SMART HOMES

Wiring for modern buildings requires new and modern training systems

- Energy efficiency
- Customised functions
- Flexibility
- Comfort

2nd edition

More Than Just Switching On and Off

Modern building management technology means that the wiring in buildings can accomplish more than simply turning lights and appliances on and off. More is required of modern wiring installations. They need to provide maximum energy efficiency, safety and security, flexibility and the utmost comfort. This can be achieved by using intelligent building management systems.

In a smart home, all of the wiring installation and the building management devices are networked with a central control system.

This means that controllers, switches and sensors can control lighting, heating, blinds, alarm systems and more via bus systems. This enables the respective equipment, either indoors or outdoors, to be used as needed at home or at work.

Smart systems can be operated by conventional switches, control panels, tablet computers or smart phones.

Network installation for all the devices in the system, plus lights, blinds and switch actuators, as well as the programming of automatic procedures will all increasingly become aspects of electricians' work.

Bus installations such as DALI, EnOcean and KNX require new knowledge and skills.

Increasing digitalisation and automation of all business sectors will also require a rethink of training requirements.

The new Lucas-Nülle training systems will provide electricians in training with excellent preparation for the digitalisation of the workplace.

New training systems for building management technology

- Conventional lighting systems (EIT 1.1)
- Fluorescent and LED tubes (EIT 1.2)
- Fluorescent (metal vapour) lighting (EIT 4)
- Energy-efficient lighting (EIT 3.1)
- Intelligent lighting management with DALI/enOcean (EIT 3.2)
- Building management systems using KNX (EIT 8.1)
- Smart homes (interconnection of various systems) (EIT 8.3)
- Smart homes (Z-Wave) (EIT 10)

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ILA Training Systems

Interactive Lab Assistant multimedia software is commonly known by its initials **ILA**.

ILA training systems combine **computer-based training courses** with **genuine hardware.** The contents for each training topic are covered by a detailed software course and then put directly into practice using the actual hardware.

Benefits of ILA courses
- Digital textbooks
- Animations, videos
- Experiment instructions
- Measurement lab
- Documentation of measurement results and of students' learning progress
- Tests of knowledge
- Print-outs (manuals and results)
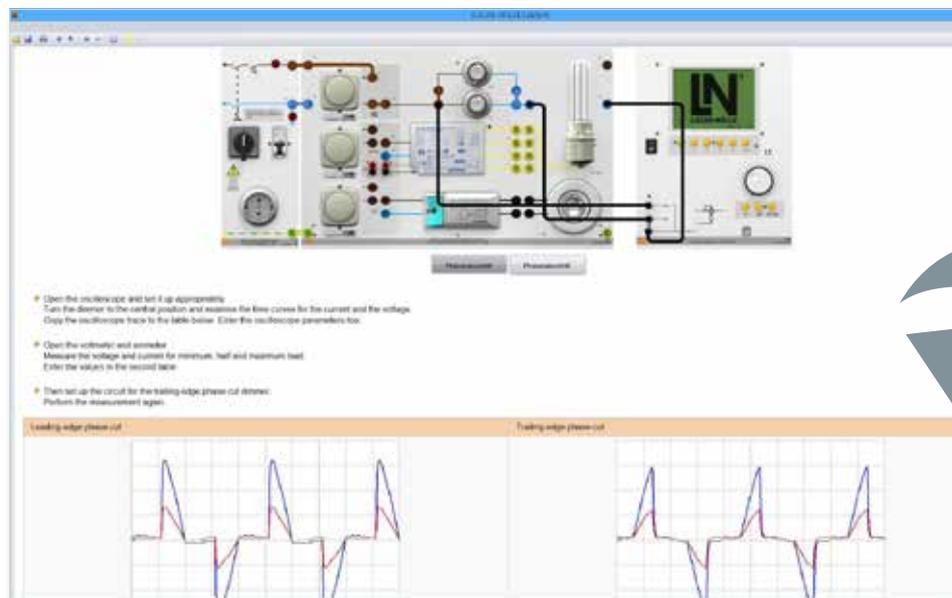
Software course

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The combination of **ILA courses** with **hardware which is actually used in practice** enables students to undertake projects teaching both theory and the practical planning, installation, configuration and testing of building management systems.

• All components needed for the experiments
• Use of conventional industrial components
• Measuring instruments
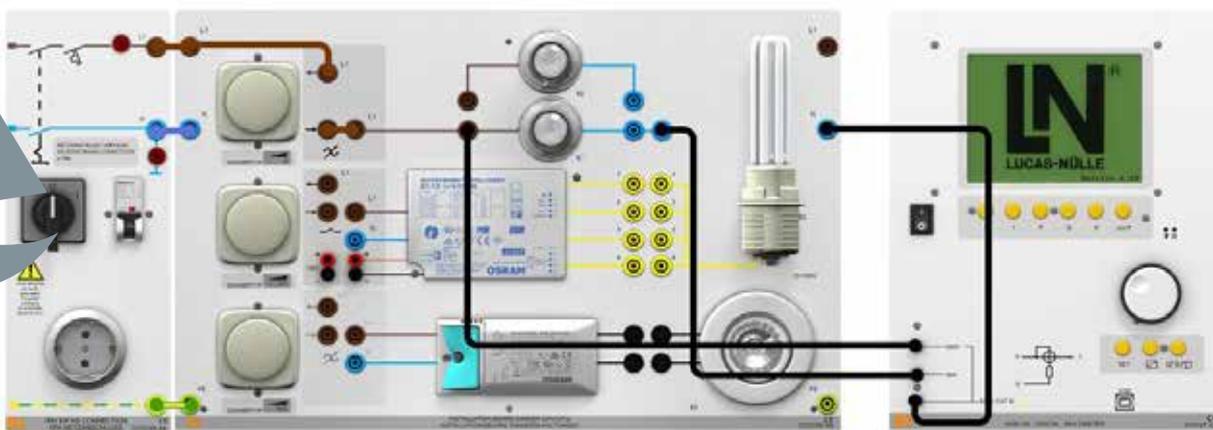
Hardware

