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## Automotive | Hybrid & EV

### Automotive Electric and Electronic Trainer



#### **Automotive Electric and Electronic Trainer**

A modern vehicle is characterised by its high degree of electrification. This means that most open and closed-loop control processes are carried out using electro-mechanical systems. These systems, as well as all those designed to enhance driver comfort and drivability, require a stable and fail-safe power supply to ensure the finest quality of driving, leading to utmost comfort for drivers.

Lucas-Nülle training systems for automotive technology offer trainees the outstanding opportunity to learn about the various aspects of how on-board vehicle networks are supplied with electrical power at an authentic practical level. They also get a vivid and detailed look at how the lighting systems work and how they can subsequently be enhanced.

# Electric Generator Trainer



## **Electric Generator Trainer**

An alternator is driven by a vehicle's internal combustion engine and converts mechanical energy into electrical energy. In order to charge a battery from the voltage generated by this means, it is nonetheless necessary to provide some voltage regulation. The following training systems demonstrate how this regulation is achieved by various regulating systems.

# Training Panel Systems



## Training Panel Systems

Please choose your product:

# Three-phase Generator with Hybrid Controller Trainer



## Three-phase Generator with Hybrid Controller Trainer

Item list ASA7

Our system enables the trainees to become familiar with the function of the hybrid controller. Experiments are conducted and observations made as to how the hybrid controller maintains the generator voltage at a certain level, regardless of speed and load. The role of the average excitation current is explored as well as how changes are brought about in the magnetic field and stator winding induction. The trainees thereby learn independently and can monitor their knowledge in exercises and tests.

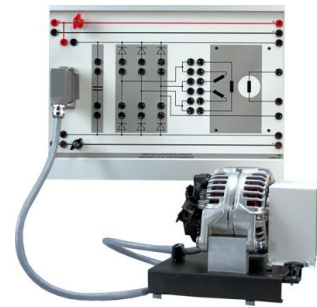
Basic equipment set, consisting of:

**Basic equipment set, consisting of:**

Pos.	Product name	Bestell-Nr.	Anz.
1	<b>Alternator</b>	CO3221-1A	1

It is possible to simulate practical faults on all the components of the generator in order to investigate their effects on the output voltage from the generator itself.

- Educationally oriented design
- How 3-phase alternating current is produced in vehicles KFZ
- Rectification of AC
- Field windings in delta circuits
  
- A conventional 12V car battery is needed to complete the experiments.
- Voltage with no load: 14V
- Current: 60A
- Lead for connection to alternator, 1.5 m long
- Dimensions: 297 x 342 x 145mm
- Weight: 6.8kg



## 2 Hybrid regulator with encapsulated housing and Hybrid regulator with encapsulated housing and integrated circuitry, stand-alone design

CO3221-1D

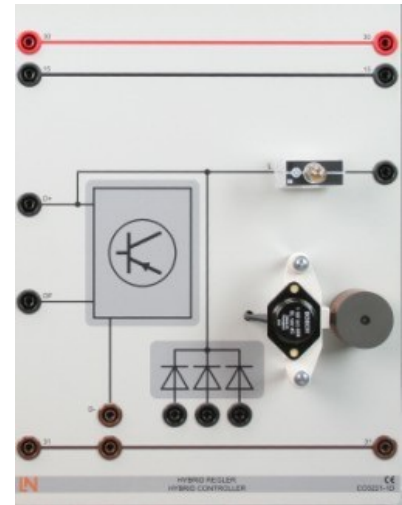
1

The job of a hybrid regulator is to maintain the alternator voltage at a specific level for all engine speeds and loading conditions. By changing the duration of the periods when it is switched on or off, an average exciter voltage is produced. This leads to a change in the magnetic field in the exciter winding and thus alters the induction produced in the stator winding.

This training system conveys the functions and operation of a hybrid regulator. The hybrid regulator is separately mounted on its own board for greater educational effectiveness. To aid set-up, the terminals for the exciter diodes of the transistor are designed as 4mm safety sockets.

