



Electrical Engineering / Electronics Digital Technology



Made
in
Germany



PRINCIPLES OF ELECTRICAL ENGINEERING

Analysis of electrical-engineering systems on component level

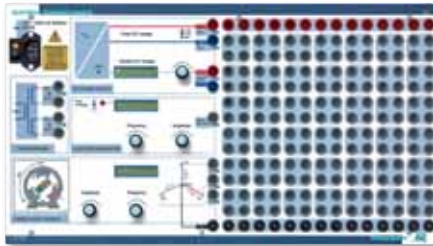




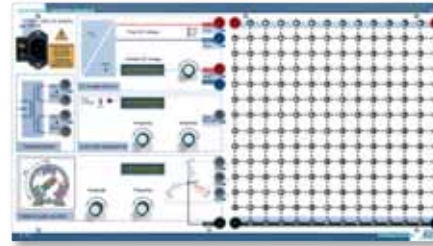
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HARDWARE

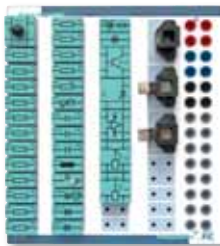
Electrical Engineering / Electronics



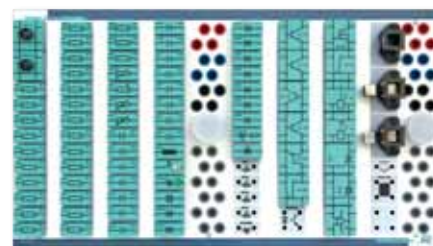
Electrical
Networks Board II



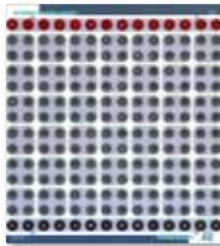
Electronic
Circuits Board II



Device Set
Electrical
Engineering



Device Set
Electronics

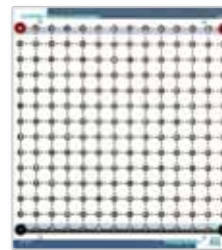


Assembly Board
Safety



Device Set
Optoelectronics

Universal Supply
Board



Assembly Board
Electronics

Measuring Instruments



Color digital oscilloscope 60 MHz



Analog multimeter



Digital multimeter

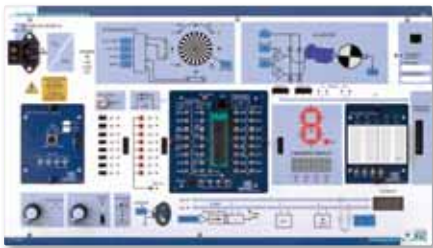


Leakage Clamp Meter

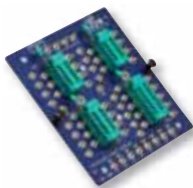
Digital Technology



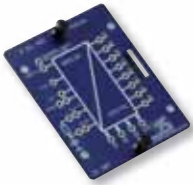
Digital Trainer Board



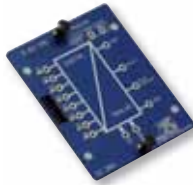
IC-Trainer



Universal Logic Module



8 Bit ADC Module



8 Bit DAC Module



Prototype Module



Basic Set Logic ICs



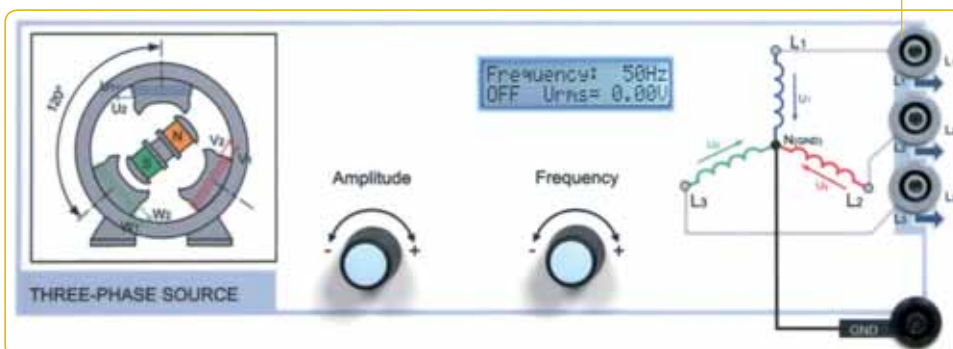
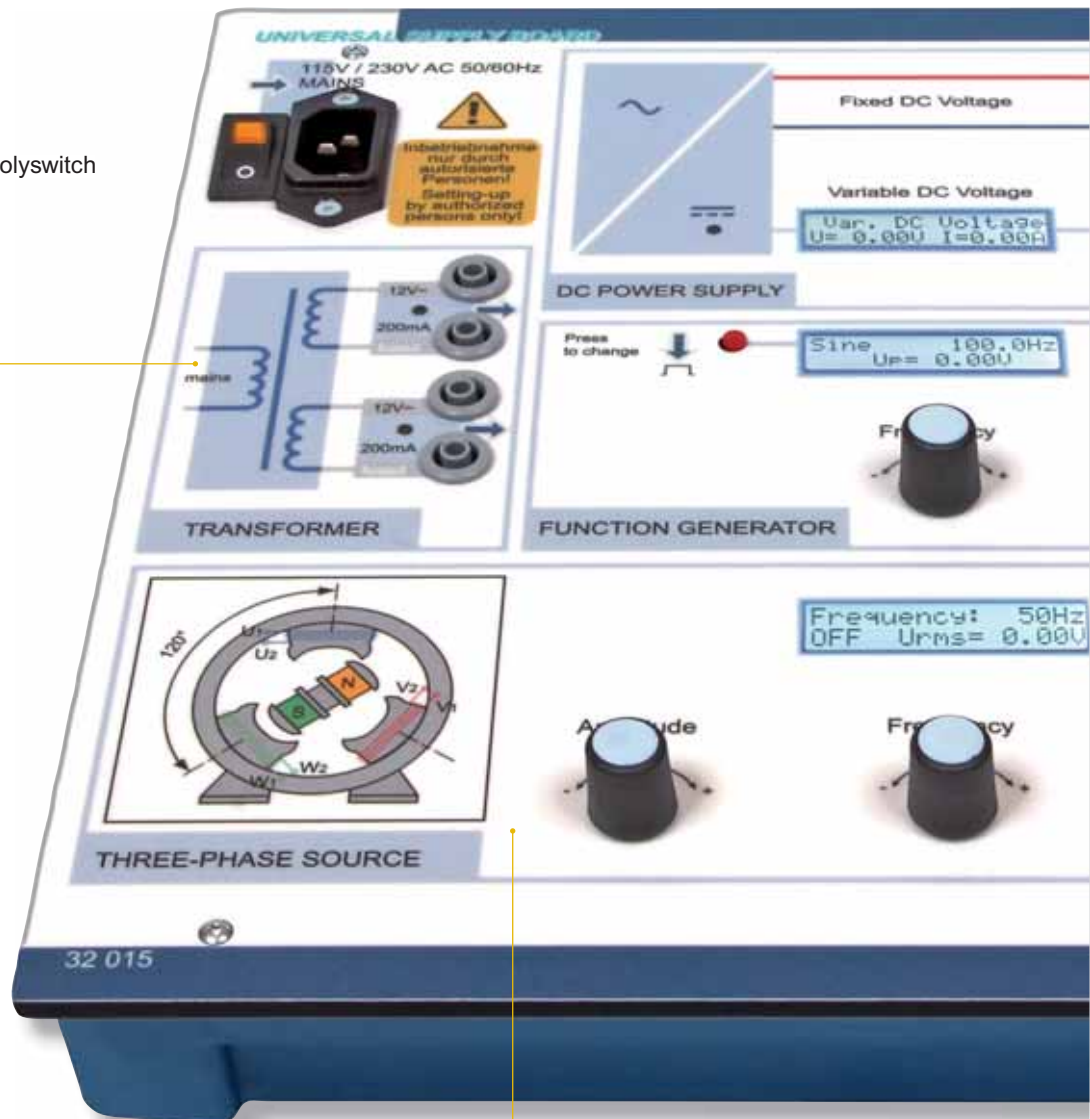
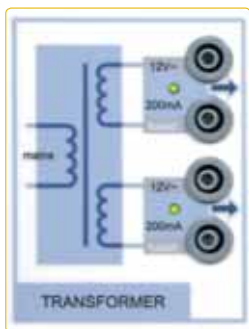
Breadboard Wiring Set

ATTRACTIVE, POWERFUL AND SAFE

Functions and operating elements

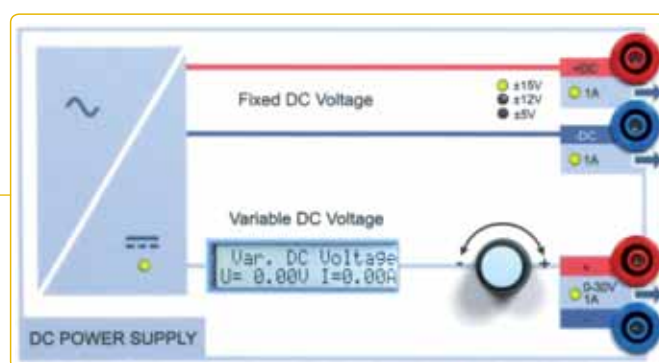
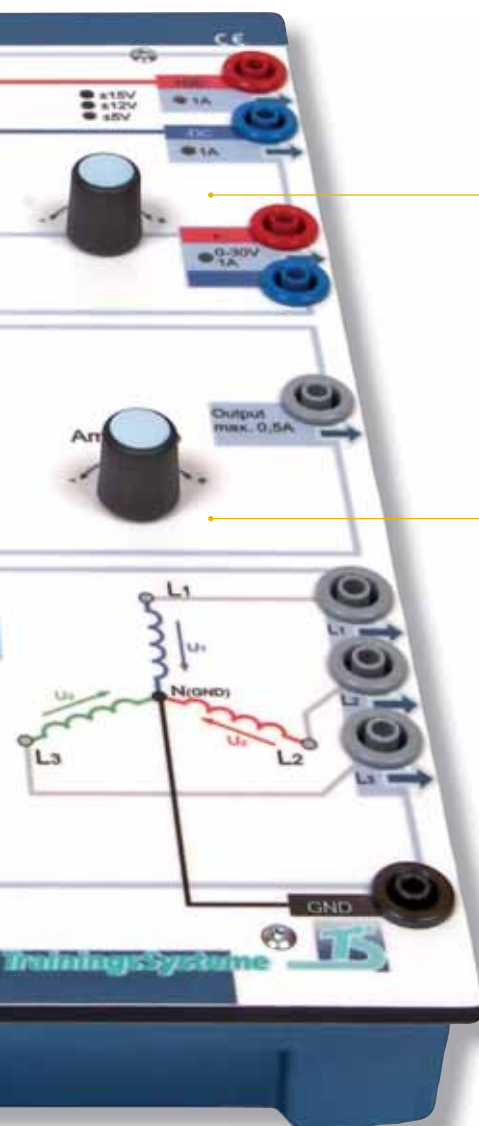
TRANSFORMER

- AC voltage sources
2 x 12 V AC / 0.2 A; 50 Hz
(mains frequency), protected by polyswitch



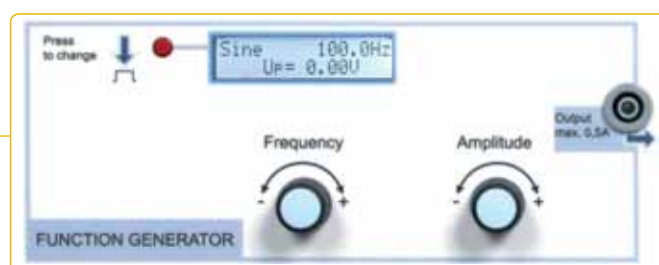
THREE-PHASE CURRENT GENERATOR

- frequency: 1...120 Hz, adjustable in 1Hz steps
- phase voltage: 0...10 V_{rms}
- line voltage: 0...17,3 V_{rms}
- line current: max. 400 mA_{rms}
- all parameters available in the LC display
- short-circuit-proof, reverse protection up to 40 V DC / 24 V AC



DC POWER SUPPLY

- variable DC voltage source, potential free, **0...30 V / 1.0 A** with voltage and current display, active current limitation for safe experimenting
- variable DC voltage source, **+15 V, +12 V or +5 V / 1.0 A**
- variable DC voltage source, **-15 V, -12 V or -5 V / 1.0 A**
- all outputs short-circuit-proof, reverse protection up to **40 V DC / 24 V AC, 40 W**
- colour LED indicating overload

