LUCAS-NÜLLE

EloTrain

Lucas-Nülle's Plug-In System

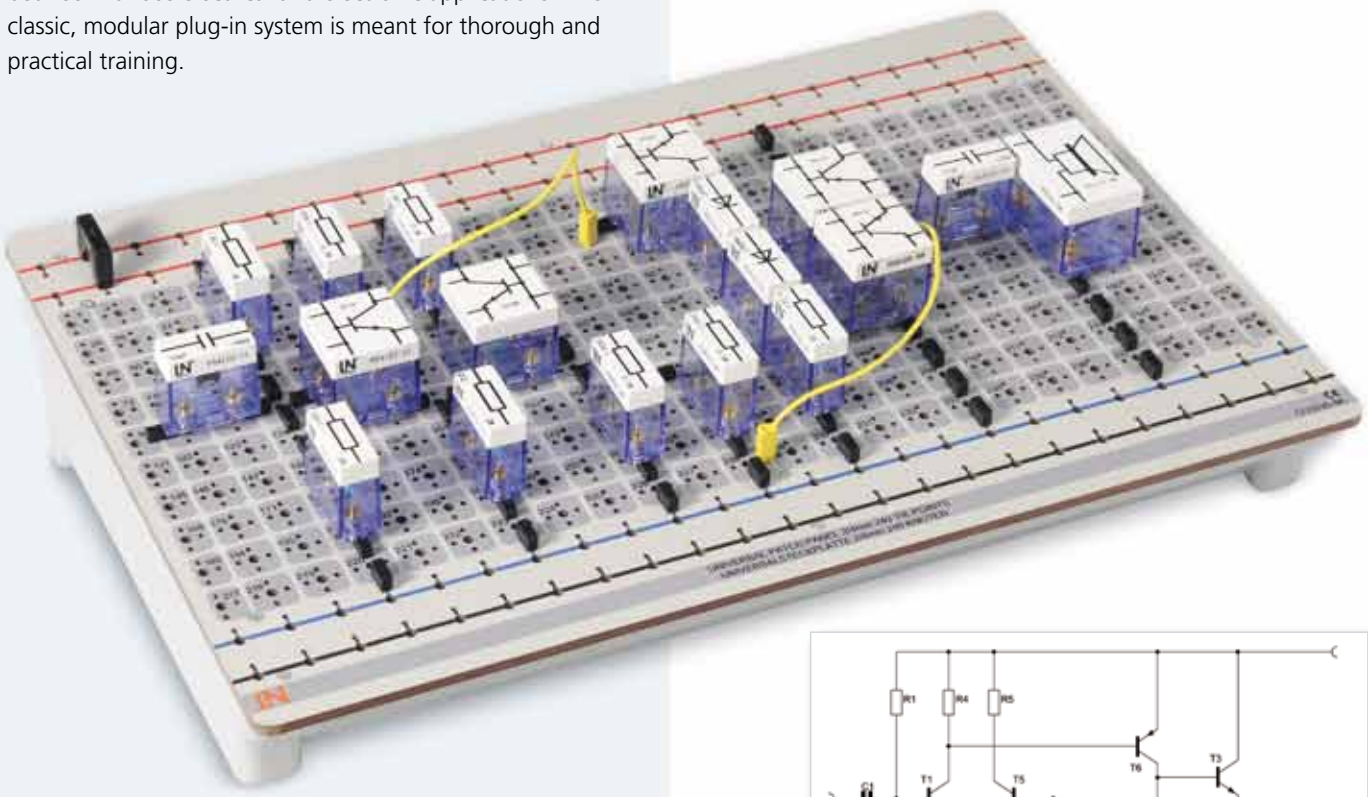
NEW!
The 2-mm multimedia plug-in system

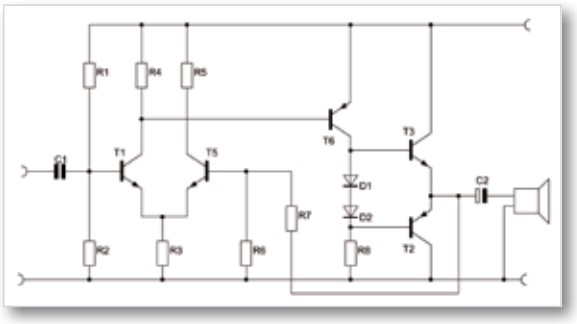
Contents

Basic Training Using the Plug-In System

Experimental Setups According to Circuit Diagrams

Sound training in the fundamentals of electrical engineering is a prerequisite for understanding the complex relationships between various electrical and electronic applications. This classic, modular plug-in system is meant for thorough and practical training.





Your benefits

- Precise mapping of circuit diagrams on the experimenter
- Understanding of complex relationships through experimentation
- Exclusive use of safety extra-low voltages (SELV)
- High transparency
- Durable components
- No loose contacts
- Fault-tolerant
- Quick setup

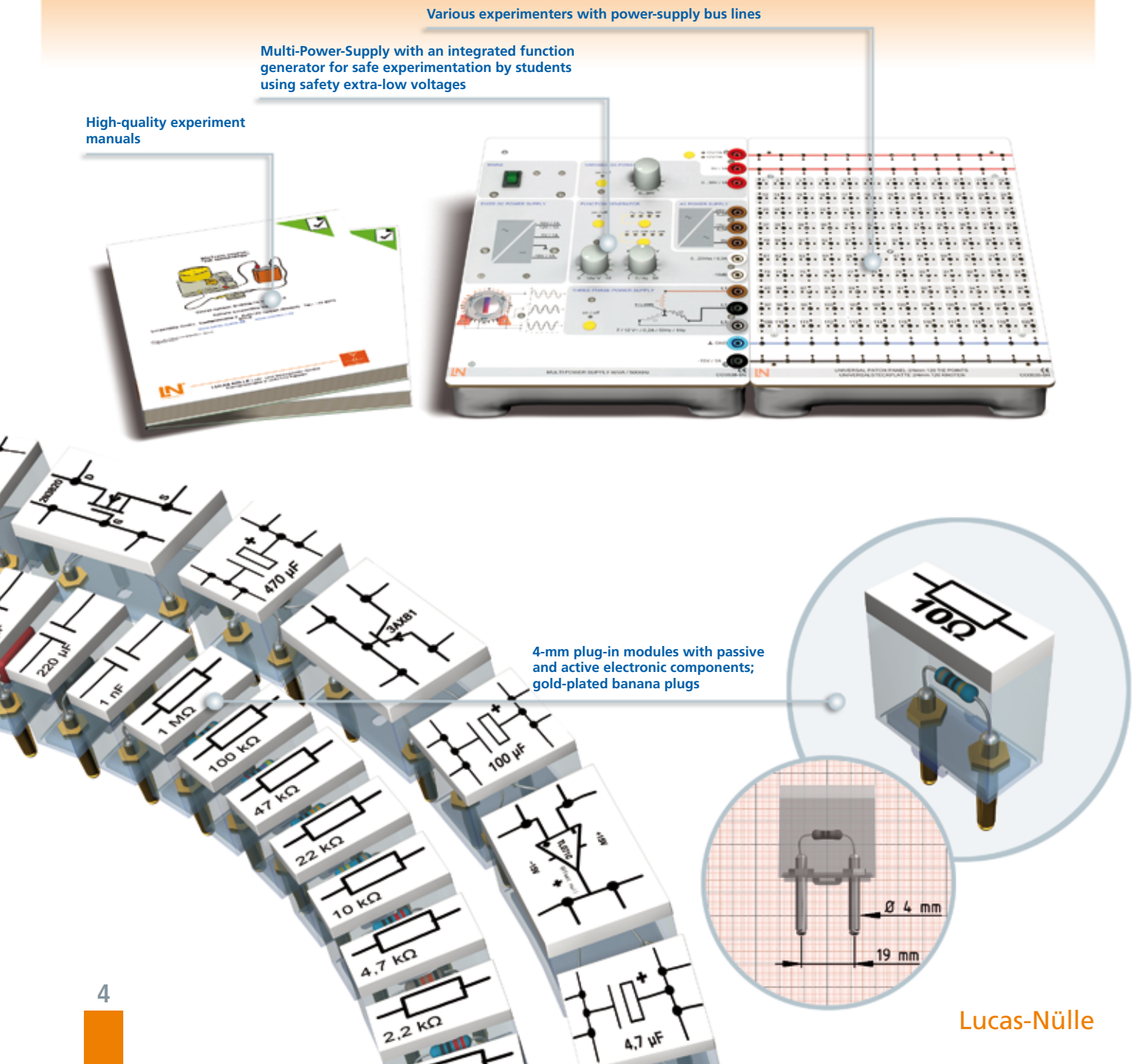
EloTrain – Lucas-Nülle's Plug-In System

The EloTrain plug-in system is an extensive kit for experimentation in the field of electrical engineering and electronics. By installing plug-in modules on special EloTrain experimenters, electronic circuits of any required size can be assembled, operated and tested.

Aided by instructions, experimentation remains absolutely safe even for novices, thanks to the use of non-hazardous low voltages. The system deepens the user's knowledge and ultimately leads to the practical competence required as a sound basis for further training.

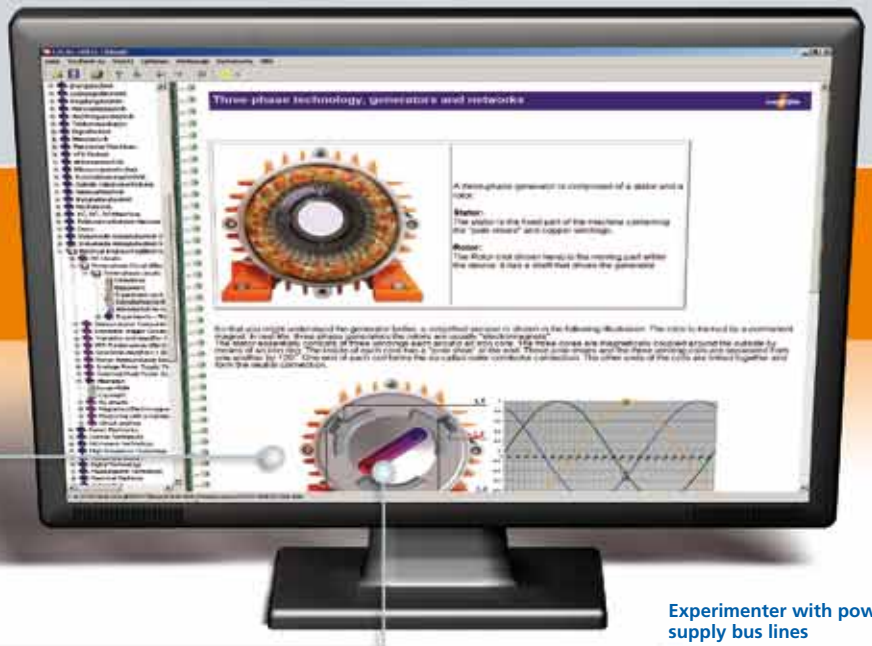
4-mm plug-in system

A universally proven plug-in system for basic training



2-mm plug-in system

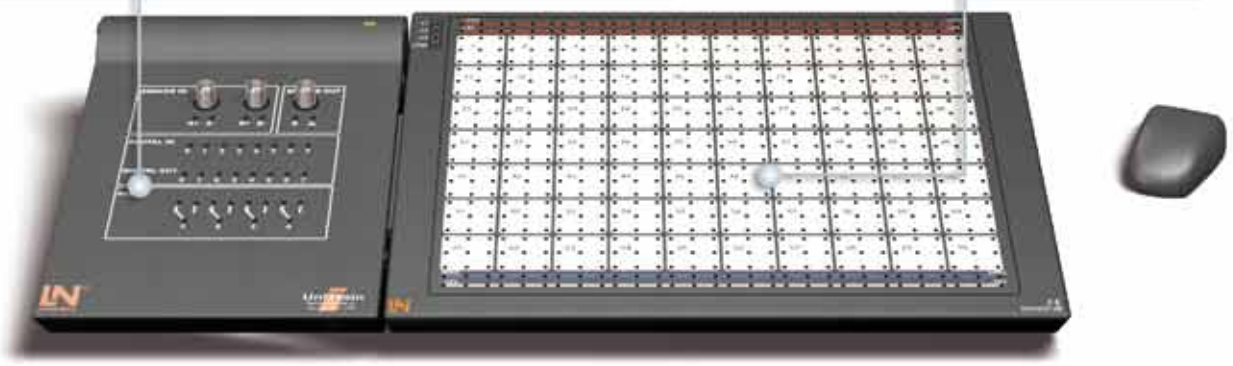
A multimedia plug-in system for UniTrain-I