Benefits

- Learning at the computer and working with authentic hardware
- All topics associated with building management systems are covered in theory and in practice
- Step-by-step instructions and animations encourage understanding
- Testing of work along with questions posed and assessed by the software itself save time
- Documentation of results shows the progress of individual students and whole classes
- The instructions, measurement results and exercises can be printed out to facilitate preparation and assessment

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Conventional Lighting Systems
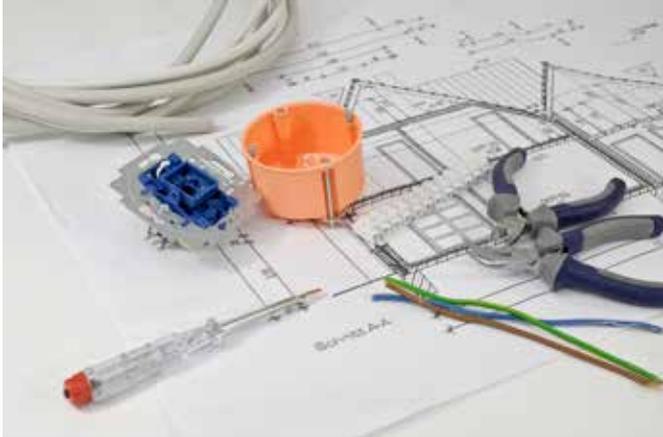
The training systems concerned with the topic of conventional lighting cover standard circuits used in the wiring of lights. This introduction to electrical wiring installation deals with drawing and working with various types of circuit diagram and using them to complete the wiring for the various experiments. It also acts as a basis for more advanced topics and more complex wiring layouts.

Training contents

- Analysis of installation plans
- Lighting circuits: simple on-off switches, multi-circuit systems, two-way circuits and intermediate switch circuits with and without electrical sockets
- Standards, regulations and safety measures

Fluorescent and LED tubes with DALI control

Fluorescent tube lights are popularly used in offices, factories and public buildings. Their benefits are obvious. They are inexpensive, efficient and have a relatively good colour spectrum.

- LED and fluorescent tube lights
- Compensating capacitors, starters
- Conventional ballast units
- Electronic ballast units with DALI control

Training contents
- Turning fluorescent lights on and off
- Lead-lag and tandem circuits for fluorescent lights
- Compensation for fluorescent lights
- Swapping conventional ballast units for DALI ballasts
- Replacing fluorescent tubes with LED tubes

Fluorescent Lights with DALI Control

Fluorescent discharge lights often use the vapour of certain metals such as sodium or mercury in addition to inert gases.

Such lights are often characterised by their excellent efficiency at high power output, meaning that they are commonly used where very bright light is needed. They are less common in private households where lighting seldom needs to be as bright. In industry, though, as well as in towns and cities, they are indispensable.

In this course you will find out how such fluorescent lights work and how they are put into operation.

Experiment: How fluorescent lights work and how to connect them via conventional ballast.

- Transformer and starter for fluorescent metal vapour lights, max. 70 W
- Fluorescent metal vapour light, 70 W, with socket
- DALI ballast for fluorescent and sodium lights
- High-pressure sodium light, 70 W

Training contents

- Halogen/metal vapour lights, high-pressure sodium lights
- Operation using conventional ballast units
- Operation using electronic ballast units
- Control via DALI in conjunction with a DALI controller

Energy-Efficient Lighting

Electricity forms the engine for our highly developed modern society. Our use of it and its provision reflects some outstanding pioneering work. However, many of the appliances we use are inefficient and waste more energy than they need to. This puts an unnecessary burden on our environment.

Lighting is responsible for some 15% of electricity consumption throughout the world. With more efficient lighting technology we can cut that consumption considerably for the benefit of our environment. This will not only save on energy costs but can even provide better quality of light.

This course shows how energy-efficient lighting technology can be used to optimise existing lighting installations to save energy.

- Dimmers (rising and falling edge phase control, 1-10 V)
- Lights (incandescent bulbs, compact fluorescent tubes, halogen lights)
- Electronic ballast for halogen and fluorescent lights

- Universal dimmers
- Electronic halogen ballast with DALI control
- Electronic LED ballast with DALI control
- Accessory case with other types of lights

Example of measurements being made with an oscilloscope:
In this case the difference between rising and falling edge phase control is being investigated.

Training contents

- Lights, their properties and efficiency characteristics, energy saving
- Dimming methods/types of dimmer, dimmer controls
- Proper use of lighting equipment, controls and dimmers
- Fundamentals of lighting management (DALI)
- Diagnostics using ammeter/voltmeters or oscilloscopes

EIT 3.1 equipment set
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Lighting Management Using DALI and EnOcean

It is no longer enough to simply switch lights on and off. Modern lighting systems control and regulate the lighting in such a way as to save energy, providing light only when needed and giving you a great deal of comfort.


