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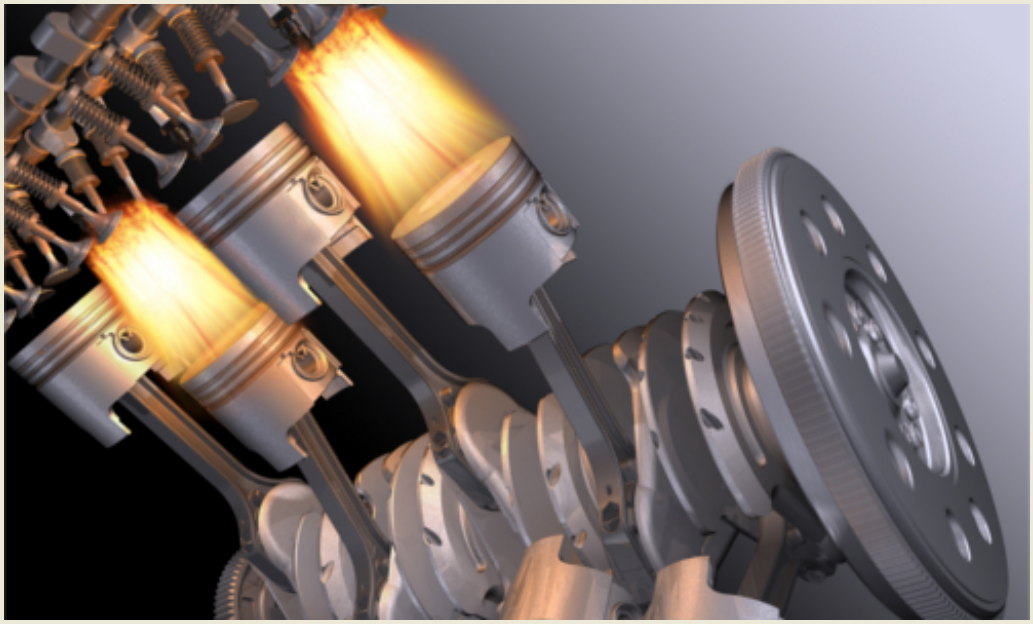


Petrol Engine Trainers

The success of the internal combustion engine dates from 1876, when Nikolaus August Otto was looking for a powerful engine which had potential for further development. The engine he devised was to become the basis for a whole raft of developments continuing until the present day. Thanks to its tremendous potential, the four-stroke engine mobilised industry as a whole, leading to huge amounts of competition, which the development of the internal combustion engine continues to drive till this day. The result was the most powerful types of engine in existence. Much time has been invested, particularly with regards to air-fuel mix and ignition. The early mechanical systems developments have now led to the directly injected high-performance engines of today with their electronic ignition and electronic control of fuel mix.

Sensor and Actuator Trainers

Sensor and Actuator Trainers

In modern motor vehicles more and more components are being monitored and controlled electronically. Sensors have several jobs to do, including the detecting of physical data and converting this information into electrical signals which can then be processed by control units. Trainees should be able to grasp how this process works and the effects different sensor stimuli have on these signals.

CarTrain

CarTrain

Please choose your product:

Sensor and actuator technology in engine management

Sensor and actuator technology in engine management

This training system from the “CarTrain” product family permits hands-on experimentation and demonstrations using a variety of engine-management sensors. The system’s practical design makes for highly realistic training. The students perform diagnostics and repair work in the area of engine management – just the way it is required on the job.

List of articles:

Pos.	Product name	Bestell-Nr.	Anz.
1	**CarTrain "Sensors, open- and closed-loop control systems"** The subject of sensors is already a core subject of training in the area of service, repairs and diagnostics. The sensors in the motor vehicle are digitally networked and in recent years have taken on ever greater importance. The number of sensors inside the motor vehicle has also increased dramatically. How sensor signals are evaluated is also becoming more and more important in practical everyday diagnostics. The way sensors and actuators interact via open- and closed-loop controlled systems has also continued to become more complex. In this training system signals are recorded and evaluated using hands-on measuring and testing methods. Faults and malfunctions are diagnosed on vehicles based on customer complaints and by applying hands-on methods working with circuit diagrams and function diagrams. Measurements are performed using the integrated measurement interface and with the aid of all other suitable measuring instrument found in the repair shop.	CO3221-6N	1

Scope of supply:

- CarTrain “Sensors, open- and closed-loop control systems” (CO3221-6N)
- Integrated measurement interface
- Set of safety measurement leads
- Interactive course on CD-ROM with Labsoft browser, course software and additional virtual instruments

Virtual measuring instruments

- Digitally networked measuring option (WLAN-capable or using cables)
- 4-channel oscilloscope
- Voltmeter
- Ammeter
- Double voltmeter
- Power meter
- Function generator
- Pulse generator