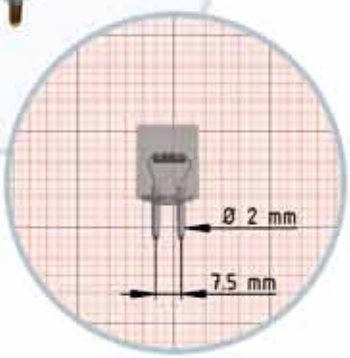
Multimedia-based educational software

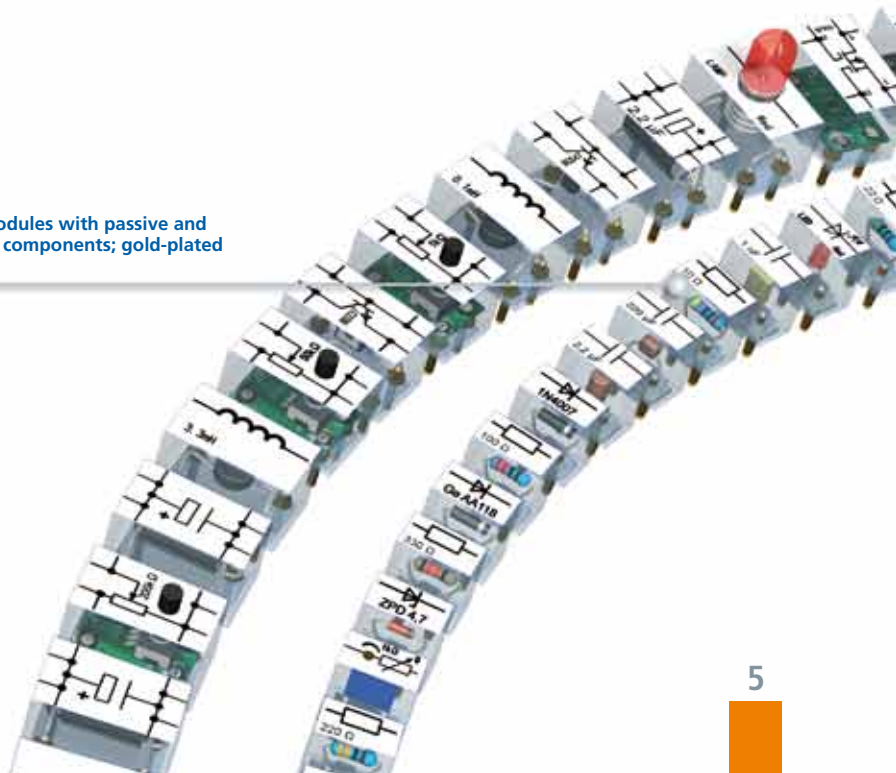
Power supply and measurement interface with virtual instruments (integrated power supply and frequency generator)

Experimenter with power-supply bus lines



2-mm plug-in modules with passive and active electronic components; gold-plated banana plugs



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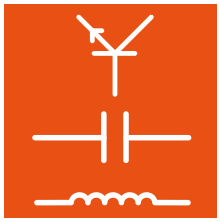
LUCAS-NÜLLE

2-mm Plug-In System for UniTrain-I



More Than Just a Training System

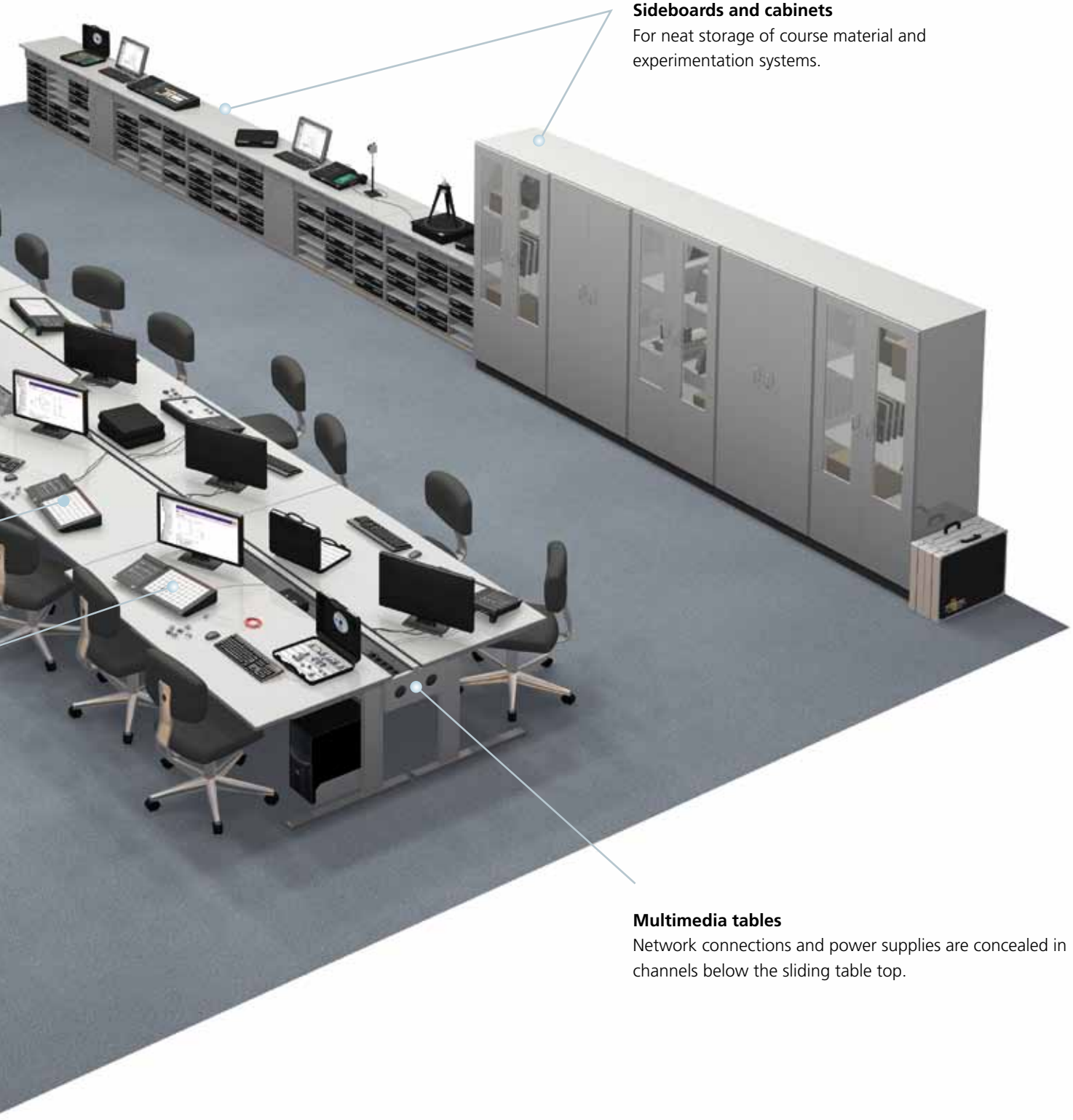
EloTrain Lab – A Complete Solution for the 2-mm Plug-In System

Presentation tools
Jointly summarize what has been learned; work out complex topics and experiments.

Everything under control with the LabSoft Classroom Manager
Manage individual users, groups and courses; check progress levels; edit existing courses and create new ones.

Multi-purpose tables
Equipped with a motorised, retractable power supply channel for accommodating 19“ 3HU inserts.

Benefits:
Multi-Power-Supply permanently fitted into power supply channel.



Sideboards and cabinets
For neat storage of course material and experimentation systems.

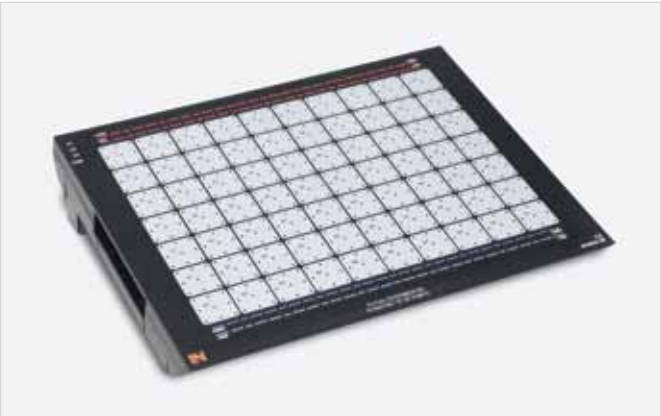
Multimedia tables
Network connections and power supplies are concealed in channels below the sliding table top.

2-mm Plug-In System for UniTrain-I

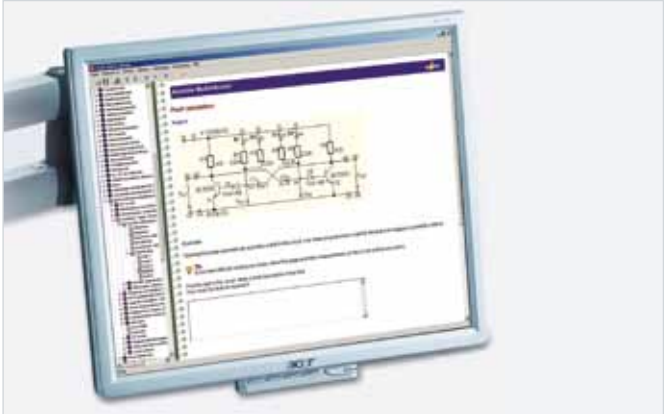
Multimedia Experimentation and Training System

Together with the multimedia experimentation and training system, the EloTrain 2-mm plug-in system provides a modern and efficient environment for sound training in the fundamentals of electrical engineering and electronics. Students are guided through the experiments by means of clearly structured course software including texts, graphics, animations and knowledge tests. The experiments are conducted on a 2-mm experimenter developed specially for the UniTrain-I. A wide range of virtual instruments are available for real-time measurements by students.

- Power supply and measurement interface with virtual instruments (integrated power supply and frequency generator)



- Experimenter with power-supply bus lines



- Multimedia-based educational software

- 2-mm plug-in modules with passive and active electronic components; gold-plated banana plugs

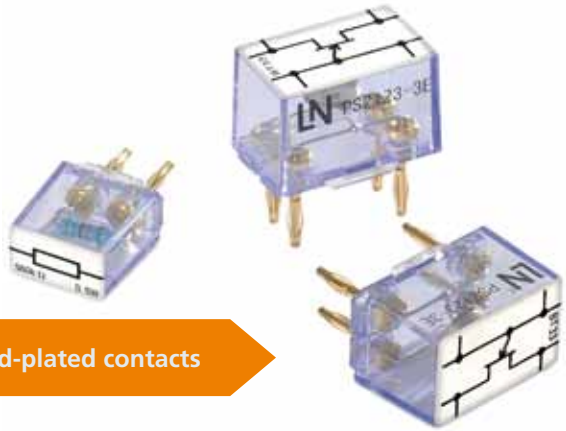
Your benefits

- Modern educational media combined with a proven system of plug-in modules
- Virtual instruments for real-time measurements; no need for external power supplies or measuring instruments
- High student motivation through new, PC-based media
- Quick success through structured courses
- Practical competence through independent experimentation
- Regular feedback through quizzes and knowledge tests
- Safe handling thanks to safety extra-low voltages

EloTrain Plug-In Modules

2-mm Plug-In Modules with Passive and Active Components

The plug-in modules contain passive and active electronic components whose contacts comprise gold-plated, 2-mm banana plugs. When plugged into the experimenter, the modules are held in place mechanically by the banana plugs. These plugs also serve to establish the necessary electrical connections to the experimenter's nodes. Cables and bridging plugs can be used to establish connections to further nodes, components or measuring instruments.



Gold-plated contacts

Plug-in modules

- All components and bridging plugs with gold-plated, 2-mm banana plugs
- Housing made of transparent, highly impact-resistant plastic (Makrolon®)
- Top with a scratch-resistant, high-contrast screen print indicating the circuit diagram and model number

Digital technology

- Digital technology plug-in modules have surface-mounted, 2-mm jacks for connecting the logic units

Repairs

- The housing can be easily opened for repairs
- Easy unsoldering / replacement of defective components

EloTrain Experimentation System

UniTrain-I Interface and EloTrain Experimenter

The UniTrain-I interface is the heart of the 2-mm plug-in system. This interface provides the inputs / outputs, switches, sources and measurement technology needed for experimentation. The EloTrain experimenter for the 2-mm plug-in system is coupled to the UniTrain-I interface and supplied with the necessary voltages. 70 nodes are available for assembling complex yet clearly laid-out circuits. The circuitry is realized by inserting plug-in modules between the nodes. Electrical connections between the nodes are established by means of 2-mm / 7.5-mm connectors.

