LUCAS-NÜLLE

TRAINING SYSTEMS FOR AUTOMOTIVE ENGINEERING

Training in the Automotive Diagnostics Workshop Lab

12th Edition

CONTENTS

MORE THAN A LABORATORY

Vivid presentation of complex educational content by means of modern training media

Complete solution for modern engine management systems, brakes, air conditioning and airbag systems

Student Measurement Stations
An environment capable of handling multiple signals is provided for each student as a guarantee for optimum learning success

Digitally networked training vehicle
Diagnostics performed directly on the motor vehicle – Testing and maintaining systems

Training panel systems
Individual experiment set-ups

UniTrain
Individualised basic and advanced training in class groups

CarTrain
Training carried out on real components

UniTrain
Experiment hardware and software – Measurements on vehicles

PRACTICAL APPROACH TO LEARNING

EXPERIMENT. LEARN. UNDERSTAND.

Sometimes theory only makes sense when applied to a practical situation. That is why we adopt a practical approach to learning. The level of adherence to genuine practice can be even greater depending on the system being used. This provides a positive learning experience and makes the whole learning process enjoyable in itself.

UniTrain

CarTrain and Modular Training Systems

Digitally Networked Training Vehicles

FEATURING INTER-ACTIVE SOFTWARE

DIGITAL TRAINING CONTENTS METHODICALLY PRESENTED

More than hardware: Interactive training contents are an essential element of all our systems. The digital courses include animations, virtual instruments and experiments for highly motivating, methodical learning.

LABSOFT – THE MULTIMEDIA TRAINING PLATFORM

LabSoft is the comfortable learning environment from Lucas-Nülle. Apart from the animated digital presentation of essential content, the software also allows for control of Lucas-Nülle hardware. With the “LabSoft Classroom Manager” we also offer a useful suite of software for designing all aspects of your own lessons.

Further information can be found at www.lucas-nuelle.com

Digital training content

Virtual instruments allow you to control training systems directly from LabSoft.

LABSOFT – DIGITAL LEARNING AND CONTROL OF HARDWARE

Smart presentation of complex content
Labsoft provides users with a simple navigation concept to access all the content. The intelligent software also controls the UniTrain Interface and all the Lucas-Nülle hardware. Labsoft also stores all the measurements made by each user separately, making it the ideal tool for monitoring progress of students.

Benefits

- Direct access to complete course content
- Control of Lucas-Nülle hardware via virtual instruments
- User-specific storage of measurement results
- The system can operate locally, on a network or in combination with learning management systems
- Available in a wide variety of languages: All languages supported by HTML

Pages featuring these icons show you that the system is accompanied by a digital LabSoft course.

LABSOFT CLASSROOM MANAGER

LabSoft Classroom Manager
Lucas-Nülle's comprehensive administration software for groups of students helps you organise your daily routines. The easy-to-install program runs on your own local network without any need to access additional databases or server systems.

Benefits
- Manager: Administer groups of students
- Reporter: All student progress at your fingertips
- Editor: Customise content
- Questioner: Devise your own assignments and exercises
- TestCreator: Monitor students' knowledge and skills
- Control Center: Effective supervision of training groups

Art. no. SO2001-5A, 5B, 5C

COLLECTION OF AUTOMOTIVE ASSIGNMENTS

Database of tests for automotive engineering
Questions specifically devised for automotive engineering: This database encompasses a huge range of exercises specifically tailored to the subject. Using the "Classroom Manager" software it is easy to assemble digital tests and even full-scale examinations. Simply choose the questions you want from the database and the program will automatically put together a test or exam for you. It is possible to check on theoretical knowledge or practical skills depending on the type of question. The database covers all the topics in automotive engineering you could wish to test.

Benefits
- Questions exist for all testable topics
- Time-saving generation of tests and exams
- Extensible to custom level
- Perfect supplement to Classroom Manager

Order no. SO2001-6F

CERTIFICATION PROGRAM AT THE LN ACADEMY

To qualify technicians and mechanics in modern automotive engineering
Bring your automotive training up to international levels. This new option from Lucas-Nülle is based on cooperation with leading certification bodies. Incorporating full-scale training laboratories with the certification programs which meet your needs, you can take your training to new levels.

Certification is indispensable
In an increasingly professional automotive environment involving more and more complex technology in vehicles, the skills demanded of mechanics handling repairs and maintenance are greater than ever before. Successful certification by us and our partners gives graduates of your courses a unique bonus. Look at all the potential employers who have backed the scheme: “My training has been based on the very latest technology. It's the ideal preparation for my career.”

Strong partnerships
Only the best is good enough. That is why we are taking on the experience of some brilliant partners in automotive certification.

IMI INSTITUTE OF THE MOTOR INDUSTRY

Volkswagen Bildungsinstitut GmbH

LN ACADEMY

- **Help your students make a successful start to their careers**
  The easiest way to stand out from the masses on a CV is to have a highly regarded certificate.
- **You will be part of a worldwide network of highly qualified members**
  Link up with a network of training institutes and mechanics covering the entire globe.
- **Your automotive training will be based on the latest educational techniques**
  LN courses not only use the most up-to-date teaching methods but also keep a finger on the pulse of the latest educational trends.
- **Make your own training institute even more attractive It is not easy to attract the finest talent. Here‘s how to improve your chances in the training marketplace.**
- **LN handles every aspect of the implementation**
- **LN will accompany you through every stage of the certification process. Get in touch with us whenever you like.**

FUNDAMENTALS OF ELECTRICAL ENGINEERING

Education based on authentic practice right from the start. Centred on the UniTrain system, our training systems for automotive engineering rely on experiments, virtual instruments and animations. This puts the focus ever more on vehicles themselves, so learning the key essentials is more fun and hands-on skills can be developed at an early stage.

DC AND AC CIRCUITS IN VEHICLES

including troubleshooting

UNITRAIN
SYSTEM

Fundamentals of electronics have become essential for vehicle mechanics. Our UniTrain course “DC and AC circuits in vehicles” gives students this knowledge by letting them experiment for themselves. The training system shows what is meant by the terms "current", "voltage" and "resistance" through hands-on experience and provides training in the use of measuring instruments.

In the course of the experiments, students can verify Ohm's law and Kirchhoff's laws for themselves. All of the required measuring instruments are already built into UniTrain’s multimedia training environment.

Training contents

- Basic terminology: Current, voltage, resistance
- Handling power sources and measuring instruments
- Usage of circuit diagrams for the analysis of electrical components
- Accident prevention regulations pertaining to work with electric current
- Measurements on series and parallel circuits, voltage dividers and mixed circuits
- Evaluation of measurement findings using comparative tables
- Recording characteristics of variable resistors (LDR, NTC, PTC, VDR)
- Troubleshooting

Order no. CO4204-7A

ELECTRONICS AND DIGITAL TECHNOLOGY IN MOTOR VEHICLES

UNITRAIN
SYSTEM

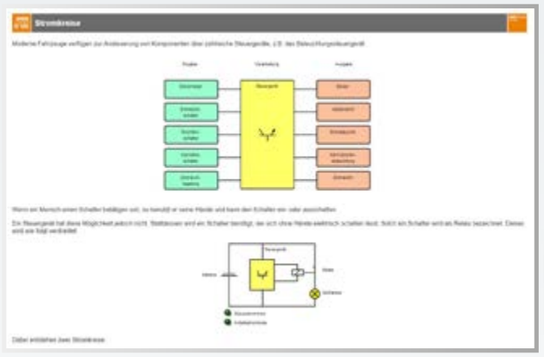
Understanding and analysing electronic components and circuits in vehicles requires in-depth knowledge of their properties and operating principles. This system trains students in the fundamentals of digital technology and electronics, e.g. transistor circuits, circuit design or how to test the valve and rectification capabilities of diodes.

Training contents

- Open- and closed-loop control of components typically used in vehicles
- Categorising components of electric/electronic circuits
- Recording diode characteristics
- **Setting the operating point on a basic transistor circuit**
- Using gain, emitter-follower and collector-follower circuits
- Design of basic logic circuitry
- Familiarisation with Boolean functions and laws
- Experiment: Static/dynamic switching characteristics
- Design of counter circuitry

Order no. CO4204-7B

PULSE-WIDTH MODULATED SIGNALS (PWM)



UNITRAIN
SYSTEM

Many actuator systems in motor vehicles require variable power levels for the devices being controlled. Actuators which need to operate over a continuous range can be controlled using pulse-width modulation.

Trainees can use this system to document measurements and signals, assess them and catalogue the results. This way they are able to isolate faults and propose suitable strategies for fault rectification.

Training contents
- Principle of PWM
- Learning about automotive PWM applications
- Adjusting the power of electrical loads with PWM
- Measuring a PWM signal’s characteristics: frequency, amplitude, mark-to-space ratio
- Analysing pulse width, edges and signal shapes
- Setting up control and operating-current circuits
- Diagnosis of PWM-controlled components

Order no. CO4204-7J, Optional: power supply and headlights

FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS

including troubleshooting

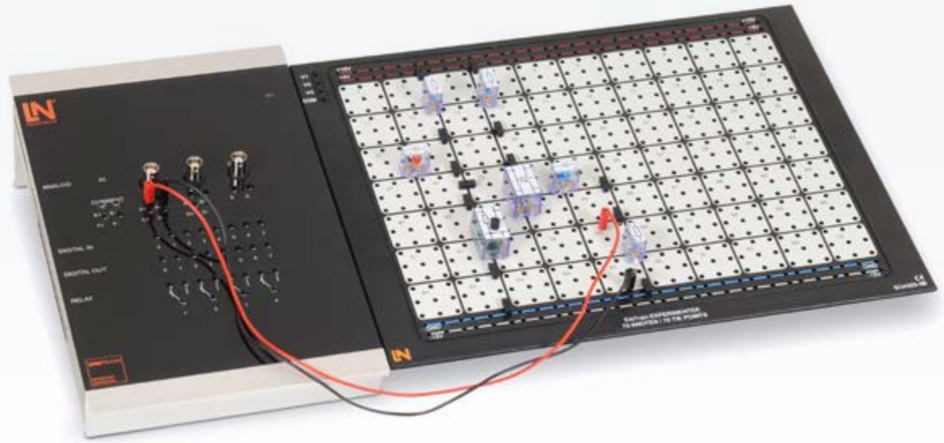
UNITRAIN
SYSTEM

This training system is your introduction to the fascinating world of electronics in vehicles. All the circuits are prefabricated and can be put into action simply by plugging in a few jumpers. One stand-out feature is learning to handle instruments skillfully for use on a customer's vehicle.

Training contents
- Introduction to parallel and series circuits
- Using multimeters
- Using oscilloscopes
- How a relay works
- Investigation of transistor circuits
- Experiments on a resistor in series with a ventilation system
- Measuring resistance

Order no. CO4205-1G

FUNDAMENTALS OF ELECTRICITY/ELECTRONICS IN VEHICLES 2-MM PLUG-IN SYSTEM



UNITRAIN
SYSTEM

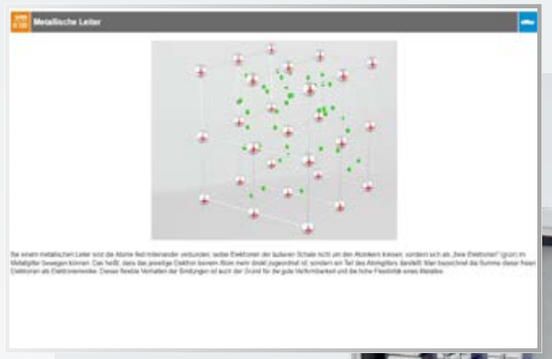
Teach the basics of electrical engineering in hands-on fashion using experiments specifically designed for vehicle mechanics. Our 2-mm plug-in system on the basis of UniTrain offers a multimedia learning experience closely aligned with actual practice. Rugged components and safety extra-low voltage ensure that learning is safe.

Training contents

- Fundamentals of electrical engineering
- Calculations using fundamental electrical variables
- Voltage dividers (with and without load)
- Measurement of voltage, current and resistance
- How to read circuit diagrams
- Fundamentals of semiconductor technology
- Characteristic curves for diodes and zener diodes
- Use of diodes for rectification
- Voltage stabilisation using zener diodes
- Fundamentals of transistors
- Transistor applications
- Transistors used as amplifiers, switches and current sources

Order no. CO4206-1J

4-MM PLUG-IN SYSTEM



All the benefits of the 2-mm system, but with bigger components, more power supply options and all contained in a single case - the 4-mm system means circuits can be put together quickly without any need for computers. A multifunctional power supply with built-in function generator and three-phase generator provides safety extra-low voltage. Self-resetting circuit breakers cut off in the event of overload current, meaning there is no need to replace fuses. Extremely safe and maintenance-free – ideal for learning the basics of electrical systems in vehicles.

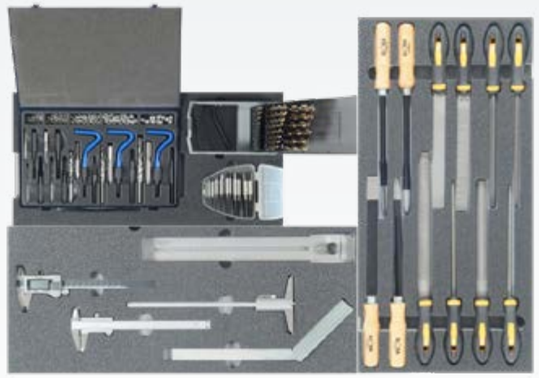
Training contents

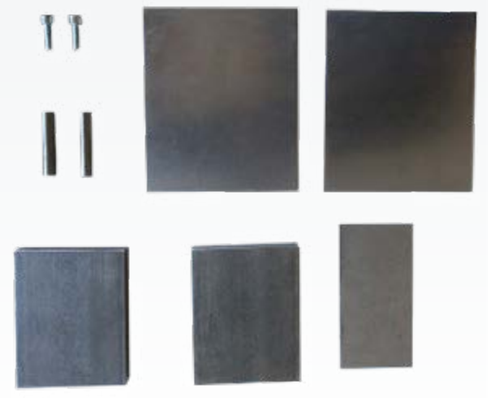
- Introduction to parallel and series circuits
- Using multimeters
- Using oscilloscopes
- How a relay works
- Investigation of transistor circuits
- Experiments on a resistor in series with a ventilation system
- Measuring resistance

Order no. PS4400-2B

Order no. PS4400-2A (without case)

FUNDAMENTALS OF METALWORKING TECHNOLOGY IN VEHICLES





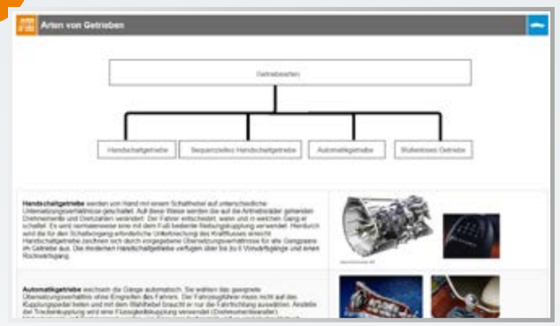
The course teaches basic knowledge of the fundamentals of metalworking technology. In all practice-related project assignments, the focus is on teaching core skills and developing technical qualifications based on autonomous planning, implementing and inspecting by the trainee. The fabrication of components is taught, as is the manufacture of simple assemblies using manually operated and machine tools.

Training contents

- Technical drawings
- Technical group and assembly drawings
- Technical documentation and information sources
- Functional descriptions
- Manufacturing plans
- Properties of metals and metallic materials
- General tolerances
- Blanks and standard parts
- Bench tools, electrical tools
- Consumables
- Fundamentals and procedures of separating and recasting
- Testing

Order no. ST8070-5F + SE905-4N

FUNDAMENTALS OF AUTOMOTIVE TRANSMISSION TECHNOLOGY



The transmission of a vehicle is one of the central elements of power transmission. Without a gearbox, a vehicle can only drive in a very narrow speed or torque window. This course imparts technical methodical competences in gear technology.
In addition to basic knowledge, a combination of control/ regulation abilities and motor skills are fundamental for professional and self-sufficient work.

Training contents

- Functions of the technical components of a gearbox
- Technical drawing
- Basics concerning equipment and safety
- Introduction to the theory
- Professionally maintaining and servicing a gear unit
- Inspection for wear

Order no. SE2905-4L + SE2905-4A

GENERAL ELECTRICAL SYSTEMS IN VEHICLES

With vehicles in the hands of electrons, a stable power supply is essential for a modern car or lorry. Electrical energy is needed for virtually all open- and closed-loop control processes, as well as for comfort and driver assistance systems. Our training systems demonstrate various aspects of how the on-board electrical system supplies power and how the whole lighting system works in detail, all in ways that closely follow authentic practice.

THREE-PHASE GENERATOR WITH HYBRID CONTROLLER

including troubleshooting

Our system enables trainees to become familiar with the function of a hybrid controller. They can experiment for themselves and observe how the voltage generated by an alternator is maintained at a given level at all engine speeds and with any loading. The role of the average excitation current is also explored as well as how changes are brought about in the magnetic field and stator winding induction.

Training contents

- Planning on the basis of job orders and fault descriptions
- Testing/repair of electrical and electronic systems
- Principle of three-phase generation and voltage regulation
- Understanding how a three-phase alternating voltage arises
- Properties of a hybrid controller
- Understanding the necessity of excitation diodes
- Investigating the exciter current
- Fault diagnosis in the system

Order no. ASA 7

THREE-PHASE GENERATOR WITH MULTIFUNCTION CONTROLLER

including troubleshooting

Today's compact generators make use of a monolithic controller. This kind of multifunction controller (MFC) has now largely replaced hybrid controllers. The training system shows how electrical energy is generated in modern vehicles with the help of experiments which build on one another.

