

Training Systems for Electrical Wiring Installation

Techniques for Electrical Wiring in Buildings,
Presented in Project-oriented Fashion to Emulate
Authentic Practice



Contents

Qualifications Through Quality

Training Systems for Electrical Wiring Installation 4

Animated Presentation of Complex Training Contents

Project-oriented Mixture of Media Content – Adaptable to any Training System 6

More Than Just a Training System

Complete Solution – Laboratory for Electrical Wiring Installation 8



Contents

InsTrain – The Multimedia Training System for Wiring Installation in Buildings

Power Supply and Wiring Installation Training Using “InsTrain”	12
InsTrain – The Multimedia Training System	14
• “Building Service Entry” Training Project Using InsTrain	18
• “Lighting and Appliance Circuits” Training Project Using InsTrain	20
• “Communications Technology” Training Project Using InsTrain	22
• “Building Management Systems Based on KNX®” Training Project Using InsTrain	24
• “Building Service Entry and Sub-distribution” Training Project Using InsTrain	26
• “Wiring and Components Embedded in Plaster” Training Project Using InsTrain	28

Training Panel Systems – Perfect for Modular Education

Versatility and Flexibility Thanks to Modular Design	32
Protection in Accordance with VDE/EN Standards	34
• Mains Systems and Protective Measures	36
• Lightning and Excess Voltage Protection	37
• Protection via Circuit Breakers Conforming to VDE/EN Standards	38
• Set of Appliance Simulators for Measuring Exercises Based on VDE 0701-0702	39
Conventional Wiring in Buildings	40
• Lighting Systems	42
• Intercom Systems	43
Bus Systems/Building Automation	44
• Wiring Installation Based on KNX®/EIB	44
• Intra-building Communications	46
• Programmable Alarm Systems Using Bus Technology	48
Industrial Installations	50
• Manual Switching in Three-phase Circuits	50
• Protective Circuits for Three-phase Systems	51
• Small-scale Programmable Logic Control Using “LOGO!”	52
• Project: Control of a Conveyor Belt Using “LOGO!”	53
Renewable Energies	54
• Solar Technology	54
• Wind Energy/Fuel Cells	55

Practice

The Perfect Supplement to Project-oriented Teaching	58
-----------------------------------------------------------	----

More Than Just a Training System

A Practical Solution – Practical Lab for Electrical Wiring Installation	60
Systems for Practicing Wiring Installation	62
• Installation Exercises: Wiring Installation in Buildings	64
• Installation Exercises: Building Intercom Systems	65
• Installation Exercises: Building Service Entry Equipment	66
• Installation Exercises: Network Installation	67
• Installation Exercises: Switching Installations	68
• Installation Exercises: Small-scale Programmable Logic Control Using “LOGO!”	69
• Installation Exercises: Construction of Switch Cabinets	70

Measuring Equipment and Accessories

Use of Measuring Instruments	74
• PROFITEST MBASE/MTECH Installation Tester	76
• PC-based Data Acquisition and Management	77
• METRATESTER 5+ Appliance Tester	78
• SECUTEST S2 N+ Appliance Tester	79
• PROFIsafe 400 Continuity Tester	80
• Multimeter Range	81
• Mains Quality/Power Analyser	82
• Thermal Imaging Camera	83
• Tool Case	84
• Workbench for Practical Lab	85

Overview Based on Training Topic	86
-----------------------------------------------	----

Qualifications Through Quality

Training Systems for Electrical Wiring Installation

Advances in technology ...

New technologies for electrical wiring require new training systems. Innovations like the increasing use of planning software, bus technologies and networking are only some examples of how this profession is changing. Due to the utmost high demands placed on electrical trainees nowadays, there is a need for modern, practically oriented training systems.



... are having a huge impact on training and education.

Giving trainees the ability to work on their own and in professional fashion is one of the key aims of any training. The new aspects involved in an electrical career and the change in orientation of the topics to be learned mean that more weight is being given to the practical side of training. The combination of new teaching media and experiment systems is also playing an ever-more important role, since self-guided learning via project work based on authentic practice gives the best grounding for teaching practical skills that will stay with students throughout their careers.

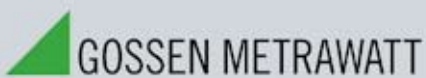
Our partners in industry



Strong partnership with industry ...

... ensures that modern practice is followed. When developing its training systems, Lucas-Nülle works with the key suppliers of building appliances and software to ensure that the systems are particularly authentic.

This means that trainees can work with genuine and up-to-date products and data sheets throughout their training.



Animated Presentation of Complex Training Contents

Project-oriented Mixture of Media Content – Adaptable to any Training System

Manuals

Manuals provide not only a detailed description of the experiments to be performed on the respective training systems but also include countless exercises, examples and projects.

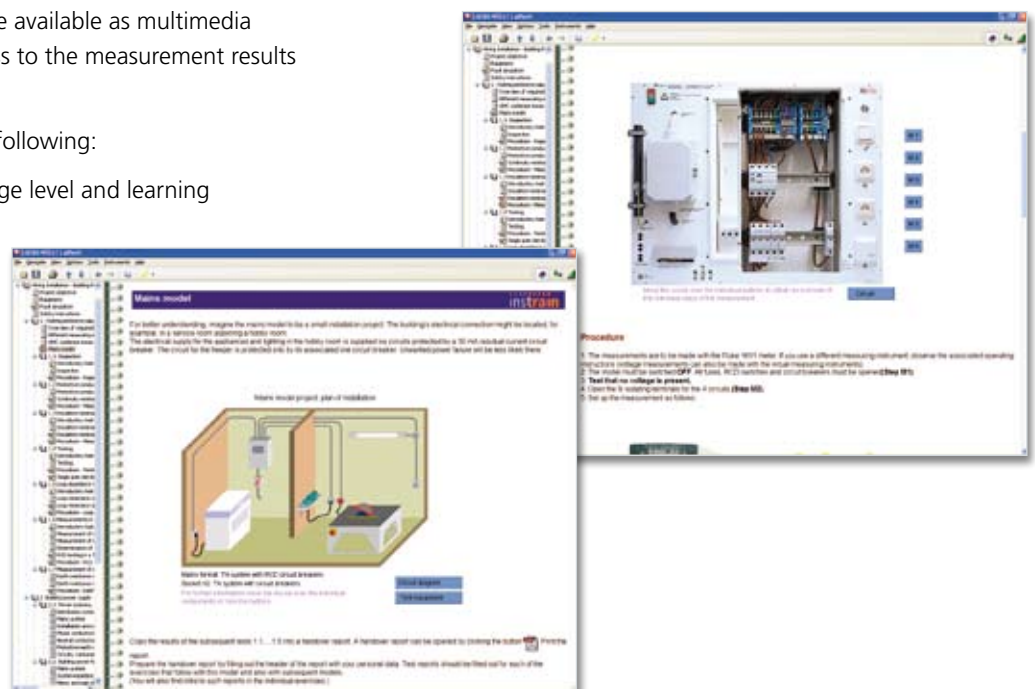


Multimedia courses

Many experiment instructions are available as multimedia courses. These allow direct access to the measurement results from various equipment.

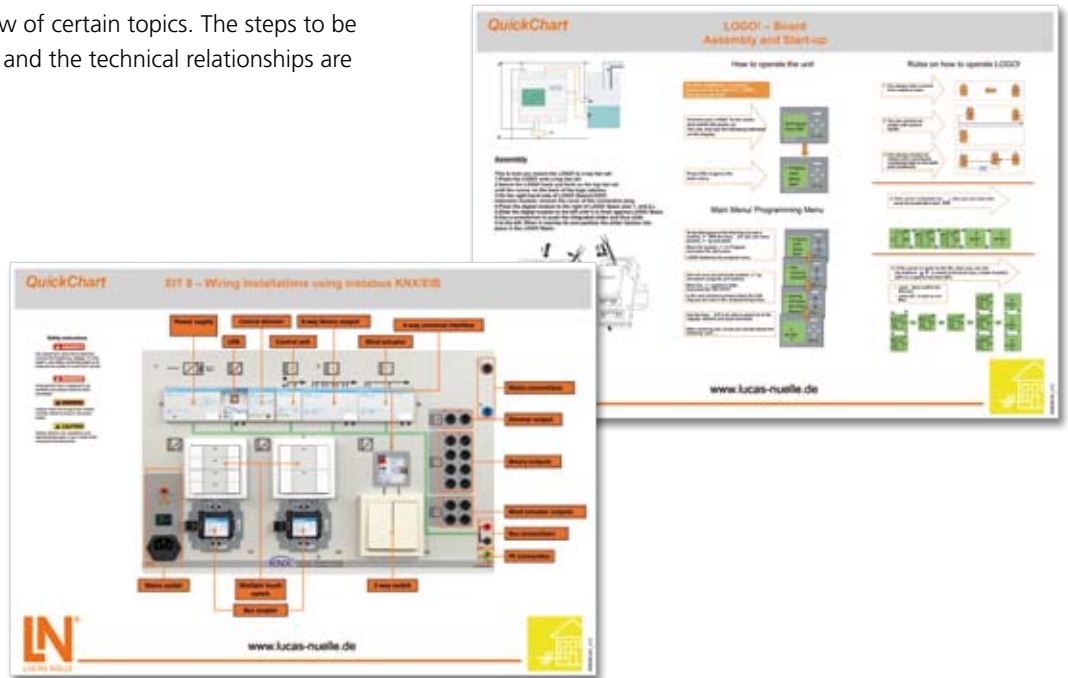
Multimedia courses contain the following:

- Questions to monitor knowledge level and learning
- Interactive experiment set-ups
- Navigation bars
- Animated sections devoted to theory



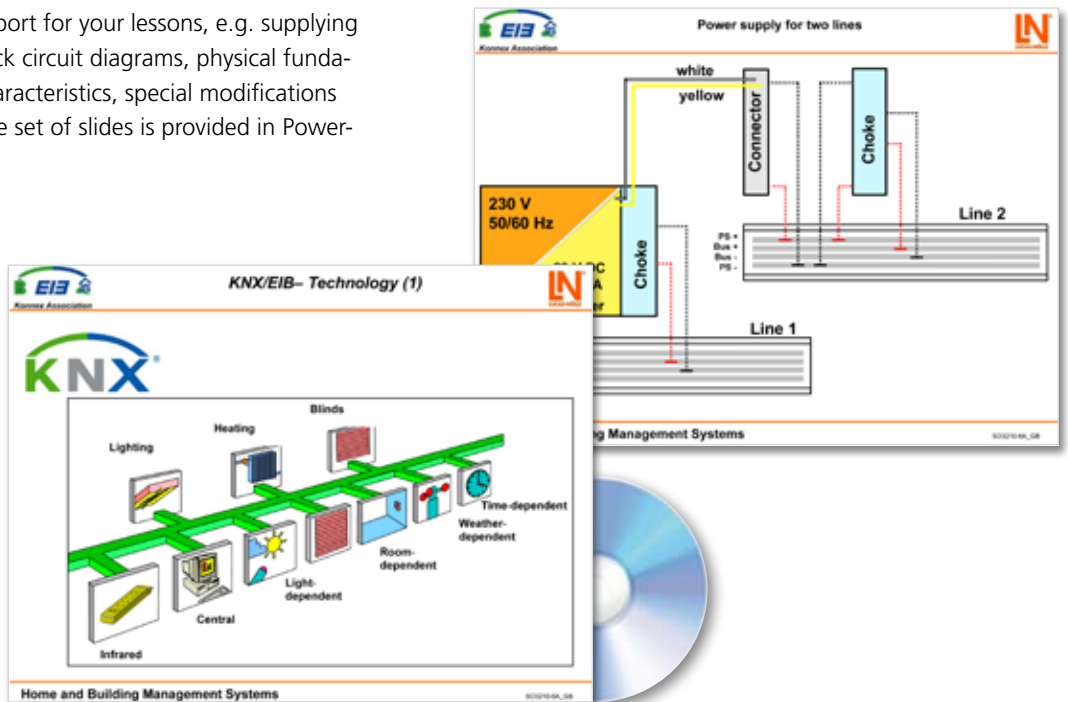
QuickCharts

These provide a quick overview of certain topics. The steps to be taken, the working processes and the technical relationships are explained briefly and vividly.



Presentation slides on CD

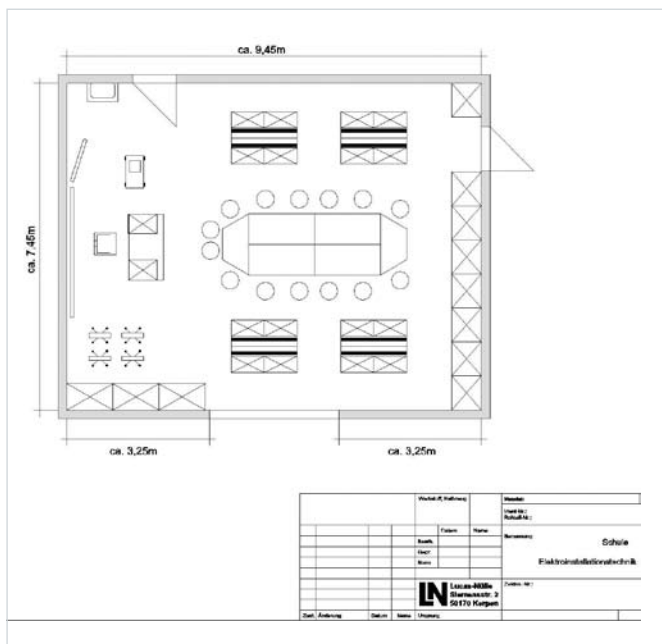
Slides on CD can provide support for your lessons, e.g. supplying background information, block circuit diagrams, physical fundamentals, specific standard characteristics, special modifications and application examples. The set of slides is provided in Power-Point format.

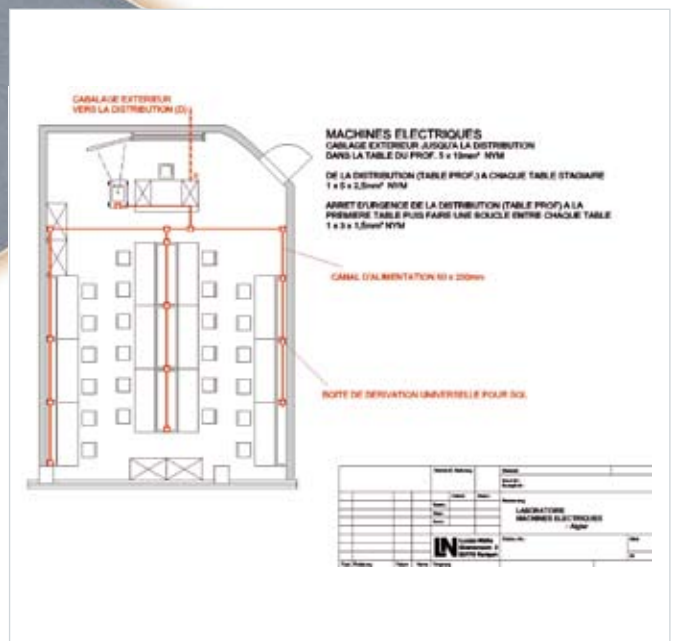


More Than Just a Training System

Complete Solution – Laboratory for Electrical Wiring Installation

Furnishing and equipping a good technology lab requires careful planning by experts. Factors such as educational and learning objectives need to be taken into account as well as aspects of the building itself and the available space. We have the necessary know-how along with years of experience and are happy to provide you with advice.