UniTrain-I interface

- 32-bit processor
- Measurement data memory
- USB interface
- Integrated virtual instruments eliminate the need for external measuring instruments
- 2 analog differential inputs
- 16 digital inputs / outputs
- Analog output
- Operation at safety extra-low voltages
- LabVIEW driver

Article no. SO4203-2A

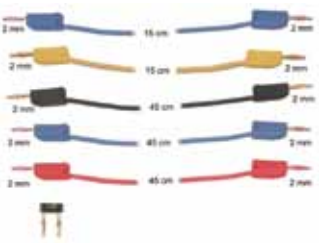
EloTrain experimenter

- Coupling to the UniTrain-I interface
- Supply of fixed and variable voltages to the system via 2-mm jacks
- Usable with 2-mm plug-in modules
- 70 nodes each with 9 x 2-mm jacks
- 7.5-mm grid spacing with 2-mm jacks
- 4 power-supply bus lines (+15 V, +5 V, -15 V, ground)
- Variable three-phase power supply
- Console housing for ergonomic operation
- Max. contact capacity: 10 A

Article no. SO4203-3B

Set of measuring cables and plugs

- 12 x measuring cables, 2 mm, 15 cm, blue
- 12 x measuring cables, 2 mm, 15 cm, yellow
- 2 x measuring cables, 2 mm, 45 cm, black
- 2 x measuring cables, 2 mm, 45 cm, red
- 2 x measuring cables, 2 mm, 45 cm, blue
- 60 x bridging plugs, 2 mm, 7.5 mm, black



Article no. SO5146-1N

EloTrain Software

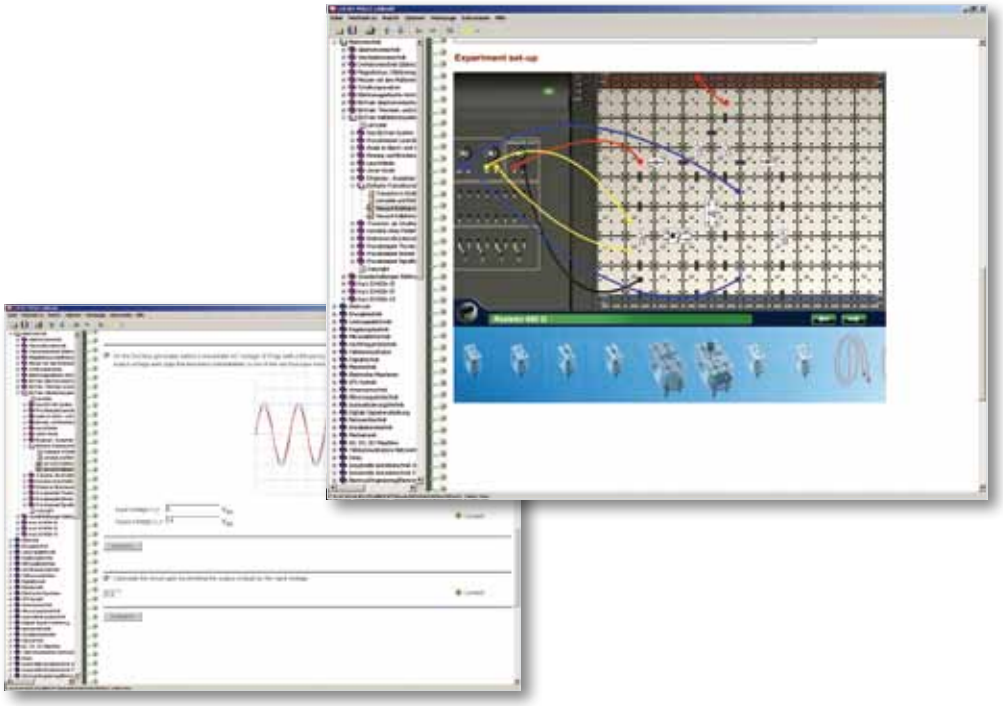
HTML-based Multimedia Courses with Virtual Instruments

These courses are tailored specially to basic training in diverse applications in the fields of electrical engineering and electronics. Complex relationships are illustrated appropriately for students with the help of numerous pictures and animations.

Students are constantly encouraged to apply their acquired knowledge in experiments using plug-in modules. Experiment instructions and virtual instruments are available for this purpose. The following topics are covered here:

EloTrain courses

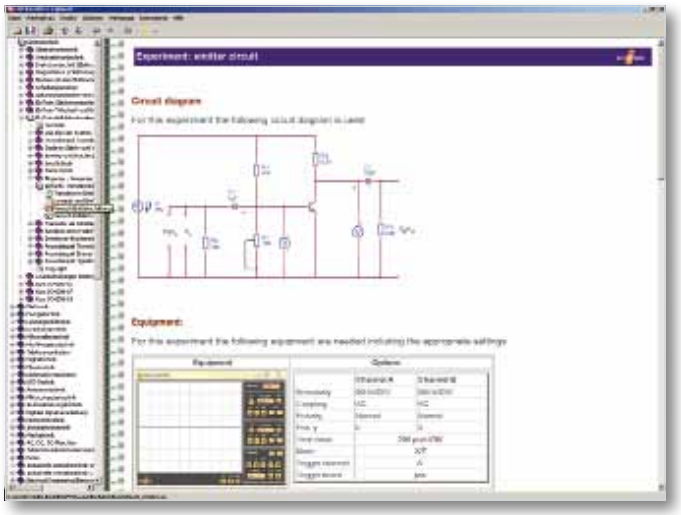
- DC technology
- AC and three-phase technology
- Semiconductor elements
- Basic electronic circuits
- Optoelectronics
- Introduction to digital technology
- Sequential circuits
- Fundamentals of automotive electrics and electronics



LabSoft

LabSoft is the EloTrain software's user interface, an open experimentation platform enabling access to all of the laboratory's media:

- Navigation window with tree structure for display and direct selection of all installed EloTrain courses
- Conduction of experiments and access to documentation
- Evaluation and storage of measurement results
- Virtual instruments for real-time measurements



Virtual instruments

LabSoft provides a wide variety of virtual instruments for real-time measurement.

- Voltmeters, ammeters, multimeters
- Dual-channel storage oscilloscope
- Function, pulse and waveform generator
- Three-phase power supply

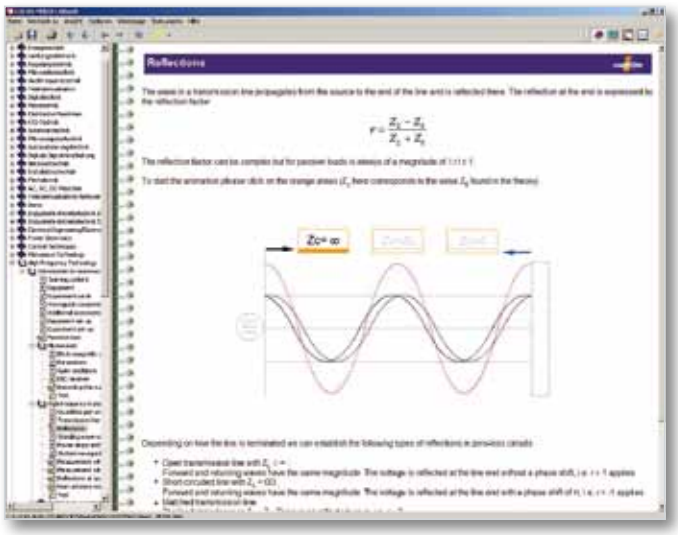
LabSoft in a network

LabSoft supports both local installation on a user PC as well as installation on a central server allowing for intranet or internet accessibility. To facilitate integration into learning management systems, international standards are observed during development of LabSoft.

LabSoft Classroom Manager

The LabSoft Classroom Manager is an extensive administration program for the EloTrain system and all LabSoft courses. Classroom Manager consists of the following program components:

- **LabSoft Reporter**
  Students' progress analysis and statistics
- **LabSoft Editor**
  Development and editing of courses and texts
- **LabSoft Manager**
  Administration of user data and courses in LabSoft



EloTrain Courses

DC Technology

Voltage, current, resistance – learn about the fundamentals of electrical engineering with the aid of the 2-mm plug-in system. This course explains the basic principles of electrical engineering by means of numerous, easily understandable experiments, and provides quizzes for consolidating acquired knowledge.

Training contents

- Setting up simple electrical circuits
- Using voltmeters and ammeters
- Ohm's law
- Series and parallel connections of resistors
- Voltage dividers in the off-load and on-load states
- Light bulb's characteristic
- Voltage-dependent resistor (VDR)
- Resistor with negative temperature coefficient (NTC)
- Resistor with positive temperature coefficient (PTC)
- Light-dependent resistor (LDR)
- Capacitor in a DC circuit
- Relay circuit

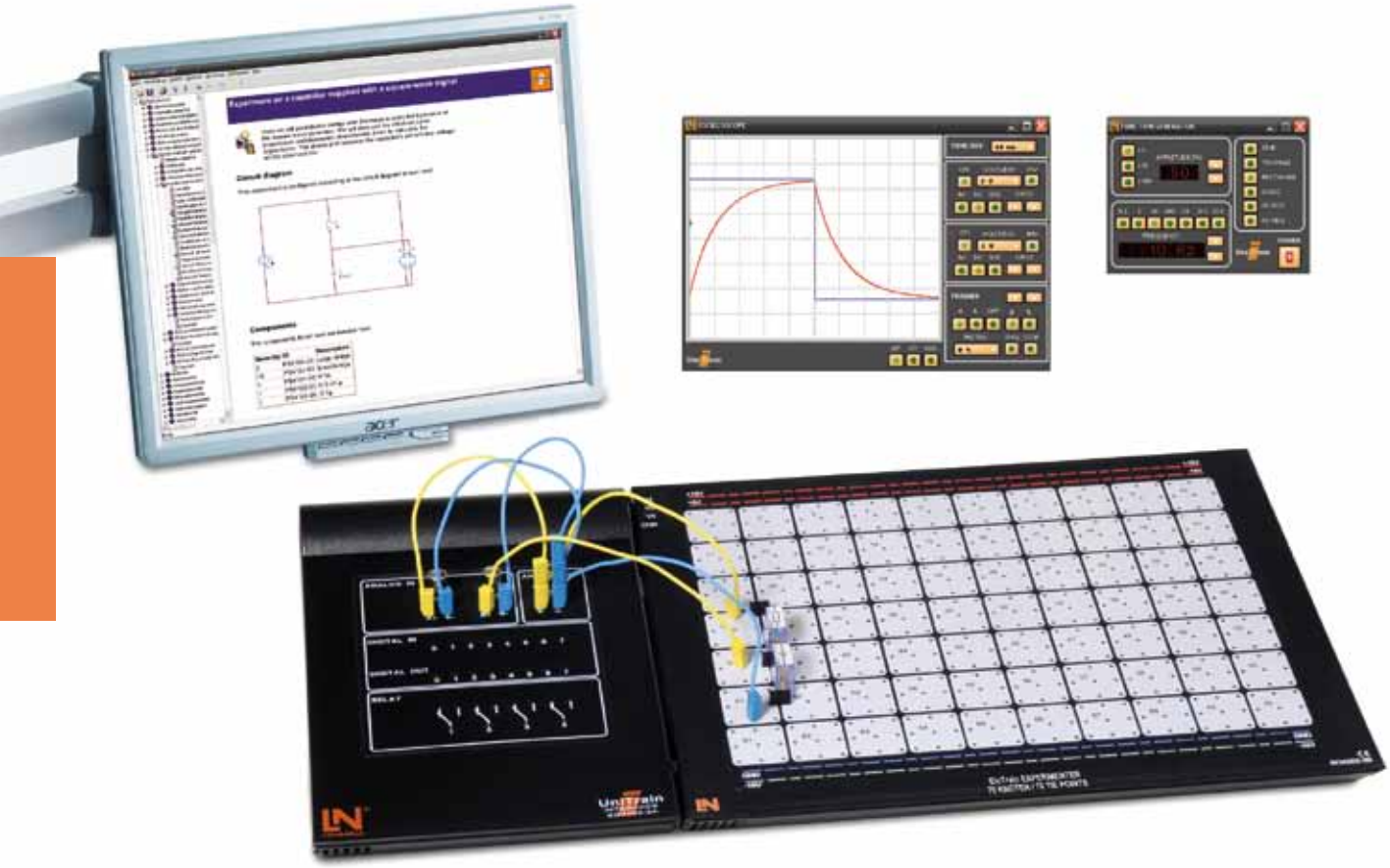
Includes

- Storage case for plug-in modules
- 1 CD with course titled "EloTrain 1 – DC Technology"
- 14 film resistors 22 Ω ... 1 MΩ
- 1 NTC, 1 PTC, 1 VDR, 1 LDR
- 2 capacitors 100 µF ... 470 µF
- 1 green LED, 1 red LED
- 1 transistor BC547, base left
- 1 switch, 1 button, 1 relay
- 1 light bulb (15 V) with socket (E10)

EloTrain Courses

AC and Three-Phase Technology

How do coils and capacitors respond to alternating current? What is an oscillator circuit and how does a transformer work? These and many other topics are explained clearly to students in numerous experiments.



