



Electrical Engineering Lab Equipment Offer

Brochure

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Life Is On

Schneider
Electric

Foreword

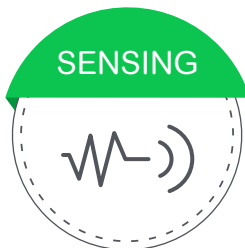
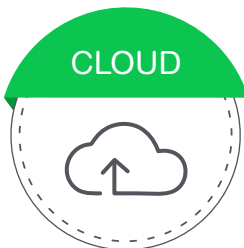
Education, skills, and resourcefulness of people are critical to sustain economic and social development. The megatrends of urbanization, digitization and industrialization is provoking the rise in energy demand leading to job creation. The current technology disruption caused by IoT, Industry 4.0 enabled by technology developments in mobility, cloud, sensing, analytics and security, creates the need for highly skilled human capital to innovate, operate and maintain this technology in the new environment.

Educational institutes face difficulties to update their syllabi in tune with this demand and with the high-speed changes taking place in the world of technology. Hence, the students graduating from the institutions are not equipped to meet the current industry requirements. In response to these challenges, Schneider Electric have intensified their academic interventions to tackle the impeding gap of human capital.

While we cannot predict the jobs of the future, there is no stopping job aspirants, industries and education systems from preparing for these jobs. One of the approaches to tackle the job-readiness challenge across the workforce is for them to work in partnership with Institutions. At Schneider Electric, we are actively working with various education providers, engineering colleges and universities to provide training in high-demand job skills in the fields of electricity, automation and energy management. Our aim is to train a skilled human capital with quality curriculum backed by systematic experiments through practical exercises.

Training individuals for the jobs of the future and allowing them to visualize what it possible today will not only make a difference in their lives but will enrich our communities now and for the future. Joint initiatives by the industry and academia will play an important part in plugging the talent gap in the years to come.

Technological changes fueling innovation...



Education, a central feature of Schneider Electric DNA

Schneider Electric, the global specialist in energy management and automation, has always been committed to support training in electricity, automation and energy management. As early as in 1929, Schneider Electric founded its own school Paul-Louis Merlin in Grenoble, to provide Technical Education to alleviate the shortage of skilled labor in the energy industry and help combat unemployment.

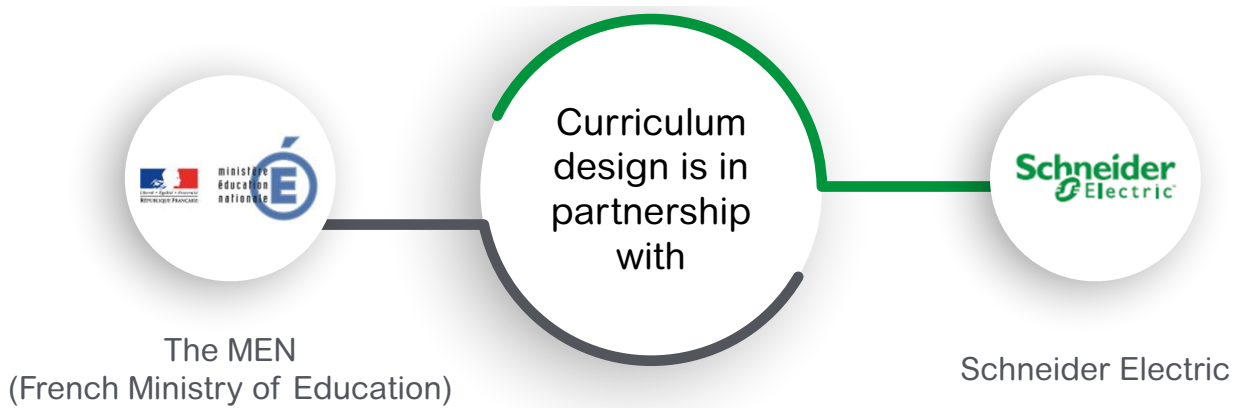
Today with our education activity, from initial training through to ongoing professional development, we support men and women as they prepare to manage their futures.

Schneider Electric is committed to energy transition, a process which is driving our economic growth. To bring about this change, we need not only to increase the use of renewable energies, but also to manage our energy requirements more efficiently. The digitization of consumption data and production methods will help us redress the balance between consumption and sustainable development, between comfort and efficiency. New technologies already exist, but they will only ever be successful if we prepare our young people to engage with the solutions of tomorrow. These are the people at the heart of energy transition; our future professionals who will have to juggle multiple technologies: communications, energy efficiency, home automation, renewable energy and smart grids. Therefore, Schneider Electric supports the world of education in facing these new challenges. Each year we train some 800 teachers and trainers through regional

technical training courses and training days. We are now also integrating more online resources into our teaching programs and materials. Rather than being a strictly linear process, learning today should also involve a commitment from students to invest in their education in a more tailored approach. This is Schneider Electric's commitment - to support you throughout these changes and achieve a successful transition.

