LN

LUCAS-NÜLLE

NETWORKED SYSTEMS | DRIVER ASSISTANCE SYSTEMS

Digital innovation in automotive vocational training

4th Edition

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

UniTrain
Individualised basic and advanced training in class groups

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

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

UniTrain
Experiment Hardware and Software – Measurements on Vehicles

UNITRAIN – NETWORKED SYSTEMS

CAN

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

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

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

Order no. CO4204-7K

CAN FD

From small private cars to the biggest commercial trucks, CAN bus systems dominate the market. However, ever-greater "networking" has driven this universal aid to the limits of its capabilities. The consequent development of CAN-FD into CAN-FD (flexible data rate) has been essential and is already breaking through into series production.

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

Training contents
- Features of CAN-FD bus systems
- Diagnostics as performed in practice at real workshops
- Measurements on a genuine CAN-FD network
- Diagnostic software for read-outs from the CAN-FD bus
- Select from various pre-set data rates edit and transmit CAN messages via PC
- Troubleshooting

Order no. CO4205-1S

LIN Bus

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

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

Order no. CO4204-7E

Optical fibres (MOST Bus)

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

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

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

Order no. CO4204-7H

UNITRAIN – NETWORKED SYSTEMS

FlexRay

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

FlexRay is the most widespread communications platform utilised in by-wire systems. The demands on such systems primarily include faster data rates, deterministic communication and a major need for systems to be both fail-safe and flexible. This UniTrain course teaches students about FlexRay in a manner closely aligned to authentic practice.

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

Order no. CO4204-6Y

Workshop communication using RFID

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

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

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

Order no. CO4205-1N

Comfort systems and keyless entry

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

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

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

Order no. CO4204-6G
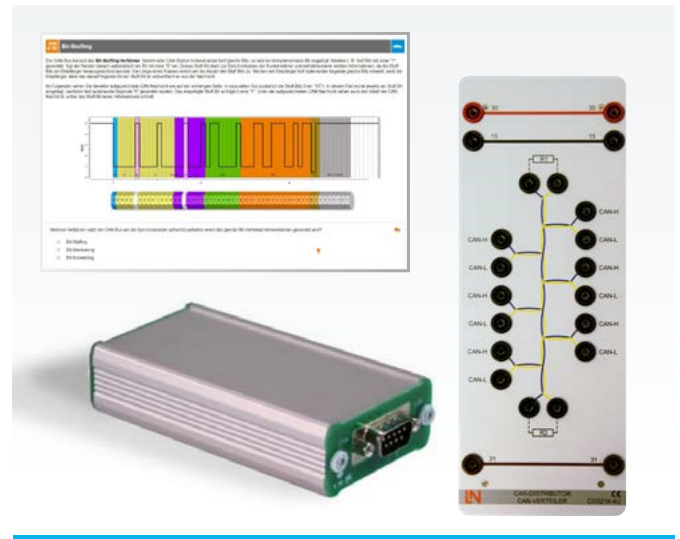
Use of CAN buses in cars, trucks and agricultural equipment

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

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

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

Order no. ATS 2

UNITRAIN – NETWORKED SYSTEMS

Ethernet in Automotive

This training system enables the trainees to set up a real Ethernet network and put it into operation. As in the real vehicle, communication with the outside world in particular is realised via the existing EOBD connection. This is integrated as a real connection on one of the three modules.

The remaining two modules represent an infotainment network that communicates via Ethernet. The focus here is particularly on the transmission of real-time data. The individual control units can be configured individually using the firmware dongles supplied. Thus, one module becomes a media server and the other a control unit for the vehicle's sound system.

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

Order no. CO4205-1A

UNITRAIN – DRIVER ASSISTANCE SYSTEMS

Rear view camera with parking assistance

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

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

Training contents
- Design and function of driver assistance system
- Incorporating the camera into the overall system
- How ultrasonic sensors work
- Purpose of driver assistance system
- Learning diagnostic techniques
- Finding out limitations

Order no. CO4205-1C

Traffic sign recognition with cruise control

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

Build this complex system into your classroom with the aid of a UniTrain course to get something which closely matches authentic practice. Trainees will then put a full-scale ADAS system into operation and carry out various practical exercises. Last but not least, they will also gain the necessary diagnostic skills.

Training contents
- Design and function of driver assistance system
- Incorporating the camera into the overall system
- Purpose of driver assistance system
- Learning diagnostic techniques
- Finding out limitations
- Physical relationships and standards
- Function and importance of optical filters

Order no. CO4205-1B

UNITRAIN – DRIVER ASSISTANCE SYSTEMS

LIDAR

Delve right into the subject of „LIDAR" (Light Detection and Ranging). This system enables you to teach essential diagnostic skills on optical distance and ranging systems. The hardware for this driver assistance system is based on an authentic LIDAR module which has been opened up to a large extent, giving trainees a unique view of the system's structure.