InsTrain

“Building Service Entry” Training Project Using InsTrain	18
“Lighting and Appliance Circuits” Training Project Using InsTrain	20
“Communications Technology” Training Project Using InsTrain	22
“Building Management Systems Based on KNX®” Training Project Using InsTrain	24
“Building Service Entry and Sub-distribution” Training Project Using InsTrain	26
“Wiring and Components Embedded in Plaster” Training Project Using InsTrain	28



InsTrain – The Multimedia Training System for Wiring Installation in Buildings

Power Supply and Wiring Installation Training Using “InsTrain”

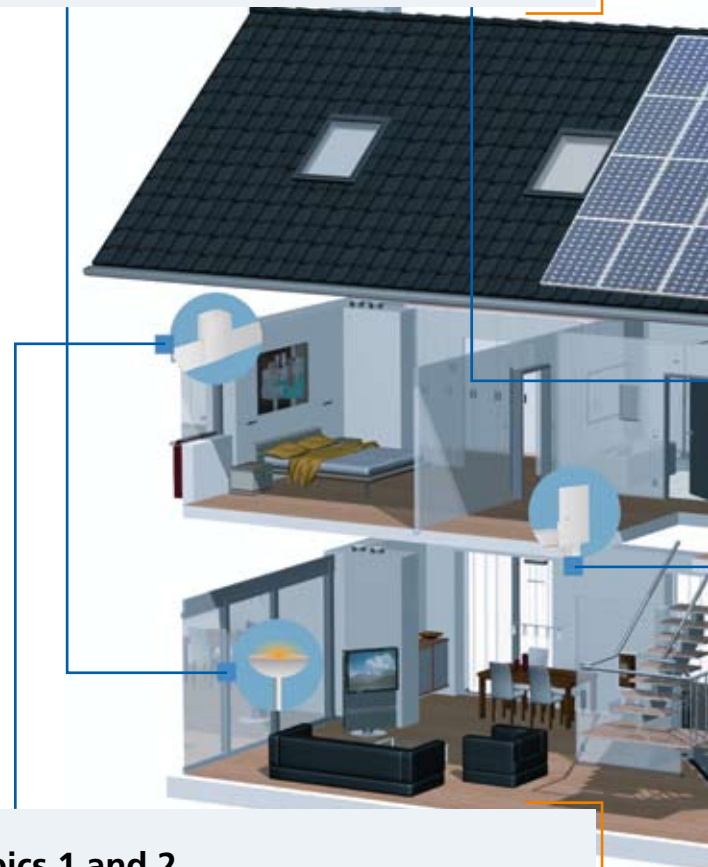


Topics 4 and 7

- Provision of systems for information technology
- Communications in buildings and offices

**Electrical wiring training system
“Communications Technology”**

page 22



Topics 1 and 2

- Carrying out electrical installation of circuits with primary and sub-distribution
- Testing protective systems

**Electrical wiring training system
“Lighting and Appliance Circuits”**

page 20

Topic 9

- Selecting and installing building management systems

Electrical wiring training system
„Building Management Systems Based on KNX®/EIB“
 page 24



Topics 1 and 5

- Building service entry
- Protective measures as per DIN VDE 0100 Part 600
- Subsequent regular testing as per DIN VDE 0701/ 0702

Electrical wiring training system
“Building Service Entry”
 page 18

InsTrain – The Multimedia Training System for Wiring Installation in Buildings

InsTrain – The Multimedia Training System

The challenge

Training and further education are in a constant state of flux:

- Topics are becoming ever more complex and teaching is becoming project-based
- More rapid renewal of products and continual innovation require constant learning
- Finances for education are falling
- New ways of learning are needed

The solution for modern teaching of training content

- InsTrain: a combination of new teaching media with experiment systems
- The experiment system makes it possible to learn on a PC and train using genuine equipment
- Multiple themed models, with an integrated interface and a universal fault simulator working together interactively with PC software
- To increase the degree of self-guided learning, users are led in structured fashion by hierarchical multimedia training software.
- Multimedia-based, animated training modules guide students through the theory and instruct them in practical experiments

Practical skills

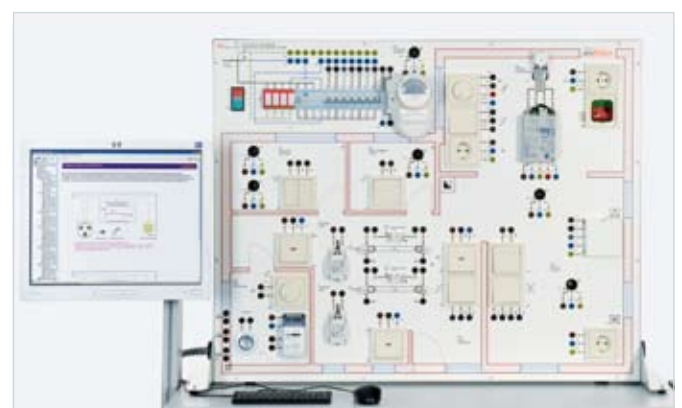
The new aspects involved in an electrical career and the change in orientation of the topics to be learned mean that more weight is being given to the practical side of training. The combination of new teaching media and experiment systems is also playing an ever-more important role, since self-guided learning via project work based on authentic practice gives the best grounding for teaching practical skills that will stay with students throughout their careers.

Compliance with VDE/EN standards

The training contents taught by the “InsTrain” electrical wiring training system are based on the VDE/EN standard, which applies throughout Europe.

Versions applicable to different countries are available on request.





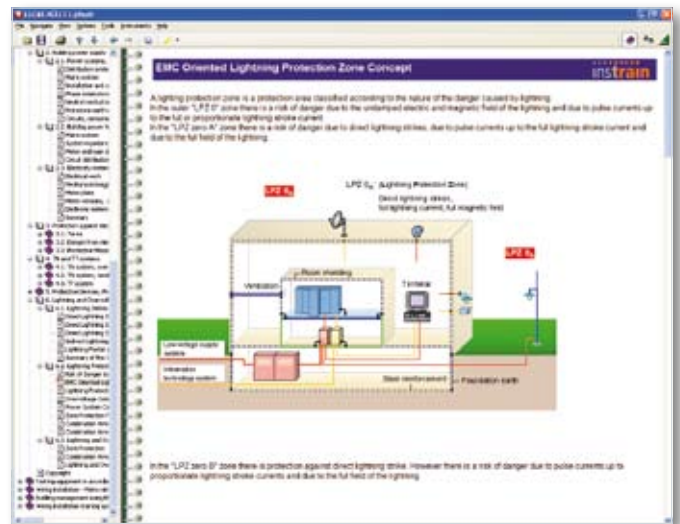
InsTrain – The Multimedia Training System for Wiring Installation in Buildings

InsTrain – The Multimedia Training System

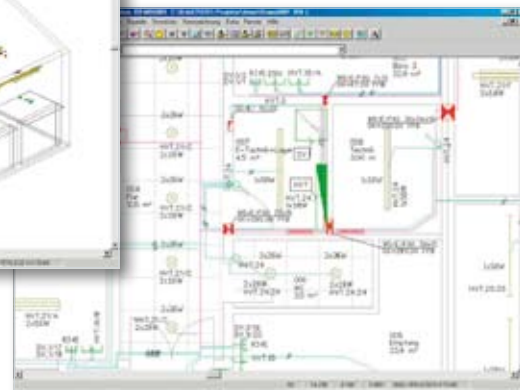
LabSoft

LabSoft is the user interface for InsTrain, an open experiment platform which allows access to all the media available in the laboratory:

- Navigation window with a tree structure for display and direct selection of all components of the course
- Execution of experiments including documentation
- Evaluation and saving of experiment results
- Built-in fault simulator
- Virtual instruments for real-time measurements
 - Voltmeters, ammeters
 - 3-channel storage oscilloscope



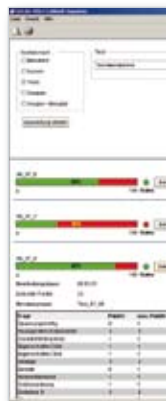
Floor plan 2-13-D



Installation plan 2-13-D

Planning software

The planning software allows for planning of entire building installations. It covers the areas of electrical installation, bathroom installation, heating, air conditioning and ventilation. Using CAD-design with modern systems, components are matched to one another in virtual space. Trainees work with the most up-to-date software, as used in authentic practice.



LabSoft in a network

LabSoft supports both local installation on a user's computer and installation on a central server to be accessed via intranet or internet. To ease integration into learning management systems, international standards have been applied to the development of LabSoft.



LabSoft Classroom Manager

LabSoft Classroom Manager is a comprehensive administration program for the InsTrain system and all LabSoft courses.

Classroom Manager consists of the following sub-programs:

LabSoft Reporter:

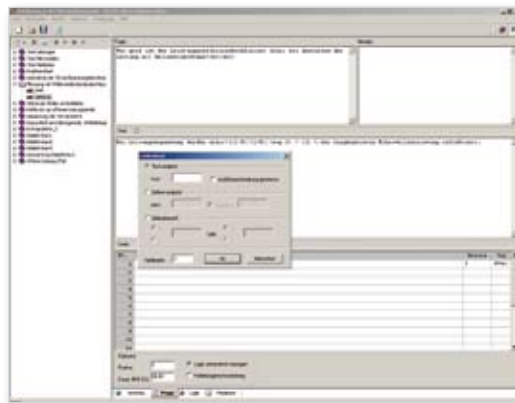
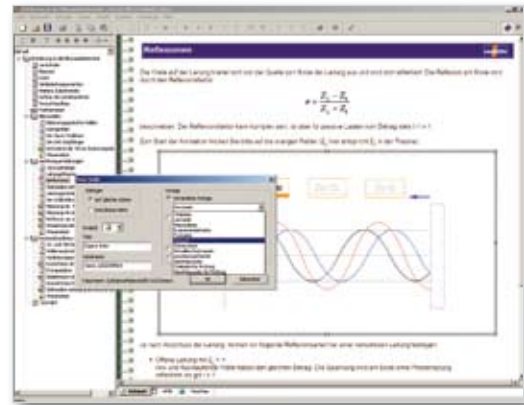
For managing learning levels and statistics

LabSoft Editor:

For creating and editing courses and tests

LabSoft Manager:

Manager for user data and courses in LabSoft



“Building Service Entry” Training Project Using InsTrain

Featuring PC Interface, Educational Training Software and Simulator

The “Building Service Entry” electrical wiring training system covers the connection of the mains system of a building to the external power feed and how to install such an interface according to regulations and test it.

Practical experiments are already integrated. A fault simulator included in the hardware allows for differing measurement exercises to be set up for trainees to solve. The distribution network for a building, the mains entry point itself and the consumer system are all covered in detail taking into account the necessary protective measures.

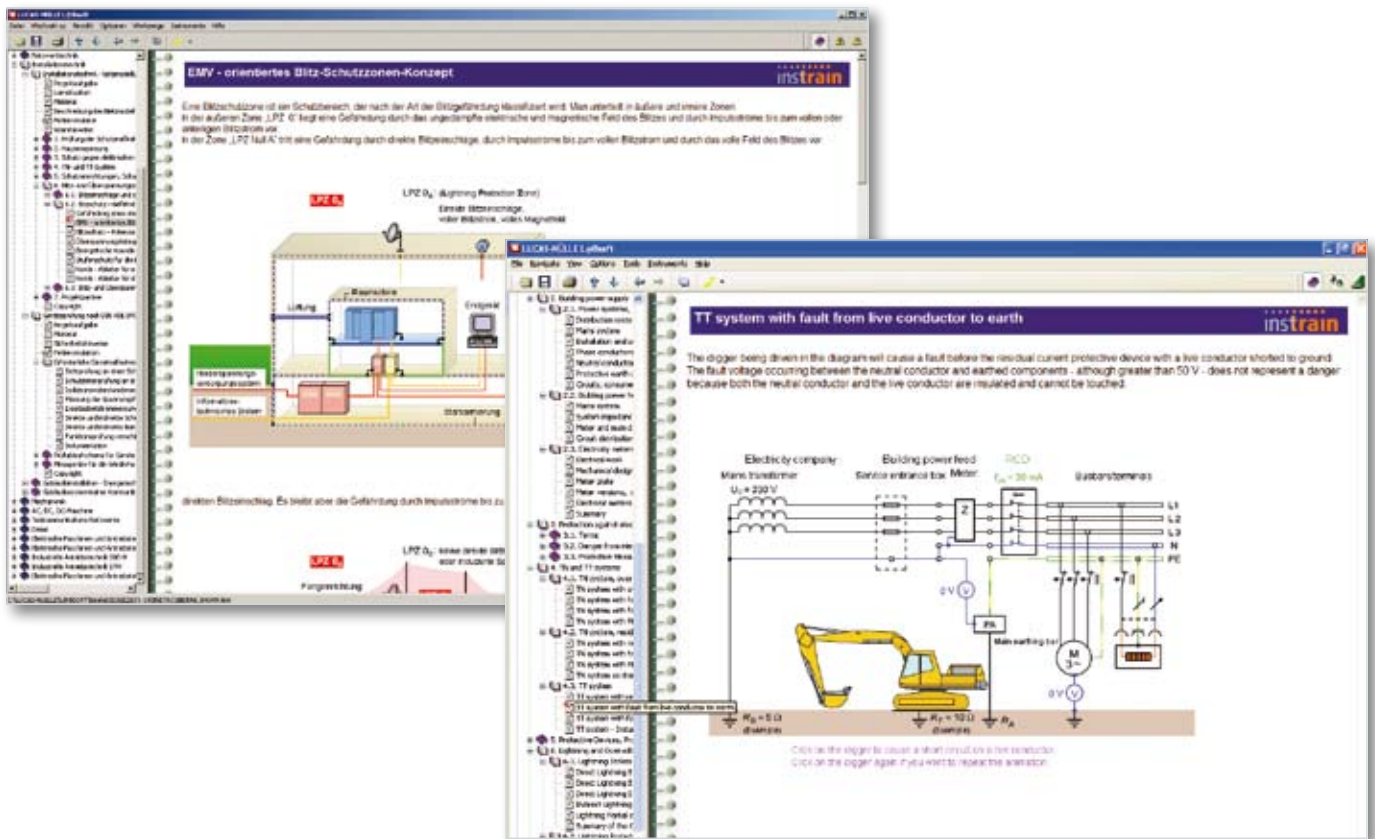


Training contents

- Design of the public network
- Power feed, distribution of power
- Protective measures against electric shocks
- Short circuits, faults to frame, faults to earth
- Lightning and excess voltage protection
- Testing an electrical system against the currently applicable standards
- Measurement of insulation, earth and loop resistance
- Checking rotating field, protective earth measurement, equipotential binding measurements
- Functioning principles of conventional and electronic electricity meters
- Testing of protective measures according to protocols for initial and subsequent regular testing
- Sub-distribution, planning, installation
- Mains systems
- Testing of TN/TT systems
- Testing of residual current protective devices (RCDs)

Experimenting, Learning, Testing and Understanding

To get an idea of the functionality and safety of existing systems, they first need to be put into operation. After this, extensive tests should be made. Often all the documentation needs to be amended or redone completely. Afterwards fault analysis and rectification need to be carried out and a handover report must be made according to applicable standards. The high degree of responsibility that the tester has towards the customer is underlined by the fact that the tester's signature must appear on the test report.



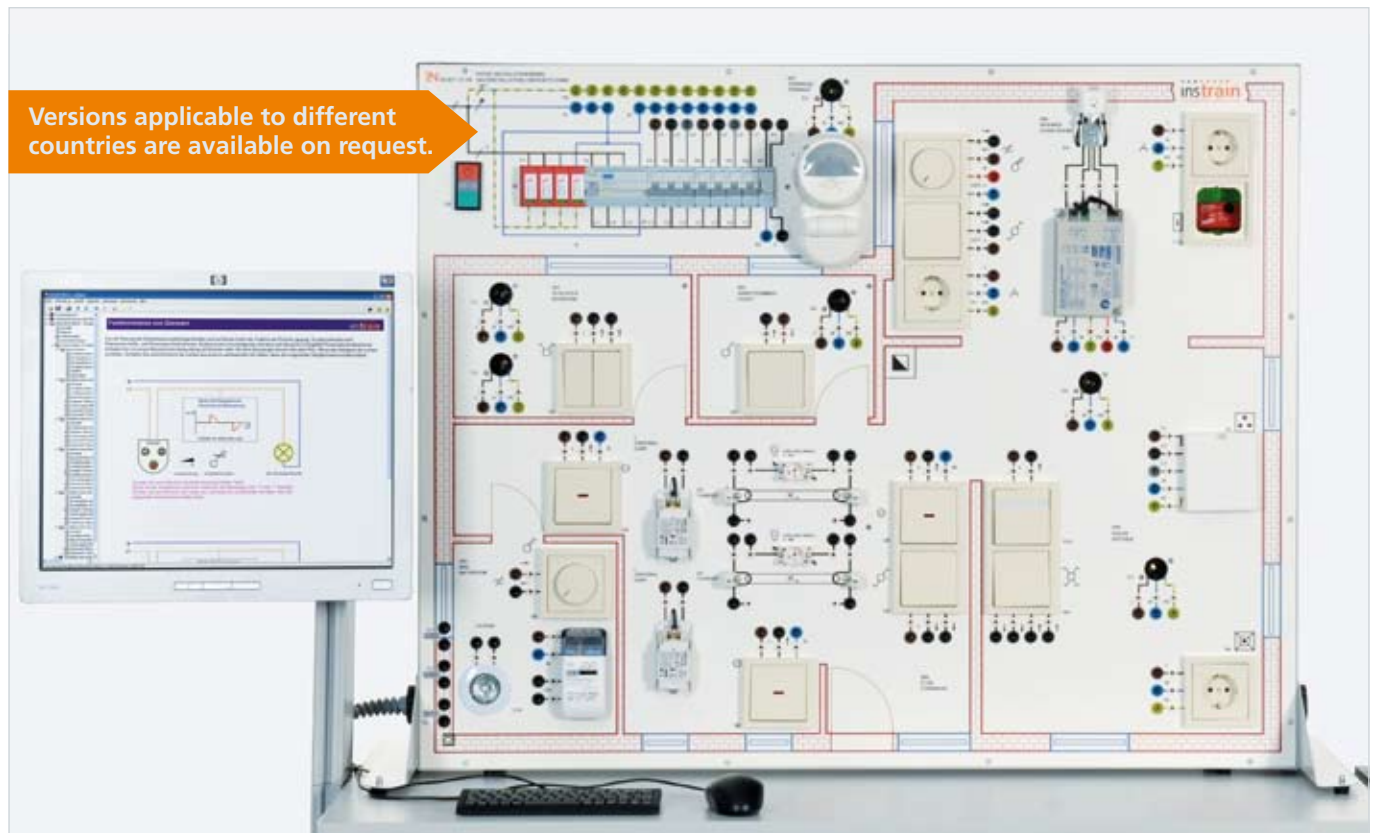
Includes

- CD-ROM with LabSoft browser and course software
- Planning software for planning complete buildings
- Wiring installation training system "Building Service Entry with Primary Distribution Box"
- PC-based universal fault simulator
- Measuring interface with three channels
- Emulation of a building service entry unit with measuring sockets
- Complete distribution box
- Digital meter and selective circuit breakers
- Lightning and excess voltage protection (coarse)

“Lighting and Appliance Circuits” Training Project Using InsTrain

Featuring PC Interface, Educational Training Software and Simulator

The “Lighting and Appliance Circuits” wiring installation training system illustrates the planning, installation and testing of common wiring circuits in a complete building. This involves emulating the wiring for the building as a whole. The meshing of theory and practice aspects means that this module ideally meets the demands on vocational teaching caused by the changes in the electrical professions. The software can activate genuine faults that are typical in authentic practice, such as short circuits, wiring faults like short circuits, faulty earth wires, weak points in the insulation and faulty appliances, all of which need to be identified and rectified by the students.



