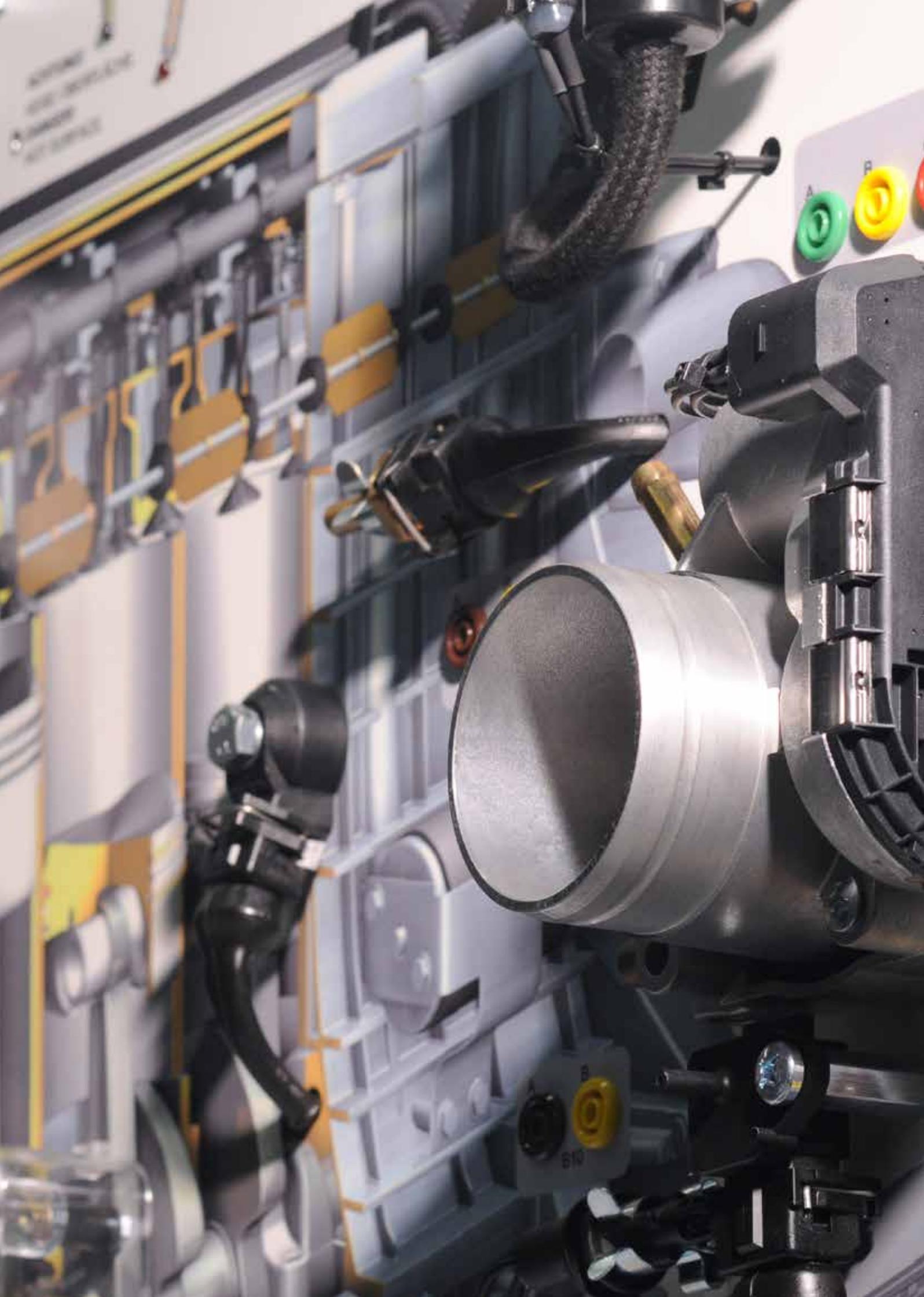


TRAINING SYSTEMS FOR AUTOMOTIVE ENGINEERING

Training in the Automotive Diagnostics Workshop Lab



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MORE THAN A LABORATORY

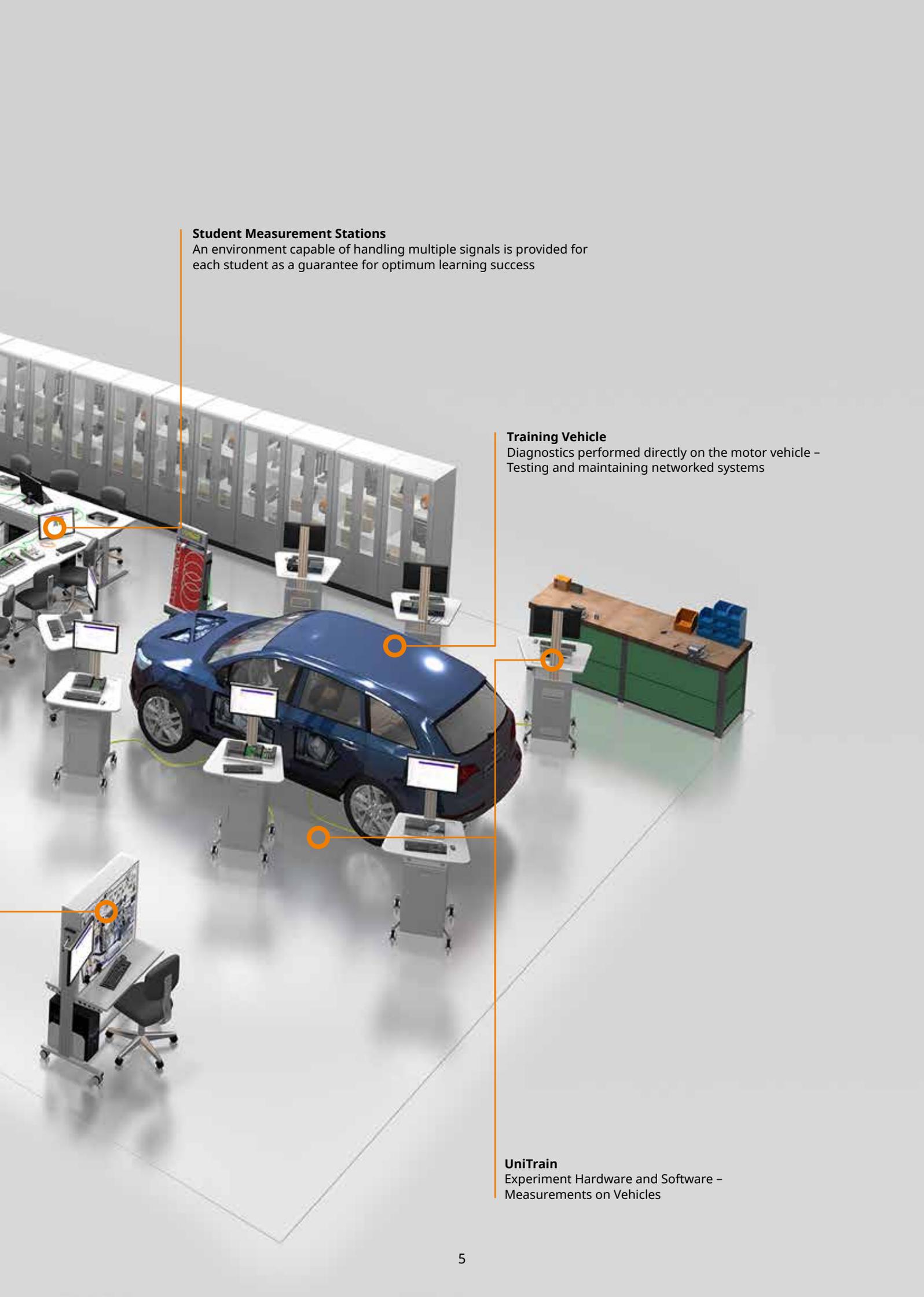
Vivid presentation of complex educational content by means of modern training media

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



Training panel systems
Individual experiment set-ups

CarTrain
Training carried out on real components



Student Measurement Stations

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

Training Vehicle

Diagnostics performed directly on the motor vehicle - Testing and maintaining networked systems

UniTrain

Experiment Hardware and Software - Measurements on Vehicles

PRACTICAL APPROACH TO LEARNING

EXPERIMENT. LEARN. UNDERSTAND.

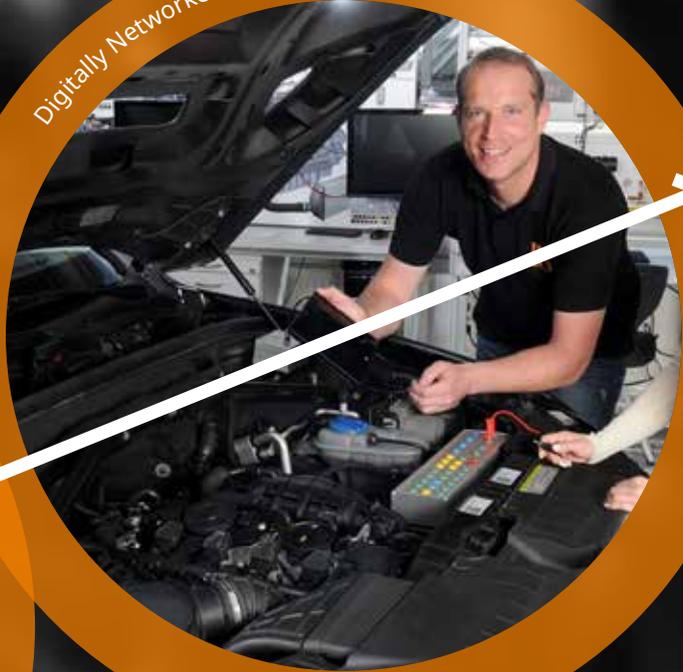
Sometimes theory only makes sense when applied to a practical situation. That is why we adopt a practical approach to learning. The level of adherence to genuine practice can be even greater depending on the system being used. This provides a positive learning experience and makes the whole learning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



CarTrain and Modular Training Systems



Digitally Networked Training Vehicles



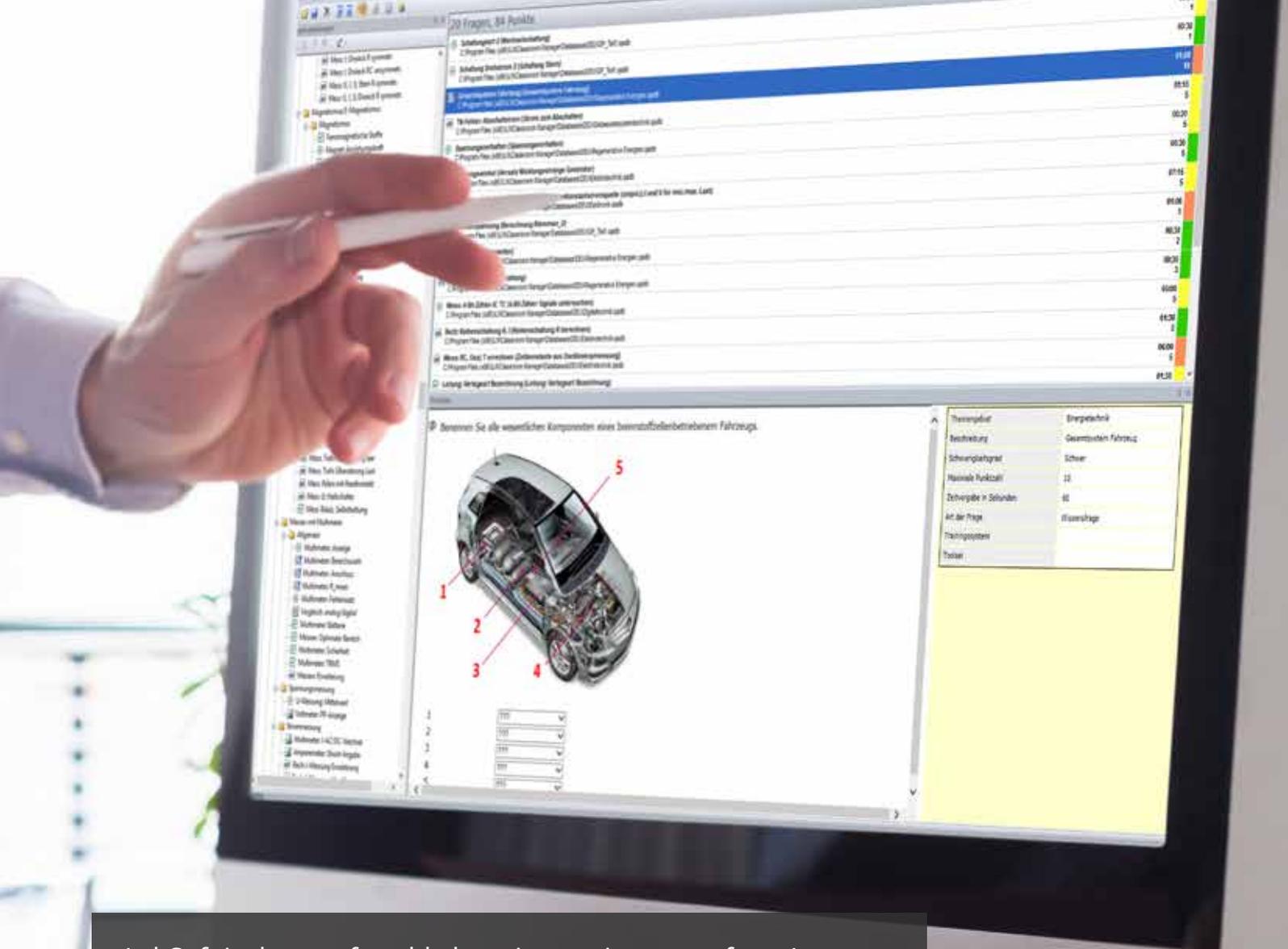
FEATURING INTER- ACTIVE SOFTWARE

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

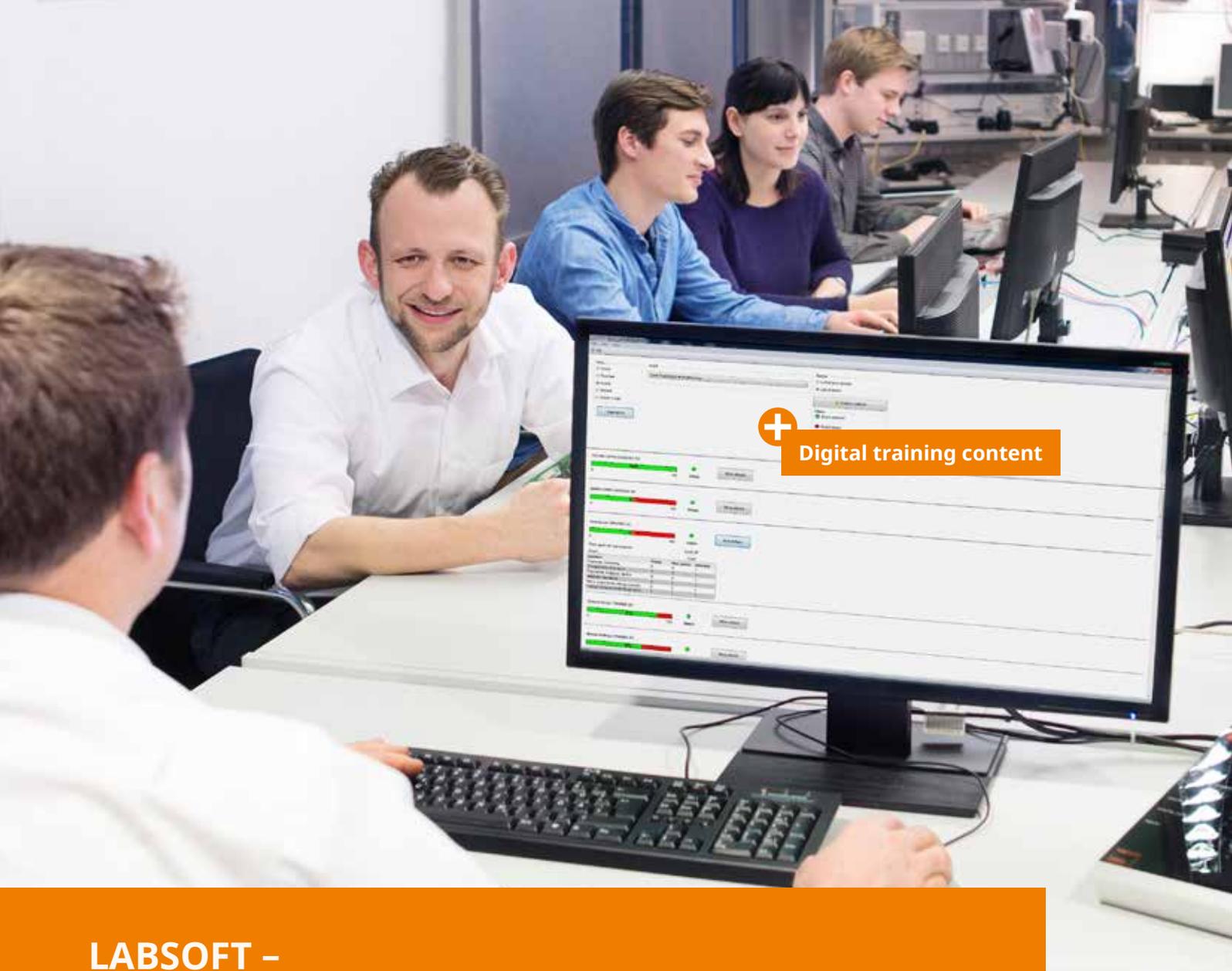


LabSoft is the comfortable learning environment from Lucas-Nülle. Apart from the animated digital presentation of essential content, the software also allows for control of Lucas-Nülle hardware. With the "LabSoft Classroom Manager" we also offer a useful suite of software for designing all aspects of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



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





+ Digital training content

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

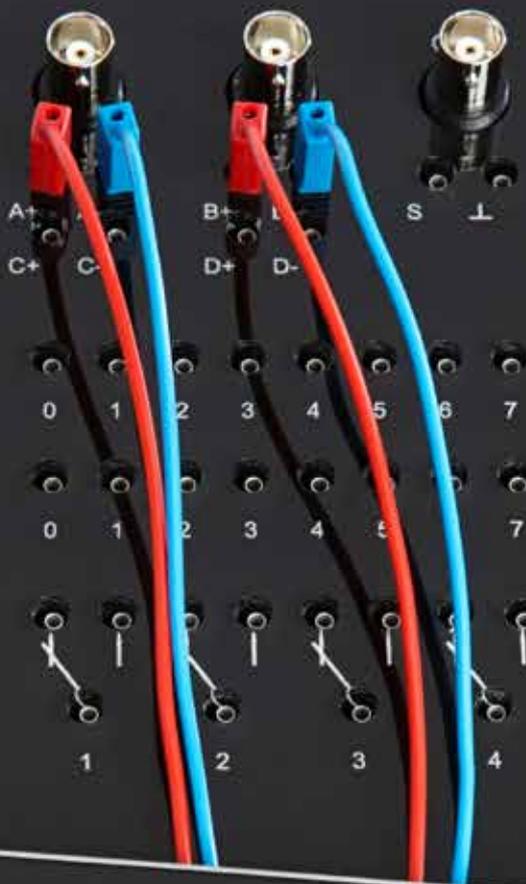


Pages featuring these icons show you that the system is accompanied by a digital LabSoft course

ANALOG IN

CURRENT

E+ E-
F+ F-



DIGITAL IN

DIGITAL OUT

RELAY

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

3-PHASE POWER SUPP... - x

AC VOLTAGE [V] FREQUENCY [Hz]

80.6 85.0

POWER

LUCAS-NÜLLE LabSoft

VOLTMETE... - x

20 V

10.0 V

DC AC

AV RMS

Offnen S
Frequer

Messen Sie die Wicklungsspannung

Lesen Sie die Messwerte von W

Multimeter A: Strangspannung $U_{str} U = 10$ V

Multimeter B: Strangsstrom $I_{str} U = 0,28$ A

Berechnen Sie aus den Messwerten die aufgenommen

11

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



LabSoft Manager



LabSoft Reporter



LabSoft Editor



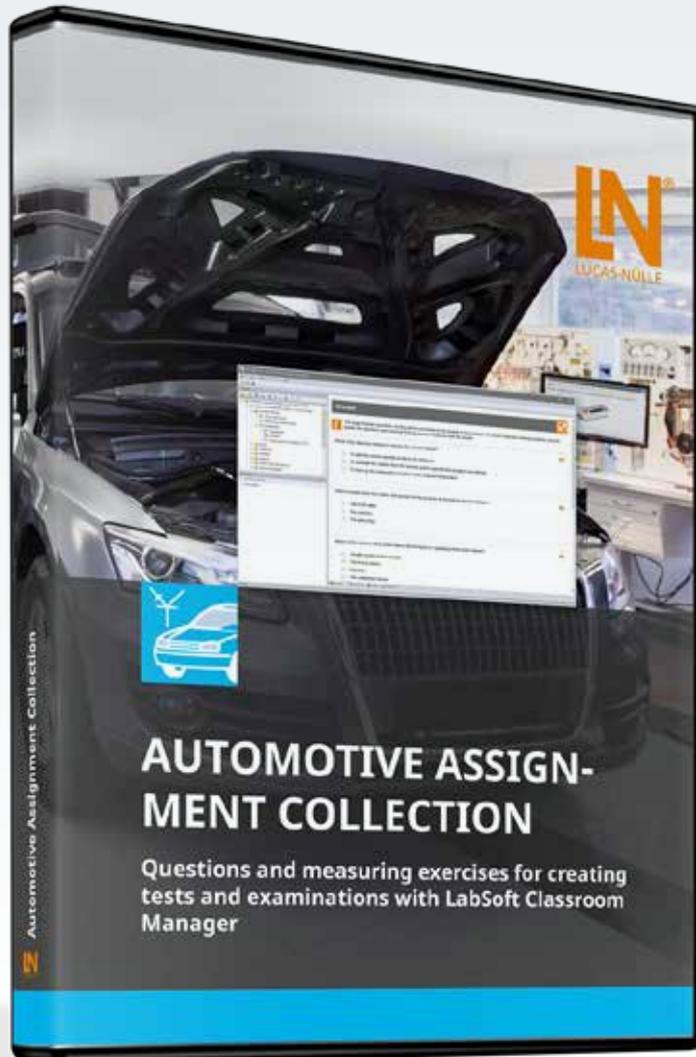
LabSoft Questioner



LabSoft TestCreator

Order no. SO2001-5A

YOUR COLLECTION OF AUTOMOTIVE EXERCISES



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
- You can even enhance the database with questions of your own
- Perfect supplement to Classroom Manager

THE CERTIFICATION PROGRAM FROM THE LN ACADEMY



To create technicians and mechanics for modern automotive engineering

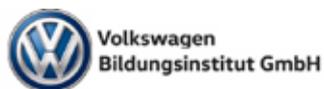
Bring your automotive training up to international levels. This new option from Lucas-Nülle is based on cooperation with leading certification bodies. Incorporating full-scale training laboratories with the certification programs which meet your needs, you can take your training to new levels.

