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UniTrain

UniTrain is a multimedia e-learning system with integrated, mobile electronics lab for general education and advanced training in electrical engineering and electronics.

UniTrain courses



UniTrain courses

UniTrain automotive technology courses

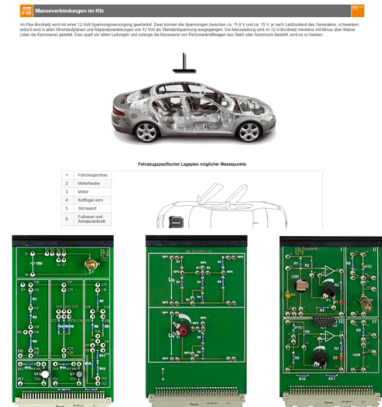


UniTrain automotive technology courses

UniTrain courses in technology for motor vehicles convey a variety of topics involving electrical circuitry and electronics as used in cars and commercial vehicles. The complete interaction of the various systems is covered in such a way as to make them easily accessible to students, e.g. by means of pictures and animated graphics. Using the equipment supplied, students are continually encouraged to apply the knowledge they have gained in practical fashion. This may involve the use of additional virtual instruments (as appropriate to the equipment).

List of articles:

Pos.	Product name	Bestell-Nr.	Anz.
1	<p>UniTrain: DC and AC circuits in vehicles</p> <p>This training system provides trainees with the perfect introduction to the topics of direct and alternating current. All the relevant contents are taught with the help of easily understood animations and interactive experiments. Thanks to the numerous test pages in the course, teachers can obtain feedback on students' progress at any time, as can the individual students themselves.</p> <p><u>Includes:</u></p> <ul style="list-style-type: none"> • 1 Experiment card with various resistor circuits • 1 Experiment card with voltage divider circuits • 1 Experiment card with circuits for investigating temperature-dependent, light-dependent and voltage-dependent resistors • Storage case • Labsoft browser and course software <p><u>Training contents:</u></p> <ul style="list-style-type: none"> • Fundamentals of electricity • Circuits • Measurement of voltage and current • Calculation of current, voltage and resistance • Series circuits • Parallel circuits • Mixed series and parallel circuits • Ohm's law • Kirchhoff's 1st law • Kirchhoff's 2nd law • Simple voltage dividers • Temperature-dependent NTC (negative temperature coefficient) thermistors • Temperature-dependent PTC (positive temperature coefficient) thermistors • Light-dependent resistors (LDRs) • Voltage-dependent resistors (VDRs) • Troubleshooting (9 simulated faults activated by relays) • Course duration: 10 h approx. (including about 1.5 h for troubleshooting) 	CO4204-7A	1
2	<p>Course - Automotive 2: Electronics and digital technology in vehicles</p>	SO4204-7B	1

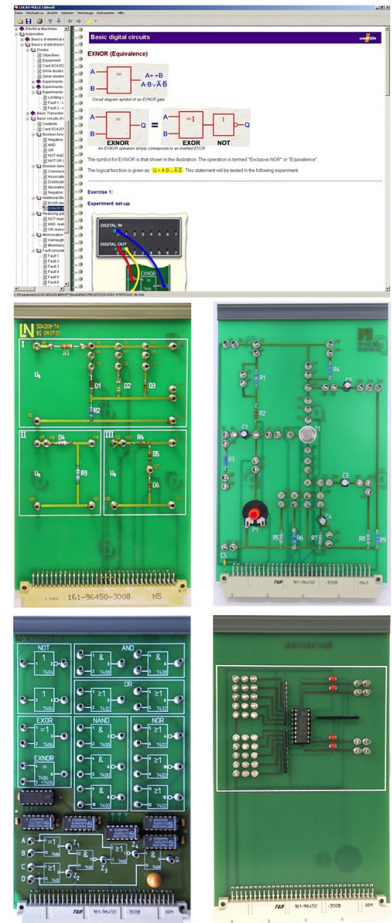


Includes:

- 1 Experiment card with diode circuits (Si, Ge and Zener diodes)
- 1 Experiment card with transistors for building various circuit configurations (common emitter, common collector, with or without feedback)
- 1 Experiment card with logic gates (NOT, AND, OR, NAND, NOR, EXOR, EXNOR) and a sequence of gates
- 1 Experiment card with JK flip-flop
- Labsoft browser and course software

Course contents:

- Introduction to common designs and properties of diodes
- Identifying typical diode applications
- Determining the valve and rectifier actions of diodes
- Recording static and dynamic characteristics for various diodes
- Determining diode parameters by measurement
- Investigation of limiting circuits using Zener diodes (with and without load)
- Introduction to basic transistor circuits
- Design and investigation of a transistor switch
- Experiment to set the operating point of a transistor
- Measurement of gain and input/output resistances in common emitter and common collector circuits
- Investigating the effect of resistive and capacitive feedback in a common emitter circuit
- Introduction to basic logic circuits
- Introduction to truth tables and symbols, logic equations and timing diagrams for each of the basic gates
- Experimental derivation of Boolean functions and laws
- Design of basic logic circuits using NAND gates and NOR-gates
- Minimisation of logic circuits with the aid of Karnaugh maps with experimental testing
- Introduction to the principle of a flip-flop



- Investigating the operation of a JK flip flop by measurement (static and dynamic input signal/single-pulse operation)
- Investigation of a counter circuit
- Fault simulation (16 simulated faults activated by relay)
- Course duration 9.5 h approx. (fault finding 2.5 h approx.)

Offer students an introduction to the fascinating world of electronics in vehicles with this training system. All the circuits are pre-fabricated and can be put into action simply by plugging in a few bridging plugs (jumpers). A key focus is in the usage and operation of measuring instruments when testing a customer's vehicle.

Training Content:

Electrical principles specifically explained for automotive applications

- Voltage DC, AC and PWM
- Resistance
- Current
- Ohms law
- Series and parallel and mixed circuits
- Understanding automotive circuits, wiring diagrams and electrical symbols

Automotive electrical component testing and diagnosis

- Fuses
- Relays
- Switches
- Transistors
- Potentiometers
- DC motors
- Light globes
- Power supplies

Automotive circuits

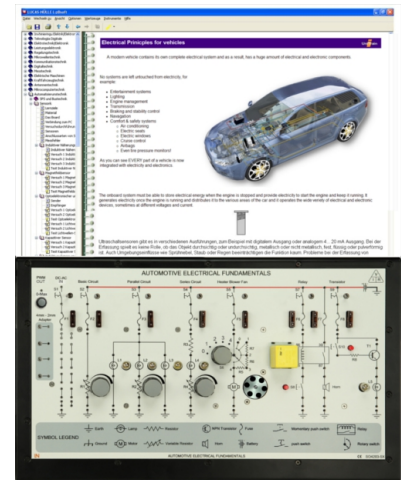
- Brake light circuit
- Instrument panel dimmer circuit
- Heater blower fan variable speed circuit
- Horn circuit

Use of typical automotive diagnostic tools found in the workshop

- Digital Multimeter
- Voltmeter
- Ohmmeter
- Ammeter
- Test light
- Oscilloscope

Diagnosing of common automotive circuit failures and components with built in automatic fault switching in the following areas

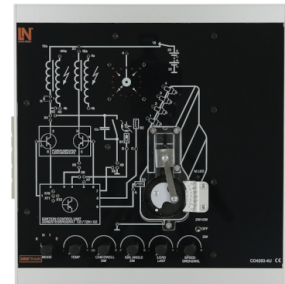
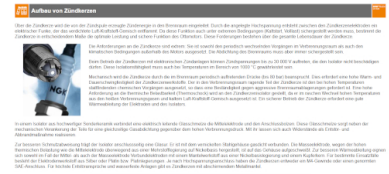
- Open circuits
- Short circuits
- Faulty components



Even conventional components of spark-ignition engines, such as the ignition system, continue to develop as a result of the advances in electronic systems. Modern ignition systems are complex and extraordinarily precise. They enable the outstanding performance of modern petrol engines while ensuring that emission standards are met. Trainees can use the UniTrain system to learn for themselves how an ignition system is constructed, what could go wrong with a system of this kind and how such faults can be diagnosed.