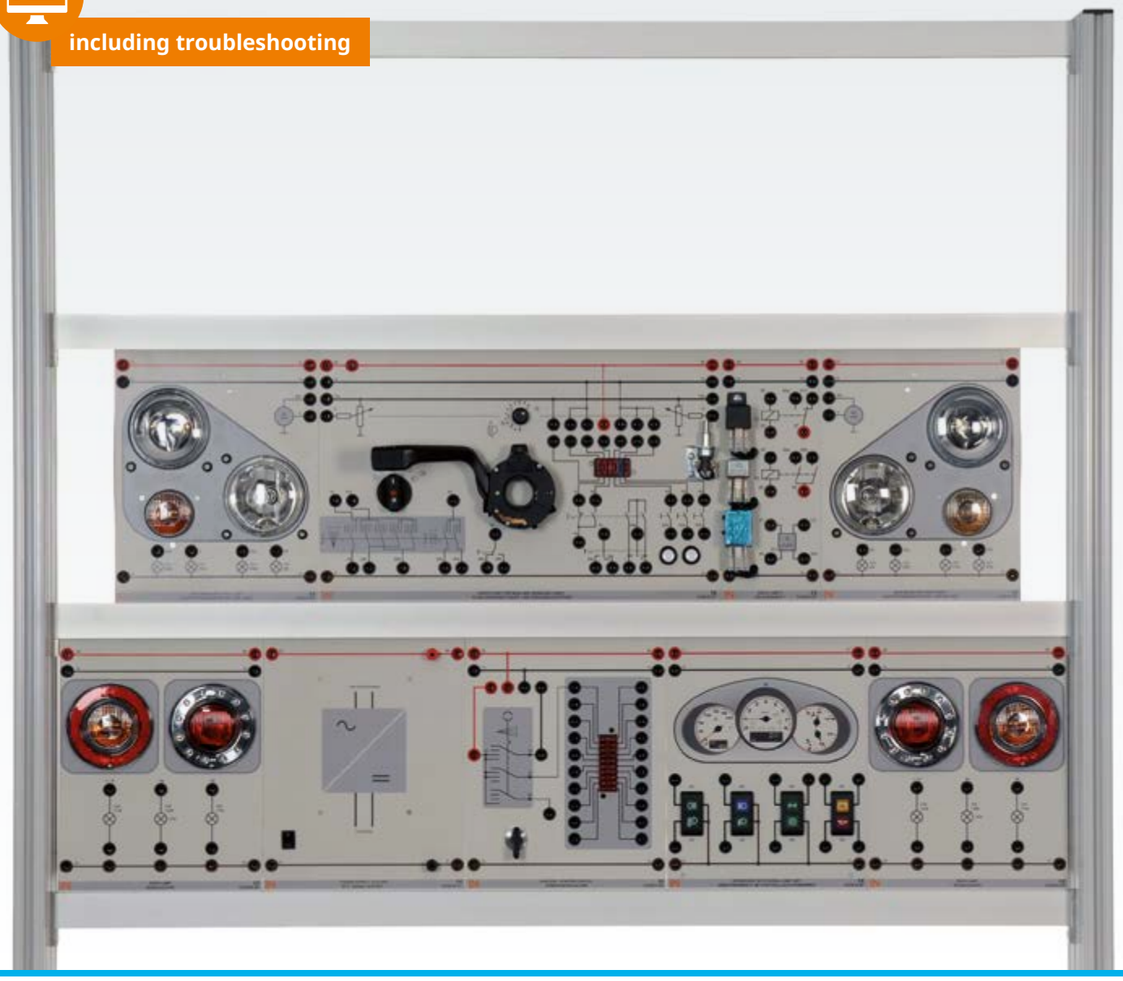
Training contents

- Planning on the basis of job orders and fault descriptions
- Testing/repair of electrical and electronic systems
- Principle of three-phase generation and voltage regulation
- Understanding how a three-phase alternating voltage arises
- Properties of a multifunction controller
- Rectification and protection using power zener diodes
- Battery monitoring (sensing)
- Preliminary control using pulse-width modulation
- Fault diagnosis in the system

Order no. ASA 6

“BASIC LIGHTING” EQUIPMENT SET

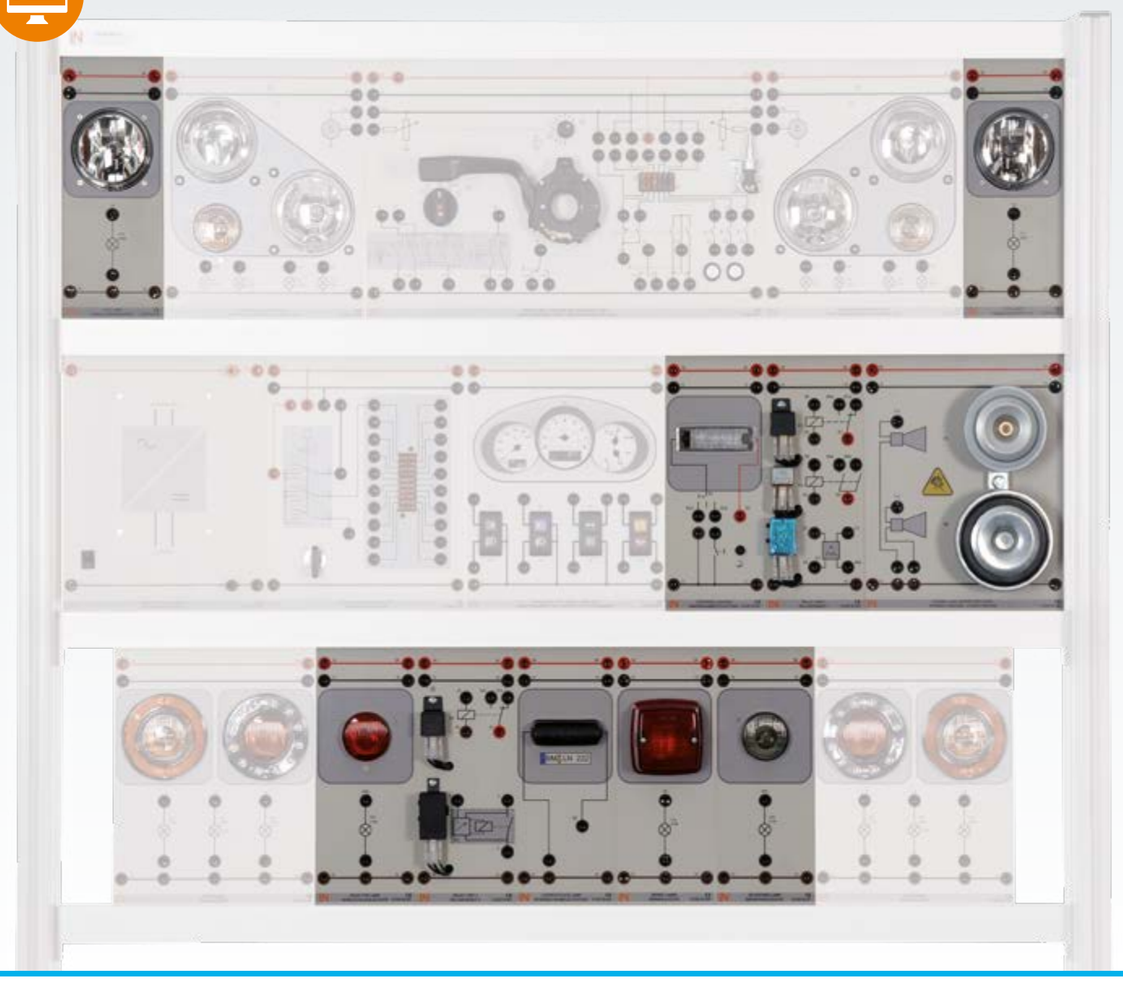
including troubleshooting



The main lighting system including all supplementary equipment is comprised of original automotive components. With this system you establish the foundation for an individually expandable lighting panel. Combine other modules together to provide clear and easy understanding of a highly complex lighting system.

Training contents
- Difference between control and load circuits
- Protecting circuits with fuses
- Use of relays
- How manual headlight range adjustment works
- Recording and documentation of measurements

SUPPLEMENTARY SET “SUPPLEMENT TO BASIC LIGHTING INCL. HORN”



This supplementary set completes the lighting system. Students become familiar with an audible signal system as well as other mandatory lights in vehicles.

Training contents
- Difference between control and load circuits
- Protecting circuits with fuses
- Use of relays
- Addition of extra lights
- Recording measurements and documenting results

SUPPLEMENTARY SET “TRAILER LIGHTING”

Teaching the topic of lighting for trailers has also become far more demanding in terms of the complexity of the electrical systems. The content imparted by the training system therefore goes beyond the principle of 7- or 13-pin plug connectors. It also explains how the towing vehicle is protected against overloading and when the control functions for the trailer meet regulations.

Training contents

- Set-up and configuration of supplementary components
- and systems according to manufacturers' stipulations
- Addition of extra lighting
- Familiarity with local road traffic regulations
- Working with circuit diagrams
- Recording of measurements and troubleshooting
- Trailer socket and plug assignments

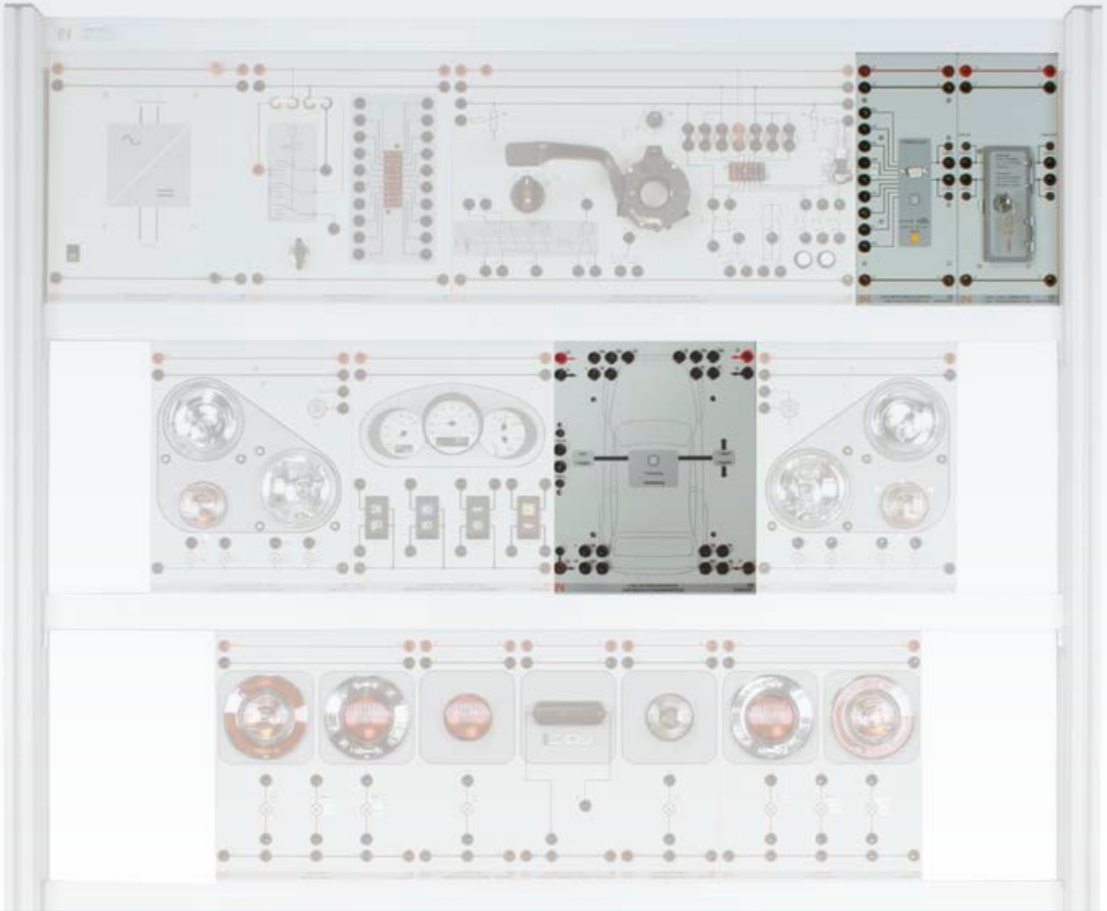
SUPPLEMENTARY SET “STATIC CORNERING LIGHTS”

Static cornering lights are an enhancement to vehicle lighting systems and include a controller and two additional lights. This means more safety and comfort when driving at night. The system involves a sensor detecting the degree of tilt (yaw) of the vehicle in its own specific control unit. As well as this key component, this set explains precisely how the system as a whole functions.

Training contents

- Use of circuit diagrams
- How a yaw rate sensor works
- Retrofitting auxiliary systems
- Combination of cornering light and low beam headlight
- Calibration of motor vehicle components

SUPPLEMENTARY SET “CAN BUS”



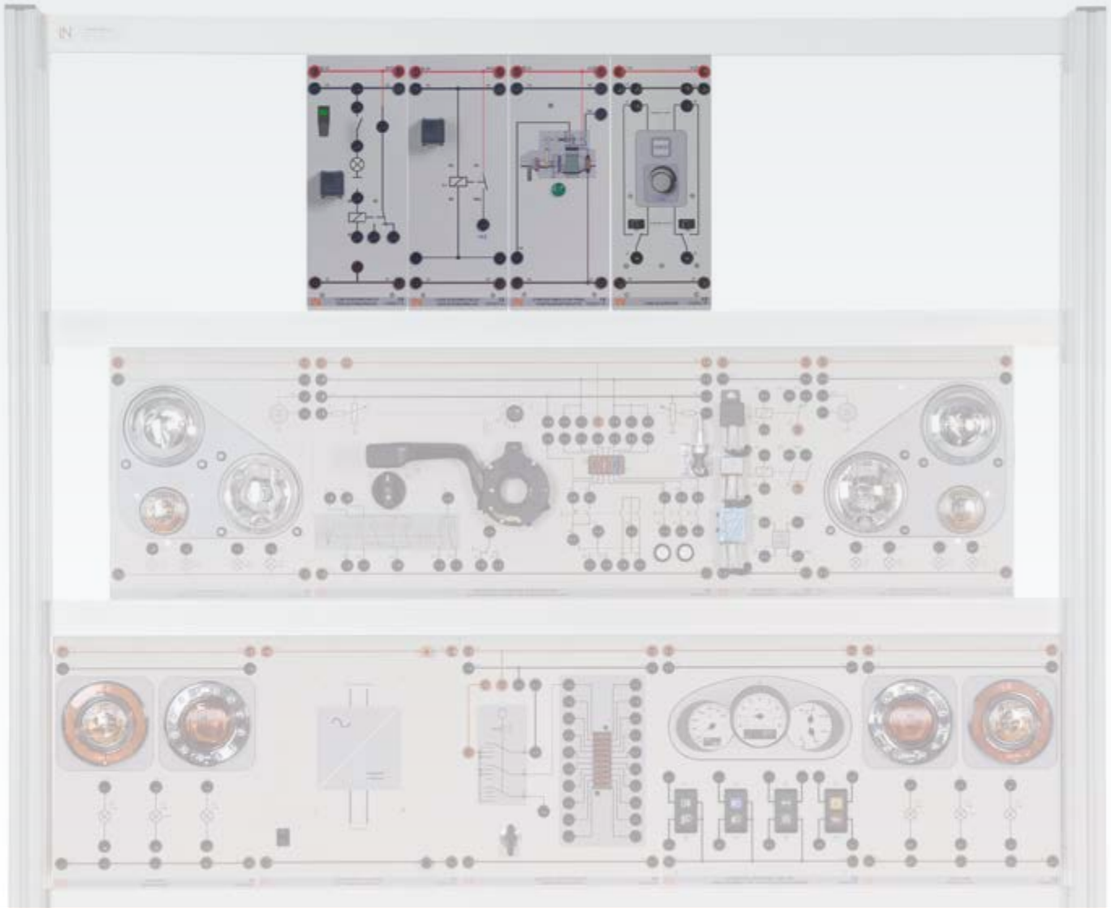
Supplement any lighting system you have with a fully diagnostic-capable CAN bus network. Apart from working in low-speed mode, this new concept also allows high-speed mode to be activated – simply at the press of a button. This means you can grasp the fundamental aspects of having differing transmission rates and the voltage levels needed to operate them.

With the help of the fault simulation system, it is also possible to set up various fault codes conforming to ISO recommendations on the CAN bus.

Training contents

- Assembling a steering column control unit
- Data transmission via a CAN bus
- Data protocol for low-speed CAN (class B), high-speed CAN (class C)
- How recordings made in the event of a fault would look: high-speed and low-speed CAN bus
- Performing diagnostics on a CAN bus and analysis of baud rate

SUPPLEMENTARY SET “ON-BOARD POWER SUPPLY”



The on-board power system in modern vehicles has become a highly complex system that is used for a multitude of purposes.

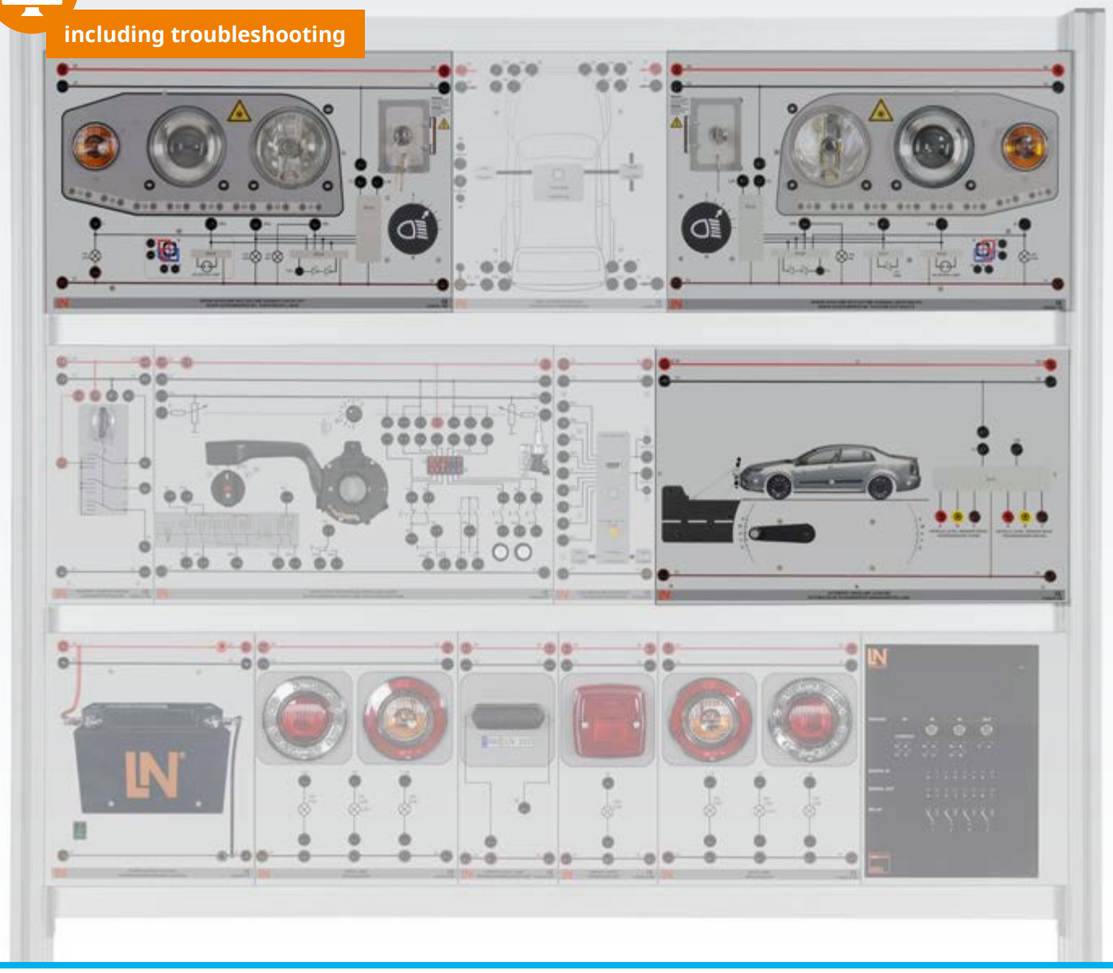
Reducing on-board power supply systems load, expanding them and adapting them to new technologies is one of the key training objectives. Achieving these ends in a practical manner is what this supplementary set makes possible.