Training contents:

- Investigate customer complaints, perform operation checks and establish diagnostics methods
- Read out fault memory
- Work safety
- Become familiar with where components are in the vehicle
- Determine faults and their causes with the aid of circuit diagrams and functional plans
- Create inspection record and document results
- Find out how data communication works between the component and the control unit
- Recognise what the repair options are
- Perform system measurements and tests
    - Determine the target data
    - Select appropriate measurement methods and instruments
    - Document measurement values
- Compile measurement values, compare these to target data and evaluate
- Measure signals to components and measure, test and evaluate systems
- Measure, test and evaluate electrical connections
- Design and function of pressure sensors
- Design and function of temperature sensors
- Design and function of air-quality sensors
- Advantages and disadvantages of individual sensor types
- Measurement options for recording the signals from various types of sensors in actual practice
- Measurement prerequisites for recording signals from various types of sensors in actual practice
- How sensors and actuators interact
- IPO principle
- Open-loop control processes in the motor vehicle
- Closed-loop control processes in the motor vehicle
- Difference between open- and closed-loop control

Components used in the experiment hardware:

- Fault simulation switches operational via WLAN

- Ignition switch
- Automotive fuses
- Intake manifold pressure sensor, frequency-controlled
- Intake manifold pressure sensor, analog for low-pressure and excess pressure measurements
- Intake manifold pressure sensor, analog with temperature detection
- Differential pressure sensor
- Air-quality sensor
- EGR valve with sensor and actuator
- Actuator motor with sensor and actuator
- E-gas throttle valve with sensors and actuator
- Knock sensor
- Temperature sensor for water cooler
- Temperature sensor for intake air temperature
- Temperature sensor for exhaust gas temperature
- Mass air-flow sensor PWM
- Mass air-flow meter, analog
- Electrically operated accelerator pedal with contactless sensors
- Control unit for connection to sensors and actuators
- Manometer for display of excess pressure and low-pressure levels
- Air connection terminal
- Automatic air-flow rate control for mass air-flow meter
- PWM generator for control system
- Automatic control of hardware components using measurement options
- 4-mm safety measurement plugs
- Connection slots for pull-up and pull-down resistors
- USB port
- 32 fault simulation options for diagnostics

Power supply:

- 100-240 V AC, 50-60 Hz

Operating voltage:

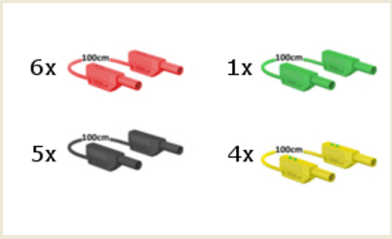
- 0 - 15 V DC

Dimensions:

- approx. 350 x 1010 x 805 (LxWxH in mm)

Additionally required:

Pos.	Product name	Bestell-Nr.	Anz.
2	**Set of leads for "CarTrain: Sensors, open- & closed-loop control in vehicles"**	CO3221-6T	1



This set of 4-mm connecting leads has been specially assembled for the "CarTrain: Sensors, open- & closed-loop control in vehicles" training system. To this end, the individual colours and the lengths of the leads are designed to support the educational aim of the training system, making it easier to wire up the sensors, actuators and power supply. Each of the measurement leads and jumpers features a special, protected design, whereby it is not possible to make contact with any current-carrying components. To make it possible to carry out measurements without difficulty, all the connector plugs include a tap socket. For each of the leads and jumpers included in the set, there is also a spare. In detail, the following components are included in the set:

Connecting leads

- 04 x Safety measurement leads (red, 100 cm)
- 03 x Safety measurement leads (black, 100 cm)
- 01 x Safety measurement leads (green, 100 cm)
- 04 x Safety measurement leads (yellow, 100 cm)

Measurement leads

- 02 x Safety measurement leads (red, 100 cm)
- 02 x Safety measurement leads (black, 100 cm)

3	**Over-/under pressure pump**	LM8213	1

Manual pump for monitoring and setting under-pressure or over-pressure functions. Quick and easy to use. Integrated discharge valve for reducing the under-pressure or over-pressure, without removing the terminal connections. With a connection hose and a variety of end pieces.

- Under-pressure: -1000....+1000mbar
- Weight: 0.4kg

Pos.	Product name	Bestell-Nr.	Anz.
4	**Multi13S digital multimeter**	LM2330	1

Universal precision lab multimeter and temperature meter with IR interface for high-quality, universal measurement and testing in educational settings, power plants, process control installations etc.

