

Content

Content	1
Electrical Power Engineering	2
Renewable Energies	2
EPH 2 Advanced photovoltaics	3
EPH 2.1 Investigating solar modules	4
EPH 2.2 Design of PV systems in an isolated power network	19
EPH 2.3 Design of PV systems in parallel network operation	37

Electrical Power Engineering

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

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

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

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

Renewable Energies

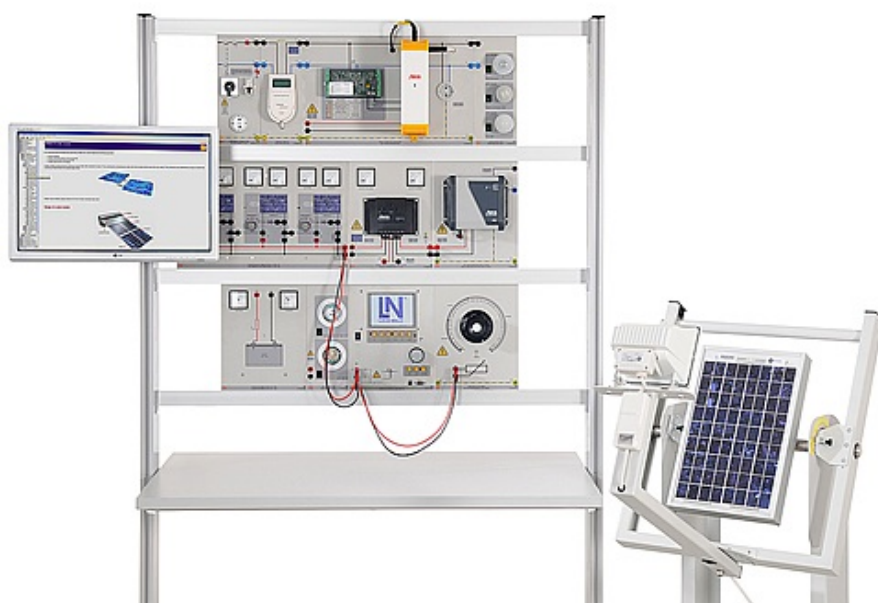


Renewable Energies

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.

EPH 2 Advanced photovoltaics



EPH 2 Advanced photovoltaics

The Advanced Photovoltaics course enables project work to be carried out with industrial components.

The system permits realistic simulation of the progression of the sun. Emulators make it possible to carry out the experiments in the laboratory without the sun.

The Interactive Lab Assistant Advanced Photovoltaic multimedia course is designed to convey the theoretical information and practical know-how, and performs the PC-supported evaluation of measurement data.

EPH 2.1 Investigating solar modules

EPH 2.1 Investigating solar modules

Training content:

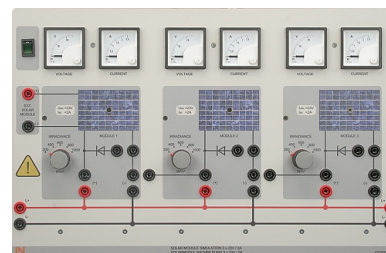
- Testing the optimum alignment of solar modules
- Recording the characteristics of solar modules
- Investigating the module's response to shadow formation
- Investigating how bypass diodes operate
- Learning about various types of wiring and connection configurations for solar modules

Equipment set, consisting of:

Equipment set, consisting of:

Pos.	Product name	Bestell-Nr.	Anz.
1	Solar module simulation model, 3-fold, 23V / 2A	CO3208-1A	1

The solar module simulation board puts at your disposal three independent simulations of a solar module allowing you realistic solar module emulations. Higher voltages and stronger currents can be realised by means of series and parallel circuit configurations. For each simulation a separate solar light intensity can be set and a bypass diode added. Areal solar module can be connected to the board by means of the two MC3 connection terminals (solar connector plugs).



The Solar Module Simulation model is designed with the following features:

- No-load voltage: 3 x 23V
- Maximum short-circuit current: 3 x 2 A
- Light intensity adjustable from 20% ... 100%
- Bypass diode connectable
- Short-circuit proof
- Power: 3 x 40 VA
- Displays: Voltmeter 0 ... 15 V (analog), ammeter 0 ... 2.5 A (analog)
- Connection terminals: PV-ADBP3, PV-ADSP3, 4 mm safety sockets
- Operating voltage: 88 ... 264 VAC, 47 ... 63 Hz
- Dimensions: 297 x 456 x 210 mm (HxWxD)
- Weight: 6.8 kg

2 Solar module with solar altitude emulator

CO3208-1B

1

The solar module rack consists of a polycrystalline solar module and a halogen spotlight as solar simulator. The brightness of the halogen spotlight can be adjusted using a dimmer. Various rooftop angles can be emulated using the tilt adjustment of the solar module allowing these effects on the solar module to be investigated. The halogen spotlight is swivel mounted permitting it to simulate the progression of the sun over a whole day. To be able to emulate the various progressions of the sun over the entire year, the tilt angle of the sun's progression can be adjusted.

Technical data – halogen spotlight:

- Power: 500W
- Power supply: 230 V

Technical data – solar module:

- No-load voltage: 21 V
- Short-circuit current: 650 mA
- Peak power: 10 Wp
- Weight: 10 kg



3 Load unit 1kOhm, 500W

CO3208-1J

1

Load resistor for solar module and solar power units.

The resistor can be used with the following:

- Solar module/simulation for recording characteristics and load resistance
- Solar charge regulator as load resistance
- Inverter as load resistor

The solar load is equipped with the following features:

- Resistor: 0...1 kOhm / 500 W continuously adjustable, with stepped winding
- Current:
 - 0 – 50 Ohm max. 6A
 - 51 – 200 Ohm max 2A
 - 201- 1k Ohm max 0.6A
- Connection terminals: 4 mm safety sockets
- Dimensions: 297 x 228 x 160 mm (HxWxD)
- Weight: 4.3 kg



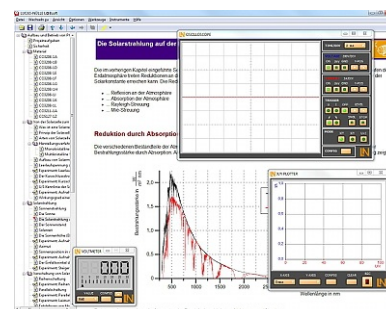
Media:

Pos.	Product name	Bestell-Nr.	Anz.
4	Interactive Lab Assistant: Photovoltaic systems - Advanced course	SO2800-3A	1

The experiment instructions come in the form of an Interactive Lab Assistant course. This multimedia course is a step-by-step guide through the topic of modern photovoltaic energy systems. The physical fundamentals are conveyed using easy to understand animations. The Interactive Lab Assistant in conjunction with the virtual instruments constitutes a comfortable experimenting environment.

