HYBRID AND ELECTRIC VEHICLES

Automotive Training Systems
TRAINING SYSTEMS
FOR ELECTRIC AND
HYBRID VEHICLES
FACTS AND FIGURES

• Training can be based on different qualification possibilities (ASE L3, IMI Awards, DGUV 200-005)
• Training as high-voltage technicians levels 2 and 3
• Training system with real high-voltage battery circuitry
• Training of disconnection procedure similar to actual practice
• For vehicle mechanics of all specialties
• Advanced training for technicians, mechanics and engineers
Hybrid and Electric Vehicles are ever increasing in popularity throughout the world and are boosting innovation in automotive technology. The next generation of skilled automotive professionals needs to be prepared to work safely with high voltage electric vehicles.

We are meeting this increasing training demand. Our recently developed Training Systems for Hybrid and Electric Vehicles are setting standards in terms of safety, functionality and usability. Our unique systems provide industry knowledge as well as hands on experiences starting from basic skills and ending in practical applications.

Safety is a big challenge while working on electric vehicles. Our Training Systems offer a comprehensive learning environment and prepare students on how to work safely on real high voltage systems.

All our products are developed to give a real-world experience that will prepare students to transition from our training system over to a real vehicle. Your students will gain real employable skills that they will be able to use with confidence in their next or current job.

Explore our state of the Art Training Systems!
Real Car

Learning to work on a genuine training vehicle forms the final stage of the Lucas-Nülle training concept. Trainees are ideally prepared for the challenge of applying the skills they have learned to use on a real car. This means they can not only enhance their skills, but also develop their own working methods.

CarTrain

The CarTrain system provides trainees with an effective and efficient learning platform. The hardware is based on the latest technology and is combined with a multimedia LabSoft course on automotive technology. The operation of modern vehicles conveyed in a practical, hands-on fashion.

The system can be put into use immediately with all the necessary components already installed and configured, and thanks to the realistic simulation of faults, trainees can gain elementary diagnostic skills. In order to carry out any measurements, the system comes complete with built-in measurement interface.

UniTrain

The UniTrain system gives an introduction to the world of automotive training and provides trainees with the necessary fundamental knowledge in a way that is simple and motivating. The system can be put to use at any time, in laboratories, classrooms or at home. The multimedia training platform ensures a high degree of motivation and the best chance of successful learning, guaranteeing effective and efficient learning.

UniTrain

In the multimedia courses, the theoretical background is explained and then experiments are carried out using experiment hardware which is specific to each course. In addition, the intelligent measuring interface includes analog and digital inputs and outputs for measurement and control. In combination with virtual instruments the whole system represents a high-quality piece of lab equipment. Learning progress can be monitored in troubleshooting exercises on the course hardware as well as by tests, all of which can be digitally documented. The electrical and electronic circuitry needed for the experiments are connected to the system by means of an “Experimenter” module. Access to the courses themselves and control of the virtual instruments and experiment hardware is provided by the LabSoft browser platform.
UniTrain “Hybrid Automotive Drives”

Students build functional electric motors and see how they operate with safe low voltage components to really understand electric motor concepts.

Advantages
- Construction and operation of synchronous and asynchronous motors
- Operation of invertors
- Energy regeneration
- Labsoft blended learning software

25 hours of Learning Content
Article no. CO4204-6V

UniTrain “DC/AC Conversion”

Because batteries can only supply direct current an inverter is required to turn the battery DC voltage into alternating current voltage that can be used by an electric motor. This difficult to understand concept is explained in an easy to understand way with the help of the hardware and theory course “DC/AC conversion”.

Advantages
- Generation of an AC voltage
- Relationship between voltage and current
- PWM signals
- Labsoft blended learning software
- Labsoft Kurssoftware

8 hours of Learning Content
Article no. SO4204-6L
UniTrain “Electrical Interlocks in Hybrid Vehicles”

The interlock is one of the most important safety devices on modern electric vehicles. The interlock separates the high voltage battery from the rest of the vehicle in the event that a cable would be incorrectly disconnected. Understanding this concept will help the technician diagnose faults or may even save someone’s life.

**Advantages**
- Operation and function of interlocks
- Measure and observe interlock signals
- Diagnosis of the interlock
- Labsoft blended learning software

7 hours of Learning Content
Article no. CO4205-1H

UniTrain “HV Battery Disconnect Systems in Hybrid Vehicles”

This training system focuses on the high voltage disconnect relay of the battery unit. The system monitors the hybrid system and only connects to the high voltage when it is considered “safe and secure”. The accompanying Labsoft course explains this complex system.

**Vorteile**
- Operation and function of the disconnect relays
- Fault finding
- Perform the service disconnect
- Labsoft blended learning software

7 hours of Learning Content
Article no. CO4205-1J
UniTrain “Safe Handling of HV Systems”

This topic covers how high voltage interacts with the human body and what can be done to understand and minimize the risks to electric vehicle technicians and drivers.