Strong partnerships

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

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 ourselves 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."





- **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



A man with short, dark, curly hair and a mustache is sitting in the driver's seat of a red car. He is wearing a black jacket with orange accents and a logo on the chest, over an orange t-shirt. He has a thoughtful expression, looking slightly to his left with his eyes closed. The background shows the interior of the car, including the steering wheel and dashboard.

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 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 electrical 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

Topic areas 3, 6, 11P, 11N, 11S, 13S

Order no. CO4204-7A

ELECTRONICS AND DIGITAL TECHNOLOGY IN THE MOTOR VEHICLE



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.

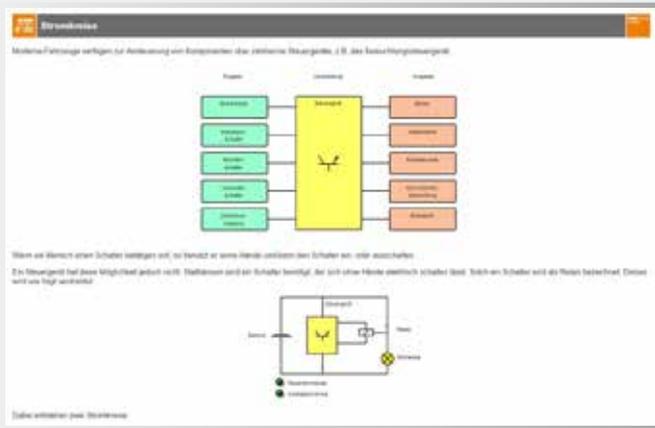
Training contents

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

Topic areas 3, 11P, 11N, 11S, 13S

Order no. SO4204-7B

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
- Automotive PWM applications
- Adjusting the power of electrical loads with PWM
- Measuring a PWM signal's characteristics: frequency, amplitude, mark-to-space ratio
- Pulse width, edges and signal shapes
- Control and operating-current circuits
- Diagnosis of PWM-controlled components

Topic areas 3, 6, 11P, 11N, 11S, 13S

Order no. CO4204-7J, Optional: Netzteil und Scheinwerfer

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 pre-fabricated and can be put into action simply by plugging in a few jumpers. One stand-out feature is the chance to handle instruments 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

Topic areas 3, 6, 8, 11P, 11N, 11S, 13S

Order no. SO4205-1G

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



Bei einem Kurzschluss (Zwischenspannungsbereich) erhöht die Lichtleistung (abhängig von der Betriebsfrequenz) kontinuierlich ab. LEDs können aber sehr gut mit Hoch- & Niederfrequenzen betrieben werden. (Dadurch wird ihre Flexibilität erweitert, die Stromversorgung ist nicht so eng angeschlossen. Verwendbare Arten:

Die Strom-Spannungs-Beziehungen von LEDs unterscheiden sich von anderen normalen Dioden. Die Rückspannung der Halbleiter hängt von der Farbe der LED ab. Die Stromspannung ist in guter Näherung proportional dem Exponentialwert. Die LEDs leuchten jedoch über die gesamte Wellenlänge hinweg, bis zum Ende der Wellenlänge. Die genaue Wellenlänge wird durch den Durchmesser des Halbleiters bestimmt.

Rot	20V
Grün	22V
Blaugrün	24V
Blaulila	26V
Violett	28V
Blau	30V
UV	32V
UV	34V
UV	36V
UV	38V
UV	40V
UV	42V
UV	44V
UV	46V
UV	48V

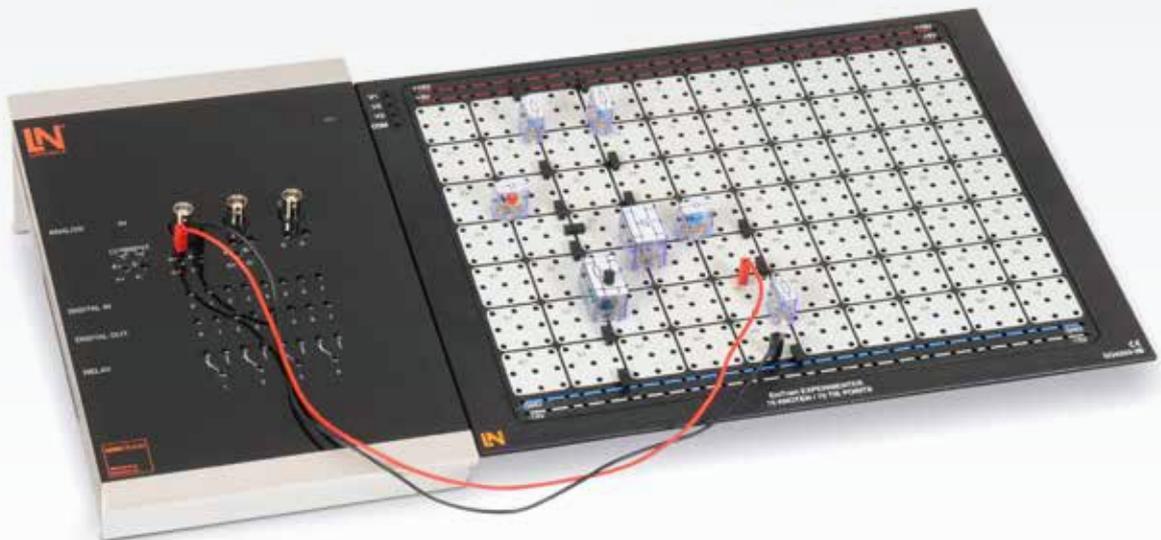
Berechnung des Vorwiderstands einer LED:

Eine LED benötigt in jedem Fall einen Vorwiderstand, damit der Strom, der durch sie fließt, begrenzt wird. Es gibt LEDs die in ihrem Gehäuse den Vorwiderstand integriert haben. Das sind Sonderformen die hier nicht betrachtet werden.

Die meisten LEDs sind als "einfache" Vorwiderstände ausgestattet. Um diesen zu beschreiben, muss man die Querspannung kennen, die die Diode erzeugt. Dem Wert des Vorwiderstands muss die Durchbruchspannung einer der meisten LEDs hinzugefügt werden. Mit diesem Wert kann man dann den Vorwiderstand berechnen:

- Zuerst bestimmt man die Durchbruchspannung von der Versorgungsquelle, setzt sie der Spannung des Vorwiderstands hinzu.
- Beispiel: 12V Netz (Zwischenspannung) - 2V Netz (Zwischenspannung) = 10V Netz (Spannung des Vorwiderstands)
- Man bestimmt nun mittels des Ohmschen Gesetzes die Größe des Vorwiderstands.
- Beispiel: Maximaler Strom = 20mA, Spannung des Vorwiderstands = 10V, Widerstand $R = U/I = 10V/0,02A = 500\ \Omega$

Man benötigt aber bei einer Versorgungsquelle von 12V Netz und einem maximalen Strom von 20mA einen Vorwiderstand von mindestens 500 Ohm.



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 authentic practice. Rugged components and safety extra-low voltage ensure that learning is safe.

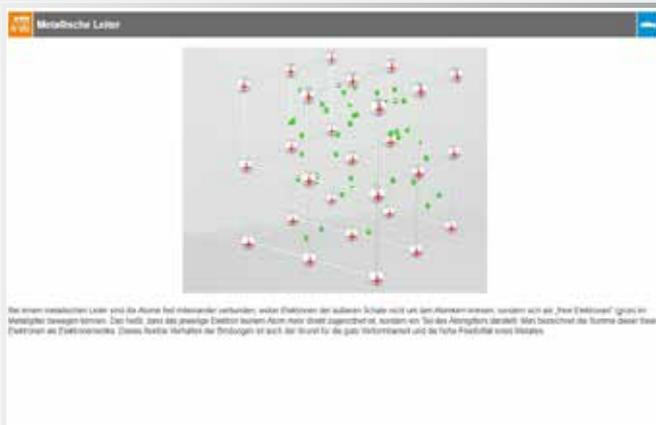
Training contents

- 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

Topic areas 3, 6, 11P, 11N, 12S, 13S

Order no. SO4206-1J

... 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 multi-functional power supply with built-in function generator and a 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

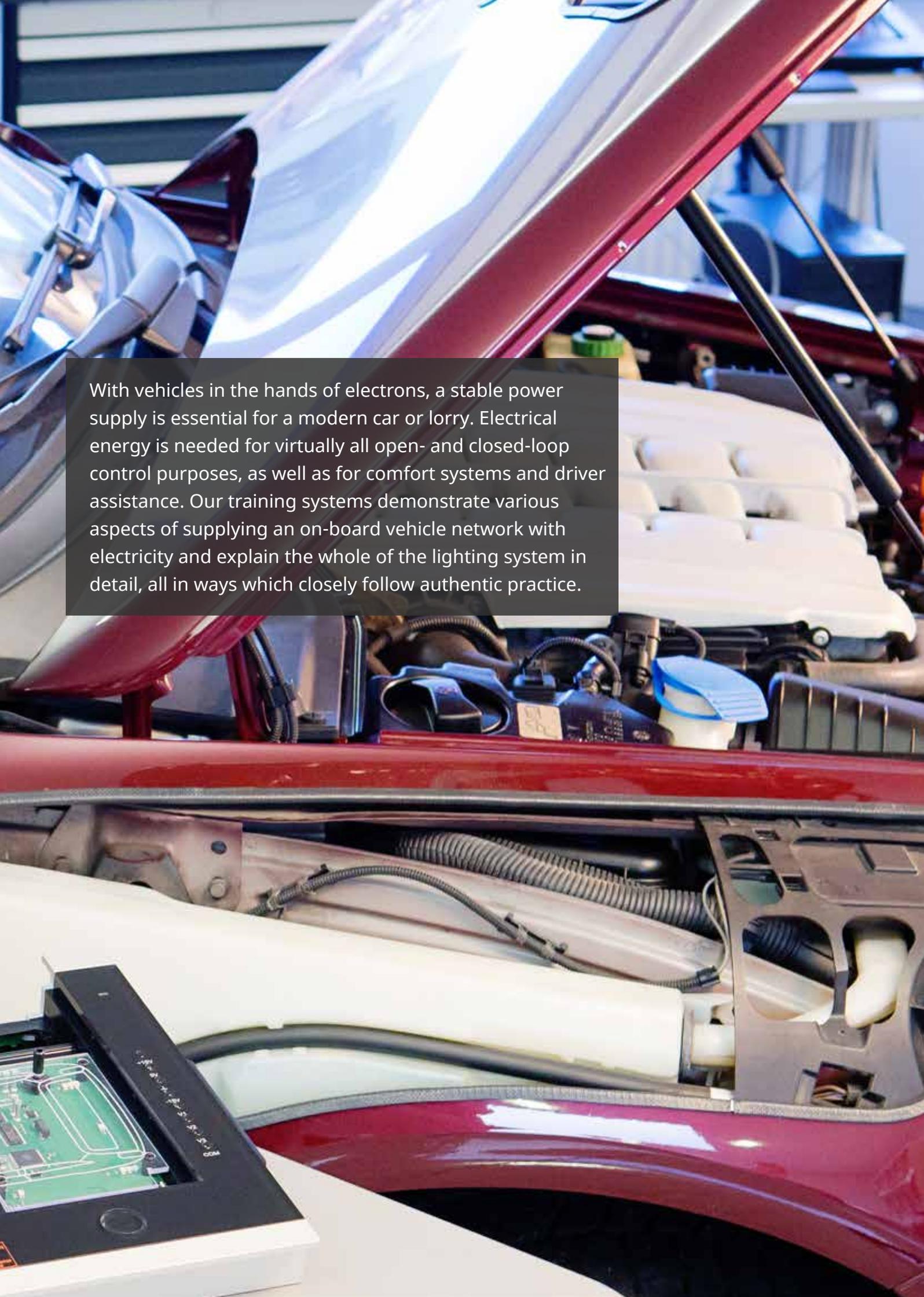
Topic areas 3, 6, 11P, 11N, 12S, 13S

Order no. ATF 4

GENERAL ELECTRICAL SYSTEMS IN VEHICLES

1. Stellen Sie sicher, dass die Tür geschlossen ist.
2. Zeichnen Sie den CAN-Busplan mit dem CAN-Monitor im Modul "COLLECT" auf.
3. Verfahren Sie jetzt die Fensterscheibe mit dem entsprechenden Taster auf der Karte "Fahrzeug/IOA" einige Male. Beobachten Sie dabei den entsprechenden Datenwert im CAN-Monitor.
4. Sobald Sie den Taster betätigen, verändern sich einige CAN-Nachrichten. Eine davon ist Ihnen schon aus dem Experiment "Adressen der Busknoten" bekannt. Konzentrieren Sie sich auf die Nachricht mit dem ID 181.
5. Füllen Sie Felder in der Versuchsauswertung aus.
6. Öffnen Sie jetzt das virtuelle Instrument "digital output display" -> "Digital" -> "Ausgänge" und schauen Sie sich an, wie der hexadezimale Wert der CAN-Nachricht mit dem ID 181 als Binärfolge dargestellt wird.
7. Stellen Sie statt der 0x10 und der 0x40 mal die Werte 0x00 bzw. 0x80 ein und schauen Sie sich die entsprechende Binärfolge im digital output display an.
8. Senden Sie diese beiden Werte (bei angelegter Tür) mit dem CAN-Monitor. Dazu müssen die Einstellungen wie folgt aussehen:

ID	TYPE	DATA	STATUS
0	298	0	FF
1	298	0	FF
2	298	0	FF
3	298	0	FF
4	298	0	FF
5	298	0	FF
6	298	0	FF
7	298	0	FF
8	298	0	FF
9	298	0	FF
10	298	0	FF
11	298	0	FF
12	298	0	FF
13	298	0	FF
14	298	0	FF
15	298	0	FF
16	298	0	FF
17	298	0	FF
18	298	0	FF
19	298	0	FF
20	298	0	FF
21	298	0	FF
22	298	0	FF
23	298	0	FF
24	298	0	FF
25	298	0	FF
26	298	0	FF
27	298	0	FF
28	298	0	FF
29	298	0	FF
30	298	0	FF
31	298	0	FF
32	298	0	FF
33	298	0	FF
34	298	0	FF
35	298	0	FF
36	298	0	FF
37	298	0	FF
38	298	0	FF
39	298	0	FF
40	298	0	FF
41	298	0	FF
42	298	0	FF
43	298	0	FF
44	298	0	FF
45	298	0	FF
46	298	0	FF
47	298	0	FF
48	298	0	FF
49	298	0	FF
50	298	0	FF
51	298	0	FF
52	298	0	FF
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86	298	0	FF
87	298	0	FF
88	298	0	FF
89	298	0	FF
90	298	0	FF
91	298	0	FF
92	298	0	FF
93	298	0	FF
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95	298	0	FF
96	298	0	FF
97	298	0	FF
98	298	0	FF
99	298	0	FF

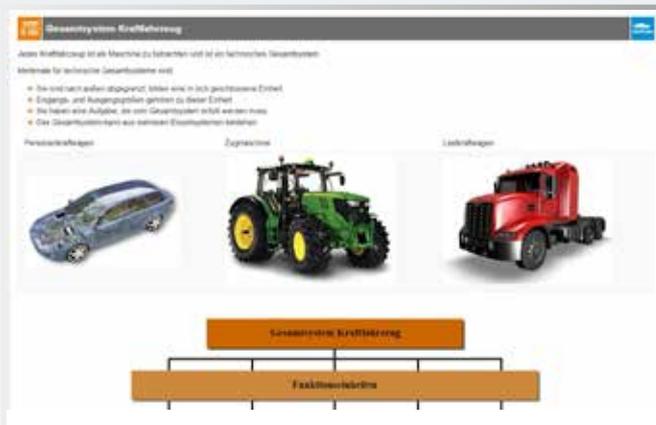
A close-up photograph of a red car's engine bay with the hood open. The engine is partially visible, along with various components like the battery and fluid reservoirs. In the foreground, a black electronic control unit (ECU) is shown, featuring a green printed circuit board (PCB) with various electronic components. The car's body is a vibrant red color, and the background is slightly blurred, suggesting an indoor setting like a workshop or training facility.

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 purposes, as well as for comfort systems and driver assistance. Our training systems demonstrate various aspects of supplying an on-board vehicle network with electricity and explain the whole of the lighting system in detail, all in ways which closely follow authentic practice.

BATTERY DIAGNOSTICS TRAINING SYSTEM



including troubleshooting



UNITRAIN
SYSTEM

Batteries used in vehicles may be subjected to extreme operating conditions. Different vehicles use a wide variety of batteries. Our battery diagnostics training system can reproducibly simulate a variety of internal resistances and voltages for safe diagnosis. Particular focus is given to AGM batteries in addition to conventional lead-acid types.

Training contents

- Safe working with car batteries
- Key characteristics of car batteries
- Types of car battery
- Fundamentals of voltage generation
- Chemical processes in lead-acid batteries
- Vehicle maintenance/battery testing
- Measurements on a battery
- Use of battery testing equipment
- Troubleshooting batteries

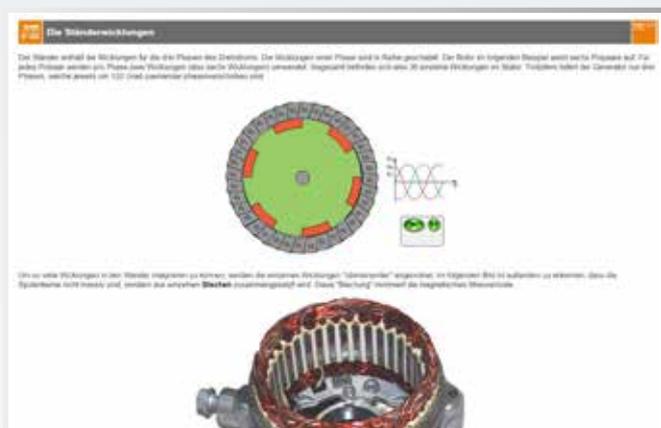
Topic areas 1, 2, 3, 5, 6, 7, 11S

Order no. C03221-9C

THREE-PHASE ALTERNATORS



including troubleshooting



UNITRAIN
SYSTEM

Virtually all modern motor vehicles are equipped with a three-phase generator 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
- Regulated three-phase alternator/generator
- Fault diagnosis
- Accident prevention

Topic areas 3, 6

Order no. CO4204-7D

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 revs and with any loading. The role of the average excitation current is 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 exciter diodes
- Investigating the exciter current
- Fault diagnosis in the system

Topic areas 3, 6

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 Z-diodes
- Battery monitoring (sensing)
- Preliminary control using pulse-width modulation
- Fault diagnosis in the system

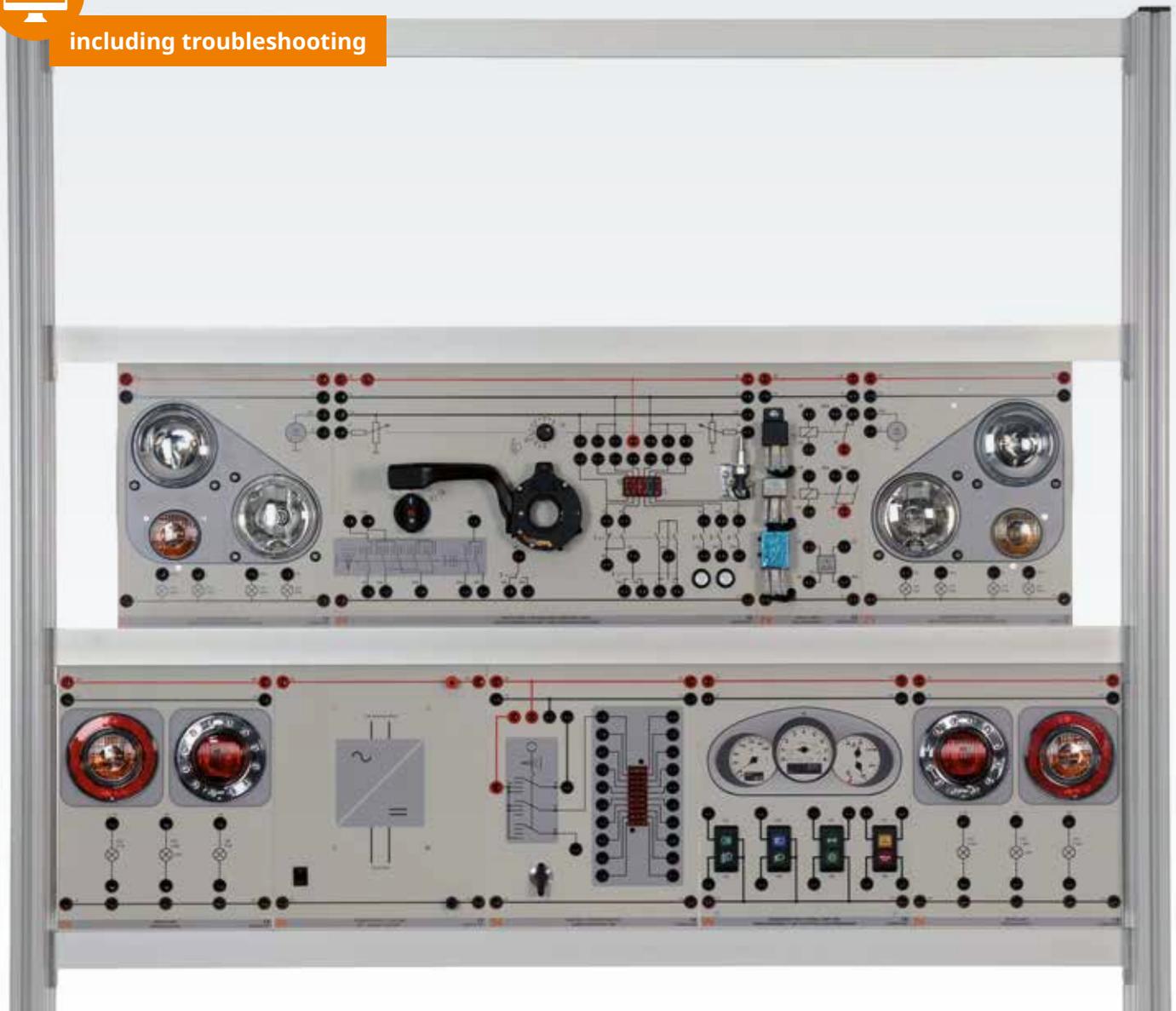
Topic areas 3, 6

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 wall. Combine other modules together to provide clear and easy understanding of a highly complex lighting system.

