Content

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 sychronisation
- Interactive multimedia training course

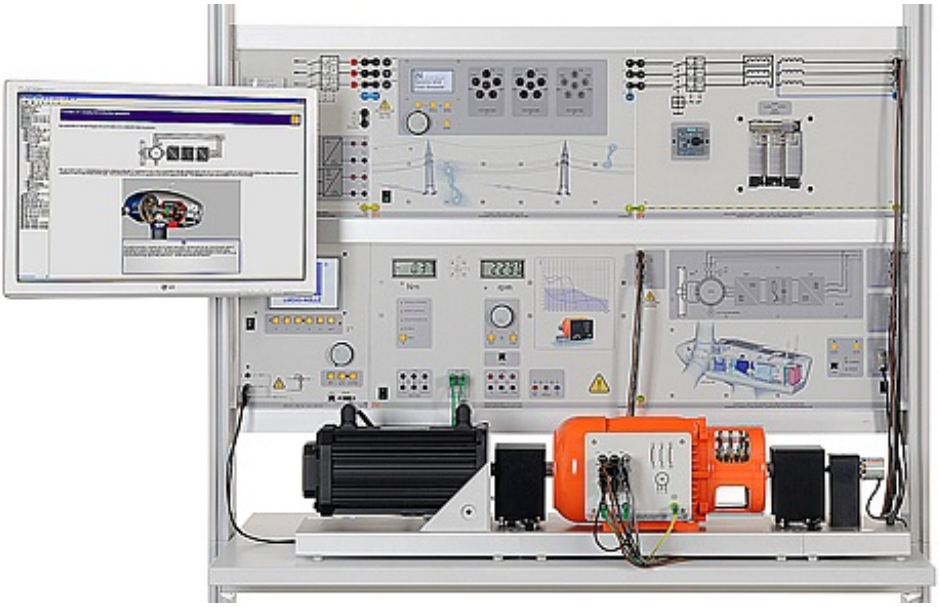
Renewable Energies

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.

EWG 1 Wind power plants



EWG 1 Wind power plants

This equipment set is used to investigate the design and operation of modern wind power stations.

The effect of wind force and the mechanical design of wind power stations can be emulated down to precise detail using the servo machine testing stand and the WindSim software. The control unit for the double-feed asynchronous machine (as a generator for the wind power plant) permits user-friendly operation and visualisation during the experiments. The corresponding Interactive Lab Assistant Multimedia course is designed to convey knowledge and provide interactive support for the experiment set-ups and allows for PC-assisted evaluation of the measured data.
Training content:

- Understand the design and operation of modern wind power plants
- Explore the physical fundamentals “From wind to wave”
- Learn about different wind power concepts
- Set up and commission a double-feed asynchronous wind generator
- Operate the generator with varying wind force levels and regulate the output voltage and frequency
- Determine optimum operating points under changing wind conditions
- Investigate the operating response during mains malfunctions “Fault ride through”

Your benefits:

- Exact emulation of the technology of the current multi-megawatt wind power generators
- A fully working and functional training system for wind turbines with Double-fed Induction Generator (DFIG)
- A wind simulation, which exactly mathematically emulates the wind at the shaft
- Investigating responses to "fault-ride-through" FRT grid malfunctions

Equipment set, consisting of:

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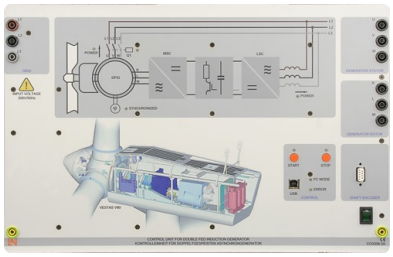
Pos.	Product name	Bestell-Nr.	Anz.
1	**Control unit for wind turbine double-fed asynchronous generator**	CO3208-3A	1



Modern wind power stations use double-feed asynchronous generators to feed electrical power into the mains. The control unit of the double-feed asynchronous generator permits control and operation of a speed-variable double-feed asynchronous generator in the laboratory. Using the control unit all of the practice-relevant operating states can be emulated and investigated. The WindSim software permits user-friendly operation and visualisation of the measurement values.