Working together with the French Ministry for Education, we have forged relationships between stakeholders in the education system and the world of business. Our initiative provides a collaborative platform to drive this initiative forward, focusing on new energy management technologies on a national and international scale.” At an international level, Schneider Electric France and the French Ministry of Education have agreed to consolidate their cooperation to support countries in implementing effective training policies.

Curriculum and Teaching pedagogy



Teaching pedagogy

Practical activity takes the large part of the training time. The theory part will be 30% and the practical 60% of the training time. The last 10% will be dedicated to the knowledge and competency assessment.

One part of the concept is the autonomous of the trainees. For this, trainees have got at their disposal a set of chronological activities and resources' document. They perform the activities by their own. Theoretical part is given by the trainer when it is needed, and the trainer become a "Facilitator"

In modern education phraseology, the word "facilitator" is increasingly taking the place of "teacher". As the word suggests, a facilitator is a person who facilitates, or who makes things easier. To a large extent, the success of the training program – or any other classroom-based program for that matter depends on the trainers' ability to assume the role of a facilitator.

The place of the practical activities would be dominant. The world Facilitator is a good definition of the Professor/Trainer.

Introduction to the Schneider Electric Educational offer

Schneider Electric has accompanied the education community for many decades. Together with you, we are determined to set up pathways to success that measure up to current changes and those to come. In keeping with our innovation-based approach, we implement solutions that bring initial training and the professional world ever closer to one another.

On the strength of the group's expertise and the experience of our staff working in our skills centres, we can provide you with teaching solutions, built on projects and equipment, that are designed entirely with development of skills and enhancement of student employability in mind.

The current revolution brought about by the arrival of digital systems, combined with the major energy issues of our time, places

Schneider Electric as your special partner in the task of preparing tomorrow.

Our mission is to make an active contribution to training students in current and future job activities to enable them to swiftly become operational, efficient and able to meet the challenges they will be called on to face. The quality of our solutions stems from joint work with institutions such as the French Ministry for Education, Higher Education and Research, or the Directorate of European and International Relations and Cooperation. The catalogue in your hands lists the solutions that will accompany you through each semester while you carry out your mission as a training officer. To put Schneider Electric's full undertaking in a nutshell: accompanying you in a changing world, to enhance student employability.

Selection matrix

Sl. No.	Didactic equipment description	UG- Semester -1	UG- Semester -2	UG- Semester -3	UG- Semester -4	UG- Semester -5	UG- Semester -6	UG- Semester -7	Page No.
1	Basic function domestic panel		✓						6
2	Motor starting panel			✓					7
3	Study bench for grounding schemes				✓				8
4	Study bench for selectivity of protecting systems				✓				9
5	Modular bench for energy efficiency in ventilation					✓			10
6	HMI and PLC					✓			11
7	PLC application Panels					✓			12
8	Industrial detector study benches					✓			13
9	Home Automation System					✓			15
10	Medium Voltage						✓		16
11	Study box for compensation of reactive energy - Basic							✓	17
12	Study cabinet for compensation of reactive energy - Advanced							✓	18
13	Micro solar plant bench for OFF-GRID locations							✓	19
14	Solar water pumping bench							✓	20
15	Photovoltaic/wind power bench for isolated locations							✓	21
16	City Grid							✓	22

1. Basic functions

Domestic panel

Training objectives

- Installing components: switches, two-way switches, sockets, etc.
- Studying the function of each component.
- Configuring a programmable timing switch
- Studying the remote control switch function.

Presentation

This panel is designed for wiring the basic functions of a residential or small services installation, such as remote control switches, timers, time switches, or dusk to dawn switches.

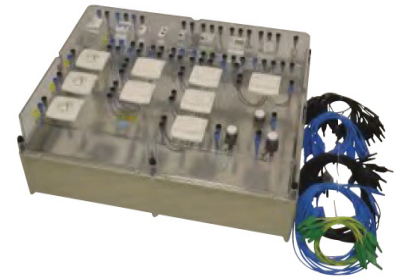
The transparent cover enables the components to be seen.
The components are wired using safety leads.