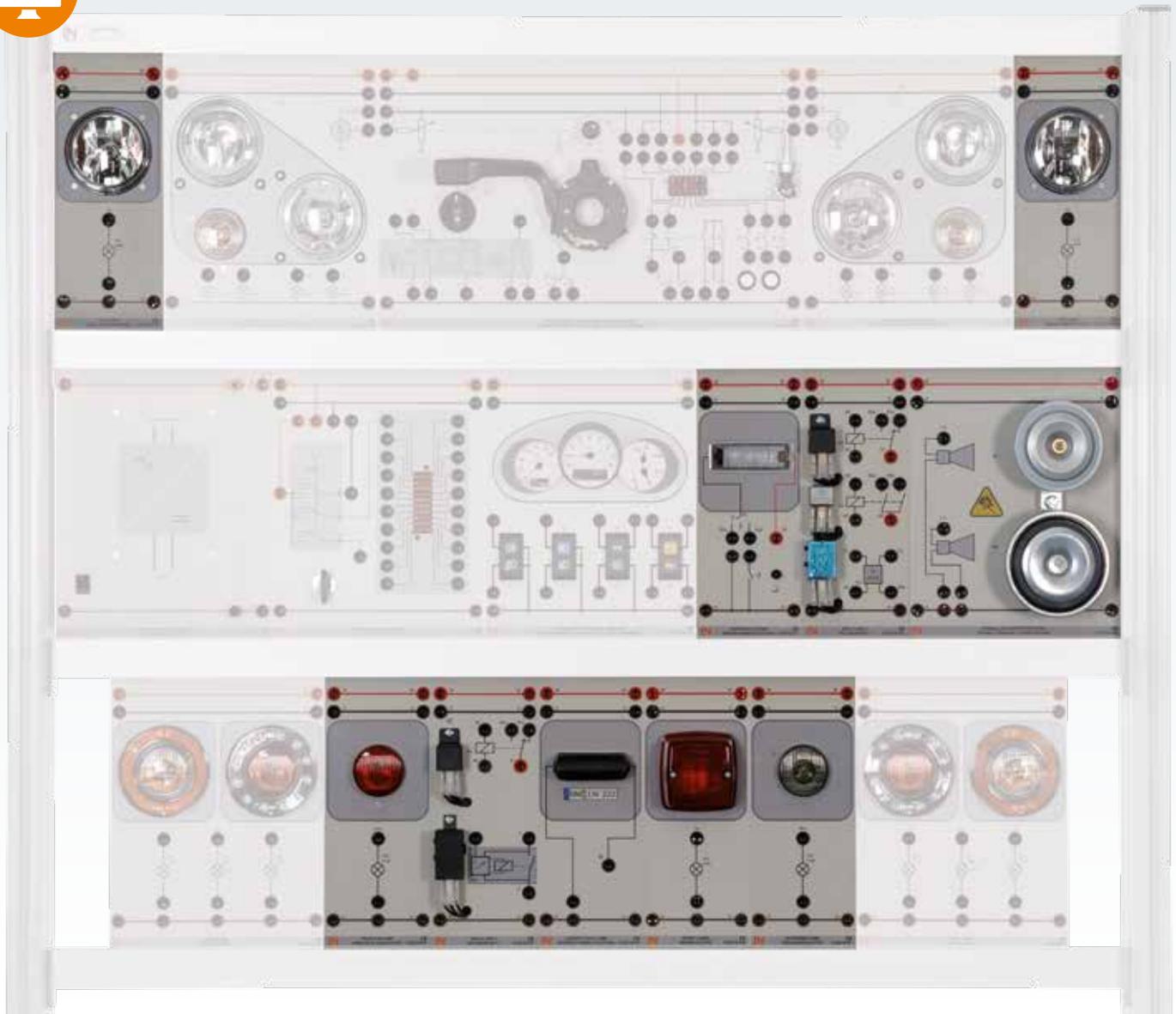
Training contents

- Learn to distinguish between control and load circuit
- Practice protecting circuits with fuses
- Learn to use electronic relays
- Investigate how the manual headlight range adjustment works
- Record measurement values and document faults

Topic areas 1, 3, 4, 6, 9, 11P, 12P, 13P, 11N, 12N, 14N, 11S, 12S, 14S

Order no. ALC 1.1

SUPPLEMENTARY SET "SUPPLEMENT TO BASIC LIGHTING INCLUDING HORN"



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

Training contents

- Learn to distinguish between control and load circuit
- Practice protecting circuits with fuses
- Learn to use electronic relays
- Addition of extra lights
- Recording measurement values and documenting faults

Topic areas 1, 3, 4, 6, 9, 11P, 12P, 13P, 11N, 12N, 14N, 11S, 12S, 14S

Order no. ALC 1.1

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.

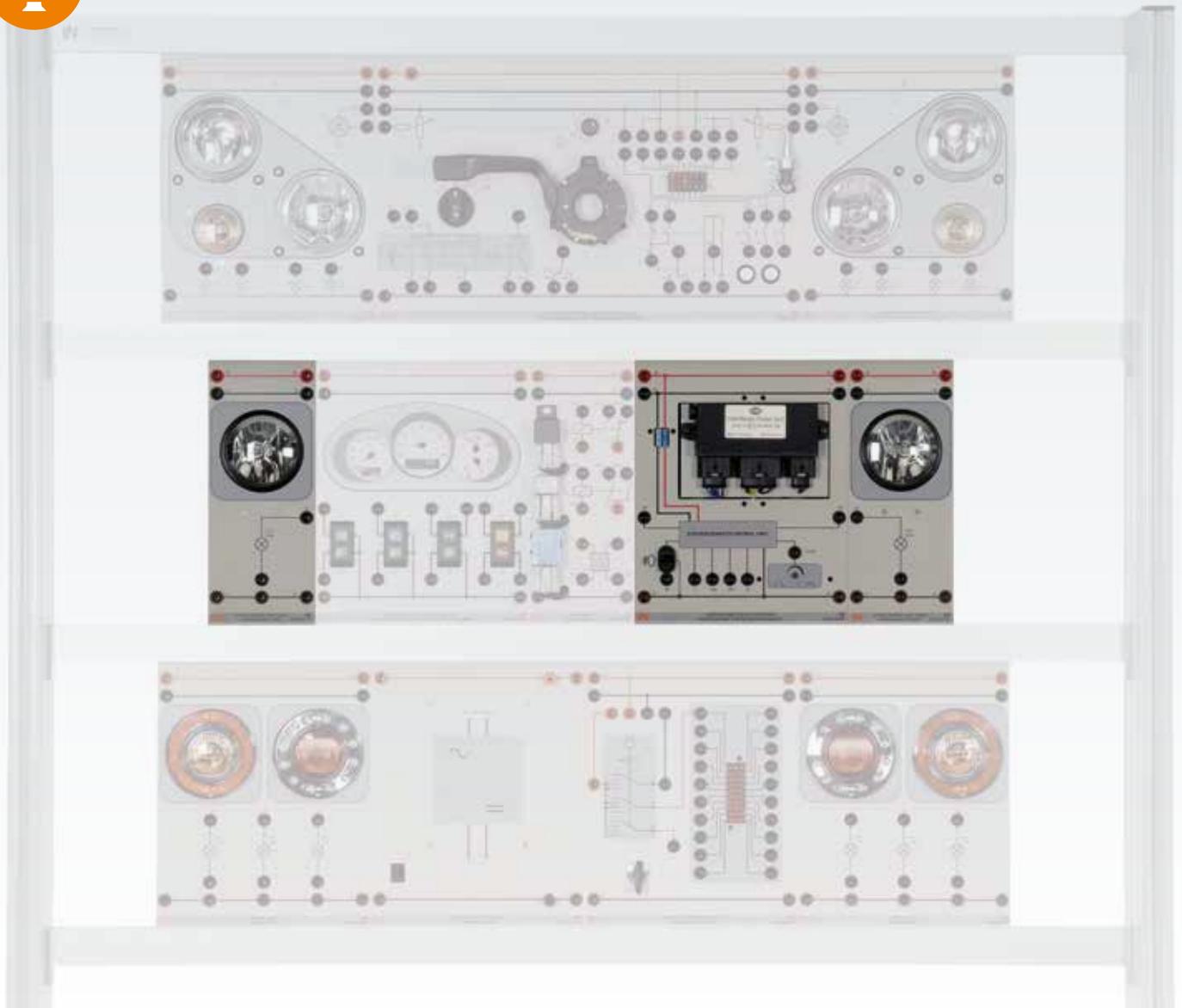
Training contents

- Set-up and configuration of supplementary components and systems according to manufacturers' stipulations
- Addition of extra lighting
- Become familiar with local road traffic regulations
- Working with circuit diagrams
- Record measured values and perform troubleshooting
- Trailer socket and plug assignments

Topic areas 1, 3, 4, 6, 9, 11P, 12P, 13P, 11N, 12N, 14N, 11S, 12S, 14S

Order no. ALC 1.3 (Supplement to ALC 1.1)

SUPPLEMENTARY SET “STATIC CORNERING LIGHTS”



Static cornering lights are an enhancement to vehicle lighting systems which includes 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.

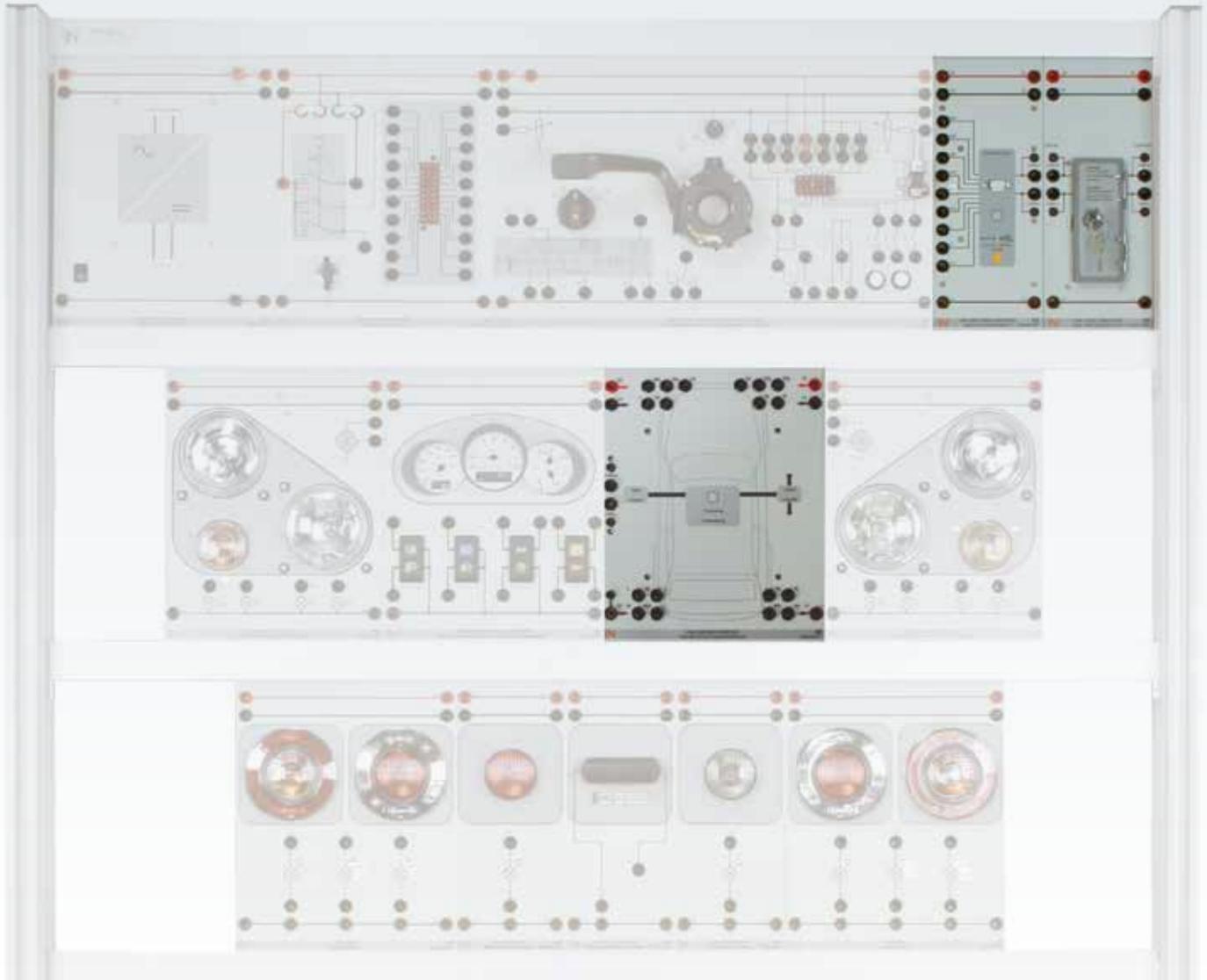
Training contents

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

Topic areas 1, 3, 4, 6, 9, 11P, 12P, 13P, 11N, 12N, 14N, 11S, 12S, 14S

Order no. ALC 1.4 (Supplement to ALC 1.1)

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.

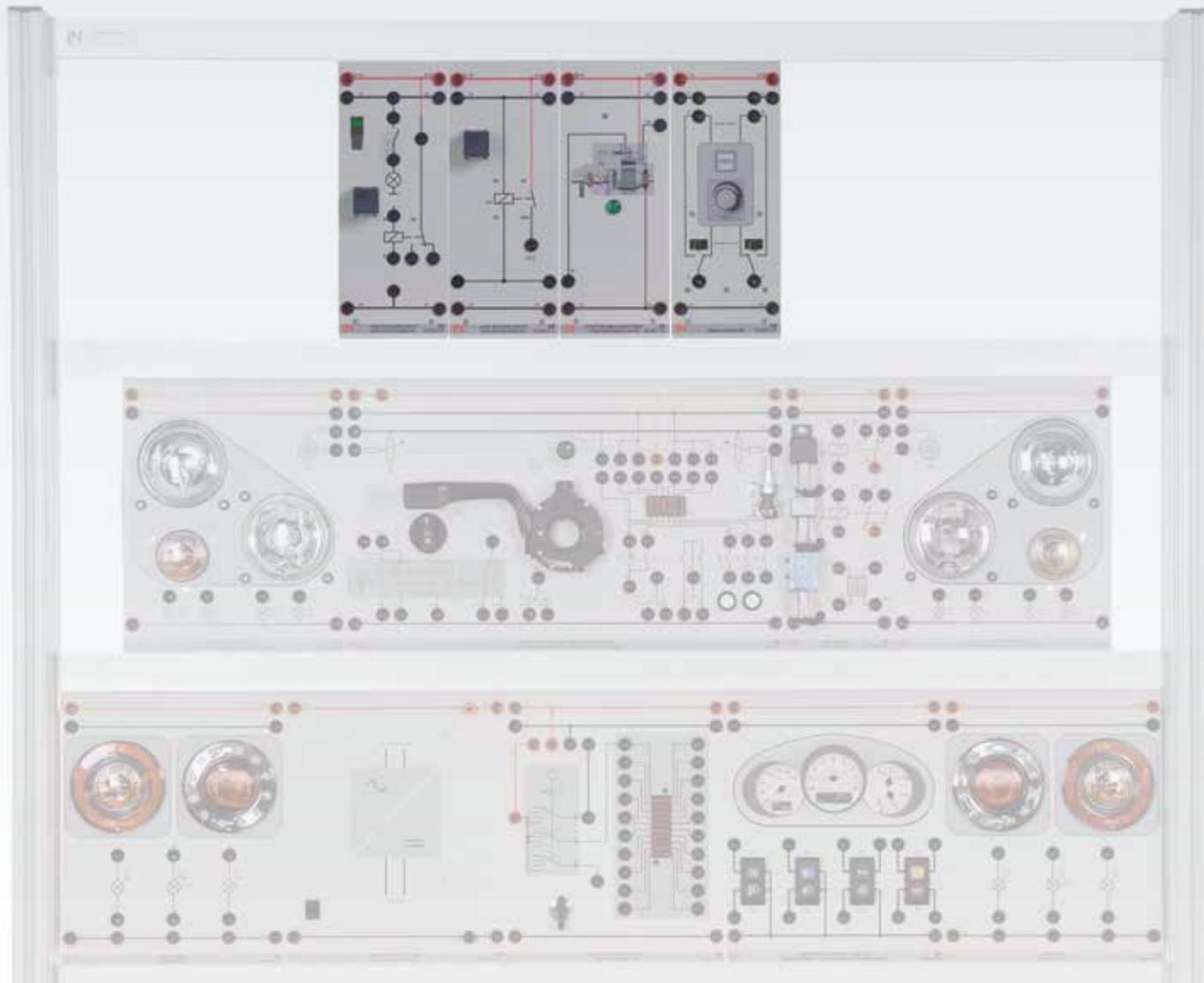
Training contents

- 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 the CAN bus and analysis of Baud rate

Topic areas 1, 3, 4, 6, 9, 11P, 12P, 13P, 11N, 12N, 14N, 11S, 12S, 14S

Order no. ALC 1.6 (Supplement to ALC 1.1)

SUPPLEMENTARY SET "ON-BOARD NETWORK"



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

Relieving on-board networks of work, 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 the load the on-board power supply during ignition
- Design of relay circuits
- Understanding starter connections and how the internal starter circuitry works

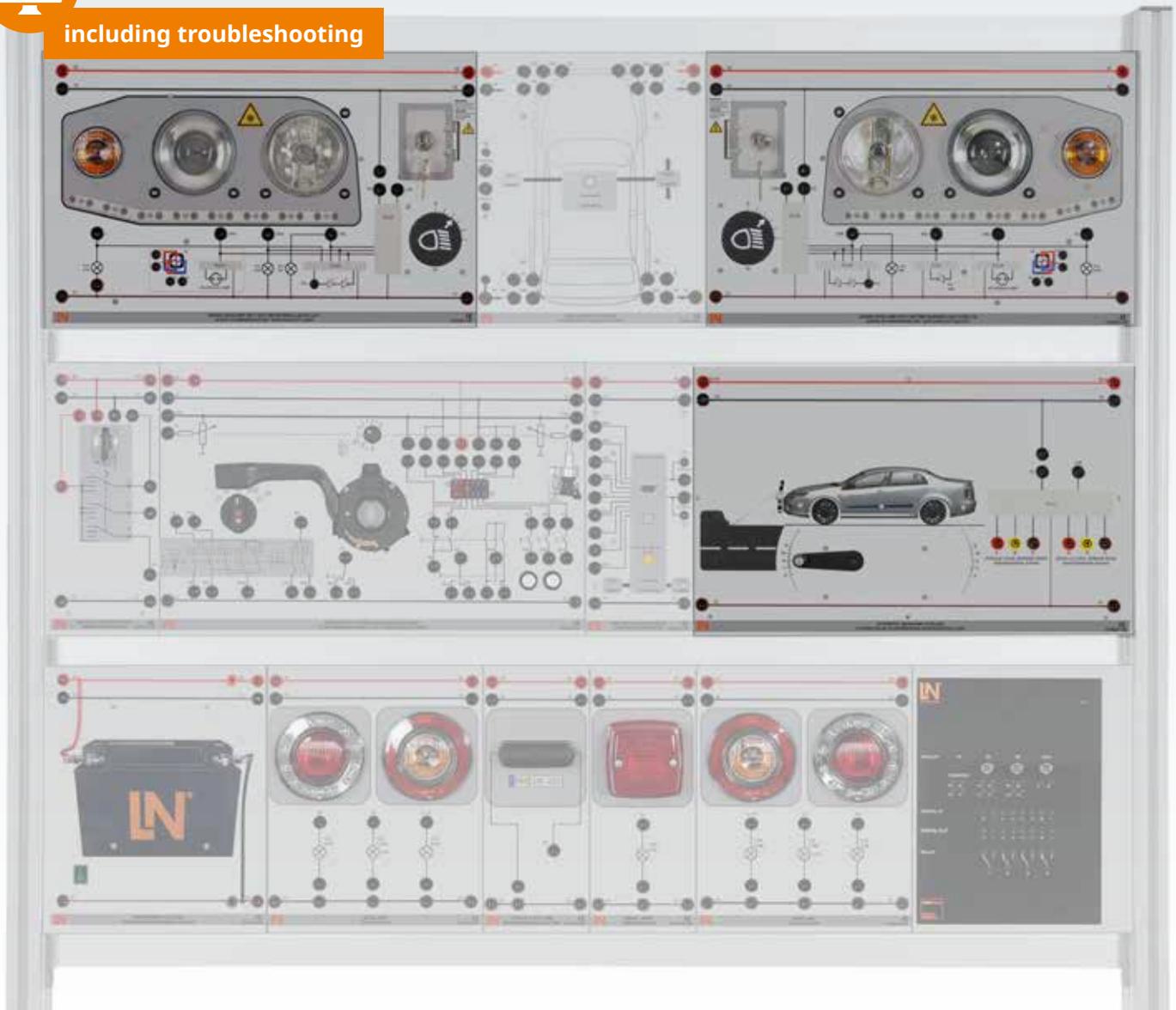
Topic areas 1, 3, 4, 6, 9, 11P, 12P, 13P, 11N, 12N, 14N, 11S, 12S, 14S

Order no. ALC 1.7 (Supplement to ALC 1.1)

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

Topic areas 1, 3, 4, 6, 9, 11P, 12P, 13P, 11N, 12N, 14N, 11S, 12S, 14S

Order no. ALC 1.8 (Supplement to ALC 1.6)

CAN/LIN COMPONENT MODULE (MQB)



including troubleshooting



Carry out practical experiments using original components from a Volkswagen Golf 7, which is based on VW's MQB modular cross-component kits. This model for networked systems deals not only with the topics of actual CAN gateways but also covers the full electronic system for a steering column and includes fully functioning front doors with comfort controls.

