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Electrical Power Engineering, Smart Grid Trainers

Training systems on the generation, distribution and management of electrical energy:

- Power engineering training system, distribution training system
- Energy generation training system, renewable energy generation training system
- Transformer training system, high-voltage transmission lines training system, protective systems training system
- Energy management training system, smart grid training systems

The Lucas-Nülle training systems have been designed in anticipation of the newest developments:

- Smart measuring instruments provided with various communication interfaces (e.g. LAN, RS485, USB) and control elements
- SCADA Power Engineering Lab software for the intelligent control and evaluation of "smart grids" using Soft PLC
- SCADA software designed for educational purposes
- Permits investigation of dynamically alternating loads and power generation inside the laboratory
- Intelligent energy management
- Modular integration of renewable energies into a smart grid using protective engineering
- Wind power plant with doubly-fed asynchronous generator (DFIG) and synchronisation to the grid
- Interactive multimedia training course

Renewable Energies

Renewable Energies

The move away from coal, oil and nuclear power to renewable forms of energy is gaining momentum. Today, technology has evolved to a point where solar energy, wind power, hydrogen fuel and biomass can be exploited as environmentally friendly energy sources.

Throughout the world well-qualified technicians and engineers are being sought after to help keep this trend moving forward. Today, technologies are undergoing rapid change. This trend is being compounded by rising expectations in training and education. Lucas-Nülle has developed the appropriate training systems needed to cope with the ever more complex world of training and education.

EHY 1 Advanced fuel cell technology

EHY 1 Advanced fuel cell technology

The generation of electrical energy using fuel cells continues to develop into a significant area with diverse application potential in electrical engineering and automotive technology. The training panel system permits a safe experimenting environment in connection with hydrogen and fuel cells. At the same it permits interesting investigations and is well suited for both practical lab work as well as demonstrations. Animated theory, experiment guidelines and information including results are supplied using the “Interactive Lab Assistant”.

Training content

- Design and operation of a fuel cell
- Design and operation of an electrolyser
- Design and operation of a metal hydride storage cell
- Thermodynamics of the fuel cell
- Characteristics and power curves of the fuel cell
- Efficiency
- Required systems for standalone power supply
- Power electronics and voltage conversion

Basic equipment set, consisting of:

Basic equipment set, consisting of:

Pos.
Product name
Bestell-Nr.

Anz.

Fuel cell with DC converter
CO3208-6A

Training panel with fuel cell stack, consisting of 10 cells connected in series. The panel contains all of the functioning elements need for the operation of an autonomous fuel cell power supply. An integrated DC-DC converter with overcurrent limiter generates a stable 12 V voltage out of the load-dependent voltage of the fuel cell. The integrated interface measures all of the relevant variables, controls the processes and monitors all of the safety-relevant parameters.

- Fuel cell stack
- Rated power / maximum power: 40W / 50W
- No-load / nominal voltage: 9V / 5V
- Nominal current / maximum current: 8A / 10 A
- Hydrogen consumption at rated power: 580 Nml/min.
- Fan with adjustable speed
- Fast action coupling connection for hydrogen supply
- Flow-rate meter for hydrogen
- Rinse valve with hose connection
- Terminal connection for hydrogen supply –solenoid valve via 9-pin S-sub socket
- Plug-in power supply, 12 V, stabilised
- 4 each 4mm safety sockets
- Status display via 2 x LEDs
- Main switch and START button
- CD with Interactive Lab Assistant “Fuel Cell Technology“
- Microprocessor control
- 7 each 4-digit 7-segment display
- RS485 interface
- USB interface

- Dimensions: 297 x 460 x 350mm (HxWxD)
- Weight: 6.8kg

2

Electronic load 200W/20V/10A
CO3208-6B

1

Electronic load for all experiments carried out in the area of fuel cell technology. The electronic load operates in constant current mode and keeps the current constant at a set value regardless of voltage fluctuations. The additional integrated lamps in the form of a traffic light are used as a 12V load

- Electronic load
- Max. continuous power: 200 W
- Voltage range: 1.2 … 20 V DC
- Max. current: 10 A
- Control accuracy: 0.1%
- 2 status LED
- Fan cooled
- Setpoint generated using 10-turn potentiometer or via RS485
- Power switch, switch LOAD ON /OFF
- 2 x RS485 interface
- Microprocessor control
- 4-digit 7-segment display
- Excess load and temperature monitoring
- Lamp power consumption 3 x 2.7 W
- Switch for lamp with 3 settings: OFF/ON/AUTO
- Dimensions: 297 x 460 x 350mm (HxWxD)
- Weight: 5kg

3

Metal hydride storage cell with solenoid valve
CO3208-6C

1

Metal hydride storage cell with solenoid valve, pressure regulator and manometer for power supply of fuel cell. The metal hydride storage cell is used fort he reversible temporary storage of gaseous hydrogen. An electrolyser is required for filling operation.