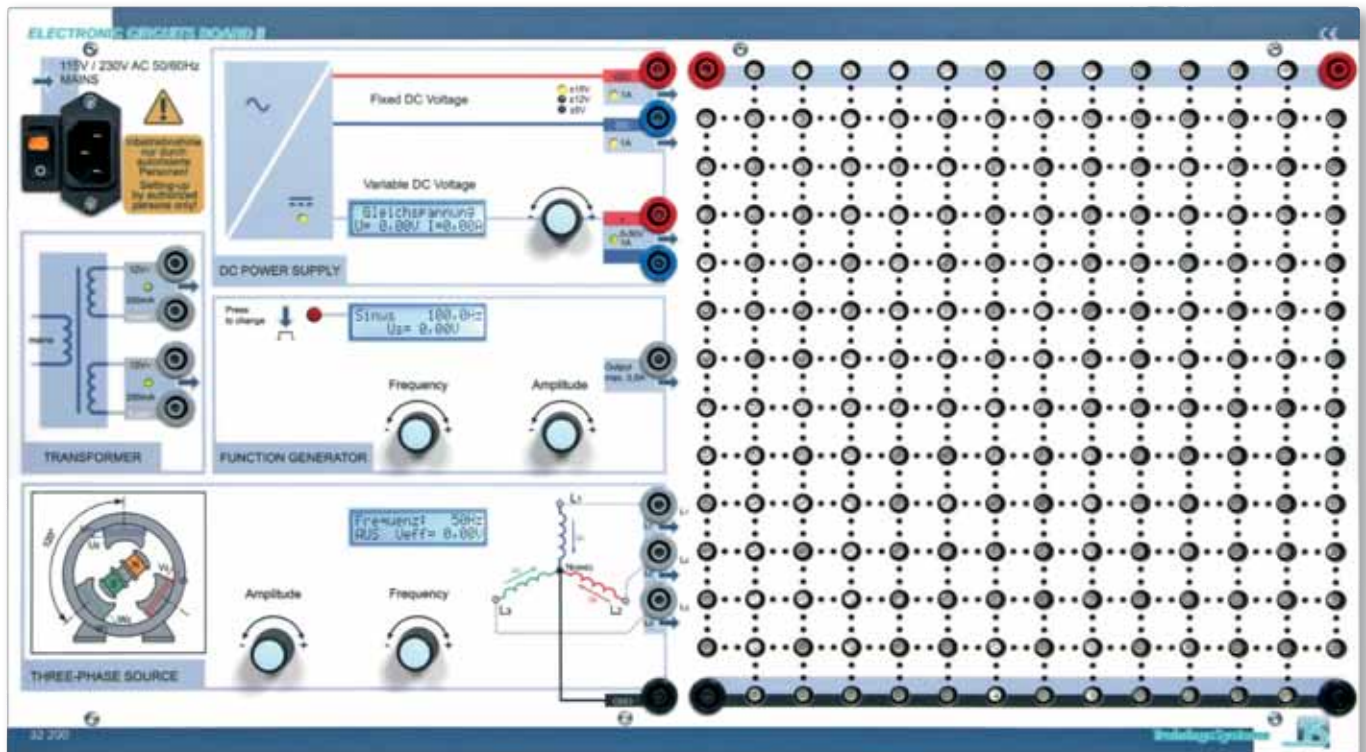


FUNCTION GENERATOR

- LC display with all parameters
- frequency **0.1 Hz...200 kHz**
- amplitude setting **0...10 Vs**, adjustment accuracy **10 mV**
- max. current load **0.5 A** (peak current)
- source impedance **15 Ω**
- wave forms: sine, triangle, square and logic

32 015 Universal Supply Board

Electronic Circuits Board II



32 200 Electronic Circuits Board II

LEARNING OBJECTIVES

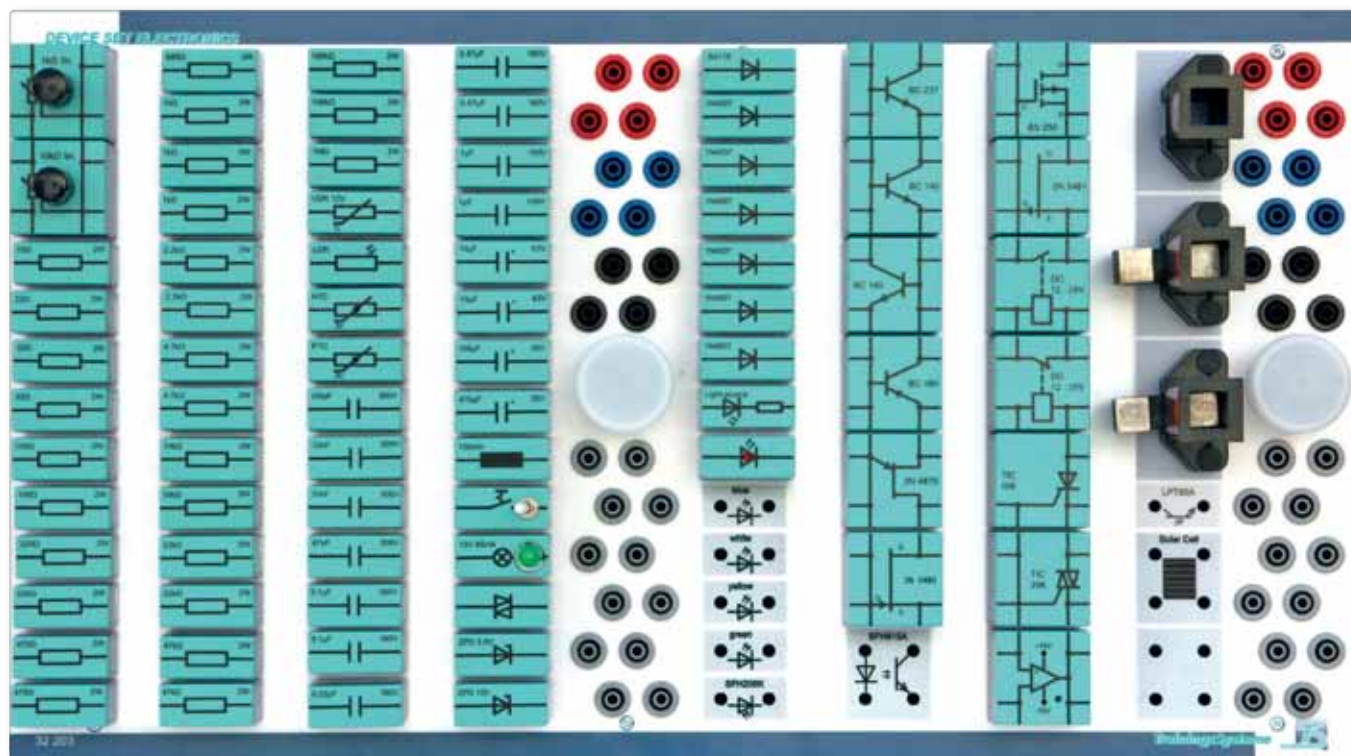
- ✓ Basics of electrical engineering
- ✓ Voltage-, temperature- and light-dependent resistors
- ✓ How to use oscilloscope, multimeter and function generator
- ✓ Behaviour of semiconductors: diodes, transistors, thyristors
- ✓ DC, AC and three-phase current technology
- ✓ Electronic circuits, amplifiers, trigger and power supply circuits
- ✓ Operational amplifier

Technical Data

- **Voltage sources:** DC ± 15 V or ± 12 V or ± 5 V/1 A; DC 0...30 V/ max. 1 A with voltage and current display; AC 2×12 V/0,2 A (protected by polyswitch)
- **Function generator:** frequency 0,1 Hz...200 kHz, variable amplitude (0...10 V_p) and wave form, display of all parameters
- **Three-phase current generator:** 0...10 V_{rms}; line voltage: 0...17,3 V_{rms}; frequency: 1...120 Hz, adjustable, display of all parameters, phase current load: max. 400 mA_{rms}
- **Experimenting field:** 4mm safety jacks arranged in a 19mm grid, surrounded by and electrically connected to four 2mm jacks.
- **Mains connection:** 115 V / 230 V AC; 50 / 60 Hz; 75 W; protection class I
- **Safety:** Supply outputs short-circuit-proof, reverse protection up to 40 V DC/ 24 V AC, 40 W



Device Set Electronics



32 203 Device Set Electronics

32 203 Device Set Electronics

Set of accessories, plugged on imprinted Storage Board:

- 28 film resistors 10 Ω ...1 M Ω
- 1 VDR resistor
- 1 LDR resistor
- 1 PTC resistor
- 1 NTC resistor
- 11 capacitors 100 pF...1 μ F
- 4 electrolytic capacitors 10 μ F...470 μ F
- 1 potentiometer linear 1 k Ω , 0,5 W
- 1 potentiometer linear 10 k Ω , 0,5 W
- 1 transformer coil N = 300
- 2 transformer coils N = 900
- 1 tape-wound core (1 pair)
- 1 coil 100 mH
- 1 transistor NPN, BC 237, base left
- 1 transistor NPN, BC 140, base left
- 1 transistor NPN, BC 140, base right
- 1 transistor PNP, BC 160, base left
- 1 unijunction transistor PN, 2N 4870
- 1 D-MOS field effect transistor, P-channel, BS 250
- 1 junction field effect transistor, N-channel, 2N 5485
- 1 junction field effect transistor, P-channel, 2N 5461
- 1 diac, ER 900
- 1 thyristor, TIC 106
- 1 triac, TIC 206
- 1 toggle switch
- 1 lamp, 15 V
- 1 light source
- 1 operational amplifier
- 1 GA-AS light emitting diode, red
- 1 Ge diode, AA118
- 6 Si diodes, 1N4007
- 1 Zener diode, ZPD 3.3 V
- 1 Zener diode ZPD 10 V
- 1 relay DC 12...15 V NOC
- 1 relay DC 12...15 V NCC



... to put things straight

The storage boards for the plug-in components are imprinted with the corresponding symbols.

PLUG-IN COMPONENTS

Passive and active components



Resistors

- series E12, 1 Ω ... 10 M Ω /2 W
(1,0 1,2 1,5 1,8 2,2 2,7 3,3 3,9 4,7 5,6 6,8 8,2)

Potentiometers

- linear, 470 Ω , 1 k Ω , 4,7 k Ω , 10 k Ω , 47 k Ω , 0,5 W

Non-linear resistors

- VDR, LDR, NTC, PTC resistors

Capacitors

- series E6, 10 pF ... 1 μ F
(1,0 1,5 2,2 3,3 4,7 6,8)



Electrolytic capacitors

- values: 10 μ F, 100 μ F, 470 μ F

Coils

- 100 mH
- transformer coils with 300 / 900 windings

Semiconductor components

- germanium and silicon diodes
- NPN and PNP transistors
- PN unijunction transistor
- D-MOS field effect transistor
- junction field effect transistor, N- and P-channel
- diac, thyristor, triac, IGBT
- operational amplifier
- Zener diode ZPD
values: 3,3 V, 10 V
- photo diode, photo transistor
- LEDs in red, green, yellow, blue, white



Switching and display components

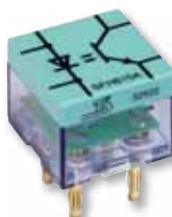
- switch, pushbutton, relays
- lamp

Other

- empty housings, with two and four pins

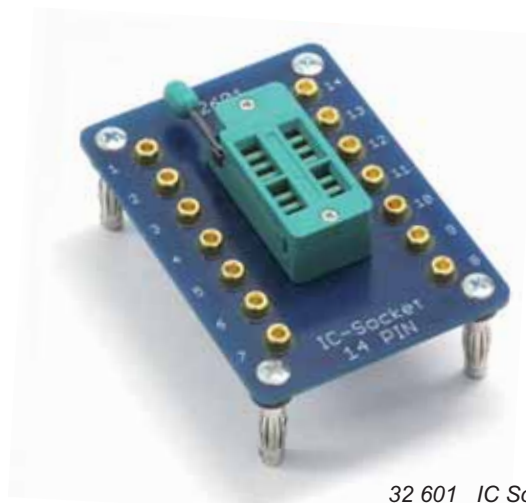


- Optoelectronics**
- Device Set Optoelectronics 32 104
(to complement device set 32 203)
 - photo transistor, photo diode
 - optical coupler, solar cell
 - LEDs