Description

Contents	
Description	Quantity
Household sockets	3
Two-way switches	2
Pushbutton switches	3
Pushbutton switch with indicator light	1
Indicator lights	3
Earth leakage circuit breaker for general protection	1
Circuit breakers, 10 A and 16 A	2
Timer	1
Timer with early OFF warning	1
Remote control switch	1
Remote control switch with command via illuminated pushbutton	1
Programmable time switch	1
Dusk-to-dawn switch	1
Power lead	1

References

Description	Reference No.
Domestic panel without leads	
Lot of leads for A2E domestic panel	AET-P01-DP



Household panel + set of leads

Decision aid

Sectors concerned

- Electrical
- Energy

Designated skills

- Analysis
- Configuring
- Studying

Themes studied

- Energy from renewable sources
- Energy management
- Measuring
- Energy storage

2. Industrial control and machine safety

Motor starting panel

Training objectives

- Finding out about the electrical diagrams of the motor starting systems (star, delta, inverter).
- Implementing a machine with an asynchronous motor.
- Studying the contactors and the motor protection devices.
- Choosing the type of motor starting on the basis of various criteria.

Presentation

This panel is designed to wire the various types of motor starting systems. It has a transparent cover that enables viewing of each component. The wiring is carried out using safety leads.

Description

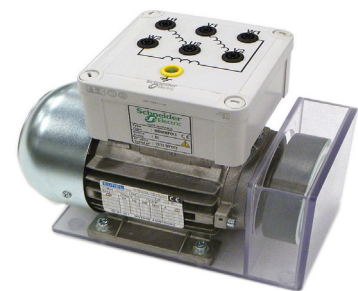
Contents	
Description	Quantity
Fuse holder isolating switch	1
Magnetic circuit breaker	1
Magneto-thermal circuit breaker	1
Contactors including 1 with auxiliary block	3
Inverter contactor,	1
Thermal relay	1
24 V AC power supply module	1
Pushbuttons	3
Safety master switch	1
Power lead	1

References

Description	Reference No.
A2E motor starting panel without leads	AET-P01-MSP
Set of leads for A2E motor starting panel	MD3BPDMCO
0.18 kW - 230/400 V three-phase asynchronous motor	MD1AMP001



A2E Motor Starting Panel



Teaching motor

Decision aid

Sectors concerned

- Electrical
- Energy

Designated skills

- Analysis
- Configuring
- Studying

Themes studied

- Energy from renewable sources
- Energy management
- Measuring
- Energy storage

3. Quality of energy

Study bench for grounding schemes

Training objectives

- Studying the various ground link schemes: TN, TT and IT.
- Applying, for each type of ground link scheme, the standards covering protection for an LV electricity distribution system.
- Grasping the principles of troubleshooting.

Presentation

These benches are designed for studies of the various ground link schemes:

- TN and TT neutral systems on one side,
- IT neutral system on the other side.

Receivers are simulated by loads located in the lower part of the bench.

Two versions are proposed:

- The IM20 version enables execution of manual troubleshooting.

Description

Study bench for grounding schemes

- The benches are mounted on a frame with locking wheels.

Composition of the benches

Description	Quantity
Distribution architecture mimic diagram	1
Single- or three-phase receivers representing a person	3
A protection system made up of thermal-magnetic circuit breakers and ground leakage circuit breakers.	
Pushbutton switch with indicator light	
Differential switches and contactors	
Permanent insulation controller for IT system	1

Accessory supplied

Description	Quantity
Set of safety leads	1

Troubleshooting kit

- To be ordered with the bench for grounding schemes, IM20 version.

Contents

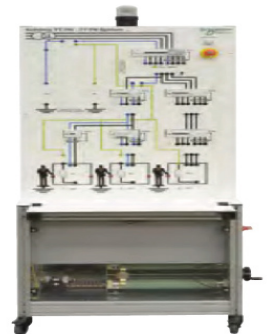
Description	Quantity
XP15 ammeter clamp	
XGR leakage current generator	1
XRM mobile receiver.	1

References

Description	Reference No.
Study bench for grounding schemes (IM20)	MDG99605
Troubleshooting kit for IM20 grounding scheme study bench	MDG99609



IT side



TT + TN side



Troubleshooting kit

Decision aid

Sectors concerned

- Electrical
- Maintenance

Designated skills

- Analysis
- Configuring
- Checking

Themes studied

- Electricity distribution

4. Applications in the building trade

Study bench for selectivity of protective systems

Training objectives

- Using an adjustable differential relay with separate ring core.
- Analysing the causes and effects of short circuit currents (calculation methods, choice of protection devices).
- Studying the operating principles of a thermal-magnetic circuit breaker (tripping curves, breaking capacity).
- Using and drawing the tripping curve for a given rating.
- Implementing selectivity between upstream and downstream protection devices.
- Simulating situations of full selectivity, partial selectivity and non-selectivity.
- Studying the notions of selectivity with 2 or 3 stages (consequences and effect on an installation).
- Selecting the impedance of the fault loop via induction coils with modular values.
- Presenting, in a simplified way, the principle of breaking via an electrical arc under very low voltage.
- Limiting the short circuit current.