Training contents

- Generation of alternating current
- Characteristic parameters of alternating current
- Ohmic resistance in an AC circuit
- Capacitor in an AC circuit
- Series and parallel connections of R and C
- Coil in an AC circuit
- Series and parallel connections of R and L
- Series and parallel connections of R, L and C
- Series and parallel compensation
- Transformer in the off-load and on-load states
- Three-phase network
- Star connection with balanced / unbalanced load
- Delta connection with balanced / unbalanced load

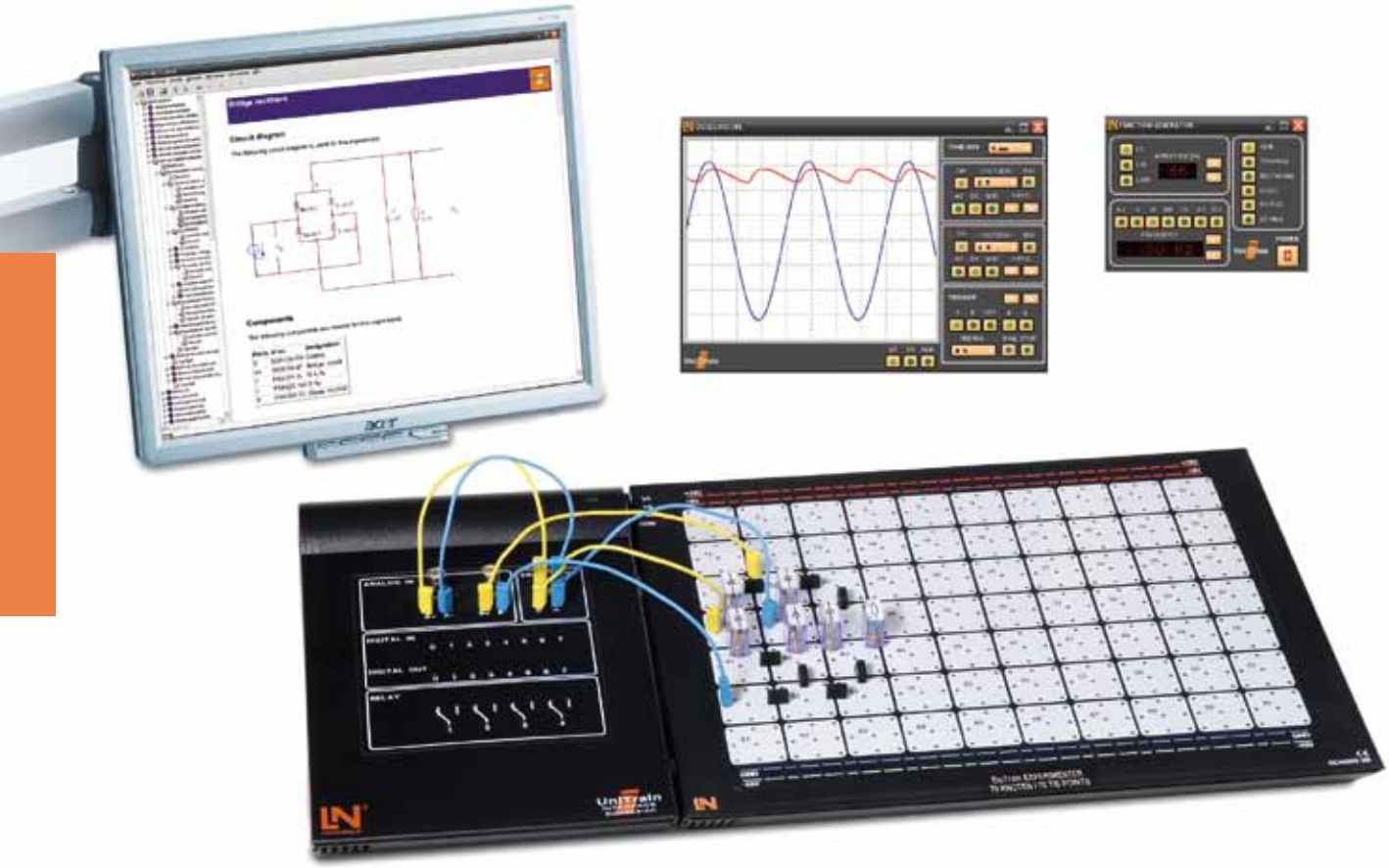
Includes

- Storage case for plug-in modules
- 1 CD with course titled "EloTrain 1 – DC Technology"
- 14 film resistors 22 Ω ... 1 MΩ
- 1 NTC, 1 PTC, 1 VDR, 1 LDR
- 2 capacitors 100 µF ... 470 µF
- 1 green LED, 1 red LED
- 1 transistor BC547, base left
- 1 switch, 1 button, 1 relay
- 1 light bulb (15 V) with socket (E10)

EloTrain Courses

Semiconductor Components

A knowledge of the properties and functions of electronic components serves as a basis for understanding and analyzing electronic and integrated circuits.



Training contents

- Diodes in DC and AC circuits
- Half-wave rectifier and bridge rectifier with smoothing
- Light-emitting diode, photodiode
- Diode properties on transistor paths
- Transistor's input, output and control characteristics
- Transistor in emitter, collector and base circuits
- Transistor as a switch and delay element
- FET as a controllable resistor and switch
- Sensor dimmer with MOSFET
- Thyristor as a switch
- Phase angle control with a TRIAC and DIAC
- Pulse generator with UJT
- Recording the characteristics of individual components

Includes

- Storage case for plug-in modules
- CD with course titled "EloTrain 3 – Semiconductor Components"
- 16 film resistors 10 Ω ... 47 kΩ
- 1 linear potentiometer, 10 kΩ
- 4 capacitors 100 µF ... 0.47 µF
- 2 electrolytic capacitors 1 µF ... 10 µF
- 1 coil, 10 mH
- 1 green LED, 1 red LED
- 6 Si diodes 1N4007, 1 Ge diode AA118
- 1 Zener diode (4.7 V), 1 Zener diode (10 V)
- 1 transistor BC547, base left
- 1 transistor BD237, base left
- 1 field-effect transistor, 2N3819
- 1 uni-junction transistor
- 1 DIAC, 1 thyristor, 1 TRIAC
- 1 loudspeaker
- 1 switch, 1 button
- 1 light bulb (15 V) with socket (E10)

EloTrain Courses

Basic Electronic Circuits

This course focuses on electronic circuit engineering and provides an introduction to the topic of electronic circuits.
Explanations of key fundamentals are followed by experiments in which various circuits are realized with the help of original components and analyzed with measuring instruments.

Training contents

- Basic amplifier circuits containing transistors
- Two-stage AC amplifier
- Darlington amplifier, emitter-coupled amplifier, differential amplifier
- Two-stage DC amplifier with complementary transistors, push-pull output amplifier
- Positive and negative feedback
- Threshold switch (Schmitt trigger)
- Astable, monostable and bistable multivibrators
- Sawtooth waveform generator (pulse generator)
- Sine waveform generators with RC and LC elements
- Amplitude modulator and demodulator
- Single-phase and three-phase rectifier circuits
- Stabilizer circuits
- Voltage and current controllers (linear)
- DC transformer
- Phase-angle control with a thyristor and TRIAC
- Operational amplifier circuits

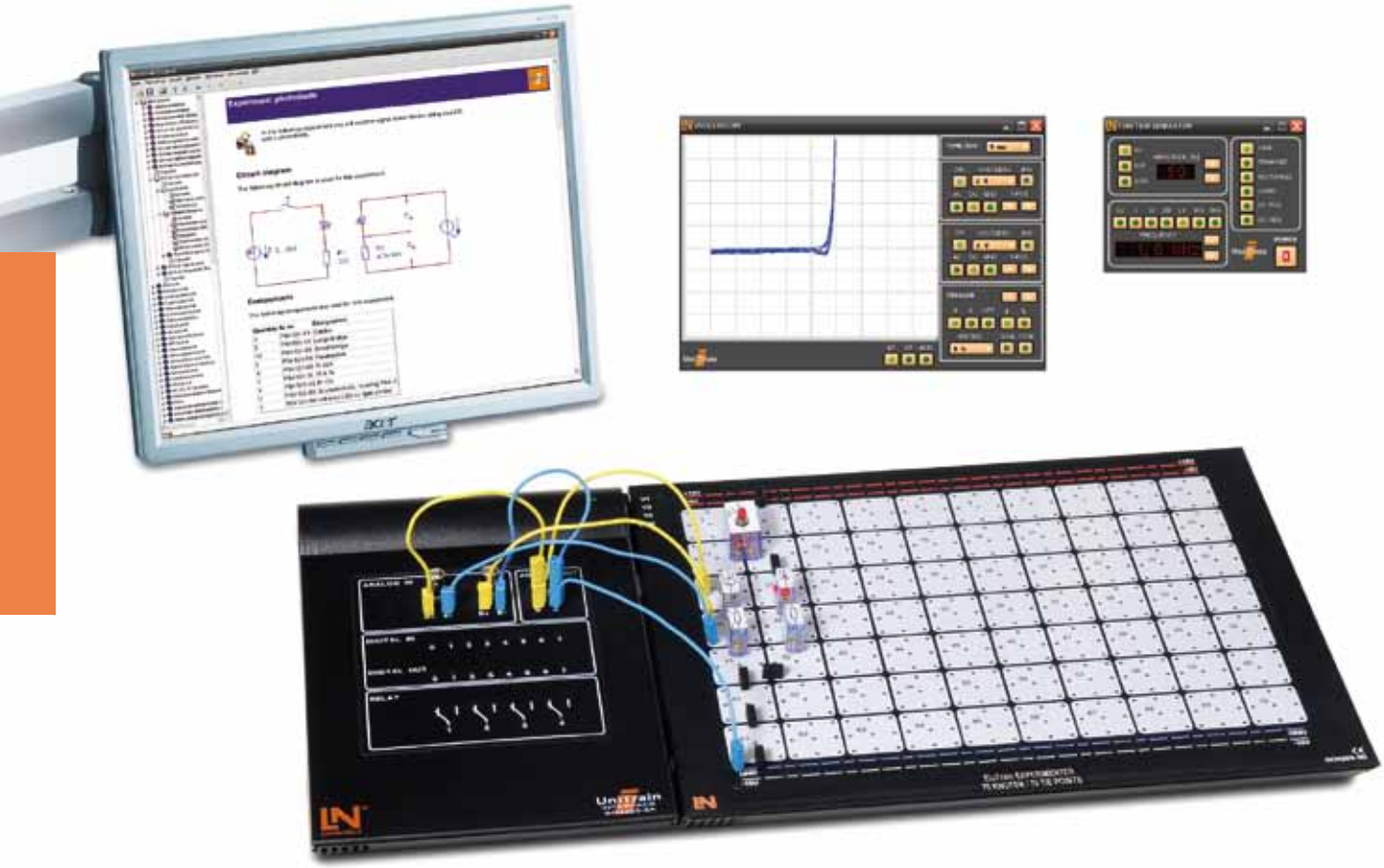
Includes

- Storage case for plug-in modules
- 1 CD with course titled "EloTrain 4 – Basic Electronic Circuits"
- 29 film resistors 10 Ω ... 1 MΩ
- 2 linear potentiometers 1 kΩ ... 10 kΩ
- 8 capacitors 100 µF ... 0.47 µF
- 6 electrolytic capacitors 1 µF ... 470 µF
- 2 coils 10 mH ... 33 mH
- 2 transformer coils N = 300, N = 900
- 1 C-core (pair)
- 2 green LEDs
- 6 Si diodes 1N4007, 1 Ge diode AA118
- 1 Zener diode 4.7 V
- 2 transistors BC547, base left
- 2 transistors BD237, base left + base right
- 1 transistor BD238, base left
- 1 field-effect transistor, 2N3819
- 1 uni-junction transistor
- 1 DIAC, 1 thyristor, 1 TRIAC
- 1 operational amplifier
- 1 switch
- 1 light bulb (15 V) with socket (E10)

EloTrain Courses

Optoelectronics

Optoelectronic equipment comprises components serving as an interface between electrical and optical elements, or devices containing such components. Optoelectronic equipment mainly incorporates micro-electronic parts operating on the basis of semiconductors.



Training contents

- LED parameters and characteristics
- LED control
- Infrared LED
- Photocell
- Photodiode
- Phototransistor
- Signal transmission using photodiodes and phototransistors
- Optocouplers
- Optical waveguides

