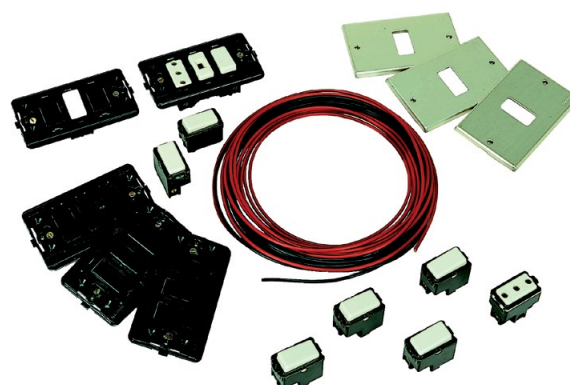
THEORETICAL-EXPERIMENTAL HANDBOOKS

Practical handbook of electric installations.

KITS FOR LIGHTING INSTALLATIONS

Mod. MIS-I/EV

Material for embedded electrical installations.



TRAINING PROGRAM:

- Lamp controlled by a switch
- Lamps controlled by a changeover switch
- Lamp controlled from two points
- Group of lamps controlled from two points + 1 socket
- Lamp controlled from 3 points
- Group of lamps controlled from 4 points + 2 sockets
- Lamp controlled from various points by relay
- Group of lamps controlled from various points by switch relay
- Control of a fluorescent lamp
- Lighting archives from 3 points
- Timed lighting of stairwell

COMPONENTS INCLUDED IN THE KITS:

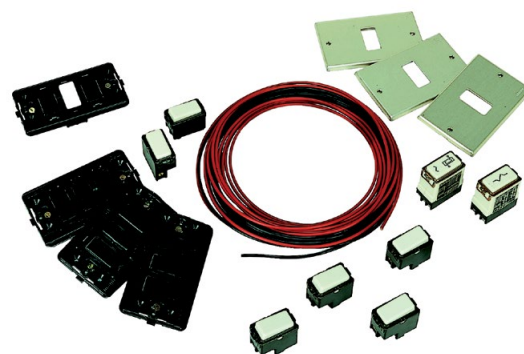
- 1 switch 1P 16 A – 250 Vac
- 1 changeover switch (2 switches) 1P 16 A – 250 Vac
- 2 two-way switches 1P 16 A – 250 Vac
- 2 inverters 1P 16 A – 250 Vac
- 3 NO lighting pushbuttons 1P 10 A – 250 Vac
- 2 universal two-pin and Unel sockets 10-16 A – 230 V
- 2 square lamp sockets E27
- 2 lamps E27 – 220 V – 40n W
- 1 fuse holder for cylindrical fuses 6x32
- 2 cylindrical fuses 6x32 6 A
- 1 single-phase transformer 115/230 – 12/24 V 50 VA
- 1 switch relay with contacts 10 A – 250 Vac, coil of 24 Vac
- 1 fluorescent lamp 230 V – 18 W – connection G13, including ballast, capacitors and starter
- 1 timing relay for stairwell lighting
- 6 supports of 3 controls
- 6 covering plates
- 10 false closing poles
- 3 closing lids

THEORETICAL-EXPERIMENTAL HANDBOOKS

Practical handbook of electric installations.

KIT FOR SIGNALLING SYSTEMS

Mod. MIS-S/EV



Material for embedded electrical installations.

TRAINING PROGRAM:

- Ringer controlled from a point
- Ringer system with call and answer
- System for controlling 3 ringers
- Ringer system for 2 flats and an outdoor unit
- Ringer system for flats and electric lock
- Optical-acoustic signalling system for offices, schools, hospitals

COMPONENTS INCLUDED IN THE KIT:

- 4 NO pushbuttons 1P 10 A - 250 Vac
- 2 NO pushbuttons 1P 10 A - 250 Vac + red warning light of 24 V

- 1 fuse holder for cylindrical fuses 6x32
- 2 cylindrical fuses 6x32 6 A
- 1 single-phase transformer 115/230 – 12/24 V 50 VA
- 3 ringers of 12 Vac
- 1 buzzer of 12 Vac
- 1 four-button strip with nameplate
- 1 receptacle for four-button strip
- 1 tag of numeric calls of 24 Vac with micro-coding
- 1 electric lock of 12 Vac
- 1 metallic support for electric lock
- 6 supports of 3 controls
- 6 covering plates
- 10 false closing poles

THEORETICAL-EXPERIMENTAL HANDBOOKS

Practical handbook of electric installations.

