DIDACTIC GMBH
ELABO Training Systems

DIDACTIC SOLUTIONS

Qualifying for the future

ETS DIDACTIC GMBH

Inspiring Technology

CONTENTS

Didactic Solutions

Made in Germany

PEOPLE AND TECHNOLOGY – ONE UNIT TO SUCCESS

Welcome to ETS DIDACTIC

ETS DIDACTIC GMBH is your partner for in-house and institutional education and training in the professional fields of electrical engineering and metal technology.

Subjects like pneumatics, Electropneumatics, drive technology, power electronics, automation engineering, sensor systems, bus systems, instrumentation, gear technology and the complete scope of building systems engineering including renewable energies can all be counted among the strengths of the company.

The spectrum of services offered by ETS DIDACTIC GMBH ranges from the planning and outfitting of complete training facilities to the provision of learning and teaching materials. Apart from the after-sales service, the offering of services is rounded off by practical workshops specially tailored for trainers and instructors.

Vocational schools, training centres of the ICC, Chamber of Crafts or the industry, polytechnics and universities are among the long-standing customers of ETS DIDACTIC GMBH.

Udo Urban
Managing Director (CEO)
ETS DIDACTIC

Technology that fascinates: understanding – comprehending – applying

ETS DIDACTIC GMBH is the pioneer and market leader in the development, manufacture and sales of electrical, automation and mechatronic workstations for training and instruction.

ETS DIDACTIC GMBH counts among the leading international manufacturers in the market environment. Located in Kinding, in the beautiful natural reserve of Altmühltal – high-quality products and solutions are developed and manufactured for you.

In the training centre in Kinding, the focus is on the practical application of the systems and fast learning of new technologies by the customers.

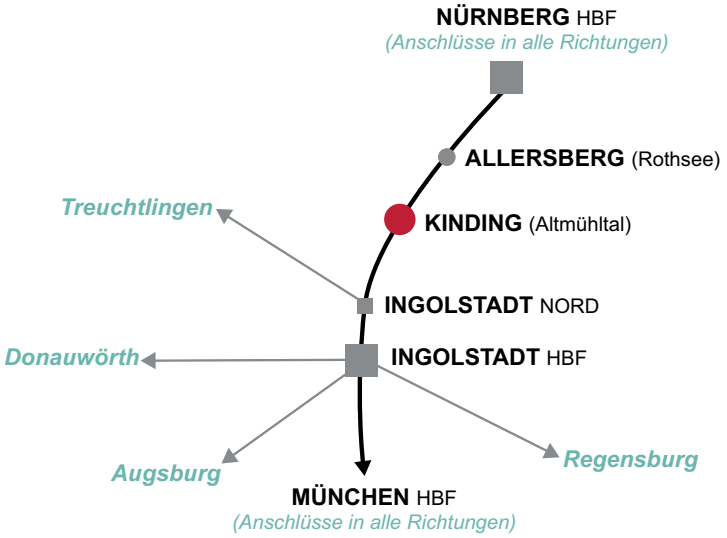
The knowledge, experience and the above-average personal involvement of the motivated employees of ETS DIDACTIC GMBH are vital factors for the company's efficiency.

MADE IN GERMANY – MADE IN BAVARIA!

Visit us in the valley of river Altmühl

Welcome in Germany – Bavaria

With the start-up of the new ICE-route between Munich and Nuremberg, the Altmühl region, with its regional railway station at Kinding has got a new connection to the national and international railway network. You now have the option to travel comfortably by train when you visit us for seminars taking place in Kinding-Haunstetten. There are local taxi companies in service for the drive to Haunstetten. We would be happy to provide help in organising the trip.



Kloster Weltenburg

Naturpark Altmühltal

PEOPLE AND TECHNOLOGY - A PERFECT MATCH

To plan a custom-made room concept with you, we proceed in the following steps:

⟩ A good room concept is based on professional advice. The technical consulants of ELABOTrainingsSysteme are pleased to support you in the local planning phase. Benefit from their technical expertise and experience.

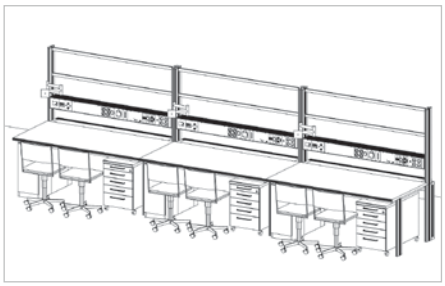
⟩ Planning a room concept is more than selecting the furniture. Each room concept is adapted to and developed for the local requirements of the customer. Taking into account the learning contents an equipment list can be set up. As soon as the extent is defined, the storage equipment is optimised and designed.

Service / Seminars

Procurement / Design construction

Consultation / planning

Conception



Analysis


0.57
1.05
0.30
1.08
0.97
0.70
2.81
R7.90
12.97
16.0°

TRAINING CONCEPT

Hardware Training Systems for every Demand

Compact Boards

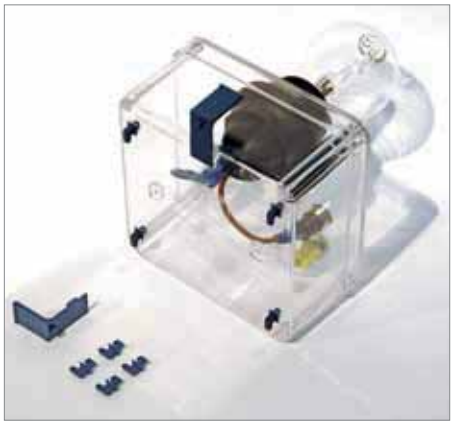
- Their didactical concept makes our training systems in A4 format outstanding.
- The photorealistic design of their front panels with pictures and warning signs assist and guide the user in his experiments.
- The systems can be mounted in an A4 frame or placed directly on a table.

BST®-BuildingSystemsTrainer

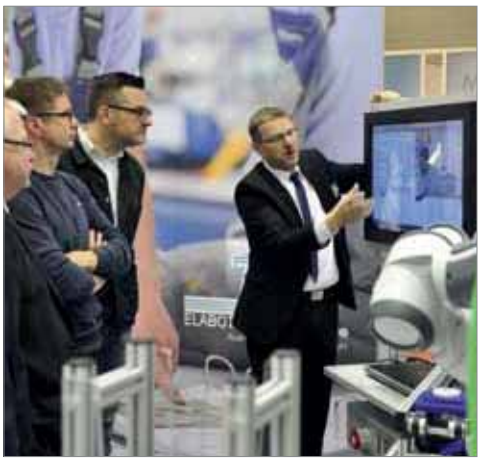
- The flexible training system from ELABOTrainingsSysteme for building automation – based on real components.

Experiment boxes

- Construct your own experiments – from simple wiring to complex circuits

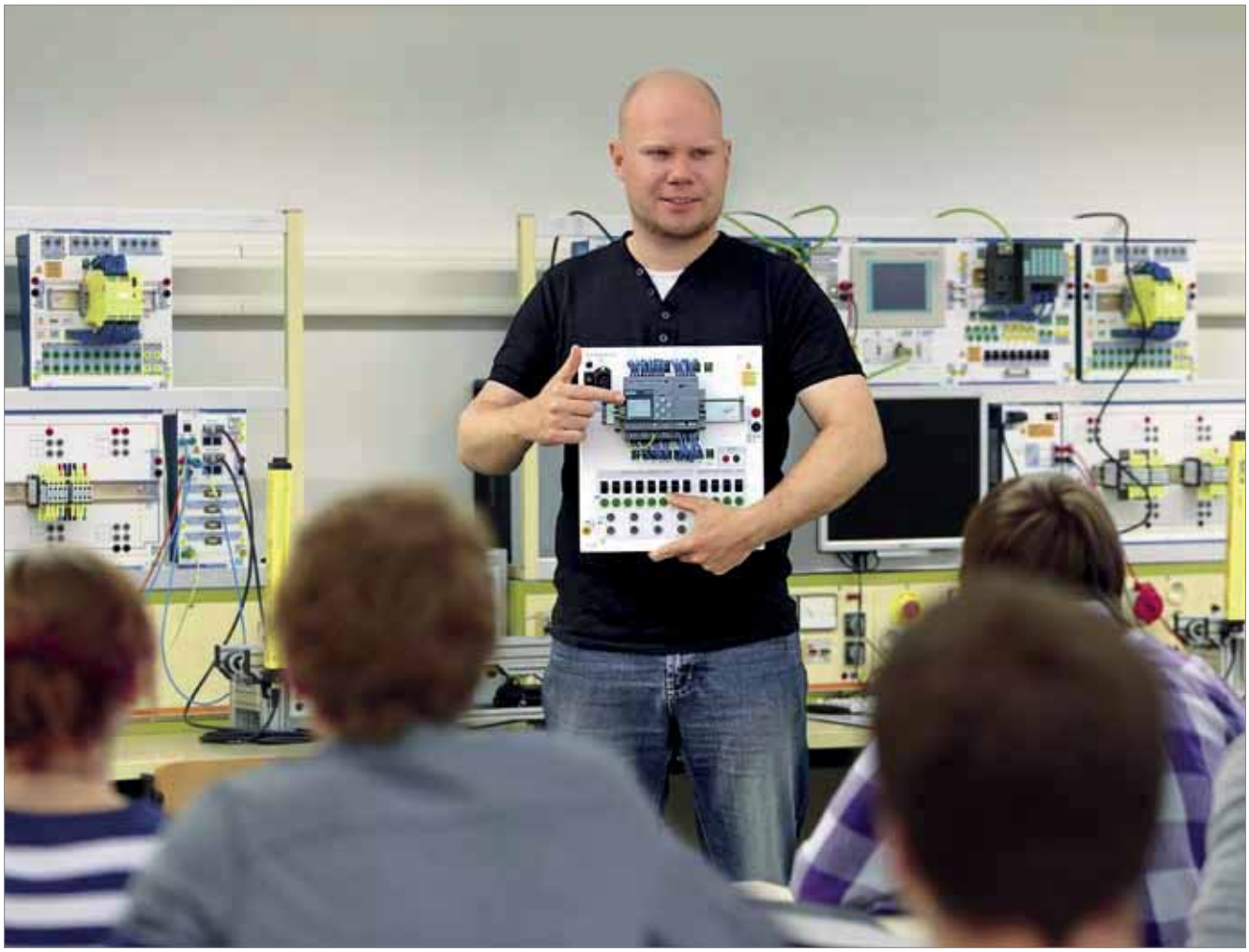


Seminars – Excellence in Training



Fast and safe into new technologies

- Seminars for instructors are offered for all fields of electrical engineering.
- Vocational schools, colleges, universities and industry are among the customers of ELABOTrainingsSysteme.