Special features:

- Interactive experiment setups
- Measured values and diagrams can be stored in the experiment instructions per drag and drop
- Virtual instruments can be started directly from the experiment instructions
- Includes questions with feedback and evaluation logic for progress monitoring
- Documents can be printed out for hardcopy of experiment instructions including solutions
- CD-ROM with Labsoft browser, course software and virtual instruments
- Course duration 14 h approx.



Measuring instruments:

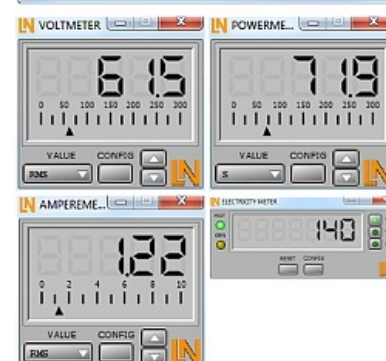
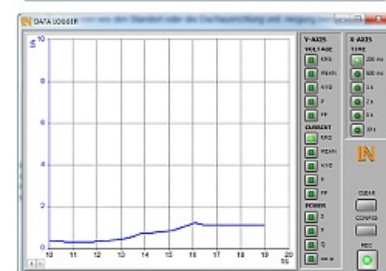
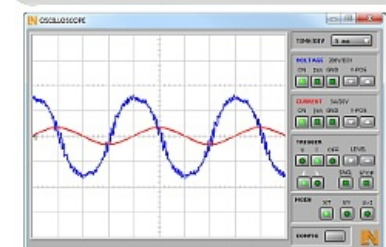
5 Analog/digital multimeter, wattmeter + power-factor meter incl. Software

CO5127-1Z

1

The areas of electrical machines, power electronics and drive technology pose particular problems for measuring instruments. In addition to high-performance overload protection, the acquisition of measurement values must be performed accurately independently of the curve's shape. The universal measuring device has been designed particularly to satisfy these requirements. It can simultaneously replace as many as four different measuring instruments – constituting a current/voltmeter, power and phase-angle meter all in one. The graphic display allows for both student as well demonstration experiments. The VI Starter software included allows for visualisation of measurements on a PC.

- Simultaneous, measurement of voltage and current independent of the curve shape (max. 600 V, 20 A) (measurement of clocked voltages)
- Calculation of active, apparent and reactive power as well as the power factor
- Measurement of the total rms (RMS-AC+DC); AC rms (RMS-AC) and arithmetic mean (AV-AC+DC)
- Impervious to electrical damage up to 20 A/600 V
- Large-scale, high-contrast background-illuminated graphic display (5,7")
- Large-scale display or display of up to 4 measurement values
- Digital or pseudo-analog display
- USB interface
- Internal resistance: current path 10mOhm, voltage path 10MOhm
- Voltage ranges: 30;300; 600V
- Current ranges: 1; 10; 20A
- Measurement accuracy: 2%
- Automatic or manual measurement range selection
- Demonstration test instrument for mains operation
- Operating voltage: 230V, 50/60Hz
- Dimensions: 297 x 228 x 140mm (HxBxT)
- Weight: 2kg






The VI Starter software allows all the measurements to be displayed on the PC. Up to 17 different displays can be opened.

- Oscilloscope display of voltage, current and power
- Consumption meter to display power consumed and output

- Data logger for 14 different variables
- Data export for data logger
- Characteristic recorder
- Labview driver and supplied examples
- 32-bit version for Windows

Accessories:

Pos.	Product name	Bestell-Nr.	Anz.
6	Safety connection plug 19mm/4mm, black, with tapping Max. sustained current: 24A <ul style="list-style-type: none"> • Contacts: 4mm laminated plugs • Contact-protected • Insulation class CAT II / 600V 	SO5126-9R	5
			
7	Safety connection plug 19mm/4mm, black Max. sustained current: 24A <ul style="list-style-type: none"> • Contacts: 4mm laminated plugs • Contact-protected • Insulation class CAT II/600V 	SO5126-9Y	20
			
8	Safety connection plug 19mm/4mm, red Max. sustained current: 24A <ul style="list-style-type: none"> • Contacts: 4mm laminated plugs • Contact-protected • Insulation class CAT II / 600V 	SO5126-9U	10
			

9 **Safety connection plug 19mm/4mm, blue**

SO5126-9V

5

Max. sustained current: 24A

- Contacts: 4mm laminated plugs
- Contact-protected
- Insulation class CAT II / 600V



10 **Safety connection plug 19mm/4mm, green/yellow**

SO5126-9W

5

Max. sustained current: 24A

- Contacts: 4mm laminated plugs
- Contact-protected
- Insulation class CAT II/600V



11 **Set of safety measurement cables, 4mm (23 leads)**

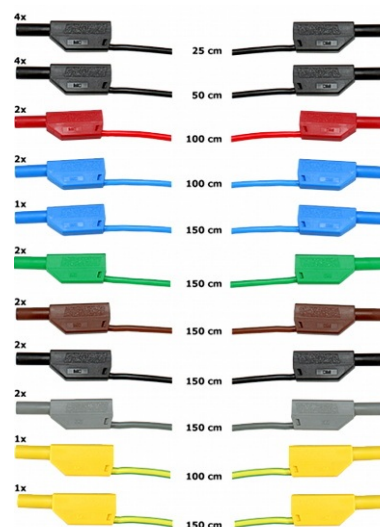
SO5148-1L

1

Safety measurement cables with 4mm safety plugs, coloured, PVC insulation, highly flexible

Each set includes the following:

- 4 x 25cm long, black
- 4 x 50cm long, black
- 2 x 100cm long, blue
- 2 x 100cm long, red
- 1 x 100cm long, green/yellow
- 1 x 150cm long, blue
- 1 x 150cm long, green/yellow
- 2 x 150cm long, green
- 2 x 150cm long, brown
- 2 x 150cm long, black
- 2 x 150cm long, grey
- Wire cross section 2.5 mm²
- Capacity/category: 600V CAT II, 32A



12 **Safety measurement cable (4mm), 50cm, red**

SO5126-8K

4

4 mm safety measurement cable, 50 cm, red

- Cable cross-section 2,5 mm²
- Insulation class CAT II / 600V

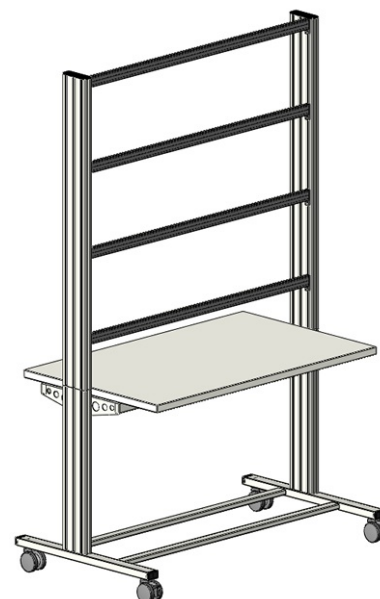


13 **Mobile aluminium experiment stand, 3 levels, 6x earthed sockets, 1250x700x1955mm** ST7200-3A 1

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 supply with 6-outlet socket strip mounted underneath the table top, 2-m lead and earthed plugs



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 swivelling 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 1955 x 700 mm (WxHxD)

14 **Wall or aluminium-profile mounting cable storage for 48 cables**

ST8003-8E

1

Accommodates about 48 safety measuring leads Suitable for mounting on walls or aluminium profiles



15 **PC holder for Syba experiment trolleys, height and width adjustable**

ST7200-5A

1

Shelf for desktop PC made of 1.5mm sheet steel punched with holes, suitable for all furniture in the SybaPro aluminium profile range

- Adjustable assembly height
- Adjustable width (160 - 255mm)
- 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



16 **Monitor holder for flat screen monitor of weight up to 10kg, VESA 75/100**

ST8010-4L

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 10kg
- 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

The set consists of the following:

- 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

17 Protection cover for three-level experiment trolleys

ST8010-9Y

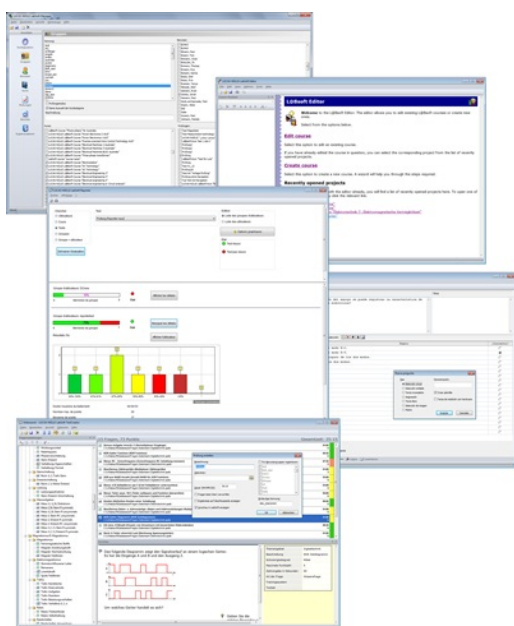
1

Dust cover for three-level experiment trolleys

- For protecting equipment from dust and damp
- For keeping equipment out of sight
- 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:



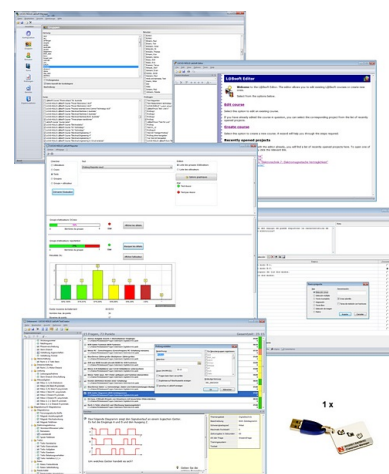
Optionally available: multi user license with 5 or 10 dongles and update to version 4.0

Pos.	Product name	Bestell-Nr.	Anz.
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18	Software, LabSoft Classroom Manager 4.0, single licence (D, GB, F, E, RU, PT)	SO2001-5A	1
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LabSoft Classroom Manager is a comprehensive set of administration software for the UniTrain-I 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: D, GB, E, F, RU, PT

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
- 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
- Calculation of average results for groups
- 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

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:

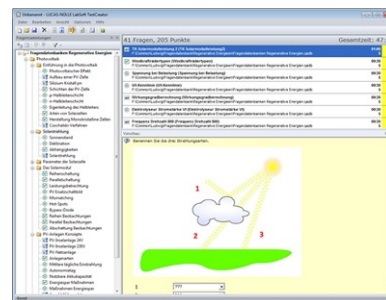
- Server or PC with Windows Vista, 7, 8 or 8.1
- Microsoft Internet Explorer 7.0 or higher
- Minimum 100 MB free disk space
- 1 free USB-port for USB-dongle

19 Collection of assignments Power Engineering / Renewable Energies

SO2001-6D

1

Collection of electronic assignments questions and measuring exercises for the UniTrain-I 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-I 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)

EPH 2.2 Design of PV systems in an isolated power network

EPH 2.2 Design of PV systems in an isolated power network

Training content:

- Installation of PV systems
- Design and testing of a standalone PV systems in direct operation
- Design and testing of a standalone PV system in storage operation
- Design and testing of a standalone PV system for the generation of 230 V AC voltage

Supplement to basic set, consisting of:

Supplement to basic set, consisting of:

Pos.	Product name	Bestell-Nr.	Anz.
20	Solar charge controller 12/24V, 6A	CO3208-1M	1

The solar charge controller monitors the charge level of the accumulator and protects this against excessive and deep depletion. To charge up the lead accumulator, the charge controller uses the IU charging processes. LEDs provide information regarding the operating and charge status.