Training contents:

- How an ignition spark is generated
- Ignition timing with mechanical and map control
- Conventional ignition systems and dual-spark systems
- Transistorised ignition systems using Hall sensors and inductive sensors
- Electronic ignition systems
- Recording and assessment of oscilloscope traces for ignition systems
- Principles of static and rotary high-voltage distribution
- Course duration 8 h approx.

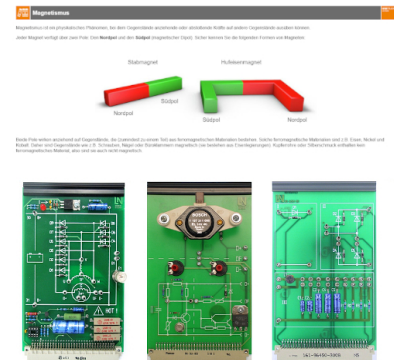


Includes:

- 1 Experiment card with three-phase generator/alternator, bridge rectifier and battery replacement circuit featuring charge monitoring light
- 1 Experiment card with integrated (original automobile component) and discretely assembled voltage regulators
- 1 Experiment card with half-wave and bridge rectifiers and load circuit
- Labsoft browser and course software
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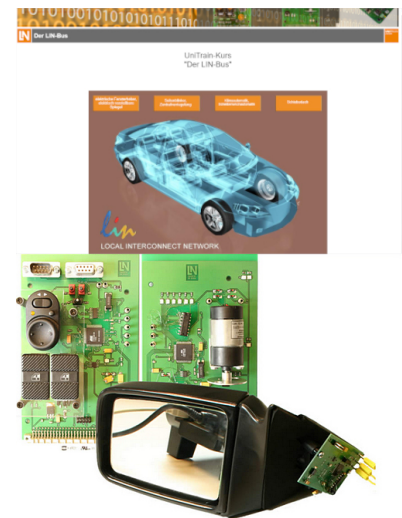
Course contents:

- Introduction to the basic terminology of magnetism/electromagnetism
- Explaining the Lorentz force phenomenon
- Introduction to the design and function of single-phase and three-phase generators
- Experimental determination of phase-shift with a three-phase generator
- Determining the number of pole pairs of a three-phase generator by measurement
- Introduction to the functioning of diodes
- Identifying difference between Zener and normal diodes
- Introduction to the functioning of transistors
- Explain the design and function of half-wave and bridge rectifiers
- Investigation of half-wave and bridge rectifiers by measurement
- Introduction to circuits in automobiles
- Experimental determination of the functioning of a charge control light
- Experimental determination of the conditions for charging a battery
- Introduction to the principle of voltage regulation in vehicles
- Introduction to the design and function of electromagnetic and electronic voltage regulators
- Investigation of how alternator voltage depends on engine speed and load by measurement
- Measurement of threshold voltage and switching tolerance for a voltage regulator
- Fault simulation (8 simulated faults activated by relay)
- Course duration 7.5 h approx. (fault finding 1.5 h approx.)



Includes:

- 1 Experiment card with LIN master and controls for LIN-bus-controlled window winders, door mirror, indicators and central locking
- 1 Experiment card with LIN slave and actuators window winder motors, and central locking, plus a sensor to detect the position of the window
- LIN-bus controlled door mirror
- Labsoft browser, course software and one additional virtual instrument, "LIN monitor"

Course contents:

- Development of bus systems in motor vehicles
- Modern automotive bus systems
- Topology and components of a LIN-bus system in a motor vehicle
- Experimental determination of electrical properties of a LIN bus (voltage levels)
- Introduction to the principle of addressing on a LIN bus
- Master and slave principle
- Investigation of data fields by measurement
- Structure of a packet frame for an LIN message
- Analysis of LIN messages using LIN monitor and oscilloscope
- Interpretation of LIN messages using LIN monitor and oscilloscope
- Editing and sending LIN messages using a PC
- Fault simulation (software-activated errors)
- Course duration: 8 h approx., (fault finding 1 h approx.)

7 UniTrain: Sensors in motor vehicles

CO4204-7F

1

Sensors serve the purpose of recording physical variables in their vicinity and converting them into electrical signals so that they can be processed by control units. This training system explains the function and diagnostic procedures involved in diagnosing key engine management sensor systems in both theory and practice.

Training contents:

- Physical principles: Induction, Hall effect, piezo-effect
- Purpose of sensors for engine control
- Inductive and Hall-type speed sensors and how they work
- Measurement of throttle valve position: throttle valve switches and potentiometers
- Mass air flow measurement using hot-filament and hot-wire sensors
- Measurement of pressure in the intake manifold
- Detection of shock waves using a knock sensor
- Temperature measurement using NTC and PTC sensors
- Troubleshooting (8 simulated faults activated via relays)
- Course duration: 10 h approx. (including about 2 hours for troubleshooting)

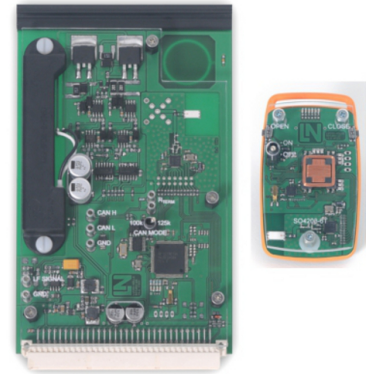
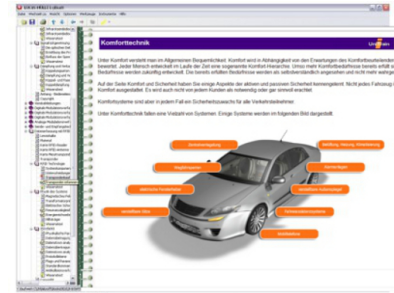


Includes:

- 1 experiment card (keyless-entry control unit with LF and HF aerials, touch pad),
- keyless entry remote (key fob) (LF-3D aerial, HF aerial, on/off button, status LEDs)
- Labsoft browser, course software and additional virtual instruments – “DIAGNOSTICS”, “CAR MONITOR”, CAN bus

Training contents:

- Comfort systems and safety
- Comfort systems in vehicles
- Central locking, electrical
- Central locking, electro-pneumatic
- Operation of central locking system, mechanical, infra-red, radio and self-triggering
- Familiarisation with various types of car key
- Keyless entry to vehicles
- Keyless locking
- Keyless entry system
- Non-contact opening of central locking
- Familiarisation with and configuration of comfort systems in vehicles
- Communication processes between vehicle and keyless entry remote (fob)
- Low-frequency RFID (communication between vehicle and key remote)
- High-frequency radio (communication between key remote and vehicle)
- HF and LF aerials
- Measurement of signal strength from aerials
- CAN network structure
- Fitting keyless systems to existing vehicles



9 UniTrain: Optical data buses for automotive applications (MOST bus)

CO4204-7H

1

Currently, optical bus systems are primarily used for multimedia systems with high data rates in luxury vehicles. Due to the ever greater amount of data processing needed in vehicles, though, such systems are becoming more widespread. Therefore, present-day trainees are likely to encounter the subject very often in their future careers. Consequently, our training system teaches the physical fundamentals of the topic as well as training students in practical diagnostics. The training system itself is an emulation of a full-scale optical fibre transmission network as used in vehicles plus a display and an attenuation meter. It also features an optical gauge to detect characteristic distortion effects in optical fibres as well as for investigation of coupling losses at splices along an optical fibre transmission line.

