

# COM4LAB

NEXT GENERATION LAB



- — COMPACT ELECTRICAL ENGINEERING LAB
- — COMPREHENSIVE CURRICULUM
- — CLOUD-BASED COURSES
- — COST EFFICIENT EDUCATION



LEYBOLD®

# COM4LAB

NEXT GENERATION LAB



## COMPACT ELECTRICAL ENGINEERING LAB

**COM4LAB** is a complete electrical engineering lab in a compact form. The system consists of a Master Unit, various experiment boards and interactive courses. **COM4LAB** combines hands-on experiments with the benefits of interactive e-learning for the best possible training outcomes.

The compact hardware design allows for flexible and mobile learning.

**COM4LAB** enables modern digital training using smartphones, tablets and laptops of any kind - on-site at school, in the company or even at home.



## COMPREHENSIVE CURRICULUM

More than 25 different courses from the fields of electrical and automotive engineering cover the entire curriculum of the German dual training system - from circuit technology and control engineering to sensor technology.

The **COM4LAB** courses prove their worth with topicality, realism and quality of the learning content. These are didactically presented to the students via animations, text, images, interactive elements and videos. The students actively perform integrated experiments on the experiment board and learn the necessary skills directly and sustainably. The theoretical and practically-acquired knowledge is automatically checked with regular learning assessments.

With the **COM4LAB** editor, courses can be quickly and easily adapted as needed, extended and translated, and exams and questions can be created.





# COM4LAB

GAIN KNOWLEDGE & UNDERSTAND TECHNOLOGY

## CLOUD-BASED COURSES

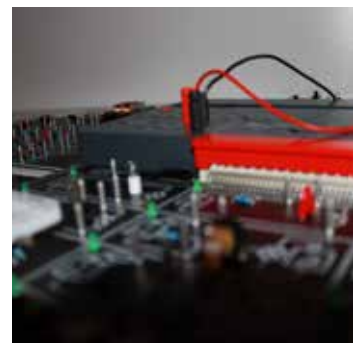
The **COM4LAB** courses are available at any time and from anywhere via the cloud. Sharing with learning management systems, such as Moodle or MS Teams, is also possible. In digital lessons, up to four students can connect their device to a **COM4LAB** workstation via the network. **COM4LAB** courses work on any device regardless of operating system and manufacturer. No software needs to be installed or maintained. Not only is a Bring-Your-Own-Device concept easily implemented, but teamwork is also promoted through group work. Students can save courses at any time and continue working on them from any location.

**COM4LAB** courses can also be used to prepare for lessons or for homework without the need for hardware thanks to its safe operation and uncomplicated handling.

## COST-EFFICIENT EDUCATION

**COM4LAB** is an efficient training system that already minimises teacher preparation time and allows for a quick start in the classroom due to its rapid set-up and stowing away. The robust and stable design ensures a long service life and low secondary costs.

**COM4LAB** also offers a high degree of future-proofing thanks to its cloud-based system and independence from operating systems and manufacturers. The compact yet complete lab has an enormously reduced maintenance effort compared to large, complex training facilities. Furthermore, the modular design enables cost-efficient additions and replacement.



# COM4LAB

THE SYSTEM AT A GLANCE

## COM4LAB



### 1. MASTER UNIT

Base station with all connections and measuring instruments

### 2. EXPERIMENT BOARD

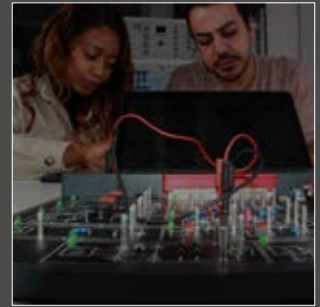
Experiment hardware for the course subject (physical experiment), safe and clearly structured with interactive course guidance

### 3. COURSE

Learning module with all learning content (theory and experiments) as well as the knowledge checks, organised into chapters





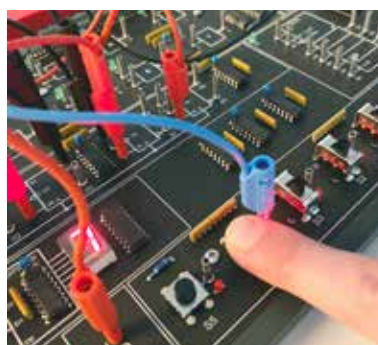


## SIMPLY COMFORTABLE

- Perfect interaction between hardware and software based on German engineering standards
- No additional accessories such as measuring instruments, function generators or power supply unit required
- Quick and easy to use, setting up and stowing away in just a few steps
- Robust and stable, suitable for students to handle safely
- Space-saving thanks to compact design
- Simple and intuitive operation of all features
- Designed for perfect learning ergonomics
- Interactive guidance within the course, including experiments and measurements via the experiment board and Master Unit
- Compatible with all previous COM3LAB experiment boards
- Can be used in any location, even without electrical socket
- Work in safety extra low voltage range