KIT FOR INTERPHONE SYSTEMS

Mod. MIS-C/EV



TRAINING PROGRAM:

- Entry phone system with electric porter, 1 outdoor unit and 1, 2, 3 indoor units
- Phonic system between two intercommunicating interphones
- Phonic system between three intercommunicating interphones and outdoor unit with relay of exclusion of outdoor speech

COMPONENTS INCLUDED IN THE KIT:

- 3 interphones provided with 1 door opening pushbutton and 3 pushbuttons for intercommunication
- 1 power supply unit for interphone system
- 1 phonic unit with microphone and loudspeaker
- 1 relay for excluding the outdoor unit for indoor intercommunications

THEORETICAL-EXPERIMENTAL HANDBOOKS

Practical handbook of electric installations.

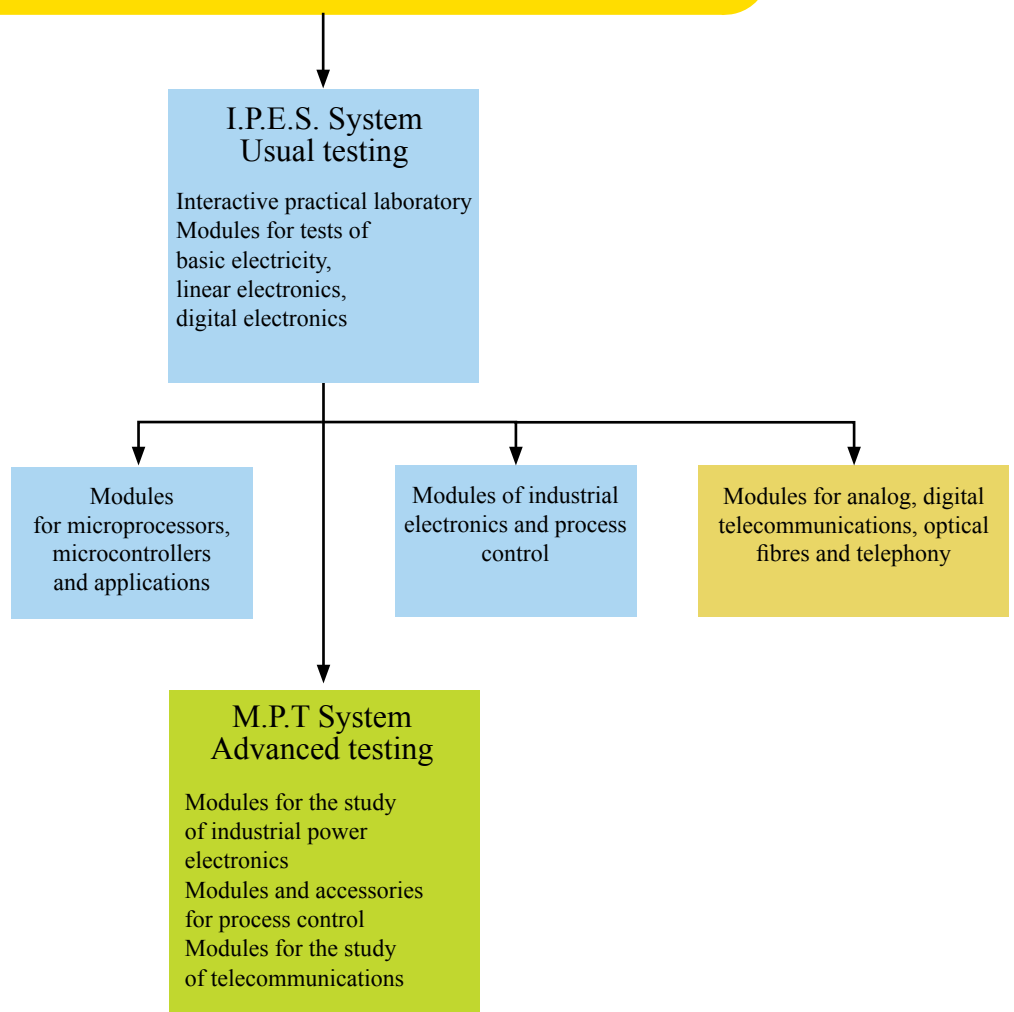
ELECTRONICS AND TELECOMMUNICATIONS:

Basic electronics, analog circuits, digital circuits, microprocessors and microcontrollers, industrial electronics and process control

THE SYSTEM USED IN THIS LABORATORY IS ALSO SUITABLE TO CARRY OUT CIRCUIT TESTING IN ELECTRONICS AND TELECOMMUNICATIONS.

THE PANEL OF TESTING IN ELECTRONICS AND TELECOMMUNICATIONS INCLUDES THE POWER SUPPLY UNIT WITH THE NECESSARY VOLTAGES AND A UNIT OF ESSENTIAL VIRTUAL TOOLS FOR THE EXERCISES OF ANALOG, DIGITAL, INDUSTRIAL ELECTRONICS, MICROCONTROLLERS, PROCESS CONTROL AND TELECOMMUNICATIONS.

Integrated Laboratory of Electronics and Telecommunications



PANEL OF TESTING IN ELECTRONICS AND TELECOMMUNICATIONS

Mod. LII-SET/EV

Possibility of using panel mod. LII-SET/EV with:

MODULES FOR TESTS OF ELECTRONICS

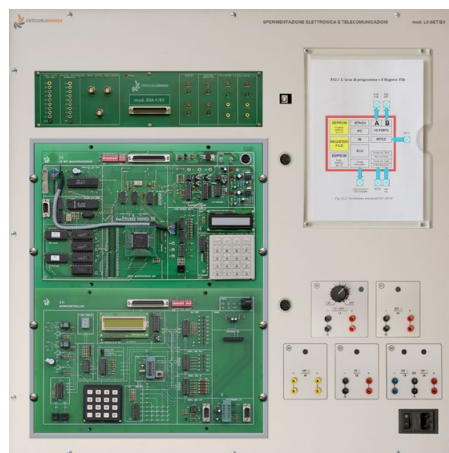
- BASIC ELECTRICITY
- LINEAR ELECTRONICS
- DIGITAL ELECTRONICS
- TESTS WITH MICROPROCESSORS AND MICROCONTROLLERS
- INDUSTRIAL ELECTRONICS

MODULES FOR TESTS OF TELECOMMUNICATIONS

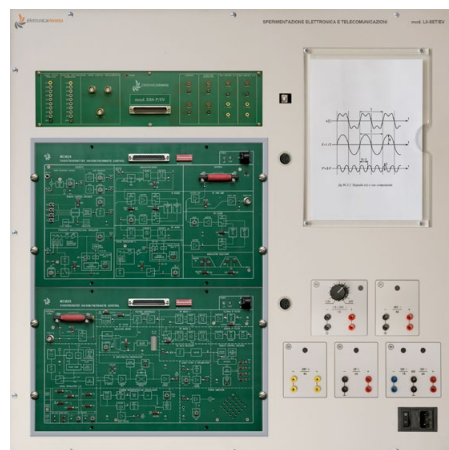
- ANALOG COMMUNICATIONS
- RADIO COMMUNICATIONS
- DIGITAL COMMUNICATIONS
- OPTICAL FIBRES
- TELEPHONY



EXAMPLE OF ELECTRONIC ANALOG CONFIGURATION



EXAMPLE OF CONFIGURATION WITH MICROPROCESSORS



EXAMPLE OF TELECOMMUNICATIONS CONFIGURATION



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