Presentation

This bench is designed to study and implement two selectivity strategies for protection devices in low voltage distribution systems:

- Ammeter selectivity.
- And chronometric selectivity.

Two isolating transformers enable limitation of the energy level involved when creating the deliberate faults required for the study.

Description

- The bench is mounted on a frame with locking wheels.

Contents

Description	Quantity
Mimic diagram panels: ammeter selectivity and chronometric selectivity	2
Isolating transformers in the lower part: 220 V / 48 V and 220 V / 220 V	2
Set of induction coils (for ammeter selectivity)	1
Rheostat (for chronometric selectivity)	1

Accessory supplied

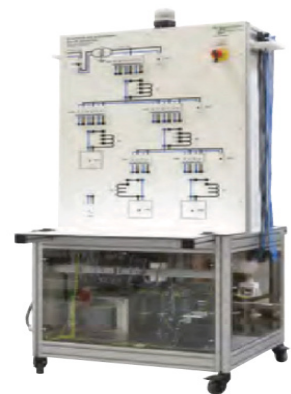
Description	Quantity
set of safety leads	1

References

Description	Reference No.
Study bench for selectivity of protective systems	MDG99610



Chronometric side



Ammeter side

Decision aid

Sectors concerned

- Electrical
- Maintenance

Designated skills

- Analysis
- Configuring
- Checking

Themes studied

- Electricity distribution

5. Energy efficiency and regulation

Modular bench for energy efficiency in ventilation

Training objectives

- Showing an energy efficiency solution.
- Measuring network and motor U/I in the light of the energy chain.
- Using a measurement unit:
 - Energy measurements,
 - Comparison of consumption levels.
- Setting the speed controller parameters under the law of energy savings.

Presentation

This modular bench makes it possible to highlight the energy savings that could be made in a ventilation or pumping installation.

The comparison is made between electro-mechanical control with a contactor and electronic control with a speed controller.

The ventilation flow rate is adjusted by means of an iris or a speed controller.

Description

Contents	
Description	Quantity
Support structure ref. MD1AM000	1
Magnetic protection module ref. MD1AM1004	1
Thermal relay module ref. MD1AM1007	1
Contactor module ref. MD1AM1008	1
PM central measurement module ref. MD1AM2003	1
3 CT 50 / 5 A module ref. MD1AM2004	1
Ethernet gateway module with Web server ref. MD1AM2005	1
Altivar module ref. MD1AM5001	1
Variable speed controller command module ref. MD1AM7001	1
Motor output command module ref. MD1AM7004	1
24 V DC power supply module ref. MD1AM4001	1
Motor fan unit with column and ball ref. MD1AMP014	1
USB/RJ45 cable for connection to the variable speed controller.	1
RJ45/RJ45 cable for connection to the gateway.	1
SoMove parameterisation software program.	

References

Description	Reference No.
Modular bench for energy efficiency in ventilation	MD1AMLATVEE



Decision aid

Sectors concerned

- Electrical engineering
- Energy
- Scientific

Designated skills

- Checking
- Studying

Themes studied

- Energy efficiency
- Energy management
- Measuring

6. HMI and PLC

Training objectives

- To program a PLC with Unity Pro
- To study the display unit
- To program the HMI terminal with Vijeo Designer
- To operate the terminal
- To manage breakdowns via feedback from the terminal

Presentation

The console consists of a Modicon M340 PLC whose logic I/Os are on surface plate. Inputs and outputs are connected from an outside operational part in form of push buttons, limit switches and the indicators respectively. The analogue I/Os are placed remotely in the form of female connectors. The male connectors are pre-wired. A Magelis display unit enables operator dialogue.

Description

Contents	
Description	Quantity
M340 Ethernet PLC	1
Discrete inputs hardwired on switches and on JAEGER 27-pin connectors	16
Discrete outputs hardwired on double-recess plugs and on JAEGER 19-pin connectors	16
Analog inputs on JAEGER 4 and 8-pin connectors	4
Voltage and current analog output, on JAEGER 4-pin connectors	1
Voltage and current analog output, on double-recess sockets	1
5.7" HMISTU Ethernet colour touch screen terminal	1
24 VDC 4 A power supply on sockets	1
- set of programming cables for the PLC and display unit	1
- set of cables with round male connectors and flying leads	1
Software license	1

References

Description	Reference No.
Training kit for HMI + PLC	AET-P01-HPL



7. Automatic control and communication

PLC Application Panels

Training objectives

- To program different types of real time applications using PLCs.
- To draw operation logic and build relevant flowcharts and convert them into PLC programs.
- These are closed loop applications, which yield actual results as seen in applications around us.
- This method empowers the programmer to cross verify the logic by putting them into operation using these simple I/O panels.