Component Overview

- 32 302 set of empty housings with 2 lamella plugs (10 pcs.)
- 32 305 set of empty housings with 2 lamella plugs (10 pcs.)
- 32 310 film resistor 10 Ω /2 W
- 32 311 film resistor 22 Ω /2 W
- 32 312 film resistor 33 Ω /2 W
- 32 313 film resistor 100 Ω /2 W
- 32 314 film resistor 220 Ω /2 W
- 32 315 film resistor 330 Ω /2 W
- 32 316 film resistor 470 Ω /2 W
- 32 317 film resistor 680 Ω /2 W
- 32 318 film resistor 1 k Ω /2 W
- 32 319 film resistor 2,2 k Ω /2 W
- 32 320 film resistor 4,7 k Ω /2 W
- 32 321 film resistor 10 k Ω /2 W
- 32 322 film resistor 22 k Ω /2 W
- 32 323 film resistor 47 k Ω /2 W
- 32 324 film resistor 100 k Ω /2 W
- 32 325 film resistor 1 M Ω /2 W
- 32 340 VDR resistor, 11 V/1 mA
- 32 342 NTC resistor (6 k Ω)
- 32 345 LDR resistor
- 32 370 capacitor 100 pF/500 V
- 32 371 capacitor 10 nF/500 V
- 32 372 capacitor 47 nF/500 V
- 32 373 capacitor 0,1 μ F/160V
- 32 374 capacitor 0,22 μ F/160 V
- 32 375 capacitor 0,47 μ F/160 V
- 32 376 capacitor 1 μ F/100 V
- 32 390 electrolytic capacitor 10 μ F/63 V
- 32 391 electrolytic capacitor 100 μ F/35 V
- 32 392 electrolytic capacitor 470 μ F/35 V
- 32 402 linear potentiometer 1 k Ω 0,5 W
- 32 403 linear potentiometer 10 k Ω 0,5 W
- 32 420 transformer coil N = 300
- 32 421 transformer coil N = 900
- 32 422 coil 100 mH
- 32 430 tape-woun core (1 pair)
- 32 440 Zener diode 10 V/40 mA
- 32 441 Zener diode 3,3 V/130 mA
- 32 442 GA-AS light emitting diode, red, without dropping reststor
- 32 443 light source
- 32 444 LED, 5 mm, blue
- 32 445 Ge diode, AA118
- 32 446 LED, 5 mm, warm white
- 32 447 LED, 5 mm, yellow
- 32 448 LED, 5 mm, green
- 32 450 Si-Diode 1 A
- 32 480 toggle switch
- 32 490 lamp, green, 15 V
- 32 501 transistor NPN, BC237, base left
- 32 502 transistor NPN, BC140, base left
- 32 503 transistor NPN, BC140, base right
- 32 504 transistor PNP, BC160, base left
- 32 505 unijunction transistor, PN 2N4870
- 32 506 D-MOS field effect transistor, BS250, p-channel, gate left
- 32 507 JFET transistor 2N5485, 25 V/10 mA, n-channel, gate left
- 32 508 JFET transistor 2N5461, 20 V/10 mA, p-channel, gate left
- 32 510 diac, ER 900
- 32 511 thyristor, TIC 106
- 32 512 triac, TIC 206
- 32 520 photodiode
- 32 521 solar cell
- 32 522 optical coupler SFH615A
- 32 523 phototransistor LPT80A
- 32 598 operational amplifier OP741 with 4mm connection sockets on the top
- 32 485 relay DC 12...15 V NOC, 2A
- 32 486 relay DC 12...15 V NCC, 2A
- 32 601 IC socket, 14-pin, on plug-in plate for 19mm grid, plate equipped with 2mm jacks for easy connection



32 601 IC Socket 14 Pin

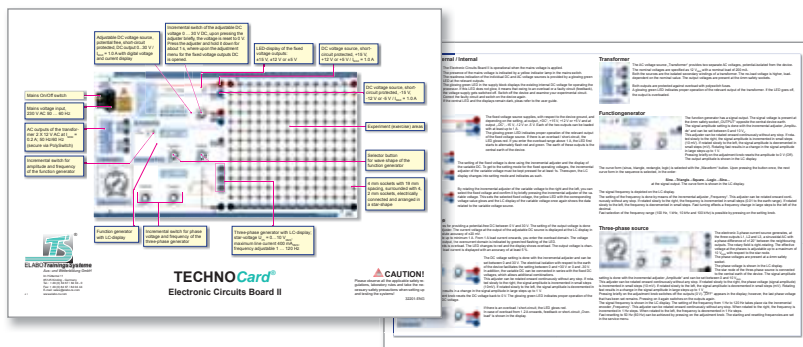
COURSEWARE

Manuals



Printed and on CD!

TECHNOCard®



32201-ENG TECHNOCard® Electronic Circuits Board II

Direct Current Technology

32120CD-ENG *Instructor's manual*

32121CD-ENG *Student manual*

Alternating Current Technology

32122CD-ENG *Instructor's manual*

32123CD-ENG *Student manual*

Semiconductor Devices in Electronics

32124CD-ENG *Instructor's manual*

32125CD-ENG *Student manual*

Electronic Circuits

32126CD-ENG *Instructor's manual*

32127CD-ENG *Student manual*

MANUAL CONTENTS

Direct Current Technology

- Electric circuit
- Ohm's law
- Electrical resistance
- Voltage and current error circuits
- Equivalent voltage sources
- Interconnection of voltage sources
- Electrical energy and power
- Efficiency and electrical power
- Power, voltage and current matching

Alternating Current Technology

- Types of current (voltage) and their characteristics
- Active power of alternating voltages
- Three-phase AC
- Capacitor in an AC circuit
- Coil in an AC circuit
- Combination of reactive and active resistance
- Oscillating circuit
- RLC filter circuit
- Transformers

Semiconductor Devices in Electronics

- Rectifier diodes
- Rectifier circuits
- Zener diodes
- Voltage stabilization
- Overvoltage protection
- Voltage limitation
- Light-emitting diodes
- Bipolar transistors
- Basic amplifier circuits
- Unipolar transistors
- Junction FET
- MOS FET
- Unijunction transistor (UJT)
- Diac
- Thyristor
- Triac
- Phase control

Electronic Circuits

- Multi-stage amplifiers
- Darlington amplifier
- Emitter-coupled amplifiers
- Phase inverters
- Differential amplifiers
- DC amplifiers
- Push-pull amplifiers
- Feedback
- Inverting op-amps
- Non-inverting op-amps
- Impedance converters
- Summing op-amp
- Subtracting op-amp
- Integrating op-amp
- Differentiating op-amp
- Sinewave generators
- Squarewave generators

ACCESSORIES

Making connections ...

Components and connections are provided with gold-plated lamella plugs assuring resistance against corrosion and low contact resistance.



2 mm connections

- 70 connecting plugs 2 mm (C6000306)
- Set of connecting leads 2 mm, 28 parts (90 049)

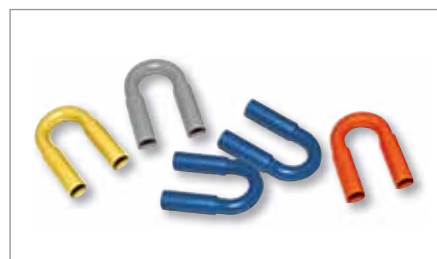
On the experimenting field provided with 4/2mm sockets, connections between components and to the power supply bar are made with 2mm connectors.



90 021 Set of 4 mm connections – classic

- 20 connecting plugs 4 mm
- 8 connecting leads with 4mm plugs

On the experimenting field provided with 4mm sockets, electrical connections are made with 4mm connectors or 4mm safety connectors.



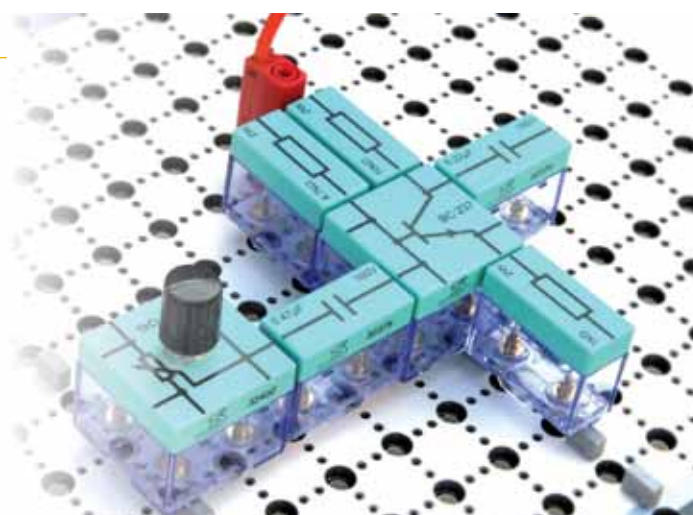
4 mm connections – safety

- Set of safety connecting leads, 11 parts (90 030)
- Set of safety bridging plugs, 24 parts, multi-color (90 031)

Measurement accessories

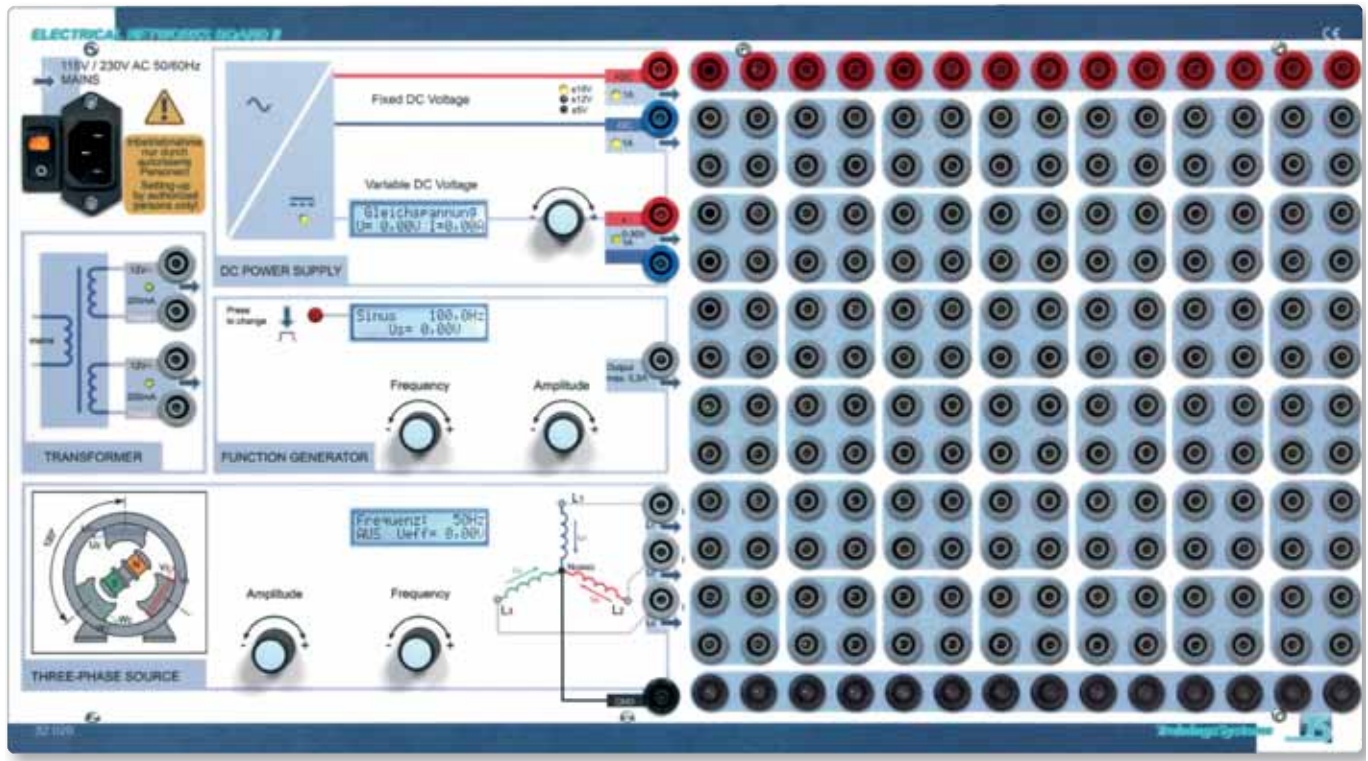
- Adapter, BNC plug to 4mm safety socket (C6010235)

Three adapters BNC to 4mm safety connectors are required for connecting standard oscilloscopes.