Training contents

- Designing a daytime running light system controlled using pulse width modulation (PWM)
- Use of an incandescent lamp circuit in practical applications
- Assembling a circuit designed to reduce load on an on-board power supply during ignition
- Design of relay circuits
- Understanding starter connections and how internal starter circuitry works

SUPPLEMENTARY SET “XENON LIGHTS, LEDS AND DAYTIME DRIVING LIGHTS”

including troubleshooting



Supplement any lighting set-up utilising a CAN bus to feature the latest lighting concepts. This package focuses on the topics of xenon lights, LEDs and daytime driving lights, all encompassed in one training system. Trainees can therefore carry out parallel studies on all these different lighting systems at once and thus determine the differences between them by practical means.

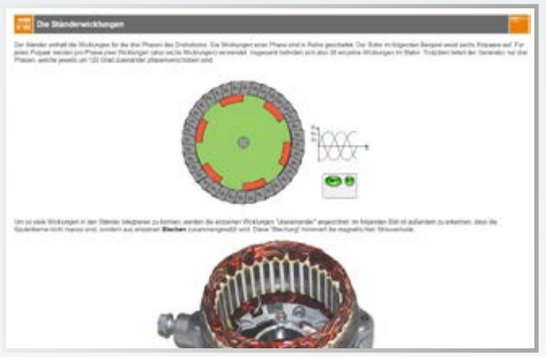
Even height and range adjustment for xenon-beam headlights is fully incorporated into the system. By activating various simulated faults you can set up faults on the LIN bus, among other things, which authentically occur in practice. Essential diagnostic skills for any trainee.

Training contents

- Activation of faults in the lighting system
- Direct comparison of modern lighting concepts
- Automatic height adjustment of headlights
- Communication via CAN bus and LIN bus
- Measurements on stepper motor

THREE-PHASE GENERATORS

including troubleshooting



UNITRAIN
SYSTEM

Virtually all modern motor vehicles are equipped with a three-phase generator/alternator to produce electrical energy. This UniTrain course offers a look at their basic functionality and demonstrates how they are controlled. Practical experiments give trainees the necessary understanding of such systems.

Training contents

- Generator principle
- Basics of three-phase current
- Diode and rectifier circuits
- Functionality of an unregulated three-phase alternator/ generator
- Discrete and integrated voltage controllers
- Use of regulated three-phase alternator/generators
- Fault diagnosis
- Accident prevention

Order no. CO4205-1X

NETWORKED SYSTEMS

Bus systems – communication is everything. Information is exchanged constantly between the various control units included in a modern vehicle. All the various systems are therefore interconnected to make up a combined network. This degree of communication in vehicles is implemented by means of bus structures. Our training systems give you an idea of the most important bus systems on the market. They explain the physical specifications of these systems and how communication proceeds within and between them. The fact that these systems are configured to mirror authentic practice so closely makes the subject tangible and comprehensible to trainees and students.

CAN BUS

including troubleshooting

UNITRAIN
SYSTEM

Modern vehicles feature many electronic control units which can constantly communicate with one another via digital bus systems. CAN bus systems are as common in construction and agricultural machinery as they are in private or commercial road vehicles.

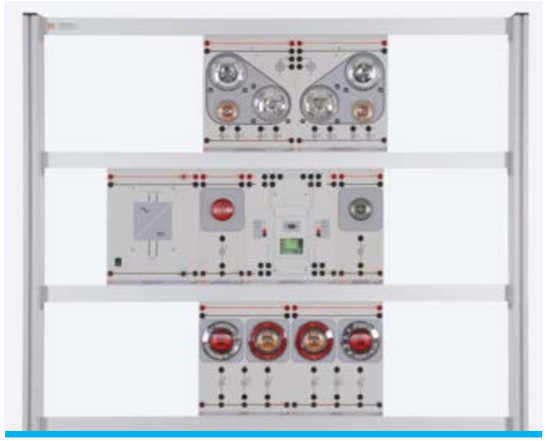
The training system teaches this key topic in a way which closely resembles authentic practice. Trainees start by learning the fundamentals of communication procedures before using simulated faults for an introduction to diagnostics.

Training contents

- Reasons for using bus systems in vehicles
- Topology and components of CAN bus systems as used in vehicles
- Differences between low-speed and high-speed CAN
- Electrical properties of a CAN bus
- Data rate, identifiers, addressing and arbitration (low-speed and high-speed CAN)
- Structure of a message frame in a CAN message
- Analysis of CAN messages using CAN monitor and an oscilloscope
- Editing and transmitting CAN messages from a PC
- Troubleshooting

Order no. CO4204-7K

CAN BUS EXTENSIONS



CAN lighting systems, programming and diagnostics

The “Lighting technology” training project supplements the CAN bus course with an additional control unit. The “Lighting technology” interface makes it possible to control any conventional lighting system. Such systems can be controlled via the switches and buttons on the UniTrain cards forming part of the “CAN bus” course.

Order no. CO3216-3F

CAN comfort systems, programming and diagnostics

Our “Driver‘s door” training project unites a genuine driver's door from a real vehicle with the LN experiment system. Essential functions for such a door (such as electric window winders or electrically adjustable door mirrors) can thus be controlled using authentic CAN bus messages. The resulting exchange of data on the CAN bus can be traced and analysed using the applications included in the LabSoft course.

Order no. SO3216-2Y

CAN-FD

including troubleshooting

UNITRAIN
SYSTEM

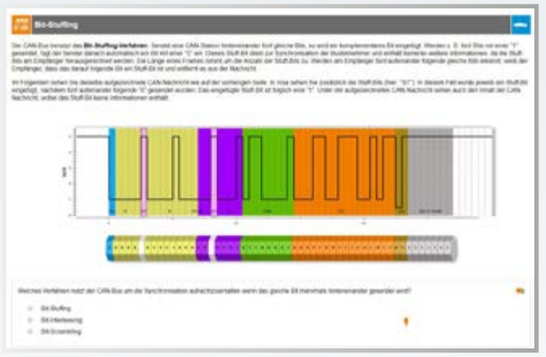
From small cars to heavy goods lorries, CAN bus systems dominate the market. However, the ever-increasing “electrification” of vehicles is stretching even universally used aids such as these to their very limits. The answer has been to develop a new version of the bus, known as CAN FD (flexible data rate), which is already appearing in production-line vehicles.

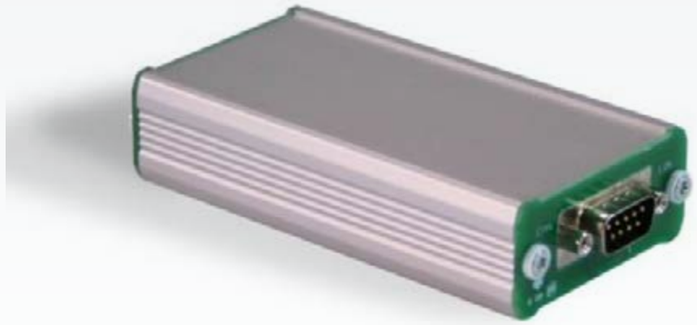
This UniTrain course explains the features introduced by this innovation in an easily understood fashion. Trainees learn efficient methods for diagnostics by means of numerous experiments. They can put their own CAN-FD networks into operation and carry out all kinds of measurements as well as diagnostic work on them.

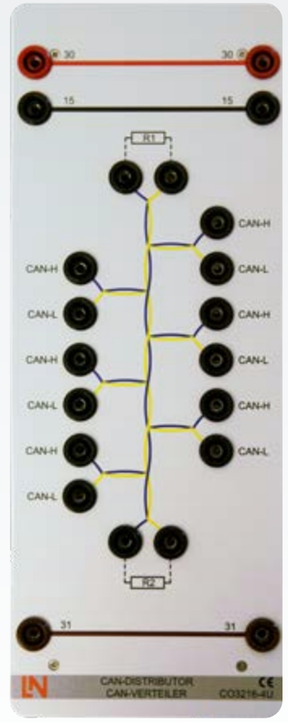
Training contents
- Features of CAN-FD bus systems
- Diagnostics as performed in practice at real workshops
- Measurements on a genuine CAN-FD network
- Diagnostic software for read-outs from the CAN-FD bus
- Selection of different pre-configured data rates

Order no. CO4205-1S

CAN BUS IN CARS, AGRICULTURAL MACHINERY AND COMMERCIAL VEHICLES







Here is a chance to gain an even greater understanding of CAN buses. This course helps trainees build up their own CAN network. A CAN distribution point can be used to put even a complex network into operation in rapid time.

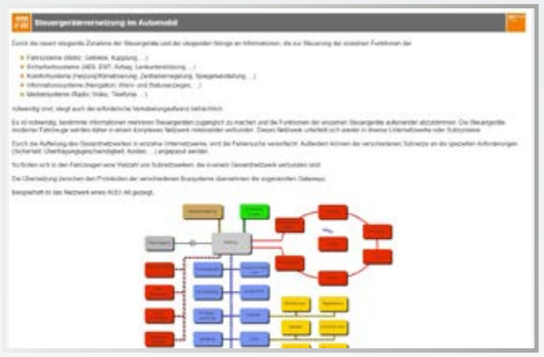
Subsequent control of the individual CAN nodes can then be carried out by a whole group, since the educational concept provides full support for group working. The system can also be supplemented with components for a lighting installation.

Training contents
- Structure of a CAN network
- Setting up a system with the aid of a CAN distribution point
- Control of CAN nodes
- Transmitting and receiving messages
- Group work (with up to four teams)

Order no. ATS 2

LIN BUS

including troubleshooting



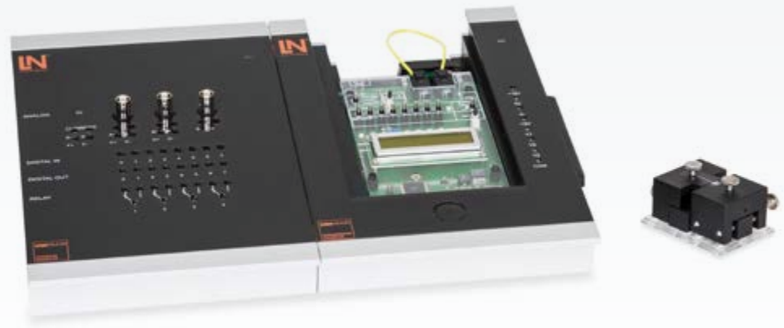
UNITRAIN
SYSTEM

Another type of bus is used in addition to CAN buses. LIN buses are mainly used for non-safety-relevant comfort systems. With our training system, trainees can learn how and where such buses can be used and what their limitations are. They also carry out investigations of the bus protocol and targeted fault finding on the system.

Training contents
- Development of bus systems in vehicles
- Topology and components of a LIN bus system
- Electrical properties of a LIN bus
- Addressing in a LIN bus
- Master-slave principle
- Investigation of data fields by measurement
- Structure of message frames
- Analysis of LIN messages
- Editing and transmission of LIN messages
- Troubleshooting

Order no. CO4204-7E

MOST BUS



UNITRAIN
SYSTEM

Currently, optical bus systems are primarily used for multi-media systems using high data rates in luxury vehicles. However, in view of the increasing data processing required in vehicles, their implementation is expanding rapidly.

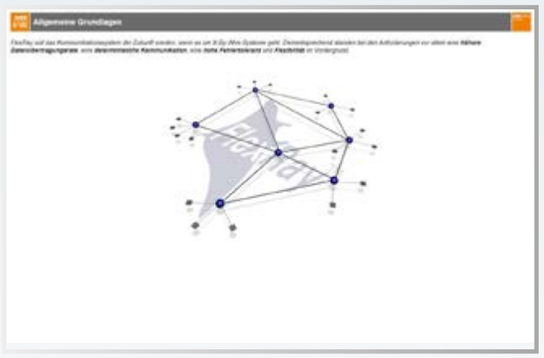
Today's trainees will therefore be encountering this topic often during the course of their careers. Our training system focuses on the physical fundamentals and teaches the kind of diagnostic techniques used in practice.

Training contents
- Data networks in vehicles
- Reasons for use of fibre optics in vehicles
- Fundamentals of MOST buses
- MOST protocol and control units
- Ring-break diagnostics
- Structure of optical fibres in vehicles
- Optical bus systems in vehicles
- Fundamentals of ray optics (refraction, reflection)
- Attenuation in optical fibres
- Data transfer and optical measurements

Order no. CO4204-7H

FLEXRAY

including troubleshooting



UNITRAIN
SYSTEM

The fact of there being more and more electronics in motor vehicles is accompanied by there being ever more complex networks. This now includes sensors, actuators and control units as well as entertainment and navigation systems.

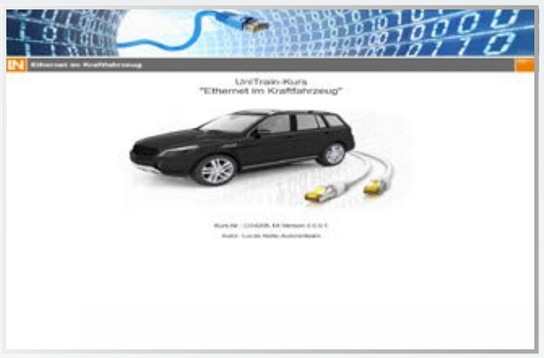
FlexRay is probably the most important communications system of the X-by-wire systems. The demands on such a system primarily include even faster data rates, deterministic communication, as well as excellent fault tolerance and flexibility. This UniTrain course covers the topic of FlexRay much as it is used in practice.

Training contents

- Bus systems in vehicles
- How a FlexRay bus works
- Communication between components via FlexRay
- Data exchange in FlexRay networks
- Practical application of the FlexRay protocol
- Identifying typical faults and how to trace them by measurement
- Functions of steer-by-wire technology and how it works

Order no. CO4204-6Y

ETHERNET



UNITRAIN
SYSTEM

This training system enables trainees to set up a real Ethernet network and put it into operation. As in the real vehicle, the communication to the outside world is achieved specifically via the existing EOBD connection. That connection is integrated as a real connection to one of the three modules. The two remaining modules form an infotainment network, which communicates via Ethernet. The special emphasis here is on the transmission of real-time data. The separate control units can be individually configured by means of firmware dongles supplied with the system. As a result, one module becomes the media server and the other module becomes the control unit for the sound system of the vehicle.

Training contents

- Setting up an Ethernet network in the vehicle
- Areas of application
- Real-time data transmission
- Ethernet system components
- Difference CAN to Ethernet
- Ethernet vs. automotive Ethernet
- Software updates of the vehicle systems via Ethernet
- Use of the OBD II interface through Ethernet
- Advantages and dangers

Order no. CO4205-1A

WORKSHOP COMMUNICATION USING RFID

UNITRAIN
SYSTEM

In one way, communication with actual customers and the drafting of customer job orders forms the basis for all of a mechanic's business. On the other hand, though, technical communication with the actual vehicle via a PC is now an essential way of gaining vital information. Nowadays, vehicle data can be stored on the vehicle's key by means of RFID (radio-frequency identification) and can then be read out from there afterwards.

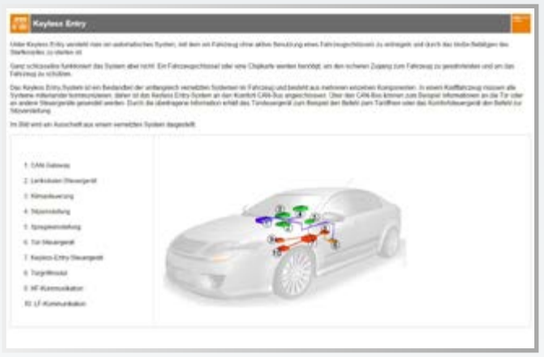
This course gives an insight into the principle of how this works and how it is used in vehicles. Trainees investigate aspects of energy and data transfer in the reader and transponder system.

Training contents

- Communication with internal and external clients
- Planning and preparation of working procedures
- Procedure of acceptance for servicing
- Compiling a work order
- Use of vehicle keys as instruments of communication
- Writing data to vehicle's key
- Reading data from a vehicle's key
- RFID applications in general and those specific to vehicles
- Understanding the essential components for data transfer
- Range of RFID transponders and antennae
- Physical relationships and standards

Order no. CO4205-1N

COMFORT SYSTEMS AND KEYLESS ENTRY



UNITRAIN
SYSTEM

Comfort systems in vehicles make a major contribution to enhancing active safety and security. Innovative operating systems are now breaking into the marketplace and setting new standards.

Keyless entry, comfort systems, safety and security technology and door locking mechanisms, this UniTrain course offers a deep insight into all these systems. This means that trainees gain skills in essential parts of their training, such as testing, diagnostics, repairs and configuring parameters to customers' own needs and desires.

Training contents

- Comfort settings in vehicles
- Active safety
- Door-locking systems
- Central locking
- Radio remote control
- Keyless access to vehicles
- Capacitive pushbuttons
- Fundamentals of antenna technology
- How central locking works via a CAN bus and how such a system can be expanded to implement keyless systems

Order no. CO4204-6G

DRIVER ASSISTANCE SYSTEMS

Increasing traffic densities in urban areas and ever larger and more dynamic vehicles also demand more and more concentration on the part of the people who operate them. That’s why automotive manufacturers are intently focused on the development of modern assistance systems that ease the burden on drivers. At the same time, synergies among the individual systems are also paving the way in the development of autonomous vehicles.