Training contents

- Planning of the wiring of an apartment
- Research and preparation for meetings with customers
- Investigating the cost-efficiency of various circuits
- Preparing lists of materials
- Calculation of contract estimates for the whole contract or parts of it
- Signing of contracts and execution of wiring work
- Initial testing of an electrical system as specified by DIN VDE 0100-600
- Handover and instruction of customers in the electrical systems installed
- Installation of various applications
- Protective measures against electric shock
- Testing of residual current protective devices (RCDs)
- Lightning and excess voltage protection
- Measurements conforming to DIN/VDE standards
- Documentation, handover and test report, customer instruction

From Customer Contract to Project Handover – All in a Single System

The contract with the customer specifies the work and business procedures of a company. These are aspects which also need to be dealt with in training. Working out complex and interwoven projects based on a customer contract requires specific independent thinking and action. This teaches the students practical skills, teamwork, customer orientation and self-guided learning.

The screenshot displays the InsTrain software interface for a wiring installation project. The main window shows a 3D model of a kitchen with blue cabinets and a white countertop. A text overlay reads: "For additional safety, avoid 90° corners over the horizontal strings." Below the model, there is a section titled "Electrical wiring installation" with a sub-section for "Cupboard lighting".

On the right side, there is a "List of materials" window. It contains the following text: "The list of materials required for this project can be derived from a wiring plan in which the type of wiring, the number of wires, the cross section and length are all specified in addition to the usual information. The type of wiring depends on the building in question. Here, it is assumed that the walls are plastered and wiring above the ceilings is in a ceiling cavity." Below this text is a technical drawing of a room with dimensions: width 4.0 m and height of rooms 2.5 m. The drawing shows a ceiling layout with various wiring paths and components like switches and sockets. A legend below the drawing lists materials: "List of materials: PVC 7/6".

At the bottom of the software interface, there is a note: "The cross section for the wires in the lighting and mains socket circuit circuit will be 1.5 mm² in general. If the length of the wires needs to be very long, it may be necessary to use wires of 2.5 mm² cross section to avoid the voltage dropping too much."

Includes

- CD-ROM with LabSoft browser and course software
- Planning software for planning complete buildings
- "Installation circuits" wiring installation training system
- PC-based universal fault simulator
- Measuring interface with three channels
- 30-mA RCD, line circuit breakers
- 4-pole lightning and excess voltage protection (medium protection)
- Fine excess voltage protection for electronic devices
- All essential dimmers, switches, sockets and lights
- Virtual instruments (ammeters, voltmeters, 3-channel oscilloscope)

“Communications Technology” Training Project Using InsTrain

Featuring PC Interface, Educational Training Software and Simulator

The “Communications Technology” wiring installation training module covers planning, installation and testing of structured communications wiring for various applications and communications services. The training project is based on a “home office”. It also covers the topics of telephony, the internet, network cabling, TV and video wiring in detail. Use of the fault simulator allows the exercises to be tailored to the level of knowledge of the student concerned.



Training contents

- Planning multimedia cabling
- Selection of data media and equipment
- Compliance with the required transmission categories
- Planning for the future with regard to cable lengths
- Carrying out various cable wiring
- Setting up a WLAN link
- Connecting two PCs with plastic optical fibre
- Connecting two PCs via RJ45 sockets (solderless, screwless, non-insulated)
- Equipping a distribution box with an NTBA, WLAN router, etc.
- Installation of a patch bay for a multimedia distribution box
- Networking of PCs using a switch and patch bay
- Inputting a signal via a DVB-T receiver
- Installation of line-through and end sockets in a ducting segment (co-ax)
- Installation, wiring and testing of two RJ45 sockets in a ducting segment
- Documentation, handover and test report, customer instruction
- Setting up a DSL connection

Plan in Advance and Lay Cabling in Structured Fashion

Structured cabling means planning in advance how the communications technology will be implemented in the project. Application-neutral communications wiring is to be planned and installed taking into account the customer’s wishes and the latest technical standards. Researching the latest developments and holding meetings with the customer are key skills that will be learned during this module.



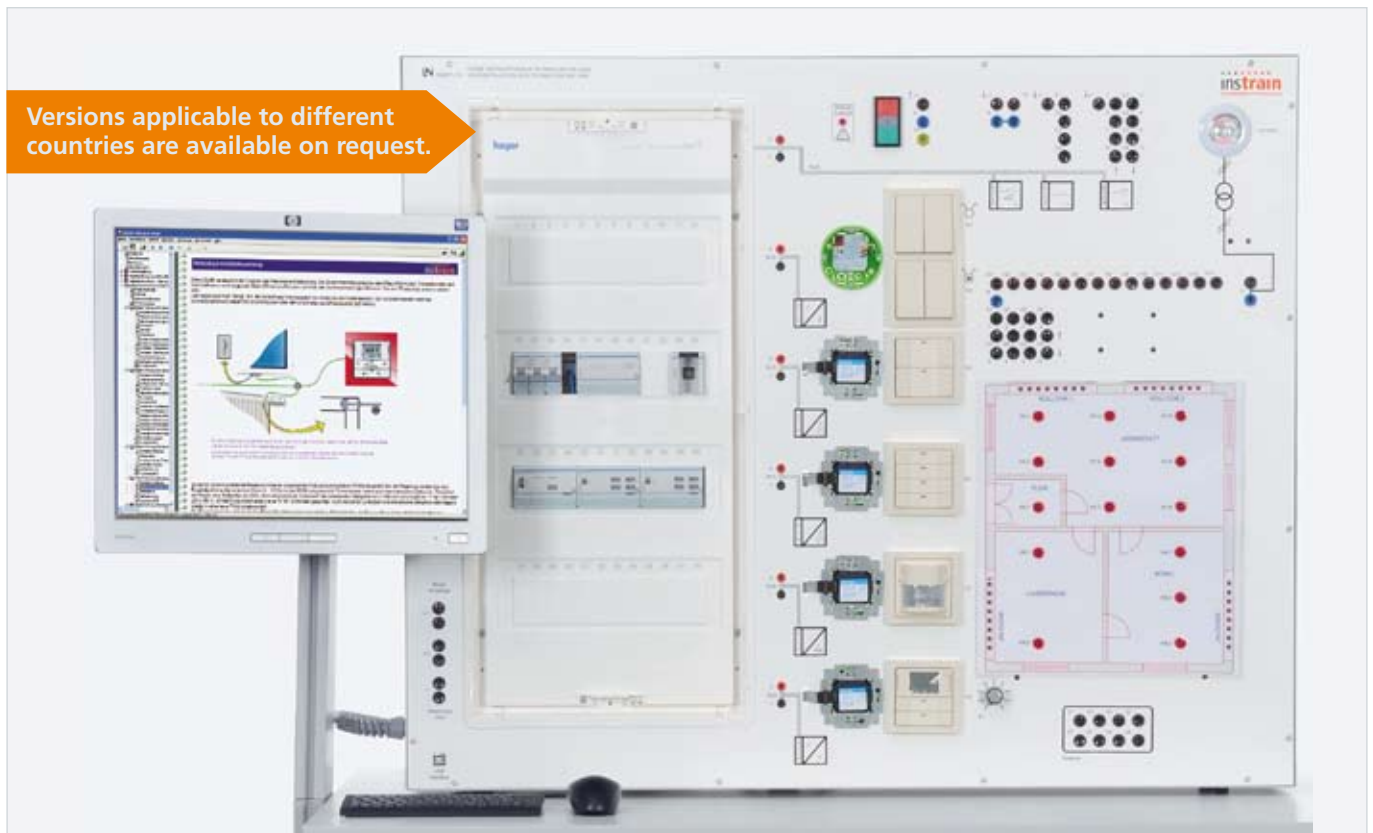
Includes

- CD-ROM with LabSoft browser and course software
- Planning software for planning complete buildings
- Wiring installation training system "Communications Technology"
- PC-based universal fault simulator
- Measuring interface with three channels
- Media sub-distribution with grid of holes (protection class II)
- All necessary rail-mounted devices such as a switch and patch module (pre-wired for 230 V)
- Channel rail-mounted devices and wiring material for self-installation
- Storage for wiring material and tools
- Virtual instruments (ammeters, voltmeters, 3-channel oscilloscope)

“Building Management Systems Based on KNX®” Training Project Using InsTrain

Featuring PC Interface, Educational Training Software and Simulator

The wiring installation training system “Building Management Systems Based on KNX®” covers planning, installation and testing of an intelligent, bus-capable installation. The key points include project planning and parameter setting as well as the wiring and connection of bus systems in a sub-distribution box. The major changes that the electrician’s profession has undergone have turned them into “electronics engineers for buildings and infrastructure systems”, so that the work is less concerned with practical wiring than with PC-based planning and programming work.

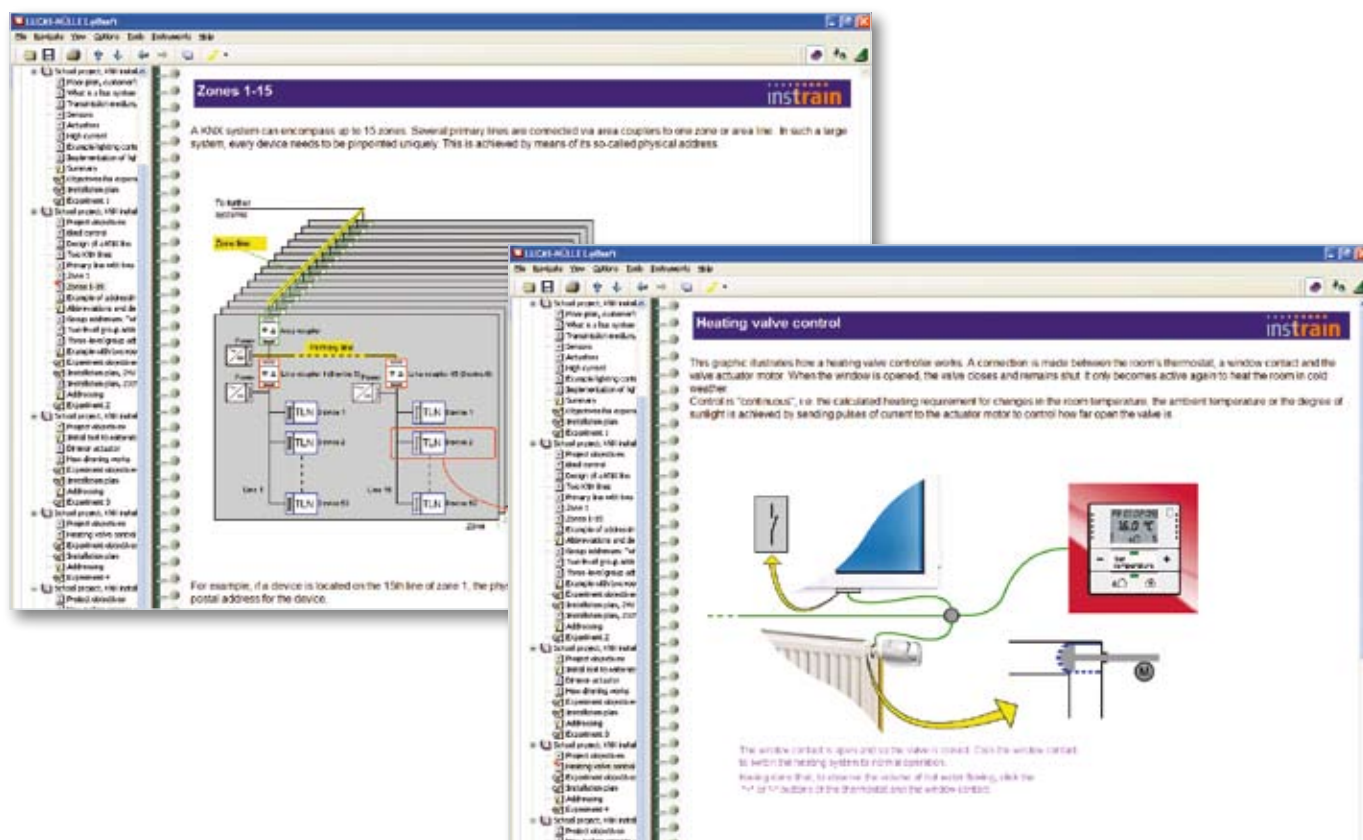


Training contents

- Planning, project management and parameter setting for KNX® systems
- Selection of suitable installation structures
- Selection of suitable equipment
- Selection of components with an eye to cost-efficiency
- Planning for the future with regard to installations
- Parameter setting and fault finding in KNX® systems
- Interfaces to other bus systems
- Design and topology of bus systems
- Ways of using KNX®/EIB
- Project planning using ETS3 software
- Packet structure and addressing
- Data media, bus lines
- Installation of a KNX®/EIB system with various applications
- Commissioning and specific testing
- Documentation, handover and test report, customer instruction

Simple Project Planning for KNX® Systems

Modern building management with KNX® components provides energy savings and comfort of use with maximum safety. Groups of lights can be switched on or off or dimmed from central or decentralised locations. Blinds and shutters can be activated centrally or locally. Controllable thermostats ensure that temperatures are brought down in rooms that are not in use. Safety lighting based on specific needs automatically turns on lights when anyone enters the area being monitored.



Includes

- CD-ROM with LabSoft browser and course software
- Planning software for planning complete buildings
- Wiring installation training system "Building Management Systems"
- PC-based universal fault simulator
- Measuring interface with three channels
- 4-pole sub-distribution panel with KNX® rail-mounted devices (pre-wired)
- Pre-wired reserve slots for your own extensions
- All the required switches and sensors
- Various room simulations (3 overlay masks)

“Building Service Entry and Sub-distribution” Training Project Using InsTrain

Project: Building Service Entry and Sub-distribution

Although this wiring installation training system is concerned with examining a complete system or finding and correcting faults set by a fault simulator, the key aspect of this project lies in the actual practical installation work. Trainees learn in realistic fashion how to plan, install and test wiring installations on their own.

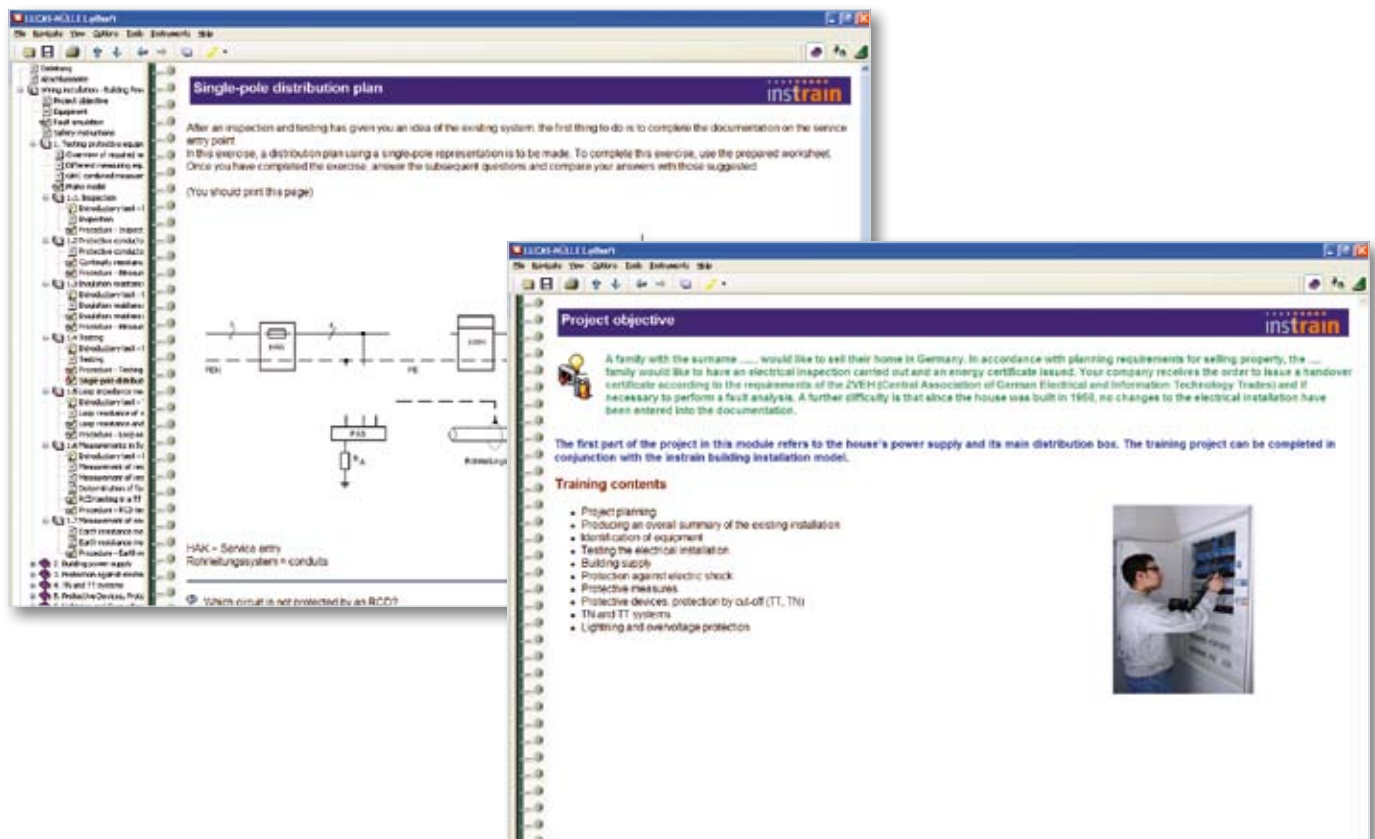


Training contents

- Planning and installation of a building's service entry or mains feed
- Carrying out a contract for a customer
- Working out a sequence of steps for installing a primary distribution box
- Various components of a building's service entry point
- Usage and conformance with standards, guidelines and technical connection requirements
- Installation and wiring of various components and learning practical skills in handling authentic components
- Measurement and testing of installed systems
- Preparing test reports conforming to DIN/VDE standards

Training Practical Skills and Knowledge

This training project is mainly concerned with teaching practical skills using the example of carrying out a contract for a customer. Various common installation methods are taught along with the subsequent making of measurements, testing and documenting.