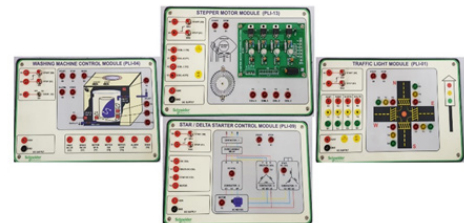
Presentation

These panels are designed to study the principles of industrial automation. The various types of PLC applications are adopted from industrial applications, building applications or general applications available around us. These panels allow the programmer to connect this application panel to the PLC and make the system operational. The resultant output allows the programmer to analyze the fault and make necessary changes to suit the applications.

Description

Different types of applications:

- PLI-01 - Traffic Light Module
- PLI-02 - Vehicle Parking Module
- PLI-03 - Elevator Lift Module
- PLI-04 - Washing Machine Control Module
- PLI-05 - Bottle Filler Control Module
- PLI-06 - Packing Module
- PLI-07 - Level & Pump Control Module
- PLI-08 - Fan Control Module
- PLI-09 - Star/Delta Starter Control Module
- PLI-10 - Safety Door Control Module
- PLI-11 - Conveyor Belt Control Module
- PLI-12 - Stepper Motor Module
- PLI-13 - DC Motor Control Module



References

Description	Reference No.
PLC Applications Panels	AET-K01-PAK

8. Industrial control and machine safety

Industrial detector study benches

Training objectives

- Finding out about the various technologies used in industrial detection:
 - Photoelectric detectors (barrier, reflex, fiber optics, background obliteration, etc.),
 - Inductive and capacitive detectors for detection of various materials,
 - Detection of rectilinear or angular movement via position switches.
- Implementing detectors.
- Making adjustments.
- Setting up a detection chain

Presentation

These detection workshops are designed to study the principles of industrial detection. The various types of detectors and targets proposed are representative of the equipment found in an industrial environment. The power supply box is equipped with indicator lights to show the states of the detectors.

The grooved plate and the case of accessories can be used to quickly mount, remove and position the detectors and the targets, and to measure the distances and angles of detection.



Plate with case and power supply box

Description

Grooved Aluminium support plate

- X axis: travel 600 mm.
- Y axis: length 460 mm

Contents

Description	Quantity
Limit switch Plastic	1
Limit switch, metal end Plunger with elastomer boot 1 NO + 1 NC PG11	1
Limit switch plastic thermoplastic roller lever 1 NO + 1 NC PG-11 cable	1
Limit switch thermoplastic roller lever plunger Horizontal action in 1direction 1 NO + 1 NC PG-11 cable entry	1
Inductive sensor M18 sensing distances 8 mm 1 NO length 62 mm	1
Inductive sensor M18 sensing distances 8 mm PNP length 62 mm	1
Inductive sensor M18 sensing distances 8 mm	1
Capacitive Proximity sensor M18 sensing distances 5 mm	1
Photo Electric sensor sensing distance 30 m thru beam need a transmitter	1
Photo Electric sensor sensing distance 30 m thru beam need a transmitter	1
Photo electric sensor nominal sensing distances 1 m defuse	1
Photo electric fibre amplifier	1
Plastic fibre optic for sensor 3 m long	1
Fibre optic Amplifier	1
Reflector	1

Case of accessories

- 2 fast-opening vices with fine screw tightening system.
- 1 cam with 15°, 30°, 45°, and 90° angles.
- 1 set of steel, aluminium or brass targets for the inductive detectors.
- 1 set of colour reflecting targets made of aluminium, cardboard, reflecting strip, glass, mirror, neutral.
- 1 set of reflectors and
- 1 set of metallic/non-metallic labels.

Power supply box with regulator

- 0-24 V variable direct current power supply (powering the detectors).
- Detector connections via safety sockets.

References	
Description	Reference No.
Sensor Case	AET-K01-SEN

9. Home Automation System

Training objectives

- Analyzing the functionalities and principles of a home automation installation on KNX bus.
- Fitting and connecting the components.
- Configuring the system according to various scenarios.
- Grasping the concepts of energy efficiency.