This course shows how intelligent lighting management works using a DALI bus or the EnOcean radio system.

Various sub-projects are undertaken in order to find out how lighting systems can be put together and set up for differing requirements. By using sensors and lighting scenarios, the lighting control provides lighting as needed and customised to the users' needs.

- DALI lighting controller
- Presence sensor
- LED strips
- EnOcean button
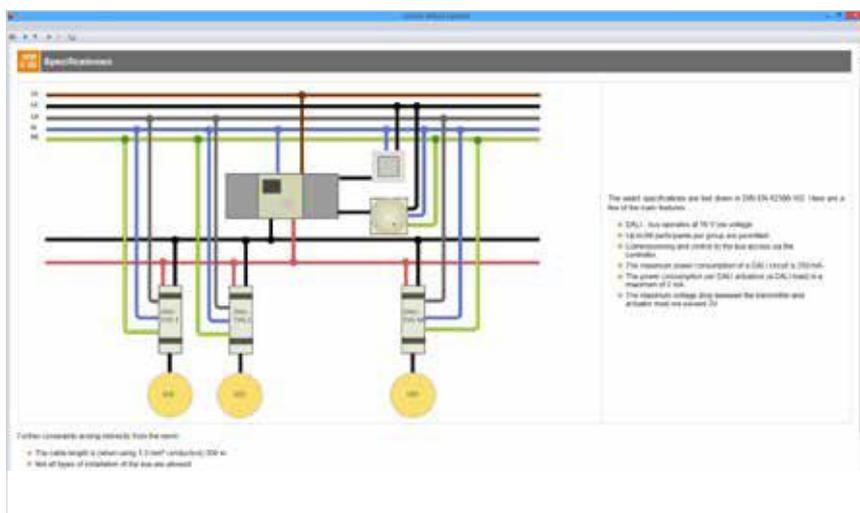
Schematic layout of a DALI bus system