Course contents:

- Data networks in motor vehicles
- Reasons for increasing use of optical fibres in motor vehicles
- Digital transmission of letters and characters
- Fundamentals of a MOST bus
- MOST protocol
- MOST controllers
- MOST ring
- Diagnosing ring interruptions
- Design of optical fibre systems in motor vehicles
- Optical bus systems in motor vehicles
- Optical characteristics of light
- Basics of ray geometrics (refraction, reflection)
- Experimental determination of properties (attenuation) of optical fibres
- Investigation of optical fibres (electrical and optical) by measurement
- Course duration 6 h approx.

Includes:

- Optical gauge
 - Width of air gap adjustable via fine thread screws
 - Sideways adjustment at splice via fine thread screws
 - Dimensions: 50 x 50 x 80 mm, (H x D x W)
- Optical fibre 2.2 mm
- Original MOST optical fibres
- Simple optical fibre cutter

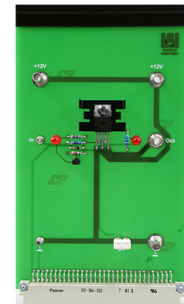


Includes:

- 1 Experiment card with FET amplifier and indicator LEDs
- Labsoft browser and course software

Course contents:

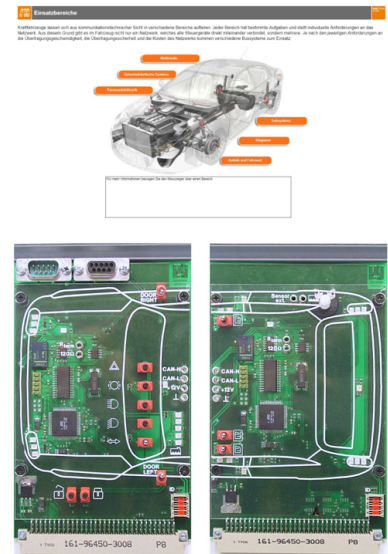
- Knowing the principle of pulse-width modulation
- List use cases of PWM in automotive engineering
- Power matching with PWM
- Explain the difference between direct and pulsed current
- Measurement of PWM signal characteristics: frequency, amplitude, pulse-width (duty cycle), edge and signal shapes
- Identify control and working circuits
- Measurement of PWM signals
- Diagnosis of PWM-controlled components
- Course duration 2.5 h approx.



With the UniTrain course "CAN bus in motor vehicles", trainees receive the perfect introduction to the most commonly used bus system to be found in motor vehicles. The CAN bus is used in practically every area of the motor vehicle and for that reason deserves special attention in automotive training. With this course the trainees learn how to understand the CAN bus by becoming familiar with both its function and its purpose. For that reason the course is particularly tailored for the automotive trainee target group, i.e. in that the theoretical portion focuses on essential and relevant material and on reaching the primary goal – namely automotive diagnostics. For this the trainee performs measurements on the CAN bus and learns how to interpret the signal traces obtained. Moreover, the trainee works with a simplified data matrix to be able to clearly trace the communication procedures in a CAN network. The last step involves having the defined ISO faults enabled in the training system which should put the trainee in a position to carry out realistic workshop diagnoses. Since the training system uses a real CAN bus as a foundation, there is also the opportunity of connecting the training system with the CAN bus of a real motor vehicle.

Course contents:

- List of reasons for increasing use of bus systems in vehicles
- Identifying various bus systems in vehicles
- Introduction to the topology and components of a CAN bus in a vehicle
- Introduction to the difference between low-speed and high-speed CAN buses
- Experimental determination of electrical properties of a CAN bus
- Experimental determination of (low-speed and high-speed CAN buses)
- Introduction to the principles of addressing and arbitration on a CAN bus
- Determining identifiers by measurement
- Introduction to the structure of a message frame for a CAN message
- Analysis of CAN packets using the CAN monitor and an oscilloscope
- Interpretation of CAN packets using the CAN monitor and an oscilloscope
- Editing and transmitting CAN message via PC
- Investigating the effect of termination on a low-speed and high-speed CAN bus by measurement
- Fault simulation (8 simulated faults activated by relay)
- Course duration 7 h approx. (fault finding 1.5 h approx.)



For around 20 years now CAN bus has been the dominant bus system in the automobile industry. This is true whether it be in the compact car segment, the luxury sedan class or even commercial utility vehicles. Seen from the bus system's perspective the CAN bus provides the foundation upon which communication within the vehicle can happen. But due to the ever growing "electronification" of the motor vehicle, even this universally deployable communication bus is now reaching its limits. For that reason, it was of the utmost importance that progress be made in the development of the CAN bus and to adapt it to the enhanced technical demands of the here and now. The result is called CAN-FD (FD stands for Flexible Data-Rate) and is currently being integrated into the mass production of major car manufacturers.

To facilitate optimum customer-oriented diagnostics in garages and repair shops, these innovations need to be understood, particularly in terms of their details appear in signal traces. A flexible transmission speed or bit rate as well as an extended data length mean that new bits have to be used which act as indicators. All of these special features as well as more efficient diagnostic approaches will be presented in this UniTrain course and explained in simple and understandable terms using a host of experiments. The trainee puts his or her own CAN FD network into operation and then proceeds to perform diagnostics that also includes a comprehensive set of measurements.

Your benefits:

- State-of-the-art technology explained in an easy and understandable way
- Perfect preparation for real diagnostics in the garage
- Measurements conducted on a real CAN FD network
- Easy to put into operation
- Includes diagnostics software to do readings on the CAN FD bus

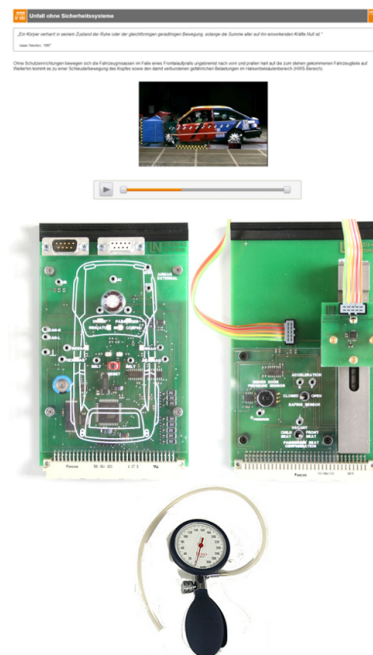


Includes:

- 1 experiment card with model of a motor vehicle with driver's airbag, front passenger airbag, side airbags on driver's and passenger's sides, head airbags and belt tensioners for driver and front passenger, fault indicator-LED, reset button and CAN bus interface
- 1 experiment card with airbag-related sensors (acceleration sensor on moving mechanism, catapult installation, seat occupancy switch, pressure sensor, safety switch)
- Labsoft browser and course software

Training contents:

- Active and passive safety in motor vehicles
- Purpose and function of airbags and belt tensioners
- How the airbag igniter works
- Purpose and function of the safety switch
- Purpose and function of the acceleration sensor
- Measuring acceleration
- Purpose and function of the pressure sensor
- Typical collision situations
- Seat occupancy detection
- Trip times and sequences
- Fault management in airbag systems
- Fault simulation (4 simulated faults individually activated via relays)
- Course duration: approx. 8 h (of which approx. 1 h fault simulation)



With the UniTrain course "Electric drives in the motor vehicle" you get the perfect introduction to the subject of hybrid and electric motor vehicles. The trainee assembles his or her own electric drive from a variety of components and then puts it into operation. Thanks to individual components coming from the areas of "energy conversion" and "drives", the most important material is presented clearly and understandably thus facilitating rapid and efficient understanding and learning. In addition to all of the technically important subjects (HV battery, inverter, synchronous and asynchronous three-phase machines, recuperation, etc.), other topics are explored such as "work safety" and the intrinsic safety of electrical and hybrid vehicles. A large number of animations and images are included to assist in the learning process as well as hands-on, practical experiments which add practical skills to the theoretical knowledge already acquired. To round off the course, all of the material is then tested by means of diverse knowledge tests so that the learning progress of each and every student or trainee can be monitored and advanced.