ELECTRICAL ENGINEERING

Electrical Networks Board II



32 020 Electrical Networks Board II

LEARNING OBJECTIVES

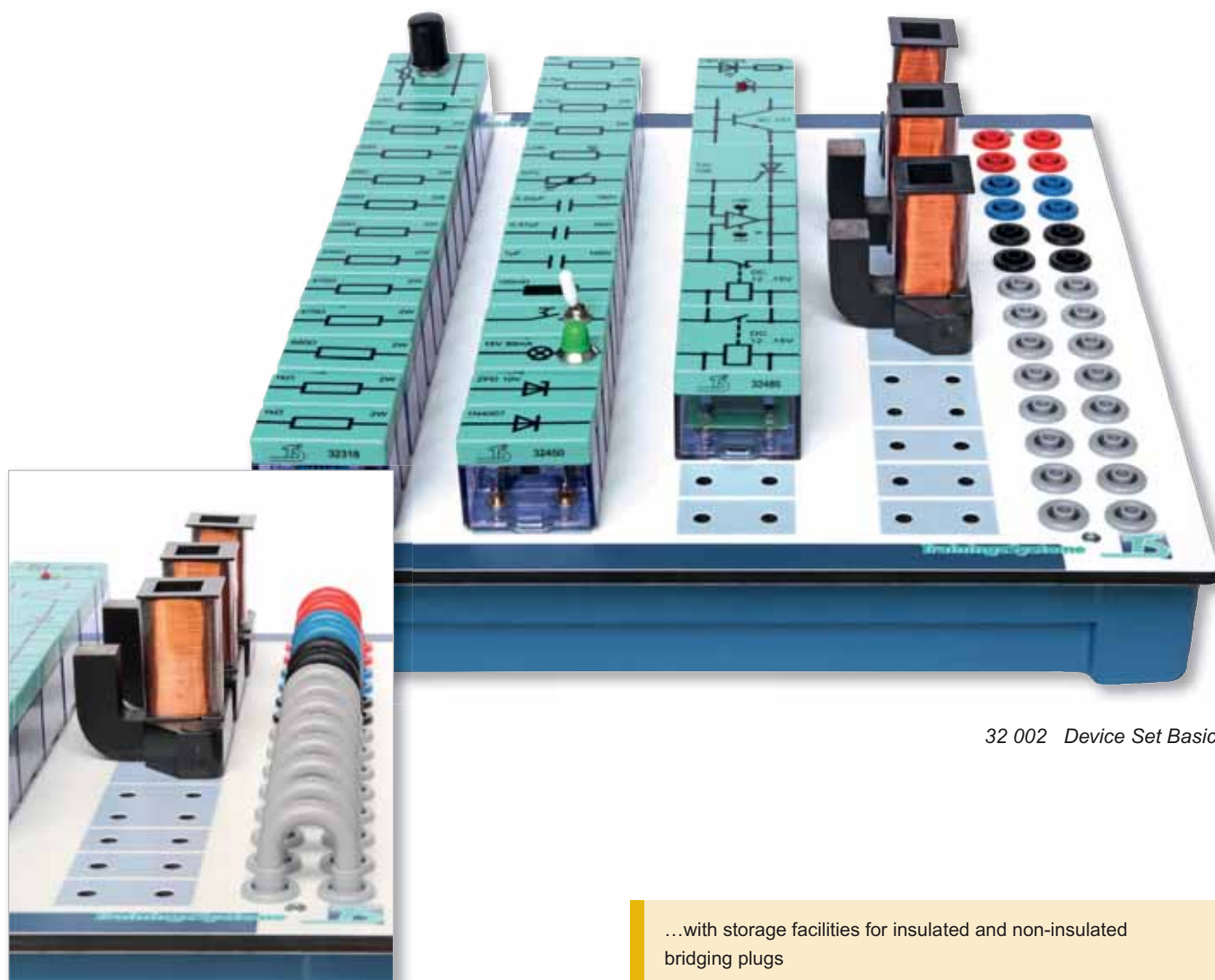
- ✓ Basics of electrical engineering
- ✓ Transformers
- ✓ How to use oscilloscope, multimeter and function generator
- ✓ Three-phase current systems
- ✓ Passive components in the DC circuit
- ✓ Behaviour of semiconductors: diodes, transistors, thyristors
- ✓ Capacitors and coils in the AC circuit
- ✓ Operational amplifiers

Technical Data

- **Voltage sources:** DC ± 15 V or ± 12 V or ± 5 V/1 A; DC 0...30 V / max. 1 A with voltage and current display; AC 2 x 12 V/0,2 A (protected by polyswitch)
- **Function generator:** Frequency 0,1 Hz...200 kHz, variable amplitude (0...10V_p) and wave form, display of all parameters
- **Three-phase current generator:** Phase voltage: 0...10 V_{rms}; line voltage: 0...17.3 V_{rms}; frequency: 1...120 Hz, adjustable, display of all parameters, phase current load: max. 400 mA_{rms}
- **Experimenting field:** 42 plug-in areas in a 19mm grid, each with 4 electrically connected 4mm safety jacks.
- **Mains connection:** 115 V / 230 V AC; 50 / 60 Hz; 75 W; protection class I
- **Safety:** Supply outputs short-circuit-proof, reverse protection up to 40 V DC / 24 V AC, 40 W



Device Set Basics



32 002 Device Set Basics

...with storage facilities for insulated and non-insulated bridging plugs

Technical Data

Set of accessories, plugged on imprinted Storage Board:

- 16 film resistors 10 Ω ...10 k Ω
- 1 LDR resistor
- 1 NTC resistor
- 3 capacitors 0,22 μ F...1 μ F
- 1 potentiometer linear 1 k Ω
- 1 transformer coil N = 300
- 2 transformer coils N = 900
- 1 tape-wound core (1 pair)
- 1 coil 100 mH
- 1 GA-AS light emitting diode, red
- 1 Si diode 1N4007
- 1 Zener diode ZPD 10 V
- 1 transistor NPN BC 237, base left
- 1 thyristor TIC 106
- 1 toggle switch
- 1 lamp 15 V
- 1 light source
- 1 operational amplifier
- 1 relay 12...15 V DC, NOC
- 1 relay 12...15 V DC, NCC

COURSEWARE

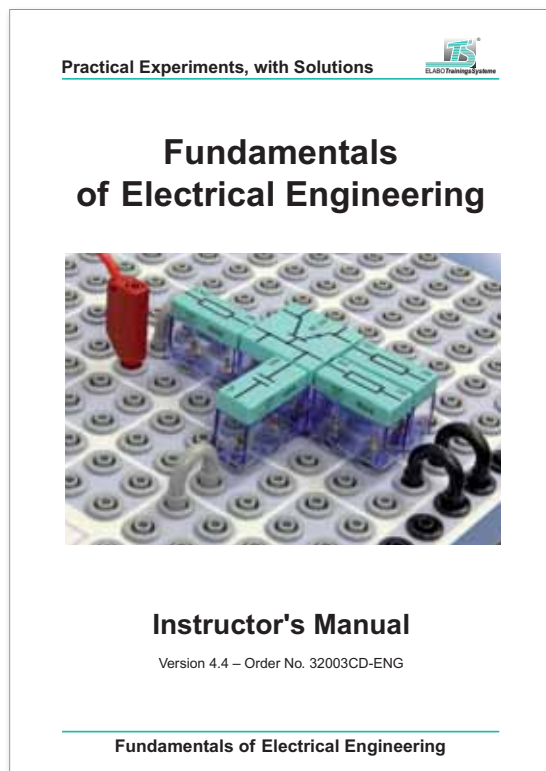
Manual



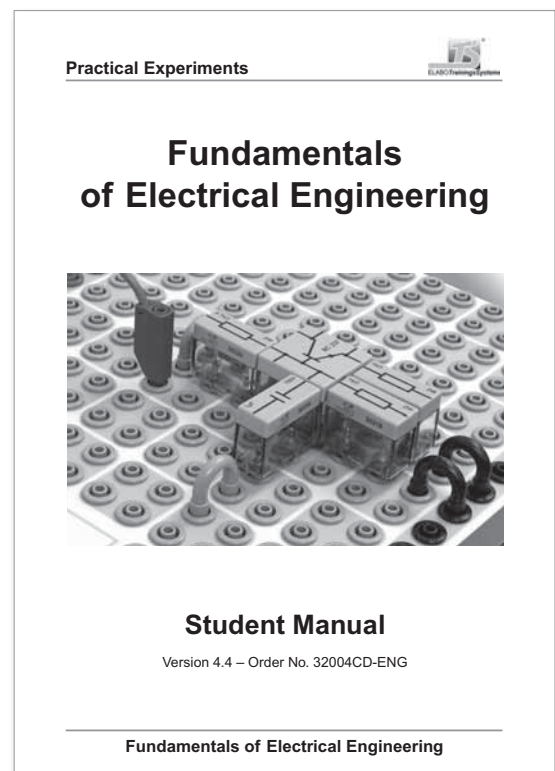
Printed and on CD!

Content

- The electrical circuit
- Ohm's Law
- Electrical resistors
- Interconnection of voltage sources
- Electrical power and work
- Efficiency
- Types of current and their parameters
- Effective power of AC voltages
- Three-phase AC current
- The capacitor in the AC circuit
- The coil in an AC circuit
- Interconnection of reactive and active resistors
- Oscillating circuits
- RLC filter circuit (filter)
- Transformers
- Diodes and rectifier circuits
- Bipolar transistors
- The triode thyristor
- Operational amplifier
- Square wave generators



32003CD-ENG *Instructor's Manual, incl. CD*
Description of theory and guided practical experiments,
with solutions, color print



32004CD-ENG *Student Manual, incl. CD*
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Guided practical experiments, greyscale print

TECHNOCards®

Adjustable DC voltage source, potential free, short-circuit protected, DC output 0...30 V / I_{max} = 1.0 A with digital voltage and current display

Incremental switch of the adjustable DC voltage 0...30 V DC. Upon pressing the adjuster briefly, the voltage is reset to 0 V. Press the adjuster and hold it down for about 1 s, where upon the adjustment menu for the fixed voltage outputs DC is opened.

LED-display of the fixed voltage outputs: ± 15 V, ± 12 V or ± 5 V

DC voltage source, short-circuit protected, ± 15 V, ± 12 V or ± 5 V / I_{max} = 1.0 A

DC voltage source, short-circuit protected, ± 15 V, ± 12 V or ± 5 V / I_{max} = 1.0 A

Experiment (exercise) area

Selector button for wave shape of the function generator

6 x 7 patch fields with 19 mm spacing, electrically connected and arranged 4 pieces of 4mm safety sockets

Function generator with LC-display

Incremental switch for phase voltage and frequency of the three-phase generator

Three-phase generator with LC-display, star-voltage $U_{N} = 0...10$ V_{eff}, maximum line current 400 mA, frequency adjustable 1...120 Hz

Transformer

The AC voltage source „Transformer“ provides two separate AC voltages, potential isolated from the device. The correct voltages are specified as 12 V_{eff} with a nominal load of 200 mA. Both the sources are the isolated secondary windings of a transformer. The no-load voltage is higher, load-dependent on the nominal value. The output voltages are present at the screw safety sockets.

Both outputs are protected against overload with poly-switch fuses.

A glowing green LED indicates proper operation of the relevant output of the transformer. If the LED goes off, the output is overloaded.

Function generator

The function generator has a signal output. The signal voltage is present at the screw safety socket „X1“ (X1/X2) opposite the central device earth.

The signal amplitude setting is done with the incremental adjuster „Amplitude“ and can be set between 0 and 10 V_{eff}.

This adjuster can be rotated continuously without any stop. If rotated slowly to the right, the signal amplitude is incremented in small steps (10 mV). If rotated slowly to the left, the signal amplitude is decremented in small steps (10 mV). Rotating fast results in a change in the signal amplitude in large steps up to 1 V.

Pressing briefly on the adjustment knob results the amplitude to 0 V (OFF). The output amplitude is shown in the LC-display.

The curve form (sine, triangle, rectangle, logic) is selected with the „Waveform“ button. Upon pressing the button once, the next curve form in the sequence is selected. In the LC-display, the curve form is shown in the LC-display.

The signal frequency is depicted on the LC-display.

The setting of the frequency is done by means of the incremental adjuster „Frequency“. This adjuster can be rotated clockwise continuously without any stop. If rotated slowly to the right, the frequency is incremented in small steps (0.01 Hz in the range). If rotated slowly to the left, the frequency is decremented in small steps. Fast turning effects a frequency change in large steps to the left of the decimal.

Fast selection of the frequency range (100 Hz, 1 kHz, 10 kHz and 100 kHz) is possible by pressing on the setting knob.

Three-phase source

The electronic 3-phase current source generates, at the three outputs L1, L2 and L3, a sinusoidal AC with a phase difference of $\pm 120^\circ$ between the neighbouring outputs. The rotary field is right-rotating. The effective voltage at the phase is adjustable up to a maximum of 10 V_{eff} with respect to the star point.

The phase voltages are present at a screw safety socket.

The phase voltage is shown in the LC-display.

The star point of the three-phase source is connected to the central earth of the device. The signal amplitude is incremented in small steps (10 mV). If rotated slowly to the left, the signal amplitude is decremented in small steps (10 mV). Rotating fast results in a change in the signal amplitude in large steps up to 1 V.

Pressing briefly on the adjustment knob switches off the output (0 V, OFF) appears in the display, however, the last phase voltage that has been set remains. Pressing on 1 again switches on the output again.

The signal frequency is shown in the LC-display. The setting of the frequency from 1 Hz to 120 Hz takes place via the incremental adjuster „Frequency“. This adjuster can be rotated clockwise continuously without any stop. When rotated to the right, the frequency is incremented in 1 Hz steps. When rotated to the left, the frequency is decremented in 1 Hz steps.

Fast selection of the frequency range (10 Hz, 100 Hz and 1000 Hz) can be achieved by pressing on the setting knob. The starting and setting frequencies are set in the service menu.