Along with the model there are more than 20 different simulated faults which can be activated as the situation requires. An OBD connection makes it possible to carry out full diagnostics. All the key electrical signals can be accessed directly via 4-mm sockets.

Benefits

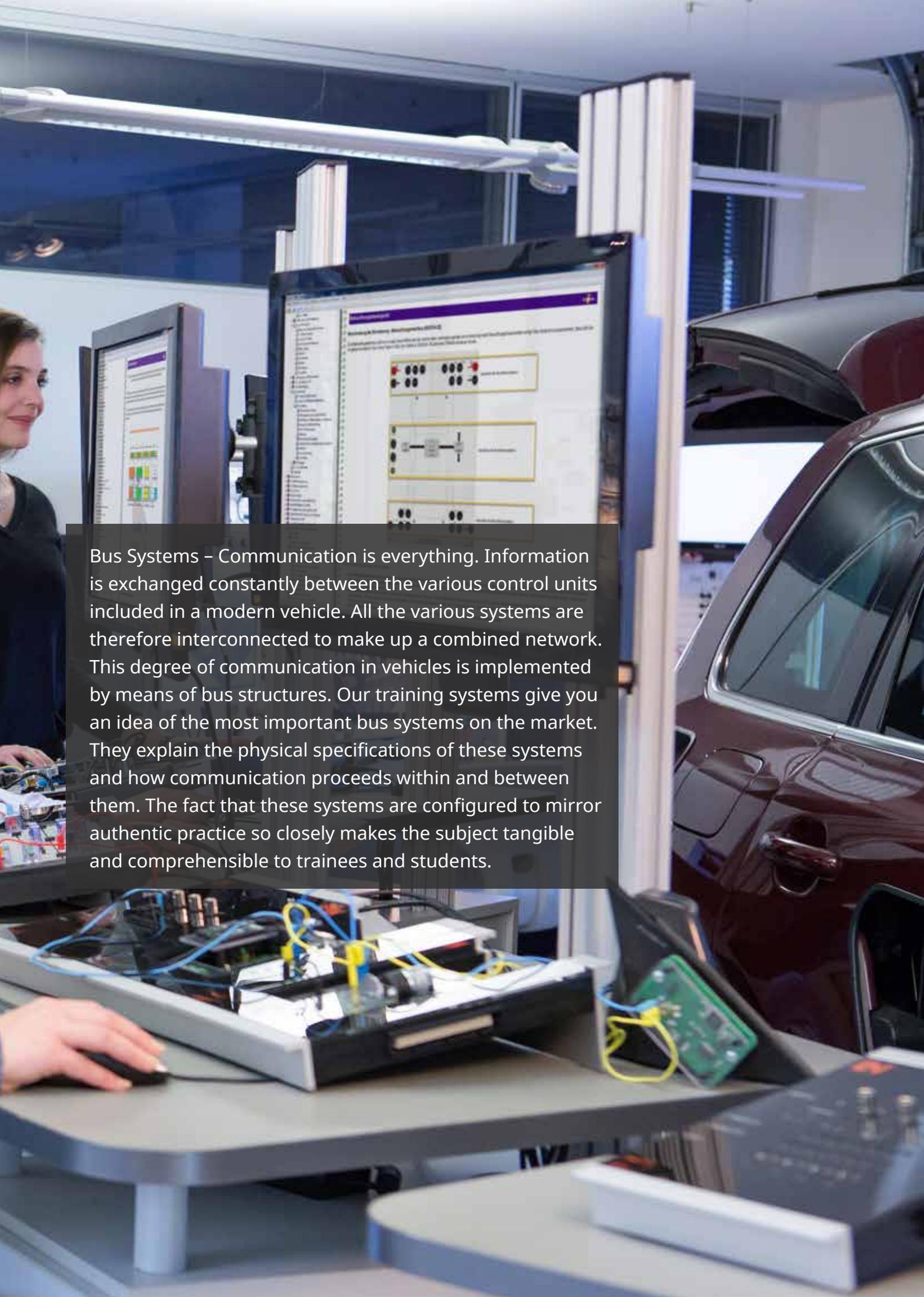
- Original components from the vehicle manufacturer
- Concept of digital networking (CAN/LIN buses)
- Twenty different simulated faults can be activated
- Break-out box with 4-mm measurement points
- OBD diagnostics
- Optional: Dynamic static cornering lights and MOST bus

Topic areas 2, 3, 6, 9, 11P, 12P, 12N, 11S, 14S

Order no. S03240-1R

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 motor vehicles incorporate numerous electronic control units which communicate with each other continually via digital bus systems. Use of a CAN bus is as common in construction and agricultural machines as it is in cars and commercial vehicles.

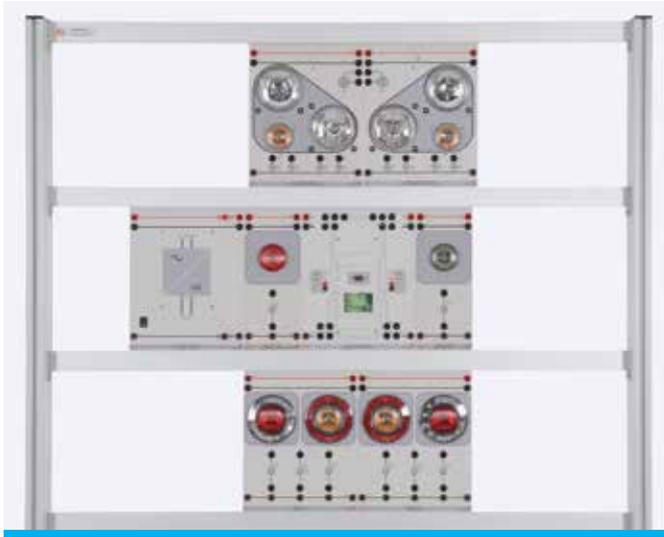
This training system thus conveys important information in a very realistic manner. Trainees start by learning the fundamentals of how communication is handled before using the fault simulation capability for an introduction to diagnosing such systems.

Training contents

- Rationale for using bus systems in motor vehicles
- Topology and components of a CAN bus system in a motor vehicle
- Differences between low-speed and high-speed CAN
- Electrical properties of a CAN bus
- Data rate, identifier, addressing and arbitration (low-speed and high-speed CAN)
- Design of a CAN message's frame
- Analysing CAN messages with a CAN monitor and oscilloscope
- Editing and sending CAN messages via a PC
- Troubleshooting

Topic areas 3, 4, 11P, 13P, 11N, 11S, 14S

Order no. CO4204-7K



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.

Topic areas 3, 4, 11P, 13P, 11N, 11S, 14S

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.

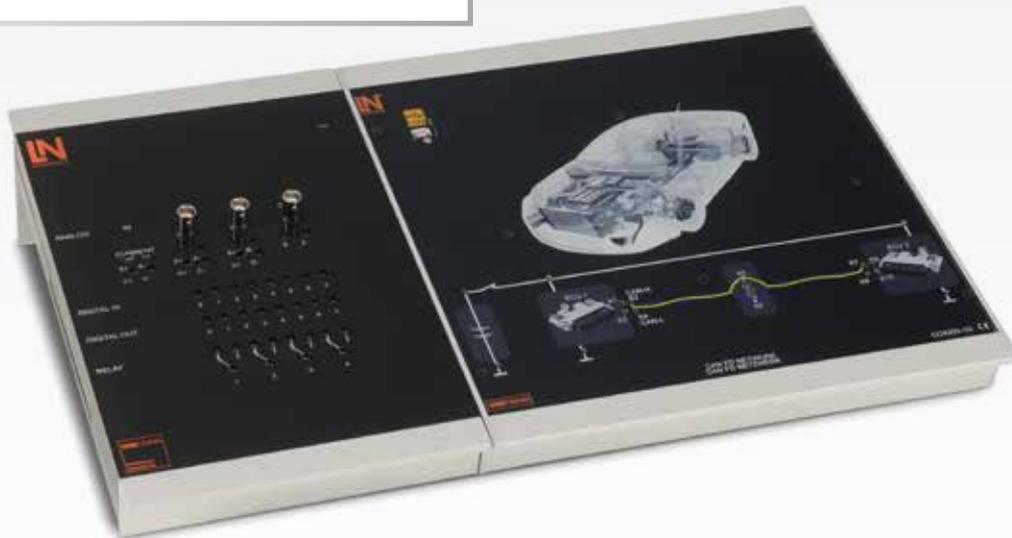
Topic areas 3, 4, 11P, 13P, 11N, 11S, 14S

Order no. SO3216-2Y

CAN FD



including troubleshooting



UNITRAIN SYSTEM

From small goods to heavy good 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 new a version of the bus, known as CAN FD (flexible data rate), which is already appearing in production-line vehicles.

This UniTrain course explains in an easily understandable way exactly what the key features of this innovation are. Trainees can learn efficient diagnostic techniques in the course of countless experiments. They can put their own CAN FD network into operation and carry out all kinds of measurements and diagnostic work in it.

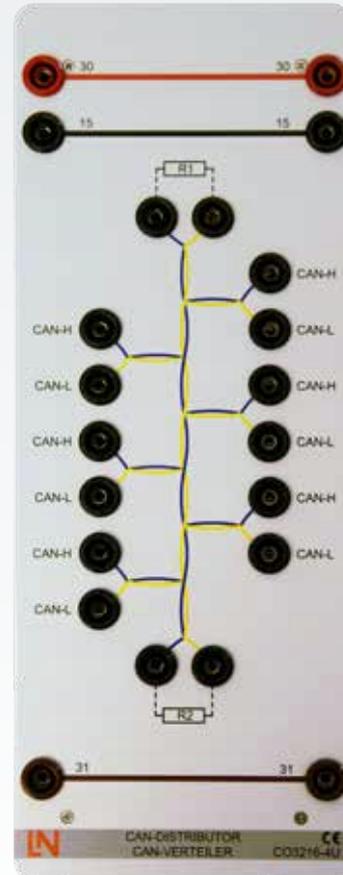
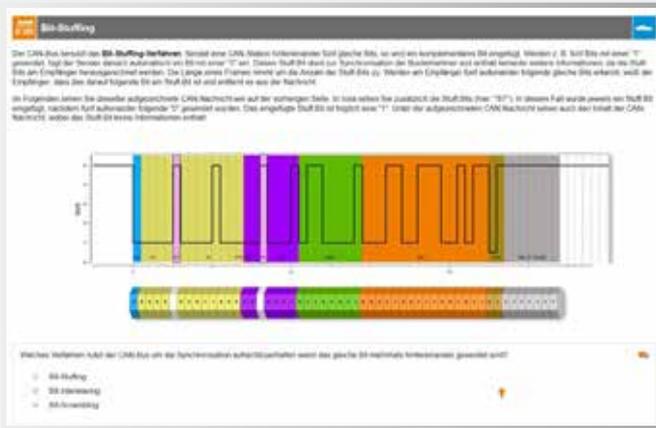
Training contents

- Key features of CAN FD bus systems
- Diagnostics as carried out at vehicle servicing workshops
- Measurements on an authentic CAN FD network
- Diagnostic software for reading out data from a CAN FD bus
- Selection of different pre-configured data rates

Topic areas 3, 4, 11P, 13P, 11N, 11S, 14S

Order no. CO4205-1S

CAN BUS IN CARS, AGRICULTURAL MACHINERY AND COMMERCIAL VEHICLES



This course goes into greater detail on the subject of CAN buses. The course assists trainees in putting together their own CAN network. By means of a CAN distribution point, a complex network can be put into operation in rapid time.

The accompanying control system for the individual CAN nodes can also be put into action by entire groups of students, since the educational concept is designed to support group working. The system can be supplemented by addition of various lighting components

Training contents

- Structure of a CAN network
- Putting a system into action with the help of a CAN distribution module
- Control of CAN nodes
- Transmitting and receiving messages
- Group work (involving up to 4 teams)

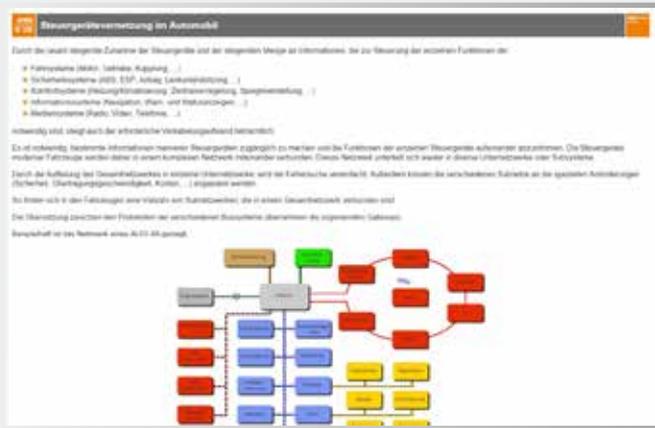
Topic areas 3, 4, 11P, 13P, 11N, 11S, 14S

Order no. ATS 2

LIN BUS



including troubleshooting



UNITRAIN SYSTEM

LIN bus systems are used in addition to CAN buses, mainly for comfort systems which are not relevant to safety. With this training system, trainees can not only get to know the possibilities of using such a bus but also where its limitations lie. They can examine the bus protocol and learn to perform systematic troubleshooting.

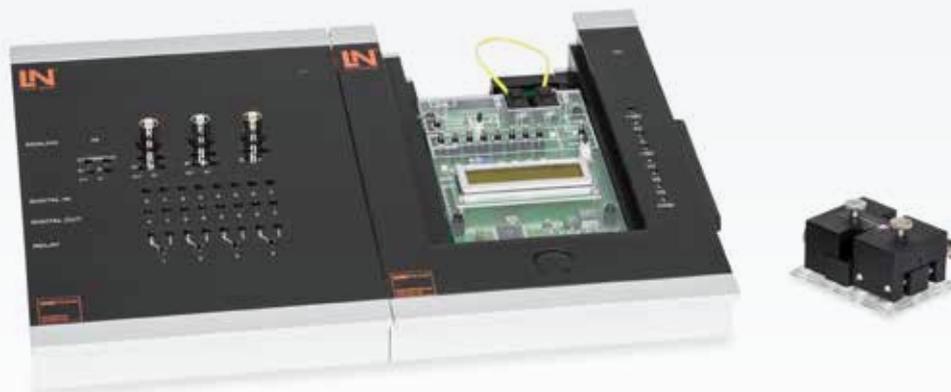
Training contents

- Development of bus systems in motor vehicles
- Topology and components of a LIN bus system
- Electrical properties of a LIN bus
- Addressing of a LIN bus
- Master/slave principle
- Measurement tests of data fields
- Message frame structure
- Analysis of LIN messages
- Editing and sending LIN messages
- Troubleshooting

Topic areas 3, 11P, 11N, 11S, 14S

Order no. SO4204-7E

MOST BUS



UNITRAIN SYSTEM

At present, optical bus systems are used mainly to achieve high data transmission rates in luxury vehicles. However, since the amount of data handled by all kinds of vehicles is on the increase, such systems are finding more and more widespread use.

Therefore trainees of today will frequently find themselves confronted with such systems in the course of their careers. Our training system covers the subject matter of their fundamental physical principles as well as teaching practical diagnostic techniques.

Training contents

- Data networks in motor vehicles
- Rationale for using optical fibres in automotive applications
- Fundamentals of a MOST bus
- MOST protocol and control units
- Ring breakage diagnosis
- Design of optical fibres in motor vehicles
- Optical bus systems in motor vehicles
- Fundamentals of ray optics (refraction, reflection)
- Attenuation by optical fibres
- Data transmission and optical measurements

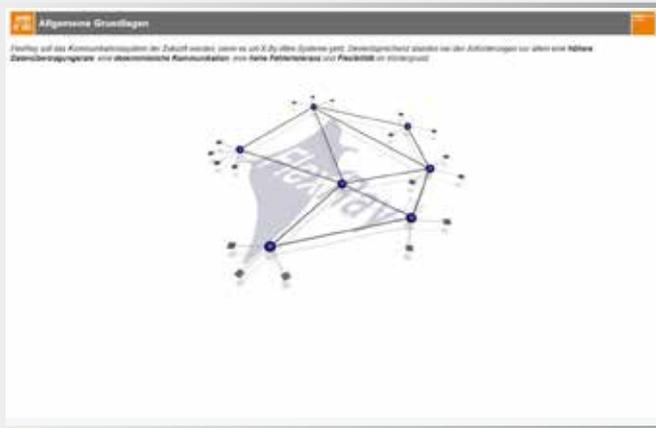
Topic areas 3, 11P, 11N, 11S, 14S

Order no. SO4204-7H

FLEXRAY



including troubleshooting



UNITRAIN SYSTEM

With the increase in the use of electronics in vehicles comes the ever-growing complexity of networks. This applies to sensors, actuators and control units as well as to entertainment and navigation systems.

FlexRay is probably the most important communications system used by electrical installations in vehicles. 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 motor vehicles
- How the FlexRay bus system works
- Communication between components by means of FlexRay
- Data exchange in a FlexRay network
- Practical applications of the FlexRay protocol
- Identification of typical errors and their verification using measurement techniques
- Learning about the function and operation of steer-by-wire technology

Topic areas 3, 11P, 11N, 11S, 14S

Order no. SO4204-6Y

CAN/LIN COMPONENT MODULE (MQB)



including troubleshooting



Carry out practical experiments using original components from a Volkswagen Golf 7, which is based on VW's MQB modular cross-component kits. This model for networked systems deals not only with the topics of actual CAN gateways but also covers the full electronic system for a steering column and includes fully functioning front doors with comfort controls.

Along with the model there are more than 20 different simulated faults which can be activated as the situation requires. An OBD connection makes it possible to carry out full diagnostics. All the key electrical signals can be accessed directly via 4-mm sockets.

Benefits

- Original components from the vehicle manufacturer
- Concept of digital networking (CAN/LIN buses)
- Twenty different simulated faults can be activated
- Break-out box with 4-mm measurement points
- OBD diagnostics
- Optional: Dynamic static cornering lights and MOST buses

Topic areas 2, 3, 6, 9, 11P, 12P, 12N, 11S, 12S, 14S

Order no. S03240-1R

AUTO SHOP COMMUNICATIONS WITH RFID



UNITRAIN
SYSTEM

On the one hand, practically everything rests on communication with customers and making up contracts to handle jobs of work. On the other hand, though, a major amount of information can be gained nowadays, primarily by means of technical communication between PCs and vehicles themselves. Vehicle data can be incorporated into the vehicle's actual key by means of RFID (radio-frequency identification) technology, and can be read out as necessary.

This course provides insight into this functionality and its applications in the area of automotive engineering. Trainees can investigate a system encompassing a reader and a transponder with reference to exchange of both energy and data.

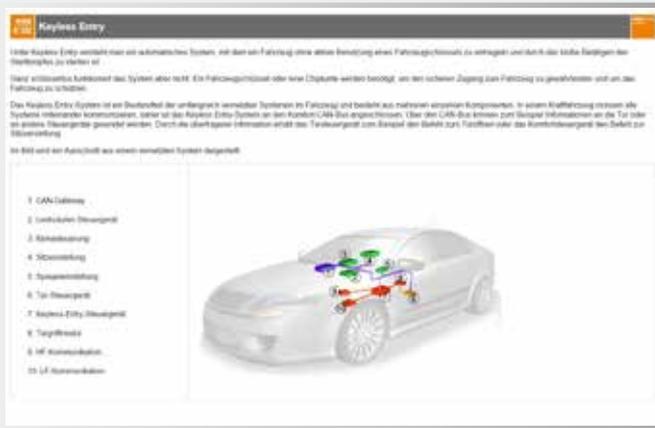
Training contents

- Communication with internal and external customers
- Planning and preparation of work processes
- Accepting a vehicle for servicing
- Service job order
- The driver's key as a communication tool
- Reading data into the motor vehicle key
- Reading data out of the motor vehicle key
- RFID applications generally and specifically in motor vehicles
- Understanding components needed for exchange of data
- RFID transponder and antenna ranges
- Physical context and standards

Topic areas 1, 2, 9, 11P, 11S, 14S

Order no. CO4205-1N

COMFORT SYSTEMS AND KEYLESS ENTRY



UNITRAIN SYSTEM

What are known as comfort systems actually make a big improvement to the active safety of vehicles. Innovative control systems are breaking into the marketplace and setting new standards.

Keyless entry, comfort systems, safety systems and door locking mechanisms are all covered in depth by this UniTrain course, to provide a fundamental understanding of how they work. This means that trainees can develop skills for key parts of the training content, including testing, diagnostics, repairs and setting parameters to match customers' needs.