Training contents

- Knowledge of various bus systems
- Fundamental knowledge of the function, design and configuration of a DALI system
- How sensors work and are incorporated into the system
- Setting up lighting scenarios
- How EnOcean works and how it is used
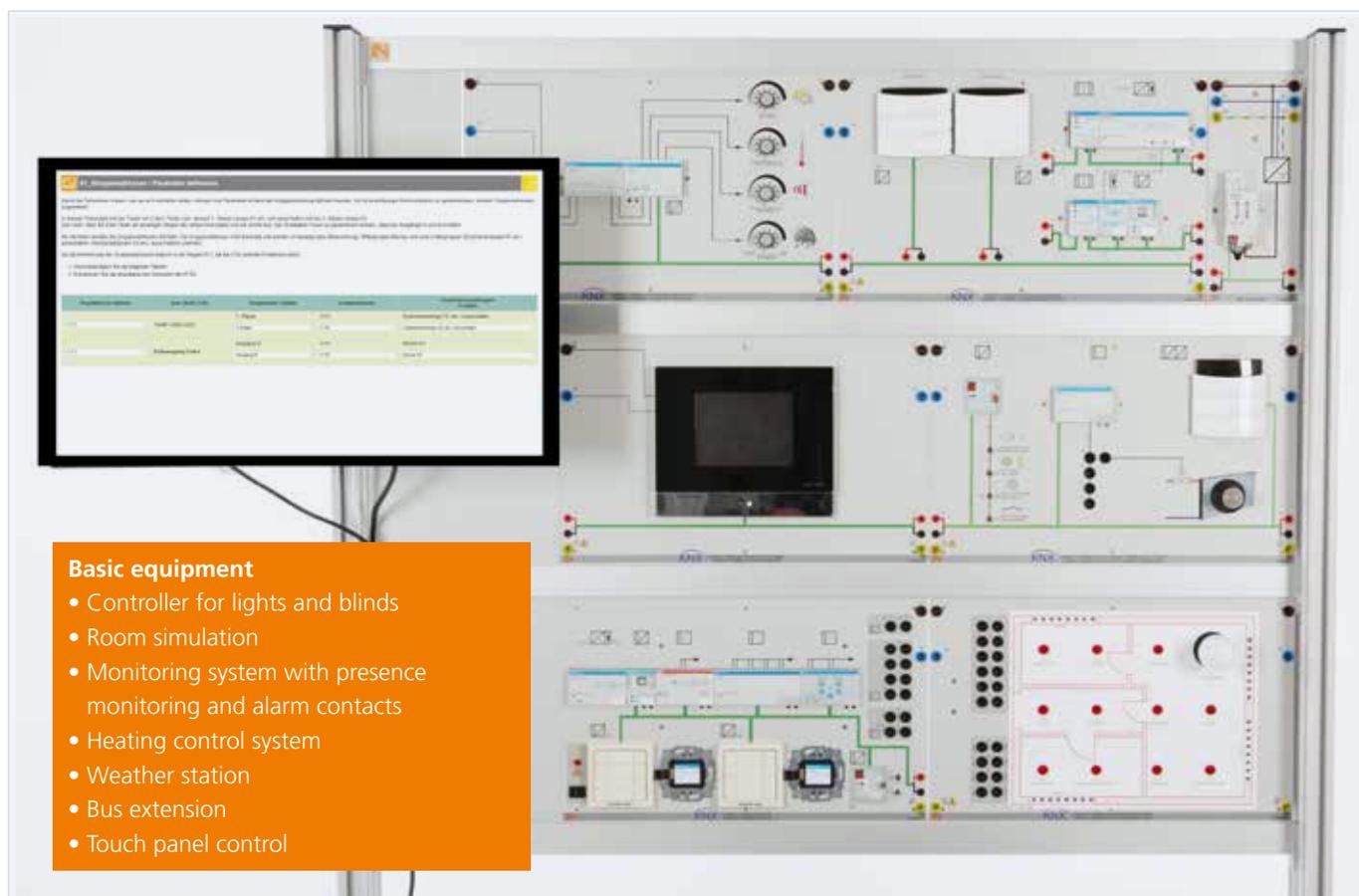- Diagnostics using ammeter/voltmeters or oscilloscopes
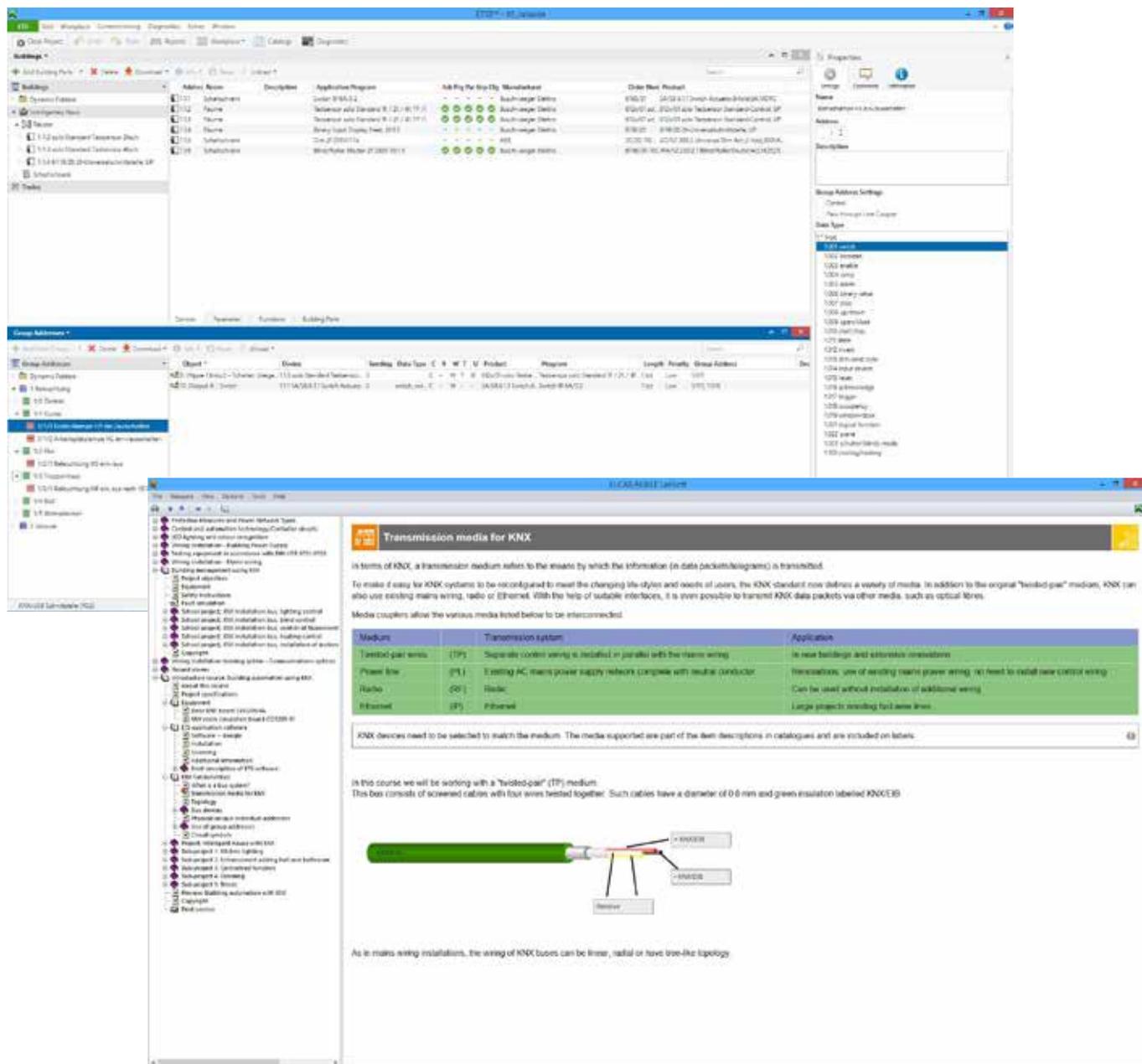
Building Management Systems Using KNX

KNX is the name of the world's most popular field bus for intelligent networking of modern building management systems. KNX can be used to control heating, lighting, blinds, ventilation and security systems as needed, regardless of their manufacture.

In this course you will learn to define, build, set up, configure and utilise the basic capabilities of a KNX system.

The course provides a detailed introduction to programming of the KNX software ETS 5.