The control unit has the following features:

- Control unit with two controlled three-phase inverters
- Operation of the double-feed asynchronous generator in under-synchronous and over-synchronous operating mode
- Integrated power switch for switching the generator on line
- Autonomous control of reactive and active power, frequency, voltage
- Manual and automatic mains synchronisation
- USB interface
- Input for incremental shaft-encoder
- Integrated brake chopper permits “Fault Ride Through” experiments
- Connection voltage: 3 x 300V, 50...60Hz
- Maximum output power: 1kVA
- Dimensions: 297 x 460 x 210mm (HxWxD)
- Weight: 8.3kg

2 **Three-phase multi-function machine, 1.0kW** SE2662-6W 1

Three-phase asynchronous motor with slip-rings which can also be used as a synchronous machine.

- Nominal voltage: 400/230V, 50Hz
- Nominal current: 2.0A/ 3.5A
- Nominal speed: 1400 / 1500rpm
- Nominal power: 0.8kW
- cos phi: 0.75
- Exciter voltage: 130VAC / 24V DC
- Exciter current: 4AAC / 11ADC
- Dimensions: 500 x 220 x 250 mm (BxHxD)
- Weight: 20kg

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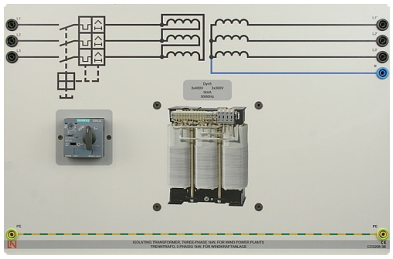
3 **3-phase isolation transformer, 1kW for wind power plants** CO3208-3B 1



Three-phase transformer for power feed of double-fed wind power plants

- Primary voltage: 3 x 400 V
- Secondary voltage : 3 x 300 V
- Rated power: 1000 VA
- Fuse: 1 automatic circuit-breaker 1.6...2.5 A (adjustable)
- Inputs/outputs: 4-mm safety sockets
- Dimensions: 297 x 456 x 150 mm
- Weight. 11kg

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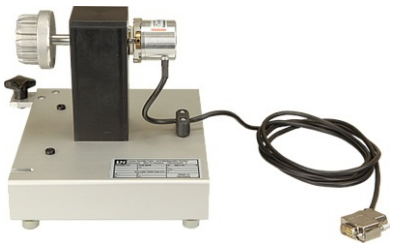
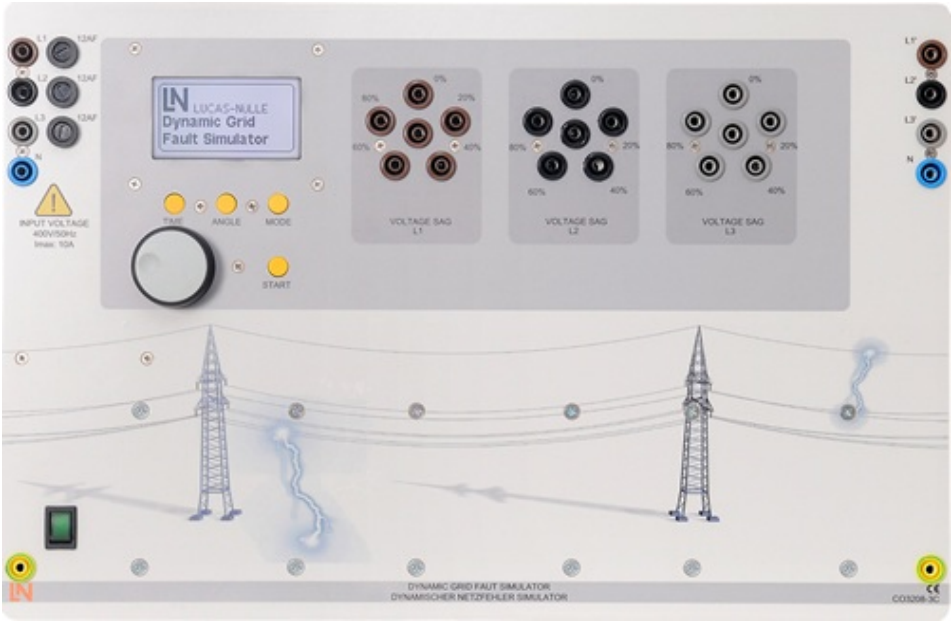
4 **Incremental position encoder 1024 pulses** SE2662-5T 1