Training contents
- Fundamentals of driver assistance systems
- Significance for self-driving vehicles
- Physical principles of light and lasers
- Safety regulations when handling and operating lasers
- Design and function of lidar systems in vehicles
- Calibration of lidar system by means of a calibration board
- Diagnostics for CAN bus, power supply and actuators
- Measuring techniques and reflection properties
- Signal processing and detection of surroundings
- Networked driver assistance systems and system architecture
- Fundamentals of antenna technology
- How central locking works via a CAN bus and how such a system can be expanded to implement keyless systems

Order no. CO4205-1E

Gesture control and capacitive sensors in vehicles

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

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

Order no. CO4205-1U

ACC - Adaptive Cruise Control

This UniTrain course shows the functionality and control strategy of the dynamic adaptive cruise control (ACC) including the emergency brake assistant. In addition to the structure and networking of the system, the course also goes into detail about the individual components that make up the driver assistance system.

The main focus is on the calibration of the radar sensor. This is carried out in a practical manner with the appropriate calibration board. By means of the adjustment points on the ACC module, the module can be optimally aligned.

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

Order no. CO4205-1V
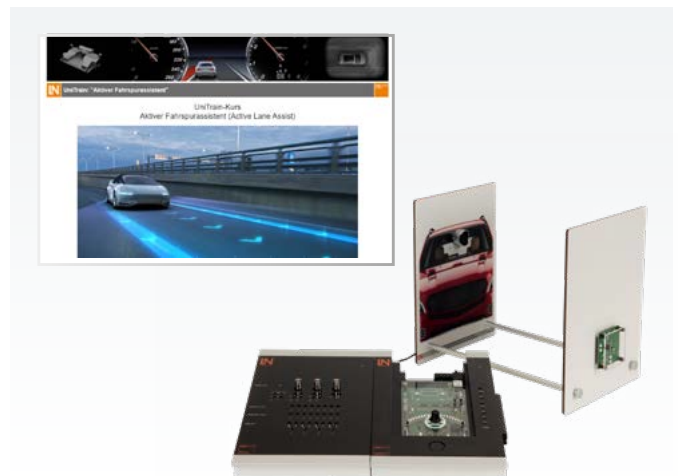
Active Lane Assist

This UniTrain course demonstrates the functioning of both the active lane change assistant and the passive variant. Thanks to the hardware including front camera and calibration target, the driver assistance system can be put into operation and calibrated in a practical manner. Calibration is carried out in a practical manner using special diagnostic software and does not require any mechanical adjustments to the camera itself.

The lane assistant can be tested in different situations on different sections of the route and evaluated in detail using the analysis tools of the diagnostic software. The necessary theoretical content is made available in the associated e-learning course and interactively prepared through the use of numerous videos and animations. The overall package is rounded off by an integrated error simulation.

Training contents
- Overview of current driver assistance systems
- Stages of autonomous driving
- Operation of the active lane assistant
- Virtual lane
- Control behaviour
- Performance limits of the active lane assistant
- Electrical components of the active lane assistant
- Networking in the vehicle
- Diagnosis including 4 workshop orders
- Calibration

Order no. CO4205-1W

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

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

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

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

Suitable for all topic areas

Tested vehicles

Choose from the following vehicles:

Hybrid drive train
- VW Golf GTE (LM8296)
- Hyundai Ionic (LM8319)

Electric drive train
- VW e-Golf (LM8295)

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

Order no. LM8293/94/95/96/98 and LM8319

Das Übersichtsdiagramm für die genormten Steckereinbauplätze entw[...]
Armaturenbretts, wo der Hersteller den OBD-Stecker platzieren darf [...]
Hersteller verpflichtet sind, den Stecker dort einzubauen. Die Bereic[...]
amerikanischen Vorschriften muss ein Hinweis an den bevorzugten [...]

THE DIGITALISATION PACKAGE –
DIGITAL DIAGNOSTICS ON A REAL VEHICLE

Interactive course with key subject including diagnostic troubleshooting

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.

Benefits
- 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

Order no. CO3223-7E

MEASUREMENT EXPANSION PACKAGE – SIMULTANEOUS WORKING FOR ANY NUMBER OF TRAINEES

Simultaneous measurement on a single vehicle

The measurement expansion package permits multiple trainees to conduct measurements and perform diagnostics at the same time on just one vehicle thanks to the inclusion of the student measurement stations.

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.