- Metal hydride storage cell with check valve and quick-action coupling
- 1-stage pressure regulator with manometer

- Solenoid valve, closed when de-energised
- Hydrogen connection line 1/8 ´´with quick action coupling system

The metal hydride battery is supplied separately since it is classified as hazardous material.

4

Electrolyser, 30 Normlitre/hour (1.06 cubic feet/h, 7.93 gallons/h, 30000 cc/h)
CO3208-6D

1

Hydrogen generator as safe and comfortable electrolysis-based source for laboratory hydrogen. For flexible and reliable generation of hydrogen of high purity for fuel cell applications. The hydrogen generator makes you independent of hydrogen suppliers that use compressed gas cylinders and is optimal for filling metal hydride storage cells thanks to its high quality of the hydrogen it produces.

Equipment features:

- Laboratory equipment for table-top setup
- Integrated tank for distilled water
- Integrated maintenance-free drying unit
- Microcontroller control and LC display that is operated intuitively
- Setpoint pressure regulation with intelligent leak detection
- Hydrogen connection terminal fits the metal hydride storage assembly

Technical data:

- Hydrogen power: 30 standard litres/h
- Hydrogen quality: 6.0 (= 99.9999%)
- Output pressure: 0.1 … 10.7 bars, digitally adjustable
- Power connection: 110 … 230 V AC, 50 …60 Hz
- Power consumption: 300 VA
- Ambient conditions.: +15 … +40 °C, 0 … 80% rF
- Noise emission: 46 dB(A)
- Dimensions: 230mm x 355mm x 410mm (W x D x H)
- Weight: 19 kg

Media:

Pos.
Product name
Bestell-Nr.

Anz.
5

Interactive Lab Assistant: Fuel cell technology - Advanced course
SO2800-3B

1

The multimedia training, measurement and experimentation software conveys everything there is to know about fuel cells in a graphic fashion, providing experiment instructions, visualisation of all measurements and giving feedback on all the solutions entered. The physical fundamentals are demonstrated using easy-to-understand animations. The Interactive Lab Assistant in conjunction with the virtual instruments forms a comfortable experiment and measurement environment.

- Interactive experiment setups
- Animated theory
- Measured values and diagrams can be stored in the experiment instructions using drag und drop technology
- Questions with feedback and evaluation logic to monitor learning progress
- Print document function for comfortable printing of the experiment instructions with solutions
- CD-ROM with Labsoft browser, course software and virtual instruments
- Course duration 7 h approx.

Accessories:
Pos.
Product name
Bestell-Nr.

Anz.

6

Safety connecting plug 4mm with tap (2x), black, 1000V/32A CAT II
SO5126-3R

6

Moulded insulation

- both sides with touch protection (safety plug + safety sockets), distance 19mm
- transition resistance max. 6mΩ
- rated data: 1000V/32A CAT II
- colour black

7

Safety measurement cable (4mm), 50cm/20", red
SO5126-8K

3

Safety measurement lead with stackable, contact-proof 4mm plugs

- colour: red
- length: 50 cm
- cable cross-section 2,5 mm^2
- ratings deliver: 600V CAT II, 32A

8

Safety measurement cable (4mm), 50cm, black
SO5126-8L

3

Safety measurement lead with stackable, contact-proof 4mm plugs

- Colour: black
- Length: 50 cm
- Wire cross section 2.5 mm^2

- 

9

Mobile aluminium experiment stand, 3 levels, power strip with 6 sockets, 1250x700x1995mm
ST7200-3A

1

High-quality, mobile experiments stand from the SybaPro range for demonstrations and experiments. Features aluminium profile legs compatible with all add-ons and extensions for the SybaPro system.
The mobile experiment stand is supplied in kit form and needs to be assembled by customers themselves.