### Training contents:

- Operation of a hybrid regulator
- Principle of voltage regulation
- Investigation of exciter current
- Designs of voltage regulators
- Necessity for exciter diodes
  
- Dimensions: 297 x 228 x 180mm (HxWxD)
- Weight: 2kg



## 3 Drive unit for alternator with rev counter and engine management

CO3221-1E

1

The drive unit is designed in the form a model typically used in industry and mounted on a base frame to damp down oscillations. It consists of a digital controller and a powerful drive motor. The control unit combines the latest technology with ease of use.

The controller has the following features:

- Regulation of idling speed on starting
- Continuous speed regulation
- Controllable via separate ignition lock
- Digital display of revs
- Drive motor connected directly to controller via compact plugs
- Thermal monitoring of motor
- Dimensions: 297 x 460 x 420mm (HxWxD)
- Weight: 18kg

A three-phase connection is not required since the drive motor is powered from the 230V mains.

The motor has the following features:

- Runs after starting like a vehicle engine with a specific idling speed
- Power: 1.5kW/230V
- Motor with temperature monitoring
- Nominal voltage 12A
- Speed range 400 – 4500rpm
- Dimensions: 360 x 300 x 200mm (HxWxD)
- Weight: 21kg



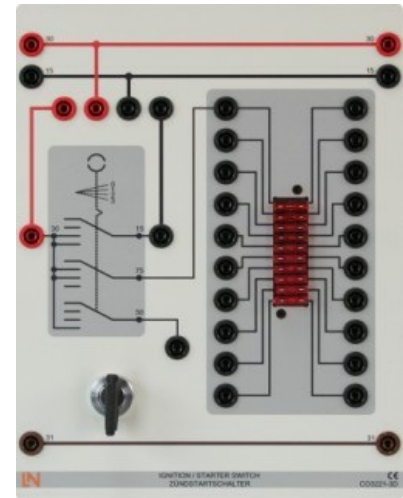
#### 4 Ignition Key with fuse

CO3221-3D

1

Safety starter motor ignition switch with three switching levels and three positions to supply current to terminals 75, 15 and 50. 10 fuse plugs are included which can accommodate plug-in vehicle circuit breakers. The circuit breaker connectors can be tapped via 4-mm safety sockets and can clearly and easily be connected via space-saving jumpers to supply current to terminals 15 or 30. Power supply is laid out for improved educational effect at the top and bottom of the board and colour-coded in accordance with DIN72551.

- I/O: 4mm safety sockets
- Dimensions: 297 x 228 x 90mm
- Weight: 1kg



#### Additionally required:

Pos.	Product name	Bestell-Nr.	Anz.
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#### 5 Auxiliary lamp

CO3216-2B

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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





## Media:



Pos.	Product name	Bestell-Nr.	Anz.
6	<b>Interactive Lab Assistant: Generator with hybrid Controller</b>	SO2803-1F	1

This multimedia course imparts to you all the theoretical knowledge you need and also provides practical experiments so that you can master the necessary diagnostic skills, all in a modern and attractive design. Countless animations show trainees how hybrid regulators work, while the practical experiments solidify that knowledge. The course offers trainees a perfect guide to leads them through the entire topic. Numerous tests of knowledge mean that the trainees can obtain continuous feedback on their progress, meaning that any areas of concern can be quickly identified and remedied.




- Magnetism
- Lorentz force
- Coil
- Electromagnetism
- Remanence
- Induction
- Design and operation of the single-phase generator
- Design and operation of the three-phase generator (alternator)
- Phase-shift
- Terminals, measuring points
- How a diode and zener diode operate
- Design and operation of a half-wave rectifier
- Design and operation of a bridge rectifier
- Function of a charge indicator lamp
- DC, AC and three-phase power
- Principle of voltage regulation
- How a transistor works
- Design and operation of an electromagnetic voltage regulator
- Design and operation of an electronic voltage regulator
- Threshold voltage, switching tolerance
- Fault diagnosis

### **System requirements:**

- Personal computer with Windows Vista, Windows 7, Windows 8, Windows 8.1
- CD-ROM drive for installing software
- USB port for connection to Interfac