Training contents

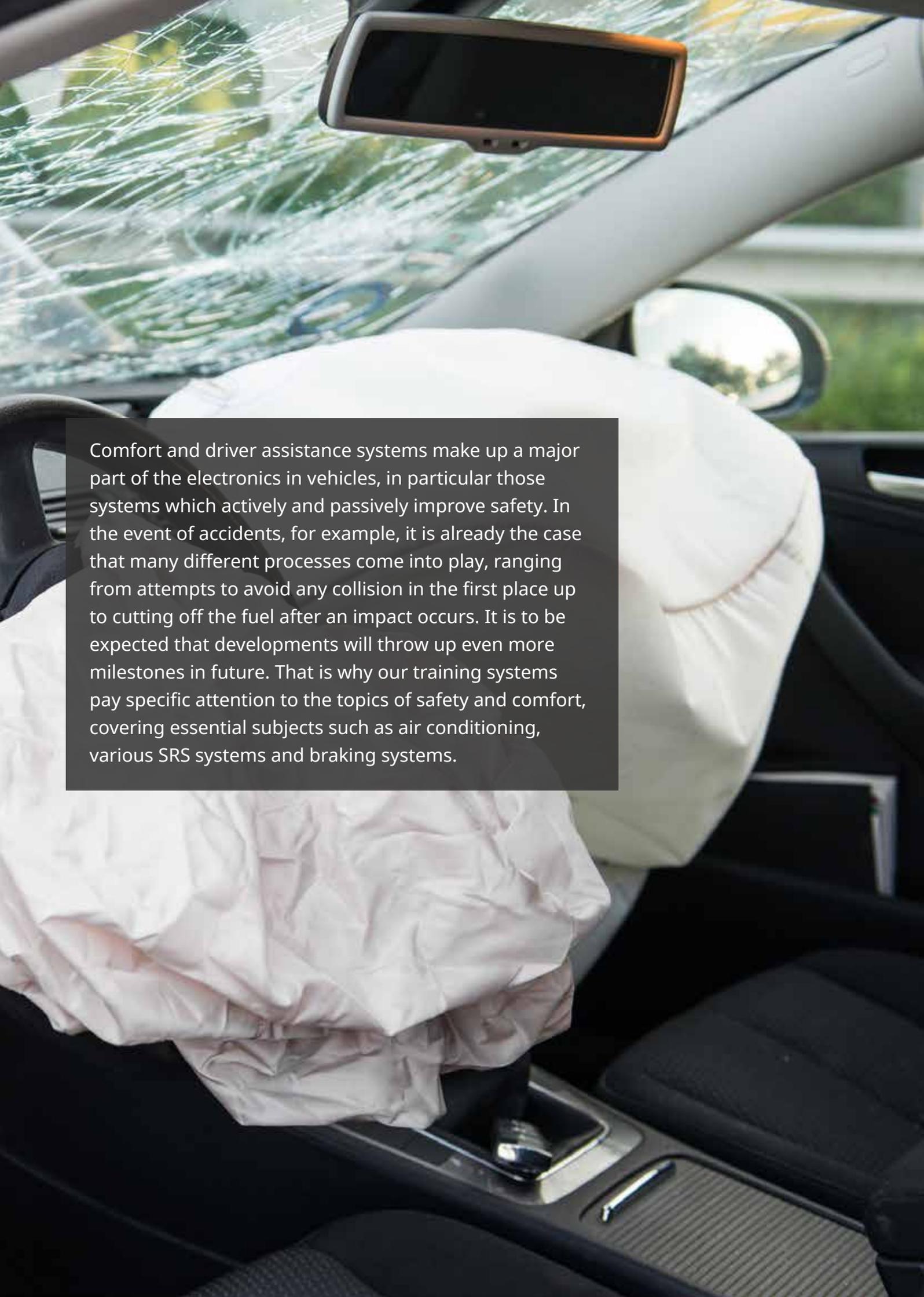
- Comfort settings in motor vehicles
- Active safety
- Door-locking systems
- Central locking
- Remote radio control
- Keyless access to vehicles
- Capacitive push-buttons
- Basics of antenna technology
- How central locking via CAN bus functions and how such systems can be enhanced to provide a keyless system

Topic areas 4, 9, 11P, 13P, 14P, 14N, 11S, 14S

Order no. SO4204-6G

SAFETY & COMFORT



The image shows the interior of a car after an accident. The windshield is shattered with a spiderweb pattern of cracks. A rearview mirror is mounted on the top of the windshield. Two white airbags are deployed: one from the passenger seat and one from the center console. The car's interior is dark, and the seats are black. The text is overlaid on a dark grey rectangular background in the center of the image.

Comfort and driver assistance systems make up a major part of the electronics in vehicles, in particular those systems which actively and passively improve safety. In the event of accidents, for example, it is already the case that many different processes come into play, ranging from attempts to avoid any collision in the first place up to cutting off the fuel after an impact occurs. 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

Topic areas 2, 8, 10, 12P, 11N, 11S

Order no. CO3221-9B

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

Topic areas 1, 8, 9, 11N, 11S

Order no. SO4204-6Z, opt. with original airbag SO3219-1P

AIRBAG TRAINING MODEL INCLUDING HEAD AND SIDE BAGS



including troubleshooting



This training model provides all the necessary diagnostic skills with the help of a complete SRS system. It consists entirely of OEM components from a Volkswagen Golf 5, thus providing authentic learning experience. It also includes an on-board network control unit, original fuses and cable harness plus a full set of crash sensors. A full set of actuators is also provided, but these devices do not actually trigger so that it is possible to work with them safely.

Apart from the two front airbags, the model also includes head and side bags, seat-belt tensioners and buckles, even seat recognition capability.

Benefits

- Built-in fault simulation (20 faults)
- 4-mm measurement terminals for direct measurement in the event of faults
- Wiring in accordance with original circuit diagrams
- Original VW diagnostic and simulation plugs are also included
- OBD connection
- Combined instrument display with SRS warning indicators
- CAN gateway

Topic areas 1, 2, 3, 5, 9, 11P, 12P, 11S

Order no. SO3240-3E

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)

Topic areas 8, 10, 12P, 11S

Order no. CO4204-6W

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 + application
- Experimental ascertainment of various functions
- Assembly, configuration and testing of mechanical components
- Design and function of disc brakes

Topic areas 2, 7, 8, 10, 12P, 11S

Order no. CO3221-9A

ALARM SYSTEMS AND IMMOBILISERS



Alarm systems are such attention seekers. They may stay quiet and unobtrusive most of the time, but if unauthorised access or interference should be detected, all eyes and ears must be assailed by flashing lights and sirens. This modular system provides a fully functional alarm system, specially adapted for educational purposes and compactly laid out on a single board.

Trainees can activate and deactivate the anti-theft warning themselves. The system can easily and optimally be integrated into existing lighting systems and it is extremely well suited to accommodate the retrofitting of auxiliary systems for teaching.

Training contents

- Alarm systems and immobilisers: Design and function
- Configuration and testing of anti-theft warning function and immobilisers
- Programming of international localisation
- Interaction with other components of the vehicle
- Troubleshooting

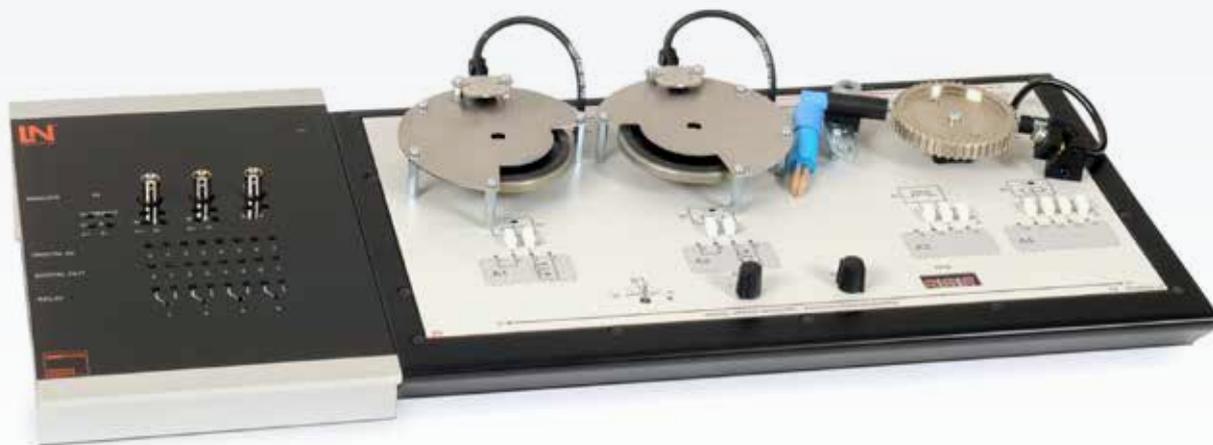
Topic areas 3, 4, 11P, 14P, 11N, 14S

Order no. ALC 7

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

Topic areas 1, 3, 11P, 11S

Order no. SO4205-1F

TRAINING MODEL "2-ZONE AIR CONDITIONING"



including troubleshooting



This training model conveys all the necessary diagnostic skills for two-zone air conditioning using a real two-zone system. It consists entirely of OEM components from a Volkswagen Golf 5 which allows students to go through an authentic learning experience. Even connection of an air conditioning service station to a complete refrigerant circuit with expansion valve is not a problem.

Thanks to continuous control of engine revs and simulation of driving speed, it is even possible to demonstrate the adjustment of pressure flaps at high speed. For the safety of trainees, dangerous locations are protected with a perspex cover. The model does not require a three-phase connection.

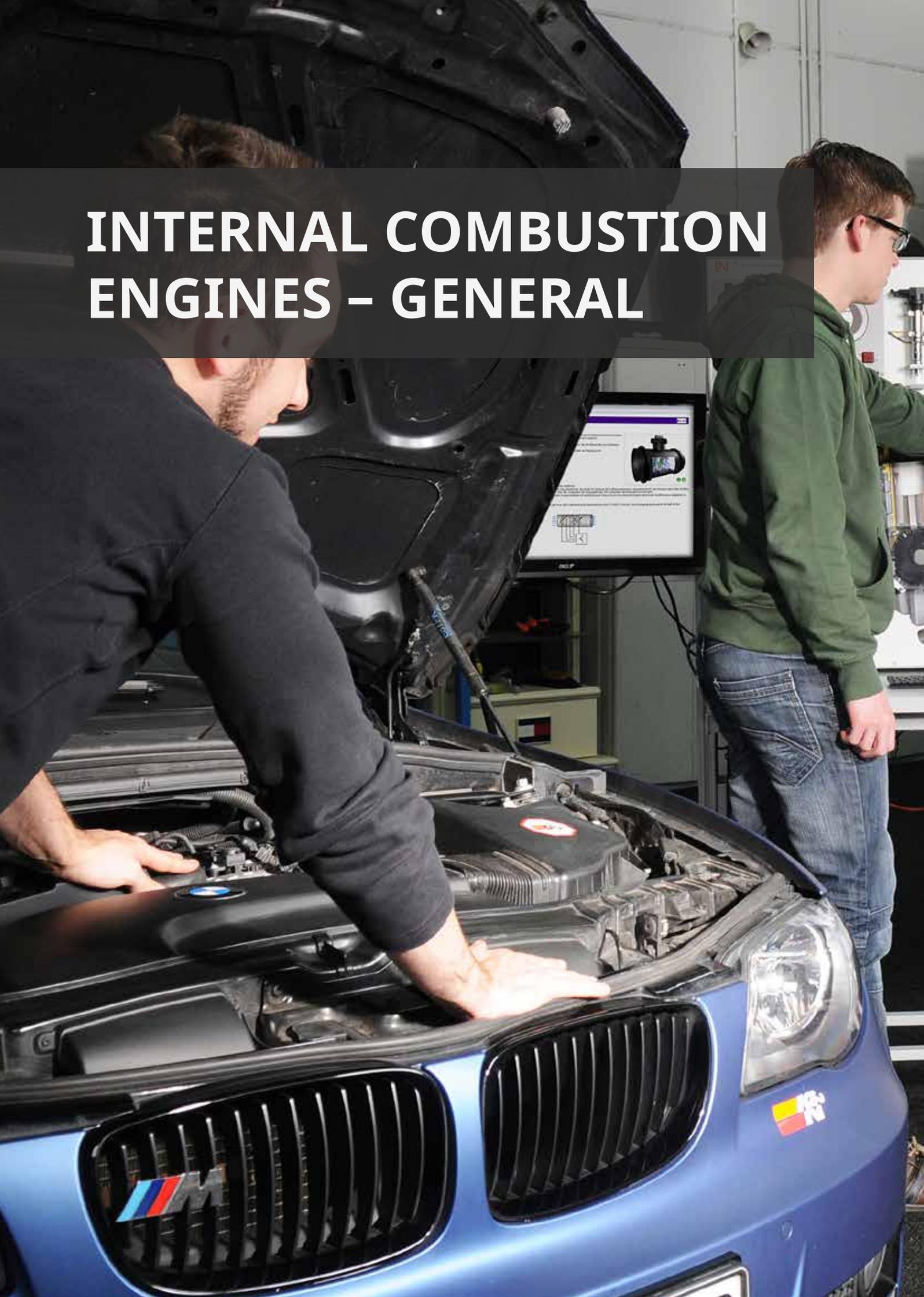
Benefits

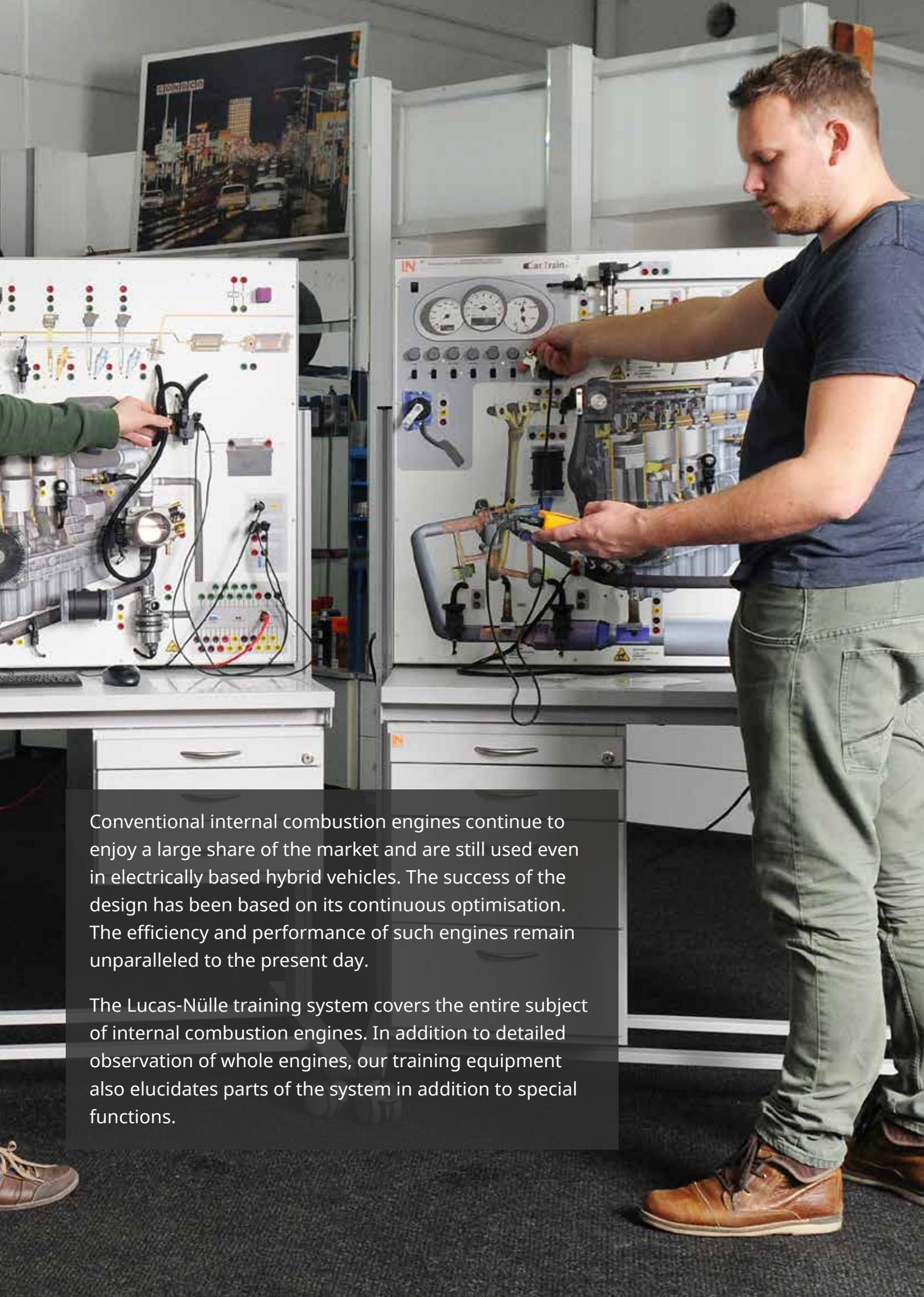
- Fully functional air-conditioning system
- Built-in fault simulation (20 faults)
- Break-out box with 62 4-mm measurement terminals
- Hella "air conditioning measuring instruments" (including test fittings, pressure gauge, quick-release couplings and digital thermometer)
- OBD diagnostic connection
- Fault-free air-conditioning control unit thanks to residual bus simulation
- Wiring in accordance with original circuit diagrams
- Includes repair guides and circuit diagrams

Topic areas 1, 2, 3, 5, 9, 11P, 11S

Order no. SO3240-3F

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 the knock sensor
- Temperature measurement with NTC and PTC sensors

Topic areas 3, 8, 10, 11P, 13P, 11N, 11S

Order no. SO4204-7F

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

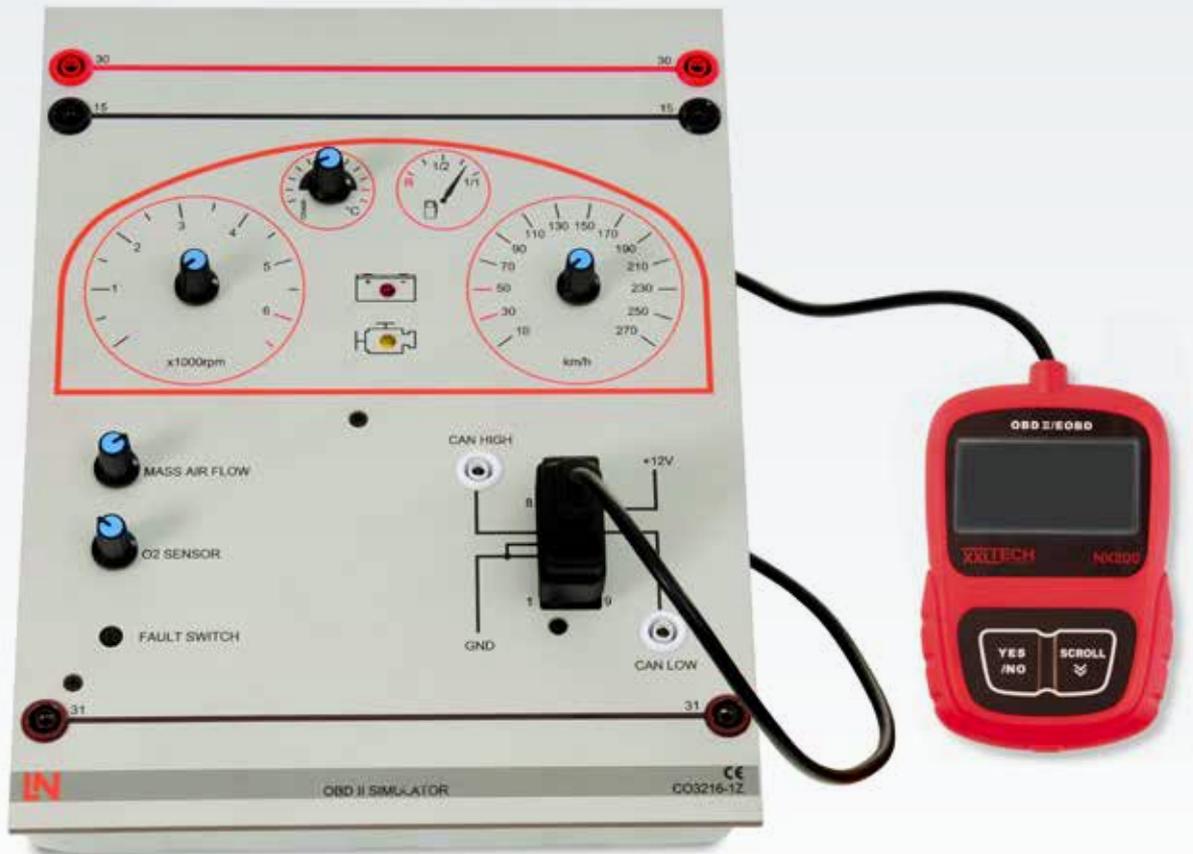
Topic areas 3, 8, 10, 11P, 13P, 11N, 11S

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 read-outs.