TRAINING CONCEPT

Innovative Hardware / Perfect Courseware

compact

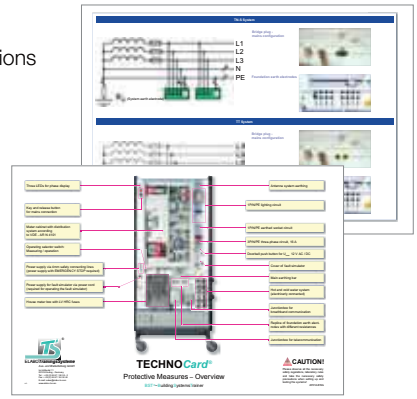
Structure of the manuals

- Ringbinder principle
- Dividers
- Incorporation of personal documents

practice-oriented

TECHNO*Cards*®

- Depiction of the parameters in function groups
- Commissioning instructions
- Safety functions
- Individual learning help



motivating

Trainer part / Practical experiments

- 100 % function guarantee
- High print quality
- Digital and on paper
- Original photographs with practical references
- Detailed work instructions

multimedia

Learning software

- Accompanying the hard- and system software
- Individual learning progress
- Combination of theory and practice
- Function simulation

efficient

Transparency sets / manufacturer documents

- Colour transparencies with legend
- Clear layout
- Fundamental instruction
- Various languages

ergonomics

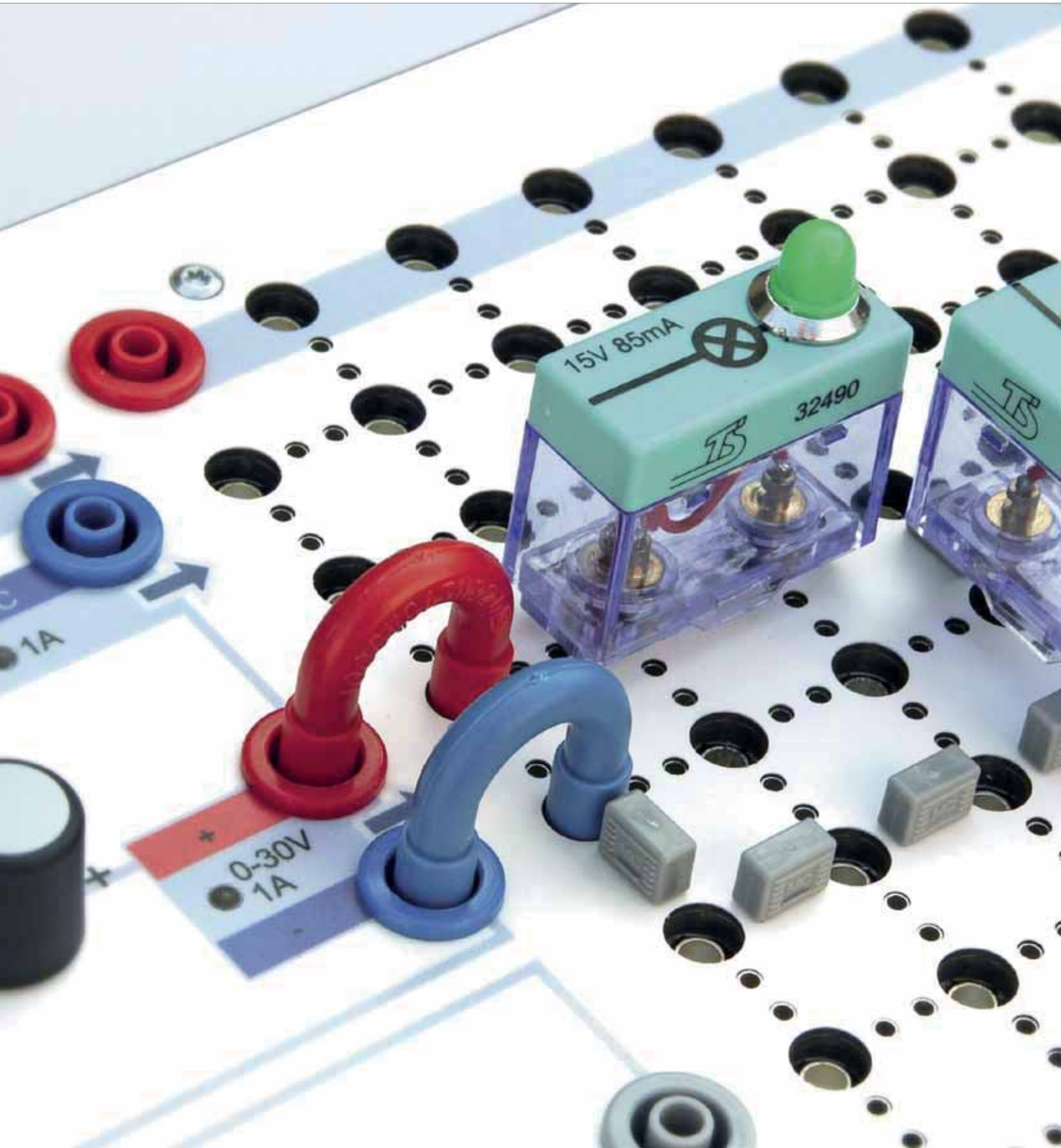
Furniture

- Technically matched conception
- Excellent functionality
- Ergonomics at the workplace
- Outstanding design

"THE" SYSTEM

- Hardware from industrial market leaders
- Didactically prepared courseware
- Perfect, ergonomic workplaces

"everything from a single source"


15V 85mA
32490
1A
0-30V
1A
+
-

ELECTRICAL ENGINEERING ELECTRONICS

MEDIA-T3BoxX

Electrical Engineering / Electronics

Digital Technology

Microcomputer / Microcontroller

Electrical Safety / Protective Measures

Control Engineering

Photovoltaics

Transformers

Reactive Power Compensation

TRAINING CONCEPT, ELECTRICAL ENGINEERING –

9 Subjects, 64 Chapters, 775 Pages in 3 Folders

Teaching – Training – Technology

MEDIA T3 BoxX
Teaching · Training · Technology

Discover the well thought-through concept of the Media-T3BoxX.

Enhance your lessons with fresh, easy and uncomplicated ideas with a hardware-independent training concept for electrical engineering.

In **9 subjects**, participants are taught the principles of electrical engineering based on a student script.

The trainer's documents are highlighted by a **connecting thread**.

1000 questions and answers as well as many complete examination units make sustained training easily achievable.
The documents are divided into approx. 160 – 175 teaching units.

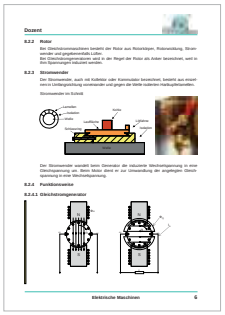
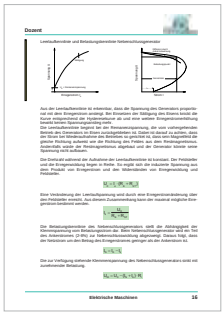
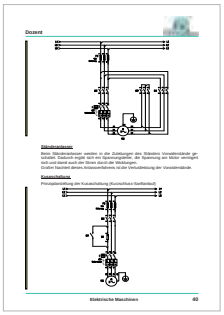
Special layout:
The instructor can see from the colours whether the student has the same information or whether he must work out the formulas, calculations or the diagram with the participants.