THE SECRET OF SUCCESS IS  
THE MIX OF THEORY & PRACTICE





# COM4LAB

SUPPORTING TEACHING AND LEARNING



**MORE MOTIVATION,  
MORE LEARNING  
SUCCESS**

## EXTRA COM4:

### INDIVIDUAL LEARNING LOCATION

- Course is always available for the student, anywhere
- Deepening knowledge at individual learning locations, from the café to the park
- Suitable for remote learning (e.g. in rural areas) due to compact size and independent power supply



### COM4LAB DIGITAL DISTRIBUTION

- Courses are made available to all students via QR code or link
- Courses can be shared via learning management systems (LMS, e.g. Microsoft Teams, Moodle)

### COM4LAB DIGITAL PREPARATION & FOLLOW-UP

- Access to COM4LAB courses in the online portal LeyLab at any time and from anywhere
- Teacher version with theory, example measurements and solutions saves preparation time



### COM4LAB DIGITAL CHECKING

- Knowledge check with automatic answer confirmation
- Returning of course to teacher by e-mail or via LMS
- Collection of all digital course protocols
- Central overview of course status possible via LMS
- Simple check of results



# COM4LAB

FROM START TO END



## COM4LAB DIGITAL COURSE WORK

- Courses can be called up on the students' tablets, laptops
- Interactive learning content independently worked through individually or in a group (up to 4 students)



## COM4LAB DIGITAL EXPERIMENTATION

- Joint experimentation via course and on the experiment board in teamwork
- Automatic, digital transmission of the measured values (virtual displays, tables and diagrams) to all devices in the work group



## COM4LAB DIGITAL COURSE PROTOCOL

- Individual evaluation of the cooperative measurement results
- Individual processing of course
- Course protocol usable as digital documentation for deepening learning content/ further processing



## EXTRA COM4:

### INDIVIDUAL LEARNING SUPPORT

- Teacher can give students tips, offer immediate help during the class or present to the class
- Focus on teaching through self-study

## EXTRA COM4:

### INDIVIDUAL LEARNING SPEED

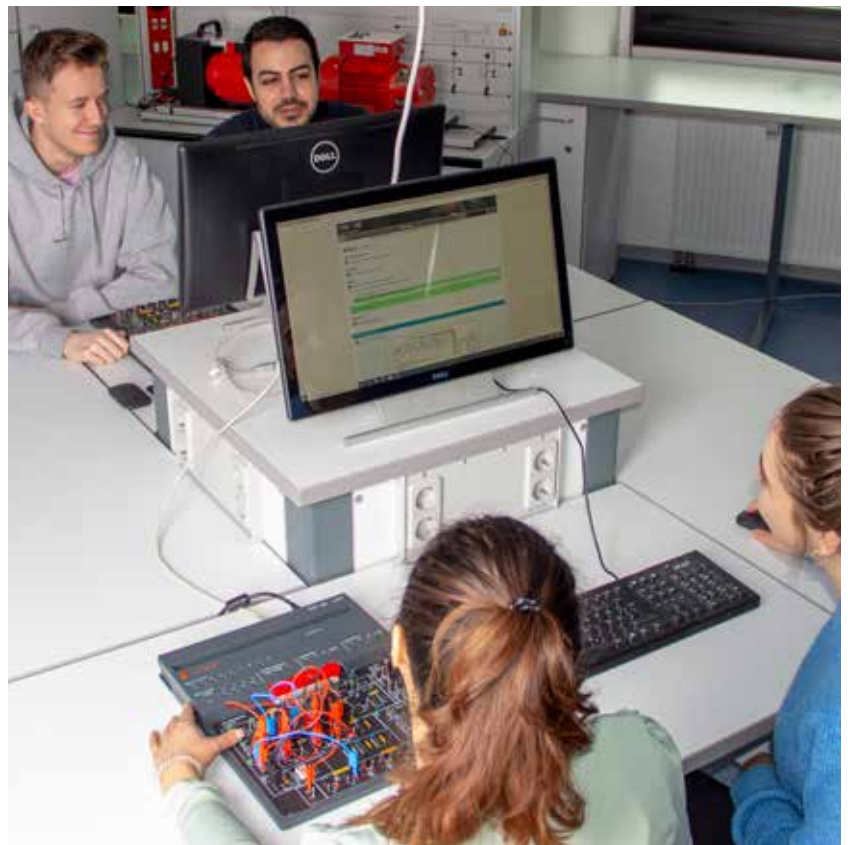
- Courses can be worked through at individual speed
- Courses can be saved at any time and then restarted
- Chapters can be printed out
- Courses can be continued without hardware