Basic equipment
- Controller for lights and blinds
- Room simulation
- Monitoring system with presence monitoring and alarm contacts
- Heating control system
- Weather station
- Bus extension
- Touch panel control

EIT 8 equipment set

Training contents

- Function and usage of KNX components
- How to use ETS application software
- Design, configuration and set-up of a KNX system
- Restructuring an existing KNX system

# Combination of Various Bus Systems in a Smart Home

Gateways are essential for the successful networking of existing systems in buildings so that that they can be controlled from a central location.

Lucas-Nülle's smart home interface can combine KNX, DALI and EnOcean installations into a single system, meaning that they can be centrally controlled from a KNX panel, a tablet computer or a smart phone.

The built-in IP gateway makes it possible to program, control and manage functions via tablet or smart phone.

This smart home project can be assembled using the smart home interface along with the following ILA training systems:

• Building management systems using KNX (EIT8)

• Intelligent lighting management (EIT3)

• Fluorescent (metal vapour) lights (EIT4)

• Fluorescent tubes (EIT1)
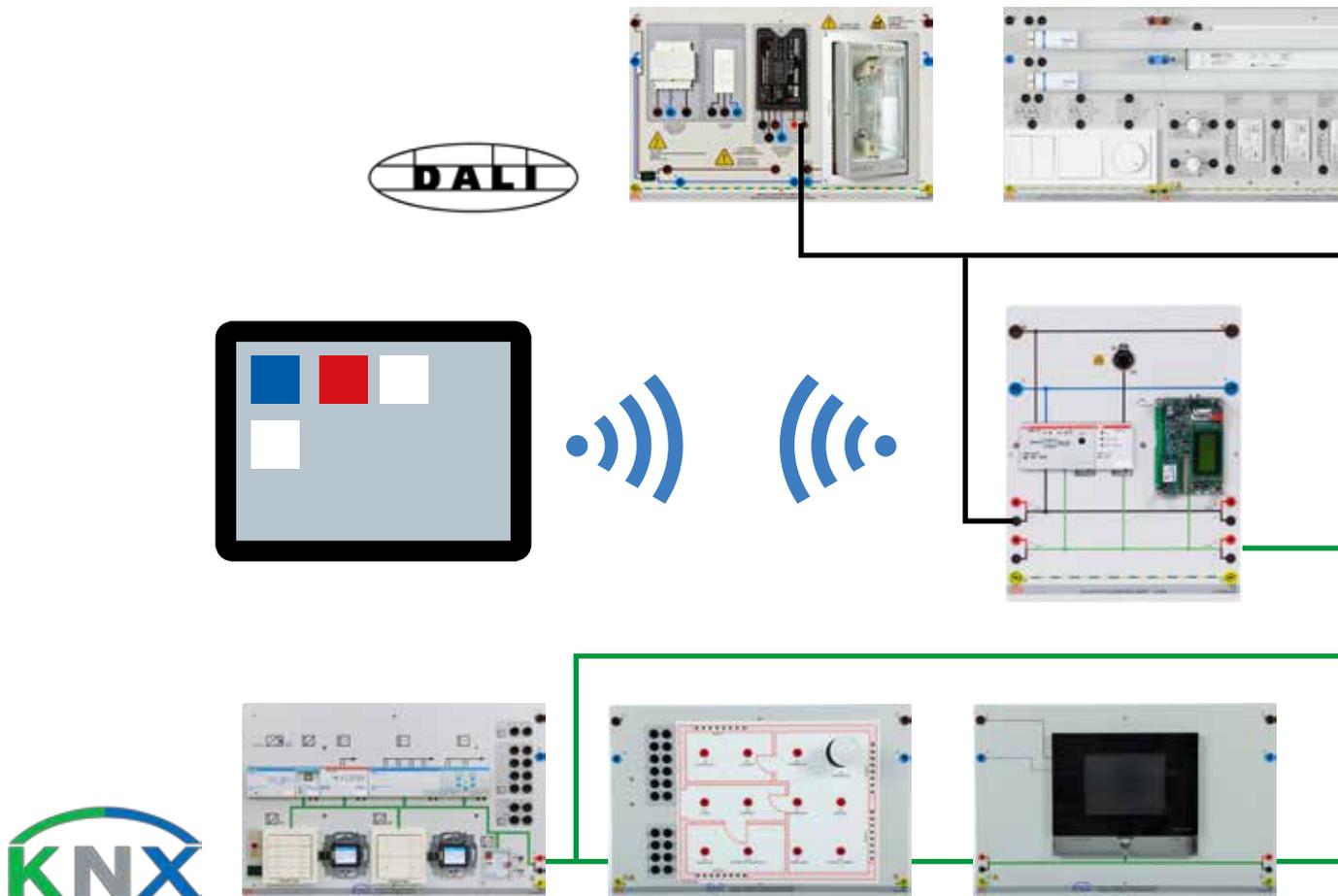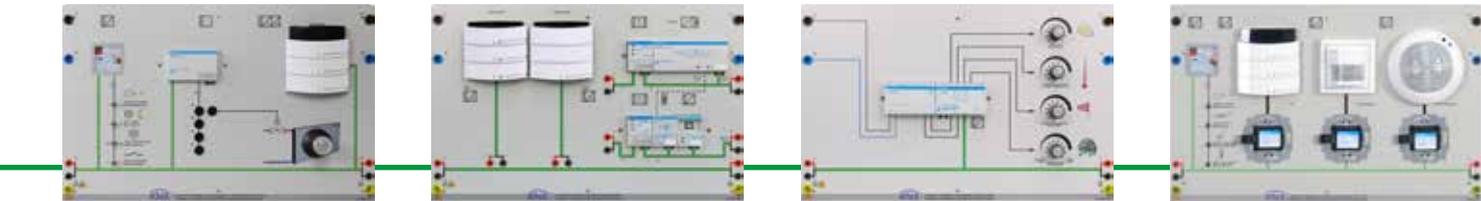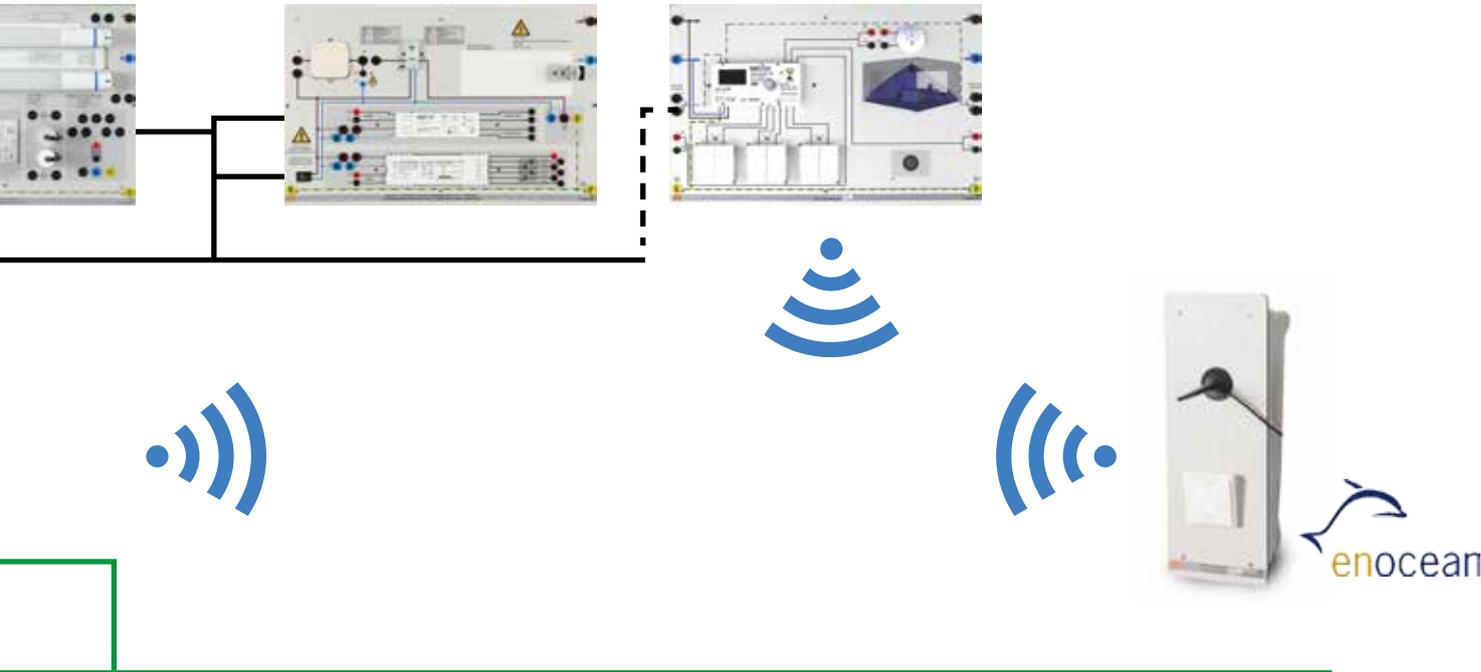
Smart Homes Using Z-Wave Components