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

Topic areas 1, 5, 8, 11P, 12P, 11N

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

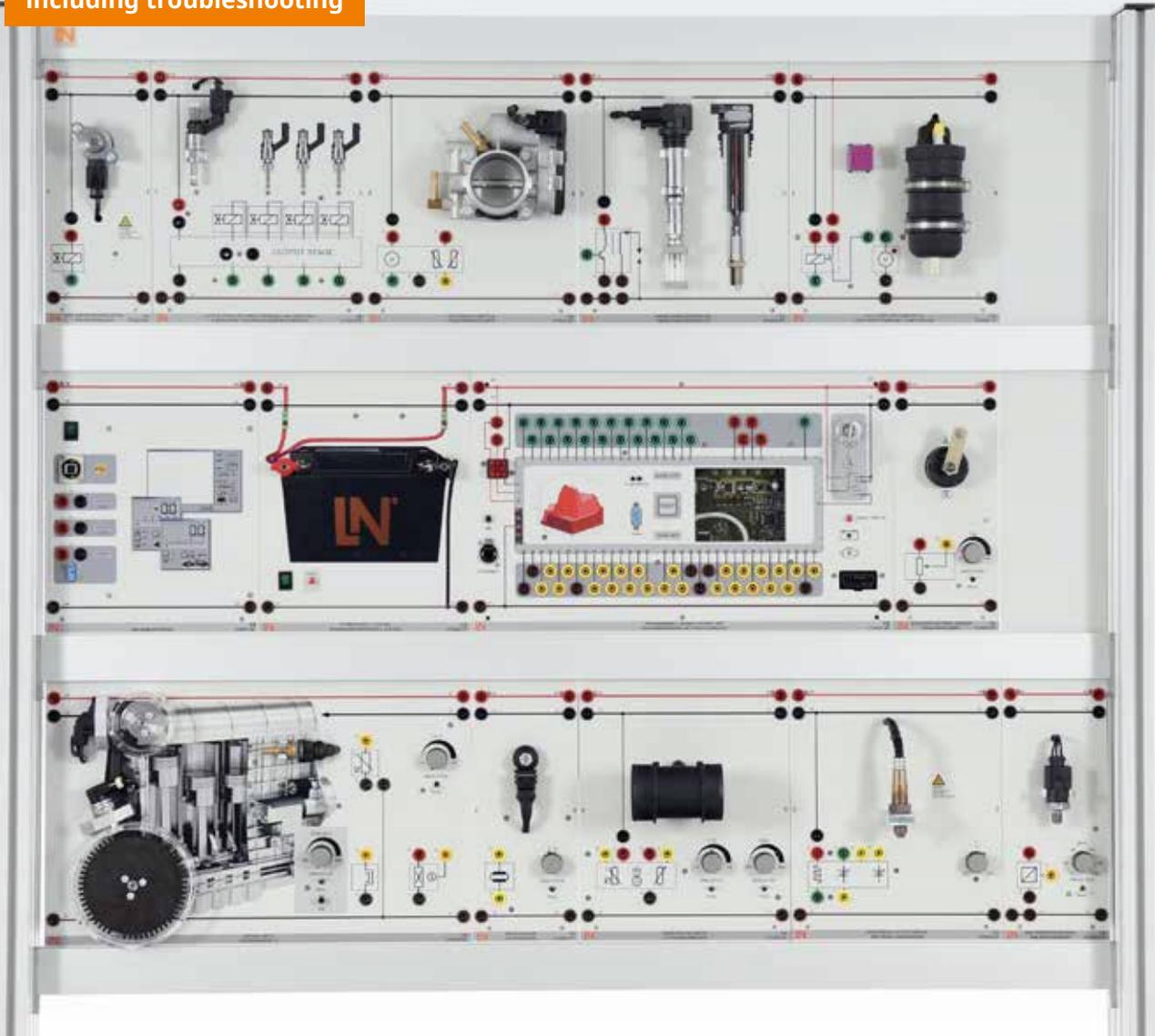
Topic areas 5, 7, 8, 11P, 12P, 13P, 14P, 13N

Order no. CO3221-9D

MODULAR ENGINE MANAGEMENT



including troubleshooting



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 subsystems
- 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 design
- 4-mm safety sockets for measurements
- Multimedia, practice-oriented course content
- Digitally networked with PCs

Topic areas 1, 2, 5, 8, 11P, 12P, 11N, 11S, 12S

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)

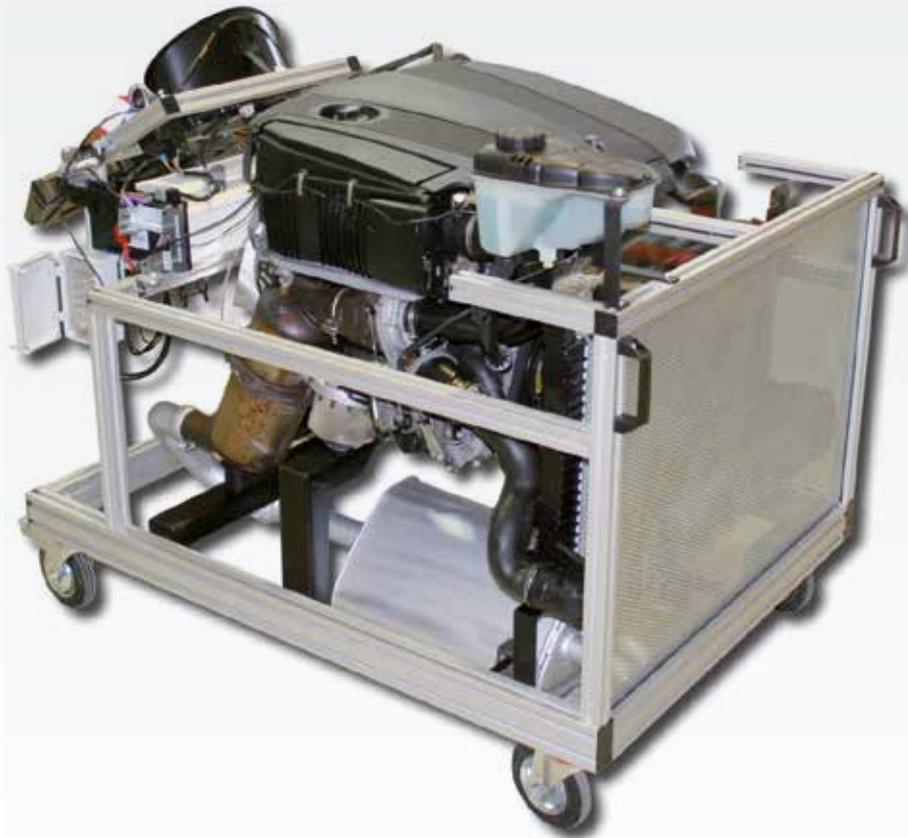
MMM7 (Motronic ME 1.0.2)

MMM8 (Motronic ME 1.0.1)

FUNCTIONAL ENGINES



including troubleshooting

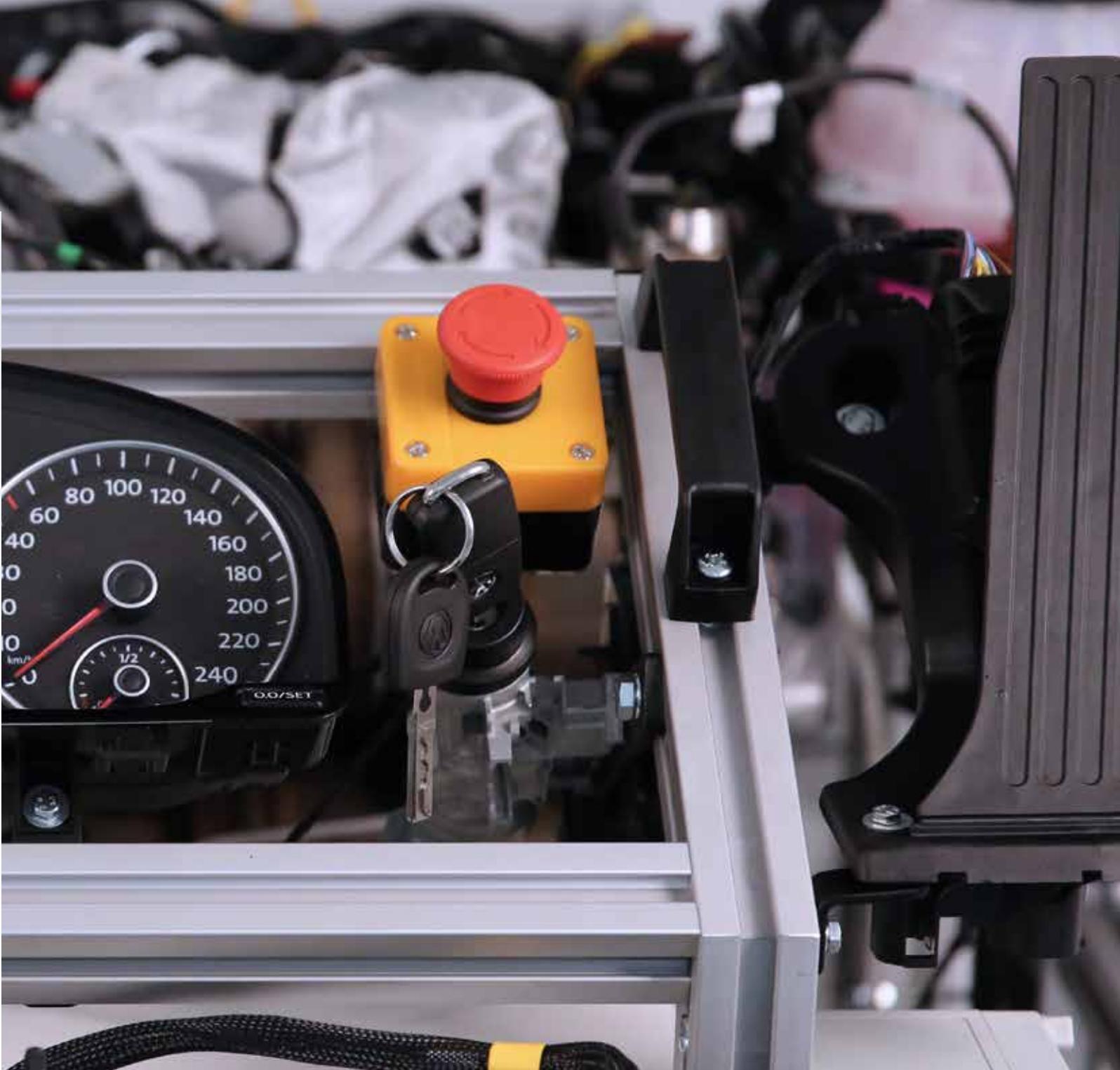


These fully operational engines ensure that none of the rotating parts are accessible and components which get hot are also covered over. Thus the working engines are very safe as well as being equipped with fault simulation. Signals from sensors and actuators can be accessed easily by means of break-out 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 plugs
- High standard of safety
- Fault simulation
- Multiple training scenarios: Contracts with customers, troubleshooting, servicing work

Topic areas 1, 2, 3, 5, 6, 7, 13P, 14P

Order nos.

SO3240-3H (VW common rail, SCR converter)

SO3240-1H (VW direct fuel injection, 3-way catalytic converter)

SO3240-1K (VW MPI, 3-way catalytic converter)

SO3240-1P (BMW direct fuel injection, 3-way catalytic converter)

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 infinitesimally 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

- Observe how the ignition spark is generated
- Learn about ignition timing (mechanical and map-based)
- Conventional ignition system and dual-spark ignition systems
- Transistorized ignition systems with Hall and inductive sensors
- Electronic ignition system
- Learn how to record and evaluate ignition oscillographs
- Basics of static and rotary high-voltage distribution

Topic areas 3, 8

Order no. SO4204-7C

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

Topic areas 5, 8, 11P, 12P, 14P, 11S, 14S

Order no. CO3221-6G

CARTRAIN MOTRONIC 2.8.2



including troubleshooting



CARTRAIN
SYSTEM

Our training system covering the Motronic 2.8.2 engine management system integrates all the management function (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

Topic areas 5, 8, 11P, 12P, 14P, 11S, 14S

Order no. CO3221-7C

DIRECT FUEL INJECTION, EXPLODED MODEL



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.

Since none of the components are either omitted or incomplete due to being cut away, then 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

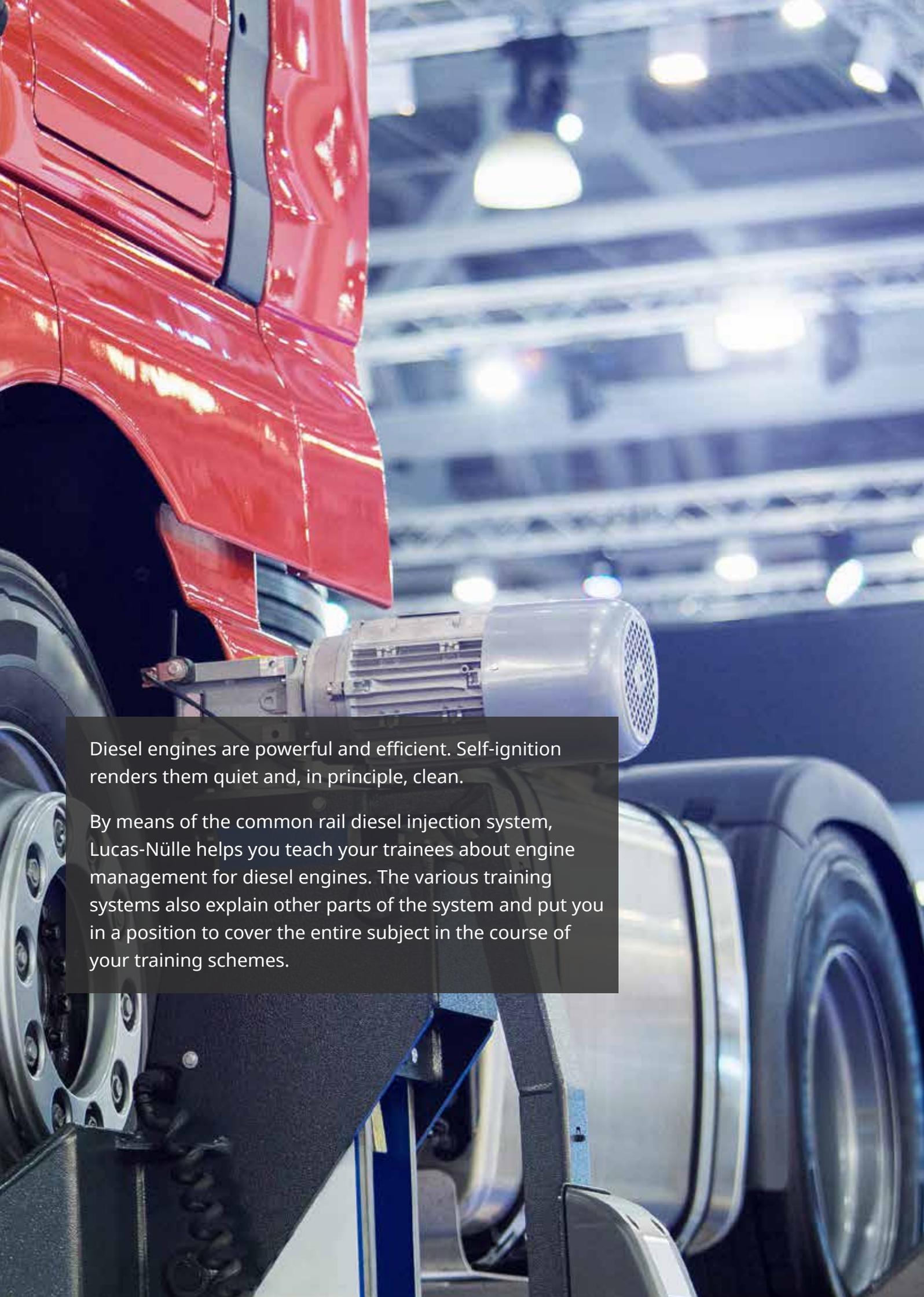
- Complete engine with all components
- All components are fully accessible
- No hazards from liquids or rotating parts
- Intercooler built into exhaust pipe
- Perfect supplement to direct fuel injection CarTrain training system

Topic areas 2, 8

Order no. SO3240-1M

DIESEL ENGINES



A red car is shown on a test rig in a laboratory setting. A white motor is connected to the engine area. The background features a blue ceiling with industrial lighting.

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.

COMMON RAIL



including troubleshooting



Fully operational original components
• Interactive fault simulation

CARTRAIN SYSTEM

The common rail engine management system incorporates all the management electronics into a single control unit. 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 original, fully operational components. Thanks to the interactive fault simulation capability, it is possible for trainees to carry out full diagnostics much as it would be done in authentic practice.

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
- Measurements on engine management components just like in genuine practice
- Fault memory read-out
- Engine management system settings

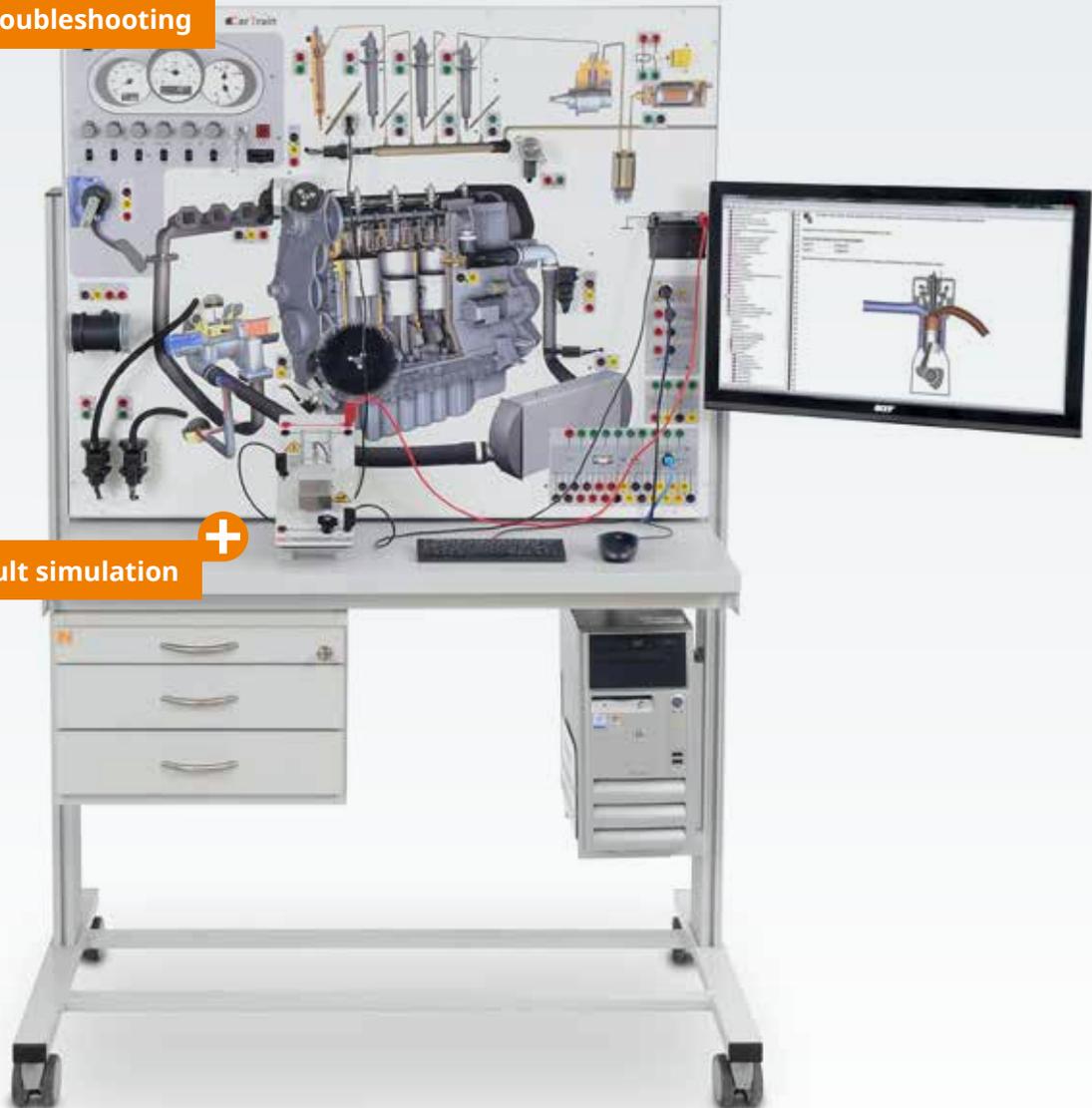
Topic areas 5, 8, 11P, 12P, 14P, 11S, 14S

Order no. CO3221-6E

COMMON RAIL WITH VARIABLE GEOMETRY TURBOCHARGER



including troubleshooting



Interactive fault simulation

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

Topic areas 8, 11P, 14P, 14N, 11S, 14S

Order no. CO3221-6J

HIGH-SPEED HEATING SYSTEM



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

Modern heating systems are controlled by pulse-width modulation with a resulting voltage of close to 12 V when it is just switched on but around 5 V in normal heating 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

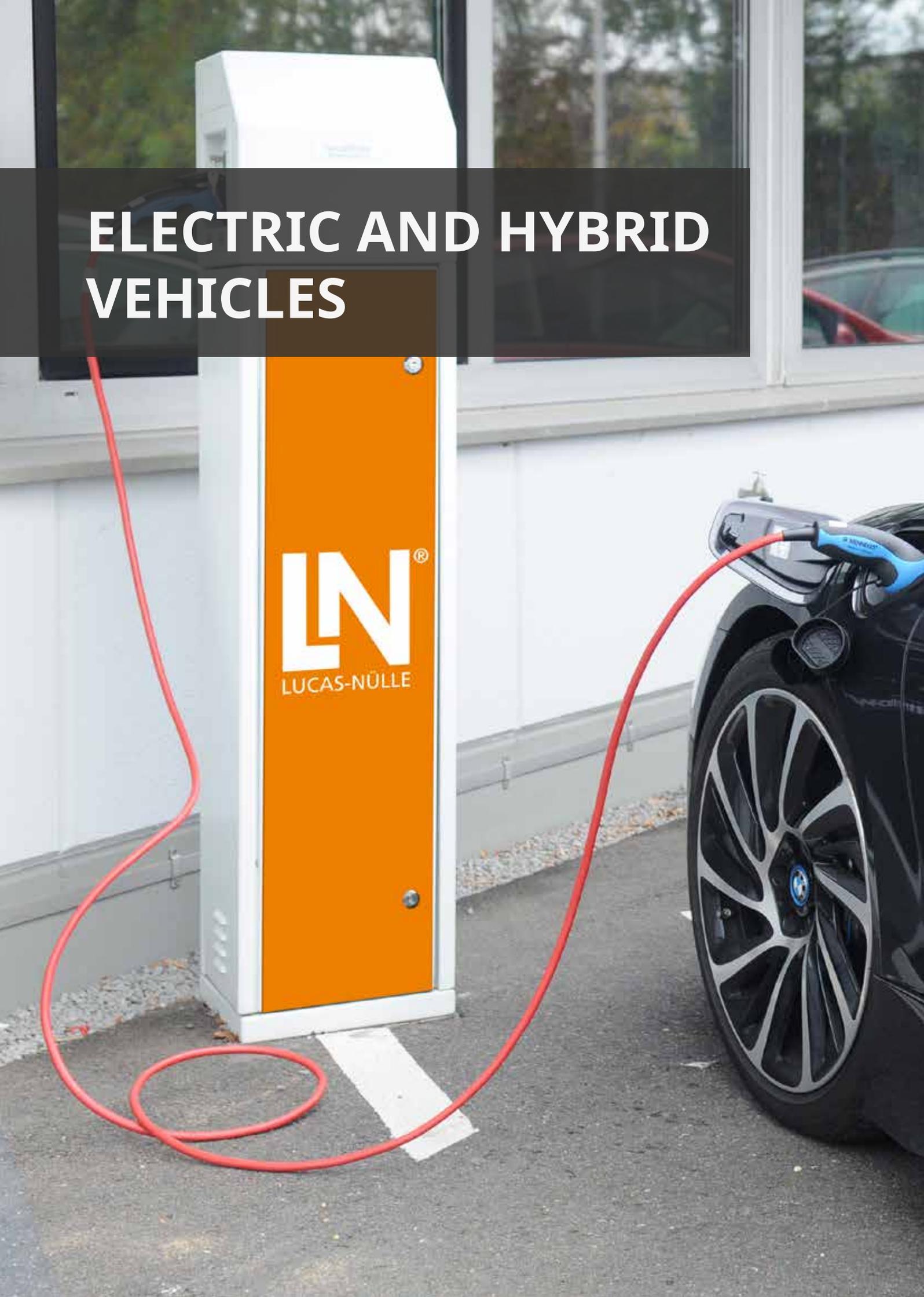
- Necessity for starting aids
- System components in a heater (glow) plug system
- Glow plugs and control unit
- Phases in the glow process before the engine is started
- Intermediate and post-glow
- Measuring voltage with an oscilloscope

Topic areas 2 ,3, 6, 7, 8, 12P, 11N,12N, 12S

Order no. ATS 1

ELECTRIC AND HYBRID VEHICLES

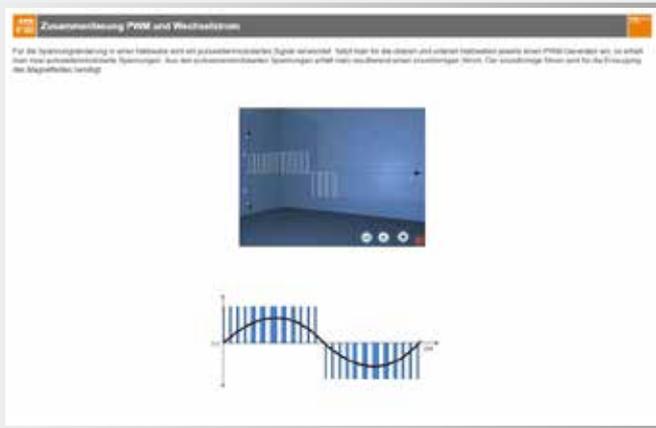
LN[®]
LUCAS-NÜLLE





This one of those charged moments in history – the age of the electric car is well and truly dawning. Companies and educational establishments across the globe are now putting their trust in Lucas-Nülle to keep them up to date with the latest in electrical traction developments. Our training systems take part in worldskills competitions, the world championships of vocational skills.