Includes:

- 1 Self-commutated current converters experiment card, microcontroller-based PWM module with 6 MOSFET transistors plus intermediate voltage circuit for up to 40 V and output current up to 1A, software-controlled multiplexer for simultaneous measurement of multiple voltages and currents, visualisation for MOSFET switching states by means of LEDs
- 1 Experiment card with intermediate circuit, charging circuit for intermediate capacitors and braking chopper.
- 1 Stator experiment card with three-phase winding and rotor, start-up and operating capacitors and a temperature sensor with its own power source.
- 1 Flyweight
- Labsoft browser, course software and additional virtual instruments

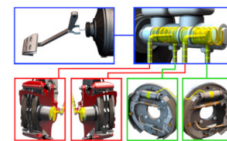
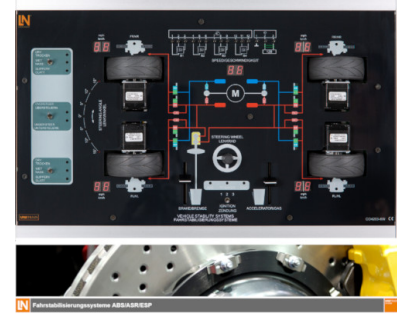
Course contents

- List of rules for working safely with hybrid vehicles
- Differences between differing drive configurations (series and parallel hybrid systems, dual-mode hybrids)
- Different operating modes for hybrid vehicles
- Design and function of electrical drives for hybrid vehicles
- Control components for hybrid drives
- Principle of carrier frequency control
- The function of inverters and intermediate circuits
- Design and function of alternators
- Experimental investigation of operating response of alternators
- Components of on-board networks for hybrid vehicles
- Principle of energy recovery from braking
- Measurement of recovered voltage in braking manoeuvres
- Measurement of voltage ratios for frequency converters
- Investigating transmission of energy and force
- Course duration 8 h approx.



Today the terms ABS, ASC and ESP are part of standard everyday vocabulary in automotive engineering. Everyone, from the master auto mechanic to the car crazed end customer is familiar with these terms and knows what they stand for. Today they are standard equipment in every passenger vehicle and truck coming off the assembly line and play an important role in boosting safety on our streets. Not only that, motor vehicle manufacturers and their suppliers are constantly trying to develop these systems further and add new features to them and expand their functionality so that performance and safety can be increased even further.

With this training system you will enjoy a unique insight into the various systems and their control processes. For the processes occurring inside the vehicle in fractions of a second, the training system is able to take individual control processes and depict them in a simple way, making them transparent and visible for the human eye. Furthermore, all of the relevant driving situations can be explored in a practical manner simply by varying simulation parameters (driving behaviour, varied street surfaces, steering angle, vehicle speed, braking strength). The corresponding multimedia course contains all the necessary theoretical content und provides simple and easy-to-understand explanations of the material based on numerous videos and animations. Thanks to the integrated fault simulator as well as the various knowledge tests, the learning progress of the student or trainee is monitored and important diagnostic skills developed.



Includes:

- 1 Experiment board for investigating anti-lock braking systems (ABS), traction control systems/anti-slip regulation (ASR) and electronic stability control (ESC)
 - Four wheel with independent drive
 - Digital speedometer display for each individual wheel and the vehicle as a whole
 - Slider for acceleration and braking
 - Simulation of various road conditions (dry, wet, icy road)
 - Steering with steering angle display via LED
 - Simulation of oversteer and understeer
- Labsoft browser and course software

Training contents:

- Process control and instrumentation
- Driving safety in motor vehicles
- Basic physics of driving
- Investigation of components
- Anti-lock braking systems (ABS)
- Understanding a system overview
- Requirements for anti-lock braking systems (ABS)
- Investigation of how an ABS control system operates
- Function of a typical ABS braking system
- How brake boosters and hydraulic brakes work
- Detecting the effects of typical faults in an ABS braking system
- Traction control systems (ASR)
- Identifying and describing functions
- Objectives and structure of ASR
- Investigation of typical control situations

- Electronic stability control (ESC)
- Requirements for electronic stability control
- Objectives and function
- Response to various driving manoeuvres
- Investigation of overall control system and control variables
- Fault simulation (faults can be activated via computer)
- Course duration: 6 h approx. (including 2 hours fault finding)

16 UniTrain: Common rail diesel injection system

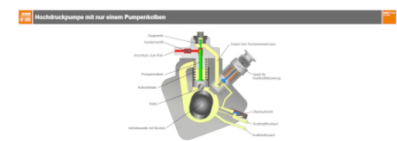
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What makes diesel vehicles quieter? How can emissions be reduced? This training system is used for the teaching of modern common rail injection systems. Trainees can use the system to learn about typical injection pressures, procedures and quantities at their own pace. In order to cover all the wide range of systems available in the market, it is possible to switch between a variety of injector types. That means the system can encompass the full scope of the subject.

Training contents

- Requirements for diesel injection systems
- Various designs of diesel injection systems
- Design and function of a common rail system
- Troubleshooting for a common rail system
- Injection response: electromagnetic and piezo-injectors.
- Low- and high-pressure circuits
- Procedure for electrical testing of injectors
- Familiarisation with hydraulic components of common rail systems
- Course duration 10 h approx.



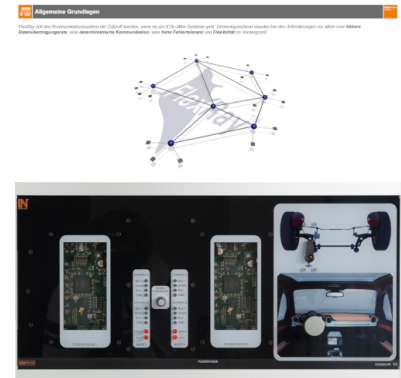
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Any introduction to motor vehicle electronics will inevitably have to cope with the ever more complex network interconnection in today's models. This involves sensors, actuators and control units, as well as entertainment and navigation equipment. FlexRay is the most important communication system for drive-by-wire and other such interconnected networks. The primary requirements for such systems are higher data transmission rates, deterministic communication, high fault tolerance and flexibility. This UniTrain course covers the subject of FlexRay in a way which closely reflects authentic modern practice.

Training contents:

- Overview of bus systems available on the market
- Introduction to the fundamental technical aspects of communications relevant to the FlexRay bus (topologies, multiplexing methods)
- Detailed explanation of the structure of a FlexRay node
- Detailed observation of signal generation (symmetrical data transfer)
- Investigation of electromagnetic compatibility aspects
- Detailed description of data link layer
- Analysis of protocol down to bit level
- Description of time base used on a FlexRay bus
- Use of measuring instruments to investigate bus signals
- Measurements of the resistance to interference on the bus
- Fault simulation (4 faults which can be activated via relays)
- Course duration 10 hours approx. (including 1 hour of fault finding)



Many experts from the automotive industry and vehicle development see fuel cells as a possible solution to the fact that the range of current electric vehicles remains too limited. As a cleaner alternative to electric/petrol hybrids with their own internal combustion engine, fuel cells may be in a position to supply electrical energy on the basis of two inexpensive and readily available substances. However, for automotive mechatronics engineers, fuel cells represent a new and hitherto untried technology, for which maintenance and diagnostics will need to be learned. This course provides the necessary knowledge and understanding of the way that such fuel cells work and how they are put together. In addition, numerous experiments and measurements on an authentic fuel cell enable trainees to gain the practical experience and diagnostic skills required for dealing with this technology.