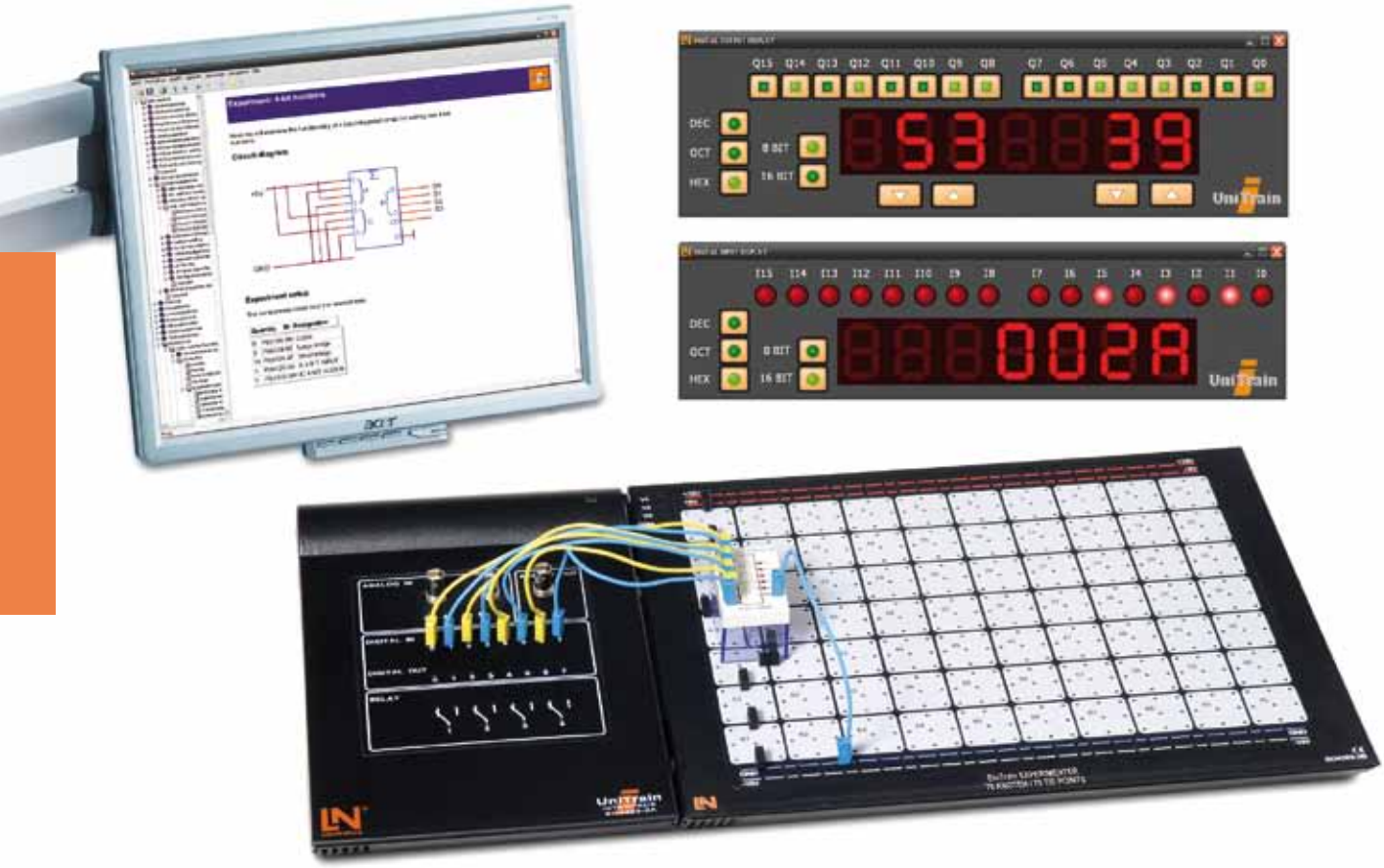
Includes

- Storage case for plug-in modules
- 1 CD with course titled "EloTrain 5 – Optoelectronics"
- 7 film resistors 100 Ω ... 22 kΩ
- 1 capacitor 10 µF
- 1 transistor BC547, base left
- 1 red LED, 1 infrared LED
- 1 Si photodiode, 1 Si phototransistor
- 1 Si photocell
- 1 optocoupler
- 2 optical waveguide housings + optical waveguide
- 1 adjustable light bulb (15 V) with socket (E10)
- 1 loudspeaker, 1 button

EloTrain Courses

Introduction to Digital Technology

Digital technology deals with the processing of discrete-value and discrete-time numerical sequences as well as digital signals. Digital circuits mainly comprise logic elements such as AND, NAND, OR, NOR, NOT, XOR, XNOR and others with which digital YES / NO information can be combined together, e.g. in counters or flip-flops.



Training contents

- NOT function; AND and NAND operators
- OR and NOR operators
- Antivalence (EXOR) and equivalence (EXNOR)
- Half-adder and full-adder
- Subtractor circuits
- Code conversion
- RS-NOR flip-flop
- Edge-triggered RS flip-flop
- Static and dynamic D flip-flop
- JK flip-flop
- JK master-slave flip-flop
- Flip-flop applications

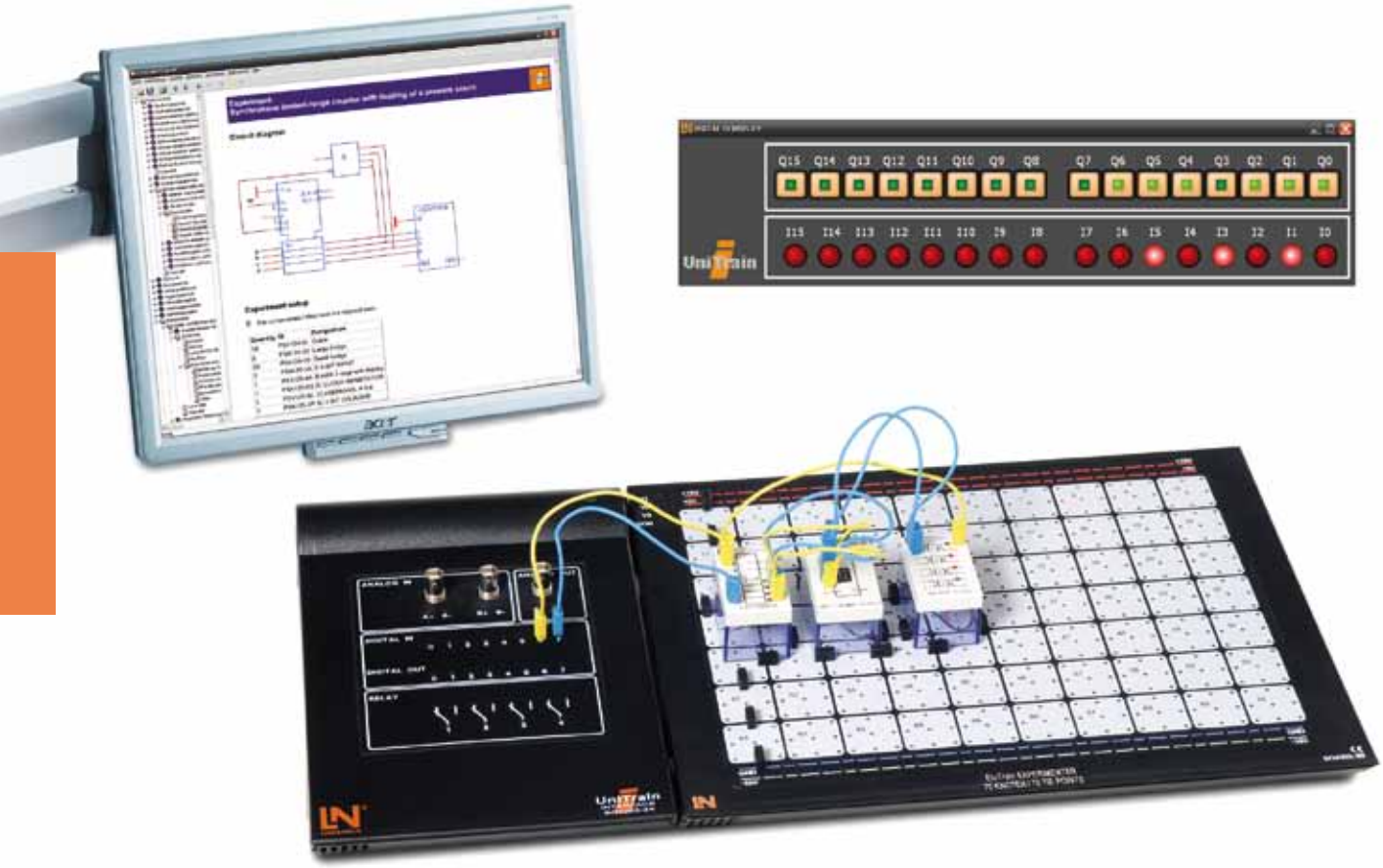
Includes

- Storage case for plug-in modules
- 1 CD with course titled "EloTrain 6 – Introduction to Digital Technology"
- 1 mono-flop, 2-fold
- 1 4-bit driver/NOT gate
- 1 module with 2 AND/NAND gates, 4 inputs each
- 2 modules with 4 AND/NAND gates, 2 inputs each
- 1 module with 4 NOR/XNOR gates, 2 inputs each
- 2 modules with 2x JK flip-flops each
- 1 module with 2x JK master/slave flip-flops
- 1 adder, 4-bit

EloTrain Courses

Sequential Circuits

Sequential circuits play their most significant role in computer engineering. Flip-flops and their derivative products such as counters, registers and dividers constitute the elementary components of any microprocessor.



Training contents

- Display of binary numbers using LEDs and LED-based displays
- Asynchronous 4-bit counter
- Synchronous counter
- Decimal counter
- Counters for special codes
- Divider circuits
- Registers and shift registers
- Serial and parallel data transmission
- Multiplexers and demultiplexers

Includes

- Storage case for plug-in modules
- 1 CD with course titled "EloTrain 7 – Sequential Circuits"
- 1 display, 7-segment
- 1 clock generator
- 1 4-bit driver / NOT gate
- 2 AND / NAND gates, 2 inputs, 4-fold
- 1 XOR / XNOR gate, 2 inputs, 4-fold
- 1 AND / OR / NOT gate
- 2 JK flip-flops, 2-fold
- 1 adder, 4-bit
- 1 shift register, 4-bit, 2-fold
- 1 multiplexer (4-to-1)
- 1 buffer, 4-bit, tri-state

EloTrain Courses

Fundamentals of Automotive Electrics and Electronics

The growing significance of electric and electronic components in motor vehicles necessitates practical training in the fundamentals of electronics. Experiments tailored specially to automotive applications facilitate an understanding of this complex subject.

Training contents

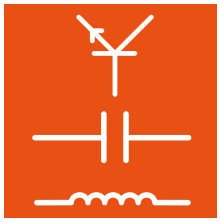
- Fundamentals of electrical engineering (Ohm's law, voltage, current, resistance)
- Calculations involving basic electrical variables (series and parallel connections, Ohm's law)
- Voltage divider (on-load / off-load)
- Measurement of current, voltage and resistance
- Use of circuit diagrams
- Fundamentals of semiconductor technology (design, intrinsic conduction, doping)
- Characteristics of diodes / Z-diodes
- Diode as a rectifier
- Decoupling diode, free-wheeling diode
- Voltage stabilization by means of a Z-diode
- Fundamentals of transistors
- Transistor applications (basic circuits, multivibrators, Darlington circuit, Schmitt trigger)
- Transistor as a power amplifier, switch and current source
- Field-effect transistors (design, application, variants)
- Thyristors (design, mode of operation, applications)

Includes

- Storage case for plug-in modules
- 1 CD with course titled "EloTrain 8 – Fundamentals of Automotive Electrics and Electronics"
- 15 film resistors 22 Ω ... 22 kΩ
- 5 linear potentiometers 2.2 kΩ ... 47 kΩ
- 1 NTC, 1 PTC, 1 LDR
- 4 capacitors 2.2 µF ... 0.1 µF
- 3 electrolytic capacitors 47 µF ... 220 µF
- 3 transformer coils N = 300, N = 900, N = 900
- 1 C-core (pair)
- 2 red LEDs
- 4 Si diodes 1N4007, 1 Ge diode AA118
- 2 Zener diodes (3.9 V, 6.2 V)
- 1 transistor BC547, base left
- 2 transistors BD237, base left + base right
- 1 field-effect transistor, 2N3819
- 1 thyristor
- 2 switches, 1 relay
- 1 light bulb (15 V) with socket (E10)

LUCAS-NÜLLE

4-mm Plug-In System



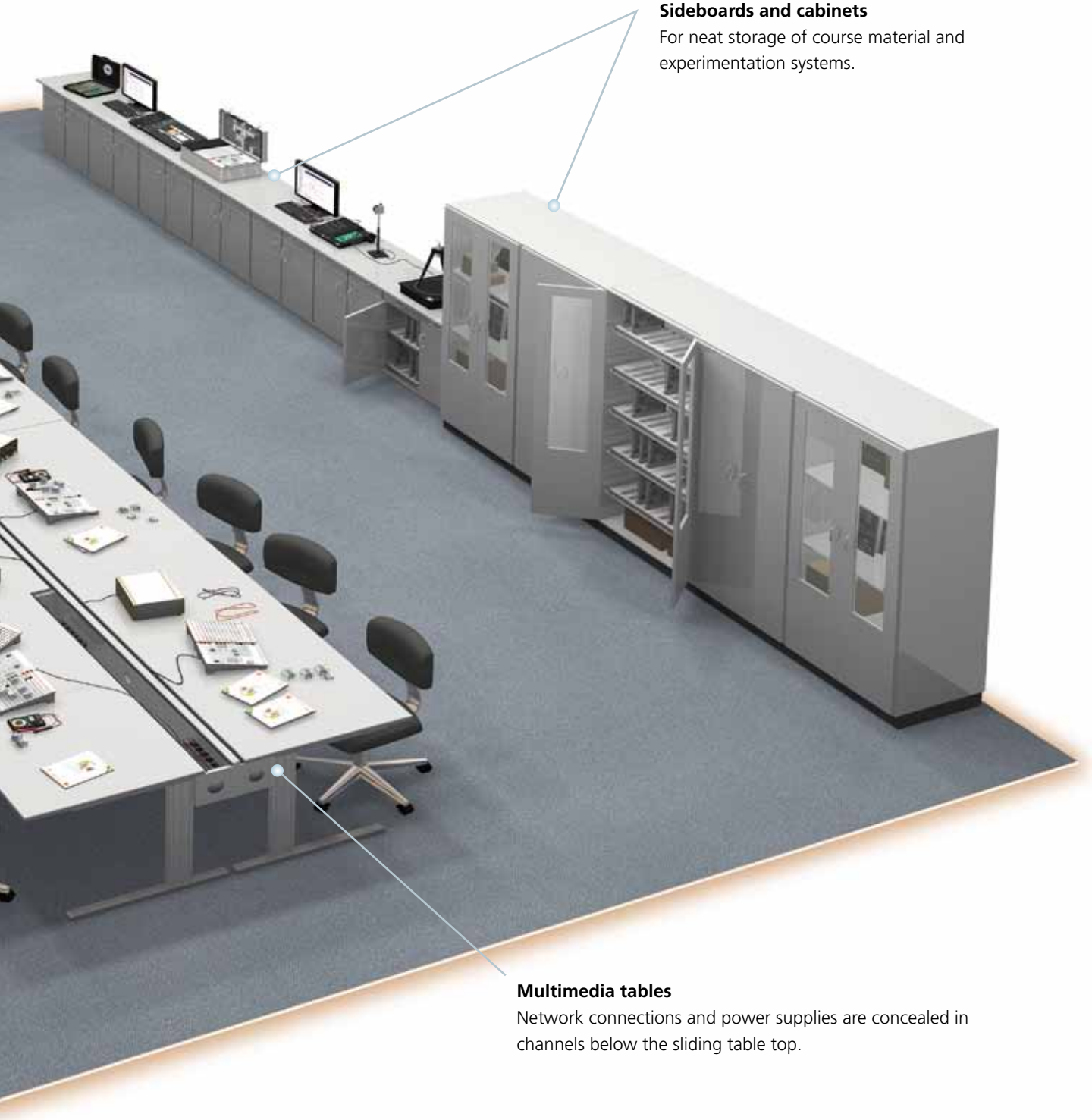
More Than Just a Training System

EloTrain Lab – A Complete Solution for the 4-mm Plug-In System

Presentation tools
Jointly summarize what has been learned; work out complex topics and experiments.