Highlights

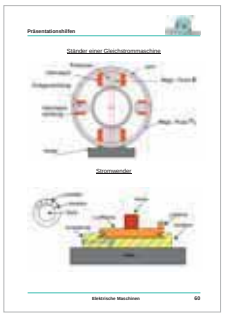
- Clear red stroke
- Approx. 1000 questions and answers
- 14 examinations
- Many Power Point transparencies
- Each chapter is complete in itself
- Hardware-independent learning
- Modular ordering possible

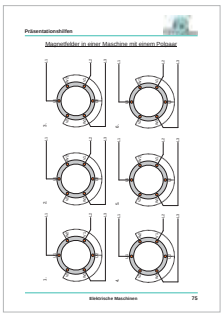
CONCEPT EXAMPLE: MEDIA-T3BOXX

Subject: Electrical Machines

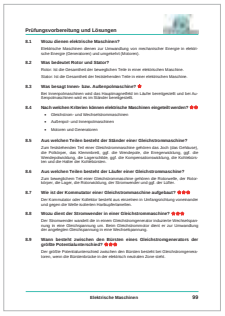




Instructor



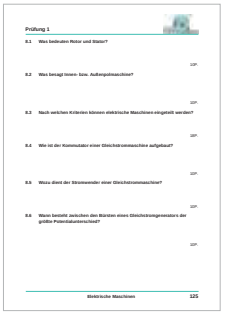
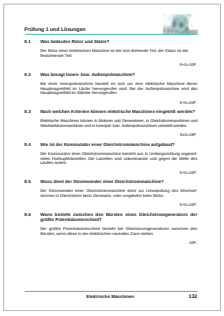
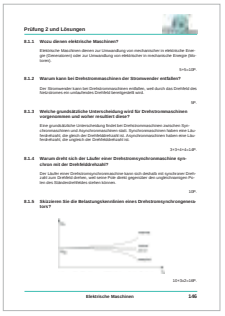


Presentation Aids

Questions | Questions and solutions

Examination preparation

Examination 1 | Examination 1 & solution | Examination 2 | Examination 2 and solution

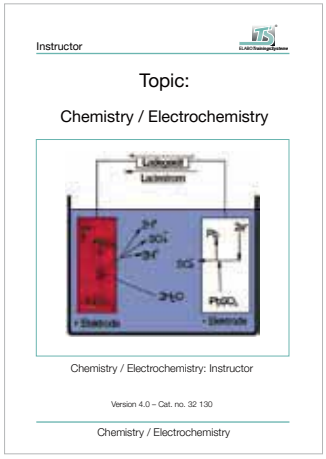
TRAINING CONCEPT, ELECTRICAL ENGINEERING

9 Subjects, 64 Chapters, 775 Pages in 3 Folders

1 Chemistry and electro-chemistry

82 pages

- Basic terms like substances, mixtures, chemical compounds
- Explaining and understanding the periodic table
- Different types of bonding
- The difference between cohesion and adhesion
- Different groups of substances
- Progression of an electrolysis
- Circuits of electrical voltage generators
- The electro-chemical equivalent
- Term: electrochemical series
- Various primary and secondary elements
- The electrical behaviour of electrochemical elements
- The chemical process of corrosion
- Types of corrosion protection



32130 Concept: Chemistry / Electrochemistry

2 DC technology

180 pages

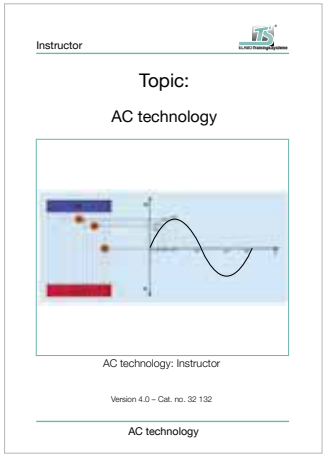
- Different voltage generation methods
- Evaluating the effect of electrical current
- The terms resistance and conductance
- Kirchhoff's laws
- The terms energy, work and power
- Coulomb's Law
- Influence, polarisation and shielding
- Structure of a capacitor and its calculations
- How electrical fields are created
- How coils work

32131 Concept: DC technology

3 AC technology

126 pages

- Explanation of AC quantities
- Effect of the capacitive reactance
- Effect of the inductive reactance
- Calculating quantities in the R-L-C AC circuit
- Recognising and using quadripoles
- Difference between star and delta circuits
- Calculations for symmetric and asymmetric three-phase load circuits
- Different types of reactive current compensation
- Calculations for reactive current compensation



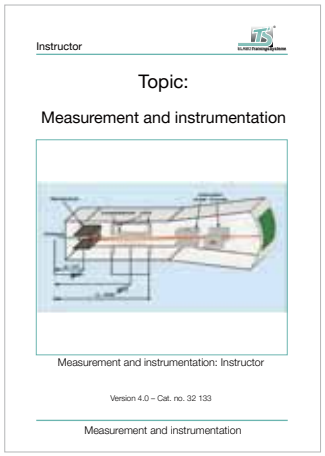
32132 Concept: AC technology

MEDIA T3 BoXX
Teaching · Training · Technology

4 Measurement technology and instrumentation

53 pages

- Difference between the basic terms measuring, testing, calibrating
- Terms measurement accuracy and measurement errors
- Recognising and avoiding display and device faults
- Measuring instruments like moving coil mechanism, moving iron mechanism, electro-dynamic mechanism
- Connecting converters and peculiarities of converters
- Signal converters
- The oscilloscope

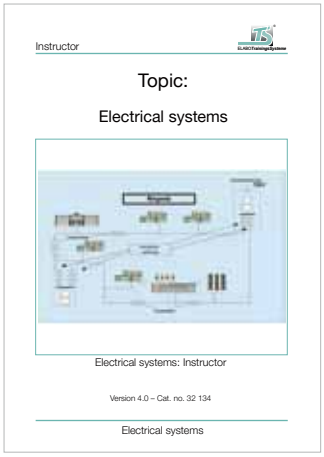


32133 Concept: measurement and instrumentation

5 Electrical systems

35 pages

- Explanation of types of generators
- Applications of possible generator types
- Supply networks and their advantages and disadvantages
- Differentiating between voltage levels
- Differentiating between forms of networks and network types
- Voltage drop and power loss on electrical cables



32134 Concept: electrical systems

6 Switchgear

45 pages

- Actuation types
- Important characteristic data
- Features of circuit breakers
- Difference between disconnectors, load break switches and circuit breakers
- Using contactors and relays in a technically correct manner
- Selecting and using safety contactor combinations

32135 Concept: switchgear

TRAINING CONCEPT, ELECTRICAL ENGINEERING

9 Subjects, 64 Chapters, 775 Pages in 3 Folders

7 Transformers — 63 pages

- Structure and effect of transformers
- Processes under load and at no-load
- Short-circuit voltage and short-circuit current
- Load characteristics
- Structure of single-phase and three-phase transformers
- Basic preconditions to ensure parallel operation of transformers
- Special transformers
- Structure of welding transformers

32136 Concept: transformers

8 Electric machines — 151 pages

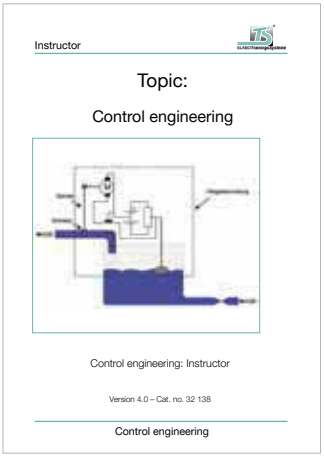
- Basic terms of electric machines
- Difference between DC generator and motor
- Armature reaction, commutation, etc.
- Circuit types of DC machines
- Structure of AC machines
- Different applications of three-phase machines
- Distinguishing between and using special motors
- Recognising the most varied single-phase motors

32137 Concept: electric machines

9 Control engineering — 45 pages

- Basic terms like plant controlled system, actuating element, actuating variable
- Difference between controlling and regulating
- Regulation types like time scheduling, fixed set point control and sequence control
- Difference between continuous and discontinuous regulators
- The most various continuous regulators and their interaction with other regulators
- Determining controlled systems according to their order