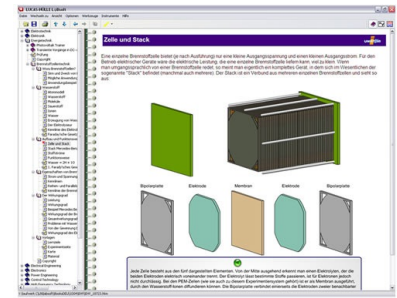
Includes:

Experiment panel with:

- PEM double fuel cell
- PEM electrolyser with scaled gas storage device
- Power supply 2V/ 2.5A
- Consumers
- Hoses, hose clamps
- Variable load for characteristic recording
- Labsoft browser and course software

Course content:

- Functional and operating principle of fuel cells
- Recording the characteristics of a fuel cell
- Learn to explain the electrochemical processes of electrolysis (Faraday's first and second law)
- Faraday's laws and determining the energy efficiency of a fuel cell
- Series and parallel configuration of fuel cells
- Considerations regarding the power of fuel cells
- Functional and operating principles of electrolysers
- Recording the VI characteristic of the electrolyser
- Faraday's laws and determining the energy efficiency of an electrolyser
- Course duration approx. 4.5 h



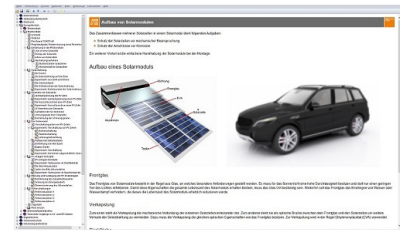
Includes:

Experiment board with the following features:

- 4 Monocrystalline solar modules, 6 V/40 mA
- 1 Solar rechargeable battery 12 V/1.2 Ah
- Integrated charging regulator with microcontroller, deep discharge protection and excess voltage protection
- 12-V PC fan and 12-V built-in LED indicator to act as fixed loads
- Variable load for recording characteristics
- Dimmable 120-W reflector lamp
- CD-ROM with Labsoft browser and course software

Training contents:

- Functioning principle and method of operation of solar cells
- Meaning of terms "solar radiation" and "solar constant"
- Various types of solar cell
- Methods of manufacture for solar cells
- Circuit designs for solar cells
- Recording the characteristic for a solar module
- How current and voltage from a solar module depend on temperature, radiation intensity and angle of incidence
- Design of a solar rechargeable battery
- Energy storage in a solar rechargeable battery
- Various types of solar plant
- Design of an insular power network with a rechargeable battery
- Course duration: 4.5 h approx.



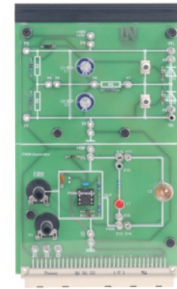
This UniTrain course provides easy-to-understand material on the benefits and function of DC/AC conversion in the automotive area. Thanks to target-group oriented theory and practical experiments, the trainee becomes familiar with the technical processes and components required to make DC/AC conversion possible.

Includes:

- 1 Experiment card (potentiometer and incandescent lamp, PWM generator, DC-AC converters)
- LabSoft browser course software and virtual instruments

Training contents:

- Electrical induction
- Lorentz force
- "Right hand rule"
- Relationship between current and voltage
- Pulse width modulation (PWM)
- PWM and voltage
- PWM and current
- Generating upper half-wave
- Generating AC voltage
- Rotating electrical field



For inverters in electric and hybrid vehicles, as well as many other applied circuits, DC voltages of multiple levels are required. This course investigates ways of converting from one DC voltage to another.

Includes

- Experiment card (step-up-converter) with circuitry for experiments in Eurocard format
- Labsoft browser, course software and additional virtual instruments
- Storage case
- Jumpers
- Extra capacitor
- Two coils with iron core

Components on experiment card:

- Push-buttons
- Electronic circuitry for a DC-DC converter
- Electrical controller for electronics with indicator light
- Sockets for a coil
- Sockets for extra capacitor
- Sockets for jumpers to connect components
- Measurement sockets

Training contents

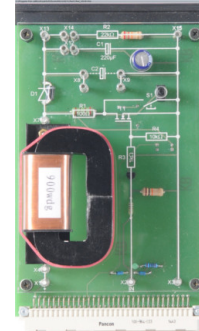
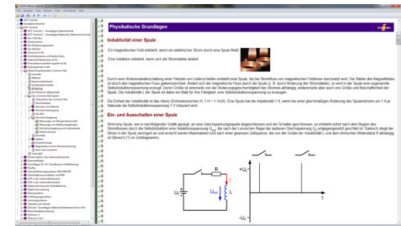
- Fundamental of DC-DC converters
- Compiling repair shop orders
- Diagnostic functions
 - Reading out fault memory with a diagnostic tester
 - Classifying faults in vehicle systems
- Function and design of a pilot line
 - Design of electric circuit
 - Principle of operation
 - Control
 - Circuit variants
- Repair methods and conversations with customers
 - Selection of repair actions as specified by manufacturers
 - Working with spare part numbers
- Investigation using measuring instruments
- Course duration 6 hours approx.

Operating voltage:

- Input voltage 5V DC
- Output voltage 5-40V DC

Dimensions/Weight:

- 100 x 170 mm (width x height)
- 0.8 kg



For inverters in electric and hybrid vehicles, as well as many other applied circuits, DC voltages of multiple levels are required. This course investigates ways of converting from one DC voltage to another.

Includes

- Experiment card (step-down-converter) with circuitry for experiments in Eurocard format
- Labsoft browser, course software and additional virtual instruments
- Storage case
- Jumpers
- Extra capacitor
- Two coils with iron core

Components on experiment card:

- Push-buttons
- Electronic circuitry for a DC-DC converter
- Electrical controller for electronics with indicator light
- Sockets for a coil
- Sockets for extra capacitor
- Sockets for jumpers to connect components
- Measurement sockets

Training contents

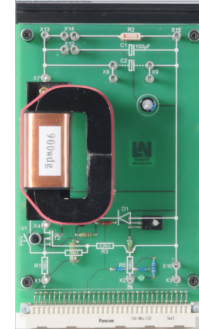
- Fundamental of DC-DC converters
- Compiling repair shop orders
- Diagnostic functions
 - Reading out fault memory with a diagnostic tester
 - Classifying faults in vehicle systems
- Function and design of a pilot line
 - Design of electric circuit
 - Principle of operation
 - Control
 - Circuit variants
- Repair methods and conversations with customers
 - Selection of repair actions as specified by manufacturers
 - Working with spare part numbers
- Investigation using measuring instruments
- Course duration 6 hours approx.

Operating voltage:

- Input voltage 15 V DC
- Output voltage 0-15 V DC

Dimensions/Weight:

- 100 x 170 mm (width x height)
- 0.8 kg



A pilot line is a protective safeguard intended to ensure the safety of users and workshop personnel in the automotive sector. Learn about pilot lines via interactively based experiments.