Multi-purpose tables
Equipped with a motorized, retractable power supply channel for accommodating 19" 3HU inserts.

Benefits:
Multi-Power-Supply permanently fitted into power supply channel.



Sideboards and cabinets
For neat storage of course material and experimentation systems.

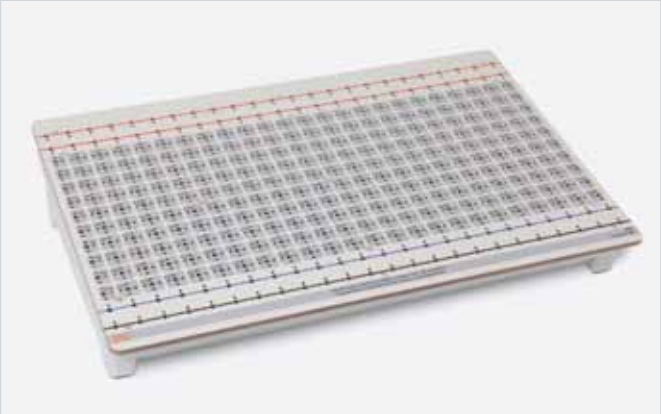
Multimedia tables
Network connections and power supplies are concealed in channels below the sliding table top.

4-mm Plug-In System

A Universally Proven Plug-In System for Basic Training

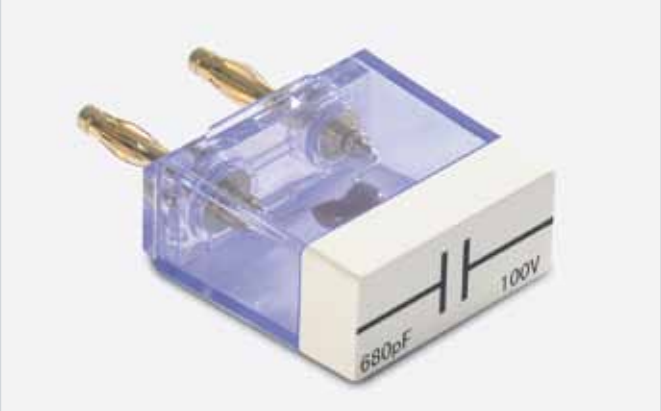
The EloTrain 4-mm plug-in system is an extensive kit for experimentation in the field of electrical engineering, electronics and digital technology. By installing 4-mm plug-in modules on an EloTrain experimenter, electronic circuits of any required size can be assembled, operated and tested. Students are guided through the experiments by means of clearly organized experimentation instructions; the knowledge acquired in this process is consolidated in numerous tests.

- Multi-Power-Supply with an integrated function generator for safe experimentation by students using safety extra-low voltages



- Various experimenters with power-supply bus lines

- High-quality experiment manuals



- 4-mm plug-in modules with passive and active electronic components; gold-plated banana plugs

Your benefits

- Precise mapping of circuit diagrams on the experimenter
- Understanding of complex relationships through experimentation
- Exclusive use of safety extra-low voltages (SELV)
- High transparency
- Durable, gold-plated components
- No loose contacts
- Fault-tolerant
- Quick setup

EloTrain Plug-In Modules

4-mm Plug-In Modules with Passive and Active Components

The plug-in modules contain passive and active electronic components whose contacts comprise gold-plated, 4-mm banana plugs. When plugged into the experimenter, the modules are held in place mechanically by the banana plugs. These plugs also serve to establish the necessary electrical connections to the experimenter's nodes. Cables and bridging plugs can be used to establish connections to further nodes, components or measuring instruments.

Plug-in modules
- All components and bridging plugs with gold-plated, 4-mm banana plugs
- Housing made of transparent, highly impact-resistant plastic (Makrolon®)
- Top with a scratch-resistant, high-contrast screen print indicating the circuit diagram and model number

Digital technology
- Digital technology plug-in modules have surface-mounted, 2-mm jacks for connecting the logic units

Plug-in power modules
- Power modules are mounted in heat-dissipating, light-metal housings

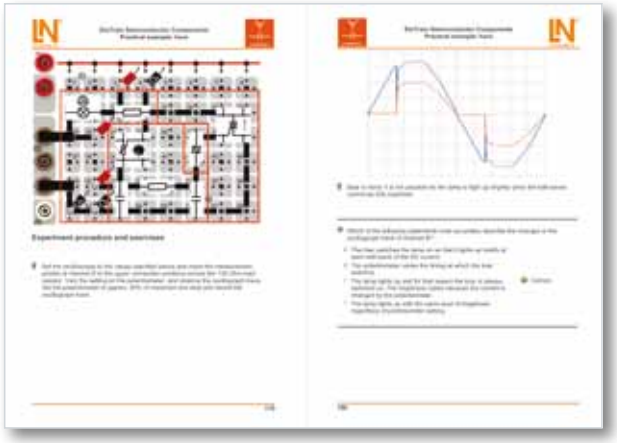
Repairs
- The housing can be easily opened for repairs
- Easy unsoldering / replacement of defective components

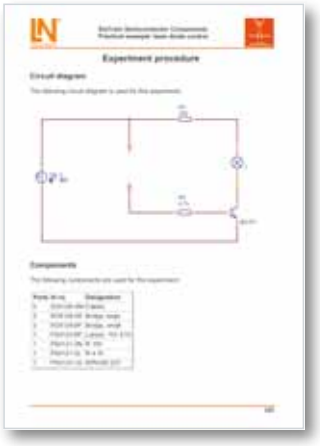
EloTrain Manuals

Experiment Manuals

High-quality, bound manuals printed in colour and furnished with a robust back are available for the various topics. The teacher's handbook comes with solutions, the students' guide with worksheets. A CD from which the documents can be printed out is also included.

Contents
- Learning objectives and introduction
- Theoretical treatment of each topic
- Experiments and their setups
- Projects
- Worksheets (students' guide)
- Solution sheets (teacher's handbook)
- Knowledge tests





The following topics are covered here:
- DC technology
- AC and three-phase technology
- Semiconductor components
- Basic electronic circuits
- Optoelectronics
- Introduction to digital technology
- Sequential circuits
- Fundamentals of automotive electrics and electronics

Includes
- Teacher's handbook with solutions
- Students' guide as a PDF version with worksheets
- Additional CD from which the documents can be printed out

EloTrain Experimenter

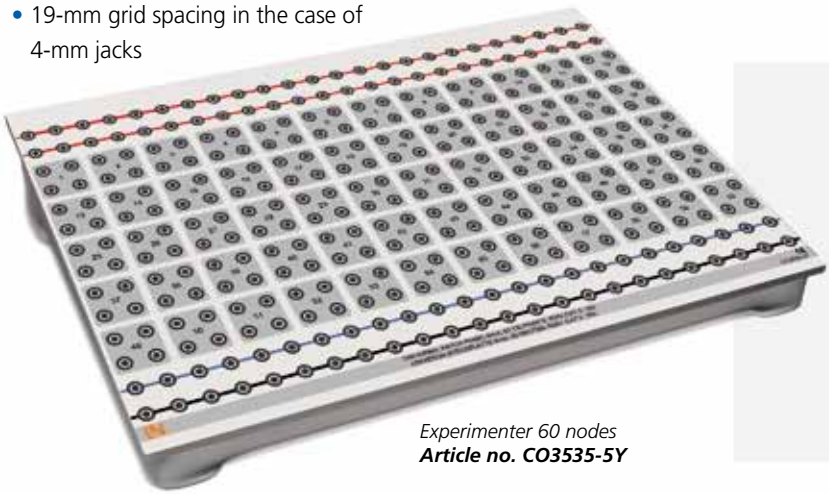
For the 2-mm and 4-mm Plug-In Systems

By installing plug-in modules on the EloTrain experimenter, electronic circuits of any required size can be assembled, operated and tested. When plugged into the experimenter, the modules are held in place mechanically by the banana plugs. These plugs also serve to establish the necessary electrical connections to the experimenter's nodes. Cables and bridging plugs can be used to establish connections to further nodes, components or measuring instruments.

Safety experimenter for 4-mm plug-in modules

Furnished with 4-mm safety jacks for contact-proof plug connectors

- 30 or 60 nodes each with 4 x 4-mm jacks
- 19-mm grid spacing in the case of 4-mm jacks



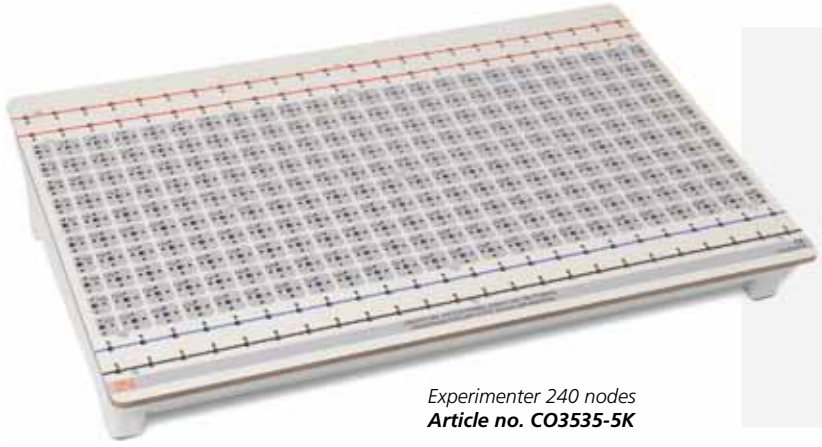
Experimenter 60 nodes
Article no. CO3535-5Y

Experimenter 30 nodes
Article no. CO3535-5X

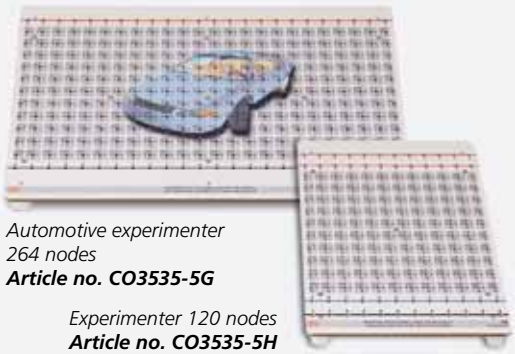
Suitable for 2-mm and 4-mm plug-in modules

Electrical connections between the nodes are established by means of 2-mm / 7.5-mm connectors.

- 100, 220 or 244 nodes each with 4 x 2-mm jacks and 1 x 4-mm jack
- 20 nodes each with 3 x 2-mm jacks and 1 x 4-mm jack
- 19-mm grid spacing in the case of 4-mm jacks; 7.5-mm grid spacing in the case of 2-mm jacks



Experimenter 240 nodes
Article no. CO3535-5K



Automotive experimenter
264 nodes
Article no. CO3535-5G

Experimenter 120 nodes
Article no. CO3535-5H

One Experimenter, Many Applications

For instance: as a desktop board …

… or built into a case

… or installed in an experimentation frame

Your benefits

- Compact circuitry
- Large number of nodes
- Experiments are possible in many different variants and magnitudes
- 2-mm and 4-mm plug-in systems can be combined (2/4-mm experimenter)
- Console design permits ergonomic, fatigue-free working
- 4 power-supply bus lines
- Suspendable in an H-profile frame and/or installable in a case
- Maximum contact capacity of 10 A
- Experimenter designed specially for automotive electronics

Multi-Power-Supply

Safe Experiments For Students Using Safety Extra-Low Voltages

The Multi-Power-Supply comprises a multi-purpose, compact power supply unit as well as function and three-phase generators for all elementary and advanced experiments in the fields of electrical engineering / electronics and digital technology. The unit has protective insulation and supplies safety extra-low voltages in accordance with EN 61010. All outputs are equipped with self-resetting fuses which safely shut off overcurrent without a need for replacing fusible cut-outs. This makes the device extremely safe, maintenance-free and especially suitable for beginners.