The incremental encoder is equipped with the following features:

- 1024 pulses
- Speed: 6000 rpm
- Torque: <= 1Ncm
- Inertia: 35 g cm²
- Weight: 1.7kg
- One shaft end



Supplementary material for "Fault Ride Through" experiments (FRT):

Training content:

- Investigating the response of wind power plants to system faults
- Exploring symmetrical fault scenarios
- Exploring asymmetrical fault scenarios
- Adjusting controller parameters
- Representing variables in the dynamic range as well as with positive phase sequence and negative phase sequence
- Compensation for the negative sequence components

Pos.	Product name	Bestell-Nr.	Anz.
5	**Dynamic grid fault simulator**	CO3208-3C	1

Modern wind turbines or photovoltaic grid power inverters are required nowadays to respond to faults in the mains grid without simply shutting down. Such a response is called "fault ride through".

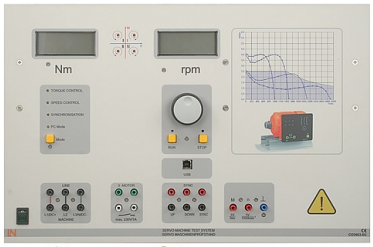
The dynamic grid fault simulator emulates such faults in the mains grid. This makes it possible to investigate the response of any equipment connected downstream from the fault.

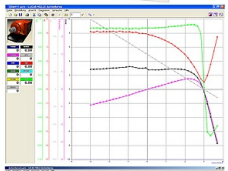
The grid fault simulator has the following features:

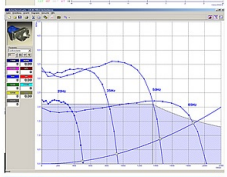
- Adjustable power failure durations from 50ms to 1000ms
- 5-level, adjustable voltage drop for all phases
- Symmetrical and asymmetrical grid faults can be set up
- Faults can be selected with or without earth contact
- Adjustable start angle fault-ride-through analysis
- Graphic display
- Connector voltage: 3 x 400V, 50...60Hz
- Dimensions: 297 x 460 x 210mm (HxWxD)
- Weight: 18kg

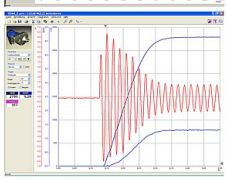
Additionally required - Machine test bench equipment set for servo-drive/braking system:

Pos.	Product name	Bestell-Nr.	Anz.
6	**Servo machine test bench for 1kW machines incl. ActiveServo software(D,GB,F,E)**	CO3636-6W	1









The servo-machine test bench is a complete testing system for examining electrical machines and drives. It consists of a digital controller, a brake and the AktiveServo software. The system combines state-of-the-art technology with ease of operation.
The system also allows manual and automated synchronisation to be carried out.

The controller has the following features:

- Dynamic and static four-quadrant operation
- 10 selectable operating modes/machine models (torque control, speed control, flywheel, lifting drive, roller/calander, fan, compressor, winding gear, arbitrarily defined time-dependent load, manual and automated network synchronisation)
- Integrated galvanically isolated amplifier for voltage and current measurement
- Speed and torque displays
- Four-quadrant monitor
- USB interface
- Thermal monitoring of the machine under test
- Testing for the presence of a shaft cover.
- Connection voltage: 400V, 50Hz
- Maximum power output: 10kVA
- Dimensions: 297 x 460 x 420mm (HxWxD)
- Weight: 14.3kg

The brake is self-cooled asynchronous servo-brake with resolver.