Presentation

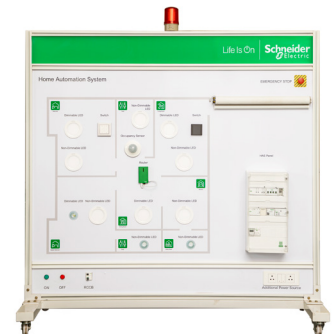
The KNX bench is designed to discover the home automation solutions for the residential and the commercial installations. The bench is made up of KNX products that are commonly used. The KNX modules are programmable and offers controllable network. The control functions improve comfort, security and flexibility for the occupant and owners. The system is complete, open and scalable.

Description

Components	
Description	Quantity
Resi9 box with 3 rows	1
10 A 30 mA ground-leakage circuit breaker	1
KNX bus power supply	1
USB interface	1
Multi-function pushbutton unit with 2 buttons	1
Multi-function pushbutton unit with 8 buttons	1
Presence detector with infrared receiver	1
Switching actuator with 4 outputs	1
Dimming actuator with 4 outputs	1
ETS5 Lite software program, 1 license	2
USB programming lead	1
10 m EIB cables for KNX bus	1
Set of KNX connectors and terminal strips	1
Accessories Kit	1

References

Description	Reference No.
Smart Home Automation - KNX Panel	AET-P01-HAS



10. Medium Voltage

Training objectives

- Finding out about a MV installation and its various components.
- Identifying risks.
- Operating and handling a MV structure.
- Finding out about the various types of cut-off device.
- Executing maintenance operations (fuses, etc.).
- Preparing for MV qualification

Presentation

These equipment units are made in compliance with the customer's sets of specifications. Their purpose is to provide training for work and procedures carried out on MV structures. On training grounds, these equipment units are powered by a 440 V supply while featuring the same functionalities as in the case of a 20 kV supply. This installation is used to learn to put the system into service.

Description

- Medium Voltage Cubicle.

Components	
Description	Quantity
400 A three-pole bars	1
Isolating switch + ground isolating switch with cut-off device in VCB	1
Over Current/Earth Fault relay	1
Master trip relay 86	1
Over voltage and Under voltage relay	1
Metering transformers	1
Suitable MCB's for various functions	1
Voltage presence indicators	1
MV/LV teaching type transformer	1

- Primary/secondary injection case for tripping tests on the protective devices.
- Low Voltage Cubicle

Components	
Description	Quantity
400 A three-pole bars	1
Isolating switch + ground isolating switch with cut-off device in ACB	1
Over Current/Earth Fault relay	1
Master trip relay 86	1
Over voltage and Under voltage relay	1
Metering transformers	1
Suitable MCB's for various functions	1
Voltage presence indicators	1

Accessory supplied	
Description	Quantity
Power Cables	1



11. Quality of energy

Study box for compensation of reactive energy - Basic

Training objectives

- Measuring electrical variables and phase offsets.
- Analysing consumption of reactive energy.
- Studying compensation of reactive energy.
- Implementing compensation capacitors.
- Studying over-compensation.

Presentation

This box is fitted with 3 lamps (linear loads) and an induction coil (nonlinear load) in order to generate a phase offset.

Compensation is provided using a set of 8 capacitors.

Each element is controlled separately.

Voltage and current measurement points are provided on the side of the box.

Description

Components of study box for compensation of reactive energy

Description	Quantity
Halogen lamps on a dimmer,	3
Phase offset induction coil	1
Capacitors,	8
Wired switches to diversify the circuits	
- for the capacitors	8
- for the lamps	3
- for the phase offset induction coil	1
- for the dimmer shunt	1
Light dimmer	1
Measurement point for the current consumed	1
Measurement point for the network voltage	1
Power lead.	1

References

Description	Reference No.
A2E study box for compensation of reactive energy	MD3BPCER



Decision aid

Sectors concerned

- Electrical
- Energy

Designated skills

- Analysis
- Configuring
- Studying

Themes studied

- Energy from renewable sources
- Energy management
- Measuring
- Energy storage

12. Quality of energy

Study box for compensation of reactive energy - Advanced

Training objectives

- Measuring the phase offset factor on linear and non-linear loads:
 - Influence of the line lengths,
 - Remedies enabling correction of the phase offset factor.
- Showing the inrush currents linked to closing of capacitors: measurement and reduction.
- Showing the overloads on capacitors (antiresonance) linked to harmonic phenomena.

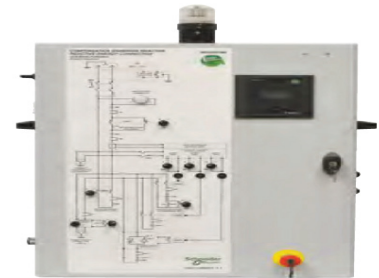
Presentation

This cabinet is representative of a reactive energy compensation installation.