**Advantages**
- Voltage pathways through the body
- High voltage safety concepts
- Safe low voltage operation
- Labsoft blended learning software

7 hours of Learning Content  
Article no. CO4205-1M

UniTrain “Step-Up / Step-Down Converter”

The course “Step Up / Step Down Converter” teaches how electric vehicles can increase high voltage battery voltage to the sometimes much higher voltages required for the electric motor. It also shows how the high voltage can be reduced to low voltage to run the 12 volt battery and run the vehicle’s electrical and electronics system.

**Advantages**
- 2 separate cards for step up and step down
- Safe low voltage operation
- Manual and automatic generation of the voltage
- Labsoft blended learning software

6 hours of Learning Content  
Article no. CO4205-1K/CO4205-1L
Motorized vehicles (cars, trucks) produce large quantities of CO2. Despite considerable advancements, the internal combustion engine still has very high CO2 emission levels. It is therefore no surprise that engineers are seeking alternative drive concepts. In this training system students get to know and understand this fascinating technology. One interesting drive concept involves the use of electrical drive motors in conjunction with a fuel cell.

**Advantages**
- Fuel cell application in the motor vehicle
- Function of a fuel cell
- Design of a fuel cell
- Fundamentals of the chemical process
- Properties of fuel cells
- Recording characteristics
- Labsoft blended learning software

4.5 hours of Learning Content
Article no. CO4204-6M

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The term photovoltaics means a direct conversion of sunlight into electrical energy by means of solar cells. The energy obtained in this manner can be supplied to ancillary consumers to enhance driving comfort, e.g. to additionally cool a vehicle’s interior in extremely bright sunshine. With our UniTrain-I Photovoltaics System students very quickly grasp the fundamentals of this technology.

**Advantages**
- 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 and storage operation
- Labsoft blended learning software

4.5 hours of Learning Content
Article no. CO4204-6N
**CarTrain “Hybrid and All Electric Vehicle Technology Trainer”**

The only electric vehicle trainer on the market that combines the 5 different possible hybrid or electric vehicle configurations that use industry level voltages. Coverage includes the Toyota Prius series-parallel hybrid and the Tesla pure electric arrangements.

The integrated touch screen display can be easily changed to explain the various driving modes and energy flow.

The system uses actual voltage levels to ensure the student is confident and prepared to work on these vehicles safely.

**Advantages**
- Touch screen displays the energy flow
- Over 20 measuring points using certified safe connections
- Industry level voltages – over 300 volts
- Able to perform the high voltage isolation procedure just like on real vehicles
- Fault switches for troubleshooting
- Labsoft blended learning software

**CarTrain “Charging Station”**

Our system teaches the students the communication and charging process of the high voltage battery vehicle is carried out.

**Advantages**
- Real charging station
- Possible to use on real vehicles
- Monitoring of the charging process
- Safety concepts
- Analysis of the communication protocol between the vehicle and the charging station
- Socket and cable provided for all vehicles

**100 hours of Learning Content**

Article no. CO3221-6K
CarTrain “High Voltage and Air Conditioning Training System”

This trainer provides a unique opportunity to understand how an A/C system is integrated into a HV vehicle.

Including a fully operative high voltage A/C system that allows students to perform actual diagnostic and service tasks.

Also included in this trainer is a fully operational hybrid drive and system overview

**Advantages**
- Industry level voltages – over 300 volts
- Variable modes of the inverter control
- Functional electrical interlock
- Touchless current measurement
- Fault switches
- Fully functioning high voltage A/C system
- View of vehicle battery with integrated A/C cooling system
- Labsoft blended learning software

80 hours of Learning Content

Article no. CO3221-6P
Working directly on a real high-voltage battery and inside it: The system is set up to be just like a high-voltage battery in a standard production vehicle. With this training system, trainees can make measurements and diagnoses inside the high-voltage battery, working down to the level of individual cells and even replacing them.

Wide-ranging yet easy to use, fault simulation prepares students for numerous things which can go wrong in the real world. While trainees are working out the best way to diagnose problems for themselves, they gain skills which will stand them in good stead for modern-day challenges in a mechanic’s repair shop.

**Training contents**
- Authentic high-voltage battery
- 16 Lithium ion cells
- 8 Temperature sensors
- Cells and sensors can be dismantled
- Air cooling
- Interlock
- Scan tool based isolation
- By removal of service and maintenance plug
- For rescue personnel
- Measuring options
  - CAN bus interconnection of BMS 1-3
  - High-voltage battery disconnecting relay
  - High-voltage level and cell voltages
  - Interlock
- Charging infrastructure
  - AC charging types 1 and 2
  - CCS DC charging

**100 hours of Learning Content**
Article no. CO3221-6S
When it comes to diagnostics on hybrid and electric vehicles, safety is absolutely paramount, especially when diagnostics or repairs need to be made on the battery itself.

In order to learn the necessary safety requirements and implement them accurately, the training system teaches the use of an overall, prescribed safety concept for work on high-voltage batteries.