Includes

- Basic service entry equipment
- Meter cabinet and cavity wall sockets
- 4-pole RCDs
- Combined lightning protection module (B-class protection, C-class protection)
- Wiring materials
- Planning software
- Electronic domestic electricity meter
- 4 line circuit breakers
- Selective circuit breakers
- Instructions for assembly

“Wiring and Components Embedded in Plaster” Training Project Using InsTrain

Project: Installation of Wiring and Components Embedded in Plaster

In addition to planning work, it is necessary to select the right materials for the job from the vast range of different components and materials available.

The installation is to be made on the front panel using plaster-embedded components and on a punched hole grid on the back using components on top of the plaster. All the wiring circuits lead back to the distribution box.

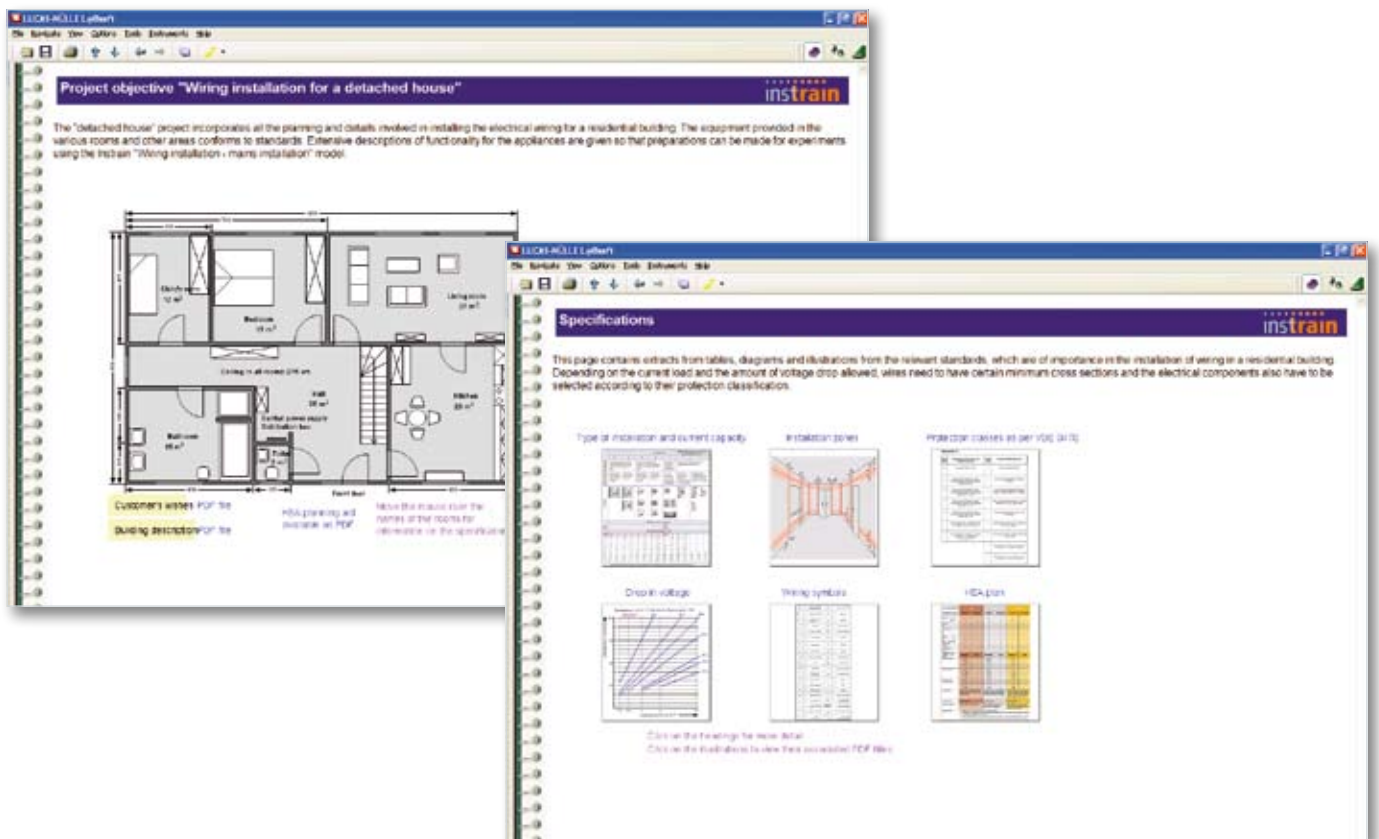


Training contents

- Planning and wiring of a residential building installation
- Carrying out a contract for a customer
- Working out a sequence of steps for wiring various rooms
- Various types of installation and wiring
- Usage and conformance with standards, guidelines and technical connection requirements
- Installation and wiring of various components and learning practical skills in handling authentic components
- Measurement and testing of the installed system
- Drawing up test reports conforming to DIN/VDE standards

Training Practical Skills and Knowledge

This project concentrates on how to use planning documents, planning time and carrying out the work. Students will use various installation methods, installing a system that conforms to standards and accomplishes the customer's wishes. The circuits are then tested according to VDE guidelines before the system is handed over and the customer instructed in its use.



Includes

- Basic unit with sub-distribution panel and cavity wall sockets
- 13 switches, on/off, multiple, crossover, buttons and sockets
- Electronic ballast
- Programmable multi-function switch
- 5 incandescent bulbs, 2 fluorescent tubes
- 1 halogen lamp, 1 compact fluorescent bulb
- 5 line circuit breakers
- Lightning and excess voltage protection (C-type protection, D-type protection)
- 2 dimmers
- Electronic transformer
- Motion sensor
- Cooker connection socket
- 4-pole RCDs
- Remote pulsed current switches



Training Panel Systems

Protection in Accordance with VDE/EN Standards	34
Training Panel Systems – Perfect for Modular Education	40
Conventional Wiring in Buildings	42
Bus Systems/Building Automation	44
Industrial Installations	50
Renewable Energies	54



Training Panel Systems – Perfect for Modular Education

Versatility and Flexibility Thanks to Modular Design

Flexible

Whether teaching at the front of a classroom or conducting practical student experiments, the training panel system allows you to use a variety of teaching methods. The height of the training panels matches the height of A4 pages so that the panels are easy to mount into stands.

One of the key points of the LN training systems is their link to authentic practice. All LN training systems are designed using components common to industry. Measurements are made using conventional measuring instruments, too.



Modular

The familiar DIN A4 dimensions, coupled with a console-shaped housing make for a universal training platform that can be used on its own or with other training systems.

Set-up times are reduced to a minimum to allow optimal use of lesson time.

Safety

All the necessary connections are made via safety sockets. All voltages in the safety extra-low voltage range (as per VDE 0100) are handled via 2 mm safety sockets. Any voltage above this range uses 4 mm safety plugs.



Understandable

The new, colourful generation of panels makes the design of the front surface even easier to understand, even including photo-realistic printing.

During the development of LN training panels, specific attention was paid to printing standard symbols on the panels and ensuring the connecting terminals also met the standards.

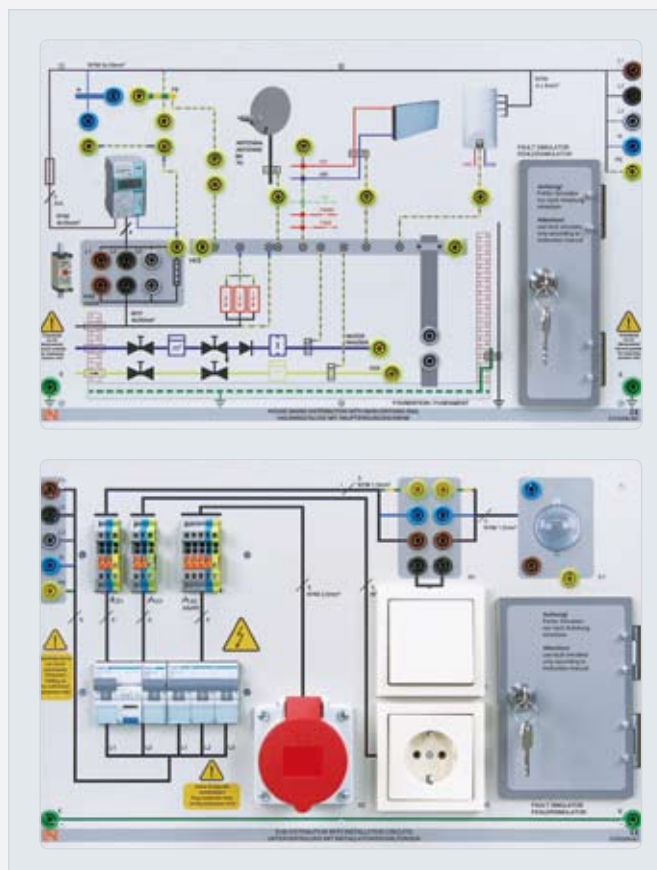
Your benefits

- Versatile and flexible thanks to modular design
- Suitable for student experiments or demonstrations
- Safety thanks to double insulation (safety sockets and leads)
- Reflects current industry usage due to integration of genuine industrial equipment
- Easy to understand thanks to the high-contrast scratchproof printing of the front panel
- Modern measuring technology linked to a PC
- Colour experiment and practice manuals
- Ability to combine with LabSoft courses
- Student worksheets and sample solutions

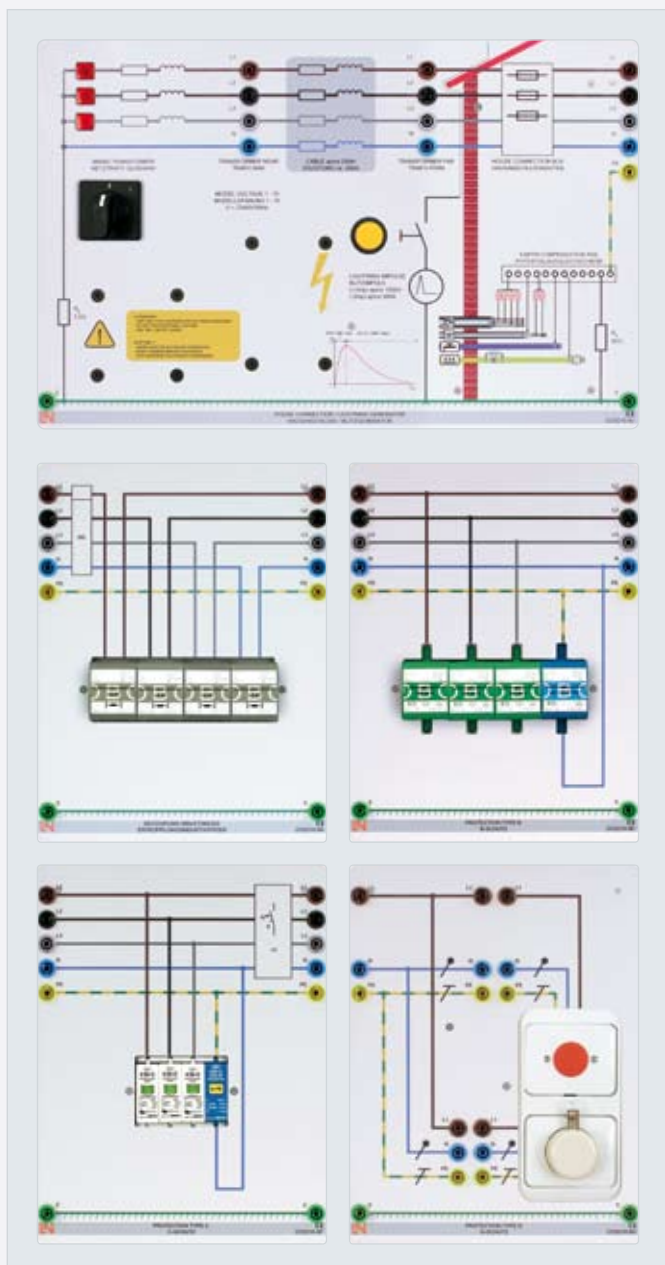
Training Panel Systems – Perfect for Modular Education

Overview: Protection in Accordance with VDE/EN Standards

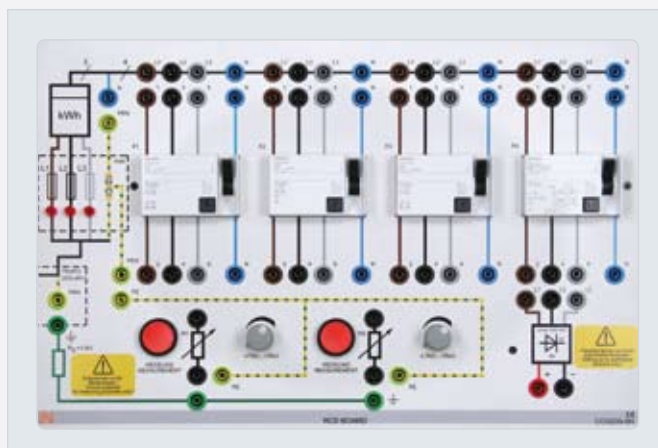
Mains systems and protective measures



Lightning and excess voltage protection



Additional protection by residual current devices (RCDs)



Testing of electrical components



Protection in Accordance with VDE/EN Standards

Mains Systems and Protective Measures

The topic of "Protection against coming into contact with high voltages (protective measures conforming to VDE 0100)" is important for all those whose career involves the manufacture, operation or repair of electrical equipment, especially for trainees in the electrical professions.

The training system provides ideal assistance in both theoretical and practical lessons teaching how protective measures conforming to VDE 0100 standards are implemented for the existing types of mains circuit. The direct link with authentic practice is one of the key aspects for LN training systems. Measurements in the various exercises are made using genuine, commonly used equipment.

Particularly suitable for
"Jobs Carried Out by Electricians or Correspondingly
Trained Specialists".

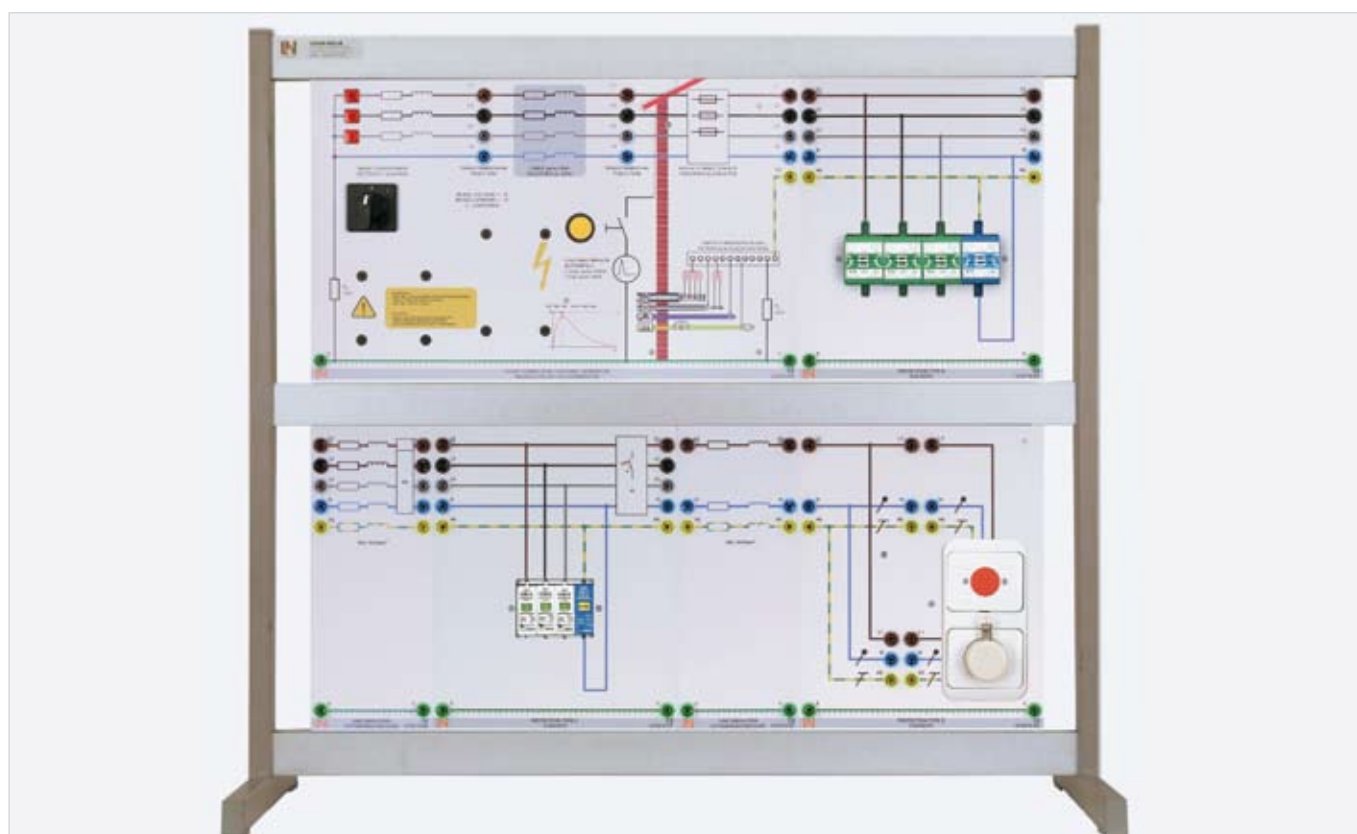


Training contents

- Various mains systems used in customer installations (TT, TN, TN-C, TN-S or TN-C-S systems)
- Choice of various protective components and how they work in different mains systems
- Various protective systems and how to test them with the appropriate measuring equipment
- Carrying out initial and subsequent tests in accordance with DIN VDE 0100-600
- Testing RCDs
- Measurement of loop impedance, local insulation impedance and insulation resistance
- Dangers of electric current
- Advice and instruction to people regarding hazards of electrical systems
- Evaluation of measurements and targeted fault finding
- Preparing documentation and test reports
- Continuity of equipotential binding conductors

Lightning and Excess Voltage Protection

The lightning and mains model allows electricians, apprentices and students to learn the basic principles of multi-level excess voltage protection with lightning and excess voltage arrestors on the model itself. The model includes a three-phase system with built-in lightning and excess voltage arrestors plus a generator for creating pulses which can be used to create artificial lightning strikes.