Table top:

- 30-mm table top made of highly compressed, multi-layer fine chipboard conforming to DIN EN 438-1
- Colour grey, RAL 7035, with 0.8-mm slightly textured laminate coating (Resopal) on both sides, conforming to DIN 16926
- Resistant to many chemicals and reagents including dilute acids and alkalis
- Resistant to heat, e.g. molten solder or heating at specific points such as by soldering tips or cigarette ends
- Table top with solid impact-resistant protective edging made of 3mm thick RAL 7047 coloured plastic
- Coating and adhesive are PVC free
- Power strip with 6 outlet sockets mounted underneath the table top, lead and earthed plug

Frame:

- 2 extruded aluminium profiles with multiple grooves 1800 x 120 x 40 mm (WxHxD)
- 8 equally sized grooves in extruded aluminium profiles (3 on each side and 1 each on the front and back)
- Grooves accommodate standard industrial mountings
- 4 H-shaped aluminium profiles, 1150 mm, for 3-layer organisation of DIN A4 panels
- Space for extension of power supply duct
- Base made of rectangular tubing with 4 swiveling double casters, 2 of which have brakes
- Table frame made of tough combination of rectangular tubing around the full perimeter
- Acid-resistant epoxy-resin coating, 80 µm thick (approx.), colour RAL 7047

Dimensions:

- Height of table top 760 mm
- 1250 x 1995 x 700 mm (WxHxD)

10

Wall or aluminium-profile mounting cable storage for 48 cables
ST8003-8E

1

Accommodates about 48 safety measuring leads (4mm), suitable for mounting on walls or aluminium profiles

- Width 200 mm, 12 guide grooves for leads
- Adjustable height for mounting on aluminium profiles
- Can be mounted on the left or right
- Can be mounted on walls
- Includes 2 screws and tenon blocks
- Acid-resistant epoxy-resin powder coating, thickness 80 µm approx., colour RAL 7047

11

PC holder for SybaPro experiment trolleys, height/width adjustable
ST7200-5A

1

Shelf for desktop PC made of 2mm sheet steel punched with holes, suitable for all furniture in the SybaPro aluminium profile range

- Adjustable assembly height
- Adjustable width (130 - 225mm)
- Can be mounted to left or right
- Includes all equipment necessary for assembly (4 bolts and 4 tenon blocks)
- Acid-resistant epoxy-resin powder coating, 80µm thick approx., colour RAL7047

12

Monitor holder for flat screen monitor of weight up to 15kg / 33lbs
ST8010-4T

1

Pivoting monitor holder for attachment to aluminium profiles of furniture in the SybaPro range. Allows a monitor to be placed in the optimum position so that work and experiments are less tiring.

- Pivoting arm with two-part joint
- Quick-lock for adjustment to any height on extruded aluminium profile
- VESA fastening 7.5 x 7.5cm
- Includes VESA 75 (7.5x7.5) - VESA 100 (10x10) adapter
- 2 Cable clips
- Adequate carrying capacity 15kg / 33lbs
- TFT monitor can be turned parallel to the table edge

- Separation can be adjusted to anywhere between 105 and 480mm

Additionally included:

Cable management set for installing cables along the profiles of the aluminium lab system furniture in the SybaPro range, consisting of:

- 3 Cross cable binders for front and rear grooves of aluminium profile
- 3 Cross cable binders for side grooves of aluminium profile
- 12 Cable binders
- 4 Aluminium cover profiles for covering and enabling wires to be run along the grooves of an aluminium profile

13

Keyboard adapter for flat screen monitor holders
ST8010-4G

1

Keyboard adapter for use in combination with flat screen monitor holders

- Mounted between monitor and mount for flat screen monitor holder
- Variable 3-level height adjustment via multiple pre-drilled mounting holes
- Two rows of mounting holes for use with equipment meeting VESA 75 and VESA 100 standards
- Keyboard shelf inclined by about 30° for comfortable and ergonomic usability
- Keyboard shelf with 11-mm folded edging to prevent falling, including handle
- Variable 2-level depth attachment for keyboard shelf (252/276 mm)
- Extra-wide keyboard shelf (640 mm) can accommodate a mouse as well
- Depth of keyboard shelf 172 mm
- Includes two cable clips for guiding and bundling cables
- Maximum load 10 kg
- Dimensions (HxWxD) 360 x 640 x 276 mm

14

Protection cover for three-level experiment trolleys
ST8010-9Y

1

Dust cover for three-level experiment trolleys

- For protecting equipment from dust and damp
- For keeping equipment out of sight (the cover must not be transparent, so is therefore opaque)

- Colour: matt dark grey with printed LN logo in orange)
- Material: nylon fabric with polyurethane coating
- High resistant to tearing, impregnated to be washable and waterproof

Recommended learning management software for all LN multimedia courses:

Optionally available: multi user license with 5 or 10 dongles and update to version 4.0

Pos.
Product name
Bestell-Nr.