32138 Concept: control engineering



Theory

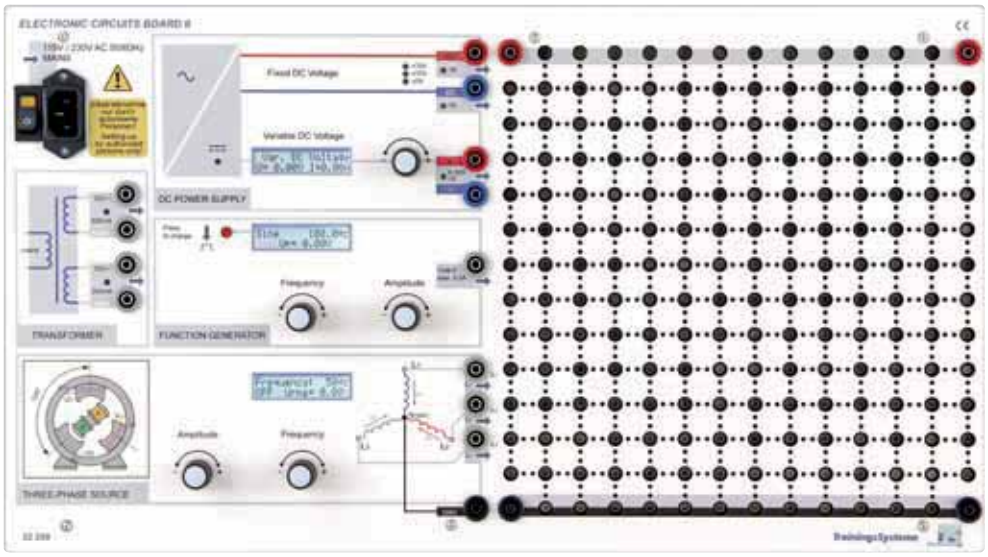
Presentation

Test preparation

Examination

ELECTRICAL ENGINEERING / ELECTRONICS

Electronic Circuits Board II



1

Learning Objectives

Electronic Circuits Board II

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

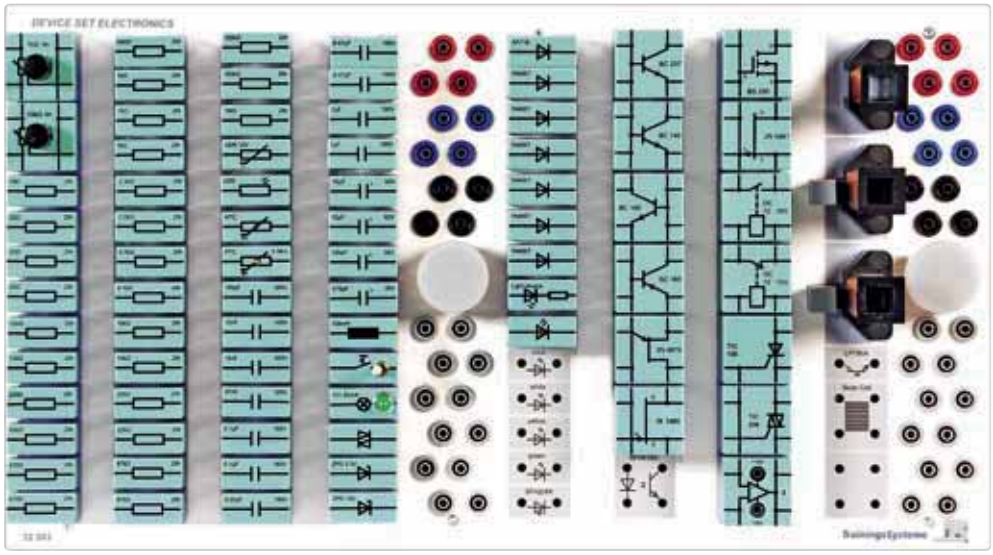
Technical Data

- 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: 0…10 V_{rms}; line voltage: 0…17.3 V_{rms}; frequency: 1…120 Hz, adjustable, display of all parameters, phase current load: max. 400m A_{rms}
- Experimenting field: 4mm safety jacks arranged in a 19mm grid, surrounded by and electrically connected to four 2mm jacks.
- Mains connection: 230 V AC; 50 Hz; 75 W; protection class I

- Safety: Supply outputs short-circuit proof and back-feed protected up to 40 V DC / 24 V AC, 40 W

No.	Designation	Order no.
1	Electronic Circuits Board II	32200
2	Device Set Electronics	32203

Device Set Electronics

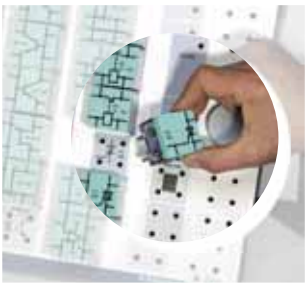


2

Device Set Electronics
Storage Plate
printed and incl. the following plug-in modules:

- 28 film resistors 10 Ω...1 MΩ
- 1 VDR resistor
- 1 LDR resistor
- 1 PTC resistor
- 1 NTC resistor
- 11 capacitors 100 pF...1 µF
- 4 electrolytic capacitors 10 µF...470 µF
- 1 potentiometer linear 1 kΩ, 0,5 W
- 1 potentiometer linear 10 kΩ, 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

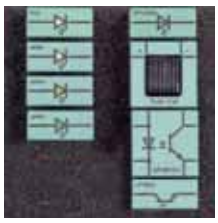
Resistors	⟩ series E12, 1 Ω ... 10 MΩ / 2 W (1,0 1,2 1,5 1,8 2,2 2,7 3,3 3,9 4,7 5,6 6,8 8,2)
Potentiometers	⟩ linear, 470 Ω, 1 kΩ, 4,7 kΩ, 10 kΩ, 47 kΩ, 0,5 W
Non-linear resistors	⟩ VDR, LDR, NTC, PTC resistors

Capacitors	⟩ series E6, 10 pF ... 1 µF (1,0 1,5 2,2 3,3 4,7 6,8)
Electrolytic capacitors	⟩ values: 10 µF, 100 µF, 470 µF
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 32104 (to complement device set 32203) ⟩ photo transistor, photo diode ⟩ optical coupler, solar cell ⟩ LEDs



Overview of the Single Components

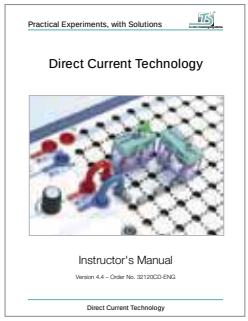
No.	Designation	Order no.
not ill.	set of empty housings with 2 lamella plugs	32302
not ill.	set of empty housings with 2 lamella plugs	32305
not ill.	film resistor 10 Ω / 2 W	32310
not ill.	film resistor 22 Ω / 2 W	32311
not ill.	film resistor 33 Ω / 2 W	32312
not ill.	film resistor 100 Ω/2 W	32313
not ill.	film resistor 220 Ω / 2 W	32314
not ill.	film resistor 330 Ω / 2 W	32315
not ill.	film resistor 470 Ω / 2 W	32316
not ill.	film resistor 680 Ω / 2 W	32317
not ill.	film resistor 1 kΩ / 2 W	32318
not ill.	film resistor 2,2 kΩ / 2 W	32319
not ill.	film resistor 4,7 kΩ / 2 W	32320
not ill.	film resistor 10 kΩ / 2 W	32321
not ill.	film resistor 22 kΩ / 2 W	32322
not ill.	film resistor 47 kΩ / 2 W	32323
not ill.	film resistor 100 kΩ / 2 W	32324
not ill.	film resistor 1 MΩ / 2 W	32325
not ill.	VDR resistor, 11 V / 1 mA	32340
not ill.	NTC resistor (6 kΩ)	32342
not ill.	LDR resistor	32345
not ill.	capacitor 100 pF / 500 V	32370
not ill.	capacitor 10 nF / 500 V	32371
not ill.	capacitor 47 nF / 500 V	32372
not ill.	capacitor 0,1 µF / 160V	32373
not ill.	capacitor 0,22 µF / 160 V	32374
not ill.	capacitor 0,47 µF / 160 V	32375
not ill.	capacitor 1 µF / 100 V	32376
not ill.	electrolytic capacitor 10 µF / 6 V	32390
not ill.	electrolytic capacitor 100 µF / 35 V	32391
not ill.	electrolytic capacitor 470 µF / 35 V	32392
not ill.	linear potentiometer 1kΩ 0,5 W	32402
not ill.	linear potentiometer 10kΩ 0,5 W	32403
not ill.	transformer coil N = 300	32420
not ill.	transformer coil N = 900	32421
not ill.	coil 100 mH	32422
not ill.	tape-wourn core (1 pair)	32430
not ill.	Zener diode 10 V / 40 mA	32440
not ill.	Zener diode 3,3 V / 130 mA	32441

No.	Designation	Order no.
not ill.	GA-AS light emitting diode, red, without dropping reststor	32442
not ill.	light source	32443
not ill.	LED, 5 mm, blue	32444
not ill.	Ge diode, AA118	32445
not ill.	LED, 5 mm, warm white	32446
not ill.	LED, 5 mm, yellow	32447
not ill.	LED, 5 mm, green	32448
not ill.	Si-Diode 1 A	32450
not ill.	flip switch (TS12)	32480
not ill.	lamp, green, 15 V	32490
Not ill.	transistor NPN, BC237, base left	32501
not ill.	transistor NPN, BC140, base left	32502
not ill.	transistor NPN, BC140, base right	32503
not ill.	transistor PNP, BC160, base left	32504
not ill.	unijunction transistor, PN 2N4870	32505
not ill.	D-MOS field effect transistor, BC250, p-channel, gate left	32506
not ill.	JFET transistor 2N5485, 25 V / 10 mA, n-channel, gate left	32507
not ill.	JFET transistor 2N5461, 20 V / 10 mA, p-channel, gate left	32508
not ill.	diac, ER 900	32510
not ill.	thyristor, TIC 106	32511
not ill.	triac, TIC 206	32512
not ill.	photodiode	32520
not ill.	solar cell	32521
not ill.	optical coupler SFH615A	32522
not ill.	phototransistor LPT80A	32523
not ill.	operational amplifier OP741 with 4mm connection sockets on the top	32598
not ill.	operational amplifier OP741 with 4mm connection sockets on the top	32599
not ill.	relay DC 12...15 V NOC, 2 A	32485
not ill.	relay DC 12...15 V relay DC 12...15 V NCC, 2 A	32486
not ill.	IC Socket 14 Pin, plug-in module IC socket, 14-pin, on plug-in plate for 19mm grid, plate equipped with 2mm jacks for easy connection	32601

ELECTRICAL ENGINEERING / ELECTRONICS

Courseware

1



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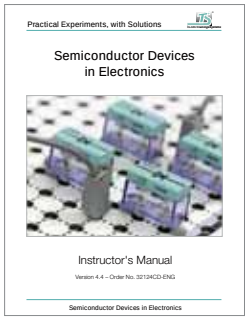

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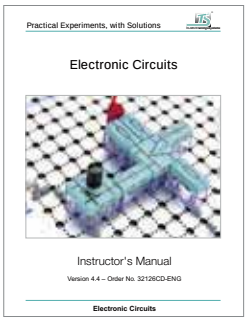

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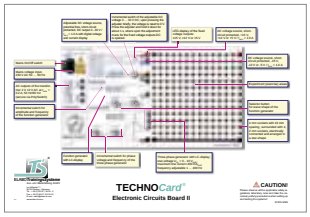