Includes:

- Experiment card with circuitry for experiments in Eurocard format
- Labsoft browser, course software and additional virtual instruments
- Storage case
- Jumpers

Components on experiment card:

- Electronic circuitry for a pilot line
- Measurement sockets
- Fault simulation circuitry

Training contents

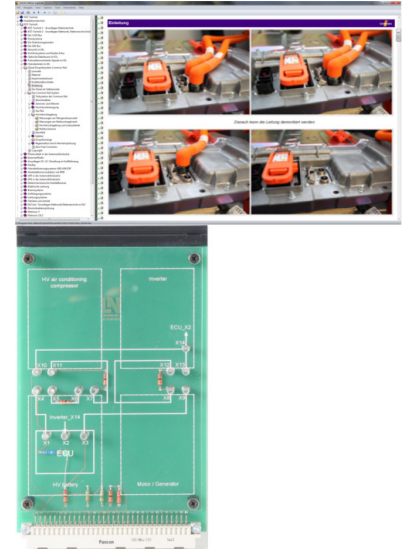
- Fundamentals of pilot lines
- Compiling repair shop orders
- Diagnostic functions
 - Reading out fault memory with a diagnostic tester
 - Classifying faults in vehicle systems
- Function and design of a pilot line
 - Design of electric circuit
 - Principle of operation
 - Control
 - Circuit variants
- Repair methods and conversations with customers
 - Selection of repair actions as specified by manufacturers
 - Working with spare part numbers
- Investigation using measuring instruments
- Practical troubleshooting (5 simulated faults which can be activated via relays)
- Course duration 7 hours approx., including 1.5 hours for troubleshooting

Operating voltage:

- 0-10 V pulse-width modulated voltage

Dimensions:

- 100 x 170 mm (width x height)



High-voltage battery disconnect unit (BDU)

The battery disconnect unit training system allows the design and operating principle for disconnecting a high-voltage battery from the on-board network to be investigated.

Includes

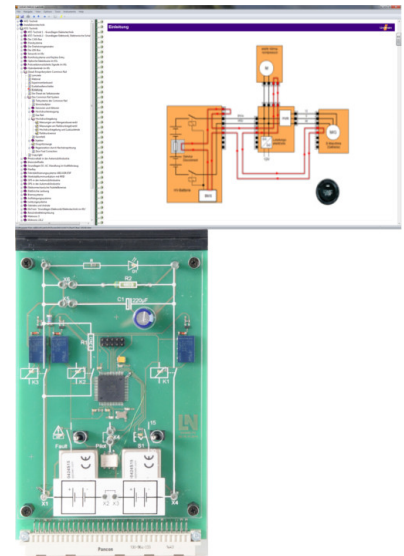
- Experiment card with circuitry for experiments in Eurocard format
- Labsoft browser, course software and additional virtual instruments
- Storage case
- Jumpers

Components on experiment card:

- Electronic circuit for battery disconnect unit (BDU)
- Measuring sockets
- Fault simulation circuitry
- Two battery blocks
- Three relays
- Microcontroller-based control
- Service and maintenance plug
- Ignition switch
- Lamp to indicate when ignition is on
- High-voltage fault switch
- High-voltage fault indicator
- Pilot disconnecting bridge
- DC-link circuit capacitor
- Load for on-board network
- Display of on-board network load
- Measurement sockets for battery blocks
- Measurement sockets for on-board network

Training contents

- Fundamentals of battery disconnect units
- Compiling repair shop orders
- Diagnostic functions
 - Reading out fault memory with a diagnostic tester
 - Classifying faults in vehicle systems
- Function and design of a pilot line
 - Design of electric circuit
 - Principle of operation
 - Control
 - Circuit variants
- Repair methods and conversations with customers
 - Selection of repair actions as specified by manufacturers
 - Working with spare part numbers
- Investigation using measuring instruments
- Effect of faults commonly seen in practice (simulated faults can be activated)
- Course duration 7 hours approx.



Dimensions/weight:

- 100 x 170 mm (width x height)
- 0.8 kg

25 UniTrain: Safe Handling of HV Systems

CO4205-1M

1

The "Safe handling of high-voltage systems" training system focuses on occupational safety in the presence of high-voltage electric vehicles and safe handling of a charging station.

Includes

- Experiment card with experiment circuit in Euro format
- Labsoft browser, course software and additional virtual instruments
- Storage case
- Measuring accessories

Components on experiment card:

- Electronic circuit for demonstrating the intrinsic resistance of a human being
- Gloves for electrical safety
- Insulating mat
- Absolute earth potential
- Measuring sockets for measuring resistance between hands
- Measuring sockets for measuring resistance between hands and one foot
- Measuring sockets for measuring resistance between hands and both feet
- Measuring sockets for measuring resistance between hands and chest
- Measuring sockets for measuring resistance between chest and one foot
- Measuring sockets for measuring resistance between chest and both feet

Training contents

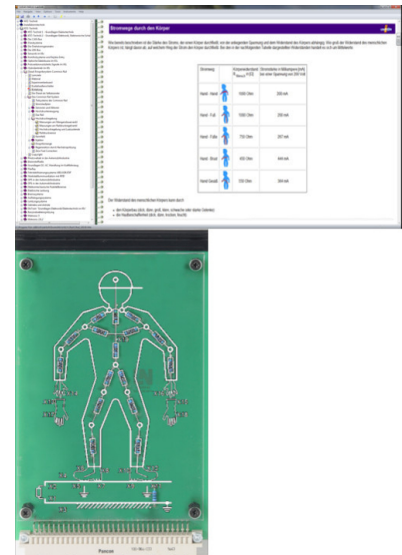
- Safety fundamentals for handling high-voltage electric vehicles
- Creating repair shop job orders
- Diagnostic functions
- Investigation by means of measurements
- Effects of practical faults (faults can be switched on or off)
- Course duration 7 hours approx.

Operating voltage:

- 30 V DC
- 12 V AC

Dimensions/weight:

- 100 x 170 mm (width x height)
- 0.8 kg



The UniTrain course "48V on-board network" describes the full structure of a 48V sub-system for an on-board power network and how it is incorporated into the rest of the vehicle with the help of intricate animations and targeted theory. Safety-related skills are fostered by means of numerous practical exercises where trainees have to use various methods to isolate the 48-V system, for example. A special focus is put on the fault case scenario, if the shutdown procedure cannot be performed correctly. The package is rounded off with built-in interactive fault simulation, which helps to convey the necessary diagnostic capabilities.

Training contents

- Design of a 48-V on-board sub-network
- Integration into vehicles
- Typical 48V components
- Isolation of 12V/48V on-board network
- Sample applications
- Circuit diagrams for 48-V on-board sub-networks
- Isolating/disconnecting 48-V on-board sub-networks
- Safety procedures for diagnostic work
- Diagnostics

Includes:

- "48-V sub-network" training system
- Built-in fault simulation
- Interactive e-learning course including theory and practical experiments



Today's traffic sign density, particularly in urban areas, in combination with very high traffic volume overall, is placing ever higher demands on the driver. In an effort to reduce those demands in recent years by transferring more and more tasks to the vehicle, the automotive industry has focused on "driver assistance systems". One very modern system of this class is the predictive speed control, which works in direct cooperation with traffic sign recognition. The core of this system is a camera that captures the full surroundings ahead of the vehicle. As soon as a traffic sign appears within the detection radius, the system analyses it and displays it to the driver visually. Under active speed control, any speed limitation is implemented automatically.

To help trainees understand this complex topic and be able to diagnose the system, a UniTrain course has been developed that brings the theory and practice of this sophisticated system into the classroom. Trainees commission a complete ADAS system and carry out a variety of practical tasks on it. The required diagnostic expertise will also be communicated within the framework of this course.

Training contents:

- Design and operation of the driver assistance system
- Integration of the camera in the overall system
- Role of the driver assistance system
- Learning about the diagnostic functions
- Familiarisation with the system limits

Includes:

- Realistic driver assistance system, including camera
- Monitoring software to display the data on the PC
- Various traffic signs
- Interactive e-learning course including theory and practical experiments



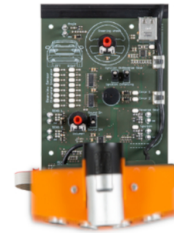
Another driver assistance system that's indispensable in the era of narrow parking spaces and large SUVs or saloons (sedans). The UniTrain course presents a complete rear end system for a vehicle comprising several ultrasonic sensors and a reversing camera. Along with the technical features of the overall system as well as the functionality of the individual components, trainees also gain practical insights into the handling and diagnosis of the system. This enables them to learn about the physical limitations of the assistance system along with ways to diagnose different malfunctions.