The motor and sensor leads are connected via polarity-safe plugs. The machine has thermal monitoring and, in conjunction with the controller, it constitutes a driving and braking system that is free of drift and requires no calibration.

- Maximum speed: 4000rpm
- Maximum torque 30Nm
- Temperature monitoring: continuous temperature sensor (KTY)
- Resolver resolution: 65536 pulses/revolution
- Dimensions: 275 x 210 x 210mm (WxHxD)
- Weight: 6kg

ActiveServo is a program for recording characteristics of machines and for determining dynamic and static operating points. It emulates

seven different loads (flywheel, pump, calander, lifting drive, compressor, winding gear, arbitrarily configurable time-dependent load) for which the parameters can be individually configured.

Features:

- Measurement, calculation and display of mechanical and electrical variables
- (Speed, torque, mechanical power output, current, voltage, active, apparent and reactive power, efficiency, power factor)
- Simultaneous display of measured and calculated values (e.g. instant display of efficiency)
- Measurement of voltage and current (including RMS values even for non-sinusoidal waveforms)
- Speed or torque-controlled operation
- Recording of variables over time
- Programming of limiting values of speed or torque to prevent inappropriate loading of the machine under test.
- Operation in all four quadrants (display of generated torque)
- Arbitrarily defined ramp functions for PC-controlled load experiments
- Display of characteristics from several experiments to better illustrate the effect of parameter changes
- Export of graphics and measurements
- 32-bit version for Windows

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7 **Rubber coupling sleeve, 1kW** SE2662-6A 2

Rubber coupling sleeve for the coupling of two machines.

- Permits rapid and safe assembly
- Designed with internal ring gear
- Material: rubber (neoprene)
- Dimensions: 40 x 58 mm (length x diameter)
- Weight: 0.1kg

8 **Coupling guard, 1kW** SE2662-6B 2

Attachable metal guard used to protect against accidental physical contact with the coupling location where rotation occurs between two connected machines.

- Material: black steel plating, folded with function plug
- Dimensions: 140 x 75 x 80mm (HxWxD)
- Weight: 0.1kg

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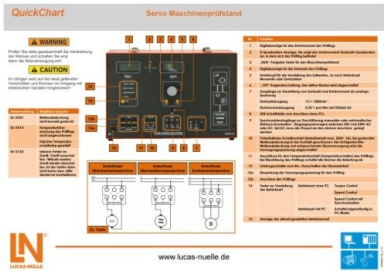
9 **QuickChart, Servo-machine test stand safety and operating instructions (GB)** SO6200-7D 1

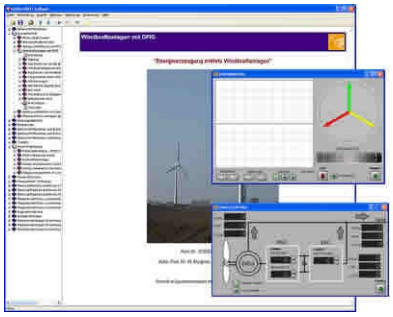


Short documentation covering the putting into operation of complex equipment and experiment set-ups.

- Terminal assignment, safety instructions, help
- Circuit and assembly diagrams
- Color print in DIN A3 format
- Laminated: 2 x 250 µm

Media:

Pos.	Product name	Bestell-Nr.	Anz.
10	**Interactive Lab Assistant: Wind power plants with DFIG**	SO2800-3D	1



The experiment instructions come in the form of the Interactive Lab Assistant course. This multimedia course is a step-by-step guide through the field of wind power stations. The basic physics and mechanical processes are demonstrated using easy-to-understand animations. The Interactive Lab Assistant together with the WindSim software forms the core elements of a user-friendly experiment environment.