# COM4LAB

THE PERFECT SOLUTION

## COM4LAB AT VOCATIONAL COLLEGE

- Broad coverage of the curriculum topics
- Quick set-up and simple, safe operation
- Support for individual and group work
- Time-saving preparation and follow-up of lessons
- Promotion of teamwork and social skills
- Students learn from and with each other
- Independent learning with students' own equipment (up to 4 devices) and at their individual speed
- Simple learning checks and securing the learning level of the entire class
- Enhancing digital competence
- Ensuring high learning level and learning quality independent of the teacher
- Course can be edited for adaptation to the respective learning level



With all possible uses, individual preparation or following up on the course can be done with or without hardware at home.



# COM4LAB

FOR VARIOUS LEARNING LOCATIONS

## COM4LAB IN COMPANIES TRAINING ON THE JOB

- Optimal training and high motivation of own employees
- Additional staff for support is unnecessary, as **COM4LAB** can be set up and worked with independently
- For use at work or at home
- Learning or deeper exploration of topics relevant to the exam, in addition to in-house training
- Courses with focus on the company's main areas of business
- Low investment with high outcome
- **COM4LAB** as a convincing argument in the trainee recruiting process



## COM4LAB AT UNIVERSITY

- A **COM4LAB** workstation for a specific curriculum topic in the lab
- Independent work on and performing of experiments
- Option of free experimentation thanks to customisable courses and openness to other systems
- Preparation for lab work and immersion in teaching systems and theory
- Promotion of technical, social and digital competences
- Transparency about learning status and ensuring consistent quality



# COM4LAB

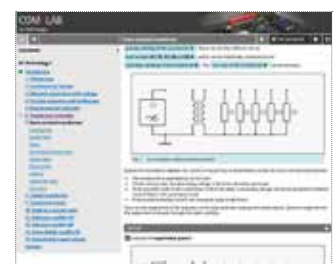
## INTERACTIVE COURSES FOR INDEPENDENT LEARNING



### INTUITIVE DESIGN AND INTERACTIVE LEARNING CONTENT

The clear preparation of learning content combined with the awesome, intuitive course design ensures that learning is fun. The students are more motivated and achieve a higher efficiency and sustainability for their learning.

- Didactically prepared, curriculum-compliant learning content with theoretical and practical elements for long-lasting success in learning
- Interesting and comprehensible imparting of the learning content via interactive graphics, animations, videos and tutorials
- Practical experiments for a quick start in professional life
- Student version and teacher version (with all results) available in the cloud
- Immediately available in national languages due to online translation feature
- Audio and help functions ensure ease of use
- Direct feedback thanks to the knowledge checks (e.g. multiple choice, fill-in-the-blanks, yes/no questions) with automatic answer review
- Course can be saved and worked on later at any time





- For all software platforms
- Any tablet, smartphone, laptop or PC
- Solution for any IT infrastructure
- Allows for „Bring Your Own Device“ (BYOD)
- No installation necessary



## QUICKLY AND EASILY EDIT AND CREATE COURSES

All **COM4LAB** course content can be edited and adapted to your own needs. This way, different learning levels or teaching scenarios can be addressed. The **COM4LAB** editor has an impressive ease of use and comprehensive options, such as:

- Editing or deleting assignments
- Adding questions and explanations
- Inserting images or videos
- Creating text tasks (e.g. multiple choice) for exams
- Integrating new experiments, including measurements

Even completely new, interactive **COM4LAB** courses can be created with the editor.



## INTERACTIVE MEASUREMENTS AND VIRTUAL 3D MEASURING INSTRUMENTS

Each course includes real experiments performed with the help of the experiment board. In addition to plugging circuits in using circuit diagrams, this also includes live measurements.

- Controlling measuring instruments directly from the course
- Measurements are transferred to the courses in real time - from virtual display to tables and diagrams
- Virtual 3D measuring instruments (oscilloscope and multimeter)
  - Modelled on professional life
  - Realistically operated for a high level of practical relevance



# COM4LAB

REAL EXPERIMENTS FOR SUSTAINABLE LEARNING

## MASTER UNIT

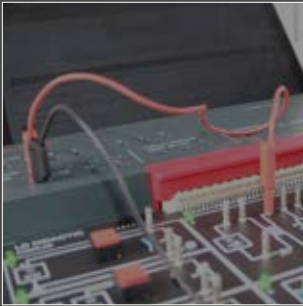
- Clearly labelled and designed
- Includes all connections (WiFi, USB, Ethernet)
- Includes all precise and fast measuring instruments and signal generators in mini format
- Activity indicators for measuring instruments
- Tablet housing slot
- Connection with up to 4 digital devices
- Compatible with all existing COM3LAB experiment boards
- Luminous strip for optical status control