Anz.
15

LabSoft Classroom Manager 5.0 software suite, single license
SO2001-5A

1

LabSoft Classroom Manager is a comprehensive set of administration software for the UniTrain system and all LabSoft courses. Classroom Manager comprises the following independent program components:

- LabSoft Manager: Administration of students and courses in LabSoft
- LabSoft Reporter: Student reports and statistics
- LabSoft Editor: Creation and editing of courses and tests
- LabSoft Questioner: Creation of questions, measuring exercises and sets of questions for courses and tests
- LabSoft TestCreator: Automatic generation of tests on the basis of sets of questions

Features:

- Ease of use of all programs thanks to graphical user interface in all component programs
- For use in local area networks or on stand-alone PC
- Ease of installation
- No additional database software required
- Access control via USB dongle
- Available languages: DE, EN, ES, FR, RU, PT, ZH, LO

LabSoft Manager:

- Administration of LabSoft network installation
- Administration of an unlimited number of students and courses in LabSoft
- Addition, deletion and editing of courses and tests in LabSoft
- Addition, deletion and editing of students and student data
- Addition, deletion and editing of student groups (classes)
- Assignment of students to classes
- Activation of team function in LabSoft
- Assignment of courses and tests to students or classes

LabSoft Reporter:

- Electronic monitoring of student progress
- Graphical presentation of progress in courses and tests
- Presentation of student or group results
- Reports on courses, tests, single users or classes
- Summary of results and time
- Export of data to clipboard or file
- Display and printing of tests which have been taken with the candidate's original answers
- Multiple search options for students, classes, courses or tests

LabSoft Editor:

- HTML editor for easy to use editing of LabSoft courses
- Editing of course pages
- Wizard for creation of new courses and course pages
- Automatic inclusion of new courses in an existing LabSoft installation
- Automatic creation of IMS-compatible navigation tree without the need for programming knowledge
- Moving course pages within the navigation tree at the click of a mouse
- Editing in WYSIWYG mode
- HTML view and page preview
- Insertion of graphics, animations and tables
- Insertion of test questions
- Page templates for a variety of page types

LabSoft Questioner:

- Program for creating and editing questions, practical measuring exercises and sets of questions (question files) for electronic evaluation
- Easy creation of exercises and questions for courses and tests
- 7 different types of question: single and multiple choice, missing text, assignment, matrices, arbitrary text, selection of images
- Ability to input meta data (points, time for questions, difficulty, required resources, etc.)
- Easy specification of tolerances for practical measuring exercises
- Changes to the assessment criteria for courses or tests (including after the test has been taken)

LabSoft TestCreator:

- Program for automatically creating electronic tests from sets of questions (question files)
- Automatic and manual selection of questions and measuring exercises
- Filter functions (e.g.: type of question, difficulty) for pre-selection of questions
- Automatic generation of tests according to a set time or number of questions
- Various test options: arbitrary order of questions in a test, immediate display of results after completion
- Automatic registration of tests in LabSoft
- Preview function showing the test as created

Includes:

- CD-ROM with LabSoft Classroom Manager
- 1 USB-dongle for operation of program

System requirements:

- Server or PC with Windows 7, 8, 8.1 or 10
- Microsoft Internet Explorer 9.0 or higher
- Minimum 200 MB free disk space
- 1 free USB-port for USB-dongle

Collection of electronic assignments questions and measuring exercises for the UniTrain courses on the topic of electrical power engineering and renewable energies. With the help of Labsoft TestCreator, these questions and measuring exercises can easily be assembled into electronic tests. The tests can then be carried out in LabSoft.

- A total of some 200 questions and measuring exercises for the UniTrain courses on the topics of Photovoltaics, Fuel cell technology, Transient processes in AC and DC networks and the multimedia course Small wind power plant

- About 25% are practical exercises to be carried using the training systems in order to test handling skills and practical abilities
- About 30% are newly assembled questions previously contained in the courses
- It is possible to extend the collection with your own questions and assignments
- Other collections can be imported
- All questions and assignments can be edited
- 6 different types of questions (single choice, multiple choice, missing text, matching, matrix matching and image choice)

- Extensive metadata for all questions and assignments to make it easier to create tests (degree of difficulty, points, topic area, time to complete, type of question, training systems needed for practical exercises)