Special features:

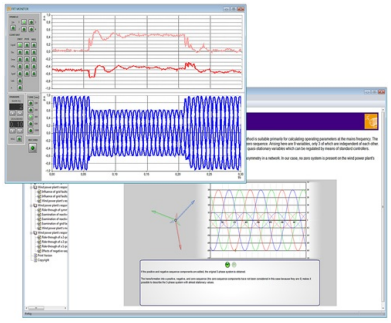
- Interactive experiment set-ups
- Measured values and graphics can be stored in the instruction section via drag and drop
- WindSim software can be started directly from the experiment instructions
- Questions with feedback and evaluation logic help to monitor progress
- Print document feature available for easy hardcopy printing of experiment instructions with solutions
- CD-ROM with Labsoft browser, course software and WindSim software

The WindSim software performs controlling operation of the control unit of the double-feed asynchronous generator and drive unit. Different wind speeds and profiles can be set and emulated with this device. This imposes the same operating states onto the generator shaft as those affecting a real wind power station. At the same time, the software permits the control, parameterisation and visualisation of the double-feed asynchronous generator's operating parameters.

Special features include:

- Detailed emulation of a modern wind power station
- Measurement, calculation and graphic representation of all mechanical and electrical operating parameters (SCADA)
- Automatic or manual operation
- Selection of setpoint values for active and reactive power
- Definition and emulation of wind power and wind profiles
- Operating with various wind forces including pitch control
- Step-by-step initial setup and commissioning to demonstrate functional operation
- Export feature for graphics and measured values
- 32-bit version for Windows
- Course duration 20 h approx.

11 **Interactive Lab Assistant: Fault Ride-Through of wind power plants** SO2800-3E 1



The experiment instructions make up an Interactive Lab Assistant course. This multimedia course goes through the topic of "fault ride through" for modern wind power plants step by step.

Features:

- Interactive experiment set-ups
- Measurements and graphics can be saved in the experiment plans themselves via drag and drop
- Questions with feedback and evaluation logic for testing knowledge
- Printable documents for easy printing of experiment instructions complete with solutions
- CD-ROM with Labsoft browser, course software and WindSim software

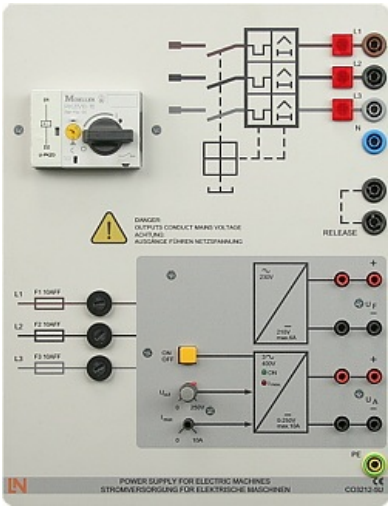
The FRT software handles recording and visualisation of the measurements.

Features:

- Display of instantaneous values
- Display of RMS values
- Pre-set templates for desired values of active and reactive power
- Export of graphics and measurements
- 32-bit version for Windows
- Course duration 16 h approx.

Power supply:

Pos.	Product name	Bestell-Nr.	Anz.
12	**Universal power supply for DC and Three-Phase Current**	CO3212-5U	1