## INTEGRATED MEASURING INSTRUMENTS

- 4-Channel-Oscilloscope with 4 differential inputs
- 8-Bit Digital Analyser
- Function Generator up to 100 KHz (square-wave, triangular, sinusoidal, DC)
- 2 x Multimeter (9 measurement ranges for current, voltage and resistance management)





## EXPERIMENT BOARD

- Equipped with everything you need to perform all experiments within an entire topic
- Explanation of the experiment board and the corresponding course elements with interactive circuit diagrams
- Visible modules and use of original components for a high degree of realism
- Clearly recognisable experiment panels with circuits and corresponding standardised circuit symbols (DIN standard 60617)
- Interactive course guidance using LED lights on the experiment board
- Robust even with faulty connections



## SAFETY

- COM4LAB only uses non-hazardous voltages and low currents
- 2 mm safety sockets and leads
- Kensington lock serves as theft protection for permanent workstation set-ups
- Courses are mechanically locked during assembly
- Security lock automatically switches off the board when opened



# COM4LAB

## COMPREHENSIVE CURRICULUM

### QUICK AND SIMPLE TOPIC CHANGES



The compact experiment boards can be efficiently stored in cabinets thanks to a special holder.

When students are working on a new topic, the Master Unit is quickly and easily slid onto the new experiment board and the new course is instantly ready for use.

### With your Master Unit you cover the following topics:

- DC technology
- AC technology
- Electronic components
- Digital technology
- Power electronics
- Three-phase technology
- Electrical machines
- Automation and bus technology
- Electro-pneumatics
- Photovoltaics
- Digital communication technology
- Modem technology
- Telecommunication lines
- Operational amplifiers
- Control engineering
- Sensor technology
- Protoboard for free experimentation
- Automotive electrics
- Automotive sensors
- Automotive digital technology
- Automotive data buses

# COM4LAB

## OVERVIEW OF COURSES

### OVERVIEW OF COM4LAB SET-UPS

### PAGE

## ELECTROTECHNOLOGY

ME1.1.1	DC Technology I	16-17
ME1.1.2	DC Technology II	16-17
ME1.2.1	AC Technology I	18-19
ME1.2.2	AC Technology II	18-19
ME1.3.1	Electrical Components I	20-21
ME1.3.2	Electrical Components II	20-21
ME1.4.1	Digital Technology I	22-23
ME1.4.2	Digital Technology II	22-23

## AUTOMOTIVE TECHNOLOGY

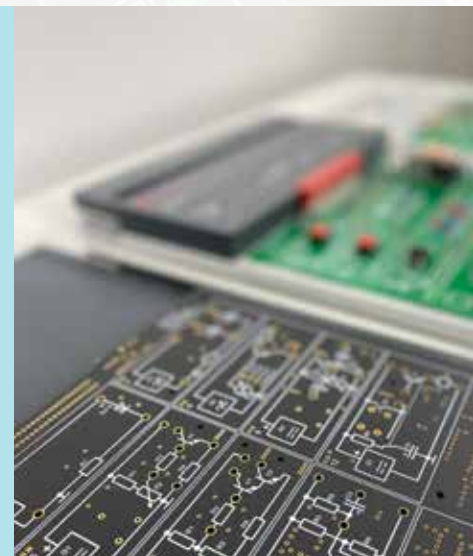
MA3.1	Automotive Digital Technology I	24-25
MA3.2	Automotive Digital Technology II	24-25

ADDITIONAL COURSES CAN BE FOUND ON OUR HOMEPAGE:  
[www.leybold-shop.com](http://www.leybold-shop.com)

### COM4LAB READY

COM4LAB is compatible with the existing COM3LAB generation.

Use the wide range of COM3LAB experiment boards with the new COM4LAB Master Unit and secure the COM4LAB benefits for the future.



# COM4LAB

## DC TECHNOLOGY

In the area of direct current technology, we offer the **COM4LAB** set-ups **DC Technology I** and **DC Technology II**. Step by step, the laws of electrical engineering are explained and worked out with experiments and animations.



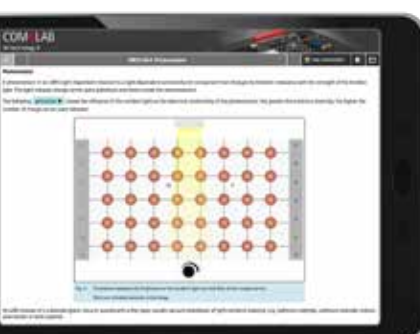
ME1.1.1 - 6. Relay

### DC TECHNOLOGY I

The fundamental concepts and laws of electrical engineering are explained and worked out in a practical environment using a variety of experiments. The course comprises 14 chapters.