TECHNOCard®
Electrical Networks Board II

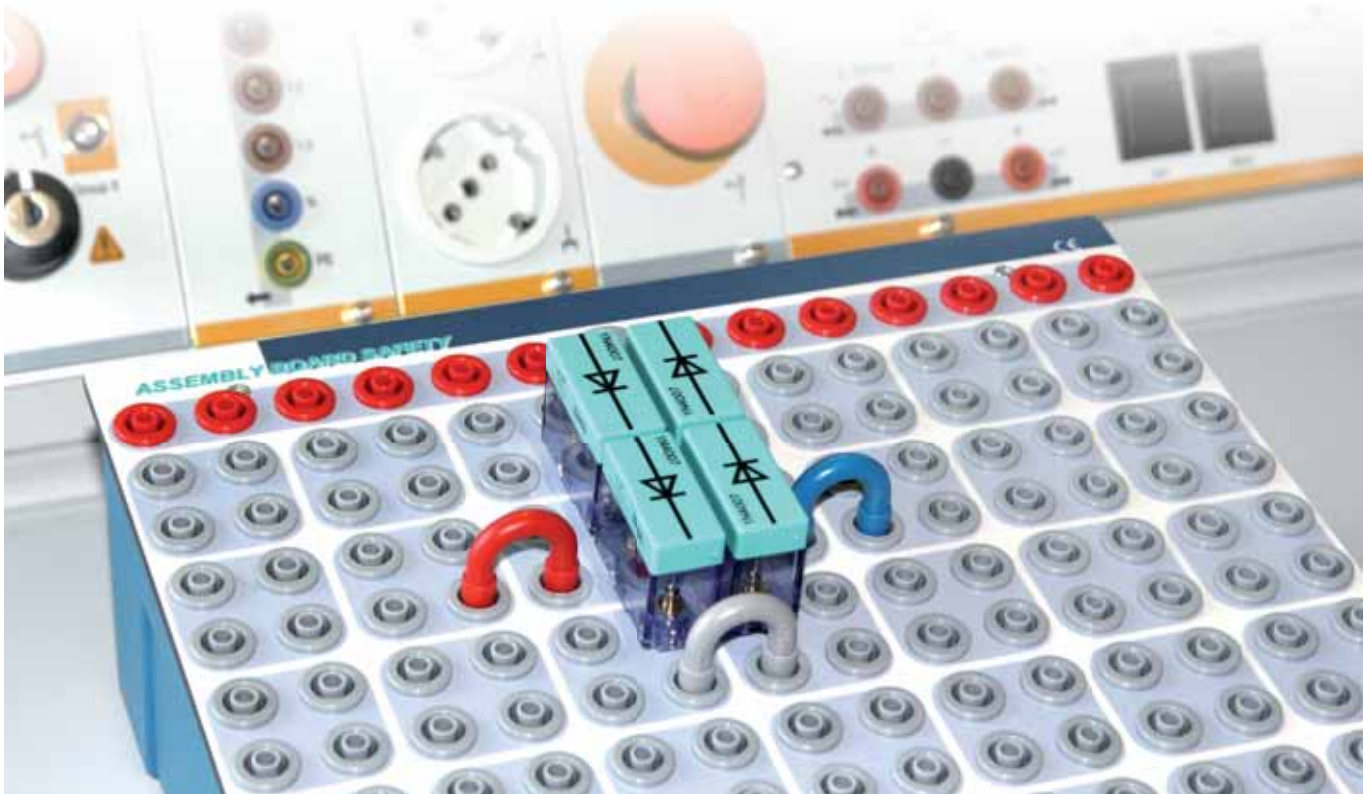
CAUTION!
Please observe all the applicable safety regulations, laboratory rules and take the necessary safety precautions when setting up and testing the system!

30201-ENG

30201-ENG TECHNOCard® Electrical Networks Board II

The TECHNOCards® are very useful complements to the training system. They are a kind of compact, clearly laid-out knowledge store for reference during practical experiments.

- Display sheets in format 303 mm x 426 mm
- Double-sided color print
- Rigid, durable quality



UNIVERSAL SOLUTIONS

Universal Supply Board



32 015 Universal Supply Board

Technical Data

- **Voltage sources:** DC ± 15 V or ± 12 V or ± 5 V/1 A; DC 0...30 V / max. 1 A with voltage and current display; AC 2 x 12 V/0,2 A (protected by polyswitch)
- **Function generator:** Frequency 0,1 Hz...200 kHz, variable amplitude (0...10 V_p) and wave form, display of all parameters
- **Three-phase current generator:** Phase voltage: 0...10 V_{rms}; line voltage: 0...17.3 V_{rms}; frequency: 1...120 Hz, adjustable, display of all parameters, phase current load: max. 400 mA_{rms}
- **Mains connection:** 115 V / 230 V AC; 50 / 60 Hz; 75 W; protection class I
- **Safety:** Supply outputs short-circuit-proof, reverse protection up to 40 V DC / 24 V AC, 40 W



Assembly Boards

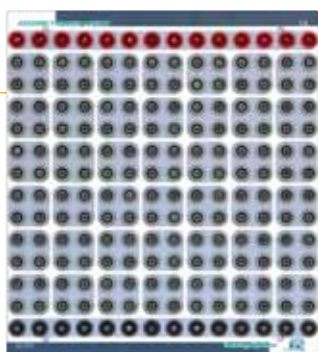


... are an ideal solution for workplaces that are provided with a power supply and a function generator or in conjunction with the Universal Supply Board 32 015.

EXTERNAL POWER SUPPLY ...