Lucas-Nülle training systems provide guidance on this complex topic. These training solutions not only provide access to the individual driver assistance systems on a target group basis, but they also illustrate the interaction among the systems. They are always based on the proven combination of digital training content and practical applications.

RECOGNITION OF ROAD SIGNS AND ACCOMPANYING SPEED CONTROL

UNITRAIN
SYSTEM

Modern driver assistance systems incorporate advanced speed control which works in conjunction with road sign recognition capability. The core of the system is a camera which focuses on the area ahead of the vehicle. The driver is shown all the road signs picked up on the camera. In the case of active speed control, the vehicle will even limit its speed accordingly all by itself.

Use a UniTrain course to practically integrate this complex system into your classroom. Trainees put a complete driver assistance system into operation and perform various practical tasks. Last but not least, the course teaches the requisite diagnostic skills.

Training contents
- Design and function of driver assistance system
- Incorporating the camera into the overall system
- Purpose of driver assistance system
- Learning diagnostic techniques
- Becoming familiar with system limitations

Order no. CO4205-1B

REVERSING CAMERA WITH PARKING ASSISTANCE

UNITRAIN
SYSTEM

A complete system for the rear of a vehicle, composed of multiple ultrasonic sensors and a camera. This UniTrain course gives trainees a practical insight into the handling of a reversing camera with parking assistance, as well as diagnosis of the system.

The training system encompasses the technical features of the whole installation, as well as showing how the individual components operate. Trainees can therefore find out about the physical limitations of the assistance system and learn diagnostic techniques for various possible malfunctions.

Training contents
- Design and function of driver assistance system
- Incorporating the camera into the overall system
- How ultrasonic sensors work
- Learning diagnostic techniques
- Becoming familiar with system limitations

Order no. CO4205-1C

GESTURE CONTROL AND CAPACITIVE SENSORS

UNITRAIN
SYSTEM

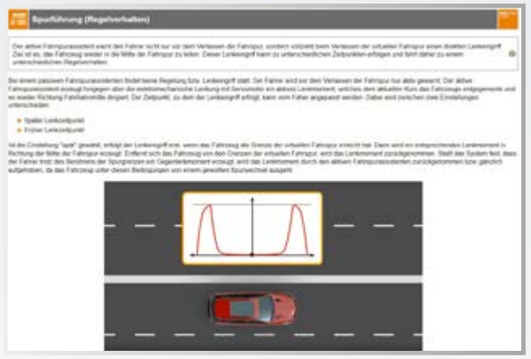
This training system enables trainees to gain a deeper understanding and learn the necessary diagnostic skills for the modern operating concepts of current motor vehicles. They learn how capacitive and resistive touch screens work, as well as their differences in operation. Closely related to the capacitive touch screens are the capacitive switches, which are also a didactic component of the training system. The highlight, however, is the integrated gesture control, which trainees will learn about in detail in a practical experiment. The overall package is rounded off by numerous diagnostic jobs, which automatically activate fault simulations on the training system.

Training contents

- Fundamentals of capacitive touch sensors
- Input, processing, output principle (IPO)
- Switching thresholds of touch sensors
- Analog and digital voltage outputs
- Control of seat heating
- Fundamentals of capacitive gesture control
- Opening a tailgate with a gesture
- Networking in vehicles - CAN bus
- Diagnostics

Order no. CO4205-1U

ACTIVE LANE ASSIST



UNITRAIN
SYSTEM

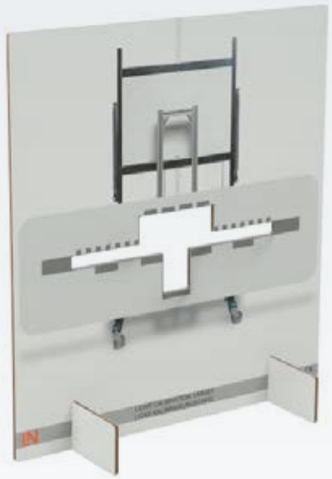
The lane departure warning system uses the front camera to monitor the vehicle's own lane and issues a warning if the vehicle threatens to leave the lane unintentionally. An extension is the active lane assist, which not only issues a warning, but also generates an active counter-steering torque to drive the vehicle back into the centre of the lane. Both variants are part of this training system.

Training contents

- Overview of current driver assistance systems
- Levels of autonomous driving
- Operating the Active Lane Assist
- Virtual lane
- Control response
- Performance limits of the Active Lane Assist
- Electrical components of the Active Lane Assist
- Networking in the vehicle
- Diagnosis including 4 workshop orders
- Calibration

Order no. CO4205-1W

LIDAR - LIGHT DETECTION AND RANGING



UNITRAIN
SYSTEM

A direct introduction to the topic of LIDAR (Light Detection and Ranging): Use this training system to teach important diagnostic skills in the area of optical distance and speed measurement. The hardware of this driver assistance teaching system is based on a real, largely exposed LIDAR module, thereby offering the trainees unique insights into the structure of the system.

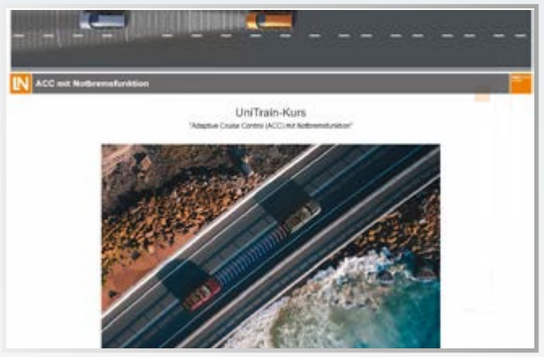
When combined with its associated e-learning course, the system not only allows you to teach how the system functions but also to demonstrate diagnostic techniques quickly and efficiently. Trainees themselves can easily activate various fault scenarios by means of the e-learning course. With the aid of the accompanying calibration board, you can also show them directly how to adjust a LIDAR system right in the classroom.

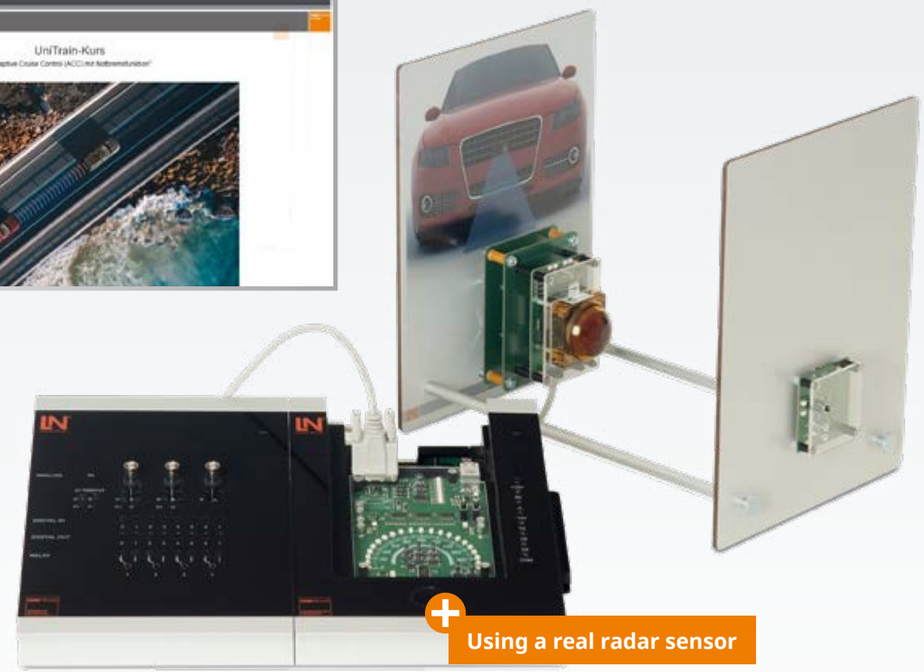
Order no. CO4205-1E

Training contents

- Fundamentals of driver assistance systems
- Significance for self-driving vehicles
- Physical principles of light and lasers
- Safety regulations when handling and operating lasers
- Design and function of LIDAR systems in vehicles
- Calibration of LIDAR system by means of a calibration board
- Diagnostics for CAN bus, power supply and actuators
- Measuring techniques and reflection properties
- Signal processing and detection of surroundings
- Networked driver assistance systems and system architecture

ACC - ADAPTIVE CRUISE CONTROL





UNITRAIN
SYSTEM

This training system shows how the dynamic distance control works as well as the emergency brake assistant. While the ACC system controls the vehicle to a desired speed and a selected distance, the Emergency Brake Assist warns if there is a risk of collision and, if necessary, brings the vehicle to a complete stop before colliding with an obstacle, a person or another vehicle.

Order no. CO4205-1V

Training contents

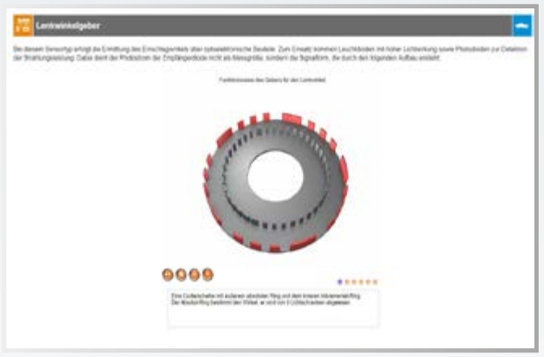
- Carrying out the calibration of the radar sensor
- Using a real radar sensor
- Calibration by laser
- Adjustment of the sensor by the trainee
- ACC system control strategy
- Networking and structure of the ACC system
- Fundamentals of radar technology

SAFETY & COMFORT

Safety and comfort underlie most vehicle electronic systems - especially the active and passive safety systems. Already today, in the case of a crash, for example, many different processes take action: ranging from collision avoidance beforehand to interruption of the fuel supply afterwards.

It is to be expected that developments will throw up even more milestones in future. That is why our training systems pay specific attention to the topics of safety and comfort, covering essential subjects such as air conditioning, various SRS systems and braking systems.

ELECTROMECHANICAL POWER STEERING



Electromechanical servo-steering offers many advantages over steering systems without such assistance. It provides not only physical, but also psychological benefits to drivers. Steering assistance is provided based on need. This means that it only becomes active when a driver wants it. Simultaneously, though, it also responds to speed, steering torque and angle.

By means of this cut-away model, trainees can learn the full scope of how electromechanical steering assistance works. In addition they can also make measurements on the steering system via the CAN bus.

Training contents

- Design of electromechanical power steering
- Function of the individual assembly groups
- Steering geometry
- CAN bus control
- Vehicle speed sensors
- Steering angle sensors
- Steering torque sensors

Order no. CO3221-9B

ELECTROMECHANICAL PARKING BRAKES WITH AUTO-HOLD FUNCTION

An electromechanical parking brake replaces the conventional handbrake with a simple switch on the dashboard. This means there is no need for a handbrake lever. The switch can activate the parking brake on the rear wheels with the aid of an electromechanical actuator.

In our system we have recreated a modern electromechanical parking brake in slightly simplified form so that trainees can carry out extensive testing in the course of experiments.

Training contents

- How rear-wheel brake actuators work
- Sensors and actuators for this type of brakes
- How an electromechanical parking brake works
- Parking brake function
- Dynamic starting assistant and emergency brake function
- Auto-hold function
- Gauging of brake discs
- Brake boosters/hydraulic brake: Mode of operation
- Technical documentation: Interpretation and application
- Experimental ascertainment of various functions
- Assembly, configuration and testing of mechanical components
- Structure and function of disc brakes

Order no. CO3221-9A

AIRBAGS, BELT TENSIONERS AND CRASH RESPONSE

including troubleshooting

UNITRAIN
SYSTEM

Active safety systems such as airbags and belt tensioners have developed into indispensable components of production-line vehicles in all price ranges. Regular checks to monitor their functionality are essential and make up an everyday part of the work in a motor repair workshop.

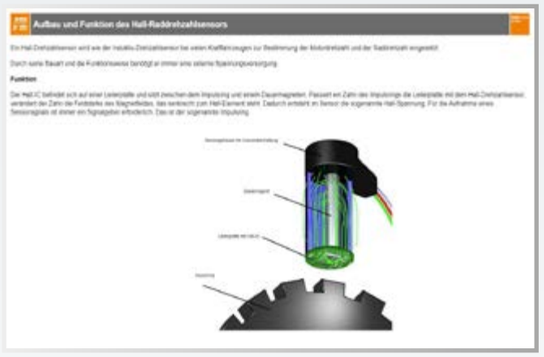
This system supplies trainees with the knowledge of such systems they will need and also shows them some realistic troubleshooting strategies.

Training contents
- Active and passive safety in motor vehicles
- Operating principles of airbags and seat-belt tensioners
- Safety switch and ignition cap
- Operating principle of pressure and acceleration sensors
- Measurement of acceleration
- Typical crash situations
- Response times and sequences
- Fault management for airbag systems
- Troubleshooting

Order no. CO4204-6Z, optional: with original airbag SO3219-1P

WHEEL SPEED SENSORS

including troubleshooting



UNITRAIN
SYSTEM

Signal recording methods for wheel speed have undergone drastic changes in recent years. The mechanics of the pulse generator ring have been replaced in many vehicles by a magnetic encoder. This has led to whole new diagnostic methods both for monitoring electrical signals and for checking mechanical components.

With our training system, students can compare conventional inductive and Hall sensors directly with a magneto-resistive sensor. Mechanical testing of pulse generator rings and magnetic encoders are also included in the practical training.

Training contents
- Purposes and applications of wheel speed sensors
- Design and function: Inductive sensors, Hall sensors
- Magneto-resistive sensors
- Mechanical checks of a pulse generator ring and magnetic encoder
- Measurements and diagnoses for an inductive sensor, Hall sensor and magneto-resistive sensor
- Changing wheel bearings possessing a magnetic encoder
- Reading and understanding circuit diagrams
- Using diagnostic functions
- Repair methods and customer consultations
- Impact of faults of practical relevance

Order no. CO4205-1F

ABS/ASR/ESP

including troubleshooting

UNITRAIN
SYSTEM

Brake systems of modern motor vehicles are becoming increasingly complex. Electronic aids such as ABS, ASR and ESP are now standard features in such systems. They are designed to keep the vehicle stable within physical limits and thus help assist in protecting drivers.

Each individual system is mutually dependent and in part uses the same sensor signals. With this training system, the trainee becomes familiar with and understands how the various systems function and interact.

Training contents
- Basic physics of driving
- Oversteer and understeer
- Sensors: Function and design
- ABS: Function and design (slip, ABS control loop)
- ASR: Function and design (controlling situations)
- ESP: Function and design (operating principle)

Order no. CO4204-6W

INTERNAL COMBUSTION ENGINES - GENERAL

Conventional internal combustion engines continue to enjoy a large share of the market and are still used even in electrically based hybrid vehicles. The success of the design has been based on its continuous optimisation. The efficiency and performance of such engines remain unparalleled to the present day.

The Lucas-Nülle training system covers the entire subject of internal combustion engines. In addition to detailed observation of whole engines, our training equipment also elucidates parts of the system in addition to special functions.

SENSORS IN MOTOR VEHICLES

UNITRAIN
SYSTEM

Sensors do the job of recording physical quantities as expressed in the surroundings and converting them into electrical signals so that they can be processed by electronic control units.

This training system helps to explain in both theory and practice the operating principles and diagnostic procedure for key sensors used in engine management.

Training contents

- Physical principles: Induction, Hall effect, piezo-effect
- Understanding the function of sensors involved in engine control
- Comprehending inductive and Hall speed sensors and their function
- Throttle valve position measurement: Throttle valve switch and potentiometer
- Air-flow measurement with hot-wire and hot-film sensors
- Pressure measurement in intake manifold
- Detection of shock waves with a knock sensor
- Temperature measurement with NTC and PTC sensors

Order no. CO4204-7F

SENSOR TECHNOLOGY, OPEN- AND CLOSED-LOOP CONTROL SYSTEMS

including troubleshooting

CARTRAIN
SYSTEM

In addition to the number of sensors in vehicles, the degree to which they are interconnected is also on the increase. Sensors and actuators work in conjunction by means of open- and closed-loop control systems.

This is a complex topic which you can teach on a practical, hands-on basis with the help of this training system. Trainees can measure, test and assess signals. They can carry out realistic diagnostics with the help of feedback from customers and working from circuit diagrams and function plans. Specialised protection for the sensitive sensing equipment allows for free and untroubled experimentation.

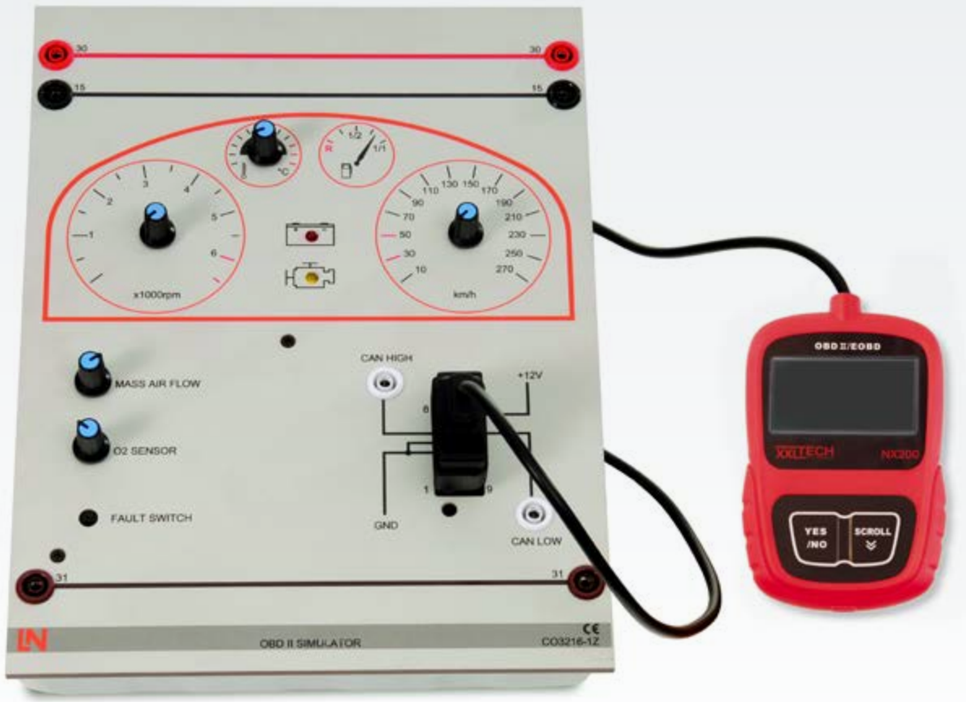
Training contents

- Interaction between real sensors and actuators
- Familiarisation with open- and closed-loop procedures
- Practical implementation of the input-process-output (IPO) model
- Extensive fault simulation (32 faults which can be activated wirelessly or via USB)
- Direct measurement of signals
- Built-in 4-channel oscilloscope
- Specially protected sensors

Order no. CO3221-6N

ON-BOARD DIAGNOSTICS TRAINING SYSTEM (EOBD/OBD II)

including troubleshooting



Read out data from components related to exhaust emissions with the help of on-board diagnostics (OBD II or EOBD). This system shows how OBD testers should be properly used and how to make optimum use of their functional capability. The course also focuses on correct interpretation of fault readouts.