In addition to systems with networking capability such as KNX and DALI, a technique which is particularly popular for domestic households is the retrofitting of smart home systems in the form of a complete solution.


The new smart home ILA training system allows you to implement a typical smart home project such as you might install in your own home.

Is made up of the following sub-projects:
• Basic board with central control unit and lighting control for setting up a smart home network
• Lighting control based on external parameters
• Heating control
• Monitoring of security in the owners' absence

The smart home system can not only be set up and controlled by the ILA training software, which teaches you the basic knowledge you need, but also via an app from a PC or tablet computer.
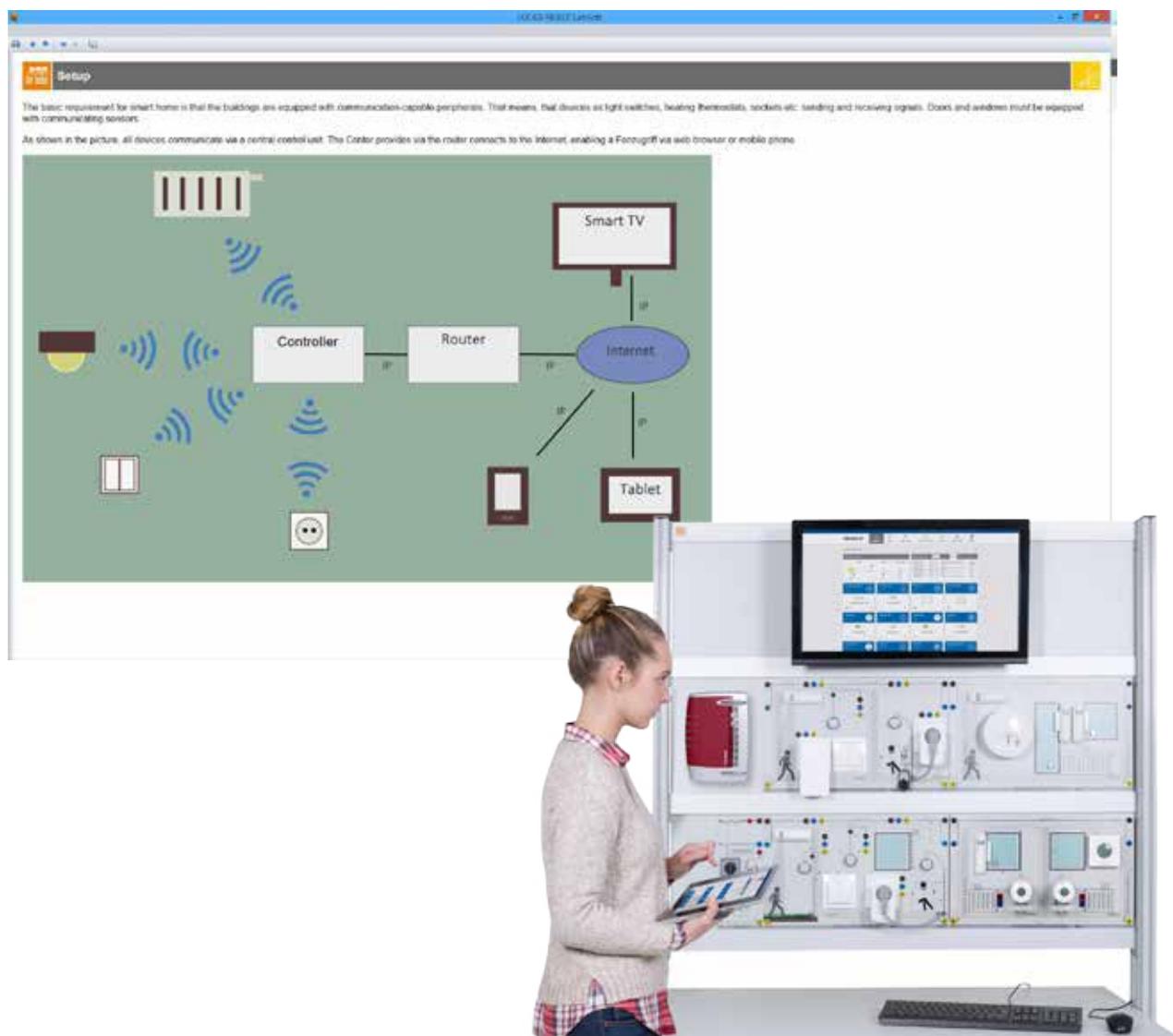
Training contents

- Initial installation of a central control unit and its integration into a network
- Installation of configuration software/app
- Incorporation of various components
- Set-up and parameter setting for a smart home system including the following features:
  - Visualisation and display of energy consumption
  - Lighting
  - Heating
  - Blinds
  - Security system

Smart Homes Using Z-Wave Components

Peripherals

Central controller
- Central controller functions
- Network design
- Operation of application

Lighting control
- Modification of existing lighting for radio operation and automation
- Incorporation of sensors (light, temperature, motion)
- Enhancement of existing lights with radio components (radio buttons, radio LEDs)
- Setting up scenes/scenarios
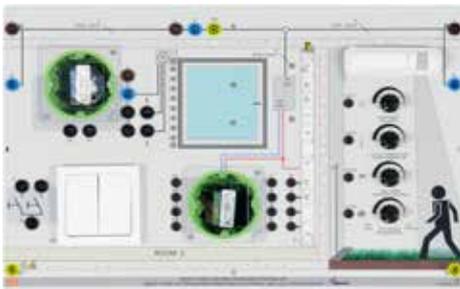
Blind/shutter control
- Installation of a shutter actuator
- Incorporation of shutter actuator and required parameter setting
- Control of a roller shutter based on time, weather or lighting conditions
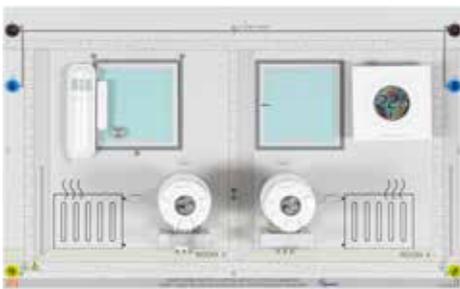
Heating
- Automatic heating control using time switches and thermostats

Safety and security
- Maximised control using smoke detectors, door and window contacts
- Alarms including notifications to tablet computer or smartphone (e-mail, SMS, etc.)