## Measuring instruments:

Pos.	Product name	Bestell-Nr.	Anz.
7	<b>Modular Measurement Interface</b>	CO3221-6C	1
	<p>The CarTrain Interface takes the form of a DIN A4 experiment card with rounded corners, colour-coded in compliance with DIN72551 for educational assistance.</p> <p>Safety measurement sockets are also coded on the basis of DIN72551.</p> <p>The design resembles circuit diagrams depicted in a detached or exploded view with power supply wiring running between panels.</p> <ul style="list-style-type: none"> <li>• Interface for multimedia experiment literature – measurements need to be copied into the experiment instruction pages using drag and drop.</li> <li>• Two voltage values and one current can all be measured simultaneously</li> <li>• 3-channel oscilloscope function can be used at the same time as the multimeter display</li> <li>• Measurement range: <math>V &lt; 250\text{ V}=\sim</math>, <math>I &lt; 15\text{ A}=\sim</math> direct measurement within the circuit</li> <li>• USB interface</li> <li>• External power supply to ensure measurements can be made even when short circuits are present</li> <li>• Current measuring range protected by automatic circuit breaker</li> <li>• Dimensions: 228 x 296 x 125 mm (WxHxD)</li> <li>• Weight: 2 kg</li> </ul>		
8	<b>Adapter BNC/4mm safety sockets, insulated</b>	LM9019	3

Adapter plug for connecting BNC connector to 4-mm safety sockets

- BNC plug, 2 insulated 4-mm safety sockets
- Contact rings and sockets for internal pin of BNC connector are made of gilded brass
- CAT II/1000 V



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## 9 Test lamp

LM8205

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Vehicle voltage tester. Due to its small current consumption of 1.5 mA, the CAR-CHECK tester is particularly well suited to finding faults with electronic components. Conventional test lamps often cause damage to these. Polarity indication via two LEDs.



- Nominal voltage range: 3...48 V
- Length of lead: 150 cm
- Weight: 0.2 kg

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## 10 Multi13S digital multimeter

LM2330

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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.



- 3<sup>3</sup>/<sub>4</sub>-digit multimeter; resolution:  $\pm 3,100$  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.
11	<b>Digital dual trace storage oscilloscope w. colour display, incl. probes 30MHz</b>	LM6210	1

Digital storage oscilloscope with colour LCD display, high resolution, backlighting and USB port for transmission of large quantities of data at high data rates.

Technical data:

- Bandwidth 30MHz/125MS/s
- Maximum input voltage 400V
- 8" TFT colour display
- USB port, USB flash disk, LAN, VGA
- Cursor function
- Five automatic measurement functions, storage and retrieval of traces
- Edge and video trigger function
- Safety specifications: EN 61010-1
- Supplied with accessories: 2 probes, mains lead, USB cable, software CD
- Dimensions: 350x157x120mm (WxHxD)
- Weight: 1.0kg



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## 12 Set of circuit breakers for vehicles (10A/15A)

SO3216-8R

5

- Single-pole thermal circuit breaker for vehicles, slim format with coloured manual trip switch
- Reliable tripping response thanks to snap-action trip switch
- Tamper-proof rip interlock to prevent reactivation of the circuit till the fault is rectified
- Plugs into low-profile vehicle fuse box
- Nominal voltage 12V



The set comprises the following components:

- 1x 10A vehicle circuit breaker
- 1x 15A vehicle circuit breaker

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## 13 Protection cover for three-level experiment trolleys

ST8010-9Y

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Dust cover for three-level experiment trolleys

- For protecting equipment from dust and damp
- For keeping equipment out of sight (the cover must not be transparent, so is therefore opaque)
- 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.
14	<p><b>Set of 4mm safety connection components for modulare training system "Alternator"</b></p> <p>Set of connectors including:</p> <ul style="list-style-type: none"> <li>• 1 x Positive terminal</li> <li>• 1 x Negative terminal</li> <li>• 1 x Battery lead, red</li> <li>• 1 x Battery lead, brown</li> <li>• 2 x Safety connector plugs 19/4mm, red</li> <li>• 18 x Safety connector plugs 19/4mm, black</li> <li>• 10 x Safety connector plugs 19/4mm, white with tap connection</li> <li>• 6 x 4mm safety measuring leads, 100 cm, black</li> <li>• 4 x 4mm safety measuring leads, 50cm, black</li> <li>• 2 x 4mm safety measuring leads, 100cm, red</li> <li>• 2 x 4mm safety measuring leads, 100cm, brown</li> </ul>	SO3216-8W	1