ASSEMBLY BOARDS



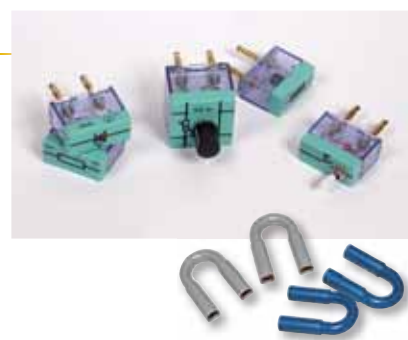
32 012 Assembly Board Safety



32 202 Assembly Board Electronics

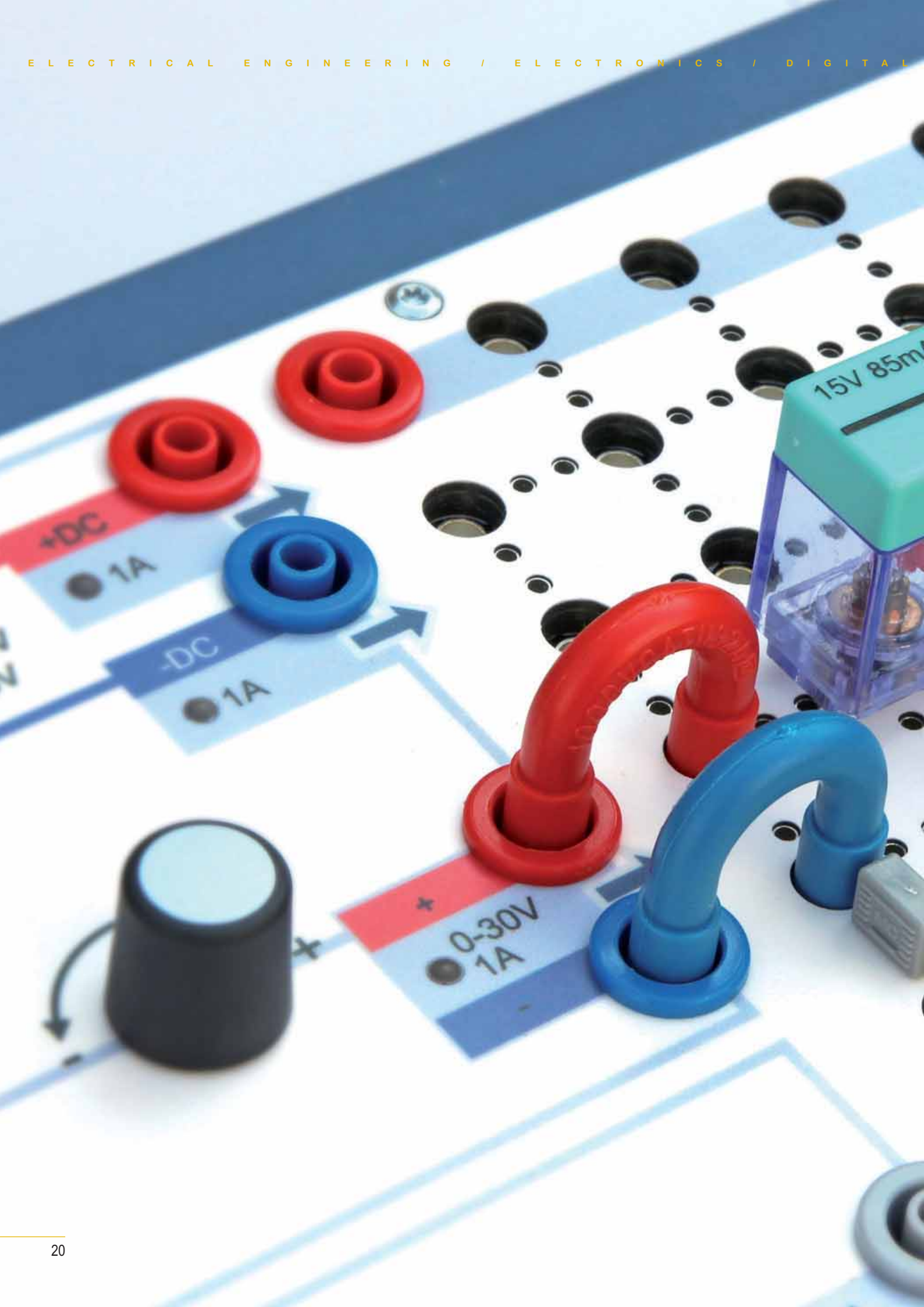


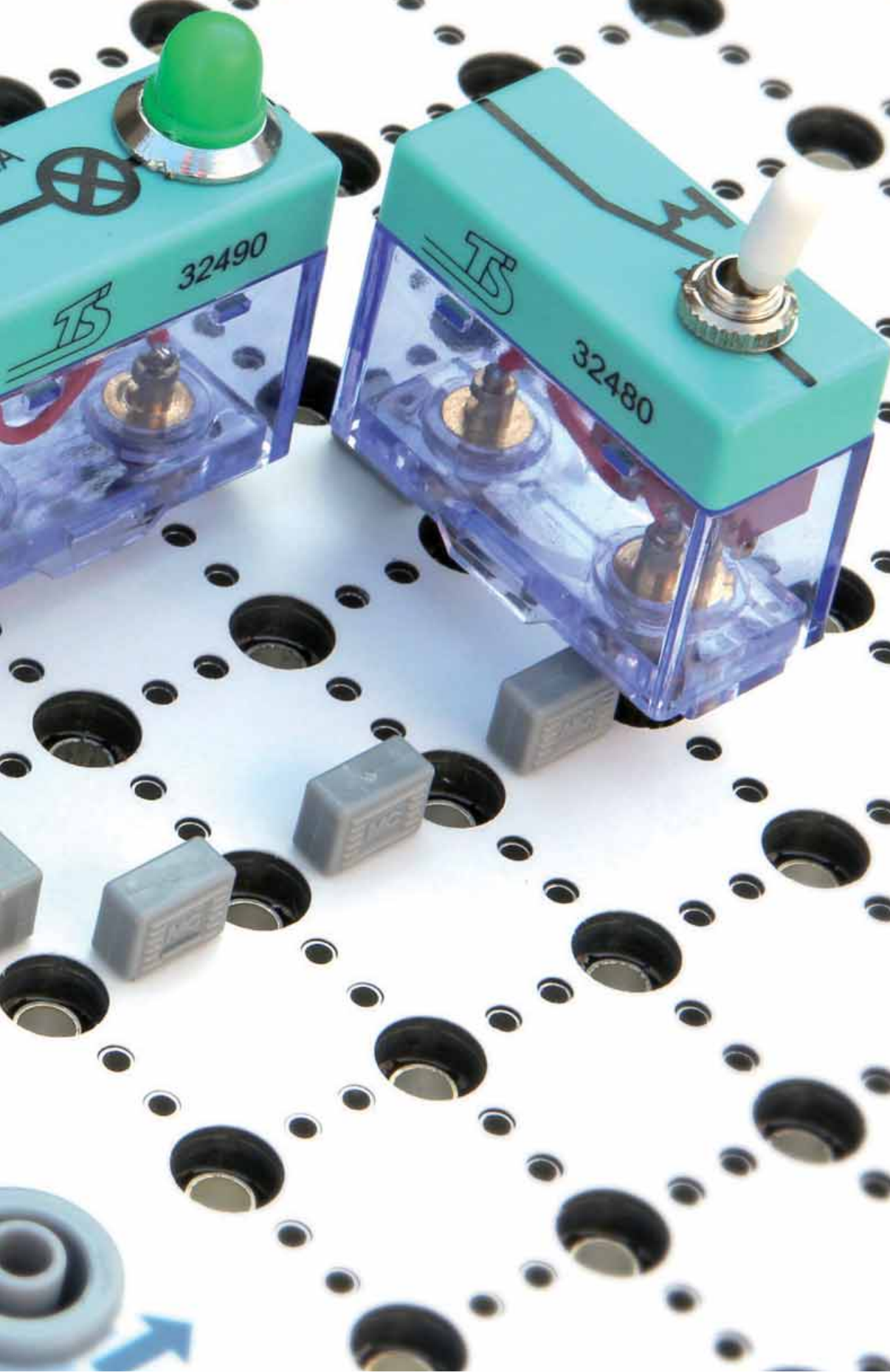
DEVICE SETS



COURSEWARE

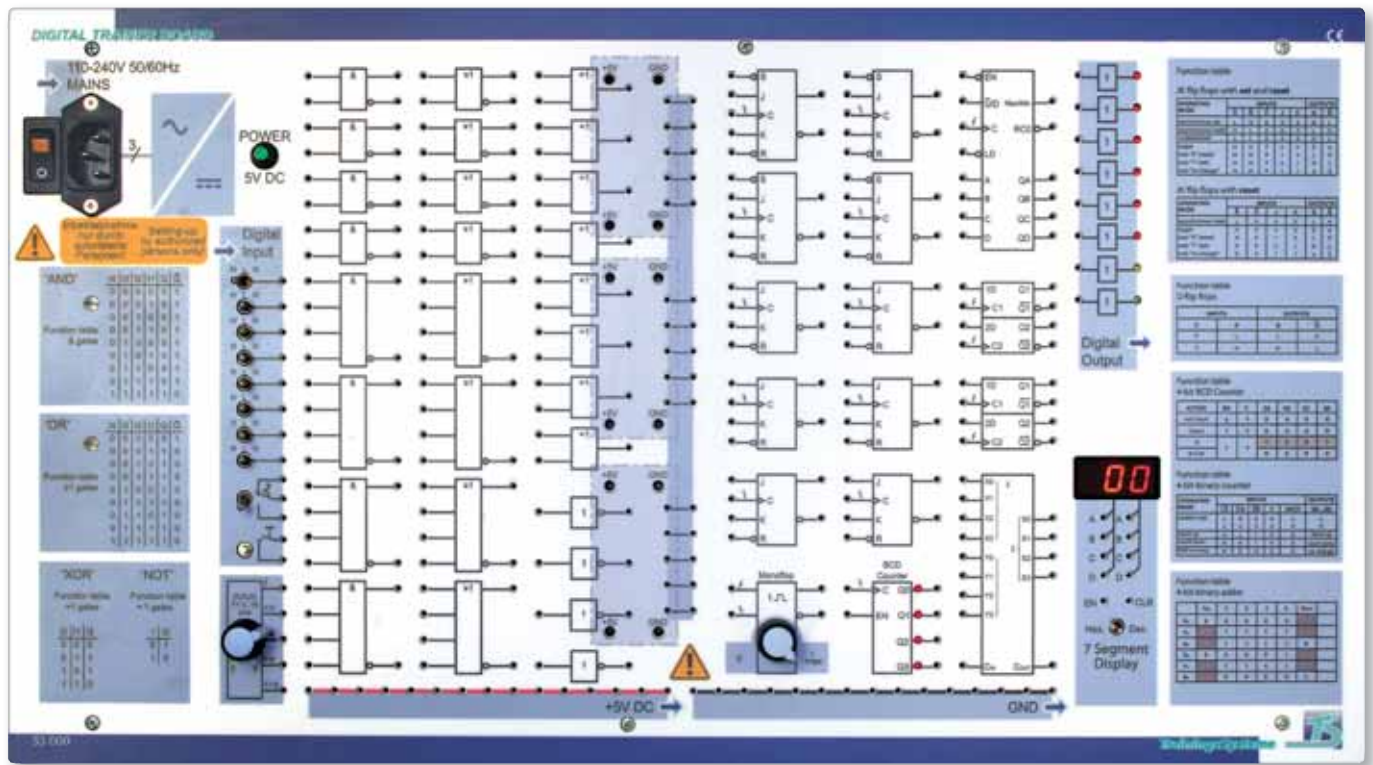






DIGITAL TECHNOLOGY

Digital Trainer Board



33 000 Digital Trainer Board

LEARNING OBJECTIVES

- ✓ Basic logical circuits, properties and parameters of digital circuits
- ✓ The laws of Boolean algebra
- ✓ Multivibrators and counter circuits
- ✓ Register and memory
- ✓ Codes and code converters
- ✓ Arithmetic circuits
- ✓ Configuring and analysing controls with digital components

Technical Data

- **Power supply:** +5 V DC/5 A stabilized, short-circuit-proof
- **Clock generator:** 0...10 kHz with subsequent frequency divider, division factors: 1:2/4/8/16
- **Mains connection:** 110...240 V AC; 50...60 Hz

Features:

Pushbuttons and switches
 AND, NAND, OR, NOR, XOR gates, inverters
 Monoflop and flipflops
 Adders, binary and decimal counters
 LED and 7-segment displays
 Voltage-supplied plug-in fields for additional modules or IC sockets

COURSEWARE



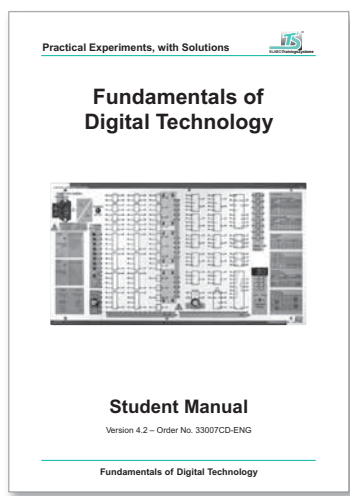
Manual



Printed and on CD!



33006CD-ENG
Fundamentals of Digital Technology
Instructor's Manual



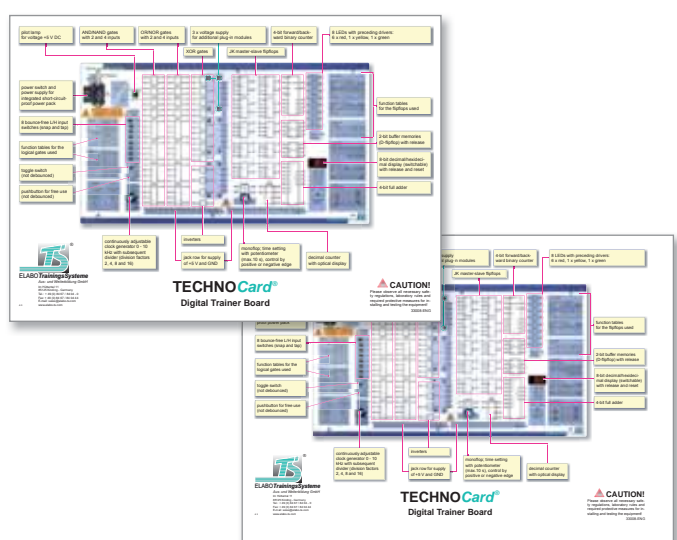
33007CD-ENG
Fundamentals of Digital Technology
Student Manual

Content

- Comparison of analog and digital technology
- Basic logic circuits
- Basic component combinations in digital techniques
- TTL integrated circuits in practice
- The laws of Boolean algebra
- Designing digital circuits
- Circuit analysis
- Multivibrators, counter circuits
- Shift registers, memory registers
- Codes and code converters
- Calculation circuits
- Analog-digital – digital-analog converters
- Multiplexer – demultiplexer
- Application examples

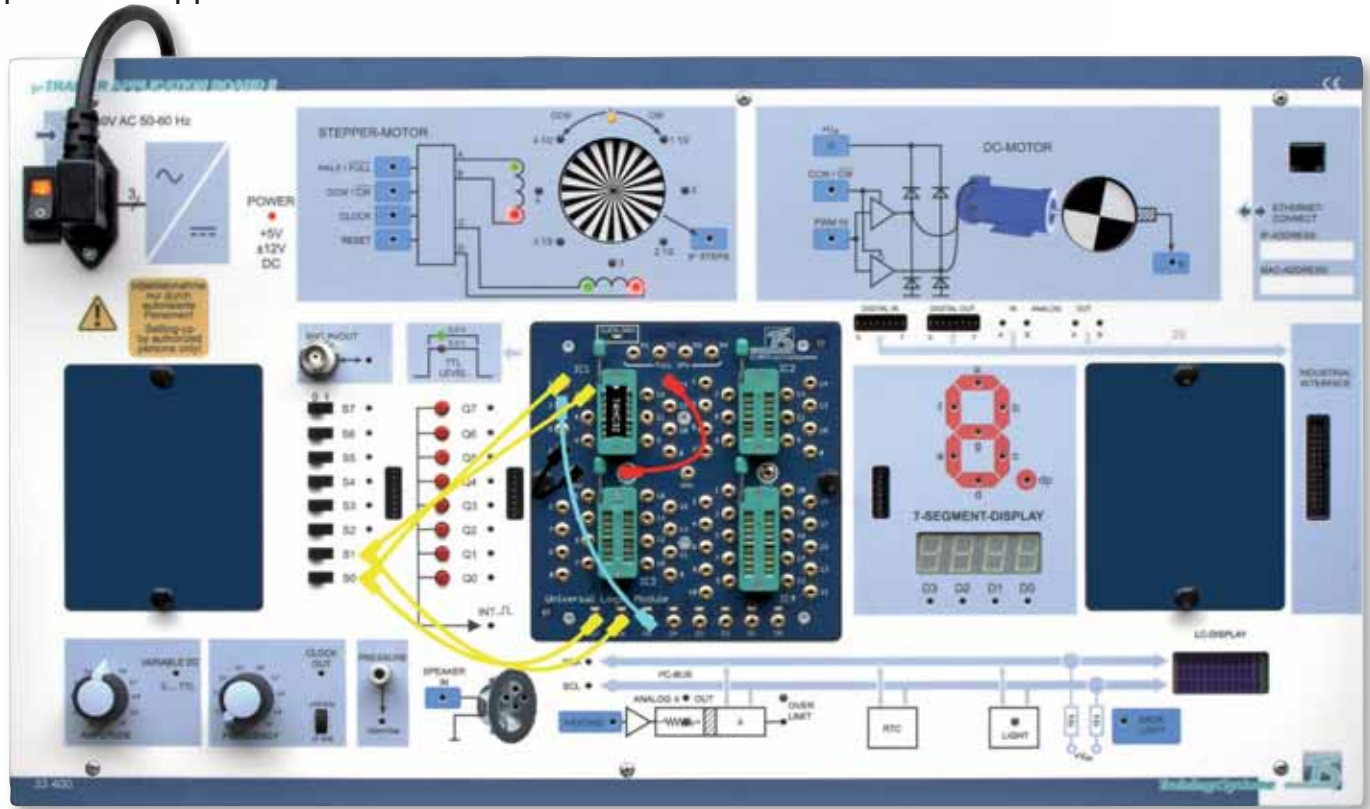


TECHNOCard®



33008-ENG Digital Trainer Board

IC-TRAINER / DIGITAL TECHNOLOGY

 μ -Trainer Application Board II33 400 μ -Trainer Application Board II with 33 406 Universal Logic Module

LEARNING OBJECTIVES

- ✓ Analysis of open loop controlled systems with digital components
- ✓ Synthesis of open loop controlled systems with digital components
- ✓ Logic circuits in practice
- ✓ Configuring circuits with ICs
- ✓ Circuit characteristics
- ✓ Instruments and procedures of measuring
- ✓ Complex logic circuits and converters

Technical Data

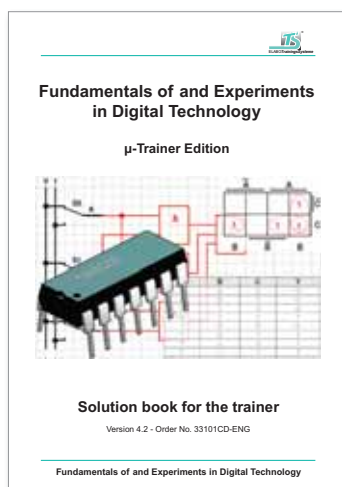
- | | |
|---|---------------------------------|
| ■ Computer interface via Ethernet | ■ Logic level 3.3 V or 5.0 V |
| ■ 2mm connectors or bus connectors (8-pin, 1:1, ribbon cable) | ■ Central on/off switch |
| ■ Power supply 110 ... 240 V AC, 50 ... 60Hz | ■ Dimensions: 532 x 297 x 85 mm |
| ■ Internal operating voltages 3.3 V; 5.0 V; +/-12.0 V | ■ Desk housing device |

COURSEWARE

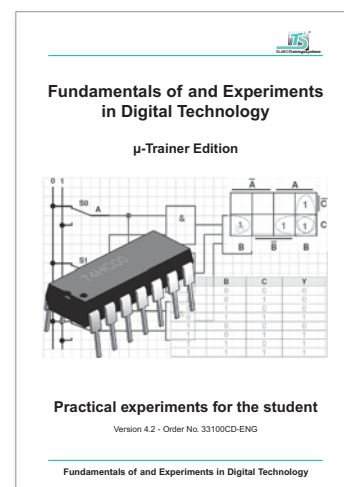
Manual



Printed and on CD!