Order no. CO3223-7F

Teacher measurement station interface

Training vehicle

Student measurement stations
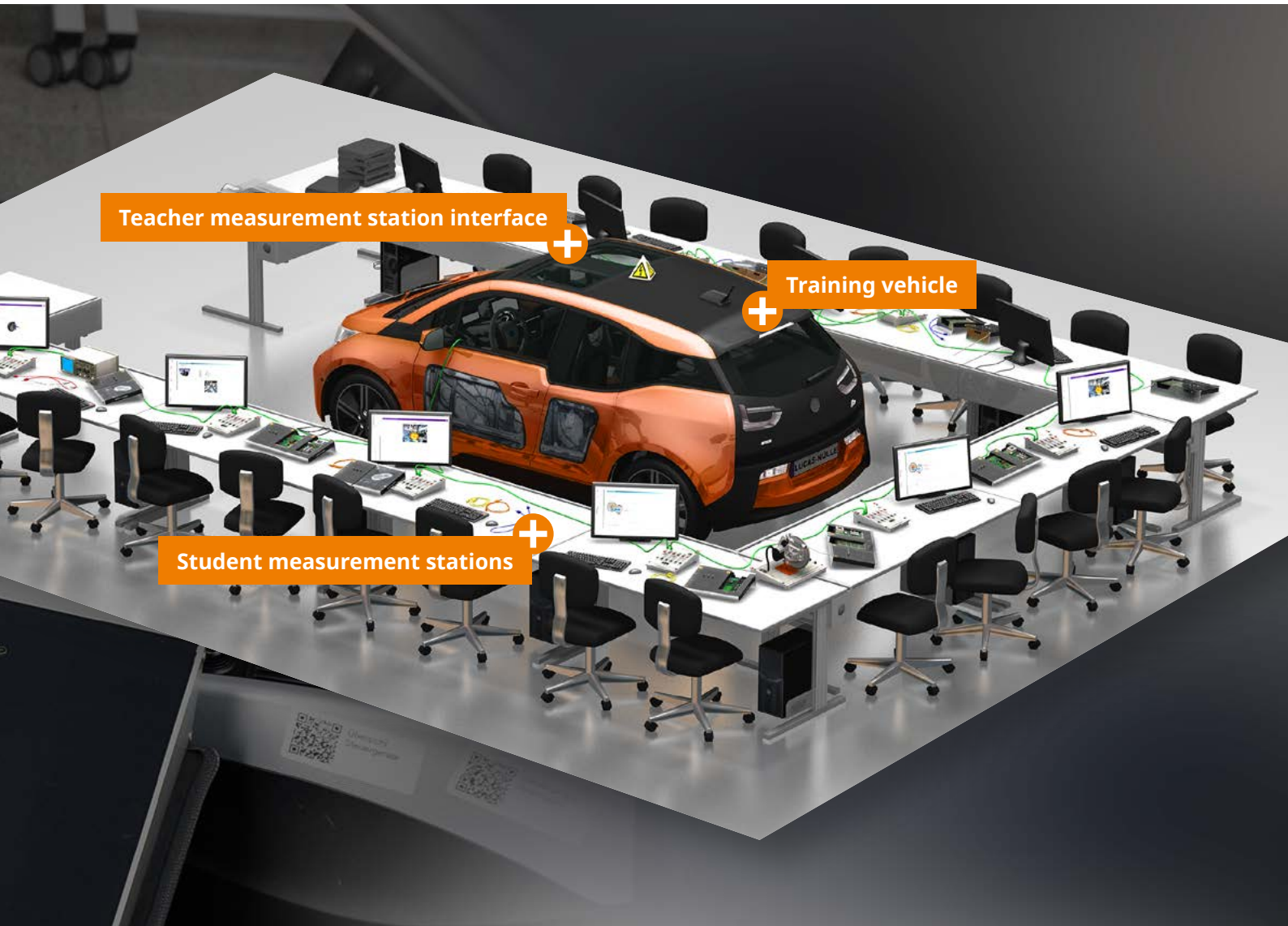
Flexible networked and safes student/teacher measuring stations
This system simultaneously transmits the desired signals to students. Any electrical system can serve as a signal source - whether vehicle or training system.

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

Teachers 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 teacher's station also includes a gateway through which CAN signals can be fed. There is even automatic bus determination.

Benefits
- Easy to assembly and disassembly
- Digital display for diagnosing circuit breaks
- No hazardous or interference responses
- Easy to network the lab by means of Ethernet cables

CALIBRATION OF DRIVER ASSISTANCE SYSTEMS (FRONT CAMERA / RADAR)

A perfectly optimized complete solution for calibration of driver assistance systems

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

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

Order no. LM8321 + LM8322

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

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

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

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

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

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