#### LEARNING OBJECTIVES

- Setup and effect of basic circuits
- Understand and apply the fundamental laws of electrical engineering



ME1.1.2 - 4. Photoresistor

### DC TECHNOLOGY II

Characteristics of various passive electrical components are recorded and the basic circuit types in electrical engineering are practically devised using a number of experiments. The course comprises 15 chapters.

#### LEARNING OBJECTIVES

- Record the characteristics of passive electrical components
- Behaviour of passive electrical components such as capacitors, coils and batteries

Would you like more information, a product presentation or an individual offer? Contact us here:



<https://info.ld-didactic.de/com4lab>





ME1.1.1 DC Technology I



ME1.1.2 DC Technology II

## COM4LAB DC TECHNOLOGY I

### TOPICS

- (Simple) electrical circuit with switch(es)
  - Series circuit
  - Multiway switching
  - Polarity reversing circuit
  - Relay
- Conductivity and electrical resistance
- Ohm's law
- Kirchhoff's circuit laws
- Analysis of resistive circuits
  - Series circuits
  - Parallel circuits
  - Unloaded/loaded voltage dividers
  - Wheatstone bridge



ME1.1.1 - 8. Ohm's law

## COM4LAB DC TECHNOLOGY II

### TOPICS

- Characteristics of the following passive electrical components:
  - Incandescent light bulb
  - VDR
  - Diode
  - LDR
  - NTC
  - PTC
- Capacitor
  - Series circuits
  - Parallel circuits
  - RC circuits
- Coil
  - Inductance
  - Moving coil instrument
- Battery
  - Series circuits
  - Parallel circuits



ME1.1.2 - 12. Moving coil instrument

### SCOPE OF DELIVERY:

Cat. No.	Name	ME1.1.1
700 11-00	COM4LAB Board: DC Technology I	1
700 11-20	COM4LAB Course: DC Technology I	1
700 00-00	COM4LAB Master Unit	1
700 00-11	USB-C Charger 45 W Europlug (Type C)*	1
700 00-22	COM4LAB Set of Safety Leads, 2 mm, 24 pcs	1

Cat. No.	Name	ME1.1.2
700 12-00	COM4LAB Board: DC Technology II	1
700 12-20	COM4LAB Course: DC Technology II	1
700 00-00	COM4LAB Master Unit	1
700 00-11	USB-C Charger 45 W Europlug (Type C)*	1
700 00-22	COM4LAB Set of Safety Leads, 2 mm, 24 pcs	1

\*Alternatively USB-C charger with UK-plug or US-plug

# COM4LAB

## AC TECHNOLOGY

For alternating current technology, the two **COM4LAB** set-ups **AC Technology I** and **AC Technology II** cover the effects of alternating currents and voltages.



ME1.2.1 – 9. Transformer losses

### AC TECHNOLOGY I

It addresses the generation of AC voltage and the functions of a transformer. Various rectifier circuits are practically devised using a number of experiments. In addition, the handling of a function generator, oscilloscope and multimeters are trained. The course comprises 14 chapters.

#### LEARNING OBJECTIVES

- Handling and usage of the function generator and the oscilloscope
- Principle and function of a transformer
- Effects of various rectifier circuits



ME1.2.2 – 13. Parallel connection of resistor and capacitor

### AC TECHNOLOGY II

Students work out the behaviour of passive components in various circuits. Various combinations of coil, capacitor and resistance are analysed and calculated. Also the students are instructed on how to use the function generator, oscilloscope and multimeters. The course comprises 20 chapters.

#### LEARNING OBJECTIVES

- Characteristics and connections in AC current circuits
- Handling and usage of the function generator and the oscilloscope

Would you like more information, a product presentation or an individual offer? Contact us here:



<https://info.ld-didactic.de/com4lab>



ME1.2.1 AC Technology I



ME1.2.2 AC Technology II

## COM4LAB AC TECHNOLOGY I

### TOPICS

- Generation of alternating voltage
  - Step voltage
  - Continuous alternating voltage
  - Electronic generation of alternating voltage
- Function generator and oscilloscope
- Transformer
  - Induction
  - Principle of the transformer
  - Short-circuited transformer
  - Loaded transformer
  - Transformer losses
- Rectifier circuits
  - Diode as a current valve
  - Half-wave rectifier M1
  - Full-wave rectifier M2
  - Graetz bridge rectifier B2
  - Symmetrical output voltage