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.

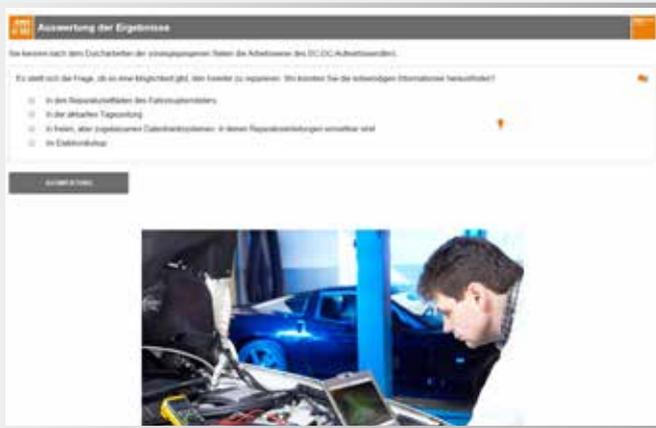
Training contents

- 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

Topic areas 3, 6, 8, 11P, 13P, 11N, 13N, 11S, 13S

Order no. SO4204-6L

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).

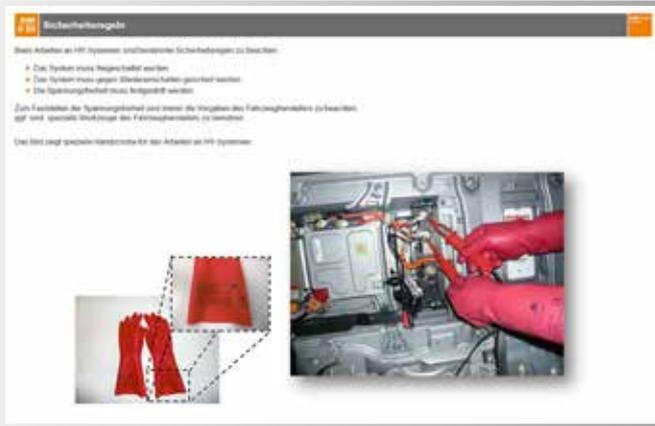
Training contents

- 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

Topic areas 3, 11P, 11N, 13N, 11S, 13S

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

HYBRID DRIVE IN MOTOR VEHICLES



UNITRAIN SYSTEM

Hybrid drives exist to achieve three essential aims: saving of fuel, reduction of toxic emissions and improving both torque and power output. There are various different hybrid concepts which may focus on one or more of these objectives. With the help of this UniTrain system, trainees can gain an understanding of the technical principles behind hybrid drives for themselves. They can independently plan their own diagnostics, maintenance and repairs of power supply and starting systems and carry them out themselves conforming to all manufacturers' specifications and health and safety regulations. By means of various measuring exercises and experiments they can then develop the practical knowledge and skills they will need in the course of their careers.

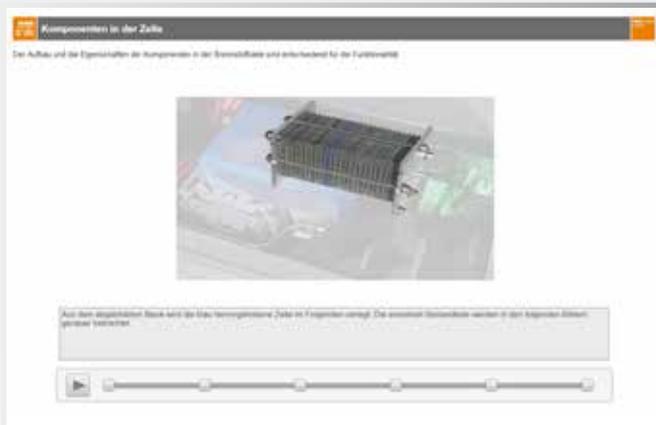
Training contents

- Benefits of hybrid systems
- Serial and parallel hybrid systems
- Combined hybrids
- Design of electrical machines (asynchronous and synchronous machines)
- Fundamentals of inverters (three-phase converters)
- Fundamentals of frequency converters
- Three-phase voltage supply
- Measurement of DC, AC and three-phase voltages
- Investigation of energy and power flows
- On-board power supply for hybrid vehicles

Topic areas 3, 6, 8, 11P, 13P, 13N, 13S

Order no. CO4204-6V

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.

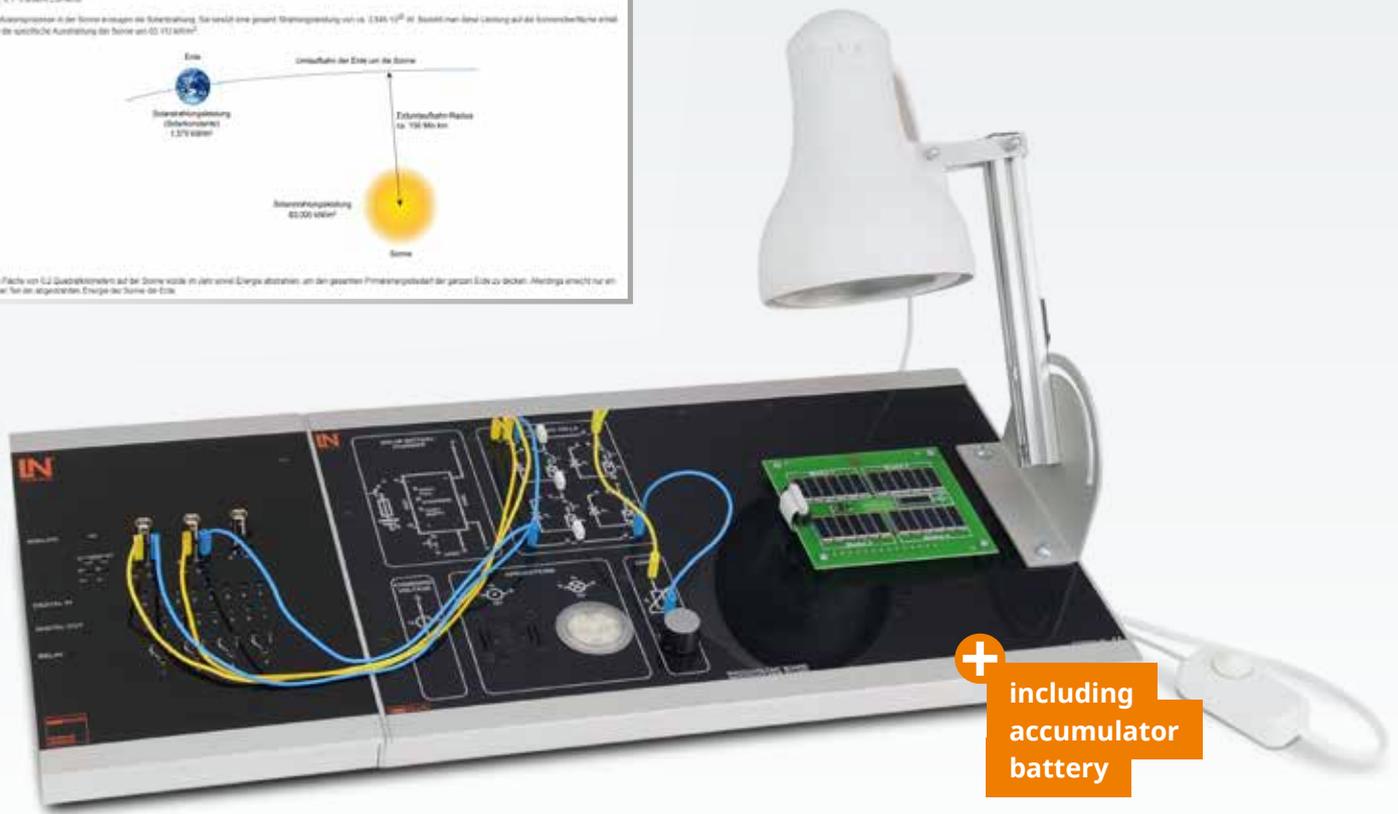
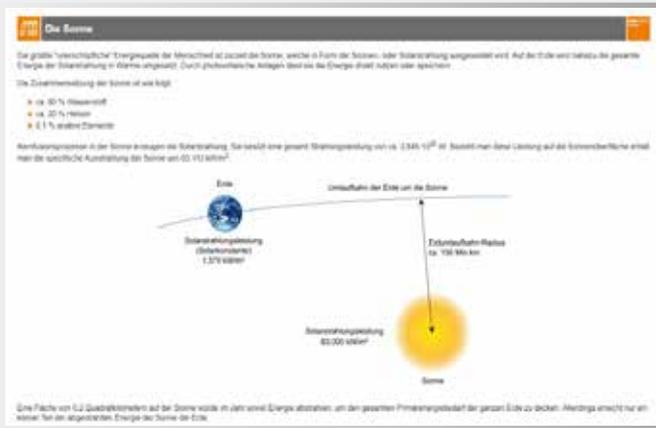
Training contents

- 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

Topic areas 1, 3, 6, 8, 9, 13N, 13S

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
- Design 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

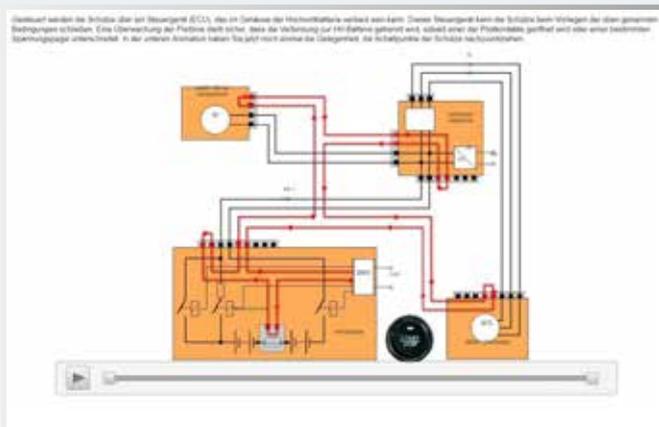
Topic areas 11P, 12P, 13P, 14P, 12N, 13N, 13S

Order no. CO4205-1P

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

Topic areas 3, 6, 13N, 11S, 13S

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

- Design 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

Topic areas 3, 6, 13N, 11S, 13S

Order no. CO4205-1J

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

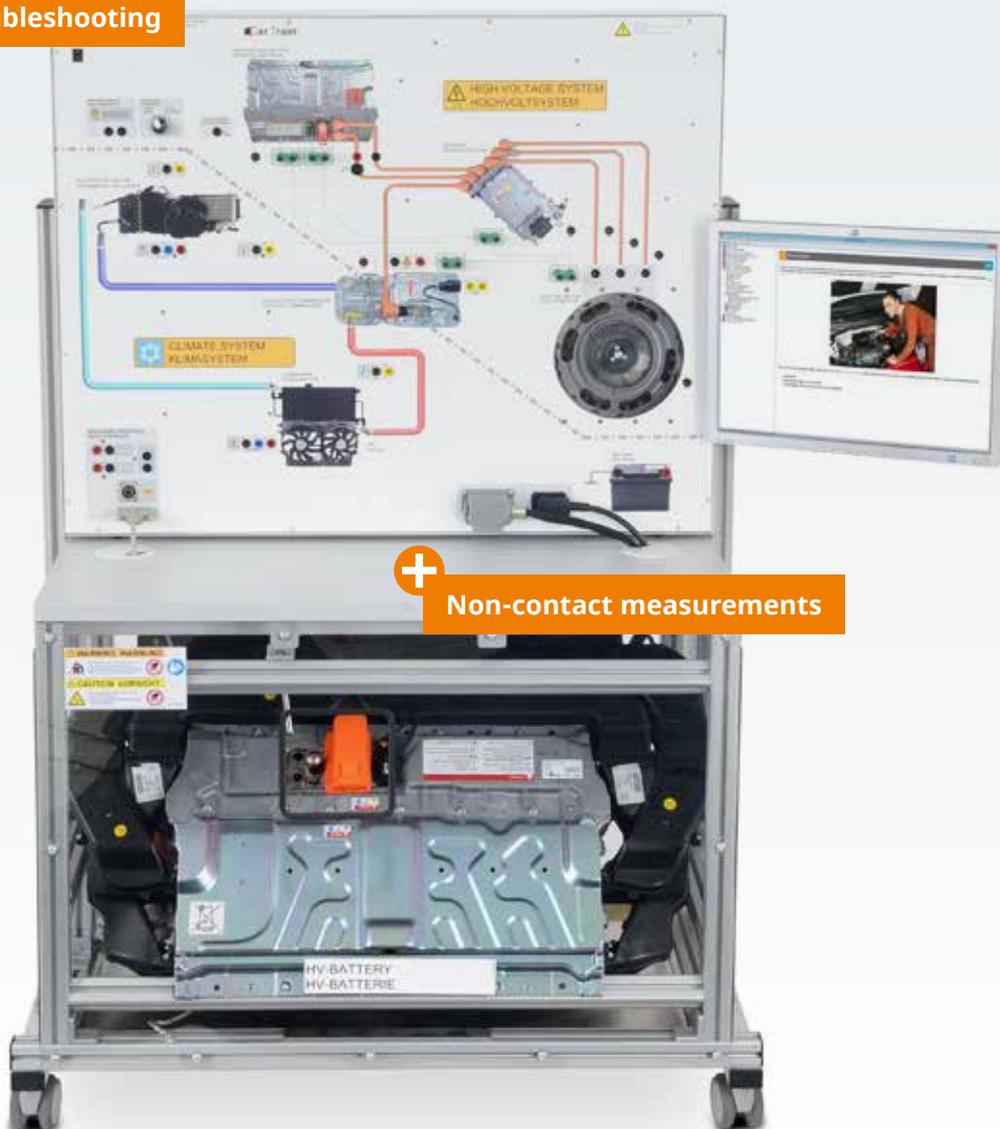
Topic areas 1, 13N, 12S, 13S

Order no. CO4205-1M

TRAINING SYSTEM FOR HIGH-VOLTAGE AND AIR-CONDITIONING SYSTEMS



including troubleshooting



Non-contact measurements

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
- HV drive, air conditioning and intrinsic safety systems

Topic areas 1, 2, 5, 6, 8, 11P, 13N, 11S, 13S

Order no. CO3221-6P

ELECTRIC AND HYBRID VEHICLES



including troubleshooting



CARTRAIN SYSTEM

This is a world first, a CarTrain system which combines five different drive configurations, including measuring points for all electrical components of a high-voltage system in a single set.

Trainees can easily understand the various drive modes and energy flows with the help of a touchscreen interface. The system works with authentic high voltage but remains safe. This means that students can practice such things as disconnecting/isolating a battery on a genuine system.

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
- Function of electrical machines (inverters, three-phase motors)
- Design of electrical machines (asynchronous/synchronous machines)
- Electromagnetic compatibility

Topic areas 1, 3, 6, 8, 11P, 13N, 11S, 13S

Order no. CO3221-6K

DIAGNOSIS AND MAINTENANCE OF A HV BATTERY



including troubleshooting



- DGV 200 005 level 3
- With personal protective equipment (PPE)

CARTRAIN
SYSTEM

More and more manufacturers are carrying 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.

Training contents

- Structure and analysis of a real high-voltage battery
- Diagnostic-based disconnection of high-voltage systems
- Disconnection via service/maintenance plug
- Disconnection by first responders in the event of accidents
- Various measurements including high voltage and temperature sensors
- Charging infrastructure (AC, CGS 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

Topic areas 11P, 11N, 13N, 11S, 12S, 13S, 14S

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

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

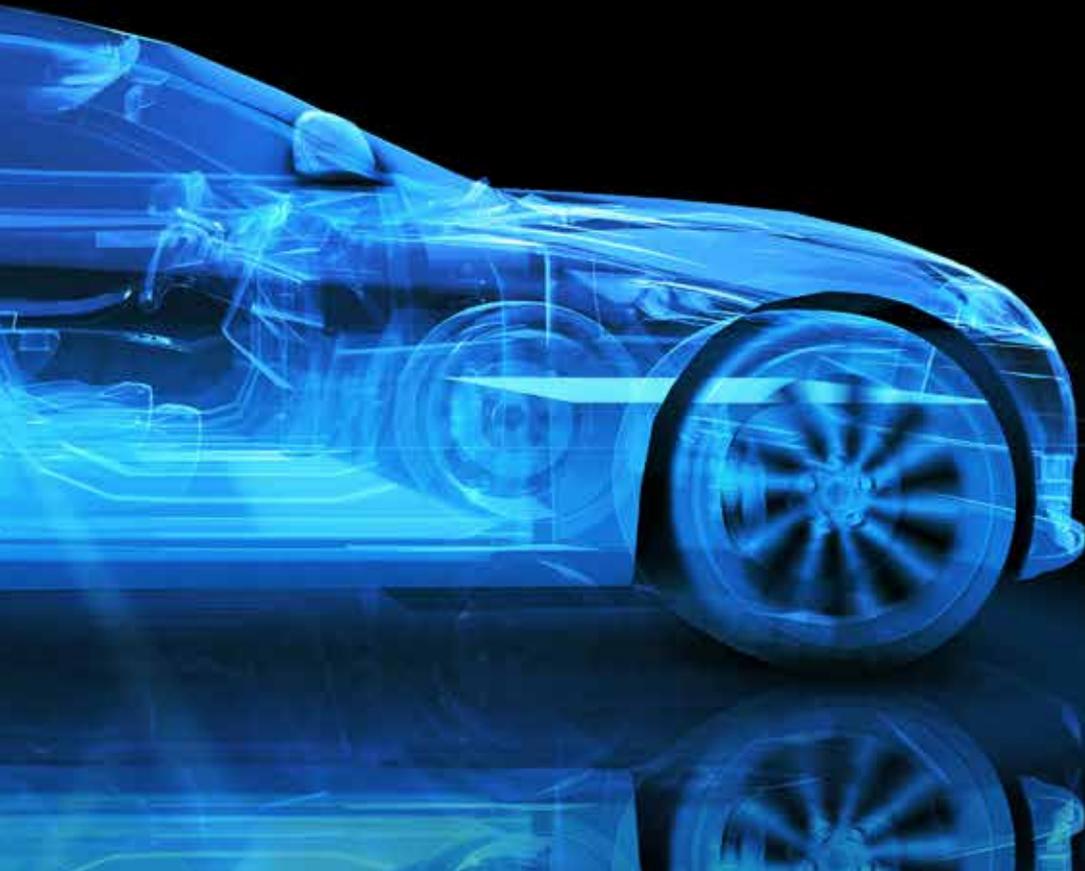
- Charging of high-voltage vehicles
- Sequence of charging procedure
- Safety concepts
- Analysis of communication between charging station and vehicle
- Function of CP and PP contacts

Topic areas 1, 3, 6, 8, 11P, 13N, 11S, 13S

Order no. C03221-6Q

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 version

Suitable for all topic areas



Tested vehicles

Choose from the following vehicles:

Conventional drive train

- Audi Q5 petrol model (LM8293)
- Audi Q5 diesel model (LM8294)

Hybrid drive train

- VW Golf GTE (LM8296)
- Toyota Prius (LM8297)

Electric drive train

- VW e-Golf (LM8295)
- BMW i3 (LM8298)

All these vehicles are specially adapted and modified for optimum usefulness in education and training. Apart from visualisation of the most important systems in vehicles, various break-out boxes are included, as well as more than 30 fault simulation switches. Every vehicle is also supplied with its original circuit diagrams, allowing diagnostics to be carried out under authentic practice conditions.