The charge regulator is equipped with the following features:

- Automatic 12/24 V switching
- Charge/discharge current: 10 A
- MPP-Tracker
- Gassing regulation
- Connection terminals for:
 - Solar generator
 - Solar accumulator
 - DC load
- Displays: Voltmeter 0 ... 15 V (analog), ammeter 0 ... 10 A (analog)
- Connection terminals: 4 mm safety sockets
- Dimensions: 297 x 228 x 105 mm (HxWxD)
- Weight: 1.1 kg



21 Solar Accumulator 12V, 7Ah

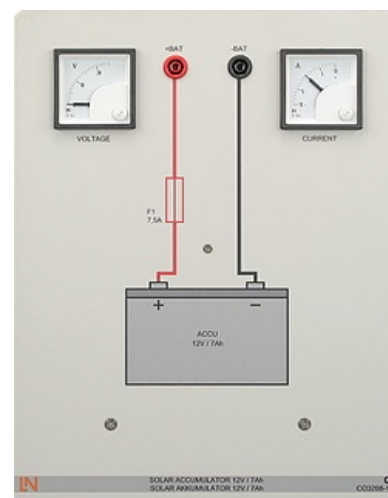
CO3208-1E

1

In modern standalone solar power systems, lead accumulators are used for energy storage. The Solar Accumulator Board is equipped with a maintenance-free and fully-enclosed lead accumulator permitting use at any location.

The solar accumulator is equipped with the following features:

- Voltage: 12 V
- Capacity: 7 Ah
- Re-chargeable
- Overcurrent protection
- Displays: Voltmeter 0 ... 15 V (analog), ammeter -6 ... 6 A (analog)
- Connection terminals: 4 mm safety sockets
- Dimensions: 297 x 228 x 135 mm (HxWxD)
- Weight: 3.7 kg



22 Off-grid inverter 230V, 275VA

CO3208-1F

1

To operate standard commercially available electrical devices used in standalone solar power systems, the generated DC voltage must be converted into AC voltage. The board consists of a commercially available off-grid inverter which generates an output voltage of 230 V AC from an input voltage of 12 V DC. The off-grid inverter is equipped with a deep depletion protection facility with which it can be connected directly to a lead accumulator.

The off-grid inverter is equipped with the following features:

- On/off switch
- LED display of operating status
- Acoustic alarm to signal warnings
- Output voltage: sinusoidal 230V +/- 5%
- Power: 275VA
- Efficiency: 93%
- Safety functions:
 - Cut out for excess battery voltage
 - Over temperature and overload protection
 - Short-circuit protection
 - Pole reversal protection
- Earthing contact socket outlet
- Connection terminals: 4 mm safety sockets
- Dimensions: 297 x 228 x 145 mm (HxWxD)
- Weight: 3.1 kg



23 Lamp board 12V

CO3208-1K

1

The lamp board allows for study and comparison of halogen and LED lights. The bulbs are of the same brightness and each can be activated individually. This allows for a variety of power-consumption scenarios to be investigated.

The lamp board has the following features:

- Halogen lamps 25W
- LEDs 2W
- Operating voltage: 12V
- Dimensions: 297 x 114 x 210 mm (HxWxD)
- Weight: 1.2 kg



24 Lamp board 230V

CO3208-1L

1

The lamp board permits the investigation and the comparison of light bulb, energy saving lamp and LED bulb.

All illuminant have the same brightness and can be switched on individually.

Technical Data:

- Light bulb: 25W
- Energy saving lamp: 4W
- LED-bulb 4W
- Operating Voltage: 230V/ 50/60Hz
- 3 sockets E27
- Dimensions: 297 x 114 x 210 mm (HxBxT)
- Weight: 1,8 kg



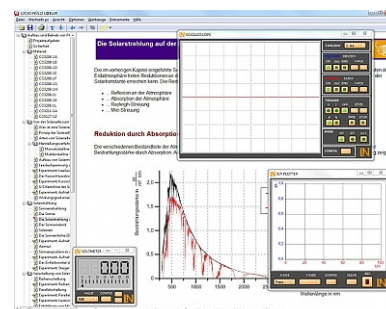
Media:

Pos.	Product name	Bestell-Nr.	Anz.
25	Interactive Lab Assistant: Photovoltaic systems - Advanced course	SO2800-3A	1

The experiment instructions come in the form of an Interactive Lab Assistant course. This multimedia course is a step-by-step guide through the topic of modern photovoltaic energy systems. The physical fundamentals are conveyed using easy to understand animations. The Interactive Lab Assistant in conjunction with the virtual instruments constitutes a comfortable experimenting environment.

Special features:

- Interactive experiment setups
- Measured values and diagrams can be stored in the experiment instructions per drag and drop
- Virtual instruments can be started directly from the experiment instructions
- Includes questions with feedback and evaluation logic for progress monitoring
- Documents can be printed out for hardcopy of experiment instructions including solutions
- CD-ROM with Labsoft browser, course software and virtual instruments
- Course duration 14 h approx.



Measuring instruments:

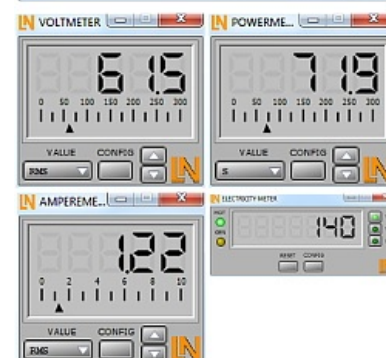
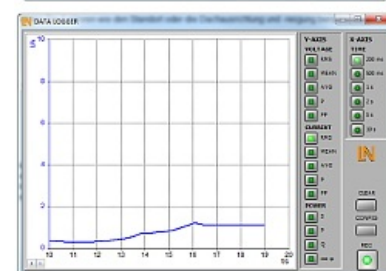
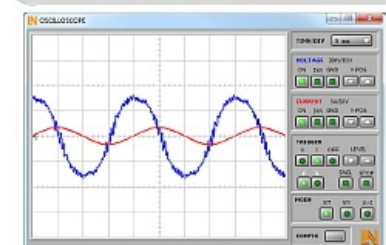
26 Analog/digital multimeter, wattmeter + power-factor meter incl. Software