Training contents

- Generation and evaluation of a standardised lightning strike (10/350) at 1000 V/500 A
- Excess voltage coupling either close to the transformer or distant from it
- Excess voltage coupling distant from the transformer with simulation of a 250-m transmission line
- Calculations and planning for a lightning and excess voltage protection system
- Use of coarse (B), medium (C) and fine (D) protection
- Observing faults if the protection hierarchy is not maintained

Protection in Accordance with VDE/EN Standards

Protection via Circuit Breakers Conforming to VDE/EN Standards

The RCD board illustrates the design and operating principle of various RCDs (residual current protective devices) and how they should best be connected together. The RCD board is used to teach the following contents: RCDs in TN or TT systems, measuring and evaluation of tripping values (time, leakage current), effect on the tripping value of changing the resistance (Rloop, RE), differences between RCDs of type A and type B, tripping values for RCDs of type B, investigation of selectivity in RCDs connected in series, measurement of leakage current for AC leakage currents, pulsating DC currents and pure DC currents.



Training contents

- Design and function of various earth leakage circuit breakers (ELCBs/RCDs)
- Use of RCDs in various mains systems (TN, TT)
- Selecting the correct RCDs for the usage in question (DIN VDE 0100-530:2005-06)
- Design of a selective, hierarchical leakage protection circuit (DIN VDE 0100-300:1996-01)
- RCDs used for additional protection as per DIN IEC 60364-4-41 (VDE 0100-410)
- Use of type-B RCDs in classrooms (DIN VDE 0100-723)
- Use of type-A or type-B RCDs for various types of fault current
- Measurement and evaluation of various tripping criteria for alternating and direct current

Set of Appliance Simulators for Measuring Exercises Based on VDE 0701-0702

All electrical equipment in public and commercial buildings is subject to constant inspection. The required regular testing, along with any testing subsequent to repairs or modifications to electrical appliances is stipulated in standards and guidelines. Only electrically trained personnel may undertake such tests. A high degree of technical knowledge is required for this. Terminology such as protection class, protective earth and insulation measurement all need to be known, as do their permitted limits in the standards. Knowing how to handle the appropriate measuring equipment makes it easier for users to evaluate the electrical appliances themselves. A built-in fault simulator allows for tests to be made on the appliance simulators in various operating states.



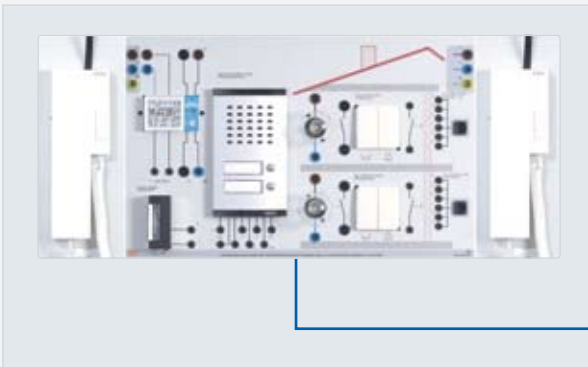
Training contents

- Legal fundamentals
- Test sequences
- Adapting measurements for appliances of protection classes I, II, III
- Reading data from rating plates
- Selection of suitable testing and measuring instruments
- Carrying out various measurements
- Preparing test reports
- Evaluating measurements according to the stipulations of BDV A3 and VDE 0701-0702
- Systematic troubleshooting of appliances

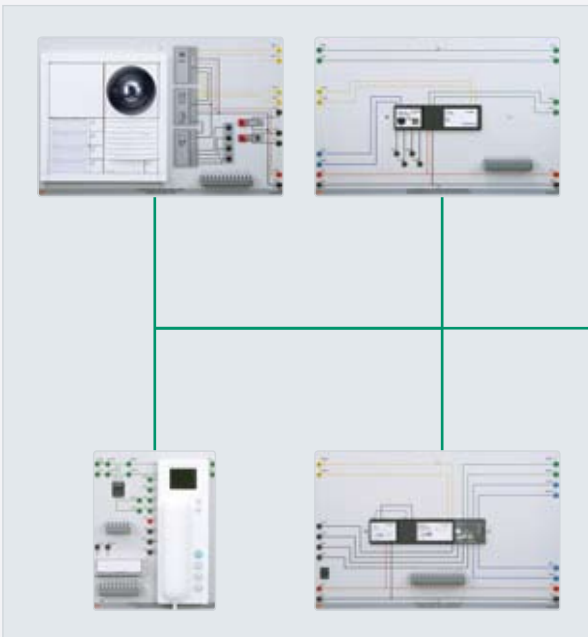
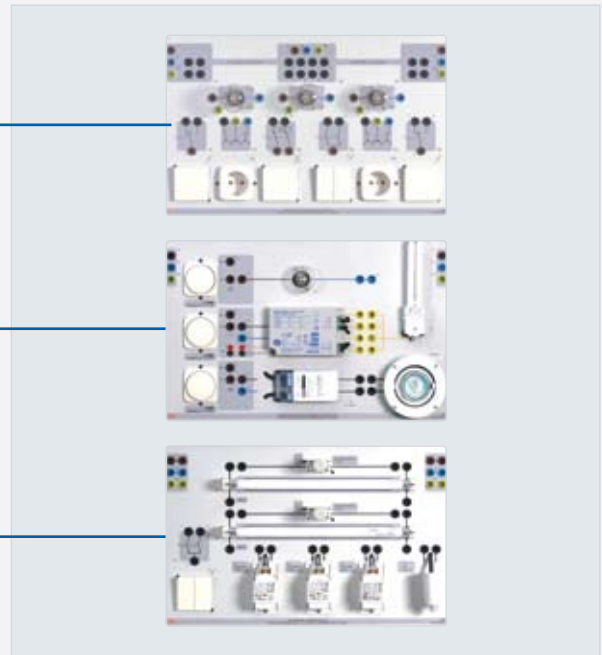
Training Panel Systems – Perfect for Modular Education

Conventional Wiring in Buildings

Building intercom systems



Lighting and appliance circuits

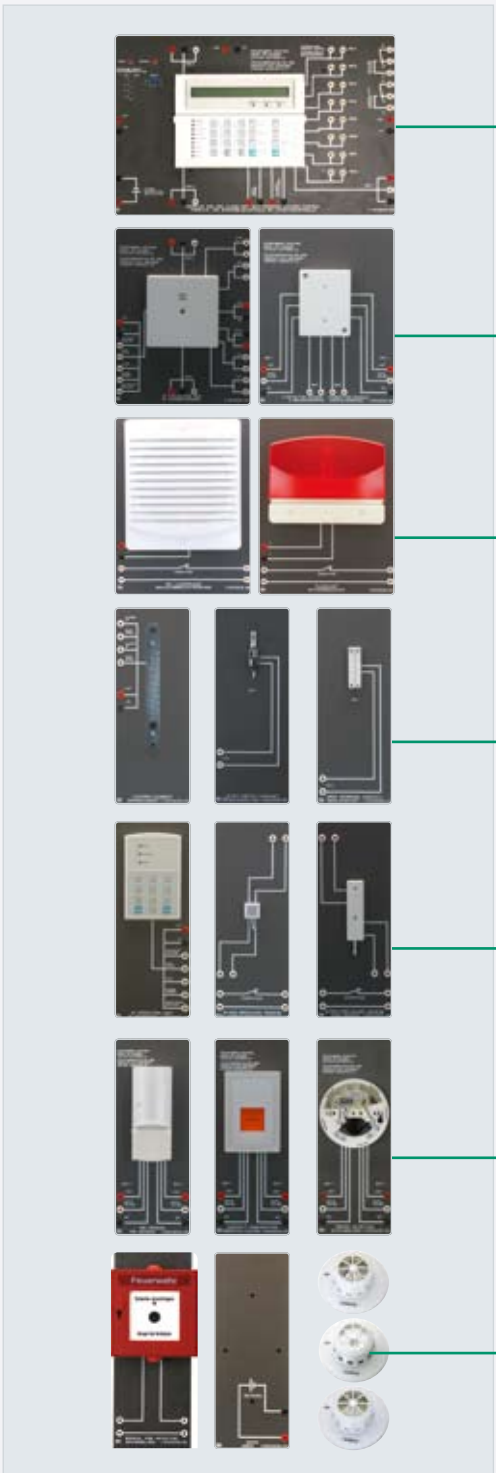
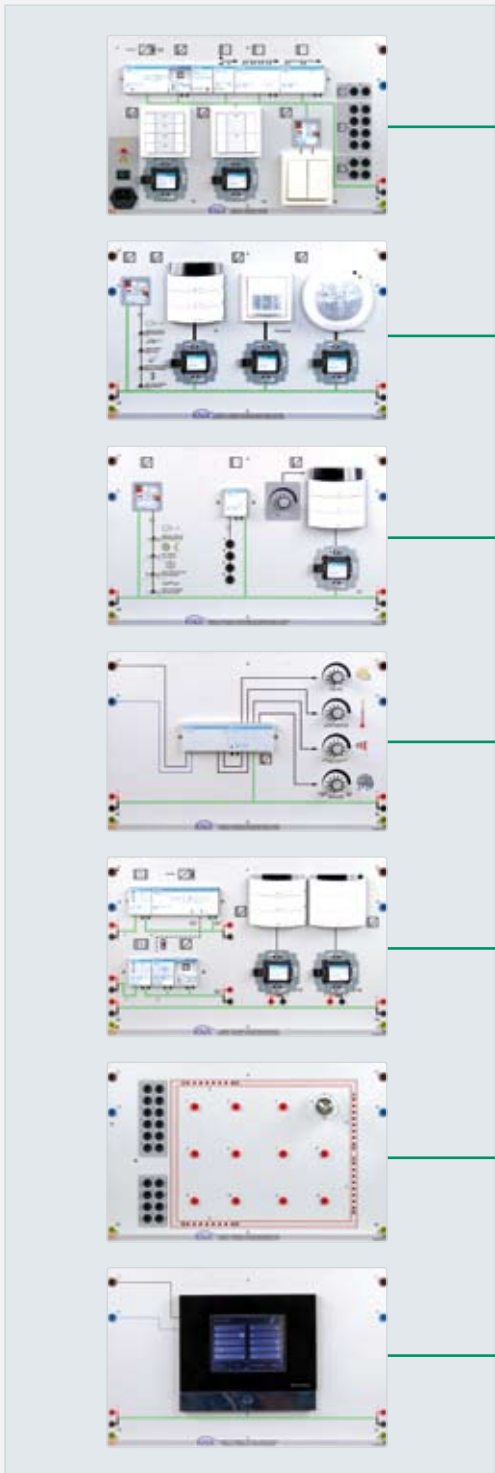


In-home buses

Bus Systems

Building management

Alarm systems



KNX®/EIB

Conventional Wiring in Buildings

Lighting Systems

The training system designed for the topic of lighting circuits includes the standard circuits used in conventional wiring installation. Preparation of and working with various types of circuit diagram forms an introduction to wiring installation and is used as a basis for subsequent topics and more complex installation circuits.



Training contents

- Analysis of installation plans
- Lighting circuits
(on/off, multiple switches, changeover switches and intermediate cross-over circuits with or without earthed sockets)
- Circuits for fluorescent lamps (on/off, multiple-switched, lead-lag and tandem circuits)
- Electronic dimming of various lights
- Calculation of efficiency
- How electronic ballast and transformers work
- Bell and door-opening systems
- Intercom systems with door opener

Intercom Systems

Building intercoms are a simple way of communicating in buildings. Such systems comprise not only the intercom itself but also receivers, turning stairway lighting on or off, door openers and door bells and combine all these basic functions in such a way as to require a minimum of wiring. The building intercom system plus other installation and communications equipment can be combined to create extensive educational projects. The particular challenge for trainees lies in the installation of circuits at various voltages.



Training contents

- Bell and door opener for one flat
- Bell and door opener for two flats
- One-way intercom
- Electric door opener
- Two-way intercom
- Two-way intercom with door opener

Bus Systems / Building Automation

Wiring Installation Based on KNX®/EIB

The demands on wiring installation in buildings are getting tougher all the time as the technology itself advances. Electricians need to keep abreast of these developments. KNX®/EIB installation technology expands upon conventional wiring and blazes a new trail, creating a full building management system. In addition to the normal wiring, a bus system is also required to allow for communication between end devices. All these devices are possessed of their own intelligence programmed via a PC. The system is decentralised and the PC is only used for programming the equipment.



Training contents

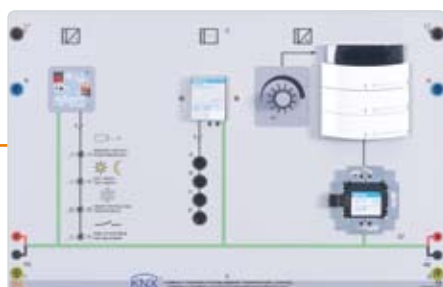
- Fundamentals of a KNX®/EIB bus
- Preparation and installation of a KNX®/EIB project
- Programming devices using an on/off circuit as an example
- Programming a two-way circuit
- Including conventional switches in a KNX®/EIB project
- Programming a central function
- Switching and dimming lights
- Control of blinds and curtains



Supplementary board EIT 8.2: Monitoring systems

Training contents

- Room monitoring
- Use of an info display
- Evaluating messages
- 3-way KNX®/EIB Triton button with display
- KNX®/EIB motion and person sensors
- KNX®/EIB button interface
- Window, door and lock-bolt contacts



Supplementary board EIT 8.3: Heating control

Training contents

- Heating control by thermostat
- Heating control with cold weather setting
- How thermostat control reacts to disturbances
- Automatic summer/winter adaptation
- Presence control



Supplementary board EIT 8.4: Weather station

Training contents

- Determining weather data from sensors
- Supply of voltage to sensors
- Processing analog values with KNX®/EIB
- Evaluation and display of analog signals



Supplementary board EIT 8.5: Coupling of lines and zones

Training contents

- Expansion of single-line topology to a complex zone topology
- Additional supply of power for various lines and zones
- Including additional devices
- Including additional USB ports



Supplementary board EIT 8.6: Operation and visualisation

Training contents

- Setting up a touch panel
- Programming a touch panel
- Graphic display on a touch panel

Bus Systems / Building Automation

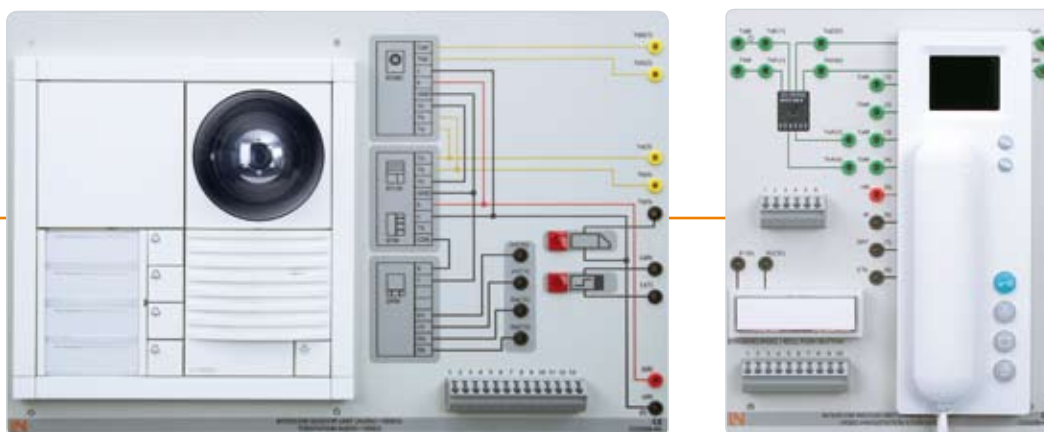
Intra-building Communications

A bus-controlled video intercom introduces a new degree of quality to intra-building communication, which comprises various functions, such as video, audio, turning stairway lighting on or off, door openers and door bells and combines all these basic functions in such a way as to require a minimum of wiring. The video intercom system can be combined with other installation and communications equipment to create extensive educational projects. To reduce volumes of data on the bus lines, complex systems are separated into zones. For this zone, the option will be provided to broadcast video or audio signals.