Order no. LM8293-98

DIGITISATION PACKAGE – DIGITAL DIAGNOSTICS ON REAL VEHICLES



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

Suitable for all topic areas

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

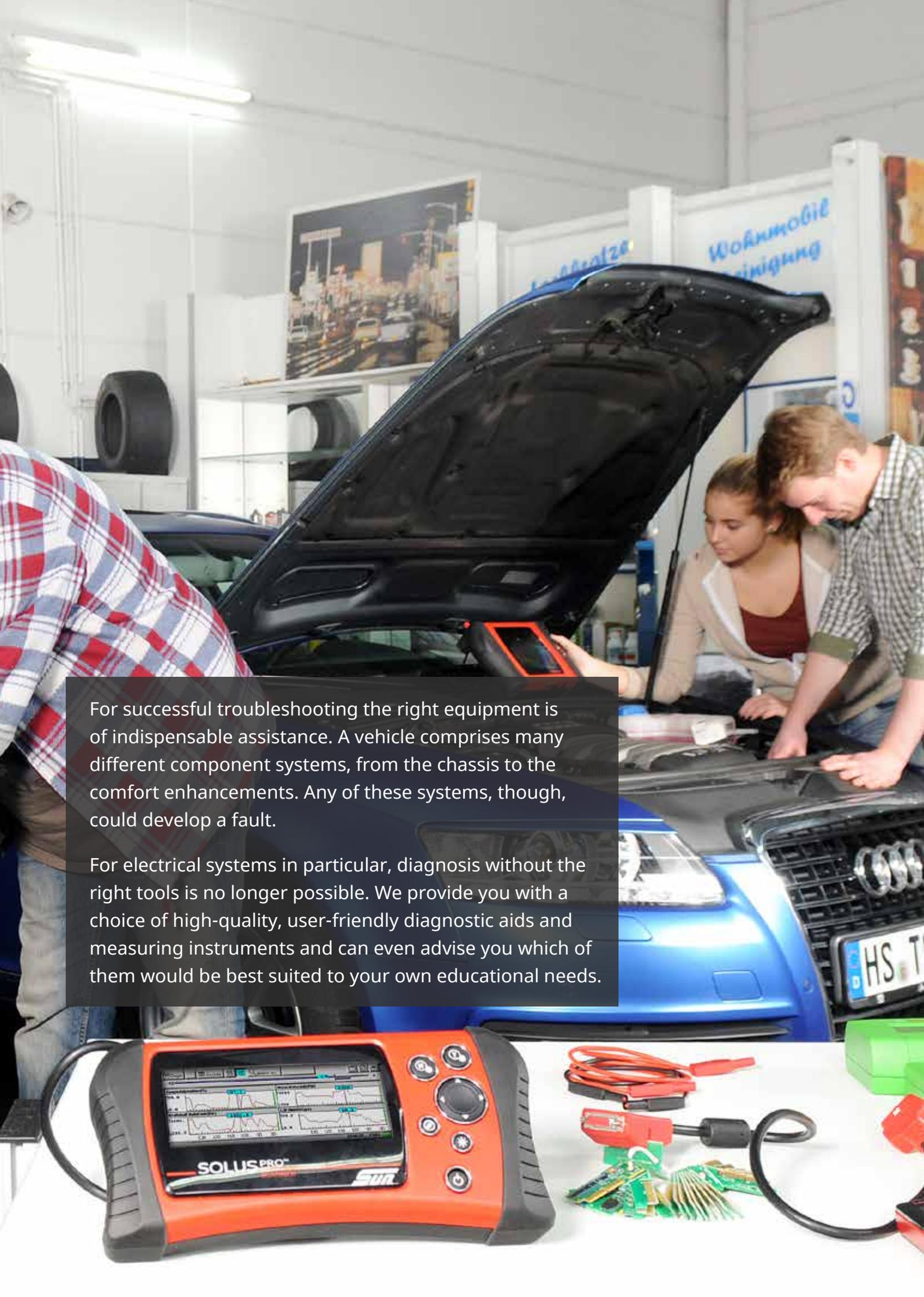
- Built-in signal interface
- Includes 6 external student workstations
- Parallel transmission of signals
- Extensible to custom level
- Capable of combination with learning environment
- Built-in CAN interface

Suitable for all topic areas

Order no. CO3223-7F

DIAGNOSTICS AND INSTRUMENTATION

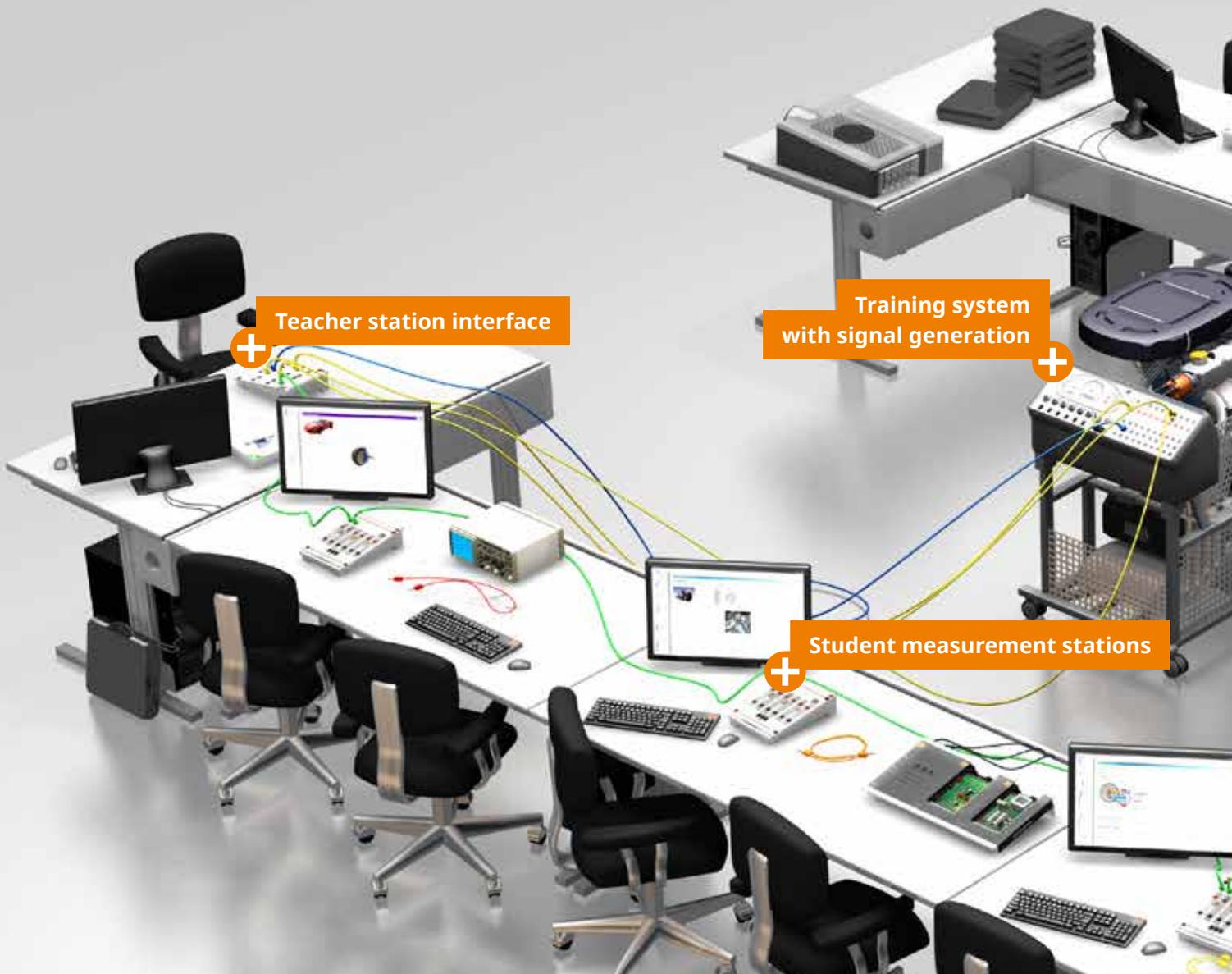




For successful troubleshooting the right equipment is of indispensable assistance. A vehicle comprises many different component systems, from the chassis to the comfort enhancements. Any of these systems, though, could develop a fault.

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.

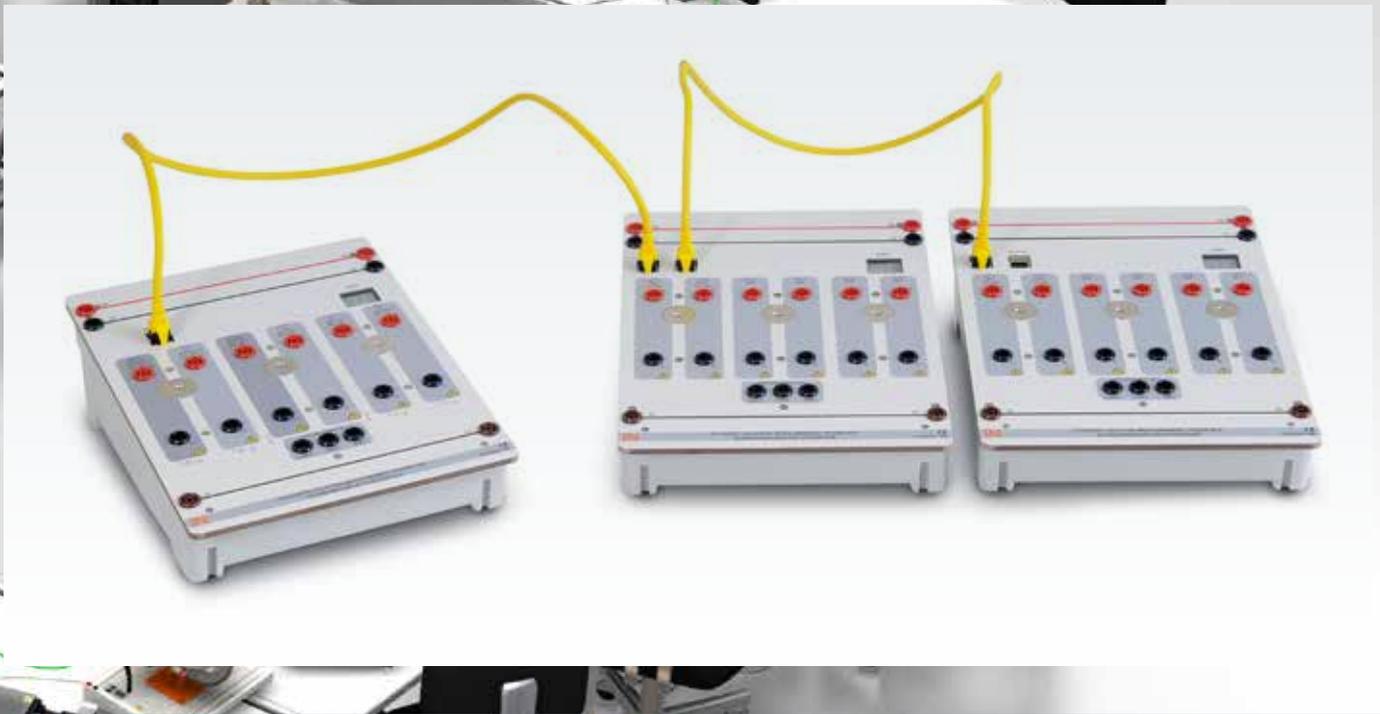
STUDENT/TEACHER MEASURING STATIONS



Student/teacher measuring stations which can be networked together in absolute safety, this system simultaneously provides trainees with the requisite signals. The source of the signals could be any vehicle electrical system, a training system 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

Topic areas 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11P, 11S, 12S, 13S

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

SUN PDL 3000/SUN PDL 5500



SUN PDL 3000

The PDL 3000 from SUN is a user-friendly scanning tool with a wide testing scope and many functions. Power can be provided from a mains adapter, a battery or from a vehicle itself.

As an inexpensive alternative to the PDL5500 some of the measurement equipment has been omitted.

Benefits

- Capability to record data logs during test drive
- Mini SD card for memory and upgrade capability
- Systems such as gearbox, ABS, ESP, SRS, TPS, dashboard
- Read-out and deletion of fault codes
- Service interval reset
- Automatic quick-scan or system ID mode
- Function tests, actuator tests and “learning” functions
- Film function (recorder mode)

Topic areas 1, 3, 6, 8, 9, 10, 11P, 14P, 11S, 12S, 13S, 14S

Order no. LM8311

SUN PDL 5500

For the PDL 5500 all the functions have been revised, simplified and optimised. There are more and quicker functions and a larger 8” colour touch screen. The PDL 5500 has been redesigned for the needs of modern workshops. It is inexpensive, offers tried-and-trusted technology and is easy to operate.

Booting only takes 5 seconds. Fault codes and live data for more than 40 vehicle marques are displayed in less than 30 seconds. It also includes a guided Fast-Track® component test to help find the causes of faults easily. Reliable and clear diagnostics thanks to rapid comparisons with known component faults.

Benefits

- Simple, practical and easy to operate
- Includes scanner, oscilloscope and expert information
- Intuitive navigation via touch screen or 4-way keyboard
- Measurement data saved to memory on Micro SD card
- Graphic, digital 2-channel multimeter
- 2-channel high-speed trigger and lab scope
- Guided component tests
- Manufacturer-specific codes, live data, function tests
- Learning and adaptation functions
- Battery charging function via OBD connection

Topic areas 1, 3, 6, 8, 9, 10, 11P, 14P, 11S, 12S, 13S, 14S

Order no. LM8264

MEGA MACS 77/MEGA MACS PC



MEGA MACS 77

The Mega Macs 77 is the new flagship tester from “Hella-Gutmann”. Setpoint values are displayed directly by the tester, as are graphic representations of reference signals. This WiFi-capable device shows you in real time whether the measured values are in the specified range (green) or do not match their setpoint (red).

Thanks to detailed guidance, even new users can obtain professional measurement results for more than 49,000 models of vehicle. This makes it possible to measure even complex electronic systems and assess the results.

Benefits

- Optional measurement module (LM8312)
- Explanation of fault codes with detailed information
- Parallel display and explanation of 16 vehicle parameters
- Coding, back settings, service resets
- Diagnosis of all components with instructions for measurement terminals
- Precision measuring equipment with automatic comparison of actual values with setpoints
- Engine and interior displays with actual component positions
- Car history including previous measurements

Topic areas 1, 3, 8, 9, 10, 11P, 14P, 11S, 12S, 13S, 14S

Order no. LM8269



MEGA MACS PC

Mega Macs PC is a software program from Hella Gutmann Solutions which transforms your workshop PC into a fully fledged diagnostic station. This means you can carry out professional diagnostics or guided repairs directly from your workshop PC or a tablet computer. Installation and menu are simple and intuitive.

Wireless sampling of all control units can be carried out from the program, as can reading and deleting fault codes or execution of service resets. The program is compatible with more than 35,000 models of vehicle.

Benefits

- Diagnostics and guided repairs via PC or tablet computer
- Documentation and printing of car history
- Bluetooth for communication between PC and device
- Regular updates

Topic areas 1, 3, 8, 9, 10, 11P, 14P, 11S, 12S, 13S, 14S

Order no. LM8274

BPC TOOL FOR BATTERY MONITORING/VCDS WIFI



BPC TOOL FOR BATTERY MONITORING

Display of current results based on around 72 per cent of all electric problems arising from malfunctions. Causes arise from severe thermal stresses, frequent short journeys and the rising quantity of electronics in vehicles.

The BPC (Battery Power Check) tool in conjunction with “Mega Macs 66” or “Mega Macs PC” make an efficient instrument for diagnostics of “battery management equipment”.

Benefits

- For lead-acid, EFB, AGM and gel batteries
- Usable with Mega Macs 66 and Mega Macs PC
- Reverse polarity protection
- Proof against water spray (IP 54)
- Bluetooth interface
- Battery voltage (V)
- Cold start current
- State of charge (%)

Topic areas 1, 2, 3, 4, 5, 6, 7, 14P, 14S

Order no. LM8301



VCDS Wi-Fi

The new diagnostic interface opens the way for smart workshops. The new HEX-NET diagnostic interface enables you to work wirelessly with VCDS in your workshop thanks to WiFi. Simply tap into the workshop’s own WiFi network and any computer in the network is able to access the vehicle.

If your workshop has no WiFi or you need to use HEX-NET off the premises, that too is no problem. HEX-NET itself can be configured as a router at the press of a button and any WiFi-capable device can make use of the system.

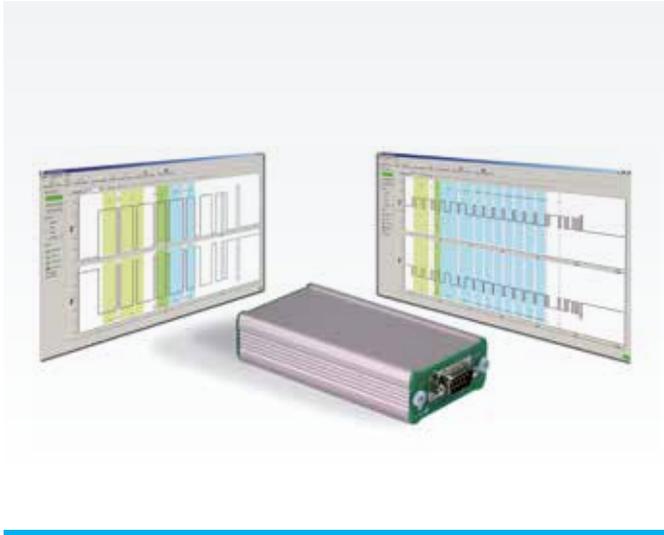
Benefits

- Full version of VCDS diagnostic software
- Usable with or without cabling
- Compatible with nearly all vehicles made by the VAG concern (including Volkswagen etc.)
- Rugged case with improved plugs

Topic areas 1, 3, 8, 9, 10, 11P, 12P, 12S, 13P, 11S

Order no. LM8306

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

Topic areas 1, 2, 3, 6, 9, 11P, 11S

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 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

Topic areas 11S,12S, 13S

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 using feed and return (leakage testing) methods
- Diagnosis and maintenance of engine management systems
- Enhancement of diagnostic skills
- Measurements on common rail systems
- How automatic rail pressure control works

Topic areas 1, 2, 3, 5

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

Topic areas 1, 2, 3, 5

Order no. LM8233

VEHICLE DIAGNOSTICS CASE/OBD II BREAK-OUT BOX



VEHICLE DIAGNOSTICS CASE

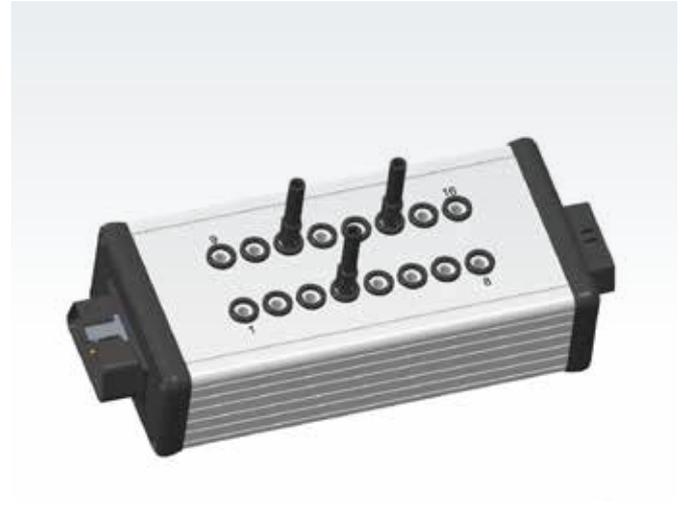
This case provides a universal set of contact equipment for all the plug connectors used in vehicles. Reliable contacts for diagnostics and troubleshooting in vehicles allow optimum measurement and test results to be achieved quickly and easily. The case keeps up with all the demands from vehicle manufacturers,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

Topic areas 1, 2, 3, 5, 6, 11P, 11S

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

Topic areas 1, 3

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

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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Albert Einstein



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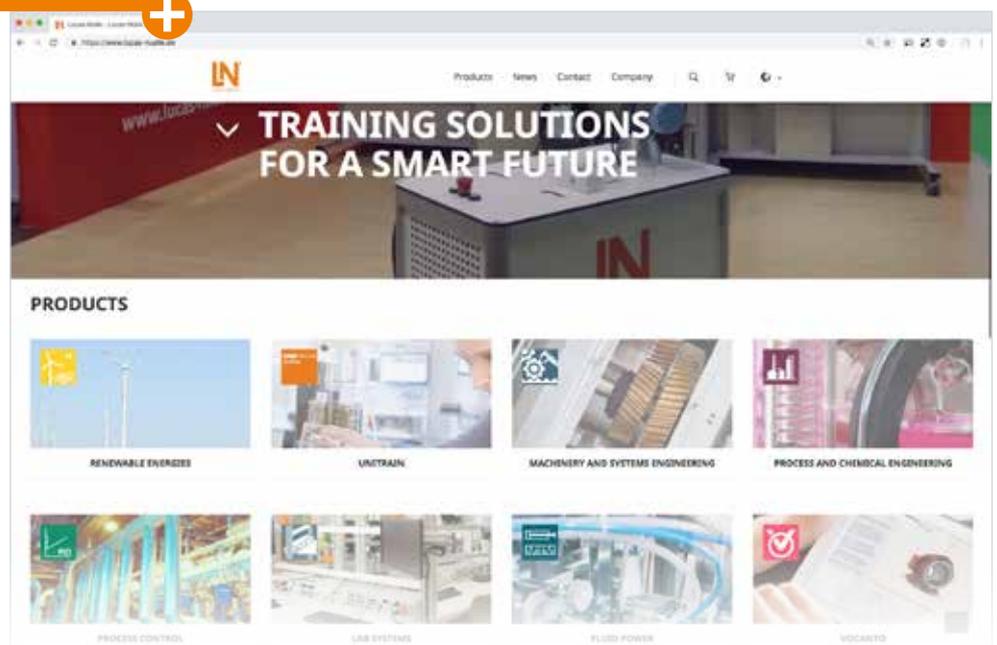


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