CO5127-1Z

1

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- Simultaneous, measurement of voltage and current independent of the curve shape (max. 600 V, 20 A) (measurement of clocked voltages)
- Calculation of active, apparent and reactive power as well as the power factor
- Measurement of the total rms (RMS-AC+DC); AC rms (RMS-AC) and arithmetic mean (AV-AC+DC)
- Impervious to electrical damage up to 20 A/600 V
- Large-scale, high-contrast background-illuminated graphic display (5,7")
- Large-scale display or display of up to 4 measurement values
- Digital or pseudo-analog display
- USB interface
- Internal resistance: current path 10mOhm, voltage path 10MOhm
- Voltage ranges: 30;300; 600V
- Current ranges: 1; 10; 20A
- Measurement accuracy: 2%
- Automatic or manual measurement range selection
- Demonstration test instrument for mains operation
- Operating voltage: 230V, 50/60Hz
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- Weight: 2kg






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- Consumption meter to display power consumed and output

- Data logger for 14 different variables
- Data export for data logger
- Characteristic recorder
- Labview driver and supplied examples
- 32-bit version for Windows

Accessories:

Pos.	Product name	Bestell-Nr.	Anz.
27	Safety connection plug 19mm/4mm, black, with tapping Max. sustained current: 24A <ul style="list-style-type: none"> • Contacts: 4mm laminated plugs • Contact-protected • Insulation class CAT II / 600V 	SO5126-9R	5
			
28	Safety connection plug 19mm/4mm, black Max. sustained current: 24A <ul style="list-style-type: none"> • Contacts: 4mm laminated plugs • Contact-protected • Insulation class CAT II/600V 	SO5126-9Y	20
			
29	Safety connection plug 19mm/4mm, red Max. sustained current: 24A <ul style="list-style-type: none"> • Contacts: 4mm laminated plugs • Contact-protected • Insulation class CAT II / 600V 	SO5126-9U	10
			

30 **Safety connection plug 19mm/4mm, blue**

SO5126-9V

5

Max. sustained current: 24A

- Contacts: 4mm laminated plugs
- Contact-protected
- Insulation class CAT II / 600V



31 **Safety connection plug 19mm/4mm, green/yellow**

SO5126-9W

5

Max. sustained current: 24A

- Contacts: 4mm laminated plugs
- Contact-protected
- Insulation class CAT II/600V



32 **Set of safety measurement cables, 4mm (23 leads)**

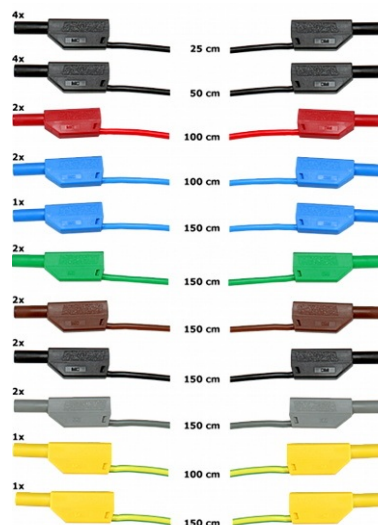
SO5148-1L

1

Safety measurement cables with 4mm safety plugs, coloured, PVC insulation, highly flexible

Each set includes the following:

- 4 x 25cm long, black
- 4 x 50cm long, black
- 2 x 100cm long, blue
- 2 x 100cm long, red
- 1 x 100cm long, green/yellow
- 1 x 150cm long, blue
- 1 x 150cm long, green/yellow
- 2 x 150cm long, green
- 2 x 150cm long, brown
- 2 x 150cm long, black
- 2 x 150cm long, grey
- Wire cross section 2.5 mm²
- Capacity/category: 600V CAT II, 32A



33 **Safety measurement cable (4mm), 50cm, red**

SO5126-8K

4

4 mm safety measurement cable, 50 cm, red

- Cable cross-section 2,5 mm²
- Insulation class CAT II / 600V

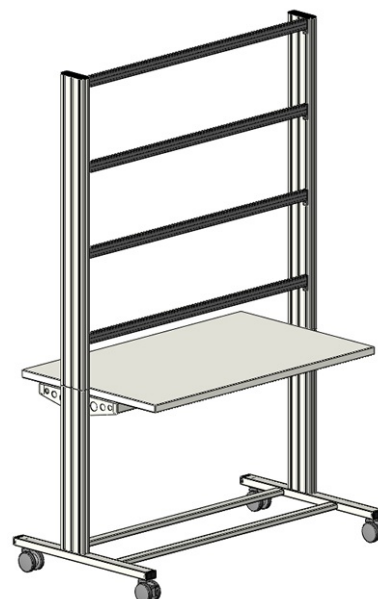


34 **Mobile aluminium experiment stand, 3 levels, 6x earthed sockets, 1250x700x1955mm** ST7200-3A 1

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 supply with 6-outlet socket strip mounted underneath the table top, 2-m lead and earthed plugs



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 swivelling 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 1955 x 700 mm (WxHxD)

35 **Wall or aluminium-profile mounting cable storage for 48 cables**

ST8003-8E

1

Accommodates about 48 safety measuring leads Suitable for mounting on walls or aluminium profiles



36 **PC holder for Syba experiment trolleys, height and width adjustable**

ST7200-5A

1

Shelf for desktop PC made of 1.5mm sheet steel punched with holes, suitable for all furniture in the SybaPro aluminium profile range

- Adjustable assembly height
- Adjustable width (160 - 255mm)
- 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



37 **Monitor holder for flat screen monitor of weight up to 10kg, VESA 75/100**

ST8010-4L

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 10kg
- 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

The set consists of the following:

- 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

38 **Protection cover for three-level experiment trolleys**

ST8010-9Y

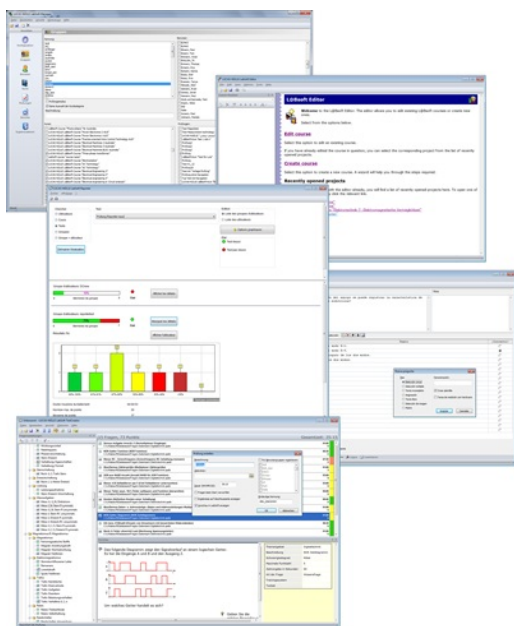
1

Dust cover for three-level experiment trolleys

- For protecting equipment from dust and damp
- For keeping equipment out of sight
- 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:



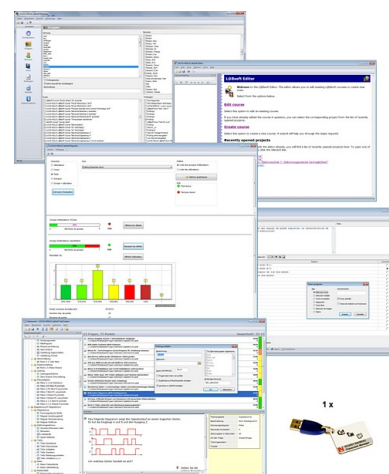
Optionally available: multi user license with 5 or 10 dongles and update to version 4.0

Pos.	Product name	Bestell-Nr.	Anz.
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39	Software, LabSoft Classroom Manager 4.0, single licence (D, GB, F, E, RU, PT)	SO2001-5A	1
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LabSoft Classroom Manager is a comprehensive set of administration software for the UniTrain-I 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: D, GB, E, F, RU, PT

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
- 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
- Calculation of average results for groups
- 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
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- 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

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:

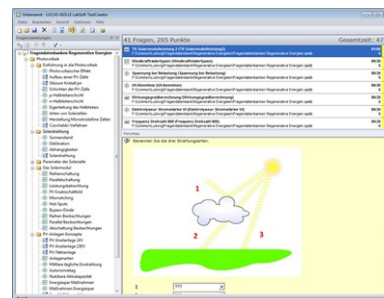
- Server or PC with Windows Vista, 7, 8 or 8.1
- Microsoft Internet Explorer 7.0 or higher
- Minimum 100 MB free disk space
- 1 free USB-port for USB-dongle

40 Collection of assignments Power Engineering / Renewable Energies

SO2001-6D

1

Collection of electronic assignments questions and measuring exercises for the UniTrain-I 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-I 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)

EPH 2.3 Design of PV systems in parallel network operation

EPH 2.3 Design of PV systems in parallel network operation

Training content:

- Installation of PV systems
- Design and testing of PV systems with mains feed
- Measure generated power of a PV system
- Determine efficiency of the grid-connected inverter
- Investigate response of a PV system to mains failure

Supplement to basic set, consisting of:

Supplement to basic set, consisting of:

Pos.	Product name	Bestell-Nr.	Anz.
41	Industrial photovoltaics inverter	CO3208-1G	1

Modern solar power systems using grid-connected inverters to feed electric power into the mains. The mains inverter board consists of one string inverter and a monitoring unit. The monitoring unit features not only an integrated main and fault current circuit breaker but an ENS unit (facility for (mains) network monitoring with an assigned switch in series). The ENS unit monitors the mains voltage, frequency and impedance and switches the system off in the event of deviations.



The grid-connected inverter is equipped with the following features:

- ENS complies with requirements according to DIN VDE 0126-1-1
- Input voltage range: 45 - 135V
- Output voltage: 230V / 50Hz
- Max. input current: 5 A
- Max. efficiency: 95.5%
- Output power: 300 W
- Expandable up to 12 string inverter (boosting power up to 3600 W)
- Earthing contact socket outlet
- Connection terminals: 4 mm safety sockets
- Dimensions: 297 x 456 x 305 mm (HxWxD)
- Weight: 5.8 kg

42 Single-phase mains supply with switch, circuit breaker and earth-contact socket

CO3211-1A

1

Mains supply 230 V/16 A

- Automatic cut-out 16A
- Main switch
- Earth-contact socket
- Output: 4mm safety sockets
- Dimensions: 297 x 228 x 155 mm. (HxWxD)
- Weight: 0.8kg



43 Energy monitor

CO3208-1H

1

The digital energy monitor is a single-phase AC meter with which the energy generated by the solar power system or the energy consumed by an electrical appliance can easily be measured. The display range spans from Wh range up to the MWh range. An absorbed or output of active power of as little as 1 Watt can be measured by the energy monitor. With the entry of a cost factor the energy monitor not only permits the display of previous energy costs but also a cost prediction for a week/month/year.

The energy monitor is equipped with the following features:

- Large easy-to-read LCD display
- Energy measurement in range from 0.000 Wh ... 99.99 MWh
- Active power measurement
- Mains voltage measurement in the range from 200 ... 250 V
- Display of measurement duration from 0:00 min ... 65.53 kh
- Display of energy costs
- Connection terminals: 4 mm safety sockets
- Dimensions: 297 x 114 x 110 mm (HxWxD)
- Weight: 0.7 kg



Optional Accessories:

Pos.	Product name	Bestell-Nr.	Anz.
44	Electronic electricity meter with integrated tariff control and SCADA interface	CO3209-7A	1

This electronic electricity meter for domestic properties, considered a new generation with regard to the billing of electricity, fulfils all the needs of electricity companies and power suppliers. It allows for smart metering and takes up far less space inside a meter cabinet. The meter is built onto a base plate with a plug connection, making it quick and easy to interchange meters, the most important factor being that this can be done without even interrupting the supply.