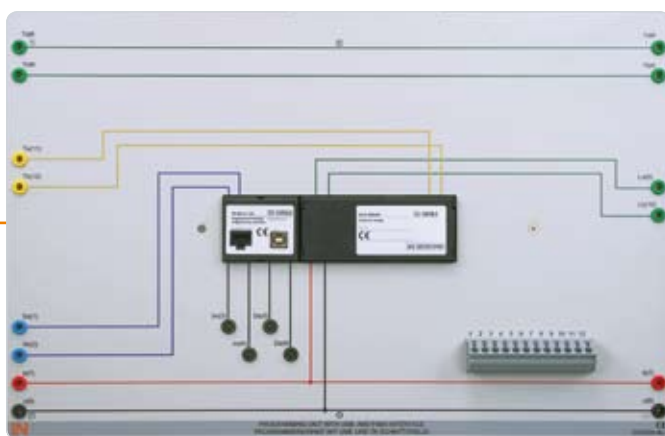
Training contents

- Design and programming of a building intercom using bus technology
- Voice-controlled two-way intercom between flat and front door
- Use of various phone equipment in the building
- Integration of a door opener
- Control of stairway lighting



Training contents EIT 9.2

- Design and programming of a building intercom using bus technology
- Extending an audio intercom to make a video intercom
- Incorporating a video camera
- Connecting multiple video components via a video distribution panel



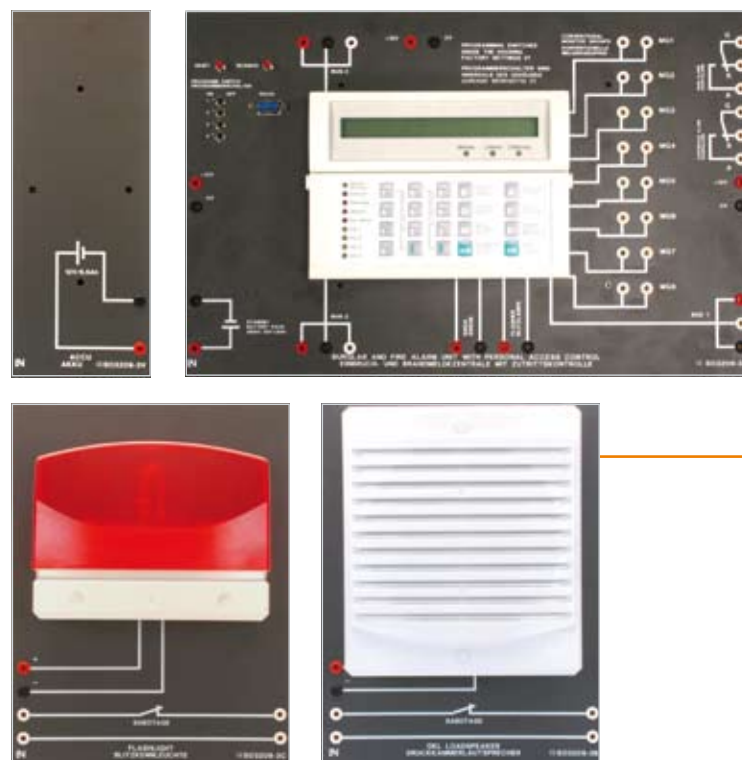
Training contents EIT 9.3

- Linking an audio intercom with an existing communication system
- Implementing control functions via telephone
- Commissioning and fault finding using a PC
- Setting parameters for service functions with a PC

Bus Systems / Building Automation

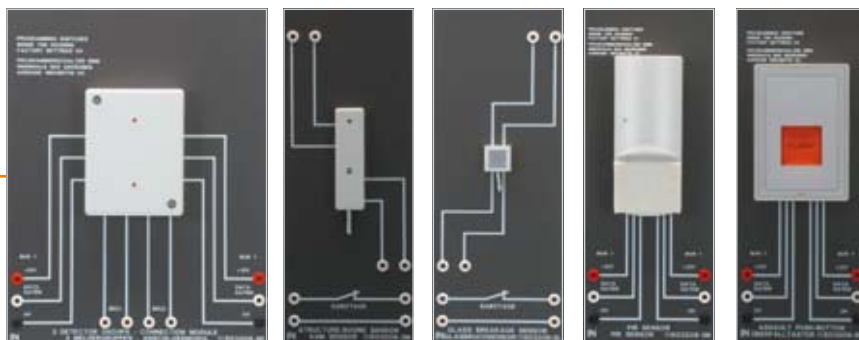
Programmable Alarm Systems Using Bus Technology

This training system concentrates on the operating principles of individual sensors, connections between sensors, arming mechanisms and the central alarm control panel. The system can be programmed for individual needs and is highly flexible in terms of setting it up for students at various levels of accomplishment. The alarm system is composed of components typically used in practice, all of which are authorised by German authorities (VdS -Verband der Sachversicherer e.V.). Operation and programming of the system can be done using a control panel with a two-row display or using a PC.



Training contents

- Wiring central alarm units
- Programming via the control panel (or PC)
- Initial commissioning of the system
- Test operation
- Basic knowledge of project management for burglar and fire alarm systems
- Physical operating principles of various sensors
- Design and programming of monitoring zones



Supplement EIT 12.2: Burglar alarms

Training contents

- Basic knowledge of project management for burglar alarm systems
- Physical operating principles of various sensors, e.g. noise conduction, broken glass or motion sensors
- Design and programming of monitoring zones



Supplement EIT 12.3: Fire alarms

Training contents

- Basic knowledge of project management for fire alarm systems
- Physical operating principles of various sensors, e.g. thermal maximum, thermal differential sensors or smoke detectors
- Design and programming of monitoring zones



Supplementary board EIT 12.4: Access control

Training contents

- Basic knowledge of project management for access control systems
- Physical operating principles of various systems, e.g. ID key access systems, key contacts or gate systems
- Design and programming of monitoring zones

Industrial Installations

Manual Switching in Three-phase Circuits

Multi-pole loads can be switched directly in three-phase circuits up to a certain power rating. Suitable switching equipment is available but needs to be used in the correct way for each specific purpose. The development of circuits and the correct choice of switching elements and appliances are the key aspects handled in this educational unit. Topics include star-delta circuits, star-delta changeover circuits and polarity switching.

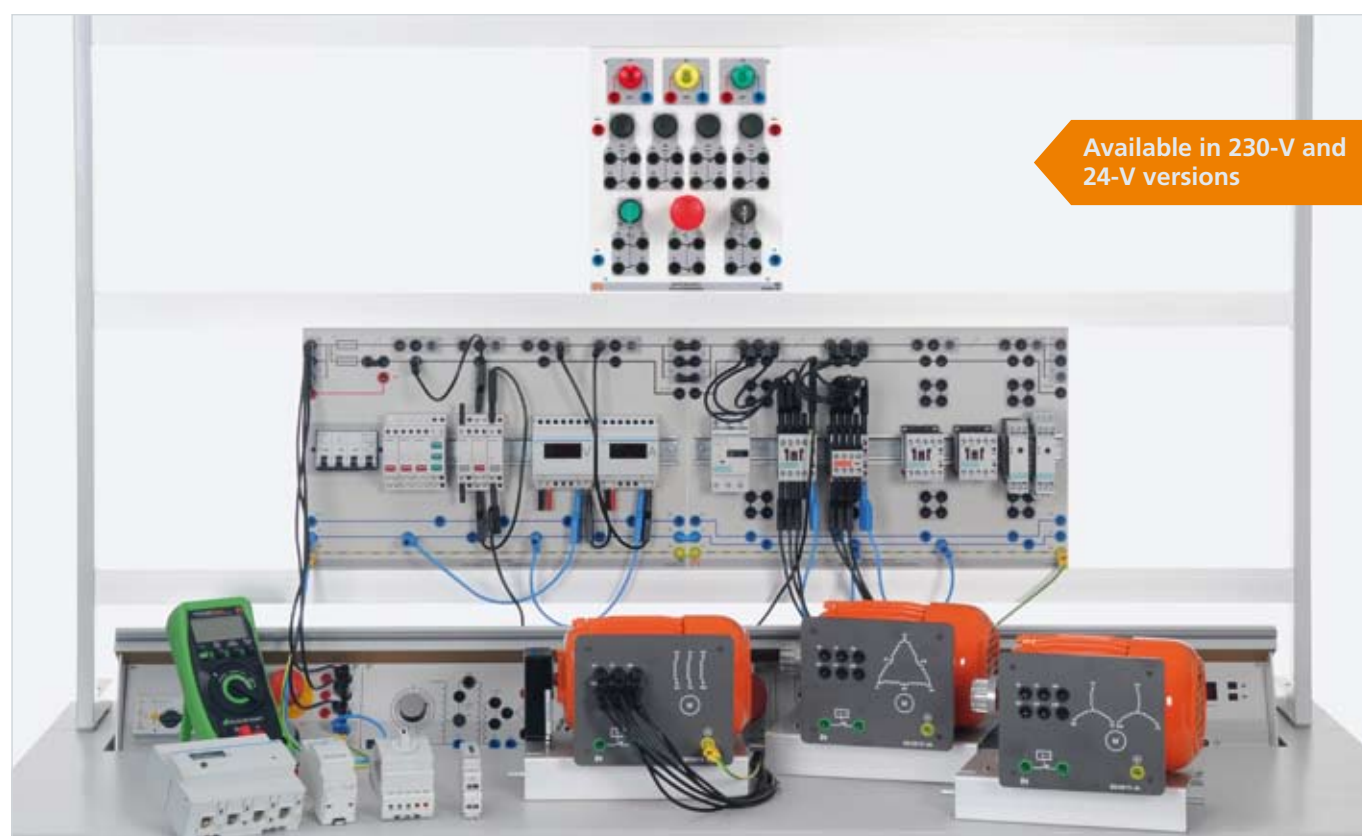


Training contents

- Manual switching in three-phase circuits
- Turning off a three-phase induction motor with squirrel cage rotor
- Star-delta circuit for a three-phase induction motor with squirrel cage rotor
- Star-delta changeover circuit for a three-phase induction motor with squirrel cage rotor
- Polarity switching with Dahlander three-phase induction motor
- Polarity switching with three-phase induction motor featuring two different windings

Protective Circuits in Three-phase Systems

As of a certain power rating, direct switching of three-phase loads becomes impossible. For this reason, such loads are switched indirectly by means of contactor circuits of many different kinds. The development of a control system and installation with functional control are the key points of this unit. The supplementary sets allow additional control exercises with more complexity to be implemented. The supplementary machine set includes all the necessary machines and equipment for testing direct and indirect control of motors in three-phase circuits.



Training contents

- Drawing up a circuit diagram
- Latching protective circuits
- Pre-trigger and post-trigger delay relays
- Changeover contactor circuit with interlock
- Setting a motor protection relay as per motor rating plate
- Limiting control with mechanical end-limit switches and reversal of direction
- Project planning, design and commissioning of complex circuits
- Operating principle and pin assignment
- Function testing and fault finding
- Connecting three-phase motors
- Pulsed contactor circuits
- Star-delta circuits
- Protective and safety functions

Industrial Installations

Small-scale Programmable Logic Control Using “LOGO!”

Small programmable logic systems for industry and building automation such as the “LOGO!” logic module are able to replace many conventional switching devices, such as relays, auxiliary contactors and time switches. Apart from the basic logic operations, more than 20 functions such as stairway light switches, operating duration timers, remote relays and time switches can be accessed. Expanding upon classical control technology and digital systems, it is necessary to know the basics of programming for such programmable logic systems.

This programming can either be done from the integrated key pad or via a PC by means of the built-in PC port.

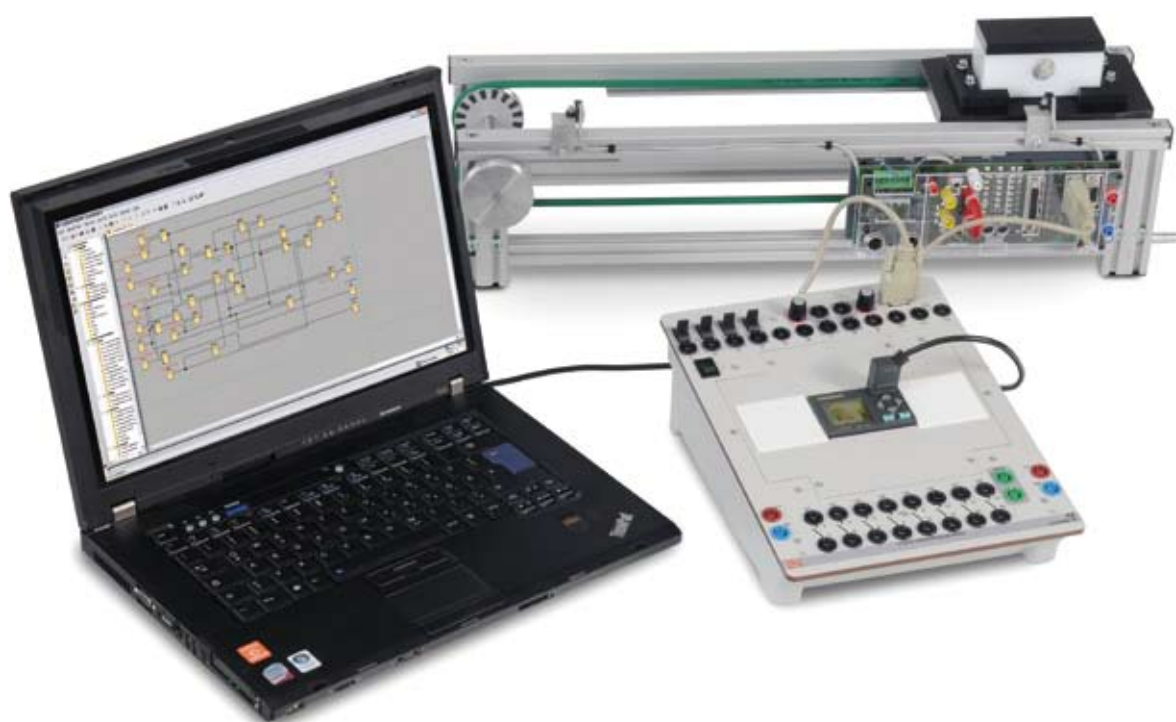


Training contents

- Connecting logic modules
- Converting circuit diagrams into function plans
- Programming basic functions
- Programming special functions
- More complex control requirements
- Testing functionality

Project: Control of a Conveyor Belt Using “LOGO!”

Typical example applications for the logic module, “LOGO!”, include control of numerous applications such as ventilators, gates, blinds, conveyor belts, revolving doors and escalators. By using it in the course of project work, knowledge learned about the programming of small PLC systems can be put into practice and the advantages of a modern technology such as this can be experienced at first hand.



Training contents

- Connecting logic modules
- Implementing control requirements in a function plan
- Programming more complex control requirements for an application
- Processing signals from the system
- Testing functionality

Renewable Energies

Solar Technology

Detailed information can be found in the "Electrical Power Engineering" catalogue.

Implementing regenerative energy sources in commercial or even in private buildings is gaining increasing importance. We provide a range of different training systems and these are described in our Energy Technology catalogue.



EPH 2 equipment set

Training contents

- Installation of photovoltaic (PV) systems
- Installation and testing of a PV system feeding back into the mains
- Measurement of the energy generated by a PV system
- Investigation of how a PV system responds in the event of a power failure
- Installation and testing of an isolated PV operating in direct or storage mode
- Trial and error to locate the optimum alignment of solar systems
- Recording the characteristics of solar cells
- Investigating response when the equipment is in shadow
- Circuit types for solar cells

Wind Energy/Fuel Cells

Detailed information can be found in the "Electrical Power Engineering" catalogue.



EWG 2 equipment set

Training contents

- Design and operating principle of modern wind power plants
- Exploring physical fundamentals from "wind to shaft"
- Installation and commissioning of a double-fed induction generator
- Determine optimum operating points under changing wind conditions
- Investigate the operating response during mains malfunctions (fault-ride-through)



EHY 1 equipment set

Training contents

- Design and function of a fuel cell
- Design and function of an electrolyser
- Design and function of a metal hydride storage cell
- Characteristics and power response curves of fuel cells
- System required for autonomous power supply



Practice

More Than Just a Training System	60
Systems for Practicing Wiring Installation	62
Construction of Switch Cabinets	70



Practice

The Perfect Supplement to Project-oriented Teaching

For assembly, it is practical skills that are of prime importance. All these exercises are firmly rooted in practice. Electric connections are made with connectors typically used in practice (junction boxes, cable ties, conduits etc.) and several different wiring methods are covered. All components other than consumables (such as wires) are reusable: The components are either attached to the punched hole panels with plastic dowels or specially developed fastening sets.



Practical skills

For education in industrial practice, great importance is placed on learning manual skills. This enhances the link with practice.

**Commonly used materials**

To make this link as strong as possible, typically used industrial circuit and wiring materials used here too. This makes it easy to carry over what has been learned into day-to-day application.

**Construction of switch cabinets**

One project for advanced trainees is the planning and implementation of a complex electrical switching system. Lucas-Nülle training systems aid in the implementation of a switch cabinet.



More Than Just a Training System

A Practical Solution – Practical Lab for Electrical Wiring Installation





Systems for Practicing Wiring Installation

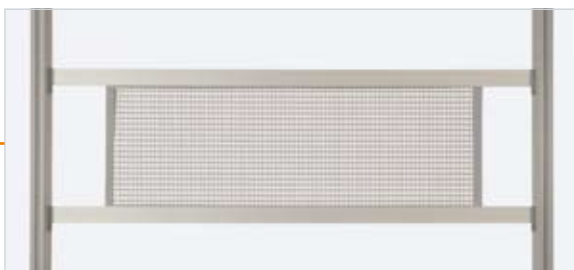
Basic Systems for Teaching Installation Techniques

Suitable for use with common components to rapidly assemble circuits and measuring set-ups. The punched hole panels are made of 1.5-mm thick steel plate with powder coating.



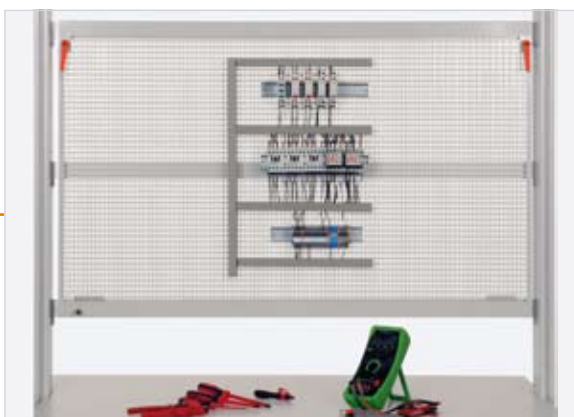
Your benefits

- Planning and execution of projects
- Learning wiring methods
- Strong link to authentic practice through the use of typical technical documentation and software
- Circuits are implemented using commonplace components
- Full project documentation



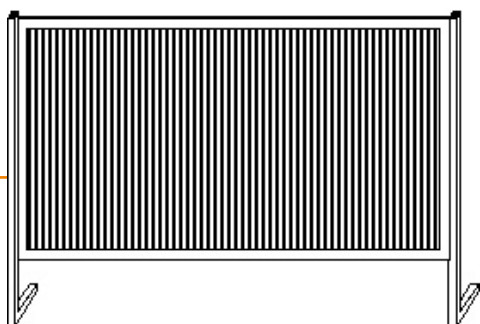
Suspended punched hole panels are inserted between the rails of the training panel frames.