**Your benefits**

- Personal protective equipment (PPE)
- Practical application of protective equipment
- Checking protective equipment
- Certified components
- Suitable for use with vehicles

- Safety zones
  - Setting up a safety zone
  - Certified components
  - Suitable for use in workshops

- Classification of high-voltage batteries
  - Critical and non critical faults
In conjunction with safety clothing and equipment, plus the high-voltage diagnostic tester, the training system provides unique diagnostic range closely aligned to authentic practice.

In addition to the guided diagnostics, trainees can carry out a variety of measurements directly on the training system itself.

Measurements on the interlock system and the battery management system (BMS) for the high-voltage battery are a very special part of the training content. Focus is placed on the HV system relay and switching the high-voltage system on and off.

**Training contents**
- Measurement of voltage in HV system
- Measurements on BMS
  - HV system relay
  - High-voltage capacitors
  - High-speed CAN bus
  - Pre-load phase
  - Active/passive discharge
- Measurements on interlock system
- Measurements on temperature sensors
- Measurements of supply voltage
Diagnosis of faults which can be specifically activated allows students to gain skills which will be of use to them in a real vehicle workshop.

The training system meets the most severe demands as regards safety. Trainees and the system itself are both protected in the event of any incorrect operation.

As soon as a diagnostic case from the digital course is opened, the fault in question is automatically activated. Then it is up to the trainees to document their own diagnostic procedures in detail. The work can be evaluated at a later date without further ado.

**Diagnostic contents**
- Over 50 different diagnostic cases
- BMS faults
  - Temperature sensors
  - CAN bus
  - HV system relay
  - Battery cooling
- Interlock faults
  - Cover for HV battery
  - Service and maintenance plug
- Disconnection faults
  - Procedure
- HV battery faults
  - Lithium ion cells
  - Insulation resistance
  - Capacitors
Choose from four different cars. The cars chosen for these training systems are selected according to strict quality guidelines. This is how we guarantee you a high-quality product with excellent cost efficiency.

All the cars are specially modified so that they fit perfectly into the educational concept. Apart from visualisation of the key systems in a vehicle, various break-out boxes are supplied, along with more than 30 fault activation switches. All these vehicles are accompanied by their original circuit diagrams, allowing diagnostics to be carried out under practical conditions.

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

Electric vehicles
- VW e-Golf (LM8295)
- BMW i3 (LM8298)
The digitalisation package – Digital diagnostics on a real vehicle

In order to exploit the full potential of a training vehicle, we recommend installing our digitalisation package. This package introduces a WiFi-capable measurement and diagnostics interface into the vehicle, allowing activation of simulated faults and transmission of measurement results to the training platform. All the measuring instruments (4-channel oscilloscope, multimeters, current probe, etc.) are already built in and can be run directly from the training platform, thus saving space.

Features
• Digitally networked training platform
• Interactive diagnostic course
• WiFi-capable measuring interface
• Includes non-contact current measuring probe
• WiFi-capable diagnostic interface
• OBD II break-out box

Measurement expansion package – Simultaneous working for any number of trainees

The measurement expansion package allows multiple trainees to carry out measurements and diagnostics on a single vehicle simultaneously by adding extra student measuring stations. Up to six different signals are fed into the vehicle’s signal interface and then made available at the students’ workplaces. The number of student measuring stations can be increased as needed. This allows a whole class of trainees to work on the same vehicle at once.

Features
• Built-in signal interface
• Includes 6 external student measuring stations
• Parallel transmission of signals
• Custom extensibility
• Can be combined with training platform
• Built-in CAN interface

Article no. CO3223-7E

Article no. CO3223-7F
LABSOFT – THE MULTIMEDIA LEARNING PLATFORM
FACTS AND FIGURES

- HTML-based multimedia courses
- All languages supported by HTML
- Animations and graphics
- Theory and diagnostic exercises in a single training unit
- Documentation of results
- Questions for testing knowledge
- Access to all virtual instruments
- Log-in with user data
- Choice of languages
- Choice of courses
- Saving of individual platform configurations

Further information is available at www.lucas-nuelle.com
LABSOFT CLASSROOM MANAGER 5.0
Administration, customisation, testing and evaluation

LabSoft Editor
Numerous wizards within the LabSoft Editor help you set up your own new courses and guide users step by step through the necessary procedures.

LabSoft Questioner
In order to set up questions, measuring exercises and tests, LabSoft Questioner provides multiple varieties of question. The exercises and questions can then be inserted into courses and tests.

LabSoft Manager
Manage your LabSoft courses, students and classes using the LabSoft Manager. This ensures that your students always have the right training content available.
LabSoft Reporter
LabSoft Reporter shows you the progress of all your students along with their test results. There are multiple student assessment options for individual or class results in courses and tests, allowing you to monitor them in a quick and targeted fashion.

LabSoft TestCreator
LabSoft TestCreator helps you set up tests so that you can check both students’ knowledge and their practical skills. Filter functions assist you with manual or automated selection of test questions.

• Optimal use of resources
• Minimisation of management work
• Maximisation of learning success at all times
• Check on student progress at any time
• Everything always at your fingertips
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