33101CD-ENG *Fundamentals of
and Experiments in Digital Technology*
Instructor's Manual



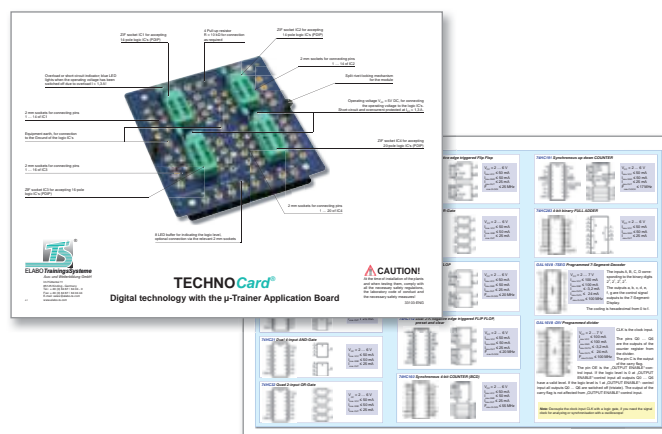
33100CD-ENG *Fundamentals of
and Experiments in Digital Technology*
Student Manual

Content

- Introduction to digital technology
- Basic logic circuits
- Logic circuits in practice
- Boolean switching algebra
- De Morgan's law
- Circuit synthesis
- Disjunctive normal form
- Conjunctive normal form
- The KV diagram
- Codes and code converters
- Adder and subtracter
- Comparators
- Flipflops
- Monostable multivibrators
- Astable multivibrators
- Counter circuits
- Shiftregisters
- Multiplexer and demultiplexer
- Analog digital converter
- Digital analog converter



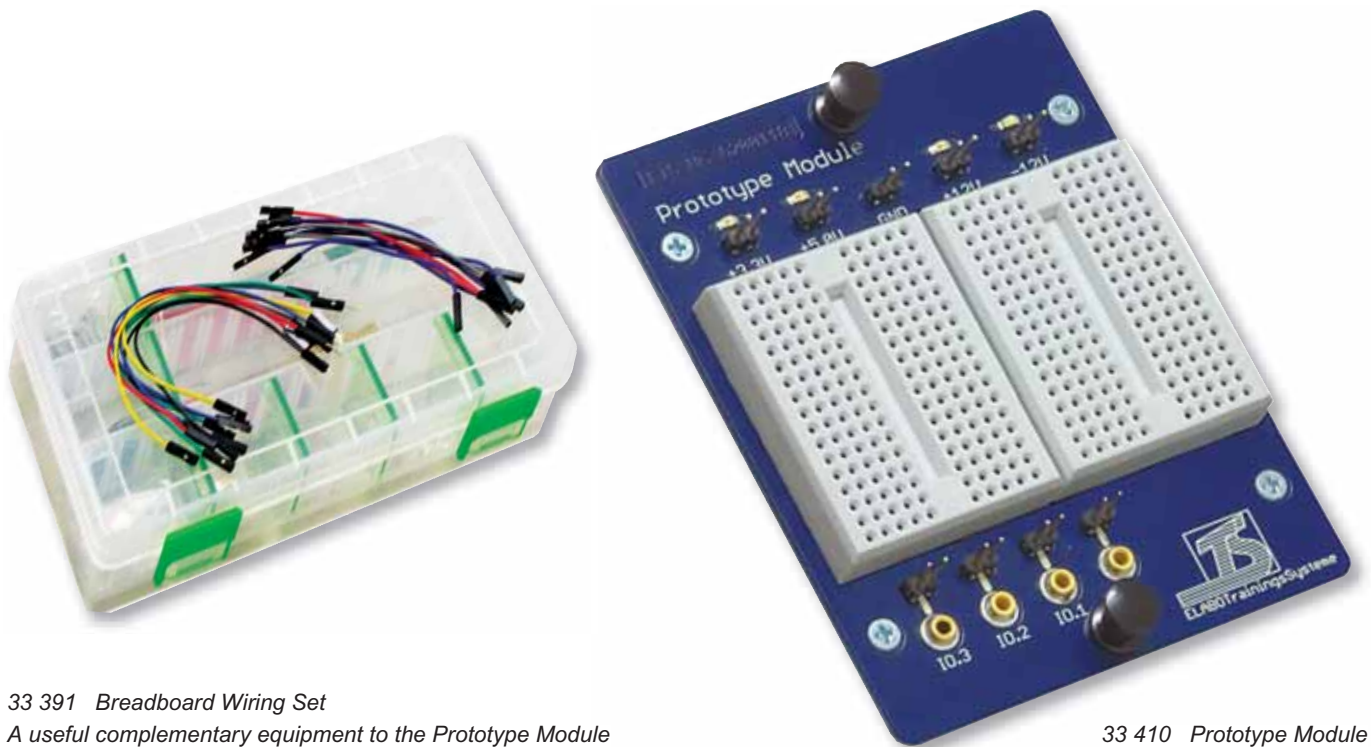
TECHNOCard®



33103-ENG *Digital Technology with the μ-Trainer Application Board*

MODULES

Prototype Module



33 391 Breadboard Wiring Set
A useful complementary equipment to the Prototype Module

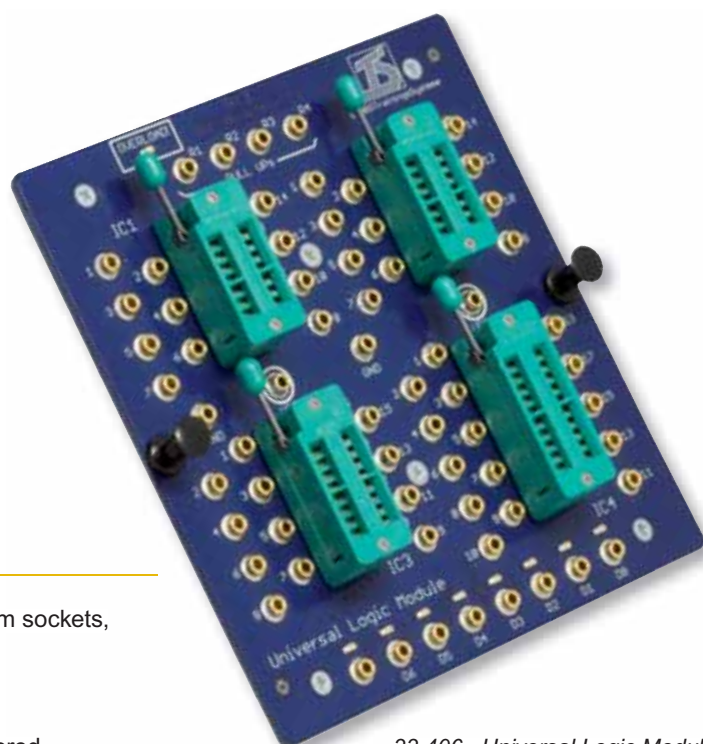
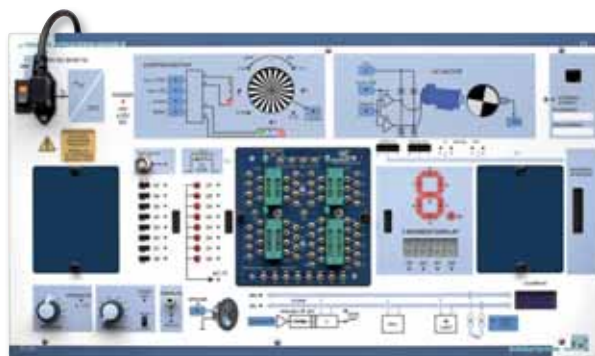
33 410 Prototype Module

The Prototype Module is a complete extension module for the Microcomputer Training System “ μ C-Trainer”. The Prototype Module allows the additional assembly and free construction of digital circuits with a breadboard system.

Technical Data

- 2 breadboard patch panels, 10x17 pins
- 4 control inputs at 2mm sockets and pin
- 4 operating voltage outputs at pins: 3.3 V, 5.0 V, +12 V and –12 V
- Operating voltages 3.3 V and 5.0 V, short-circuit protected, $I_{\text{nom}} \leq 1.3 \text{ A}$
- Operating voltages +12 V and –12 V, short-circuit protected, $I_{\text{nom}} \leq 0.3 \text{ A}$ (permanent load)
- Indication of ready state by LED
- Dimensions 78 x 95 x 32 mm

Universal Logic Module



Technical Data

- 4 ZIF sockets, all pins can be optionally connected via 2mm sockets,
 - 2 x ZIF sockets 14 pin
 - 1 x ZIF socket 16 pin
 - 1 x ZIF socket 20 pin
- 8 x LED with separate inputs for display of logic levels, buffered
- 4 x Pull-Up resistors 10 k Ω
- Logic level: +5 V TTL
- Operating voltage, short-circuit protected, $I_{nom} \leq 1,3$ A
- Overload display by bright blue LED
- Dimensions 125 x 120 x 30 mm

33 406 Universal Logic Module

The Universal Logic Module (33 406) is a complete extension module to Microcomputer Training System "µC-Trainer" for free experimenting and examination of logical integrated circuits.

Component set "Logic Integrated Circuits"



33 390 Basic Set Logic ICs

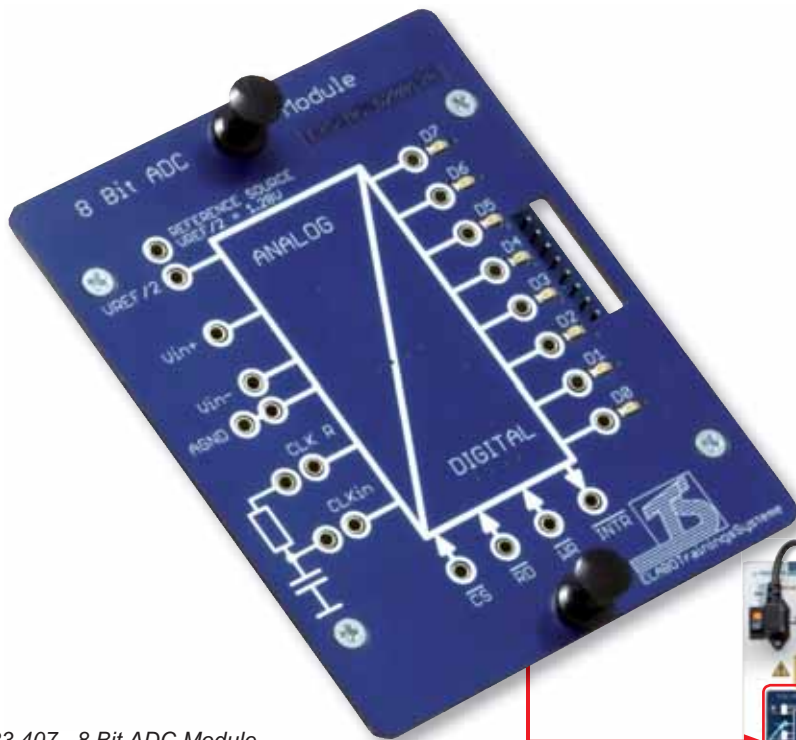
Technical Data

- 2 pcs. 4xNAND gate, each with 2 inputs
- 2 pcs. 2xNAND gate, each with 4 inputs
- 2 pcs. 2xAND gate, each with 4 inputs
- 2 pcs. 4xNOR gate, each with 2 inputs
- 2 pcs. 4xOR gate, each with 2 inputs
- 2 pcs. 4xXOR gate, each with 2 inputs
- 2 pcs. 6xinverter
- 2 pcs. 2xD-flipflop
- 2 pcs. 2xJK-flipflop
- 2 pcs. 2xJK-flipflop with preset and delete
- 2 pcs. synchronous 4-bit counter BCD
- 2 pcs. up-down counter, binary
- 1 pc. GAL programmed as a 7-segment decoder
- 1 pc. GAL programmed as a divider

Component set in robust assortment box made of unbreakable plastic with 18 compartments and 26 circuits.

MODULE

8 Bit ADC Module



33 407 8 Bit ADC Module

The 8 Bit ADC Module is a complete extension module for the Microcomputer Training System "µC-Trainer".

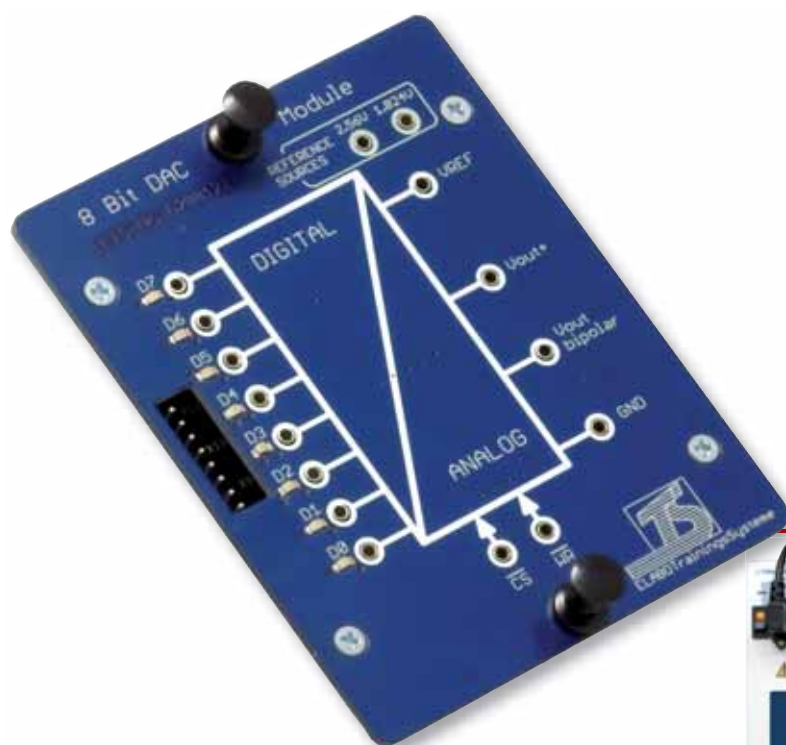
The 8 Bit analog-to-digital converter can be used either with static control signals or via microcontroller to examine the functional principle of an analog-to-digital converter.



Technical Data

- 1-channel analog-to-digital converter
- Reference voltages: 2.56 V, V_{CC} internal or external, upto max. 5 V
NOTE: The reference voltage input level is $0.5 \times V_{REF}$!
- Differential input at 2mm sockets
- 8 outputs at 2mm sockets and bus connector
- 4 control inputs and outputs at 2mm sockets
- Logic level: +3.3 V or +5 V depending on the settings of the Programmer Module
- Dimensions 78 x 95 x 32 mm
- Delivered with programming examples on CD-ROM and operating instructions

8 Bit DAC Module



The 8 Bit DAC Module is a complete extension module for the Microcomputer Training System "µC-Trainer".