Students can adjust parameters themselves in order to practice recognising the effects on the tester. It is also possible to trace the transmitted CAN signals for display on an oscilloscope.

Training contents

- Permits the diagnosis of emission-relevant systems
- Systematic development of troubleshooting and diagnostic strategies
- Working properly with diagnostic testers
- Evaluating and documenting test results

Order no. CO3216-1Z

CHANGING TOOTHED BELTS IN AN ENGINE WITH OVERHEAD CAMSHAFT

Access to crankshaft drive without disassembling components

Changing toothed belts is one of the key jobs to be carried out when servicing vehicles controlled using such belts. It is particularly important to keep the timing accurate and not to change the position of the camshaft with respect to the drive shaft. This training system teaches you the best and safest way to change a timing belt.

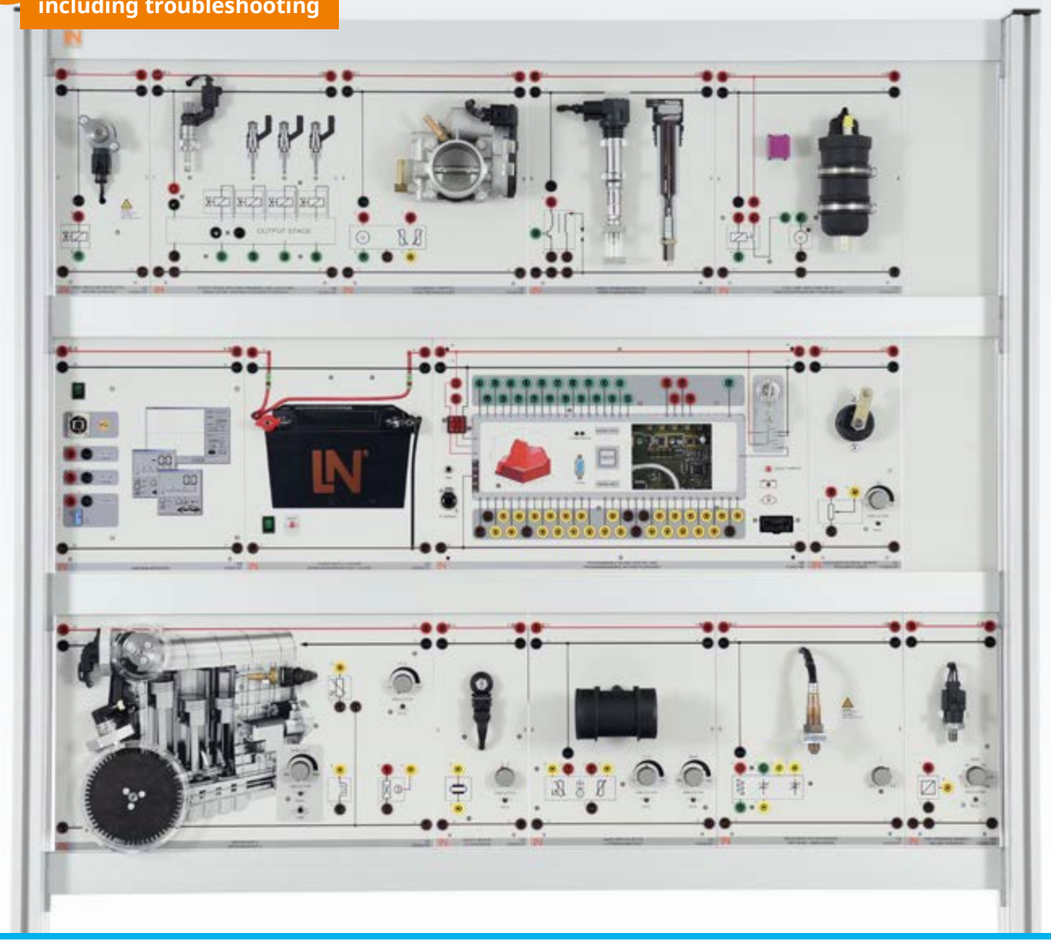
Training contents

- Changing timing belts
- Info: Maintaining wearing systems
- Engine management
- Purpose of the pulleys
- Correct tensioning of belts
- Interaction between crankshaft and the valves
- Correct tightening torque for screws

Order no. CO3221-9D

MODULAR ENGINE MANAGEMENT

including troubleshooting

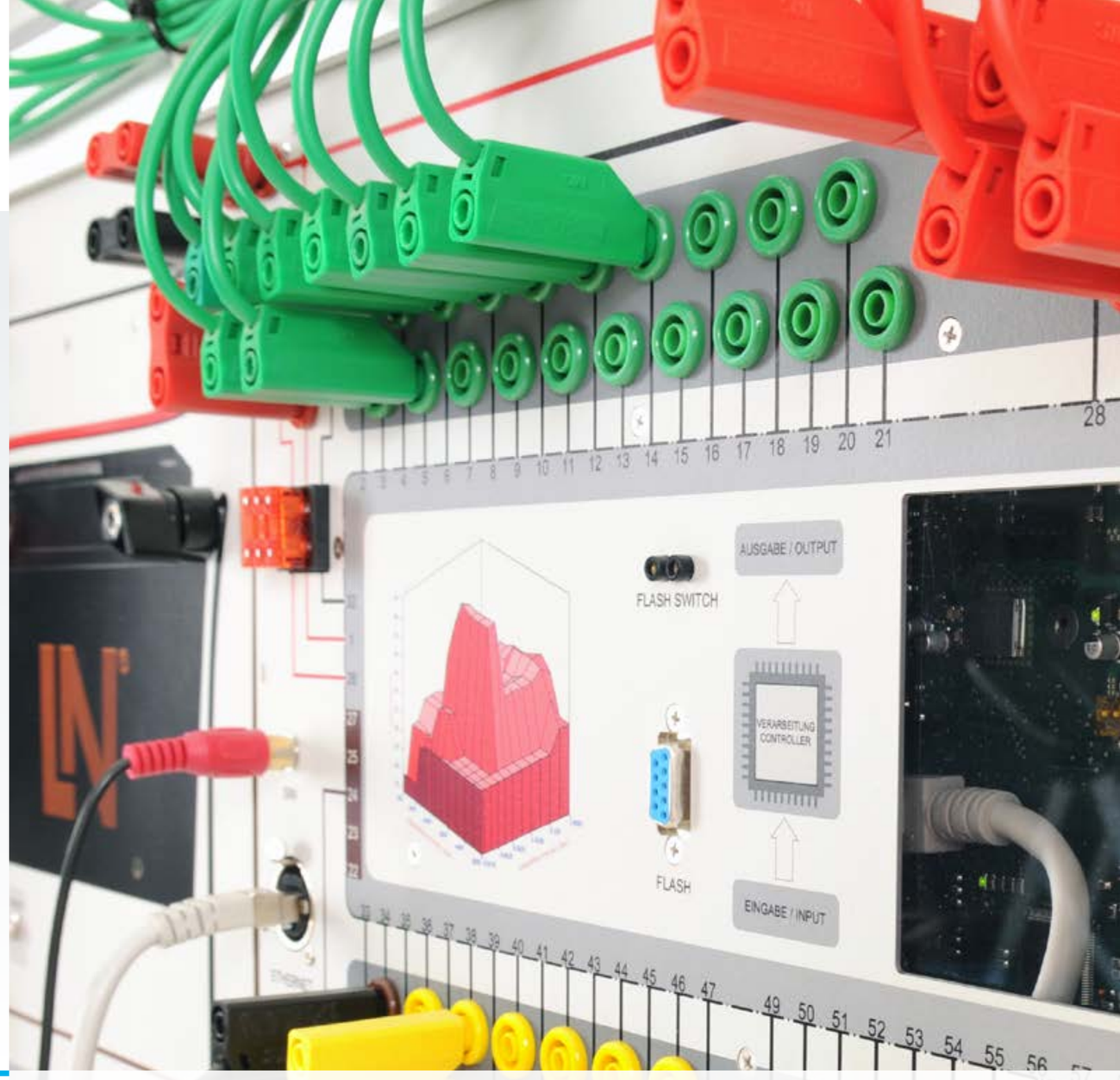


Understanding open- and closed-loop control of engines: In order to understand open- and closed-loop control of an engine, your students can use this training system to learn use of the IPO model for themselves as well as how to efficiently employ circuit diagrams for the purposes of diagnosis. The modular design allows the engine management system to be adapted specifically for learning each separate sensor, actuator or learning unit in conjunction with different fuel injection techniques or the diesel common rail system.

To make that essential link between theory and practice easily understandable, Lucas-Nülle systems always use authentic OEM items. Simulation or real modes can also be set up in order to aid success in learning.

Training contents

- Various fuel injection systems plus common rail
- Sensors and actuators as part of engine management
- Interactions between sub-systems
- Recording of signal waveforms
- Understanding the principle of input-process-output (IPO)
- The relationships and dependencies of open-loop and closed-loop control systems
- Selecting and using appropriate measurement and test techniques
- Acquiring diagnostic skills



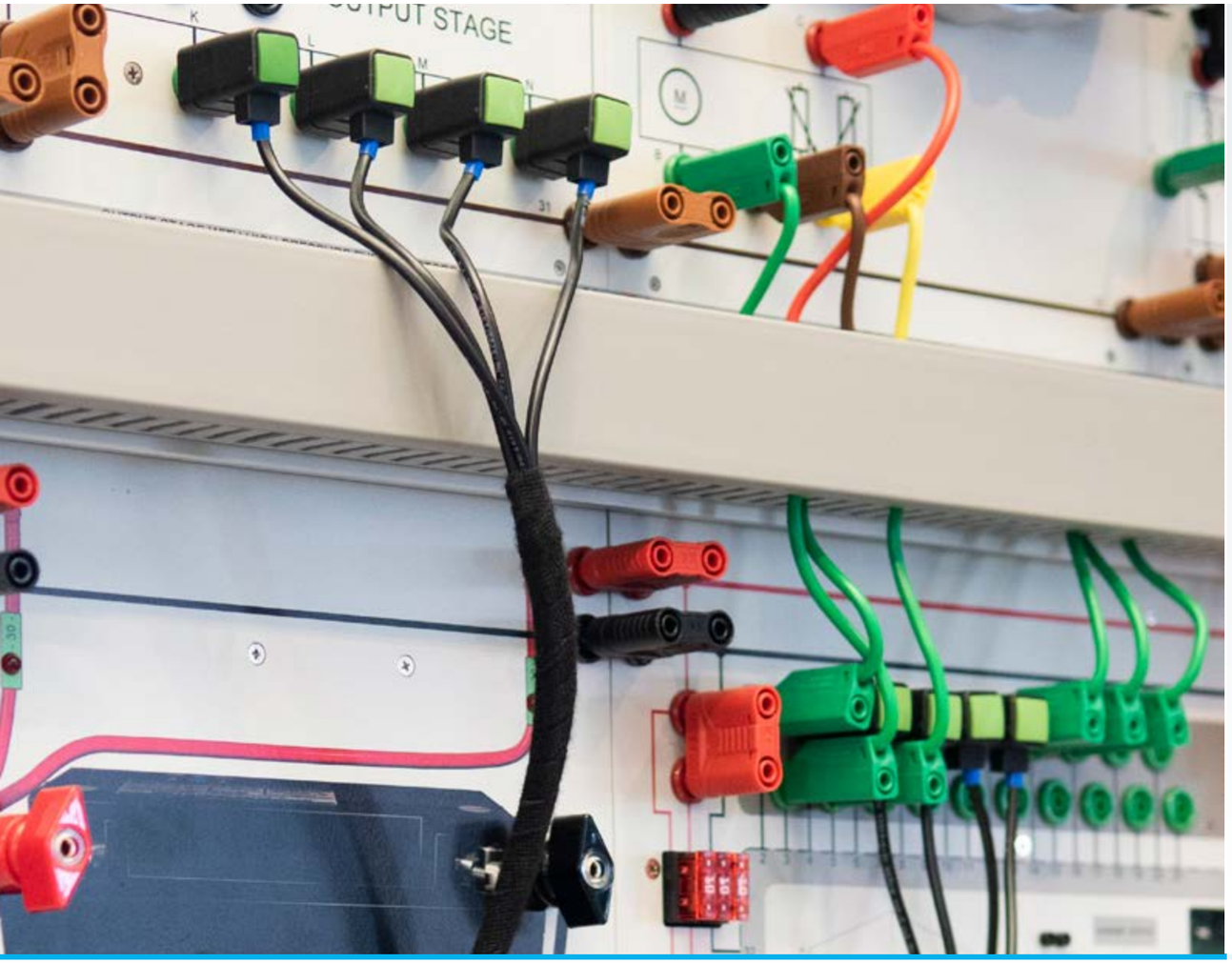
Benefits

- Engine control unit programmable for different engine management systems
- Fault memory which can be read via an OBD port
- All-in-one measuring instrument
- Modular structure
- 4-mm safety sockets for measurements
- Multimedia, practice-oriented course content
- Digitally networked with PCs

Order nos. for diesel engines
MMM1 (common rail)

Order nos. for petrol engines
MMM2 (direct fuel injection)
MMM3 (Motronic 2.8.2)
MMM4 (Motronic 2.8.1)
MMM7 (Motronic ME 1.0.2)
MMM8 (Motronic ME 1.0.1)

CABLE HARNESS REPAIR



This cable harness repair set includes all the components needed to practically present, in combination with the modular training systems, the topic “Repair of cable harnesses”. To impart the basic theoretical knowledge, course SO2803-3E supports this set to ensure that all theoretical and practical skills are perfectly conveyed.

Training contents

- Cable harness design
- Types of plug connectors
- Assembly of connectors
- Bundling of wires
- Cable harness repairs

Order no. SO2803-3E + CO3223-7T

Benefits

This training system can be used in conjunction with the following LN systems:

Order nos. for diesel engines
MMM1 (common rail)
Order nos. for petrol engines
MMM2 (direct fuel injection)
MMM3 (Motronic 2.8.2)
MMM4 (Motronic 2.8.1)
MMM7 (Motronic ME 1.0.2)
MMM8 (Motronic ME 1.0.1)
MMM9 (direct fuel injection with on-demand fuel pump)

Order no. for modular lighting system ALC 1.1 - ALC 1.8

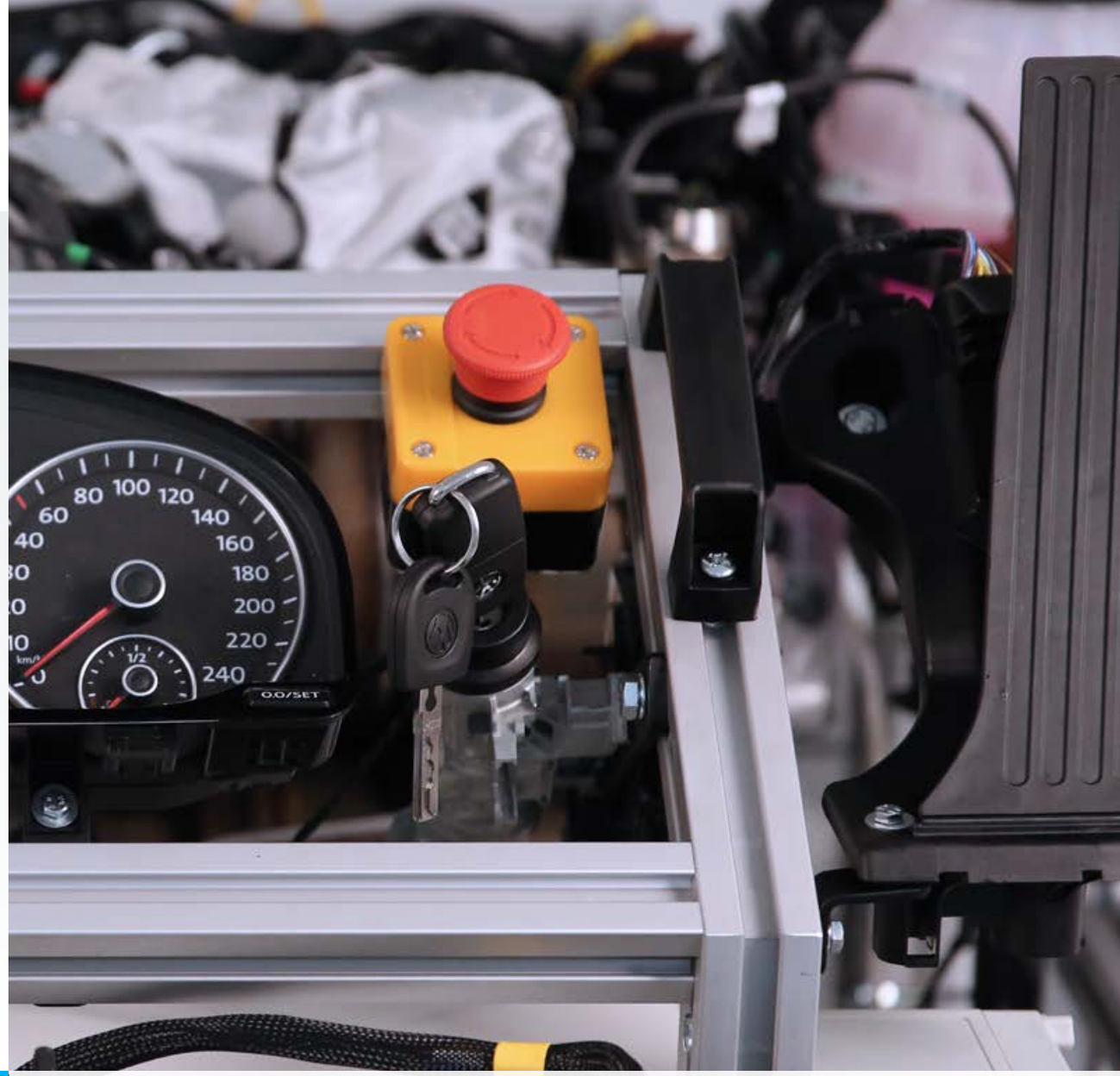
FUNCTIONAL ENGINES

+ including troubleshooting

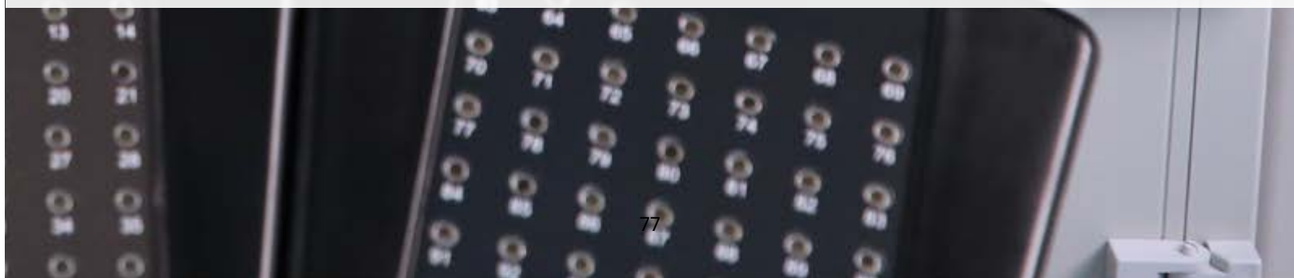
These fully operational engines ensure that none of the rotating parts are accessible and components which get hot are also covered over. Thus the working engines are very safe as well as being equipped with fault simulation. Signals from sensors and actuators can be accessed easily by means of break-out boxes.