15	<p><b>AGM 50Ah/12V battery with wooden case and circuit breaker</b></p> <ul style="list-style-type: none"> <li>• Absorbent glass mat (AGM) battery, 55 Ah/12 V</li> <li>• Acid-resistant housing</li> <li>• Automatic circuit breaker for protection against short circuits</li> <li>• 4mm safety connectors</li> <li>• Terminals for battery cables</li> </ul>	CO3221-1M	1
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Dimensions: 325 x 330 x 275 mm  
Weight: 23.5 kg



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16 **Deposit certificate for starter batteries**

BD3216-1A

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Pfandgutschein  
Deposit voucher



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17 **Mobile aluminum experiment stand, 3 levels, power strip with 6 sockets, 49"x28"x79" WxDxH (1250x700x1995mm)**

ST7200-4C

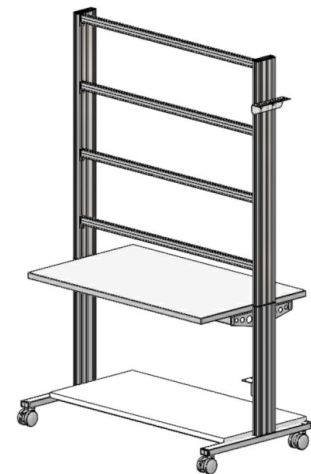
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High-quality mobile experiment and demonstration trolley from the SybaPro range featuring aluminium table legs and low-level shelf. This trolley is suitable for mounting under-table cabinets and is compatible with all add-ons and extensions in the SybaPro range.

It is supplied with one shelf, an angle bracket for attaching a PC and a cable holder.

Table top + Shelf:

- 30-mm table top made of highly compressed, multi-layer fine chipboard conforming to DIN EN 438-1
- Colour grey, RAL 7035, with 0.8-mm slightly textured laminate coating (Resopal) on both sides, conforming to DIN 16926
- Resistant to many chemicals and reagents including dilute acids and alkalis
- Resistant to heat, e.g. molten solder or heating at specific points such as by soldering tips or cigarette ends
- Frame with solid impact-resistant protective edging made of 3mm thick RAL 7047 coloured plastic
- Coating and adhesive are PVC free
- Power strip with 6 outlet sockets mounted underneath the table top, lead and earthed plug



Frame:

- 2 extruded aluminium profiles with multiple grooves 1800 x 120 x 40 mm (WxHxD)
- 8 equally sized grooves in extruded aluminium profiles (3 on each side and 1 each on the front and back)
- Grooves accommodate standard industrial mountings
- 4 H-shaped aluminium profiles, 1150 mm, for 3-layer organisation of DIN A4 panels
- Space for extension of power supply duct
- Base made of rectangular tubing with 4 swiveling double casters, 2 of which have brakes
- Table frame made of tough combination of rectangular tubing around the full perimeter
- Acid-resistant epoxy-resin coating, 80 µm thick (approx.), colour RAL 7047

Cable holder:

- Width 200 mm with 12 cable slots to accommodate 48 x 4-mm safety measurement leads

PC attachment bracket:

- With 3 screw-on rubber stoppers, dimensions 65x65x114 mm approx. (top fixing for PC)

> The height of the cable holder and PC attachment bracket can be adjusted along the aluminium profiles

> For attachment to left or right, fastening materials included

> Acid-resistant epoxy-resin powder coating of thickness 80 µm approx., colour RAL 7047

Dimensions:

- Height of table top 760 mm
- 1250 x 1970 x 700 mm (WxHxD)

The mobile experiment stand is supplied in kit form and needs to be assembled by customers themselves.