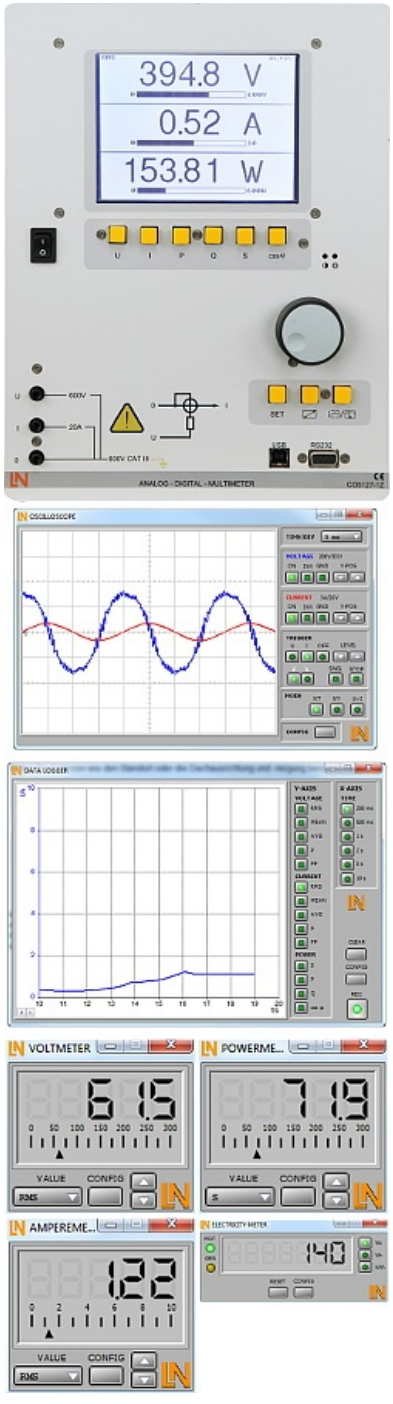


Mains power supply for DC, AC and three-phase current and for excitation of synchronous machines. The mains supply is specially designed for use with electrical machines.

- Outputs:
  Three phase: L1, L2, L3, N from 4 mm safety sockets
  DC: 0...240VDC variable, controlled and electronically protected against overload and short circuits.
  Output current: 3...10A (adjustable current limiting)
- Second DC supply ca. 210VDC, 6A fixed
- Protective systems:
  Motor protection switch adjustable from 6.3...16A
  Undervoltage trip
  Safety cut-out
- Mains connection: 3x 230/400V, 50/60Hz via CEE plug with 1.8m mains lead
- Dimensions: 297 x 228 x 140mm (HxWxD)
- Weight: 3kg

Measuring instruments:

Pos.	Product name	Bestell-Nr.	Anz.
13	**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.
14	**Safety connection plug 19mm/4mm, black, with tapping** Max. sustained current: 24A • Contacts: 4mm laminated plugs • Contact-protected • Insulation class CAT II / 600V	SO5126-9R	20
15	**Safety connection plug 19mm/4mm, black** Max. sustained current: 24A • Contacts: 4mm laminated plugs • Contact-protected • Insulation class CAT II/600V	SO5126-9Y	20
16	**Safety connection plug 19mm/4mm, green/yellow** Max. sustained current: 24A • Contacts: 4mm laminated plugs • Contact-protected • Insulation class CAT II/600V	SO5126-9W	4

17 **Safety connection plug 19mm/4mm, blue** SO5126-9V 2

Max. sustained current: 24A

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

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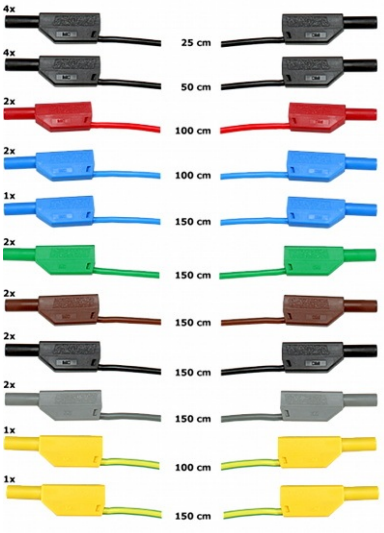
18 **Set of safety measurement cables, 4mm (23 leads)** SO5148-1L 1

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

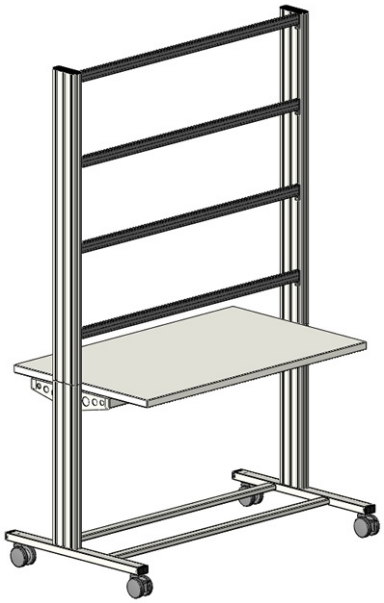
Each set includes the following:

- 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 mm^2
- Capacity/category: 600V CAT II, 32A



19 **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)

20 **Power supply for mobile working stations** ST8008-8M 1

400-V CEE distribution panel with automatic circuit breakers for attachment to profiles on experiment trolleys or direct to table-top.