6

No.	Designation	Order no.
1	Media Folder Set	91903
2	Direct Current Technology – Instructor's Manual	32120CD-ENG
Not ill.	Direct Current Technology – Student Manual	32121CD-ENG
3	Alternating Current Technology – Instructor's Manual	32122CD-ENG
Not ill.	Alternationg Current Technology – Student Manual	32123CD-ENG
4	Semiconductor Devices in Electronics – Instructor's Manual	32124CD-ENG
Not ill.	Semiconductor Devices in Electronics – Student Manual	32125CD-ENG
5	Electronic Circuits – Instructor's Manual	32126CD-ENG
Not ill.	Electronic Circuits – Student Manual	32127CD-ENG
6	TECHNOCard® – Electronic Circuits Board II	32201-ENG

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

Alternating Current Technology

- Types of current (voltage) and their characteristics
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- 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

Accessories

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

1

3

2

4

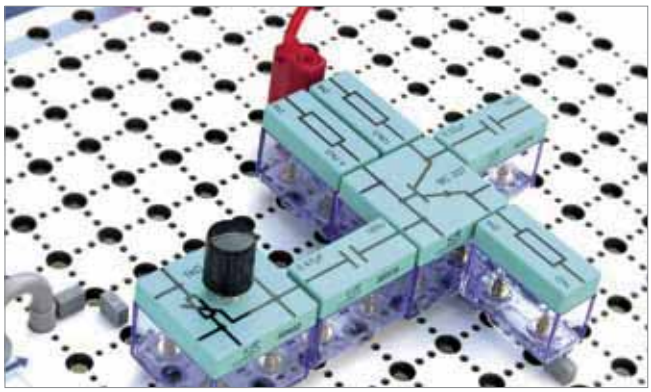
4mm connections – safety
- Set of safety connecting leads, 11 parts
- Set of safety bridging plugs, 24 parts, multi-color

Adapter, BNC plug to 4mm safety socket
- Three adapters BNC to 4mm safety connectors are required for connecting standard oscilloscopes.

Set of 4mm connections – classic
- On the experimenting field provided with 4mm sockets, electrical connections are made with 4mm connectors or 4mm safety connectors.

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

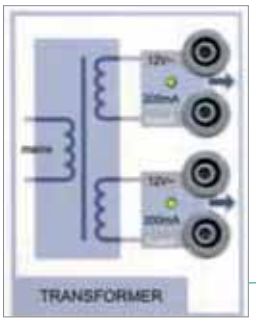
No.	Designation	Order no.
1	4mm connections – safety, 11 parts	90030
1	4mm connections – safety, 24 parts, multi-color	90031
2	Adapter, BNC plug to 4mm safety socket	C6010235
3	Set of 4 mm connections, 20 connecting plugs, 8 connecting leads	90021
4	Set of 2 mm connections, 70 connecting plugs	C6000306
4	Set of 2 mm leads, 28 parts	90049



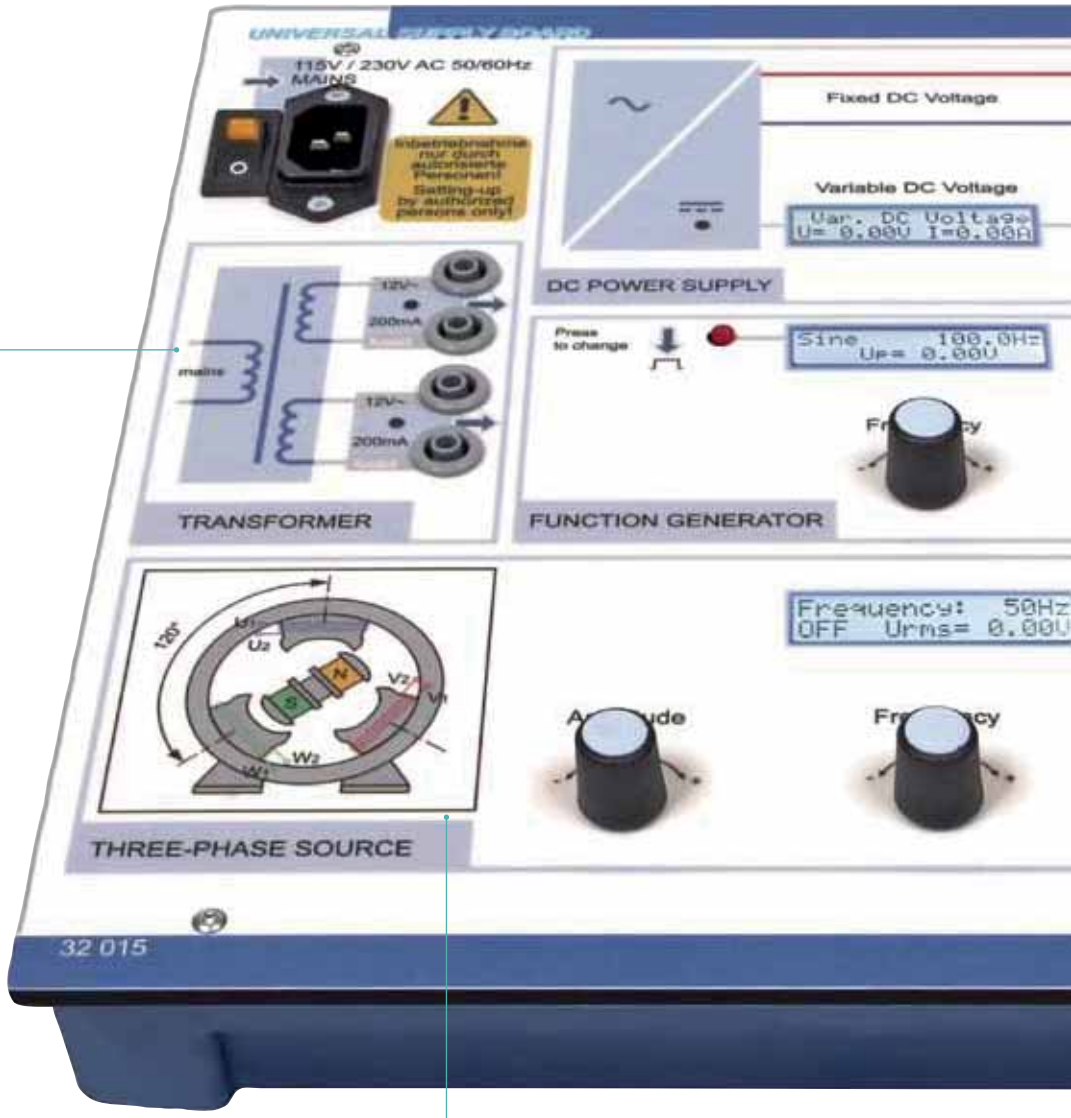
ATTRACTIVE, POWERFUL AND SAFE

Functions and Operating Elements

TRANSFORMER

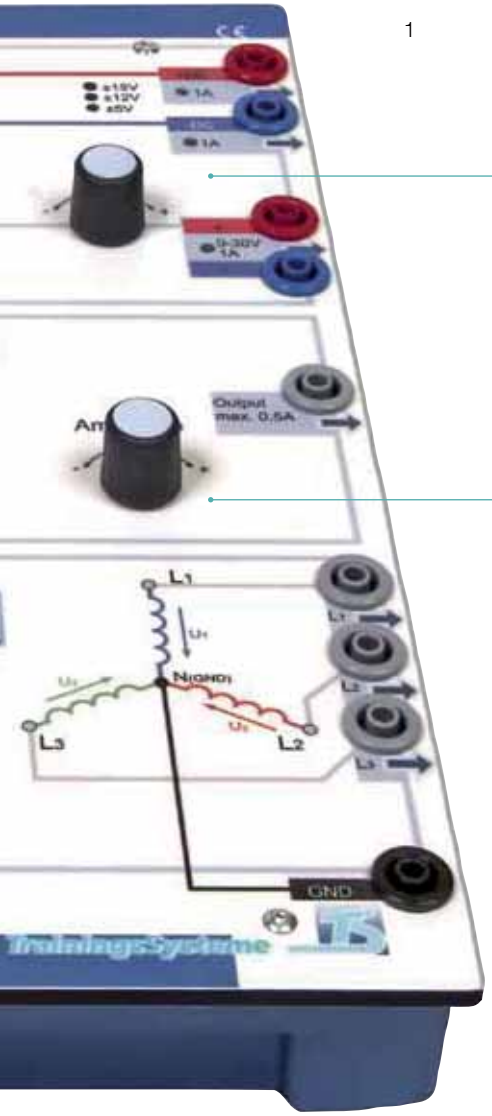


⟩ AC voltage sources
2 x 12 V AC / 0.2 A; 50 Hz
(mains frequency), protected
by polyswitch



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 and back-feed proofup to
40 V DC / 24 V AC



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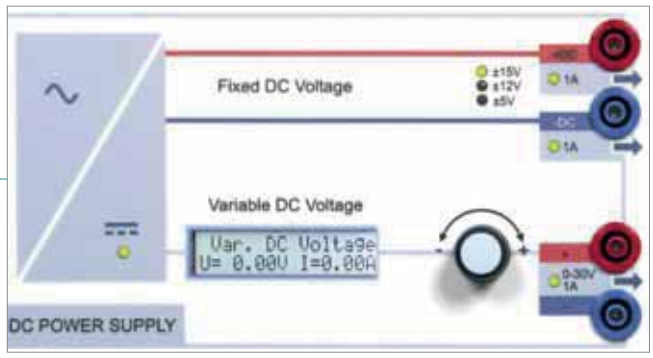
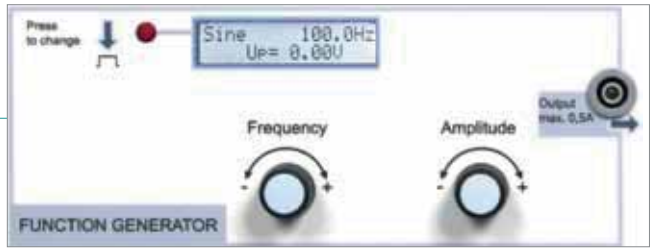