It features the following functions:

- Linear phase offset loads enabling variations in the phase offset factor for the installation,
- Varmetric measurement system,
- Reactive energy compensation system provided by banks of capacitors slaved by the varmetric relay,
- Static contactor enabling cut-off of the inrush current linked to the capacitors,
- A system of non-linear loads showing the antiresonance phenomena linked to circulation of harmonics in the capacitors,
- Corrective device with antiresonance induction coil.

Comment: execution of measurements and projects involves use of an RMS type universal controller or specific instruments (harmonic analyser).



RPC study cabinet

Description

Control cabinet	
Description	Quantity
Mimic diagram	1
VarPlus Logic measurement system	1
Set of 3 capacitors.	1
Set of 3 induction coils	1
Measurement points on the right-hand side	

Lamp cabinet	
Description	Quantity
500 W halogen lamps controlled by a dimmer	3

References	
Description	Reference No.
RPC study cabinet for reactive power compensation	MDG99160

Decision aid

Sectors concerned

- Electrical
- Energy

Designated skills

- Analysis
- Configuring
- Studying

Themes studied

- Energy from renewable sources
- Energy management
- Measuring
- Energy storage

13. Renewable energies

Micro solar plant bench for OFF-GRID location

Training objectives

- Connecting the photovoltaic panels to study the various series/parallel combinations.
- Grasping the various constituent elements of a photovoltaic generation chain in isolated locations.
- Measuring the energy levels at the various points of the installation.
- Studying the battery charging and discharging constraints.

Presentation

This bench can be used to implement a solar power generation chain, from the photovoltaic panels to the 230 V AC receivers.

Description

Photovoltaic structure

photovoltaic structures (ref. MD3BPPV) can be linked together to constitute the generation field.

Each structure can be swivelled to determine the best exposure. Each structure consists of panels containing six photovoltaic cells.

Each panel is equipped with MC4 connection systems; it is necessary to know how to connect them (in series or in parallel*) depending on the electrical constraints of the conversion chain.

The connection is made via a coupling box connected to the main box via a 10 m cable (thus enabling studies to be carried out indoors).

By linking two structures, it is hence possible to provide a wider range of connections and higher power generation level.

Conversion box

This is equipped with: a regulator, a battery, an inverter, two selectable 230 V AC loads and protection and measuring equipment.

The regulator powers the 12 V DC battery and the 12 V DC/ 230 V AC inverter.

The inverter provides power for two 6 W or 11 W LED lamps.

Measurement points and ammeters are used to display and measure the charge and discharge current.



Photovoltaic structure



Conversion box and coupling box

References

Description	Reference No.
Photovoltaic structure for micro-solar plant bench	MD3BPPV
Conversion box for micro-solar plant bench	MD3BPSOLI

Note: With each conversion case (ref. MD3BPSOLI) two quantity of MD3BPPV shall be procured.

Decision aid

Sectors concerned

- Electrical
- Energy

Designated skills

- Analysis
- Checking
- Studying

Themes studied

- Renewable energies
- Measuring
- Energy storage

*Minimum two numbers of solar panels required for series or parallel combination.

14. Renewable energy

Solar water pumping bench

Training objectives

- Finding out about the bench for drawing water and implementing it.
- Studying operation, parametrisation and maintenance work on the ATV312 Solar variable speed controller.
- Sizing the photovoltaic panels necessary to operate the bench.

Presentation

This bench reproduces an autonomous solar-powered pumping solution proposed by Schneider Electric, in areas where no connection to the electricity network is possible. The electrical energy supplied by photovoltaic panels powers a specific variable speed controller directly. The system operates without a battery, with the objective of providing a constant supply of water thanks to the sizing of the tank in the light of the quantities of water needed and the daily number of hours of sunshine.

To facilitate use as a training tool, this model is powered:

- Either by a field of PV panels with a 300 V DC output,
- Or by a 24 V DC laboratory power supply,
- Or by the 230 V AC mains power supply.

Description

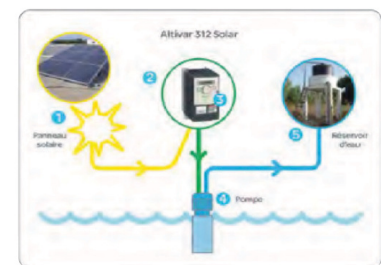
Contents	
Description	Quantity
Altivar 312 Solar 180 W variable speed controller	1
Centrifugal pump	1
High tank level limit switch with level sensor	1
Low tank level limit switch to simulate the water table	1
Pump on/off switch	1
Rotary knob to adjust the voltage	1
Pump on indicator light	1
Pump fault indicator light	1
Mushroom-head emergency stop button.	1
Power lead	1
Protective circuit breakers	

The bench requires two solar panels MD3BPPV to be linked to the 24 V DC input.