- 2 CEE sockets (400 V, 16 A, 5-pole) with safety flap
- 1 Mains socket with earth (230 V) plus safety flap
- Circuit breaker: 1 x 3-pole line circuit breaker, type B, 16 A
- Mains connection: 3 x 230/400 V, 50/60 Hz via CEE plug, 4-m mains lead
- Dimensions: 530 x 130 x 110 mm (HxWxD)
- Weight: 3 kg

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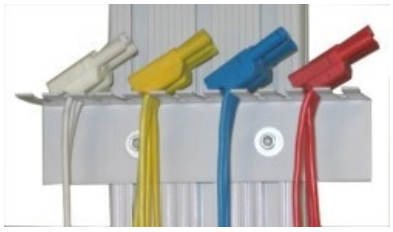
21 **Wall or aluminium-profile mounting cable storage for 48 cables** ST8003-8E 1



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

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22 **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

23 **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:

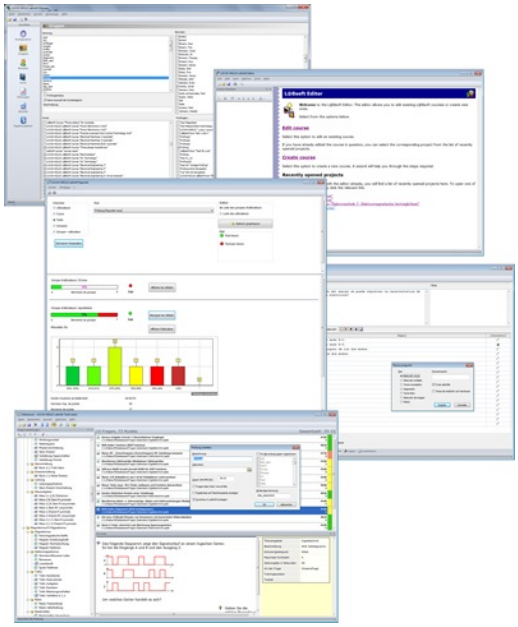
- 3 Cross cable binders for front and rear grooves of aluminium profile
- 3 Cross cable binders for side grooves of aluminium profile
- 12 Cable binders
- 4 Aluminium cover profiles for covering and enabling wires to be run along the grooves of an aluminium profile

24 **Protection cover for three-level experiment trolleys** ST8010-9Y 1

Dust cover for three-level experiment trolleys

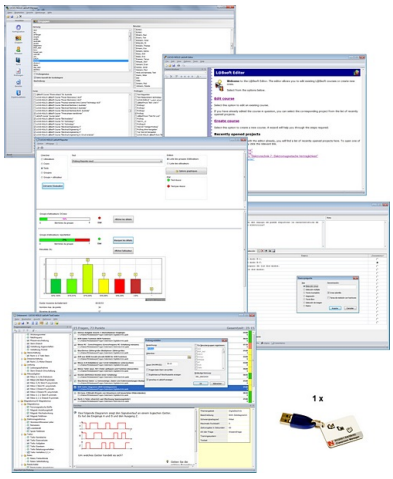
- For protecting equipment from dust and damp
- For keeping equipment out of sight
- Colour: matt dark grey with printed LN logo in orange)
- Material: nylon fabric with polyurethane coating
- High resistant to tearing, impregnated to be washable and waterproof

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.
25	**Software, LabSoft Classroom Manager 4.0, single licence (D, GB, F, E, RU, PT)**	SO2001-5A	1



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

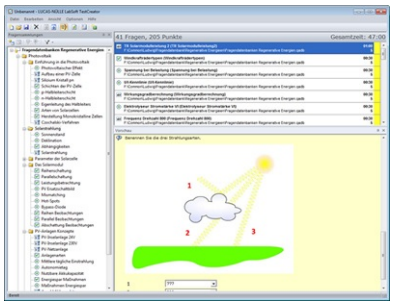
Includes:

- 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

26 **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)