The 8 bit digital-to-analog converter can be used either with static control signals or via microcontroller to examine the functional principle of a digital-to-analog converter.



33 408 8 Bit DAC Module

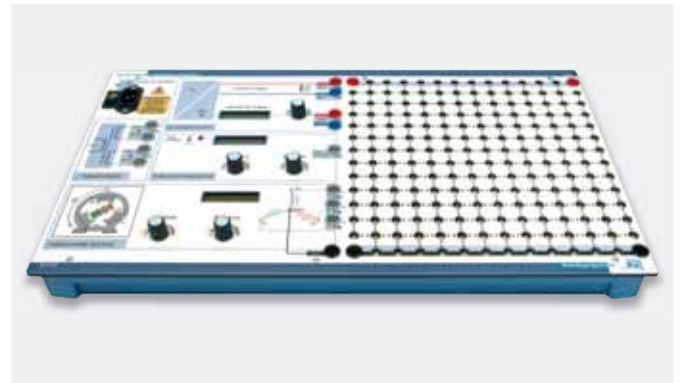
Technical Data

- 1-channel digital-to-analog converter
- Reference voltages: 2.56 V, 1.024 V or external up to max. 4.2 V
- 8 inputs at 2mm sockets and bus connector
- 1 output at a 2mm socket, unipolar
- 1 output at a 2mm socket, bipolar
- 2 control inputs at 2mm sockets
- Logic level: +3.3 V or +5 V depending on the settings of the Programmer Module
- Dimensions 78 x 95 x 32 mm
- Delivered with programming examples on CD-ROM and operating instructions

Experimenting at any place and time!

Our Boards and accessories for teaching the fundamentals of electrical engineering and electronics allow training wherever it may suit ...

... ON THE TOP OF A TABLE



... HUNG IN A FRAME

... SCREWED IN A CASE ESPECIALLY DESIGNED FOR MOBILE TRAINING.

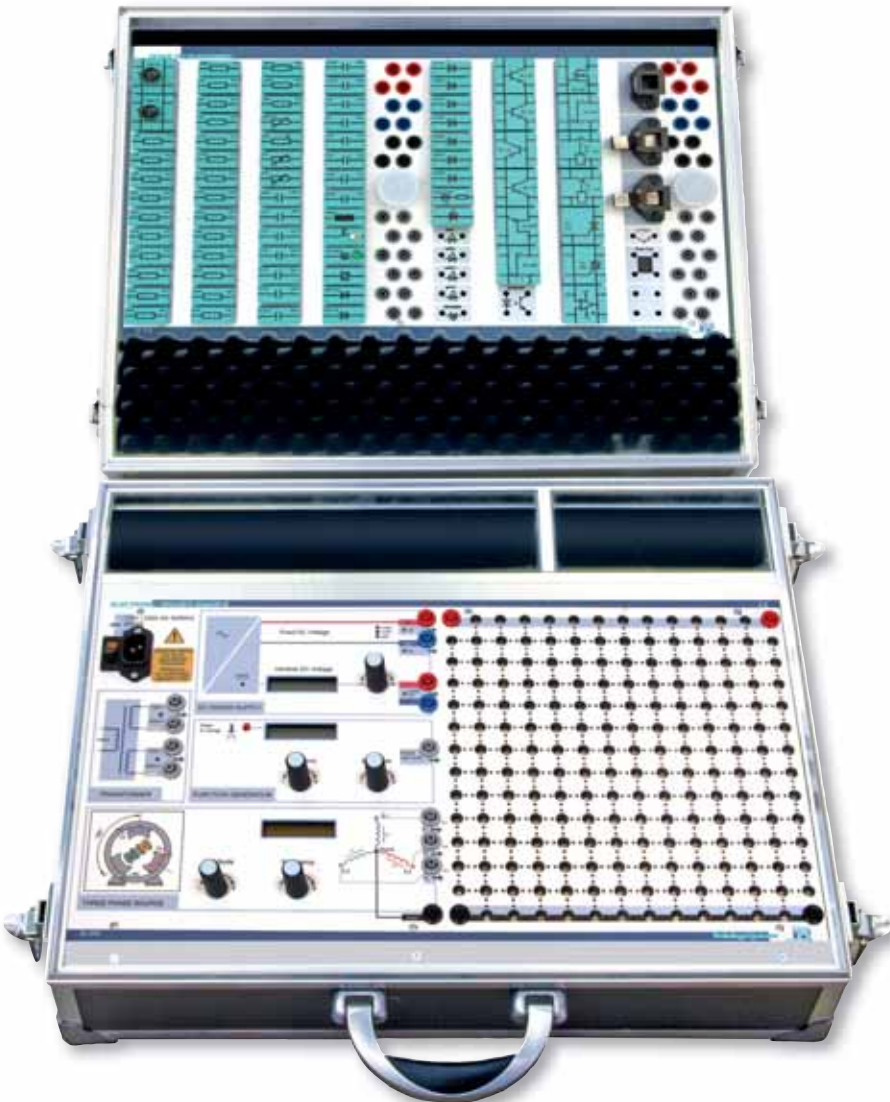


Our Boards are available in a lockable experimental case with removable lid and space for the set of accessories.

Its rugged, but still lightweight aluminium shell makes it suitable for transportation and guarantees safe and dust-free storage of the training systems.



91 801 Experimental case



91 801 Experimental case with Electronic Circuits Board II and Device Set Electronics

MEASURING INSTRUMENTS



90 600 *Digital multimeter*

Digital multimeter

Functions

- Mechanical protection against incorrect operation
- AC and DC voltage up to 1000V
- AC and DC current up to 10A
- Resistance measurement up to 30MΩ and continuity test
- Frequency and capacitance
- Temperature with PT1000 probe
- Diode test and duty cycle
- Autorange mode
- MAX / MIN and Data HOLD
- AutoPowerOFF



90 200 *Analog multimeter*

Analog multimeter

Functions

- Voltage measurement: 0...100/300 mV/1 V=; 0...3 /10 /30 /100 /300 V=~/~
- Current measurement: 0...100 μA/1/10/100 mA/1 /3 A =~/~
- Zero point: selectable **on the left or at mid-scale**
- High, constant input impedance; automatic battery shutdown
- Accessories

Compact basic analog multimeter for use in education and vocational training



90 266 *Color digital oscilloscope 60 MHz*

Color digital oscilloscope 60 MHz

Functions

- 125 MSa/s per channel
- Record length 10.000 x 8 bits per channel
- 2 channels
- Vertical sensitivity 2m V/div. ... 10 V/div.; horizontal scale 5ns/div. ... 100s/div.
- USB interface, incl. software and driver
- Color display



90 604 *Leakage current clamp meter*

Leakage current clamp meter

Functions

- AC current up to 100A TRMS
- 100 Hz low pass filter
- Resolution: 1 μA – 0.1 A
- Data HOLD
- Auto HOLD
- Peak Hold
- Manual and automatic range
- Auto Power OFF

YOUR INQUIRY



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Im Hüttental 11

85125 Kinding / Germany

Tel.: + 49 (0) 84 67 / 84 04 - 0

Fax: + 49 (0) 84 67 / 84 04 44

Name, Position

Company / Institution / Government agency

Street, Post box

ZIP Code, City, Country

Telephone

Fax

E-mail

We would like to be contacted:

☐ by telephone

☐ by e-mail

☐ Please send us an offer:

| Order no. | Description / Title | Qty | Order no. | Description / Title | Qty |
|---|---|-----|--|--|-----|
| Fundamentals of Electrical Engineering | | | Fundamentals of Digital Technology | | |
| <input type="checkbox"/> 32 020 | Electrical Networks Board II | | <input type="checkbox"/> 33 000 | Digital Trainer Board | |
| <input type="checkbox"/> 32021-ENG | TechnoCard® Electrical Networks Board II | | <input type="checkbox"/> 33008-ENG | TechnoCard® Digital Trainer Board | |
| <input type="checkbox"/> 32 002 | Device set Fundamentals of Electrical Engineering | | <input type="checkbox"/> 33006CD-ENG | Instructor's manual, incl. CD | |
| <input type="checkbox"/> 32003CD-ENG | Instructor's manual, incl. CD | | <input type="checkbox"/> 33007CD-ENG | Student manual, incl. CD | |
| <input type="checkbox"/> 32004CD-ENG | Student manual, incl. CD | | Microcomputer / Digital Technology | | |
| Fundamentals of Electrical Engineering/Electronics | | | <input type="checkbox"/> 33 400 | µ-Trainer Application Board | |
| <input type="checkbox"/> 32 200 | Electronic Circuits Board II | | <input type="checkbox"/> 33100CD-ENG | Student manual, incl. CD | |
| <input type="checkbox"/> 32201-ENG | TechnoCard® Electronic Circuits Board II | | <input type="checkbox"/> 33101CD-ENG | Instructor's manual, incl. CD | |
| <input type="checkbox"/> 32 203 | Device Set Electronics | | <input type="checkbox"/> 33103-ENG | TC® Digital Technology with the µ-Trainer Application Board | |
| <input type="checkbox"/> 32 104 | Device set optoelectronics | | <input type="checkbox"/> 33 406 | Universal Logic Module | |
| Direct Current Technology | | | <input type="checkbox"/> 33 407 | 8 Bit ADC Module | |
| <input type="checkbox"/> 32120CD-ENG | Instructor's manual, incl. CD | | <input type="checkbox"/> 33 408 | 8 Bit DAC Module | |
| <input type="checkbox"/> 32121CD-ENG | Student manual, incl. CD | | <input type="checkbox"/> 33 410 | Prototype Module | |
| Alternating Current Technology | | | <input type="checkbox"/> 33 390 | Basic Set Logic ICs | |
| <input type="checkbox"/> 32122CD-ENG | Instructor's manual, incl. CD | | <input type="checkbox"/> 33 391 | Bread Board Wiring Set | |
| <input type="checkbox"/> 32123CD-ENG | Student manual, incl. CD | | Connections, measuring instruments, accessories | | |
| Semiconductor Devices in Electronics | | | <input type="checkbox"/> 90 021 | Set of 4mm connections – classic | |
| <input type="checkbox"/> 32124CD-ENG | Instructor's manual, incl. CD | | <input type="checkbox"/> 90 048 | Set of 2mm measuring leads, 60 parts, for digital technology | |
| <input type="checkbox"/> 32125CD-ENG | Student manual, incl. CDD | | <input type="checkbox"/> 90 049 | Set of 2mm measuring leads, 28 parts | |
| Electronic Circuits | | | <input type="checkbox"/> C6000306 | Bridging plugs, 2mm, spacing 5mm | |
| <input type="checkbox"/> 32126CD-ENG | Instructor's manual, incl. CD | | <input type="checkbox"/> 90 030 | Set of 4mm safety connecting leads, 11 parts | |
| <input type="checkbox"/> 32127CD-ENG | Student manual, incl. CD | | <input type="checkbox"/> 90 031 | Set of 4mm safety bridging plugs, 24 parts | |
| Universal Boards for Electrical Engineering | | | <input type="checkbox"/> C6010235 | Adapter, BNC plug to 4mm safety socket | |
| <input type="checkbox"/> 32 015 | Universal Supply Board | | <input type="checkbox"/> 90 600 | Digital multimeter | |
| <input type="checkbox"/> 32016-ENG | TechnoCard® Universal Supply Board | | <input type="checkbox"/> 90 200 | Analog multimeter | |
| <input type="checkbox"/> 32 012 | Assembly Board Safety | | <input type="checkbox"/> 90 266 | Color digital oscilloscope 60 MHz | |
| <input type="checkbox"/> 32 202 | Assembly Board Electronics | | <input type="checkbox"/> 91 801 | Experimental case | |
| | | | <input type="checkbox"/> 90 604 | Leakage current clamp meter | |

INFORMATION AND CONSULTATION

CONSULTANCY

- Design of customer oriented solutions
- Presentation, product demonstration and on-site consultation
- Assistance in the choice of products complying with syllabuses
- Customized products according to requirements
- Development of room concepts
- Design of ergonomic workplaces
- Turnkey projects



CONTACT

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Service-Center

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Fax: + 49 (0) 84 67 / 84 04 44

sales@elabo-ts.com

www.elabo-ts.com

EXPERIENCE

- Design and manufacturing of technical training systems
- Comprehensive range of innovative products, systems and solutions – MADE IN GERMANY
- Quality service from first consultation to delivery and beyond
- Trainer seminars onsite or inhouse
- References worldwide
 - Industrial training institutions
 - Vocational schools / technical schools
 - Chambers of crafts
 - Technical colleges
 - Universities / Universities of Applied Sciences



WE ASSIST YOU

- On-site installation and commissioning
- Technical support
- Warranty and maintenance
- Briefing and training
- Qualification, advanced training, workshops
- Comprehensive product documentation
- Detailed courseware for trainers and students



DIDACTIC GMBH
ELABO Training Systems

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Phone +49 8467 8404-0 | Fax +49 8467 8404-44
sales@ets-didactic.de | ets-didactic.de

Made
in
Germany