DC POWER SUPPLY

- 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 -5V / 1.0 A
- all outputs short-circuit and back-feed proof up to 40V DC / 24 V AC, 40W, colour LED indicating overload



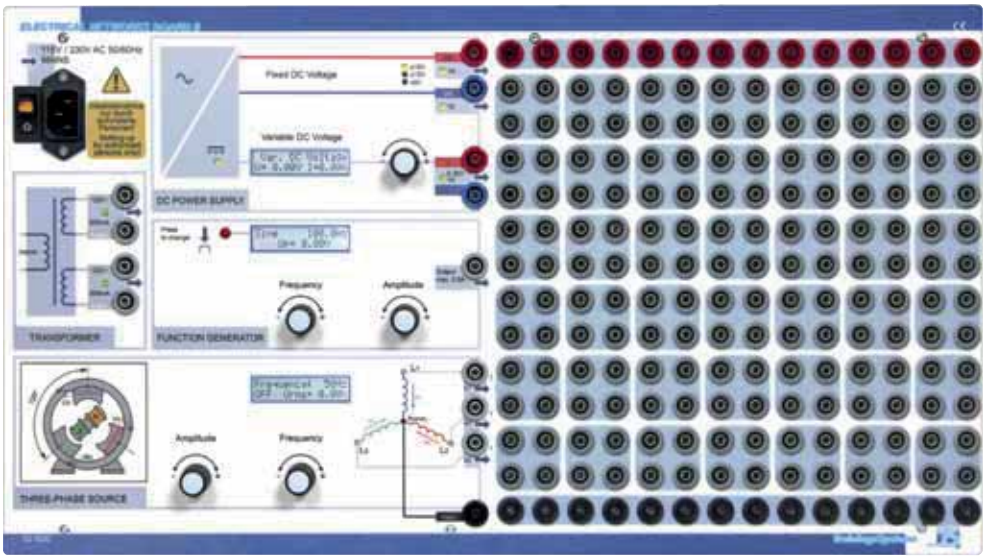
FUNCTION GENERATOR

- 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 5 Ω
- wave forms: sine, triangle, square and logic

No.	Designation	Order no.
1	Universal Supply Board	32015

ELECTRICAL ENGINEERING

Electrical Networks Board II



1

Learning objectices

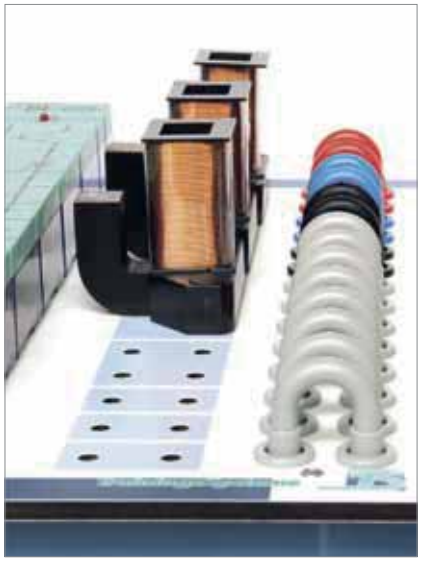
- Basics of electrical engineering
- How to use oscilloscope, multimeter and function generator
- Passive components in the DC circuit
- Capacitors and coils in the AC circuit
- Transformers
- Three-phase current systems
- Behaviour of semiconductors: diodes, transistors, thyristors
- Operational amplifiers

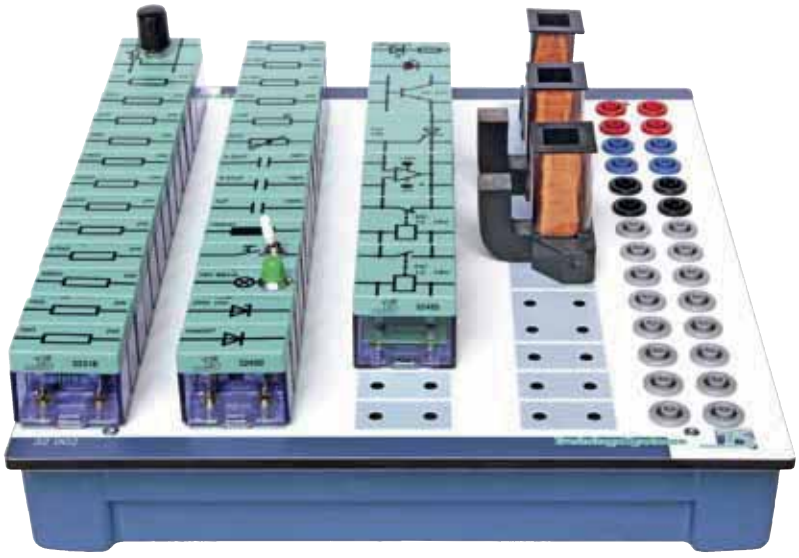
Technical data

- 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…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}
- Experimenting field:
  42 plug-in areas in a 19 mm grid, each with 4 electrically connected 4mm safety jacks.
- Mains connection:
  230 V AC; 50 Hz; 75 W; protection class I
- Safety:
  Supply outputs short-circuit proof and back-feed protected up to 40 V DC / 24 V AC, 40 W

No.	Designation	Order no.
1	Electrical Networks Board II	32020
2	Device Set Basica	32002

Device Set Basics





2

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

Technical data

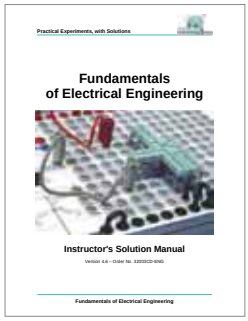
Set of accessories, plugged on imprinted Storage Board:

- 16 film resistors 10 Ω...10 kΩ
- 1 LDR resistor
- 1 NTC resistor
- 3 capacitors 0,22 µF...1 µF
- 1 potentiometer linear 1 kΩ
- 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

ELECTRICAL ENGINEERING

Courseware

1



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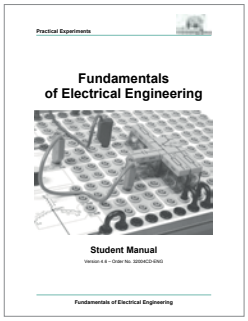
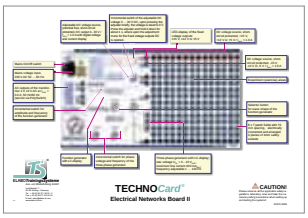


3

Printed an on CD

Contents

- 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



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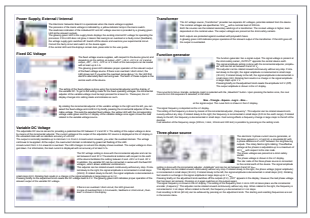


4

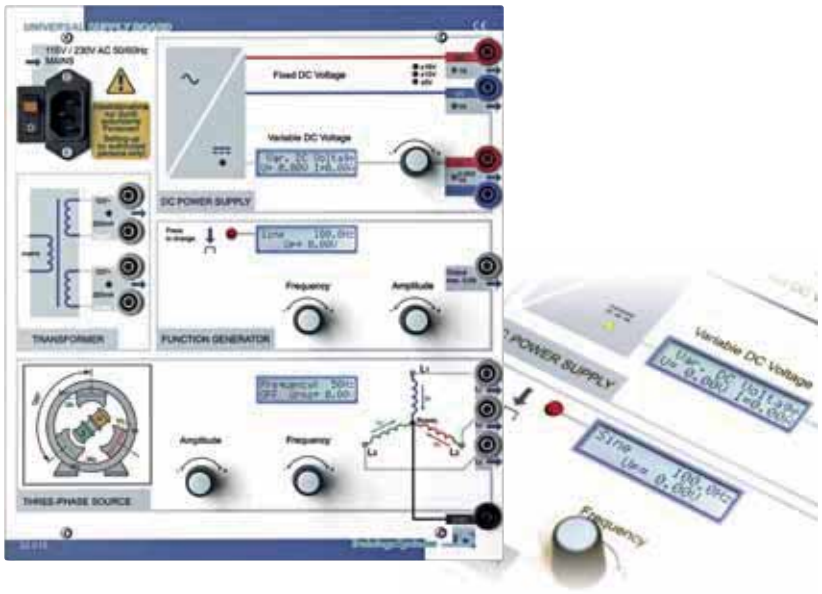
TECHNOCards®

- 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

No.	Designation	Order no.
1	Media Folder Set	91903
2	Fundanmentals of Electrical Engineering – Instructor's Manual	32003CD-ENG
3	Fundanmentals of Electrical Engineering – Student Manual	32004CD-ENG
4	TECHNOCard® – Electrical Networks Board II	32121-ENG
5	Assembly Board Safety	32012
6	Assembly Board Electronics	32202