This allows the combined usage of DIN-A4 training panels and punched hole panels along with the wiring components.



When interchangeable frames are used, suspended punched hole panels can easily be used by hanging them in front of the aluminium profile frames.

This allows rapid exchanging of training panels and punched hole panels.



Punched hole panels with their own base are available in several variants, for table top with an L-shaped base or a table-top frame with a T-shaped base, either with the lowest rail touching the ground or for installation under a power channel system.



It is possible to enter the installation cabin, which then serves as a basis for assembly projects in an authentic environment.

Design and dimensions have been chosen in such a way that trainees can work without injury, even when working on quite complex tasks (such as ceiling installation, corner installation etc.).

Systems for Practicing Wiring Installation

Wiring Installation in Buildings

Example training project: The stairway of a multi-storey building shell is to be lit with multiple lamps controlled via a stairway timing circuit using a timing relay. Fluorescent lights are to be used in place of conventional lights in the basement. Additionally the basement storey needs two sockets that can be switched on or off from multiple locations.



Training contents

- Wire stripping exercises
- On/off circuit (installed in conduits)
- Remote control circuit with socket
- Function and use of automatic safety equipment
- Methods for laying wires above the plaster or embedded underneath it, using plain cables or conduits
- Testing and commissioning of circuits to ensure they match the installation and circuit diagram
- Wiring fluorescent lighting circuits in conduits or with plain cables
- On/off and lead-lag circuits with a fluorescent lamp and a socket
- Tandem circuit with a fluorescent lamp and a socket
- Exercise in bending wires and eyelets as well as in wiring
- Multi-circuit, two-way and intermediate circuits with socket
- Stairway lighting circuit with timing relay

Building Intercom Systems

Example training project: A maisonette is to be equipped with a building intercom. This is to include a central door communications set-up and a station on each floor with the wiring laid above the plaster in conduits.



Training contents

- Installation and wiring
- Intercom with door opener
- Intercom and door bell systems
- Testing and commissioning of circuits, ensuring they match the circuit diagram and installation plan
- Installation and wiring of one-way and two-way intercoms, ensuring they match the circuit diagram and installation plan
- Testing and commissioning of circuits

Systems for Practicing Wiring Installation

Building Service Entry Equipment

Example training project: A service entry box with an electricity meter is to be installed in a new building. In this instance, conformance with the valid regulations is the focus. Protection is to be provided by ordinary fuses, automatic safety equipment and RCDs.



Training contents

- Assembly, installation and wiring of a meter cabinet with a sub-distribution box.
- Installation of an electricity meter
- Installation of RCDs, line circuit breakers, etc.
- Wire stripping exercises
- Wire laying exercises installing above the plaster using plain cables or conduits
- Function and use of automatic safety equipment
- Installation of various mains systems for the power feed

Network Installation

Example training project: A telecommunications switchboard in an old building is to be modernised. Private branch exchange (PBX) equipment is to be used for this, which can be connected to both an analog connection and ISDN via a basic rate interface. In addition, a door intercom and multiple PBX units are to be integrated as well.



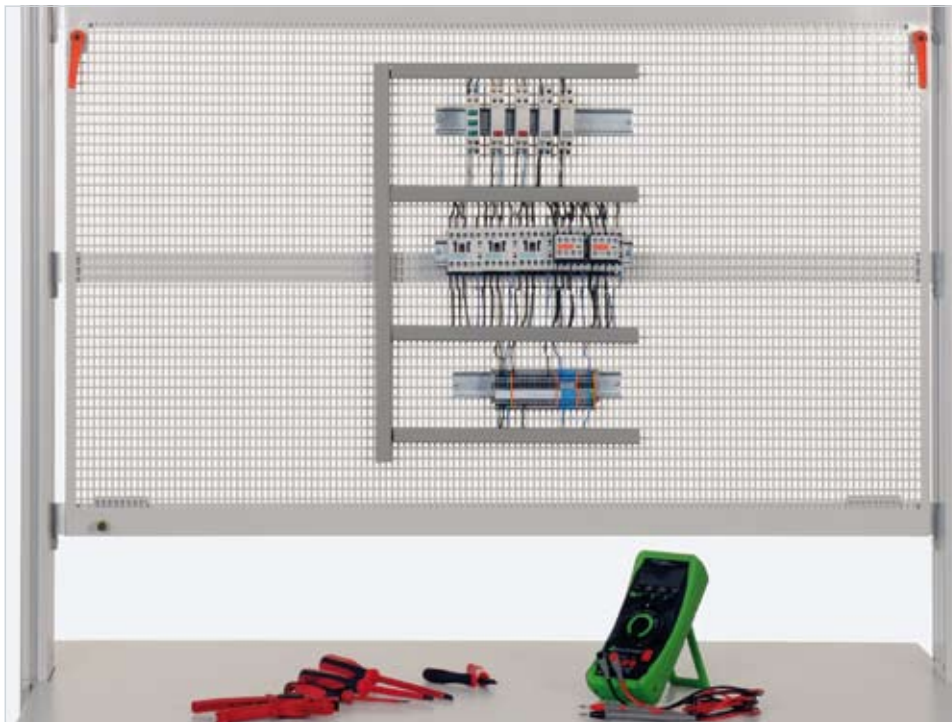
Training contents

- Analog connection via Germany's TAE system or the international modular system
- Components of an ISDN installation
- ISDN basic rate interface
- Installation and administration of PBX units
- Connection to analog (POTS) or digital (ISDN) telephone lines
- Connection of door intercom to PBX units
- Design usage and functioning of cables plugs and sockets
- Use of hand tools and measuring equipment for the installation

Systems for Practicing Wiring Installation

Switching Installations

Example training project: An electrical machine is to be connected in a star-delta circuit with the aid of contactors.

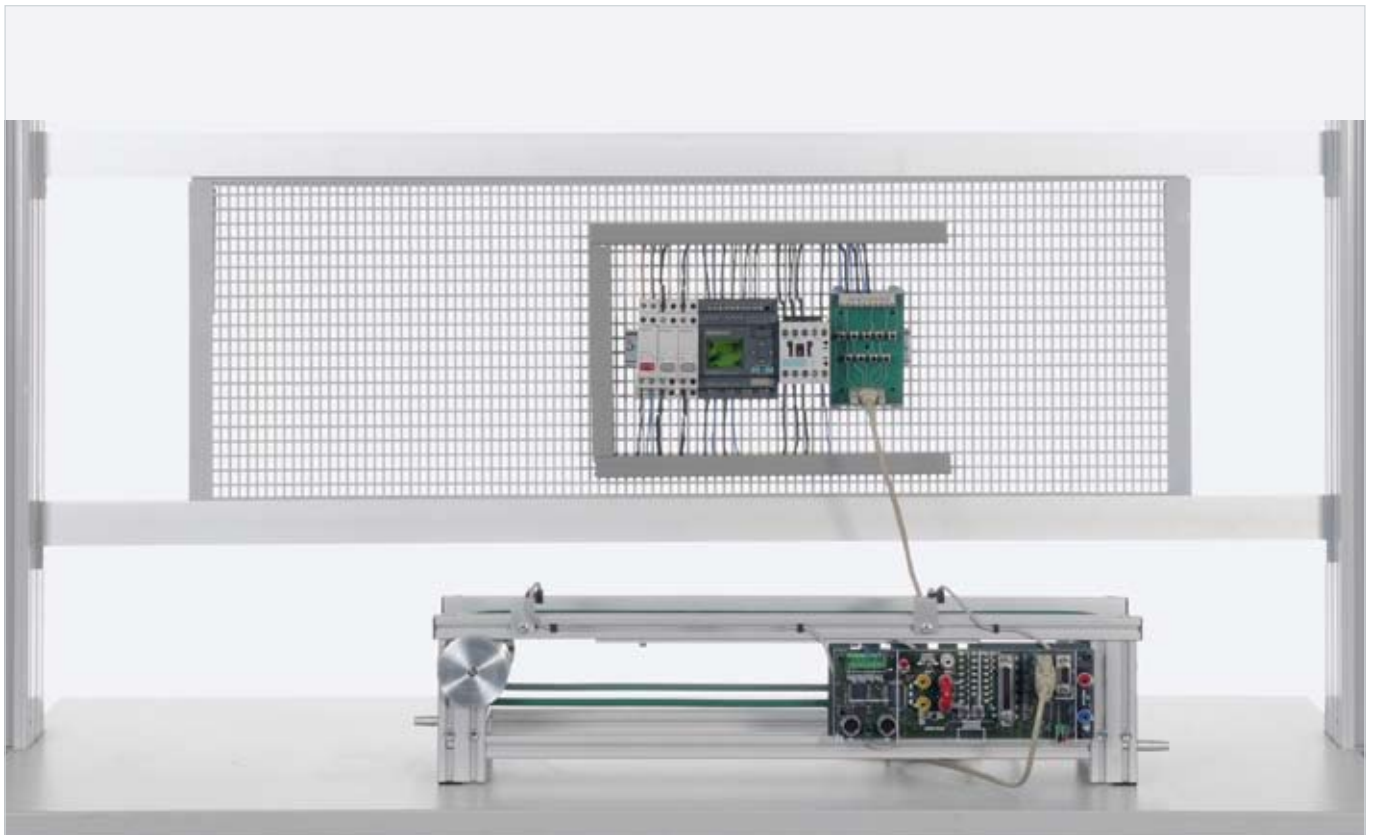


Training contents

- Components and various wiring techniques
- Installation and commissioning of circuits using this method
- Contactor control with on/off switches, inching control, latching and two control sites
- Contactor circuits for motors with two speeds and two separate windings
- Reversing and follow-up circuits using contactors
- Forced follow-up circuits alongside the main circuit
- Dahlander circuit with contactors
- Starter circuit for motor with slip-ring rotor
- Interlocking of contactor control
- Contactor control with time-delay relay
- Star-delta circuit using contactors

Small-scale Programmable Logic Control Using “LOGO!”

Example training project: A conveyor belt is to be controlled by means of the miniature programmable logic control system, “LOGO!”. The belt should be able to move a workpiece right or left under manual or automatic control until it reaches an end-limit sensor. Automatic control should be interlocked to prevent faulty operation.



Training contents

- Wiring the components of the system
- Connecting logic modules
- Implementing circuit diagrams in a function plan
- Programming basic functions
- Programming special functions
- More complex control requirements
- Testing functionality

Construction of Switch Cabinets

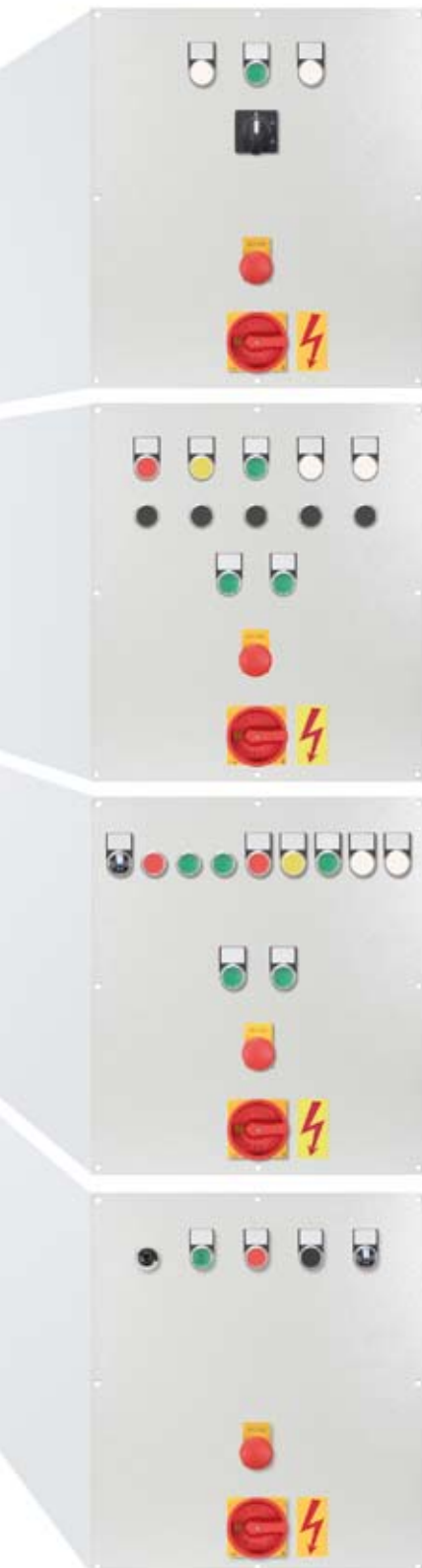
Control Technology

When assembling circuits, it is manual skills that take the focus. All exercises are strongly linked to authentic practice. The “Switching Systems Installation Exercises” training system allows trainees to learn about the installation and wiring of electrical components in a realistically practical environment. Use of typical industrial components is an ideal way to enhance the strong link to authentic practice. Thus, various projects typical within the industry can be built and tested.



Your benefits

- Preparation and analysis of circuit diagrams
- Fully prepared basis system for all educational projects
- Final inspection as per DIN EN, measurement of protective earth and insulation
- Parameter setting and programming of components
- External connection of existing test items via 4-mm safety sockets or direct wiring via terminal strip
- Simple installation by replacing the front panel inside a switch cabinet
- Easy to extend for your own projects



Project: Direct switching of three-phase motors – EWS 5.1

- Preparation of a switch cabinet to accommodate installed circuitry
- Installation and setting of motor protection switches according to motor rating plate
- Installation of an on/off circuit for a three-phase motor
- Installation of a star-delta circuit for three-phase motors
- Installation of a star-delta reversing switch for three-phase motors
- Installation of a polarity reversing switch for Dahlander three-phase motors
- Installation of a polarity reversing switch for three-phase motors with two separate windings

Project: Control of motors using contactors – EWS 5.2

- Preparation of circuit diagrams
- Installation of latching and non-latching contactor circuits
- Installation of contactor circuits with fault notification triggered by overloading of the motor being controlled
- Installation of contactor circuits with time-delay relays
- Installation of contactor circuits with pulsed contactor circuitry
- Installation of reversing contactor circuits with contactor and button interlock
- Installation of limit control using mechanical end-limit switches plus reversal of direction
- Installation of an automatic star-delta reversing circuit

Project: Motor control using “LOGO!” – EWS 5.3.3

- Development of circuits for small-scale programmable logic control
- Designing protective concepts for small PLC controllers
- Installation of a small PLC system such as “LOGO!”
- Parameter setting for various educational projects, e.g.:
 - Motor control
 - Control of conveyor belts
 - Lift control

Project: Motor control with a frequency transformer and “LOGO!” – EWS 5.4

- Preparation and analysis of a circuit diagram
- Design and wiring of a switch with appropriate electromagnetic compatibility using standard industrial components
- Commissioning
- Final inspection as per DIN EN standards
- Measurement of protective earth
- Insulation measurement
- Parameter setting for frequency converter
- Programming the “LOGO!” miniature controller



Measuring Equipment and Accessories

Measuring Equipment	76
Accessories	84



Measuring Equipment and Accessories

Use of Measuring Instruments

The measuring equipment for the power supply and building wiring installation modules is used for two main purposes:

- Measurement and testing of electrical appliances
- Initial and subsequent measurements on the installation as a whole

All these measurements/tests may only be carried out by experienced and qualified technicians.

Lucas-Nülle training systems help prepare trainees for making these highly safety-relevant measurements.



On-site measurement and testing of fixed installations:

- Initial measurements on an installation as per VDE 0100 T610
- Subsequent regular measurements as per VDE 0105

Required measurements of the following:

- Loop impedance
- Internal impedance
- RCDs
- Earth resistance
- Insulation resistance
- Equipotential bonding

**Measurement and testing of electrical appliances:**

- After repairs (VDE 0701)
- After regular testing as per VDE 0702

VDE 0701 and VDE 0702 are identical in terms of the measurements to be made. The two standards have been combined since June 2008.