Supplied modules:

- Electronic duplex multi-tariff electricity meter
- Optical port at rear
- Tariff control and manual/automatic operation
- RS232 interface
- SCADA interface

Technical data:

- Nominal voltage: 230/400 V
- Operating voltage, AC: 196/230/264 V
- Frequency: 50 Hz
- Operating temperature: -25 to 60 °C
- Operating current: 0.1 to 60 A
- Power consumption: 2 VA
- Measuring mode: direct connection
- Start-up current: 0.02 A
- Inputs and outputs: 4-mm safety sockets
- Dimensions: 224 mm x 296 mm x 160 mm
- Weight: 1.6 kg



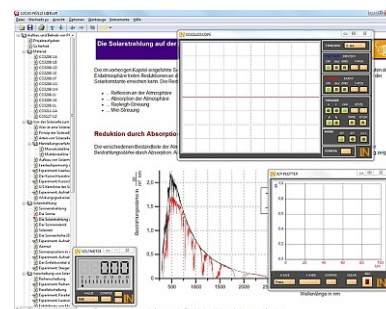
Media:

Pos.	Product name	Bestell-Nr.	Anz.
45	Interactive Lab Assistant: Photovoltaic systems - Advanced course	SO2800-3A	1

The experiment instructions come in the form of an Interactive Lab Assistant course. This multimedia course is a step-by-step guide through the topic of modern photovoltaic energy systems. The physical fundamentals are conveyed using easy to understand animations. The Interactive Lab Assistant in conjunction with the virtual instruments constitutes a comfortable experimenting environment.

Special features:

- Interactive experiment setups
- Measured values and diagrams can be stored in the experiment instructions per drag and drop
- Virtual instruments can be started directly from the experiment instructions
- Includes questions with feedback and evaluation logic for progress monitoring
- Documents can be printed out for hardcopy of experiment instructions including solutions
- CD-ROM with Labsoft browser, course software and virtual instruments
- Course duration 14 h approx.



Measuring instruments:

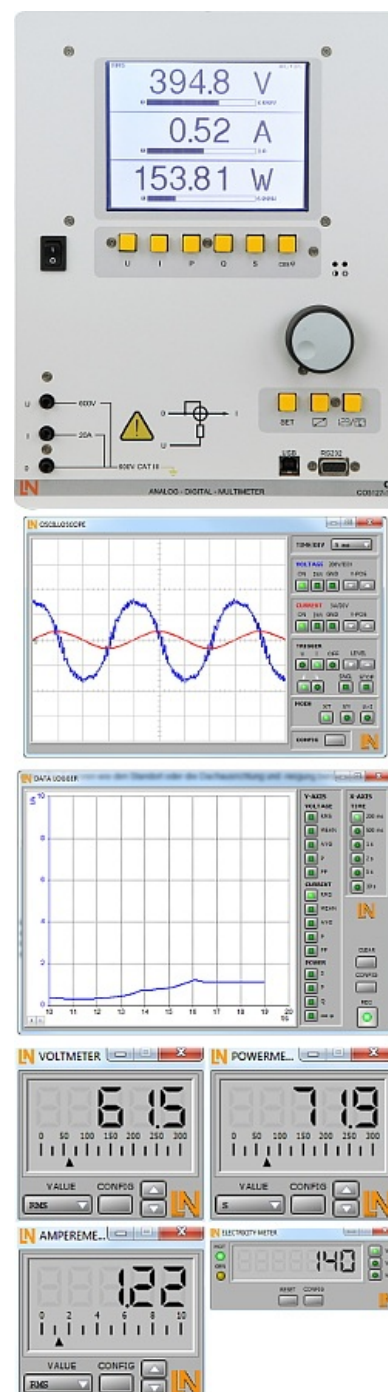
46 Analog/digital multimeter, wattmeter + power-factor meter incl. Software

CO5127-1Z

1

The areas of electrical machines, power electronics and drive technology pose particular problems for measuring instruments. In addition to high-performance overload protection, the acquisition of measurement values must be performed accurately independently of the curve's shape. The universal measuring device has been designed particularly to satisfy these requirements. It can simultaneously replace as many as four different measuring instruments – constituting a current/voltmeter, power and phase-angle meter all in one. The graphic display allows for both student as well demonstration experiments. The VI Starter software included allows for visualisation of measurements on a PC.

- Simultaneous, measurement of voltage and current independent of the curve shape (max. 600 V, 20 A) (measurement of clocked voltages)
- Calculation of active, apparent and reactive power as well as the power factor
- Measurement of the total rms (RMS-AC+DC); AC rms (RMS-AC) and arithmetic mean (AV-AC+DC)
- Impervious to electrical damage up to 20 A/600 V
- Large-scale, high-contrast background-illuminated graphic display (5,7")
- Large-scale display or display of up to 4 measurement values
- Digital or pseudo-analog display
- USB interface
- Internal resistance: current path 10mOhm, voltage path 10MOhm
- Voltage ranges: 30;300; 600V
- Current ranges: 1; 10; 20A
- Measurement accuracy: 2%
- Automatic or manual measurement range selection
- Demonstration test instrument for mains operation
- Operating voltage: 230V, 50/60Hz
- Dimensions: 297 x 228 x 140mm (HxBxT)
- Weight: 2kg






The VI Starter software allows all the measurements to be displayed on the PC. Up to 17 different displays can be opened.

- Oscilloscope display of voltage, current and power
- Consumption meter to display power consumed and output

- Data logger for 14 different variables
- Data export for data logger
- Characteristic recorder
- Labview driver and supplied examples
- 32-bit version for Windows

Accessories:

Pos.	Product name	Bestell-Nr.	Anz.
47	Safety connection plug 19mm/4mm, black, with tapping Max. sustained current: 24A <ul style="list-style-type: none"> • Contacts: 4mm laminated plugs • Contact-protected • Insulation class CAT II / 600V 	SO5126-9R	5
			
48	Safety connection plug 19mm/4mm, black Max. sustained current: 24A <ul style="list-style-type: none"> • Contacts: 4mm laminated plugs • Contact-protected • Insulation class CAT II/600V 	SO5126-9Y	20
			
49	Safety connection plug 19mm/4mm, red Max. sustained current: 24A <ul style="list-style-type: none"> • Contacts: 4mm laminated plugs • Contact-protected • Insulation class CAT II / 600V 	SO5126-9U	10
			

50 **Safety connection plug 19mm/4mm, blue**

SO5126-9V

5

Max. sustained current: 24A

- Contacts: 4mm laminated plugs
- Contact-protected
- Insulation class CAT II / 600V



51 **Safety connection plug 19mm/4mm, green/yellow**

SO5126-9W

5

Max. sustained current: 24A

- Contacts: 4mm laminated plugs
- Contact-protected
- Insulation class CAT II/600V