ME1.2.1 - 11. Half-wave rectifier M1

## COM4LAB AC TECHNOLOGY II

### TOPICS

- Generation of AC voltage
- Characteristic variables in AC technology
- Ohmic resistance in an AC circuit
- Coil in an AC circuit
  - Inductive resistance
  - Series connection and parallel connection of resistor and coil
- Capacitor in an AC circuits
  - Capacitive resistance
  - Series connection and parallel connection of resistor and capacitor
- Series connection and parallel connection of resistor, coil and capacitor
- Series compensation
- Parallel compensation
- Series resonance
- Parallel resonance resonance



ME1.2.2 - 19. Series resonance

### SCOPE OF DELIVERY:

Cat. No.	Name	ME1.2.1
700 13-00	COM4LAB Board: AC Technology I	1
700 13-20	COM4LAB Course: AC Technology I	1
700 00-00	COM4LAB Master Unit	1
700 00-11	USB-C Charger 45 W Europlug (Type C)*	1
700 00-22	COM4LAB Set of Safety Leads, 2 mm, 24 pcs	1

Cat. No.	Name	ME1.2.2
700 14-00	COM4LAB Board: AC Technology II	1
700 14-20	COM4LAB Course: AC Technology II	1
700 00-00	COM4LAB Master Unit	1
700 00-11	USB-C Charger 45 W Europlug (Type C)*	1
700 00-22	COM4LAB Set of Safety Leads, 2 mm, 24 pcs	1

\*Alternatively USB-C charger with UK-plug or US-plug

# COM4LAB

## ELECTRONIC COMPONENTS

The topic Electronic Components comprises the **COM4LAB** set-ups **Electronic Components I** and **Electronic Components II**. A wide variety of components are needed for electrotechnical and electronic circuits. Both set-ups focus on active electronic components that have an amplifying effect or permit control.

### ELECTRONIC COMPONENTS I

The most important diode types and their behaviour are presented. The functions, circuits and characteristics of the npn and pnp transistors are explored. The students are instructed on how to use the function generator, oscilloscope and multimeters. The course comprises 19 chapters.

#### LEARNING OBJECTIVES

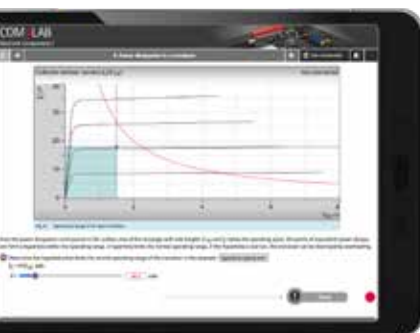
- Setup, function and use of diodes and transistors
- Record characteristics of diodes and transistors using an oscilloscope
- Standard circuits and their applications

### ELECTRONIC COMPONENTS II

Special transistor types and semiconductors from the power electronics sector are used. One of their main applications, phase angle control, is examined taking the thyristor and the TRIAC as examples. The students are also instructed on how to use the function generator, oscilloscope and multimeters. The course comprises 14 chapters.

#### LEARNING OBJECTIVES

- Setup, function and use of field-effect transistors, MOSFETs, IGBTs, DIACS, Thyristors and TRIACS
- Record characteristics of these active components with an oscilloscope



ME1.3.1 - 8. Power dissipation in a transistor



ME1.3.2 - 5. Characteristics of a MOSFET

Would you like more information, a product presentation or an individual offer? Contact us here:

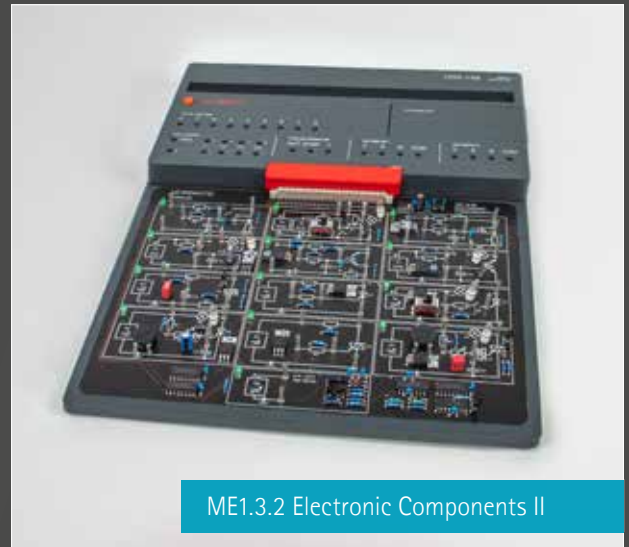


<https://info.ld-didactic.de/com4lab>





ME1.3.1 Electronic Components I



ME1.3.2 Electronic Components II

## COM4LAB ELECTRONIC COMPONENTS I

### TOPICS

- Diode characteristics
- Characteristic of a Zener diode
- Characteristic of a light-emitting diode
- Diode branches in a transistor
- Characteristics of a transistor
  - Input characteristic
  - Output characteristic
  - Control characteristic
- Power dissipation in a transistor
- Characteristic of a phototransistor
- Darlington configuration
- Operating point of a transistor
- Transistor in a common emitter circuit
- Transistor in a common collector circuit
- Transistor in a common base circuit
- Transistor in timer circuits