UNIVERSAL SOLUTIONS

Universal Supply Board



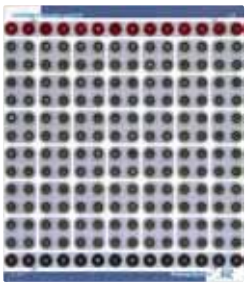
Technical data

- 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 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: 230 V AC; 50 Hz; 75 W; protection class I
- Safety: Supply outputs short-circuit proof and backfeed protected 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 + Device Sets + Courseware



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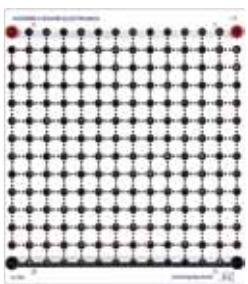

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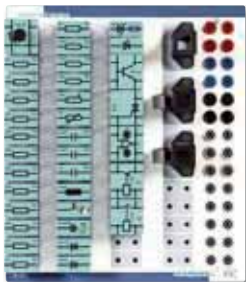
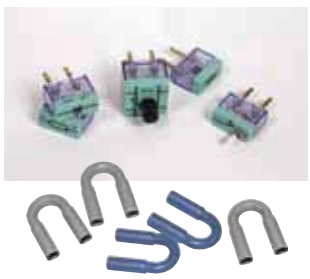
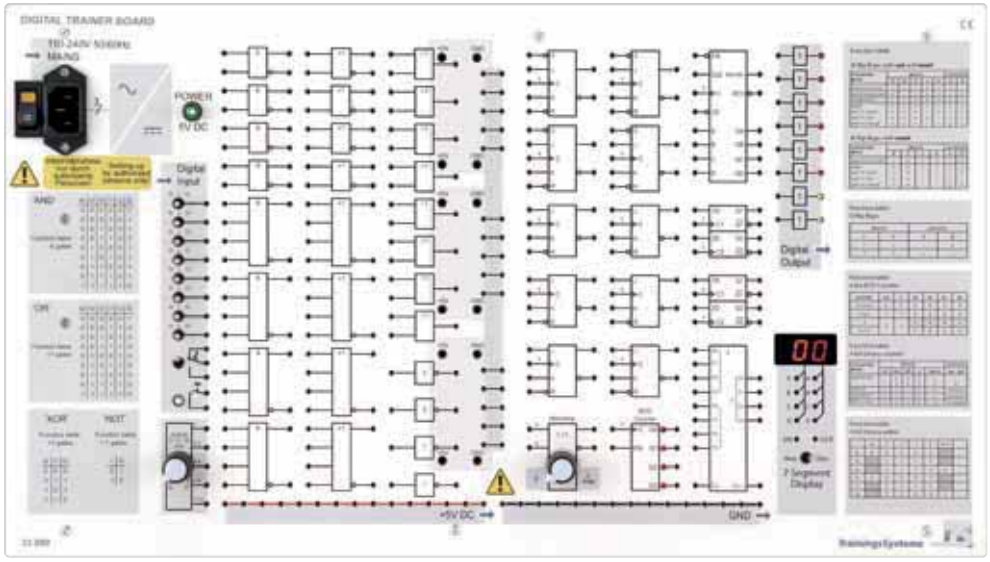




DIGITAL TECHNOLOGY

Digital Trainer Board



1

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

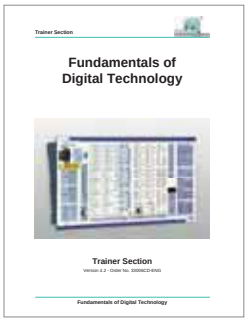
Pushbuttons and switches
AND, NAND, OR, NOR, XOR gates, inverters
Monoflop and flipflops
Adders, binary and decimal counters
LED and 7-segment displays
Voltage-supplied plug-in fields for additional modules or IC sockets

No.	Designation	Order no.
1	Digital Trainer Board	33000
2	Media Folder Set	91903
3	Fundanmentals of Digital Technology – Instructor's Manual	32003CD-ENG
4	Fundanmentals of Digital Technology – Student Manual	32004CD-ENG
5	TECHNOCard® – Digital Trainer Board	33008-ENG

Courseware

2

Printed an on CD

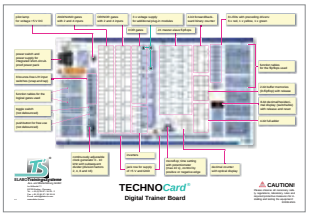


3

4

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



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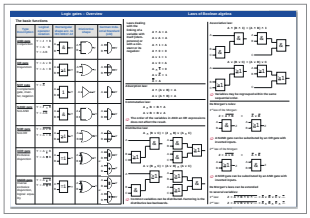
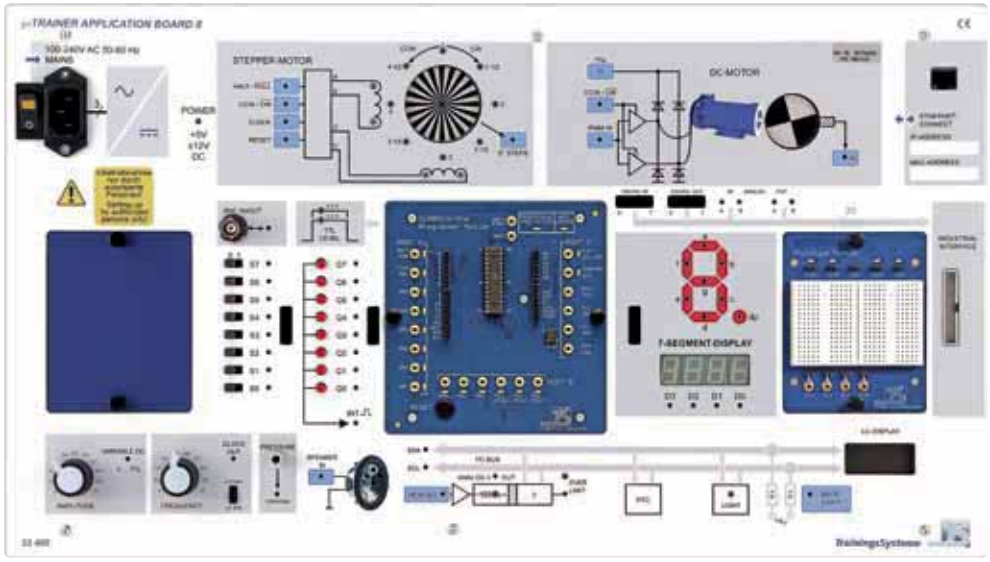


5

MICROCONTROLLER

µ-Trainer Application Board II

New Generation!



1

The "µ-Trainer Application Board II" is the basic module of the microcomputer training system "µ-Trainer". It has the following features and functions:

- 8 ON/OFF switches
- 8 push buttons
- 1 interrupt output
- 4 7-segment displays
- 1 heating module
- 1 I2C temperature sensor
- 1 I2C real time clock
- 1 I2C ambient light sensor
- 1 I2C LC display with back light
- 1 analog pressure sensor up to 4 bars
- 1 analog temperature sensor up to 100°C
- 1 bipolar stepper motor, 0.9° incremental motion
- 1 DC motor with motor driver and speed sensor
- 1 speaker
- 1 adjustable DC voltage level: 0 … TTL level
- 1 clock generator 100 Hz … 10 kHz, TTL level
- 1 BNC socket for adapting measuring instrument inputs to 2mm connections
- 1 plug-in field for programming modules
- 2 plug-in fields for expansion modules
- 1 industrial interface connection with 8 digital inputs, 8 digital outputs, 2 analog inputs, 2 analog outputs

Technical data

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

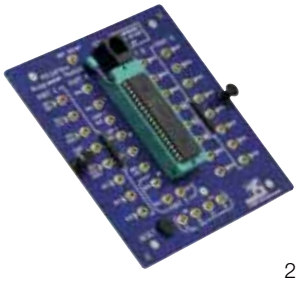
The "µ-Trainer Application Board II" is delivered with:

CD-ROM with driver software, power cord, Ethernet connecting cable 2 m, 1 bus cable 10 cm, 1 bus cable 20 cm, 1 bus cable 30 cm, 1 bus cable 50 cm, 1 adapter bus cable 20 cm, operating instructions.