Original circuit diagrams are supplied with all systems.
You can choose from a range of engines.

Training contents
- IPO model
- OBD diagnostics on a real engine
- Design of an engine
- Open- and closed-loop control processes
- Servicing work on an engine



Benefits
- Authentic engine adapted for educational needs
- Fault memory can be read out via OBD interface
- Realistic measurements on cable harness and plug connectors
- High standard of safety
- Fault simulation
- Original circuit diagrams



PETROL ENGINES

It was one of those combustible ideas. It is now well over a hundred years since the success story of the internal combustion engine began. Since then, the design has shown itself to be flexible to developments and has undergone any amount of optimisation. Nowadays, increasing use of electronics has immensely heightened the precision of its processes for open- and closed-loop control.

IGNITION SYSTEMS

UNITRAIN
SYSTEM

Even conventional components such as the ignition systems in petrol engines have undergone spectacular developments thanks to electronics. Modern ignition systems are complex but extremely precise. They have made it possible to unleash remarkable advances in the performance of combustion engines while conforming to ever stricter emissions regulations.

Now trainees can learn for themselves on the basis of the UniTrain system not only how ignition systems are designed but how they can go wrong and how such faults can be diagnosed.

Training contents
- How an ignition spark is generated
- Ignition timing (mechanical and map-based)
- Conventional ignition systems and dual-spark ignition systems
- Transistorised ignition systems with Hall and inductive sensors
- Electronic ignition systems
- Recording and evaluating ignition oscilloscope traces
- Basics of static and rotary high-voltage distribution

Order no. CO4204-7C

DIRECT FUEL INJECTION

including troubleshooting

CARTRAIN
SYSTEM

MED direct fuel injection with turbocharging represents the current apex of modern petrol engine development. Direct fuel injection and turbocharging provide the perfect platform for so-called “downsizing”.

This training system enables students to control actuators on the basis of the relevant sensor signals and therefore to understand various driving conditions. All sensors and actuators of the engine management system are fully functional components.

Training contents
- Understand how the engine management system works
- Function and operation of the relevant control loops
- Design and operating principles of the sensors and actuators
- Interpretation and application of circuit diagrams
- Execution of measurements as carried out in practice
- Fault memory read-out
- Engine management system settings
- All sensors and actuators are fully functional original components

Order no. CO3221-6G

MOTRONIC 2.8.2

including troubleshooting

CARTRAIN
SYSTEM

Our training system covering the Motronic 2.8.2 engine management system integrates all the management functions (including preparation of fuel mix and ignition) into a single control unit. Each of the cylinders in a multi-point injection system has its own injection valve.

This CarTrain system enables students to control actuators on the basis of the relevant sensor signals and therefore to understand various driving conditions. All sensors and actuators of the engine management system are original, fully operational components.

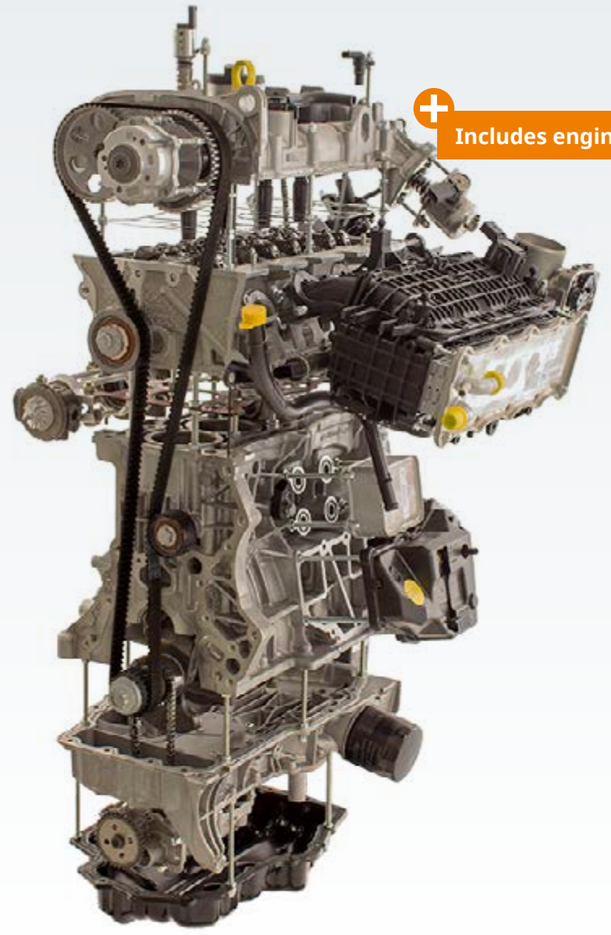
Training contents

- Understand how the engine management system works
- Function and operation of the relevant control loops
- Design and operating principles of the sensors and actuators
- Interpretation and application of circuit diagrams
- Execution of measurements as carried out in practice
- Fault memory read-out
- Engine management system settings
- All sensors and actuators are fully functional original components

Order no. CO3221-7C

DIRECT FUEL INJECTION, EXPLODED MODEL

Includes engine mounting



Give your students the chance to view an engine in startling detail. This exploded mechanical model of an authentic direct injection engine with turbocharger offers decisive advantages over conventional cut-away models.

Because none of the components are omitted or incomplete due to being cut away, this means no part of the engine is lost from sight. In addition, components which would normally be hidden from outside view are now freely accessible in the exploded model. The model is entirely free of hazards resulting from liquids, rotating parts or hot surfaces.

Benefits

- Complete engine with all components
- All components are fully accessible
- No hazards from liquids or rotating parts
- Intercooler built into exhaust pipe
- Perfect supplement to direct fuel injection CarTrain training system

Order no. SO3240-1M

DIESEL ENGINES

Diesel engines are powerful and efficient. Self-ignition renders them quiet and, in principle, clean.

By means of the common rail diesel injection system, Lucas-Nülle helps you teach your trainees about engine management for diesel engines. The various training systems also explain other parts of the system and put you in a position to cover the entire subject in the course of your training schemes.

HIGH-SPEED GLOW PLUG SYSTEM

Operation with real 12 V starter battery

For diesel engines to start well when cold, it is necessary to pre-condition the combustion chamber to the right temperature.

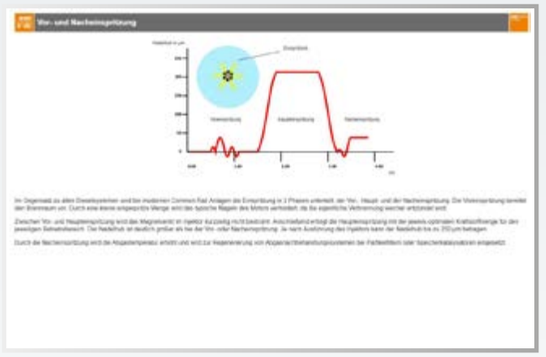
Modern glow plug systems are controlled by pulse-width modulation with a resulting voltage of close to 12 V when first switched on but around 5 V during normal glow plug operation.

The training system focuses on practical investigation of so-called high-speed glow plugs on a foundation of theory as provided by our digital courses.

Training contents
- Necessity for starting aids
- System components in a heater (glow) plug system
- Glow plugs and control unit
- Phases in the glow process before the engine is started
- Intermediate and post-glow
- Measuring voltage with an oscilloscope

Order no. ATS 1

COMMON RAIL DIESEL INJECTION SYSTEM



Piezo technology with up to five injection cycles

UNITRAIN SYSTEM

How can diesels be so quiet? How is it possible to reduce emissions? This training system helps you teach students about modern common rail injection systems.

The system helps them learn about typical injection pressures, procedures and quantities at their own pace. In order to cover the whole variety of systems available on the market, it can be reconfigured for a whole range of different injector types. This means that this one equipment set is able to cover the full scope of the topic.

Training contents
- Requirements to be met by diesel injection systems
- Introduction to various designs
- Structure and functionality of a common rail system
- Fault localisation on a common rail system
- Injection response: electromagnetic and piezo-injectors
- Low-pressure and high-pressure circuits
- Understand the process of electrical tests of injectors
- Examination of a common rail system’s hydraulics

Order no. CO4204-6X

COMMON RAIL WITH VARIABLE GEOMETRY TURBOCHARGER

including troubleshooting

Original fully functioning components

This combination of a common rail engine management system with a variable geometry turbocharger illustrates the fascinating topic of charge optimisation in a modern fuel injection system.

Trainees can investigate and assess all sensors and actuators by means of various measurements. The built-in fault simulation feature makes it just like authentic practice.

Training contents

- Understand how the engine management system works
- How the control loops making up the system function
- Design and operating principles of the sensors and actuators
- Interpretation and application of circuit diagrams
- Measurements on engine management components just like in genuine practice
- Fault memory read-out
- Engine management system settings

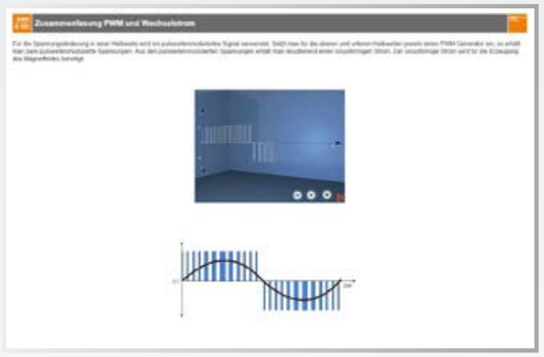
Order no. CO3221-6J

ELECTRIC AND HYBRID VEHICLES

Charged situations – Electric vehicles have truly arrived on the market. Businesses and institutions all around the world are relying on Lucas-Nülle to keep them right up to date with the latest developments in electric and hybrid vehicles. Our training systems are even used in the Worldskills contests.

With the help of Lucas-Nülle you can cover the full range of topics and teach subjects such as high-voltage electrical systems with the same degree of safety guaranteed by all our other systems.

DC/AC CONVERSION



UNITRAIN
SYSTEM

Vehicles obtain their electricity in the form of direct current from batteries and most components utilise the energy in this DC guise. Modern electric traction equipment, however, operates using alternating current and requires a waveform as close as possible to a sine wave.

This course provides a simple and clear description of how alternating current and voltage can be generated using inverters. Students can apply the theoretical knowledge they gain from the course in a series of experiments. All the components and circuits needed for this are provided. There are also tests of knowledge to monitor student progress.

Training contents
- Ohm's law
- Pulse-width modulation
- Generation of half-wave sinusoidal current
- Generation of a negative voltage
- Alternating voltage and alternating current
- Magnetic fields permeating a coil
- The rotating electrical field

Order no. CO4204-6L

DC-DC STEP-UP AND STEP-DOWN CONVERTERS

UNITRAIN
SYSTEM

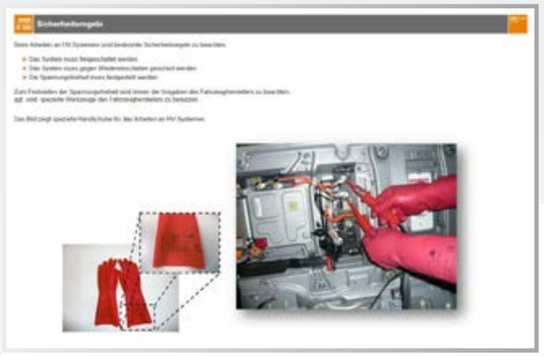
Direct voltages of various levels are required by the inverters of all-electric and hybrid vehicles, as well as numerous other application circuits. With the help of this training system, students can investigate the possibilities for conversion of DC voltages using UniTrain as their basis.

One of the courses covers step-up conversion (converting voltage at one DC level to a higher DC voltage), while another deals with step-down conversion (high-voltage to low voltage).

Training contents
- Step-up conversion (1 course)
- Step-down conversion (1 course)
- Safe handling thanks to safety low voltage
- Practical experience of voltage conversion
- Function and design of DC-DC converters
- Measurement of input and output voltages

Order nos. CO4205-1K/CO4205-1L

ELECTRIC DRIVE IN CARS, COMMERCIAL VEHICLES AND TWO-WHEELERS



UNITRAIN
SYSTEM

The UniTrain training system for electric drives provides trainees with the perfect and safe introduction to HV drive systems, giving them an initial overview of the three main components: the motor, the inverter and especially the HV battery, with its many safety functions.

In practical exercises and various diagnostic orders with fault simulation, they develop practical knowledge and essential diagnostic skills.

Training contents
- Smart HV relays with measurement points
- Complete electric drives (HV battery, inverter, motor)
- Service maintenance plug
- Interlock
- Inverter control
- Synchronous and asynchronous (induction) motors
- Practical measurements and troubleshooting

Order no. CO4204-6N

FUEL CELL

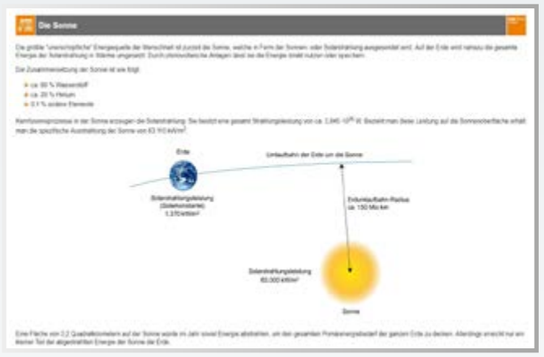
UNITRAIN
SYSTEM

The future of motoring is a blank page. That means it is always essential to pursue the development of powering alternatives. One of the more popular options at present is the use of fuel cells in conjunction with electric traction. This training system can help students get to know about this fascinating topic.

Training contents
- Fuel cell application in motor vehicles
- Function and design of fuel cells
- How a fuel cell works
- Fundamentals of the chemical process
- Recording characteristics
- Efficiency of a fuel cell

Order no. CO4204-6M

PHOTOVOLTAICS



UNITRAIN
SYSTEM

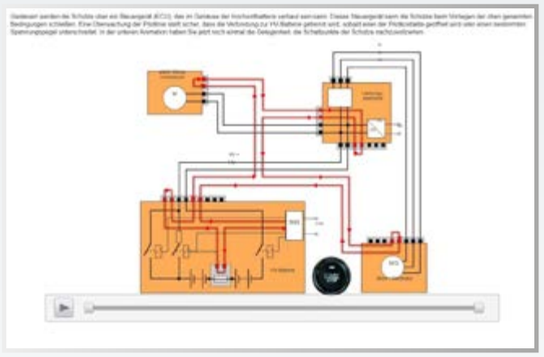
Photovoltaics is a term describing the direct conversion of sunlight into electrical energy by means of solar cells. In vehicles, energy obtained in this way is used for auxiliary electrical loads, i.e. for the comfort of drivers and passengers, for instance cooling the interior on hot sunny days. This UniTrain system helps trainees understand the technological principles behind this in rapid time.

Training contents
- Use of a photovoltaic system on a motor vehicle
- Structure of a photovoltaic cell
- Open-circuit voltage
- Short-circuit current
- *V-I characteristic*
- Power of a photovoltaic cell
- Series-connected photovoltaic cells
- Parallel-connected photovoltaic cells
- Direct operation and energy storage

Order no. CO4205-6N

INTERLOCKS

including troubleshooting



UNITRAIN
SYSTEM

Interlock systems are an essential safety precaution in vehicles. They ensure the safety not only of vehicle users but also of mechanics working in service workshops. Should a cable become disconnected or faults occur, the interlock system will isolate the high-voltage battery.

This training system helps trainees become familiar with interlocks by means of interactively based experiments.

Training contents
- Electric circuitry for interlocks
- Interlock signals
- Investigation of an interlock by measurement
- Simulation of faults commonly encountered in practice

Order no. CO4205-1H

HIGH-VOLTAGE BATTERY DISCONNECTION UNIT

including troubleshooting

UNITRAIN
SYSTEM

This training system explains how the contactors of a high-voltage battery disconnection unit work. The system monitors the high-voltage network and only connects the battery when a self-test has successfully proven that the system is safe.

With this system you can gain an in-depth understanding of high-voltage battery monitoring systems in a way which would not be possible in a real vehicle.

Training contents

- Structure and function of battery disconnection unit
- How the contactors work
- Sequence of contactors in circuit
- Fault diagnostics – simulated faults can be activated
- Investigation by measurement

Order no. CO4205-1J

48 V ONBOARD POWER SUBSYSTEM

including troubleshooting

UNITRAIN
SYSTEM

A 48 V subsystem for an onboard network opens up a multitude of options for digitalisation of vehicles. The higher voltage of the network based on the use of lithium-ion batteries does however require some rethinking with regard to working with such systems.

This UniTrain course focuses particularly on the safe handling of the new technology. The complete package shows ways to carry out practical and targeted work on a 48 V subsystem. This provides trainees with essential diagnostic skills.