ME1.3.1 - 19. Transistors in timer circuits

## COM4LAB ELECTRONIC COMPONENTS II

### TOPICS

- Field-effect transistors (FET)
  - Transfer characteristic of the JFET
  - Output characteristic family of the JFET
  - JFET as switch
- MOSFET
  - Characteristics
  - MOSFET as switch
- IGBT
  - Characteristics
  - IGBT as switch
- DIAC
- Thyristor
  - Characteristic
  - Thyristor in a DC circuit
  - Phase angle control with a thyristor
- TRIAC
  - Characteristic
  - Phase angle control with a TRIAC



ME1.3.2 - 8. IGBT as a switch

### SCOPE OF DELIVERY:

Cat. No.	Name	ME1.3.1
700 15-00	COM4LAB Board: Electronic Components I	1
700 15-20	COM4LAB Course: Electronic Components I	1
700 00-00	COM4LAB Master Unit	1
700 00-11	USB-C Charger 45 W Europlug (Type C)*	1
700 00-22	COM4LAB Set of Safety Leads, 2 mm, 24 pcs	1

Cat. No.	Name	ME1.3.2
700 16-00	COM4LAB Board: Electronic Components II	1
700 16-20	COM4LAB Course: Electronic Components II	1
700 00-00	COM4LAB Master Unit	1
700 00-11	USB-C Charger 45 W Europlug (Type C)*	1
700 00-22	COM4LAB Set of Safety Leads, 2 mm, 24 pcs	1

\*Alternatively USB-C charger with UK-plug or US-plug

# COM4LAB

## DIGITAL TECHNOLOGY

With the two COM4LAB set-ups *Digital Technology I* and *Digital Technology II* students learn the fundamentals of digital technology. Both set-ups examine the troubleshooting procedure in detail.

### DIGITAL TECHNOLOGY I

The fundamentals and laws of Boolean algebra are described using logic operations. The focus of the course is also on troubleshooting. The course comprises 16 chapters.

#### LEARNING OBJECTIVES

- Setup, function and functional principle of the individual gates and other logic components
- Learning important laws of propositional logic
- Perform troubleshooting procedures on the logic components

### DIGITAL TECHNOLOGY II

This course explores several flip-flop types and various applications such as counters, shift registers and parallel-serial converters. The course, comprising 12 chapters, also examines the troubleshooting procedure in detail.

#### LEARNING OBJECTIVES

- Setup, function and functional principle of the individual flip-flops
- Usage of flip-flops and other multivibrators
- Perform troubleshooting procedures on the logic components



ME1.4.1 - 15. Multiplexer and demultiplexer



ME1.4.2 - 3. Clocked RS flip-flop



Would you like more information, a product presentation or an individual offer? Contact us here:

<https://info.ld-didactic.de/com4lab>



ME1.4.1 Digital Technology I



ME1.4.2 Digital Technology II

## COM4LAB DIGITAL TECHNOLOGY I

### TOPICS

- TTL modules
  - AND gate
  - OR gate
  - NOT gate
  - XOR gate
  - NAND gate
- Operation with binary inputs
- Basic laws
  - De Morgan's laws
  - Associative law
  - Distributive law
- Karnaugh map
- Binary code
- Seven-segment display
- Half adder
- Full adder
- Multiplexer and demultiplexer
- Fault simulation



ME1.4.1 - 10. Karnaugh map

## COM4LAB DIGITAL TECHNOLOGY II

### TOPICS

- Bistable multivibrators
  - SR flip-flop
  - Clocked SR flip-flop
  - D flip-flop
  - JK flip-flop
  - JK master-slave flip-flop
- Monostable and astable multivibrator
- Schmitt trigger
- Flip-flop applications
  - Frequency divider
  - Counter
  - Shift register
  - Parallel-serial converter



ME1.4.2 - 10. Counter

### SCOPE OF DELIVERY:

Cat. No.	Name	M1.4.1
700 17-00	COM4LAB Board: Digital Technology I	1
700 17-20	COM4LAB Course: Digital Technology I	1
700 00-00	COM4LAB Master Unit	1
700 00-11	USB-C Charger 45 W Europlug (Type C)*	1
700 00-22	COM4LAB Set of Safety Leads, 2 mm, 24 pcs	1