References	
Description	Reference No.
WATER OF THE SUN bench for drawing water using solar power	MD3BPODS
Photovoltaic structure for micro-solar plant bench	MD3BPPV



SUN WATER



Principle

Decision aid

Sectors concerned

- Electrical engineering
- Energy

Designated skills

- Analysis
- Studying

Themes studied

- Power electronics
- Renewable energies

15. Applications in the building trade

Photovoltaic / wind power bench for isolated locations

Training objectives

- Identifying the equipment.
- Operating the system and using the Web pages.
- Studying and sizing a solar and wind power installation.
- Studying the energy transfer and calculating autonomy depending on the battery configuration.
- Measuring and comparing the PV/wind power performance levels.

Presentation

This product is designed to help learners to find out about production of energy from renewable sources, using a solar panel and/or wind power, in the case of an isolated location. The electrical energy stored in the batteries can be used to power an outside equipment unit (230 V / 1 A maximum).

The wind turbine is driven by an asynchronous motor with a variable speed controller, to simulate different wind strengths.

A PLC monitors the state of charge of the batteries and switches the power supply over to the mains if necessary.

Description

Contents	
Description	Quantity
Aluminium profile structure fitted with wheels	1
Electrical box with mimic diagram panel	1
Swivelling PV panel measuring about 0.7 m ²	1
350 W wind turbine driven by an asynchronous motor	1
12 V lead gel batteries	1
24 V battery charger.	1
Regulator	1
24 V / 230 V inverter for isolated locations	1
PLC	1
Magelis terminal for dialogue, piloting and display of measurements	1
Ethernet coupler	1
Voltage and current measurement points for the photovoltaic and wind power systems	



Panel Side



Box Side

References

Description	Reference No.
Photovoltaic and wind power bench for isolated locations	MDG99215

Decision aid

Sectors concerned

- Electrical
- Energy

Designated skills

- Analysis
- Configuring
- Studying

Themes studied

- Energy from renewable sources
- Energy management
- Measuring
- Energy storage

16. City grid

Training Objectives

- Preparation of the operations of realization, commissioning, maintenance.
- Setting up, assembly and wiring of different systems.
- Modification of existing educational equipment to enable them to communicate.
- Installation of a communication network layer between equipment and supervision system.
- Study and implementation of different pre-configured consumption/production scenarios in a grid.
- Understanding interactions and associated consequences.

Description

Power grids are rapidly evolving. The phase-out of nuclear power and the reported growth in renewable energies are leading grid operators to a new model for balancing energy consumption and production. Historically, production has adapted to consumption. Producers use consumption forecasts to plan the production resources required and modulate capacity with enough margin as consumption changes over the course of a day. However, the mass introduction and the rising share of renewable energies has challenged this method. Non-controllable renewable energies, like wind and solar power, represents a high risk of imbalance for the grid. If generation substantially exceeds consumption, or vice versa, power outages are likely to happen. The solution is the smart grid, which modulates consumption to track changes in production. Hence consumption adapts to production. At a local scale, it is known and developed as a microgrid.

- To explain how an intelligent electrical grid operates, we modeled the operation of an eco-district. This eco-district is made up of different areas which represent different profiles of consumption and production:
 - Residential zone: composed of nearly 50 houses with electric heating, renewable energy self-production and electric vehicle charging terminals.
 - Tertiary zone: composed of 1 building of offices with thermal storage and renewable energy self-production.
 - Industrial zone: composed of 1 manufacturing site with 2 production lines and power generator.
 - Infrastructure zone: represented by a street with public lighting and electric vehicle charging terminals.
 - Energy production zone: represented by renewables energies, with photovoltaics and wind turbines, associated with a conventional grid power supply.
- The five Zones are supervised by an Operator Station in charge of managing the needs and resources necessary for the overall functioning. This coordinator continuously visualizes the consumption/production balance of all the Zones. He sends the orders for energy storage or shedding and impose the operating mode (automatic, manual, connected), under the concept of "Balance Response".
- The main interest of this set is to be able to connect each Zone control station to an existing educational equipment, consistent with the associated Zone. This connection is made thanks to the GRIDBOX.
- In case the educational equipment would not exist on the pedagogical platform, it can be replaced by a Simulation Box coherent with the desired area

References

Description	Reference No.
Citygrid complete 6 stations	MDGCGCITY
Citygrid simu box building	MDGCGSIMUBUILD
Citygrid simu box energies	MDGCGSIMUENR
Citygrid simu box industry	MDGCGSIMUIND
Citygrid simu box infrastructure	MDGCGSIMUINFRA
Citygrid simu box resi	MDGCGSIMURESI



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