52 **Set of safety measurement cables, 4mm (23 leads)**

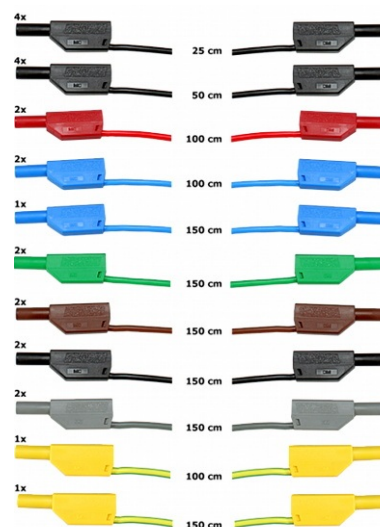
SO5148-1L

1

Safety measurement cables with 4mm safety plugs, coloured, PVC insulation, highly flexible

Each set includes the following:

- 4 x 25cm long, black
- 4 x 50cm long, black
- 2 x 100cm long, blue
- 2 x 100cm long, red
- 1 x 100cm long, green/yellow
- 1 x 150cm long, blue
- 1 x 150cm long, green/yellow
- 2 x 150cm long, green
- 2 x 150cm long, brown
- 2 x 150cm long, black
- 2 x 150cm long, grey
- Wire cross section 2.5 mm²
- Capacity/category: 600V CAT II, 32A



53 **Safety measurement cable (4mm), 50cm, red**

SO5126-8K

4

4 mm safety measurement cable, 50 cm, red

- Cable cross-section 2,5 mm²
- Insulation class CAT II / 600V

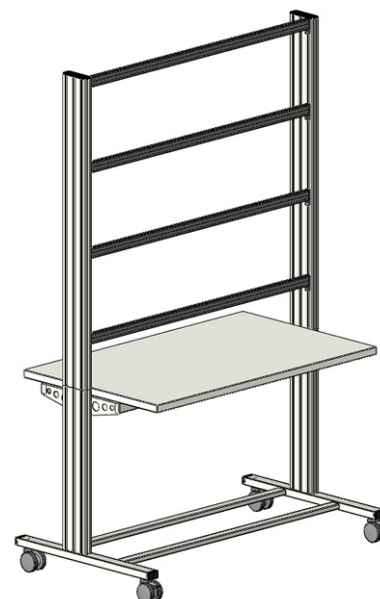


54 **Mobile aluminium experiment stand, 3 levels, 6x earthed sockets, 1250x700x1955mm** ST7200-3A 1

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- Table top with solid impact-resistant protective edging made of 3mm thick RAL 7047 coloured plastic
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Frame:

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- 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 swivelling 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 1955 x 700 mm (WxHxD)

55 **Wall or aluminium-profile mounting cable storage for 48 cables**

ST8003-8E

1

Accommodates about 48 safety measuring leads Suitable for mounting on walls or aluminium profiles



56 **PC holder for Syba experiment trolleys, height and width adjustable**

ST7200-5A

1

Shelf for desktop PC made of 1.5mm sheet steel punched with holes, suitable for all furniture in the SybaPro aluminium profile range

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- Adjustable width (160 - 255mm)
- 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



57 **Monitor holder for flat screen monitor of weight up to 10kg, VESA 75/100**

ST8010-4L

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
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58 **Protection cover for three-level experiment trolleys**

ST8010-9Y

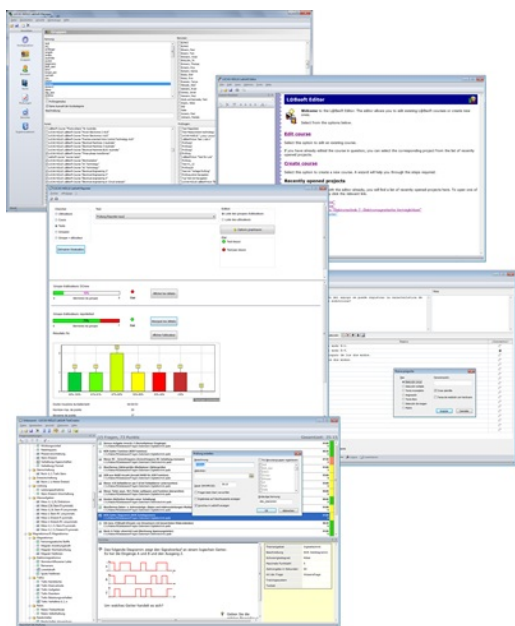
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Dust cover for three-level experiment trolleys

- For protecting equipment from dust and damp
- For keeping equipment out of sight
- 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:



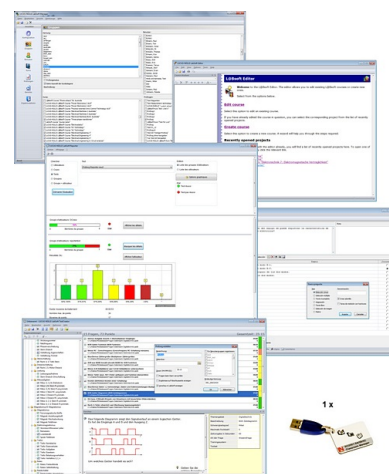
Optionally available: multi user license with 5 or 10 dongles and update to version 4.0

Pos.	Product name	Bestell-Nr.	Anz.
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59	Software, LabSoft Classroom Manager 4.0, single licence (D, GB, F, E, RU, PT)	SO2001-5A	1
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System requirements:

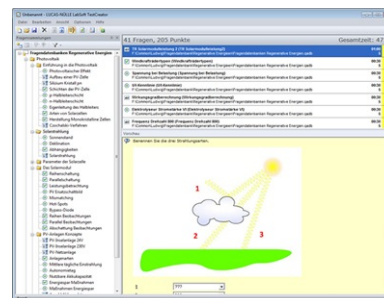
- Server or PC with Windows Vista, 7, 8 or 8.1
- Microsoft Internet Explorer 7.0 or higher
- Minimum 100 MB free disk space
- 1 free USB-port for USB-dongle

60 Collection of assignments Power Engineering / Renewable Energies

SO2001-6D

1

Collection of electronic assignments questions and measuring exercises for the UniTrain-I 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-I 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)