Cat. No.	Name	M1.4.2
700 18-00	COM4LAB Board: Digital Technology II	1
700 18-20	COM4LAB Course: Digital Technology II	1
700 00-00	COM4LAB Master Unit	1
700 00-11	USB-C Charger 45 W Europlug (Type C)*	1
700 00-22	COM4LAB Set of Safety Leads, 2 mm, 24 pcs	1

\*Alternatively USB-C charger with UK-plug or US-plug

# COM4LAB

## AUTOMOTIVE DIGITAL TECHNOLOGY

With both COM4LAB set-ups [Automotive Digital Technology I](#) & [Automotive Digital Technology II](#) students learn digital technology from the ground up. The subject areas are matched to automotive technology in a realistic and applied manner.

### AUTOMOTIVE DIGITAL TECHNOLOGY I

The basic principles of Boolean algebra are described using logic operations. The focus of the course is also on troubleshooting. The course comprises 10 chapters.

#### LEARNING OBJECTIVES

- Setup, function and functional principle of the individual gates and other logic components
- Perform troubleshooting procedures on the logic components

### AUTOMOTIVE DIGITAL TECHNOLOGY II

This course explores several flip-flop types and various applications such as counters and shift registers. The course, comprising 8 chapters, also examines the troubleshooting procedure in detail.

#### LEARNING OBJECTIVES

- Setup, function and functional principle of the individual flip-flops
- Usage of flip-flops and other multivibrators
- Perform troubleshooting procedures on the logic components



MA3.1 - 2. OR-Gatter



MA3.2 - 7. Counter

Would you like more information, a product presentation or an individual offer? Contact us here:



<https://info.ld-didactic.de/com4lab>





## COM4LAB AUTOMOTIVE DIGITAL TECHNOLOGY I

### TOPICS

- TTL modules
  - AND gate
  - OR gate
  - NOT gate
  - XOR gate
  - NAND gate
- Operation with binary inputs
- Binary code
- Seven-segment display
- Multiplexer and demultiplexer
- Fault simulation



MA3.1 - 5. Logic Operations

## COM4LAB AUTOMOTIVE DIGITAL TECHNOLOGY II

### TOPICS

- Bistable multivibrators
  - SR flip-flop
  - Clocked SR flip-flop
  - JK flip-flop
- Monostable and astable multivibrator
- Schmitt trigger
- Flip-flop applications
  - Counter
  - Shift register



MA3.2 - 2. SR flip-flop

### SCOPE OF DELIVERY:

Cat. No.	Name	MA3.1
700 17-00	COM4LAB Board: Automotive Digital Technology I	1
700 17-30	COM4LAB Course: Automotive Digital Technology I	1
700 00-00	COM4LAB Master Unit	1
700 00-11	USB-C Charger 45 W Europlug (Type C)*	1
700 00-22	COM4LAB Set of Safety Leads, 2 mm, 24 pcs	1

Cat. No.	Name	MA3.2
700 18-00	COM4LAB Board: Automotive Digital Technology II	1
700 18-30	COM4LAB Course: Automotive Digital Technology II	1
700 00-00	COM4LAB Master Unit	1
700 00-11	USB-C Charger 45 W Europlug (Type C)*	1
700 00-22	COM4LAB Set of Safety Leads, 2 mm, 24 pcs	1

\*Alternatively USB-C charger with UK-plug or US-plug

# COM4LAB

WORKRELATED LEARNING

## — PRACTICAL EXAMPLE HYDROPOWER PLANT PUMP STORAGE



## — PRACTICAL EXAMPLE ELECTRIC MOTORS



## KNOWLEDGE NEEDED FOR THE WORKING WORLD:

### Generating electrical energy

- Synchronous generator
- Mains synchronisation
- Load behaviour



### Generating mechanical energy

- Asynchronous motor
- Load start-up
- Efficiency



# COM4LAB

BRING THE REAL WORLD INTO YOUR LAB

## LD DIDACTIC TRAINING SYSTEMS "ELECTRICAL DRIVES AND MACHINES"



*Learning on large training systems with modular training panels covering all required training topic areas*



## UNDERSTAND COMPLEX INSTALLATIONS

### COM4LAB ELECTRICAL MACHINES

MOST COMPACT SOLUTION ON THE MARKET FOR THE TOPIC OF ELECTRICAL MACHINES

- Highlight is the integrated machine test system
- Recording characteristics and connection techniques of electrical motors and generators



# COM4LAB

## CONTACT



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