Article no. CO3538-8N

Your benefits

- A single device for all experiments
- Simple operation
- Exclusive use of safety extra-low voltages (SELV)
- Short-circuit-proof design prevents incorrect operation
- Suitable for beginners

4-in-1: An All-Rounder

Direct-voltage source

- Regulated and short-circuit-proof
- 15 V / 1 A
- 12 V / 1 A
- 5 V / 1 A
- -15 V / 1 A
- 0 … 30 V / 1 A

Alternating-voltage source

- Short-circuit-proof by means of a self-resetting fuse
- 50 Hz
- 12 V / 0.2 A
- 24 V / 0.2 A

Three-phase power source, short-circuit-proof

- Frequency: 50 Hz
- Slow-motion function (switchable to 1 Hz)
- Star voltage: 7 V
- Delta voltage: 12 V

Function generator, short-circuit-proof

- Functions: sine, delta, square-wave, TTL
- Frequency ranges in Hz: 50, 500, 5 k, 50 k, 500 k
- Frequency fine adjustment: 1 … 50
- Amplitude at output 1: -10 … 0 … +10 V / 0.3 A
- Output 2: -10 dB

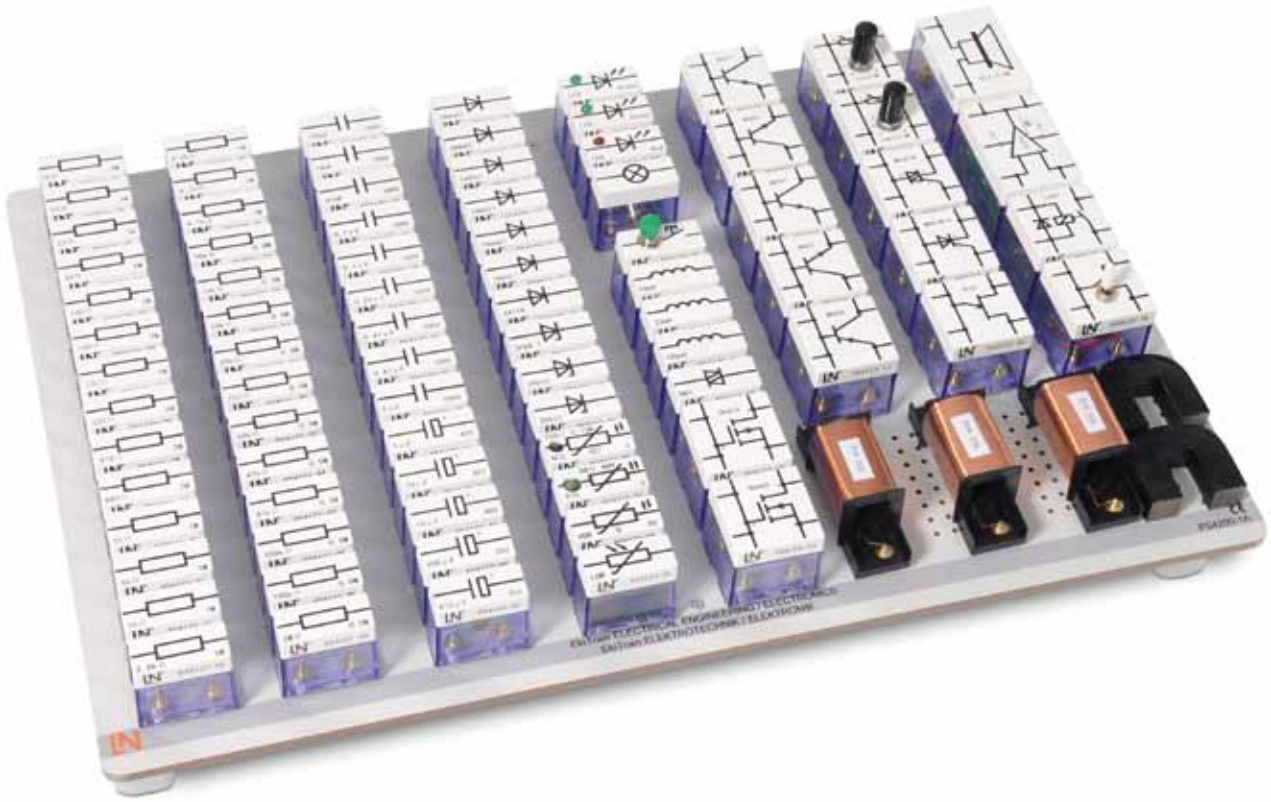
Also Available for the 19-Inch Rack-Insert System

Article no. ST8008-6K

EloTrain Basic Equipment

Electrical Engineering / Electronics

Consisting of eighty-one 4-mm plug-in modules, this set allows a vast range of experiments on the fundamentals of electrical engineering and electronics. The set comes on an A4 storage plate with scratch-resistant, colour print.



Includes

- Storage plate printed with the circuit symbols of the various components
- 28 film resistors 10 Ω ... 1 MΩ
- 2 linear potentiometers 1 kΩ + 10 kΩ
- 1 NTC, 1 PTC, 1 VDR, 1 LDR
- 9 capacitors 100 µF ... 1 µF
- 4 electrolytic capacitors 1 µF ... 470 µF
- 3 coils 10 mH ... 100 mH
- 3 transformer coils N = 300, N = 900, N = 900
- 1 C-core (pair)
- 2 green LEDs, 1 red LED
- 6 Si diodes 1N4007, 1 Ge diode AA118
- 1 Zener diode (4.7 V), 2 Zener diodes (10 V)
- 2 transistors BC547, base left + base right
- 2 transistors BD237, base left + base right
- 1 transistor BD238, base left
- 2 field-effect transistors 2N3819 + 2N3820
- 1 uni-junction transistor
- 1 DIAC, 1 thyristor, 1 TRIAC
- 1 operational amplifier
- 1 loudspeaker
- 1 switch, 1 button, 1 relay
- 1 light bulb (15 V) with socket (E10)

Manuals

Electrical Engineering / Electronics

DC Technology

- Setting up simple electrical circuits
- Measurement; reading of scales
- Use of voltmeters and ammeters
- Internal resistance of voltmeters and ammeters
- Ohm's law
- Series and parallel connections of resistors
- Extending the measurement range of voltmeters and ammeters
- Measuring the internal resistance of voltage sources
- Voltage dividers in the off-load and on-load states
- Light bulb's characteristic
- Voltage-dependent resistor (VDR)
- Resistor with negative temperature coefficient (NTC)
- Resistor with positive temperature coefficient (PTC)
- Light-dependent resistor (LDR)
- Capacitor in a DC circuit
- Relay circuit

Article no. SH5002-7A

AC and Three-Phase Technology

- Generation of alternating current
- Characteristic parameters of alternating current
- Ohmic resistance in an AC circuit
- Capacitor in an AC circuit
- Series and parallel connections of R and C
- Coil in an AC circuit
- Series and parallel connections of R and L
- Series and parallel connections of R, L and C
- Series and parallel compensation
- Transformer in the off-load and on-load states
- Three-phase network
- Star connection with balanced / unbalanced load
- Delta connection with balanced / unbalanced load

Article no. SH5002-7C

Manuals

Electrical Engineering / Electronics

Semiconductor Components

- Diodes in DC and AC circuits
- Half-wave rectifier and bridge rectifier with smoothing
- Visualization of diode characteristics on the oscilloscope
- Light-emitting diode, photodiode
- Diode properties on transistor paths
- Transistor's input, output and control characteristics
- Transistor in emitter, collector and base circuits
- Transistor as a switch and delay element
- Characteristic of a field-effect transistor (FET)
- FET as a controllable resistor and switch
- MOSFET characteristic
- Sensor dimmer with MOSFET
- Characteristics of a DIAC, thyristor and TRIAC
- Thyristor as a switch
- Phase angle control with a TRIAC and DIAC
- UJT characteristic; pulse generator with UJT

Article no. SH5002-7E

Basic Electronic Circuits

- Basic amplifier circuits with bipolar and field-effect transistors
- Two-stage AC amplifier
- Darlington amplifier
- Phase inversion stages
- Differential amplifier, push-pull output amplifier
- Two-stage DC amplifier with complementary transistors
- Positive and negative feedback
- Square-wave and sawtooth generators
- Threshold switch (Schmitt trigger)
- Astable, monostable and bistable multivibrators
- Sine waveform generators with RC and LC elements
- Amplitude and frequency modulator / demodulator
- Single-phase and three-phase rectifier circuits
- Voltage multiplier
- Stabilizer circuits
- Voltage and current controllers (linear)
- Switching-voltage controller, direct-voltage transformer
- Pulse generation with a TRIAC and DIAC and uni-junction transistor
- Phase-angle control with a thyristor and TRIAC
- Full-wave control with a zero-voltage switch
- DC switch with thyristors
- Operational amplifier as an inverting / non-inverting amplifier
- Operational amplifier as a differential amplifier

Article no. SH5002-7F

EloTrain – Supplementary Equipment

Optoelectronics

Consisting of eight 4-mm plug-in modules, this set is a supplement to the basic EloTrain equipment. Allowing additional experiments in the field of optoelectronics, the set comes on an A4 storage plate with scratch-resistant, colour print.

Includes

- Storage plate printed with the circuit symbols of the various components
- 1 photodiode
- 1 infrared LED
- 1 red LED
- 1 phototransistor
- 1 photocell
- 1 optocoupler
- 1 variable light source
- 1 optical waveguide
- 2 mountings for optical waveguides

Optoelectronics Manual

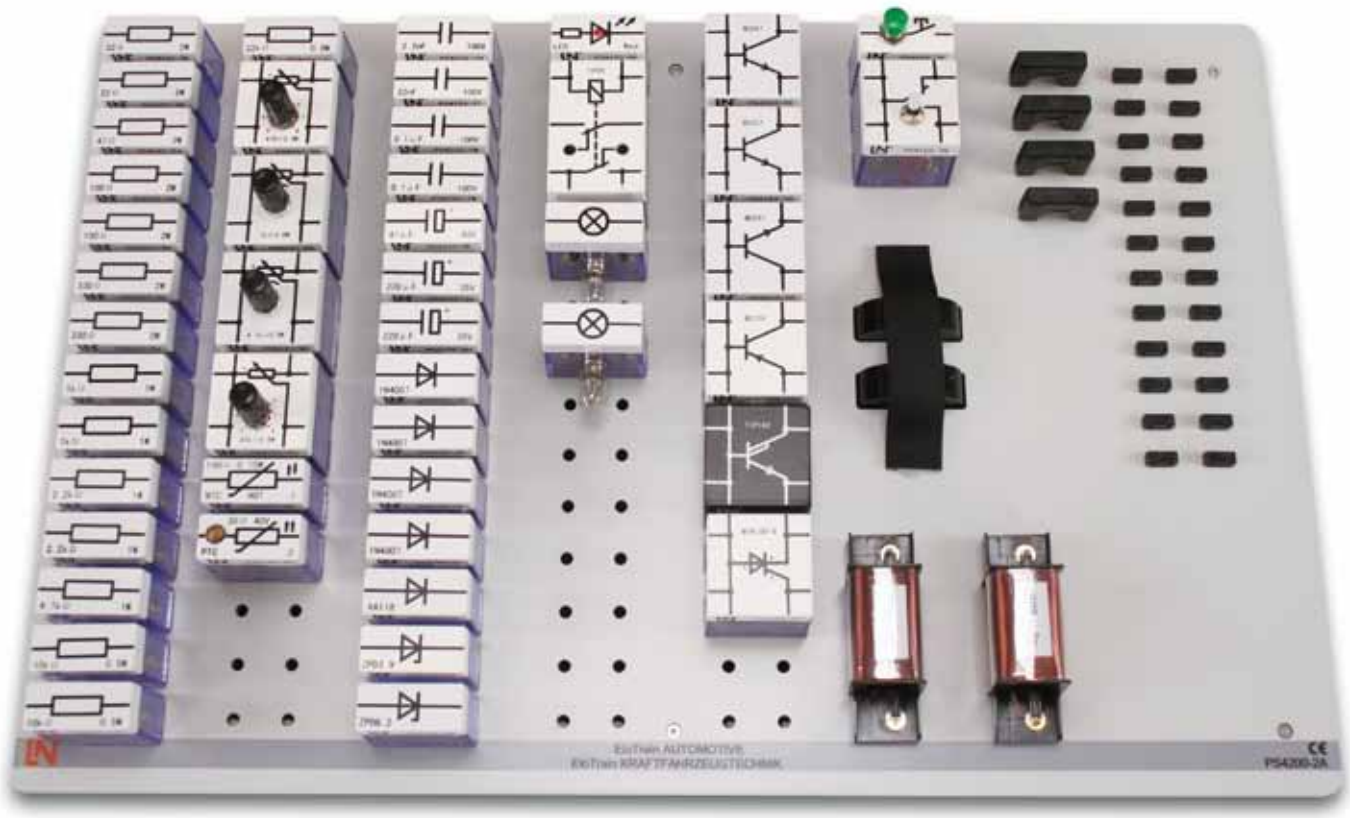
- Introduction to semiconductor-based light sensors
- Characteristics and parameters of photodiodes and phototransistors
- Characteristics and parameters of LEDs and infrared LEDs
- Examination of a photocell's switching characteristics and open-circuit voltage
- Signal transmission in open space
- Signal transmission via optical waveguides
- Signal transmission via optocouplers

Article no. SH5002-7C

EloTrain Equipment

Automotive Engineering

Consisting of eighty-two 4-mm plug-in modules and 2-mm connectors, this set allows a vast range of experiments on the fundamentals of automotive electrical engineering and electronics. The set comes on an A4 storage plate with scratch-resistant, colour print.