**Voltage, phase, continuity, polarity testing and display of direction of rotating field**

Common measurements of electrical wiring installations are usually carried out with the following instruments:

- Continuity testers
- Multimeters



Measuring Equipment

PROFITEST MBASE/MTECH Installation Tester

The testers in the "PROFITEST Master" range provide professional electricians with a set of universal measuring tools featuring the highest level of technology. The meters can undertake all measurements concerning the effectiveness of protective measures in electrical systems as required by VDE 0100 Part 600 and defined in the individual sections of VDE 0413. It is therefore ideal for final inspection and regular testing of electrical systems on site. Classified in measurement category CAT IV, PROFITEST equipment guarantees users the utmost safety



Features

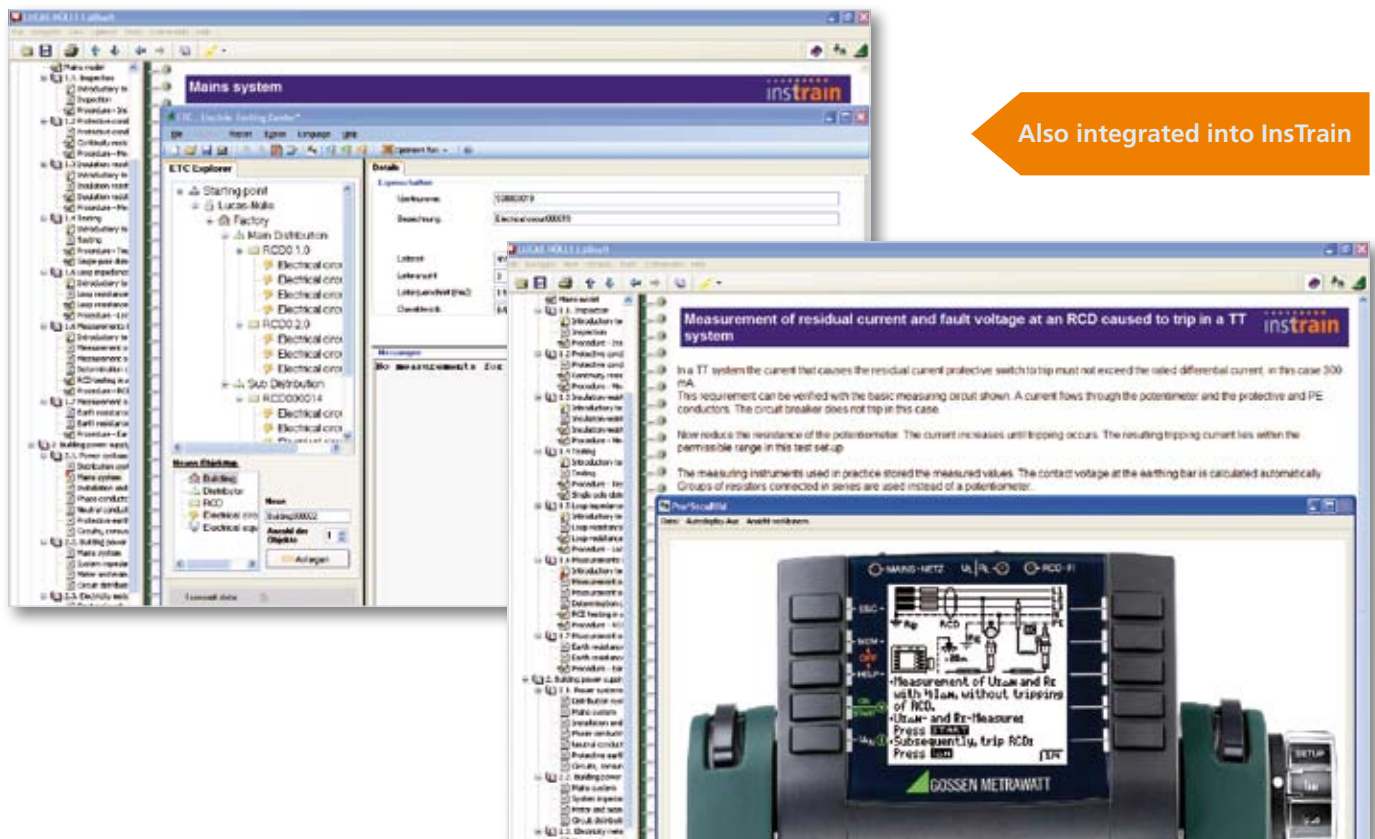
- Measurement of voltage drop
- Current measurement with a Metraflex meter
- Automatic cable compensation using the four-cable method
- All measurements conform to VDE 0100 Part 600/IEC 60364.6.61/EN 61557
- RCD testing with a continuously rising ramp
- 1-mA varistor trigger test with insulating voltages measured up to 1,000 V
- Two-pole measurement with plug unit or interchangeable 2/3-pole adapter
- Measurement of RINS with increasing voltage
- Connection to RFID or barcode scanner
- Includes ETC software

Additional functions of LM8556:

- Loop measurement without tripping RCDs (with pre-magnetisation)
- DC testing of type-B RCDs
- Selective earth measurement

PC-based Data Acquisition and Management

The Electric Testing Center (ETC) supports seamless communication between PROFITEST Master testers and PCs. The PROFITEST M can process individual testing structures which have previously been created with the help of ETC on a PC. Once they have been uploaded they are reflected 1:1 on the tester itself. This means any structure can be assembled from any number of objects: number and type of customers, buildings, distribution boxes, circuits and RCDs can be selected at will. After the measurements have been made, they can be transferred back to the PC, where a test report can automatically be generated from the results.



Also integrated into InTrain

Your benefits

- The software encompasses all the key data for testing and reporting as per DIN VDE 0100 Part 600
- Test protocols (as provided in Germany by the ZVEH - Zentralverband der deutschen Elektrohandwerke) can be produced automatically and distribution structures with data for circuits and RCDs can be defined individually
- Structures defined in this way can be saved and loaded when necessary
- PROFITEST M and a PC can exchange data bi-directionally via a USB link
- It is possible to export data in EXCEL, CSV and XML formats

Measuring Equipment

METRATESTER 5+ Appliance Tester

This tester is designed for testing and measuring newly repaired or modified equipment. The appliance being tested is connected to the tester via the test socket. Safety sockets for rapid voltage measurement are connected in parallel with the test socket and allow measurements to be made on test appliances with no earthed plug or on those that are wired permanently into place. To test that no voltage is present on conductive components which it might be possible to touch or in order to measure load currents, the test appliance is connected to the mains socket of the test device.

This easy-to-use equipment has a convenient and compact plastic housing with fold-out carrying handle. Mains lead and measuring cables are permanently wired in. The mains lead can be wound onto a fitting on the back of the housing and measuring leads can be stored in a cable compartment integrated into the unit. The quantity to be measured can be selected by means of a rotary switch.



Features

Testing of electrical safety for electrical appliances in accordance with DIN VDE 0701-0702: 2008. The following measurements are to be made to this end:

- Protective earth resistance
- Insulation resistance
- Contact current (ensuring there is no voltage by measuring current)
- Protective earth current (equivalent leakage current method/differential current method)
- Mains voltage
- Load current

SECUTEST S2 N+ Appliance Tester

To evaluate electrical safety, tests of the protective earth connections, insulation resistance and leakage current (differential current, equivalent leakage current, appliance leakage current, patient leakage current and contact current) need to be made. Safety tests conform to the following (among others):

- Safety of electrical equipment as per DIN VDE 0701-0702
- Safety of electrical equipment used in medicine as per DIN VDE 0751/IEC 62353



Features

- Equivalent leakage current, differential current and direct measurements
- Test current from ± 200 mA for protective earth testing, also capable of detecting faults due to corrosion
- Automatic detection of protection class and determination of optimum test procedure
- Additional tests for extension leads and appliances which can only be tested while active or while passive
- A checklist for visual inspection is integrated as well
- Signals on IT networks
- Account is taken of intrinsic deviations when evaluating test results
- Modifiable testing templates stored on the tester
- Extensive accessories for testing three-phase equipment (including differential current measurements)

Measuring Equipment

PROFIsafe 400 Continuity Tester

The PROFIsafe tester is a two-pole voltage tester with LED display conforming to EN / IEC 61243-3 (VDE 0682 Part 401). The PROFIsafe device can carry out tests on DC and AC voltages in the range from 12 to 400 V.

In addition, polarity, phase and direction of rotating can all be determined and continuity tests can be made for resistance values up to 500 k Ω . The power source for the additional functions (continuity/rotating field/phase) is a rechargeable lithium battery, charged by a powerful solar cell, which works even under poor lighting conditions. Normal batteries are not required. No power source is required for voltage measurements. The PROFIsafe tester can even be used in the rain thanks to its high protective classification (IP 65).



Features

- Voltage testing
- Phase testing
- Polarity testing
- Display of rotating field direction
- Continuity testing
- Robust housing, can be used without risk even in damp conditions, protective class IP 65
- Easy to operate, VDE-GS tested
- Measurement category CAT IV

Multimeter Range

Universal laboratory multimeter and temperature measurement range with patented automatic socket protection and infra-red interface for highly demanding, universal measurement and logging in education, energy technology, process management etc. An infra-red data interface allows the devices to be coupled for direct transfer of data to the UniTrain-I system.



LM2322: METRAHIT TEACH



LM2330: Basic meter



LM2331: TRMS instrument with measurement of capacitance, frequency and dB

Features

- 3 $\frac{3}{4}$ to 4 $\frac{3}{4}$ digit multimeters
- Measurement category CATII - 1,000 V
- Couples to UniTrain-I system via IR data interface
- Various measuring ranges for voltage, current and resistance depending on the application
- Special ranges: °C for measuring temperature using PT100/1000 thermocouples
- Continuity and diode testing
- Automatic range selection and battery shut down, min/max and data-hold functions
- High current fuse for mA range at voltage greater than 1,000 V
- LM2330 and LM2331: display with bar graph and background lighting
- Includes: Rubber protective pouch, measuring leads, replacement fuse, 9-V battery, calibration certificate
- Automatic socket protection

Measuring Equipment

Mains Quality/Power Analyser

The three-phase mains analyser from the MAVOWATT range has eight independent input channels and is operated via touch screen. During automatic set-up, the type of mains system to which the device is connected is detected, a configuration is selected and the equipment is then ready to use. Users can select the length and type of data acquisition, including fault finding, recording of data, monitoring of mains quality, distribution of power or load. Measurements can be made in oscilloscope, multimeter and event modes and displayed as a frequency spectrum or vector diagram in real time. The MAVOWATT range can be equipped with optional RS232, Ethernet or USB ports and conforms to currently applicable standards.



Features

- 8 Channels
(4 voltage inputs for up to 600 VRMS, 4 current inputs)
- Intuitive operation via colour touch-display
- Automatic limit configuration
- Analysis of up to 63 harmonics
- Conforms to EN 50160, EN 61000-4-30, EN 61000-4-15, EN 61000-4-7, EN 61000-3-2/-3-3 standards
- Built-in battery for use as uninterruptible power supply for up to 3 hours
- Compact Flash-card memory up to 128 MB
- Graphic display of online measurements and stored events
- Data transfer to PC via compact Flash cards, RS232, Ethernet or USB
- DranView PC evaluation/analysis software
- NodeLink software for remote data queries via RS232/modem, USB or Ethernet TCP/IP
- User interface can be switched between European and Asian modes

Thermal Imaging Camera

Thermography or thermal imaging is a technique that allows infra-red radiation to be made visible. Thermography allows temperature measurements to be made and displayed for entire surfaces. Sources of hazard such as contacts with excessive junction resistances or overheated components can be pin-pointed easily and quickly using the thermal imaging camera. Such cameras are commonly used, for example, for the regular testing of switch cabinets and installations.



Features

- Thermal imaging camera for temperature measurement from -20 to 350°C
- Built-in digital camera
- Temperature display as a visual image
- Radiometric detector (UFPA) with 19,200 measuring points (160 x 120 pixels)
- Resolution up to 0.1°C
- High accuracy (+/-2% of measured value)
- 2.7" LCD display
- Transfer of images to PC via USB 2.0
- Operated using standard batteries
- Housing of protection class IP 43
- Includes "Thermography Studio" software

Accessories

Tool Case

The tool case is made of leather and its document pouch and satchel straps mean it is ideal for the needs of trainees. The edges are reinforced by aluminium corner pieces and the bottom incorporates a strong galvanised base tray. The front and back of the case can be folded out separately and the case can also be locked.



Features

- 1 Telephone clip, straight
- 1 Combined clip
- 1 Side cutter
- 1 Wire stripper
- 2 Workshop screwdrivers
- 2 Cross-head screwdrivers
- 4 Electrician's screwdrivers
- 1 VDE voltage tester
- 1 Cable tester
- 1 Jokari cable tester
- 1 PUK pocket saw
- 1 Electrician's chisel
- 1 Stone chisel
- 1 Locksmith's hammer
- 1 Sledge hammer
- 1 Artist's trowel
- 1 Plaster tray
- 1 Brush

Workbench for Practical Lab

Detailed information can be found in the "Laboratory Furnishings" catalogue.

The flexibly configurable workbenches with metal underframe, chest of drawers underneath and tough beech multiplex surface on top are things that no practical lab should be without. Countless detailed solutions offer plenty of opportunity for developing completely new ways of working and provide systematic support to users. Ergonomics form the basis for productive working.



ST8070-2A



ST8070-3A

Features

- Workbench with tough beech multiplex table top, surface treated to repel dirt
- Numerous types of drawer with fine-tunable capabilities for division
- Central lock for drawers
- Tough metal underframe
- Can be adapted flexibly to the needs of any laboratory

Electronics Engineers for Electrical Installations

Topics	p. 18	p. 20	p. 22	p. 24	p. 26	p. 28	p. 36	p. 37	p. 38
	"Building Service Entry" Training Project Using InsTrain	"Lighting and Appliance Circuits" Training Project Using InsTrain	"Communications Technology" Training Project Using InsTrain	"Building Management Systems Based on KNX®" Training Project Using InsTrain	"Building Service Entry and Sub-distribution" Training Project Using InsTrain	"Wiring and Components Embedded in Plaster" Training Project Using InsTrain	Mains Systems and Protective Measures	Lightning and Excess Voltage Protection	Protection Via Circuit Breakers Conforming to VDE/EN Standards
1 Analysis and Function Testing of Electrical Systems	X	X			X	X			
2 Planning and Execution of Electrical Wiring Installation	X	X			X	X	X	X	X
3 Analysis and Adaptation of Controls									
4 Preparation of Information Technology Systems			X						
5 Electrical Power Supplies and Assuring the Safety of Components	X	X			X	X	X	X	X
6 Analysis and Testing of Appliances and Components in Networks							X		
7 Programming and Implementing Control Systems for Plant				X					
8 Selection and Integration of Drive Systems									
9 Installation and Commissioning of Wiring Installation in Buildings		X		X				X	X
10 Installing and Maintaining Mains Power Supply Equipment	X	X						X	
11 Commissioning and Maintaining Automated Plant									
12 Planning and Implementing Electrical Systems				X					
13 Maintenance and Modification of Electrical Systems									

Electronics Engineers for Power Supplies and Building Installations

Topics	p. 18	p. 20	p. 22	p. 24	p. 26	p. 28	p. 36	p. 37	p. 38
	"Building Service Entry" Training Project Using InsTrain	"Lighting and Appliance Circuits" Training Project Using InsTrain	"Communications Technology" Training Project Using InsTrain	"Building Management Systems Based on KNX®" Training Project Using InsTrain	"Building Service Entry and Sub-distribution" Training Project Using InsTrain	"Wiring and Components Embedded in Plaster" Training Project Using InsTrain	Mains Systems and Protective Measures	Lightning and Excess Voltage Protection	Protection Via Circuit Breakers Conforming to VDE/EN Standards
1 Analysis and Function Testing of Electrical Systems	X	X			X	X			
2 Planning and Execution of Electrical Wiring Installation	X	X			X	X	X	X	X
3 Analysis and Adaptation of Controls									
4 Preparation of Information Technology Systems			X						
5 Electrical Power Supplies and Assuring the Safety of Components	X	X			X	X	X	X	X
6 Analysis and Testing of Appliances and Components in Networks							X		
7 Programming and Implementing Control Systems for Plant				X					
8 Selection and Integration of Drive Systems									
9 Installation and Commissioning of Communications Systems in Residential and Commercial Buildings				X					
10 Commissioning and Maintaining Building Wiring Installations		X						X	
11 Installing, Commissioning and Maintaining Mains Power Supply Systems									
12 Planning and Implementing Mains Power and Building Wiring Installations				X					
13 Maintenance and Modification of Mains Power and Building Wiring Installations									

																			Set of Appliance Simulators for Measuring Exercises Based on VDE 0701-0702	p. 39
X					X				X										Lighting Systems	p. 42
X	X				X				X										Intercom Systems	p. 43
						X				X									Intra-building Communications	p. 46
											X								Wiring Installation Based on KNX®/ EIB	p. 44
																			Programmable Alarm Systems Using Bus Technology	p. 48
											X								Manual Switching in Three-phase Circuits	p. 50
											X								Protective Circuits in Three-phase Systems	p. 51
																			Small-scale Programmable Logic Control, "LOGO!"	p. 52
																			Project: Control of a Conveyor Belt Using "LOGO!"	p. 53
																			Solar Technology / Wind Energy / Fuel Cells	p. 54
																			Installation Exercises: Wiring Installation in Buildings	p. 64
																			Installation Exercises: Building Intercom Systems	p. 65
																			Installation Exercises: Building Service Entry Equipment	p. 66
													X						Installation Exercises: Network Installation	p. 67
																			Installation Exercises: Switching Installations	p. 68
																			Installation Exercises: Small-scale Programmable Logic Control Using "LOGO!"	p. 69
																			Installation Exercises: Construction of Switch Cabinets	p. 70

Decisive Product Benefits

... for Long-term Customer Satisfaction



Zdravko Djuric, teacher at the Otto Brenner vocational college in Hanover:

“Use of the InsTrain systems in the teaching of wiring installation has absolutely benefited our students.

Topics that are usually difficult for students to grasp such as VDE measurements, electrical installations and mains systems need not be taught merely on a theoretical level any more, but can be supplemented by practical work using the InsTrain systems.

This link between theory and practice means that lots of lessons can be designed in thoroughly new and more interesting ways, which is highly motivating for our students.

At the moment we are using the “Building Service Entry” and “Lighting and Appliance Circuits” wiring installation training systems from the InsTrain range and these cover some key topics.

Our experience shows that the educational concept and flexible design of the InsTrain systems enable teachers to continually change the situations in which people are learning and so make them interesting and challenging, all of which improves the effectiveness of teaching. It also boosts the involvement of students, which is highly important for understanding the material.”

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 is a byword for customized vocational training systems in the following areas:



Installation Engineering



Electropneumatics, Hydraulics



Electrical Power Engineering



Instrumentation



Power Electronics, Electrical Machines,
Drive Technology



Microcontrollers



Electrical and Electronic Circuits



Automation Technology



Communications Technology



Automotive Technology



Process Control



Lab Systems

Ask for detailed information via any of the contact methods mentioned above.
Our employees will be happy to advise you.

Further information on our products can also be found at:

www.lucas-nuelle.com

www.unitrain-i.com

Lucas-Nülle Lehr- und Meßgeräte GmbH

Siemensstraße 2 · D-50170 Kerpen-Sindorf · Germany
Telephone: +49 2273 567-0 · Fax: +49 2273 567-39
www.lucas-nuelle.com