Training contents:

- Design and operation of the driver assistance system
- Integration of the camera in the overall system
- Functionality of the ultrasonic sensors
- Role of the driver assistance system
- Learning about the diagnostic functions
- Familiarisation with the system limits

Includes:

- Realistic driver assistance system, including camera
- Monitoring software to display the data on the PC
- "Parking space" graphic to simulate the parking procedure
- Interactive e-learning course including theory and practical experiments



This training system makes it possible for you to gain a profound understanding of modern operating concepts of the latest motor vehicles and to learn the necessary skills to perform diagnostics on these systems. You will learn how capacitive and resistive-type touchscreens work and the different ways they are operated. Capacitive switches are very closely related to capacitive touchscreens and are also included in the training material used in this training system. But the highlight of this system is the integrated gesture control system which you will become very familiar with in the practical experiments. The entire package is rounded off with a host of diagnostic assignments which includes switching on fully automated fault simulations integrated into the training system. The trainee must work through the faults on his or her own using a diagnostics strategy in order to be able to isolate the malfunction.



Training contents

- Fundamentals of capacitive touch sensors
 - Touch slide controller
 - Touch rotary controller
 - Touch using haptic feedback signals
 - Concepts of gesture recognition
- The IPO principle
 - Allocation of components
- Switching thresholds of touch sensors
 - Determination using measurement techniques
 - Mathematical determination
- Analog or digital voltage outputs
 - Measurement verification of the analog or digital output signal
- Seat heating control
 - Signal recording for temperature control
- Fundamentals of capacitive-type gesture control
 - Interplay of several gesture control zones
 - Fan control using hand gesture
- Opening rear hatch (tailgate) with hand gesture
 - Interaction of electronic key and non-contact capacitive sensors
- Network in the motor vehicle - CAN
 - CAN communication
 - Signal recording
- Diagnostics
 - Basic principles
 - Basic measurements
 - Work with the circuit diagram
 - Work with a list of desired values
 - Work with a diagnostics flow chart
 - Hands-on troubleshooting

Additionally recommended:

Pos.	Product name	Bestell-Nr.	Anz.
30	UniTrain storage case for experiment board	SO4203-2V	1

Sturdy aluminium case with moulded foam block to accommodate an experiment board

- Capable of accommodating 1 experiment board and smaller accessories
- Lockable padlock; stable padlock hinge
- Colours: aluminium, black, chrome
- Dimensions: 600 x 450 x 175 mm
- Weight: 2.5 kg



Additionally recommended:

CAN bus-controlled passenger door



CAN bus-controlled passenger door

Accessory to the UniTrain course "Automotive 10: CAN bus"

List of articles:

Pos.	Product name	Bestell-Nr.	Anz.
31	Golf V passenger door, CAN connection, window lift, mirror, mobile	SO3216-2Y	1

Front passenger door of a Volkswagen "Golf Mk V" mounted on a metal frame. The door can be connected to a 12V power supply and the CAN-bus training system. Operation by switches and push buttons in the door itself, via software or via the CAN-bus training system. Messages conform to Volkswagen's original programming.

- Operating voltage: 12V
- Control elements: power window controls, door lock
- Bus inputs: 4mm safety plugs
- Load outputs: 4mm safety plugs
- Dimensions: 1220 x 1200 x 460mm
- Weight: 38.7kg
- The colour of the door may vary



Please note that the door is used, not new, and may exhibit signs of use.

Power supply:

Pos.	Product name	Bestell-Nr.	Anz.
32	Power supply, 13.5 V, 45 A	CO3223-1C	1

The "Power supply" module is part of various training systems including the "Modular engine management" system. It provides power to various components in a similar to the way they are supplied in practice in a real engine by means of a 12 V battery. The module employs a 600 watt power unit which can supply a maximum current of 45 A at 13.5 V between its screw terminals. To protect the training system, a maximum current of 30 A can be tapped via the 4-mm safety sockets. This protective function is implemented by electronic monitoring of the 4mm safety sockets. Thanks to the high-resolution printing on the front panel, the module can immediately be identified as a typical car battery.

Technical highlights:

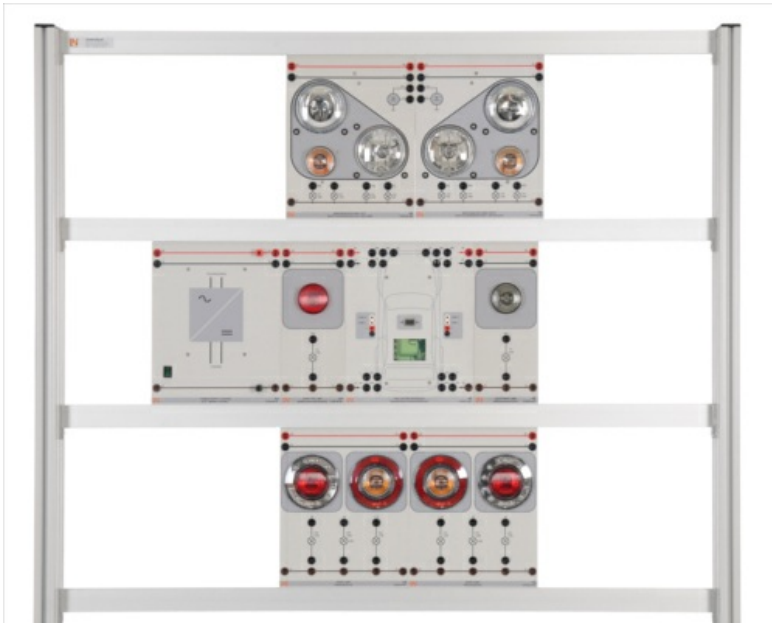
- Stable on-board network voltage of 13.5 volts
- Automatic cut-out without fuses
- Short-circuit protection
- Typical appearance of a vehicle battery thanks to high-resolution printed image of a starter battery
- Maximum current: 45 A

Technical details:

- Operating voltage: 90-264 V AC (47-63 Hz)
- Dimensions: 297 x 227 x 180 mm (HxWxD)
- Weight: 1.6 kg



CAN bus-controlled vehicle lighting



CAN bus-controlled vehicle lighting

Accessory to the UniTrain course "Automotive 10: CAN bus"

List of articles:

Pos.	Product name	Bestell-Nr.	Anz.
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33 CAN lighting interface

CO3216-3F

1

Control unit for controlling vehicle lighting components from the UniTrain-I card "CAN Node Front" via CAN bus or switching interface CO3216-2X

- Baud rate parameters can be configured
- Compatible with Low-Speed and High-Speed CAN buses (ISO 11898-2 and ISO 11898-3)
- Operating voltage: 12 V/13.8 V
- Outputs: 18 load outputs, max.7.5 A
- Bus outputs: 2-mm and 4-mm safety sockets
- Load outputs: 4-mm safety sockets
- Dimensions: 297 x 228 x 60 mm
- Weight: 1.1 kg



34 **Main headlight unit with side light, headlight range control & indicator (right)**

CO3216-2N

1

Complete headlight unit with headlight range control

- Operating voltage: 12 V
- Operational units: Actuator motor for range control
Indicator light PY 21W
Dipped headlight H7 55W
Main beam H7 55W
Parking light T 4W
- Inputs/outputs: 4mm safety sockets
- Dimensions: 297 x 228 x 160 mm



35 **Main headlight unit with side light, headlight range control & indicator (left)**

CO3216-2M

1

Complete headlight unit with headlight range control

- Operating voltage: 12 V
- Operational units: Actuator motor for range control
Indicator light PY 21W
Dipped headlight H7 55W
Main beam H7 55W
Parking lights T 4W
- Inputs/outputs: 4mm safety sockets
- Dimensions: 297 x 228 x 160 mm



36 **Tail light unit with LED rear light (left)**

CO3216-2P

1

Complete tail light unit with modern LED rear light and stipulated reflector

- Operating voltage: 12 V
- Operational elements: LED rear light 1.8W
Brake P21W
Indicator light PY 21W
Reflector
- Inputs/outputs: 4mm safety sockets
- Dimensions: 297 x 114 x 120 mm



37 Tail light unit with LED rear light (right)

CO3216-3D

1

Complete tail light unit with modern LED rear light and stipulated reflector

- Operating voltage: 12 V
- Operational elements: LED rear light 1.8W
Brake P21W
Indicator light PY 21W
Reflector
- Inputs/outputs: 4mm safety sockets
- Dimensions: 297 x 228 x 120 mm



38 Auxiliary lamp

CO3216-2B

2

The auxiliary lamp can be used as a fog lamp, searchlight or for other auxiliary lighting purposes.