Includes

- Storage plate printed with the circuit symbols of the various components
- 15 film resistors 22 Ω ... 22 kΩ
- 5 linear potentiometers 470 Ω, 1 kΩ, 4,7 kΩ, 4,7 kΩ, 47 kΩ
- 1 NTC, 1 PTC, 1 LDR
- 4 capacitors 2.2 µF ... 0.1 µF
- 3 electrolytic capacitors 47 µF ... 220 µF
- 3 transformer coils N = 300, N = 900, N = 900
- 1 C-core (pair)
- 2 red LEDs
- 4 Si diodes 1N4007, 1 Ge diode AA118
- 1 Zener diode (3.9 V), 1 Zener diode (6.2 V)
- 2 transistors BD237, base left + base right
- 1 transistor BC547, base left
- 1 Darlington transistor TIP 162, base left
- 1 thyristor
- 2 switches
- 1 relay
- 1 light bulb (15 V) with socket (E10)
- 4 4-mm bridging plugs
- 24 2-mm bridging plugs

Manuals

Automotive Engineering

Fundamentals of Automotive Electrics and E lectronics

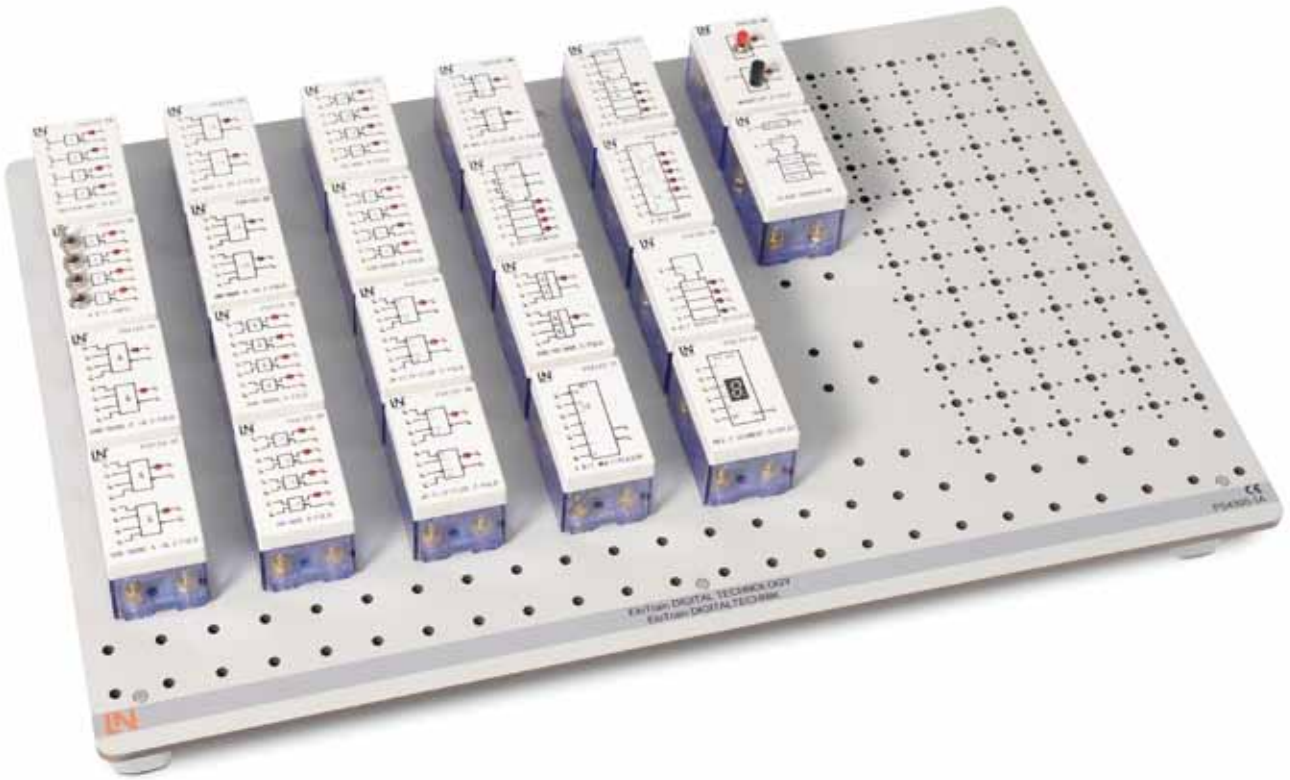
- Fundamentals of electrical engineering (Ohm's law, voltage, current, resistance)
- Calculations involving basic electrical variables (series and parallel connections, Ohm's law)
- Voltage divider (on-load / off-load)
- Measurement of currents, voltages and resistances
- Use of circuit diagrams
- Fundamentals of semiconductor technology (design, intrinsic conduction, doping)
- Characteristics of diodes / Z-diodes
- Diode as a rectifier
- Decoupling diode, free-wheeling diode
- Voltage stabilization by means of a Z-diode
- Fundamentals of transistors
- Transistor applications (basic circuits, multivibrators, Darlington circuit, Schmitt trigger)
- Transistor as a power amplifier, switch and current source
- Field-effect transistors (design, applications, variants)
- Thyristors (design, mode of operation, applications)

Article no. SH5005-1V

EloTrain Equipment

Digital Technology

Consisting of twenty-two 4-mm plug-in modules, this set allows a vast range of experiments in the field of digital technology. The set comes on an A4 storage plate with scratch-resistant, colour print.



Includes

- Storage plate printed with the circuit symbols of the various components
- 1 4-bit driver / NOT gate
- 1 4-bit input
- 2 AND / NAND gates, 4 inputs, 2-fold
- 1 OR / NOR gate, 4 inputs, 2-fold
- 2 AND / NAND gates, 2 inputs, 4-fold
- 2 OR / NOR gates, 2 inputs, 4-fold
- 1 XOR / XNOR gate, 2 inputs, 4-fold
- 2 JK flip-flops, 2-fold
- 1 JK master slave flip-flop, 2-fold
- 1 counter, 4-bit
- 1 AND / OR / NOT gate
- 1 multiplexer (4-to-1)
- 1 shift register, 4-bit, 2-fold
- 1 adder, 4-bit
- 1 buffer, 4-bit, tri-state
- 1 display, 7-segment
- 1 mono-flop, 2-fold
- 1 clock generator

Manuals

Digital Technology

Introduction to Digital Technology

- NOT function; AND and NAND operators
- OR and NOR operators
- Antivalence (EXOR) and equivalence (EXNOR)
- Half-adder and full-adder
- Subtractor circuits
- Code conversion
- RS-NOR flip-flop
- Edge-triggered RS flip-flop
- Static and dynamic D flip-flop
- JK flip-flop
- JK master-slave flip-flop
- Flip-flop applications

Article no. SH5002-8A

Sequential Circuits

- Display of binary numbers using LEDs and LED-based displays
- Asynchronous 4-bit counter
- Synchronous counter
- Decimal counter
- Counters for special codes
- Divider circuits
- Registers and shift registers
- Serial and parallel data transmission
- Multiplexers and demultiplexers

Article no. SH5002-8C

EloTrain Case

A Practical Means of Storing Plug-In Modules

Handy aluminium-profile case with a handle and removable cover for storing a complete experimentation system with 4-mm and/or 2-mm plug-in modules.

EloTrain case for A4-format experimenters
Article no. SO5127-3L

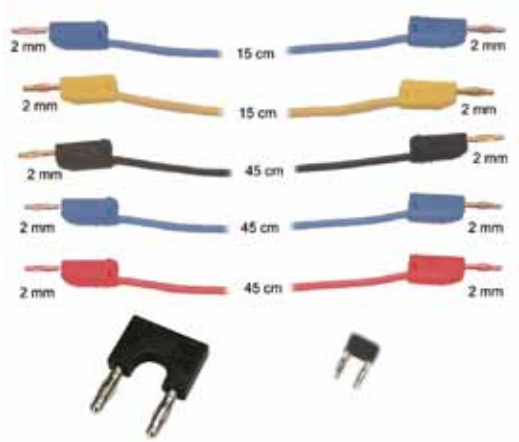
EloTrain case for A3-format experimenters
Article no. SO5127-3B

Your benefits

- Storage facility for one power supply unit and one experimenter, each 228 mm wide
- Capacity for storing more than 100 plug-in modules in the cover
- Cover with coloured, scratch-proof, screen print
- Lockable compartment for small items and experiment cables
- Lockable padlock, robust padlock hinge
- Colour: aluminium, black, chrome

EloTrain Accessories

Set of measurement cables and plugs, consisting of:
- 12 x measuring cables, 2 mm, 15 cm, blue
- 12 x measuring cables, 2 mm, 15 cm, yellow
- 2 x measuring cables, 2 mm, 45 cm, black
- 2 x measuring cables, 2 mm, 45 cm, red
- 2 x measuring cables, 2 mm, 45 cm, blue
- 60 x bridging plugs, 2 mm, 7.5 mm, black
- 8 x bridging plugs, 4 mm, 19 mm, black



Article no. SO5146-1M

Article no. LM6210

Digital dual-channel storage oscilloscope
- LCD colour display with high resolution and backlighting
- USB port for transferring large data volumes
- Bandwidth of 25 MHz / 100 MS/s
- Maximum input voltage of 300 V
- 7.8″ TFT colour display
- USB interface
- Reading with cursor function
- Five automatic measurement functions; saving and retrieval of characteristics
- Edge and video trigger function
- Safety standards: EN 61010-1
- Accessories: 2 x probes, power cord, USB interface cable, software CD

Digital multimeter
- 3-¾ figure multimeter; resolution: ±4,000 digits
- Measurement category: CATII–1000 V
- Voltage and current measurement functions: 400 mV–1000 V DC, 400 mV–1000 V AC; 40 µA–10 A DC; 40 µA–10 A AC
- Resistance ranges: 100 mΩ –40 MΩ
- Capacitance measurement: 1 pF to 200 µF
- Frequency measurement: 0.001 Hz to 500 kHz
- Measurement of mark-to-space ratios
- Continuity and diode tests
- Automatic range selection and battery shut-off; min. / max. and data-hold function
- Includes: protective case, measurement cables, battery

Article no. LM2332

Decisive Product Benefits

... provide customers with long-term satisfaction

A space-saving, robust plug-in system provides the basis for practice-oriented instruction in electrical engineering and electronics. Now the fundamentals can be conveyed even more effectively with the new multimedia plug-in system from Lucas-Nülle.

„The new solution for UniTrain-I provides three major advantages for training facilities. The 2-mm plug-in system for UniTrain-I is connected to the LabSoft virtual learning environment, does not require an additional multi-power supply and is a very flexible classroom resource whose compact size makes it adaptable to different classroom sizes," says Simone Renger, a second year apprentice.

The connection to LabSoft gives the trainees even greater independence in working with the plug-in system and allows them to carry out clearly comprehensible experiments alone or as part of a group. The course's easy-to-understand explanations and animations have a motivating effect. The multimedia learning environment thus creates an ideal framework for coming to grips with the basics of electronics.

The trainees can assemble any real circuits they want and test them directly with the integrated measuring instruments. On the PC, the learning environment provides them with the theory as well as the circuit and assembly diagrams, and they can use the virtual measuring instruments to test the circuits. As usual, all the measurement results and comprehension-related answers are stored and the trainees receive immediate feedback. All the ClassRoomManager tools are available for evaluations.

The new UniTrain-I plug-in system is completely safe for students and trainees as only safety extra-low voltages are used. The fact that assembly is even more straightforward because the plug-in system does not require an additional external power supply saves valuable lesson time and makes the system less expensive to buy.

The Whole is Greater than the Sum of its Parts

Individual Consultation with Lucas-Nülle

Do you require detailed advice or a specific quotation?

You can contact us as follows:

Phone: +49 2273 567-0

Fax: +49 2273 567-39

Lucas-Nülle stands for tailor-made training systems for vocational training and education in the following areas:

Installation Engineering


Electrical Power Engineering


Power Electronics, Electrical Machines, Drive Technology


Electrical and Electronic Circuits


Communications Technology

Process Control


Electropneumatics, Hydraulics


Instrumentation


Microcontrollers


Automation Technology


Automotive Engineering


Lab Systems

Simply contact us for details. Our employees will be happy to advise you.

Lucas-Nülle training systems meet the highest safety and quality standards. Changes in areas like environmental protection, customer benefits, design and construction entail corresponding advancements to systems or components. This can lead to discrepancies between product details and relevant items in the scope of delivery.

Further information on our products can also be found at:

www.lucas-nuelle.com

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