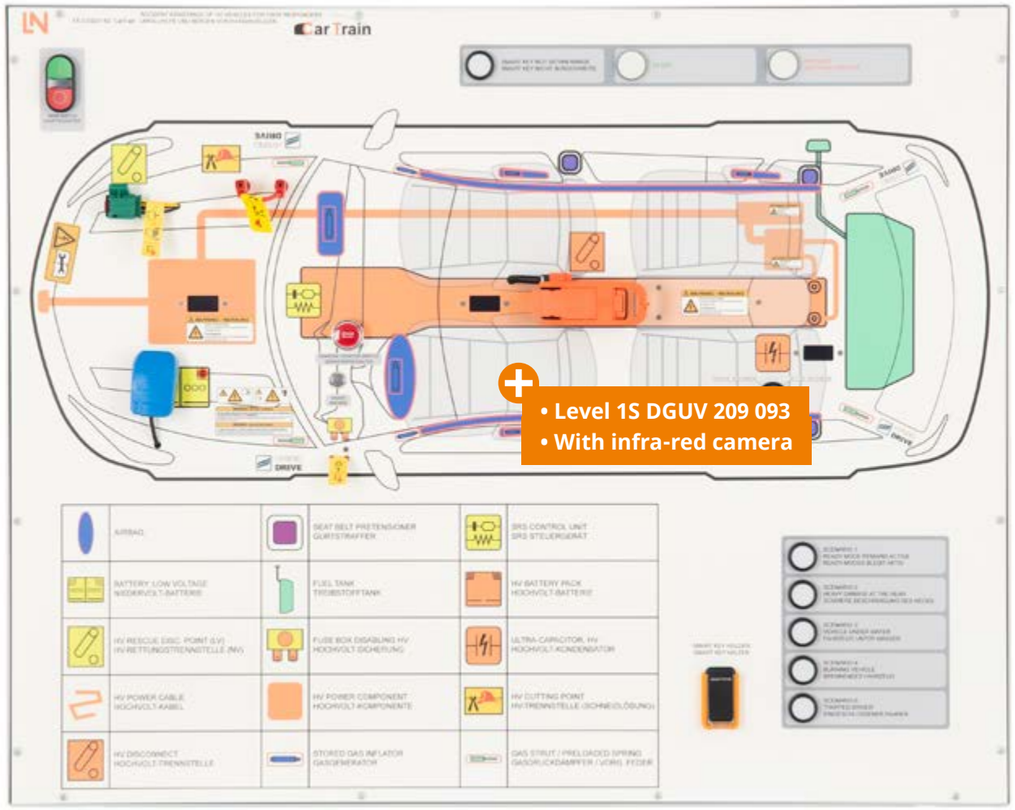
Training contents

- Benefits of a 48 V onboard power subsystem
- Structure of a 48 V onboard power subsystem
- Possible dangers from electricity
- Disconnection/isolation of a 48 V system using a tester
- Manual disconnection of a 48 V system
- Diagnostics in 48 V systems

Order no. CO4205-1T

CARTRAIN
FIRST RESPONDER TRAINER FOR HV ELECTRIC VEHICLES

including troubleshooting



CARTRAIN
SYSTEM

The growing number of electric vehicles on the road presents a new challenge, especially for emergency and rescue services.

Lucas-Nülle has developed a unique training concept for first responders. This makes it possible to carry out the new tasks with seasoned professionalism and assurance. Integrated accident scenarios perfectly round out this training package.

Training contents
- How to handle burning HV batteries
- Methods for disconnecting the HV system
- How to handle wrecked cars
- Simulation of an actual rescue operation

Order no. CO3221-6Z

SAFE HANDLING OF HIGH-VOLTAGE SYSTEMS

including troubleshooting

UNITRAIN
SYSTEM

Safety when working on high-voltage electric vehicles and the hazards of high current flowing through the human body are fundamental aspects for any professional work on hybrid and electric vehicles. This training system imparts key fundamental knowledge within the safe environment of the UniTrain system. The hazards to a human body can still be directly measured, though, with the help of a model.

Training contents

- Fundamentals: Safety when working with high-voltage vehicles
- Effects of faults encountered in practice
- Using a model to measure the current passing through a human body

Order no. CO4205-1M

TRAINING SYSTEM FOR HIGH-VOLTAGE AND AIR-CONDITIONING SYSTEMS

including troubleshooting

Fully functional AC cooling system for the high-voltage battery

CARTRAIN
SYSTEM

This combined system enables an advanced introduction to high-voltage systems in vehicles. It focuses on diagnostic skills for the aspects of high-voltage drive systems, intrinsic safety systems and high-voltage air-conditioning.

Trainees can carry out non-contact measurements on a high-voltage traction motor itself – in the utmost safety. Interlock and insulation monitors are made comprehensible on a measured level. The method used imparts theoretical knowledge and practical repair skills to an equal degree.

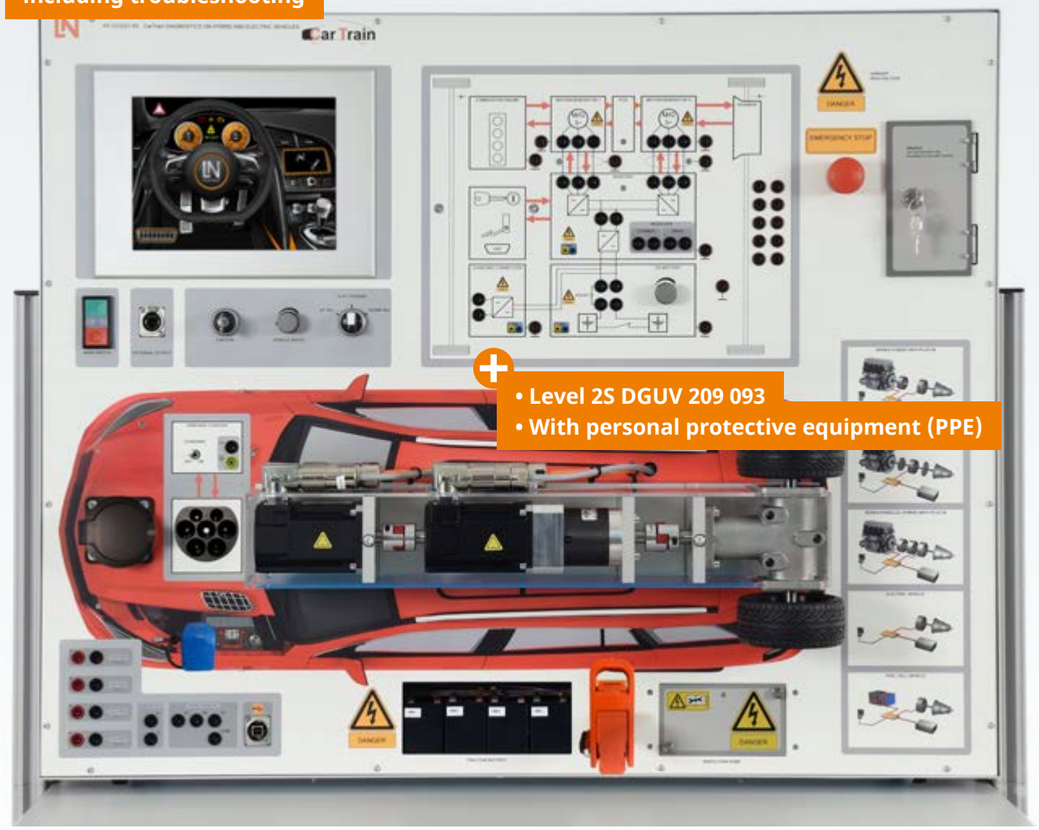
Training contents

- Optimisation of control for high-voltage drive systems
- Measurements on interlock system
- Measurements on insulation monitor
- Diagnostic work based on practical experience using customer job orders
- High-voltage drive, air conditioning and intrinsic safety systems

Order no. CO3221-6P

HYBRID AND ELECTRIC VEHICLES

including troubleshooting



• Level 2S DGUV 209 093
• With personal protective equipment (PPE)

CARTRAIN
SYSTEM

The way that CarTrain unites in a single system five different drive configurations, including all the relevant measuring points for a high-voltage installation, is unique in the world. This renowned training system has been improved still further to meet levels 1 and 2 of the recommendations from the German insurers' organisation DGUV. Trainees can easily grasp the various drive modes and energy flows with the help of the new touchscreen.

Thanks to the fault simulation capability which allows various HV faults to be activated, they can learn vital diagnostic skills on a training system which has been specifically designed for safety.

Order no. CO3221-6X

Training contents

- Drive concepts in HV vehicles
- Energy flows in high-voltage systems
- On-board power supply for high-voltage vehicles
- Measurement of equipotential bonding and screening
- Charging sockets for vehicles
- Structure and function of electrical machines
- Preparations for inductive charging
- Diagnostics on HV systems similar to authentic practice, including use of fault codes
- Tester-based disconnection
- Manual (emergency) disconnection
- CAN communication in HV systems
- Genuine interlock systems
- Emulation of pre-load phase using testers

DIAGNOSIS AND MAINTENANCE OF A HV BATTERY

including troubleshooting

• Level 3S DGUV 209 093
• With personal protective equipment (PPE)

CARTRAIN
SYSTEM

More and more manufacturers carry out repairs on high-voltage batteries. This is a new challenge for mechanics and requires a special understanding of the systems involved. This training system makes it possible to work directly with a real high-voltage battery. Trainees can carry out measurements inside the battery, work at cell level and even change actual cells.

An extensive system which is nevertheless easy to use. Fault simulation capability enables study of many potential problems. While trainees work out the right ways to carry out diagnostics, they also gain practical skills for the latest workshop challenges.

Order no. CO3221-6S, optional: Disconnection set LM8671

Training contents

- Structure and analysis of a real high-voltage battery
- Diagnostic work on HV battery via fault simulation activation
- Disconnection (isolation) via service/maintenance plug
- Extra training for first responders (fire service, police)
- Various measurements including high voltage and temperature sensors
- Charging infrastructure (AC, CCS DC)
- Disconnection as carried out in practice using high-voltage diagnostic tester
- Dealing with damaged HV batteries (accident-damaged vehicles)
- Classification of HV batteries according to potential hazards

CHARGING STATION

A real charging station: This training system provides an educationally modified version of an authentic charging station. In conjunction with the CarTrain electric vehicle set, it is possible to understand how communication between vehicles and charging stations proceeds.

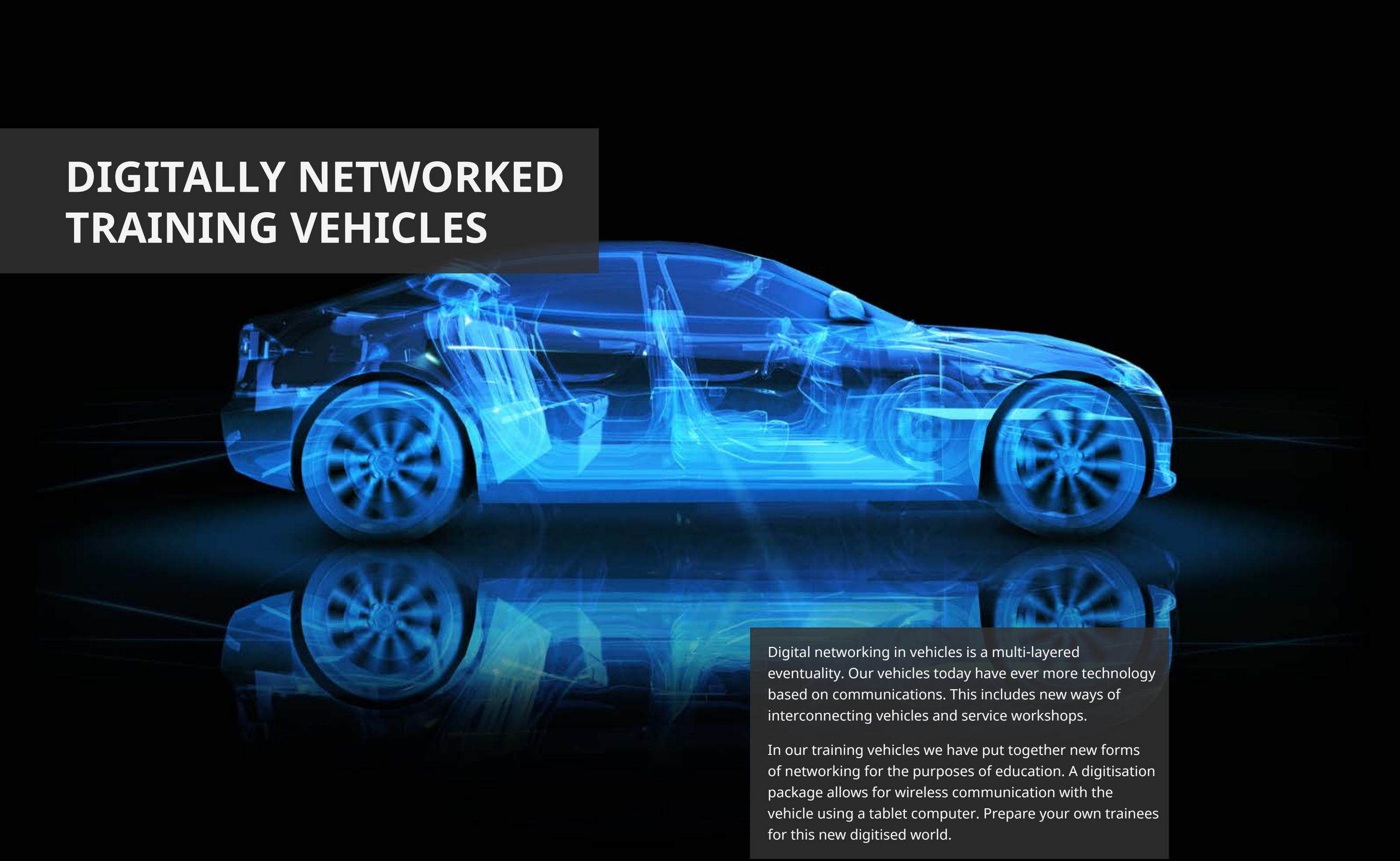
Of course, the system encompasses all the necessary safety precautions. One other capability is the option of remote control via a smart electricity grid. In addition, you can even charge real electric vehicles.

Training contents

- Charging of high-voltage vehicles
- Sequence of charging procedure
- Safety concepts
- Analysis of communication between charging station and vehicle
- Function of CP and PP contacts

Order no. CO3221-6Q

DIGITALLY NETWORKED TRAINING VEHICLES



Digital networking in vehicles is a multi-layered eventuality. Our vehicles today have ever more technology based on communications. This includes new ways of interconnecting vehicles and service workshops.

In our training vehicles we have put together new forms of networking for the purposes of education. A digitisation package allows for wireless communication with the vehicle using a tablet computer. Prepare your own trainees for this new digitised world.

DIAGNOSTICS ON TRAINING VEHICLES – CONCEIVED FOR THE NEEDS OF MODERN TRAINING

We provide a choice of six different training vehicles. These not only include models with conventional drive trains using petrol or diesel engines but also vehicles with hybrid or purely electric traction.

The vehicles are picked out with reference to strict quality guidelines. This is how we can guarantee high-quality, yet very cost-efficient products.

Features of vehicles

- Fully tested high-quality vehicles
- Recent vehicles
- Enhanced trim
- Visually perfect condition
- Choice of drive train
- European versions

You can select from various vehicles

All the cars are specially modified such that they fit perfectly into the educational concept. Apart from visualisation of the key systems in a vehicle, various break-out boxes are supplied, along with fault activation switches. All of these vehicles are accompanied by their original circuit diagrams, allowing diagnostics to be carried out under practical conditions.

Individual offer on request

THE DIGITALISATION PACKAGE – DIGITAL DIAGNOSTICS ON A REAL VEHICLE

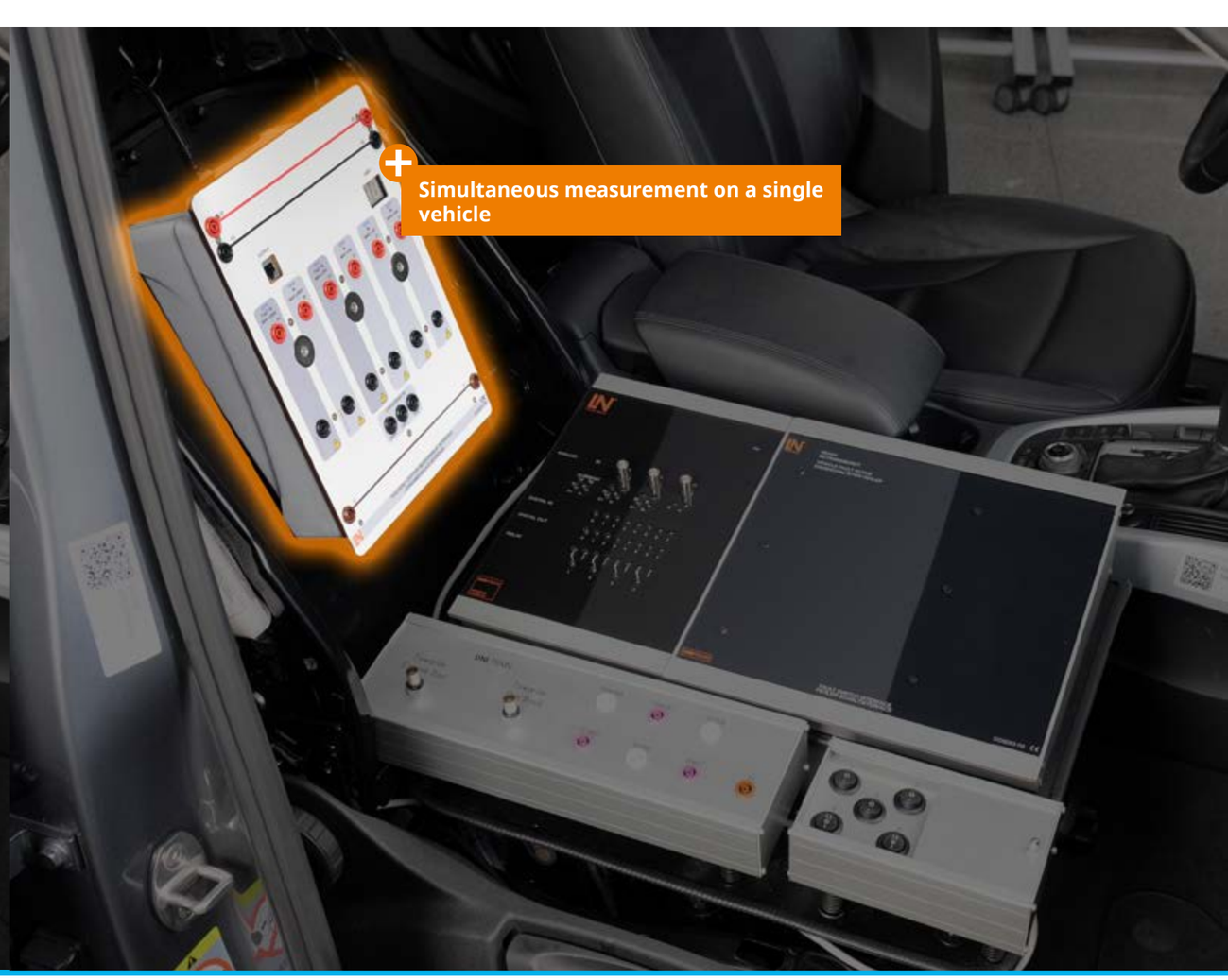
In order to bring out the full potential of our training vehicles, we recommend installing the digitisation package. This set equips a vehicle with a WiFi-capable measurement and diagnostic interface, allowing simulated faults to be activated and measurements to be saved to the learning environment.
All the measuring instruments (4-channel oscilloscope, multimeters, current probe etc.) are already built in and can be comfortably started from the learning environment, thus saving space.