- Operating voltage: 12V
- Headlamp: 55 W/H3
- Inputs and outputs: 4mm sockets
- Dimensions: 297x114x70mm
- Weight: 1.4kg



39 Rear fog lamp

CO3216-2E

1

The rear fog lamp is suitable for subsequent installation and for supplementing the overall lighting system.

- Operating voltage: 12V
- Power: 21W
- Inputs and outputs: 4mm sockets
- Dimensions: 297x114x120mm
- Weight: 1.0kg



40 Reversing lamp

CO3216-2F

1

The reversing light is suitable for subsequent installation and for supplementing the overall lighting system.

- Operating voltage: 12V
- Power: 21W
- Inputs and outputs: 4mm sockets
- Dimensions: 297x114x120mm
- Weight: 1.0kg



Power supply:

Pos.	Product name	Bestell-Nr.	Anz.
41	Power supply, 13.5 V, 45 A	CO3223-1C	1

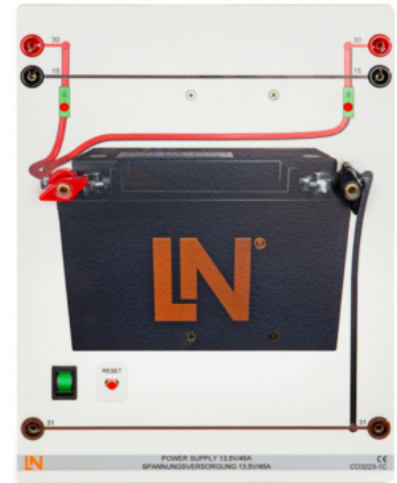
The "Power supply" module is part of various training systems including the "Modular engine management" system. It provides power to various components in a similar to the way they are supplied in practice in a real engine by means of a 12 V battery. The module employs a 600 watt power unit which can supply a maximum current of 45 A at 13.5 V between its screw terminals. To protect the training system, a maximum current of 30 A can be tapped via the 4-mm safety sockets. This protective function is implemented by electronic monitoring of the 4mm safety sockets. Thanks to the high-resolution printing on the front panel, the module can immediately be identified as a typical car battery.

Technical highlights:

- Stable on-board network voltage of 13.5 volts
- Automatic cut-out without fuses
- Short-circuit protection
- Typical appearance of a vehicle battery thanks to high-resolution printed image of a starter battery
- Maximum current: 45 A

Technical details:

- Operating voltage: 90-264 V AC (47-63 Hz)
- Dimensions: 297 x 227 x 180 mm (HxWxD)
- Weight: 1.6 kg

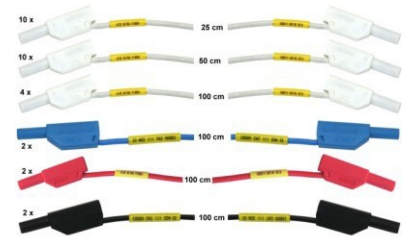


Accessories:

Pos.	Product name	Bestell-Nr.	Anz.
42	Set of safety measurement cables, 4mm (30 leads)	SO5148-1A	1

Set of safety measurement leads with stackable 4 mm laminated plugs and highly flexible, double insulated wires, consisting of the following:

- 10 Safety measurement leads, 4 mm, 25 cm, white
- 10 Safety measurement leads, 4 mm, 50 cm, white
- 2 Safety measurement leads, 4 mm, 100 cm, red
- 2 Safety measurement leads, 4 mm, 100 cm, black
- 2 Safety measurement leads, 4 mm, 100 cm, blue
- 4 Safety measurement leads, 4 mm, 100 cm, white
- Wire cross section 2.5 mm²
- Rating: 600 V, CAT II, 32 A



43	Safety connecting plug 4mm with tap (2x), white, 1000V/32A CAT II	SO5126-3X	16
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Moulded insulation

- both sides with touch protection (safety plug + safety sockets), distance 19 mm
- transition resistance max. 6 mΩ
- rated data: 1000 V / 32 A CAT II
- colour white






44	Panel mounting frame for 1200mm table, T-shaped base, 3 levels	ST8003-1D	1
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Training panel frame with aluminium profile rails to accommodate training panels of DIN A4 height. The aluminium profile rails have inward-facing brushes to allow quick and quiet replacement of training panels without the need for tools.

- Side sections with T-shaped base where the bottom rail rests on the table top
- Side sections made of rectangular steel tubing (30 x 20 x 2 mm), powder-coated grey surface (RAL 7047)
- 4 Naturally brushed aluminium profile rails with inward-facing brushes
- Usable on lab benches with and without power supply ducts as well as any other existing surface
- Dimensions, WxH: 1160 x 1060 mm, 3 levels



Additionally recommended:

Pos.	Product name	Bestell-Nr.	Anz.
45	Steering wheel unit with Airbag Complete steering wheel with airbag - container and fully functional reusable airbag. <ul style="list-style-type: none">• Operating voltage: 12 V/DC• Air supply: max. 10 bar• Air connection: 4mm quick-action plug connection• Air volume: mind. 32 litres• Inputs and outputs: 4mm sockets• Dimensions: 297x456x290mm• Weight: 5.8kg	CO3219-1P 	1
46	Adapter - connection cable, 4/2mm (100cm, white) Connection cable with one 2mm connector and one 4mm connector for connections between 2mm and 4mm laboratory connection systems. <ul style="list-style-type: none">• Connector type: 2mm system / 4mm system• Cable length: 100 cm• Color: white	SO5126-6V 	2
47	Adapter - connection cable, 4/2mm (100cm, black) Connection cable with one 2mm connector and one 4mm connector for connections between 2mm and 4mm laboratory connection systems. <ul style="list-style-type: none">• Connector typ: 2mm system / 4mm system• cabel length: 100 cm• color: black	SO5126-6Y 	1

48 **Adapter - connection cable, 4/2mm (100cm, red)**

SO5126-6W

1

Connection cable with one 2mm connector and one 4mm connector for connections between 2mm and 4mm laboratory connection systems.



- Connector typ: 2mm system / 4mm system
- cabel length: 100 cm
- color: red

49 **Compressor, low-noise**

SE2902-9L

1

Extremely quiet compressed air system with compressor motor, thermo switch and automatic pressure switch. Tanks made of special steel with security valve and non-return valve, master pressure gauge, condensation drain, stop valve and maintenance unit

- Motor output: 0.34 k W
- Suction capacity: 50 l / min
- Power consumption at 8 bars: 2.9 A
- Pressure: 8 bars
- Tank capacity: 15 l.
- Noise level: 40 d B (A) / 1 m
- Operating voltage: 230 V AC
- incl. tube and connection set
- Dimensions: 500x410x410 mm (HxWxL)
- Weight: 19 kg