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Software Tools

The **ILA training course "Smart homes (Z-Wave)"** lets trainees work their way, by means of a project-oriented methodology, into the world of digitally controlled households. The course shows how smart homes work and the possibilities they open up on both a theoretical and practical level. It explains, step by step, how the user interface of the smart home controller is used. Trainees learn how to install, set up and use a smart home network. With this knowledge they will later be in a position to advise customers based on their own needs and transform their homes into "smart homes".
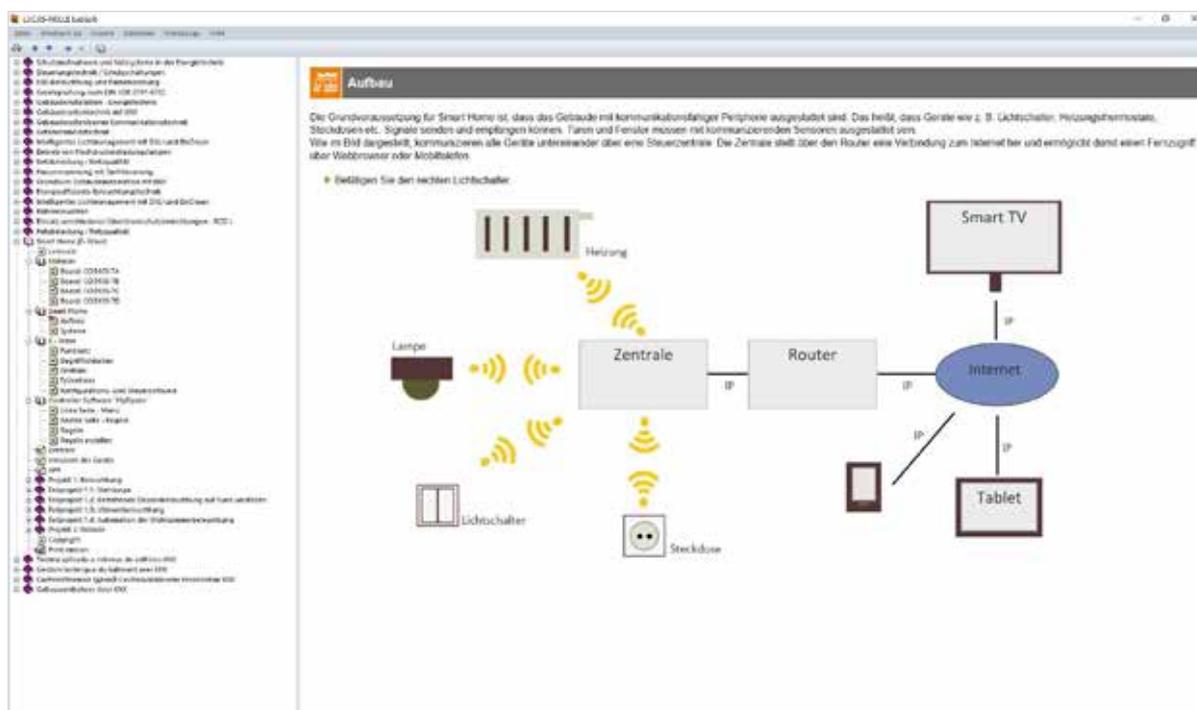
The smart home network is put together and set up by means of the **user interface**. You can use this interface to set the parameters for all devices in the network and also establish rules by which they can work together or automate sequences of actions. Operating status is displayed for each device.

Smart metering operation can also be incorporated. The electricity consumption of the actuators is regularly measured and shown on a visual display. You can use a PC, smartphone or tablet computer to find out about processes, electricity consumption and the safety of your "smart home" at any time, wherever you are.

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Train the Trainer

Can you save energy by having a smart home? Is there a single solution or are there many?
What constitutes a smart home is not yet fully defined. This means that the market for electronically enhanced home systems is continually growing. Individual products are increasingly on offer for private homes which involve interconnection of building wiring installations and household appliances in the areas of building automation, electronics and telecommunications. Such technical solutions need to work together intelligently, intuitively and safely. You can find out how to teach all this to your trainees in our seminars.

Contents

- Networking and central control of smart homes
- Planning and installation of a smart home system
- Practical treatment of enhanced functionality for programming and parameter setting
  (logic, loops, function blocks etc.)
- Smart home projects controlled by wire or by radio control
- Setting smart home parameters via an app

Supervisor

Lutz Schulz
Heike Schoermann

Target groups

Trainers and vocational teachers of power and building management systems to electronics engineers and electricians

Prerequisites

Knowledge of electrical engineering/ electronics, basic knowledge of KNX, DALI, enOcean or other building management bus systems

LN® Academy

YOUR PARTNER FOR TECHNICAL EDUCATION:
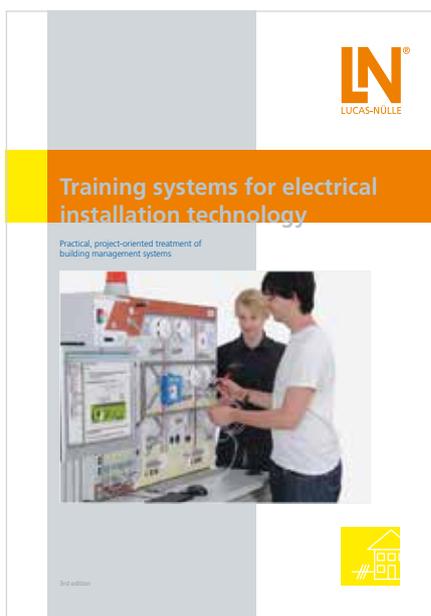**PRACTICAL SEMINARS FOR TEACHERS.**

*"Learning is experience.
Everything else is just information."*
Albert Einstein

Lucas-Nülle GmbH

Siemensstraße 2 · D-50170 Kerpen-Sindorf
Telephone: +49 2273 567-0 · Fax: +49 2273 567-69
www.lucas-nuelle.com · export@lucas-nuelle.de

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3rd edition

Further information can be found in our wiring installation catalogue.

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