Features

- Digitally networked learning environment
- Interactive diagnostic course
- WiFi-capable measurement interface
- Includes current probe
- WiFi-capable diagnostic interface
- OBD II break-out box

Order no. CO3223-7E

MEASUREMENT ENHANCEMENT PACKAGE – PARALLEL WORKING FOR ANY NUMBER OF TRAINEES



The measurement enhancement package makes it possible for multiple students to carry out measurements and diagnostics simultaneously on the same vehicle.

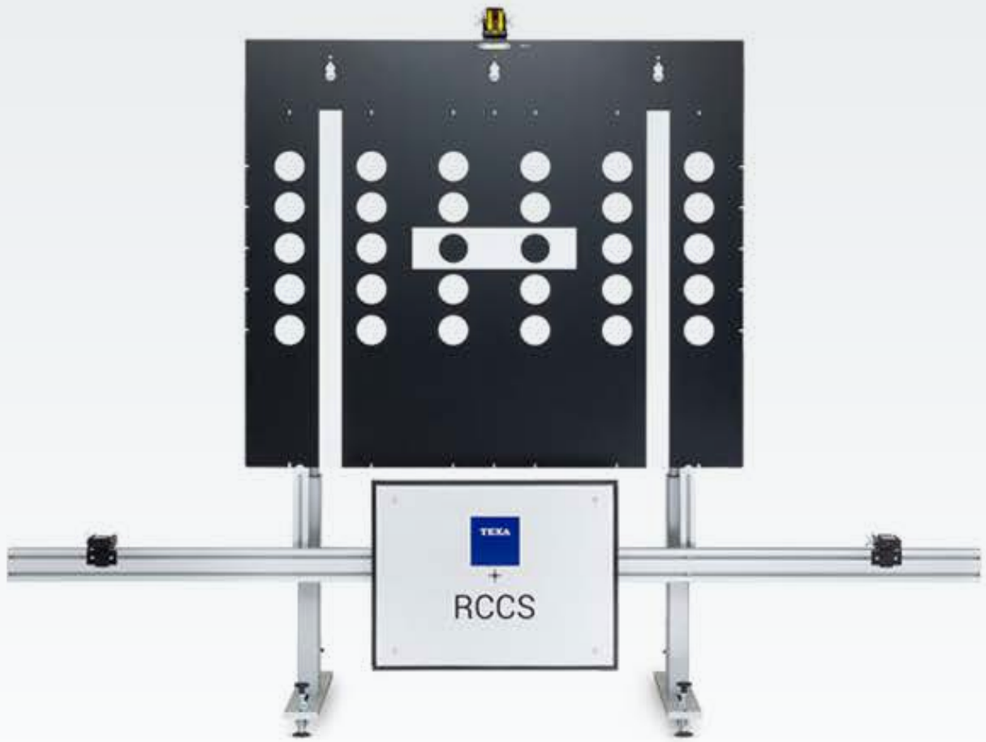
By means of the signal interface in the vehicle itself, up to six different signals can be fed in and then made available to the student workstations. The number of workstations which can be added is limitless. This makes it possible for a whole group to work on just one vehicle.

Features

- Built-in signal interface
- Includes 6 external student workstations
- Parallel transmission of signals
- Extensible to custom level
- Capable of combination with learning environment
- Built-in CAN interface

Order no. CO3223-7F

CALIBRATION OF DRIVER ASSISTANCE SYSTEMS (FRONT CAMERA / RADAR)



A perfectly optimised complete solution for calibration of driver assistance systems

This training system focuses on calibration of a front camera. At the same time, it offers many options to expand the scope of the training and calibrate other system components. Using this course, you can teach essential skills for the servicing and repair of modern driver assistance systems in vehicles of any price range. After all, improved manufacturing procedures already mean that such things as radar and camera systems are no longer confined to the most expensive luxury cars.

Such systems offer drivers clear benefits with regard to safety and comfort. However, they do need to be perfectly calibrated to achieve this, otherwise detection could go wrong or systems may fail entirely. Ensuring that all systems still operate properly after any repair work is the job of vehicle mechatronics engineers. For example, if a windscreen is replaced or modifications made to a chassis, it would be essential to recalibrate all the driver assistance systems.

Order no. LM8328 + LM8322

This training package has been developed in conjunction with TEXA Deutschland GmbH and exclusively features nothing but high-quality components perfectly optimized to work together:

- Calibration tool for camera and radar systems
- Calibration panels included for Volkswagen Audi Group and Toyota
- Diagnostic tester
- Self-centring wheel adapter clamp
- Digital spirit level and laser-based distance measurement

Recommended
This package is the ideal supplement to our digitally integrated training vehicles

Note
Before purchasing this package in conjunction with a digitally integrated training vehicle, you must ensure that the vehicle is equipped with a front camera system.

Note
Vehicles manufactured by BMW have a built-in calibration function, meaning that they carry out calibration automatically during a reference drive.

DIAGNOSTICS AND INSTRUMENTATION

For successful troubleshooting, the right equipment is of indispensable assistance. A vehicle comprises many different component systems, from the chassis to the comfort enhancements. Any of these systems, though, could develop a fault.

For electrical systems in particular, diagnosis without the right tools is no longer possible. We provide you with a choice of high-quality, user-friendly diagnostic aids and measuring instruments and can even advise you which of them would be best suited to your own educational needs.

STUDENT/TEACHER MEASURING STATIONS

Flexibly interconnectable and secure student measuring stations. This system also provides trainees with the required signals. The source of the signals can be any electrical system, whether it be the training system itself or a real vehicle.

Benefits

- For universal use in all training classes
- Transmission of both analog and digital signals
- Signal inputs up to ±500 V; Signal outputs up to ±15 V
- Suitable for high-voltage systems
- Accurate transmission of signals

Instructors can feed in high-voltage signals from their own desks. These are then automatically output at student workstations at a safe voltage. The key point is that the actual signal waveform remains unaltered. The teachers' station also includes a gateway through which CAN signals can be fed. There is even automatic bus determination.

Benefits

- Ease of assembly and disassembly
- Digital display for diagnosing circuit breaks
- No hazardous or interference responses
- Ease of networking in the lab by means of Ethernet cables

Order no. CO3221-7A and CO3221-7B

DIAGNOSTIC TESTERS

AXONE diagnostic tester with Navigator TXTs

The full set includes everything you need to carry out diagnostics on multiple car makes, including passenger cars, sports cars, luxury cars or even lightweight commercial vehicles. Vehicles featuring OBD diagnostic ports can be connected directly to Navigator TXTs modules. In addition to remarkably intuitive operation, the AXONE NEMO stands out due to its high-quality manufacture and extraordinary computing power. Customers also get Supercar software provided free with any purchase of an AXONE NEMO with its basic passenger car software. Using the Navigator TXTs, customers can also make use of the pass-through (Pass-Thru) technology provided by manufacturers.

Benefits

- Unparalleled diagnostic coverage for cars and light commercial vehicles (vans).
- SUPERCAR diagnostics included free
- Dual-mode, display of oscilloscope/multimeters and self-defined diagnostic procedures
- Automatic interrogation of fault memory for all known systems
- Read-out and deletion of fault memory entries plus display of trouble code descriptions
- Electrical circuit diagrams with component layout
- Search for for status indications and parameters
- Configuration and encoding
- Built-in camera for documentation of repairs
- High-capacity rechargeable battery
- Wireless communication with diagnostic interface via Bluetooth®
- WiFi interface
- Pass-Thru technology
- Automatic update function

Order no. LM8322

Navigator TXTs diagnostic tester (PC version)

IDC5 PKW diagnostic software makes it possible to diagnose passenger cars (including via HV vehicle and driver assistance systems apps) and lightweight vans. The BIKE and SUPERCAR options for motorcycles, sports and luxury cars can also be integrated into the functionality. The Navigator TXTs diagnostic interface works entirely without wires thanks to the supplied USB Bluetooth® antenna. The IDC5 diagnostic software can be installed on any commonplace PC.

The Navigator TXTs module also offers the option to record parameters and to make use of the Pass-Thru standard (J2534 and ISO22900). Enhancements are also available so that the Navigator TXTs can be used for trucks, OHW vehicles, bikes (motorcycles) and marine applications.

Benefits

- Unparalleled diagnostic coverage with more than 350,000 options
- Simplified car identification using VIN or engine code
- Automatic interrogation of fault memory in all known systems (TGS3)
- Read-out and deletion of fault memory entries plus display of trouble code descriptions
- Electrical circuit diagrams with component layout
- Search for status indications and parameters
- Configuration and encoding
- Control of actuators
- Wireless communication with diagnostic interface via Bluetooth®
- Pass-Thru standard
- Parameter recording

Order no. LM8323

OSCILLOSCOPE MODULE FOR NAVIGATOR TXTS / BRAKE FLUID TESTER

Oscilloscope module for Navigator TXTs

The UNIProbe instrumentation module combines all the functions needed for use in professional workshops, whether it involves complex testing using a 4-channel oscilloscope and a signal generator or routine measurement using a multimeter. Even complicated checks of a data bus will in future be capable of assessment using software. One particular feature, though, is the ability to measure pressures. Communication is via wireless link with an AXONE tester or Windows.PC. The necessary software is supplied or seamlessly integrated via the IDC4/5 diagnostic software .

Benefits

- 4-channel oscilloscope with SIV (signal information viewing) function
- Battery and starter system checks
- Analysis of CAN, VAN and LIN data bus networks
- Signal generator for control of actuators
- Multimeter function for measuring voltage, current and resistance
- Measurement of turbocharger and fuel pressures

Order no. LM8324

Brake fluid tester

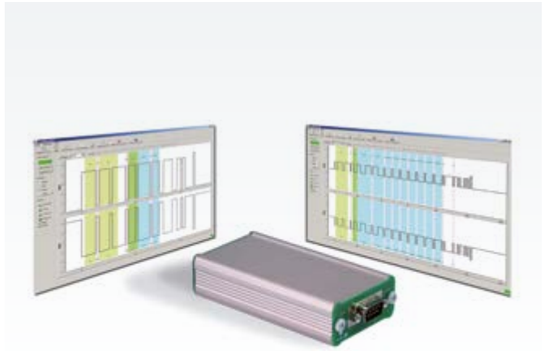
This practical pen-type brake-fluid tester is suitable for determining the quality of brake fluid to classes DOT 3, DOT 4 and DOT 5.1. It measures the moisture content in the brake fluid and displays it by means of three LEDs. To carry out a test, the cover of the brake fluid tank should be unscrewed and the cap removed. The tester is then turned on by the button. The test class can be selected by holding the button down. Once the tester is properly configured, immerse the end of the probes fully in the brake fluid. After about two seconds, the result of the test can be read from the three LEDS which display quality.
A function test can be carried out by dipping the tester in a container holding water. The test procedure for this is the same as when testing brake fluid. The test is satisfactory if all the LEDs light up.

Technical data

- Test classes: DOT 3, DOT 4, DOT 5.1
- Display
  ' 3 LEDs (Quality)
  ' 2 LEDs (Class)
- Power: 1.5 V/AAA
- Impact- and acid-resistant plastic

Order no. LM8314

CAN-LIN MONITOR / HV MEASURING INSTRUMENTS



CAN / LIN MONITOR

The CAN/LIN monitor allows bus protocols on a CAN bus and LIN bus to be recorded, displayed, transmitted and investigated.

Benefits

- Visual display of bus protocol structure
- Option for displaying in binary or hexadecimal code format
- Recording of bus packets
- Transmission of bus packets
- Suitable for student experiments and demonstrations
- Display of identifier, data length, period
- Simple, user-defined interface

Order no. SO2000-2A

HV instrumentation AVL DITEST HV SAFETY 2000

This flexible measurement system permits rapid, safe and simple diagnosis of high-voltage motor vehicles. Here emphasis is on maximum protection of personal safety and the motor vehicle.

Benefits

- Simple to integrate into testing and diagnostic platform
- Adaptable interface: Logging of test procedures and results
- Multimeter up to 1000 V
- Measurement of HV insulation resistance (test voltage up to 1000 V in accordance with SAE J1766)
- Easy to operate even when wearing clothing to protect against high voltage
- Calibration certificate compliant with DIN EN ISO 9002
- Measurement of equipotential bonding with test current max. 1000 mA
- Automatic disabling of test voltage in the event of a fault or physical contact

Order no. LM8258

COMMON RAIL DIAGNOSTIC SETS

HIGH-PRESSURE INJECTORS IN FEED AND RETURN SYSTEMS

The portable diagnostics set allows common rail high-pressure injectors to be tested while the engine is running. All common rail systems in widespread use can be connected to the diagnostics set by means of original connectors. You can measure fuel reflux, pressure and temperature in fuel return line at all times during a diagnosis and can analyse results via the application on the LabSoft course.

Training contents

- Understanding how common rail technology works
- Testing high-pressure injectors in feed and return systems
- Diagnosis and maintenance of engine management systems
- Enhancement of diagnostic skills
- Measurements on common rail systems
- How automatic rail pressure control works

Order no. LM8265

TESTING LOW-PRESSURE CIRCUITS

Pressure readings in the feed and return lines of various systems need to match the manufacturers' specifications. Testing the low-pressure circuit enables faults to be located and rectified. It enables you to detect air bubbles and contamination within the fuel system.

Training contents

- Introduction to common rail low-pressure systems technology
- Diagnosis and maintenance of engine management systems
- Enhancement of diagnostic skills
- How automatic rail pressure control works
- Measurements on common rail systems

Order no. LM8233

VEHICLE DIAGNOSTICS CASE/OBD II BREAK-OUT BOX

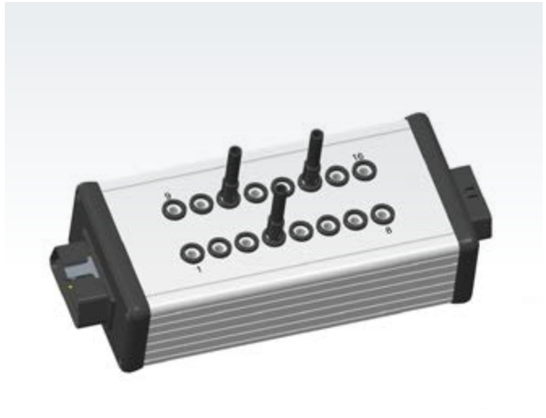
VEHICLE DIAGNOSTICS CASE

This case provides a universal set of contact equipment for all the plug connectors used in vehicles. Reliable contacts for diagnostics and troubleshooting in vehicles allow optimum measurement and test results to be achieved quickly and easily. The case keeps up with all the demands from vehicle manufacturers, vehicle workshops and training establishments.

Benefits

- High-quality, comprehensive service case for diagnostics and troubleshooting in vehicles
- Built-in universal lab multimeter
- Safe contacts for the most important vehicle connecting plugs
- Flexible, heat-resistant adapter leads
- Steel needle-form miniature spring test probes, especially suitable for enclosed plugs

Order no. LM8243



OBD II BREAKOUT BOX

This bundle allows you to analyse the individual terminals of an OBDII or EOBD connection in detail. All the contacts of an OBD plug are accessible via 4-mm terminals. This makes it possible to simply connect all kinds of measuring instruments.

Since the break-out box handles both inputs and outputs, it is possible to measure and analyse data exchanged between the tester and OBD interface in real time.

Benefits

- Usable with any vehicle featuring an OBD II interface
- Usable with any training systems featuring an OBD II interface
- 4-mm measurement socket for every PIN
- Very easy and quick to start using
- No additional software required

Order nos. LM8303 (12V), LM8299 (24V)

VCDS WIFI / INFRA-RED CAMERA FOR VEHICLE DIAGNOSTICS

VCDS WIFI

The new diagnostic interface paves the way for smart workshops of the future. The new HEX-NET diagnostic interface makes it possible to carry out VCDS work in your workshop wirelessly. Simply incorporate the system into the workshop's WiFi network and any computer in the network will be able to access the vehicle.

If you have no WiFi in the workshop or you want to use HEX-NET while you are out on a job, that is also no problem. You can simply configure the HEX-Net device itself as a router by the simple press of a button and any WiFi capable device will be able to access it.

Benefits

- Full version of VCDS diagnostic software
- Usable with or without cables
- Compatible with almost all vehicles made by the Volkswagen-Audi Group (VAG)
- Rugged case with improved plug

Order no. LM8306

Infra-red camera for vehicle diagnostics

This thermal imaging camera allows surface temperatures to be displayed in the form of a real time image. This facilitates diagnostics for such things as engine compartments, brakes, cooling and heating systems. Hot and cold points are coded on a colour display to identify the hottest and coldest temperatures detected. In addition, it is possible to save images to the devices own memory and also to transfer them to computers by means of a USB cable.

Technical data

- Measuring range (optimum): 0.2 – 50 m
- Screen: 3.2" TFT display
- Colour palette: Selectable
- Temperature measurement range: -20 – 300°C
- Measurement precision: ±2°C
- Emission level (adjustable): 0.1 – 10.0
- Device memory: 3 GB
- Image resolution: 220 x 160 pixels
- Image format: JPG
- Power supply: Rechargeable battery

Order no. LM8315

TRAINING WORKSHOP

A good education needs the best theoretical lab as well as a modern training workshop. To meet your own individual needs, we work together with well-respected partners. Simply contact us if you require a custom estimate for the equipping of your workshop.

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