- 3¾-digit multimeter; resolution: ±3,100 digits
- Measurement classification CATII-1000 V
- Can be connected to UniTrain system via IR interface
- Voltage and current measuring ranges: 30 mV-1000 V DC, 3 V-1000 V AC; 3 mA-16 A DC; 30 mA-10 A AC
- Resistance ranges: 30 ohm-30 Mohm
- Special functions: °C for temperature measurements using PT100/1000 thermocouple (optional accessory)
- Continuity and diode testing
- Automatic range selection and battery shut-off, min./max. and data hold function
- Safety fuse for current measurement range up to 300 mA
- Protection against high currents in the mA range for nominal voltage of 1000 V
- Display with bar chart and backlighting
- Includes protective sleeve, measuring leads, 1 x spare fuse, 9V battery, calibration certificate

Additionally recommended

Pos.	Product name	Bestell-Nr.	Anz.
5	**Protection cover for CarTrain/InsTrain experiment trolleys**	ST8010-9X	1

Dust cover for CarTrain/InsTrain experiment trolleys

- For protecting equipment from dust and damp
- For keeping equipment out of sight
- Colour: matt dark grey with printed LN logo in orange)
- Material: nylon fabric with polyurethane coating
- High resistant to tearing, impregnated to be washable and waterproof

Accessories:

Pos.	Product name	Bestell-Nr.	Anz.
6	**SybaPro mobile InsTrain/CarTrain experiment trolley, 1070x1350x700mm**	ST7200-3K	1

The mobile aluminium-profile experiment trolley is specially designed to accommodate components of the InsTrain and CarTrain system. All the Ins-Train and CarTrain system components can be safely mounted in structured fashion for lessons from the front of a class or for students' own practicals. For students, this provides a modern, educationally designed workplace with a worktop and connections for multimedia.

- The mobile experiment stand is delivered in kit form and needs to be assembled by the customer
- Aluminium profile with integrated grooves for attaching a wide variety of components (e.g. PC and monitor-holders)
- 4 steerable double casters, 2 with brakes
- Worktop 1000 x 30 x 700 mm (WxHxD)
- Table top made of highly compressed multilayered chipboard conforming to DIN EN 438-1, light grey, with double-sided 0.8 mm slightly textured laminate coating (Resopal) in compliance with DIN 16926
- Table top bordered with solid, impact-resistant edging made of 3-mm thick plastic, colour RAL 7047
- Coating and adhesives must be PVC-free
- Power strip with 5-outlet sockets and power switch, lead and earthed plug
- Height of table top 830 mm
- Dimensions without CarTrain/InsTrain-System: 1070 x 1350 x 700 (WxHxD)
- Dimensions with CarTrain/InsTrain-System: 1070 x 1650 x 700 (WxHxD)

7 **PC holder for SybaPro experiment trolleys, height/width adjustable** ST7200-5F 1

Shelf for desktop PC made of 2 mm sheet steel punched with holes, suitable for all furniture in the SybaPro aluminium profile range

- Adjustable assembly height
- for slim PCs, adjustable width (60 - 160 mm)
- Can be mounted to left or right
- Includes all equipment necessary for assembly (4 bolts and 4 tenon blocks)
- Acid-resistant epoxy-resin powder coating, 80 µm thick approx., colour RAL7047

8 **Monitor holder for flat screen monitor of weight up to 15kg / 33lbs** ST8010-4T 1

Pivoting monitor holder for attachment to aluminium profiles of furniture in the SybaPro range. Allows a monitor to be placed in the optimum position so that work and experiments are less tiring.

- Pivoting arm with two-part joint
- Quick-lock for adjustment to any height on extruded aluminium profile
- VESA fastening 7.5 x 7.5cm
- Includes VESA 75 (7.5x7.5) - VESA 100 (10x10) adapter
- 2 Cable clips
- Adequate carrying capacity 15kg / 33lbs
- TFT monitor can be turned parallel to the table edge
- Separation can be adjusted to anywhere between 105 and 480mm

Additionally included:

Cable management set for installing cables along the profiles of the aluminium lab system furniture in the SybaPro range, consisting of:

- 3 Cross cable binders for front and rear grooves of aluminium profile
- 3 Cross cable binders for side grooves of aluminium profile
- 12 Cable binders
- 4 Aluminium cover profiles for covering and enabling wires to be run along the grooves of an aluminium profile

9 **Under-table cabinet, suspended, 4 drawers, central locking** ST8007-1A 1

- 1 Utensil drawer
- 1 Drawer, 2 HU
- 2 Drawers, 4 HU
- Usable width: 330mm, usable depth: 480 mm
- Central locking
- Metal drawers with surrounding row of slots
- Body made of 19 mm-thick, highly-compressed, multi-layered fine chipboard with grade E1 plastic coating on both sides
- Dimensions: 430 x 580 x 590 mm (WxDxH)