No.	Designation	Order no.
1	µ-Trainer Application Board II with additional modules	33400

Main Modules

1



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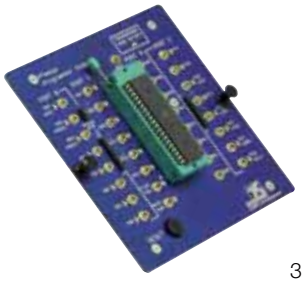

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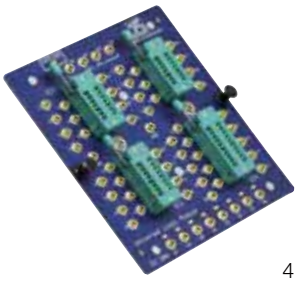

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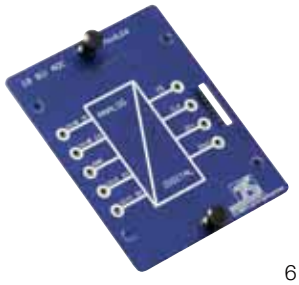
Additional Modules



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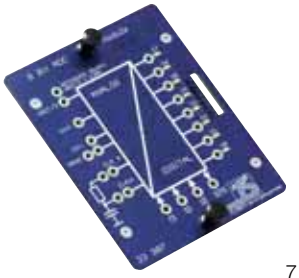

7

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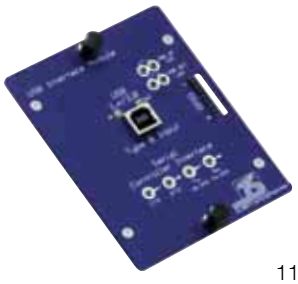


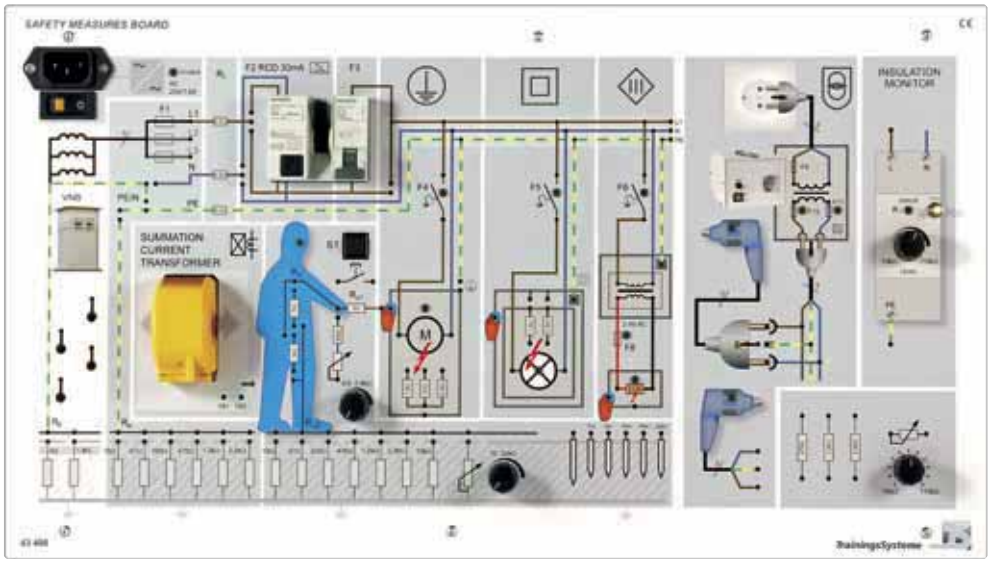
11

No.	Designation	Order no.
	Main modules	
1	PIC16F84A Programmer Module	33401
2	PIC16F8xx Programmer Module	33402
3	ATmega Programmer Module	33403
4	Universal Logic Module	33406
5	ELABOino-one	33413
	Additional modules	
6	10-Bit ADC Module	33404
7	8-Bit ADC Module	33407
8	8-Bit DAC Module	33408
9	Prototype Module	33410
10	Serial Interface Module	33480
11	USB Interface Module	33481

"aligned to your requirements"

PROTECTIVE MEASURES

Safety Measures Board



1

The Safety Measures Board is designed for experiments related to the subject of electric protective measures.
Safety extra-low voltage ensures optimum safety for the user.
Connected to the mains supply with a SCHUKO plug, the device can be used in any room.
The Board allows experiments on all the topics listed above and reproducing the earthing systems TN-C, TN-C-S, TN-S TT and IT.

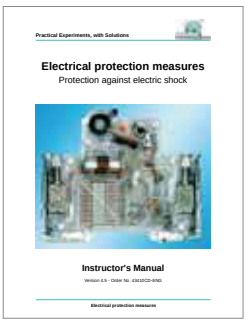
Learning objectives

- Protective insulation
- Protective isolation
- Protection against direct and indirect contact
- Protection through safety extra-low voltage
- Residual current operated device
- Overcurrent protection device
- Summation current transformer
- Protective measures in the TN-, TT- and IT-network
- Heart current factor
- Earthing device
- Voltage gradient

Technical data

- Operating voltage 230 V / 50 – 60 Hz
- Experimenting voltage 23 V, 1.5 A
- $^{1}/_{10}$ of the mains voltage
- RCD 23 V / 30 mA
- Circuit breaker C0, 3 A
- Summation current transformer
- Simulation of a human
- Safety extra-low voltage
- Protective isolation
- Simulation of a voltage gradient

2



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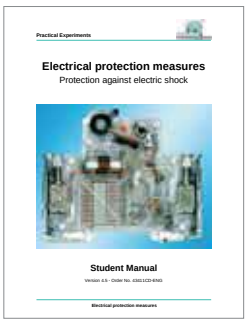

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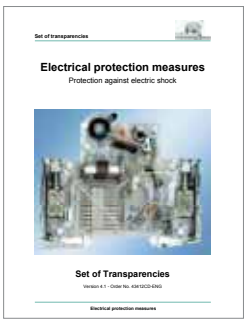

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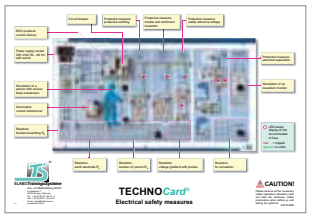
Printed and digital



6

Content

- Fundamentals
- Network systems
- Protection against direct and indirect contact
- Fault current protective devices
- Fault current protective devices in networks
- Protective separation
- IT network
- Protection insulation
- Protective extra-low voltage and functional extra-low voltage
- Step voltage

Benefits

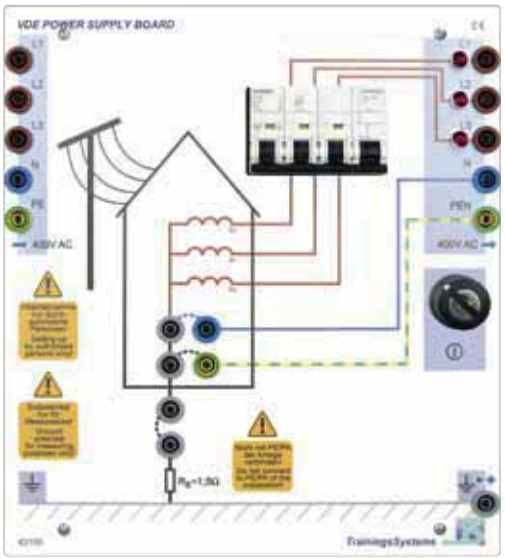
- Carrying out experiments safely by using low voltage 1:10
- No special measuring instruments required
- Depiction of the protection degrees

Commercial multimeters suffice for experiments

No.	Designation	Order no.
1	Safety Measures Board	33400
2	Media Folder Set	91903
3	"Protective measures" – Instructor's Manual	43410CD-ENG
4	"Protective measures" – Student Manual	43411CD-ENG
5	"Protective measures" – Set of Transparencies	43412CD-ENG
6	TECHNOCard® – "Protective measures"	43415-ENG
7	Digital multimeter	90600

MAINS SYSTEMS AND PROTECTIVE MEASURES

Mains Supply



1

Learning Objectives

⟩ Using the voltage source of the mains system
⟩ Getting familiar with the generation of mains systems with direct earthing (TN system; TT system)

Technical Data

⟩ Line circuit breakers (I_N = 6 A) with undervoltage release
⟩ Key-operated switch for voltage release
⟩ Phase control lamps: L1, L2, L3
⟩ Simple change of mains form with bridging plugs

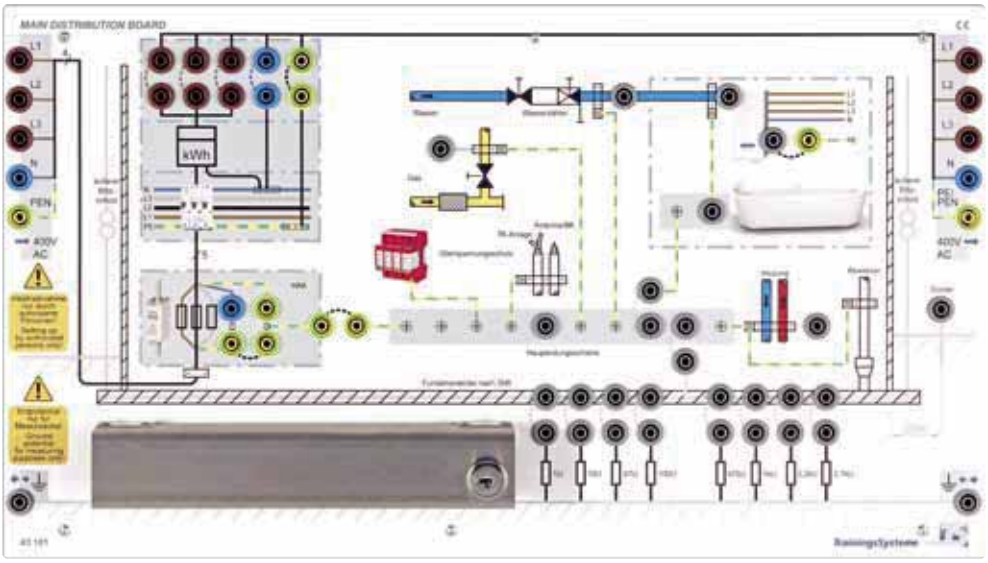
Your Benefit:

With the VDE Power Supply Board, all measurements according to DIN VDE 0100-600, as e.g. loop resistance or RCD test, can be carried out without actuating the Ram RCD.

No.	Designation	Order No.
1	VDE Power Supply Board	43100

MAINS SYSTEMS AND PROTECTIVE MEASURES

Electrical System in a Customer's Home



Learning Objectives

- Consumers of the mains system
- Getting to know the design of the customer's mains system (TN system; TT system)
- Getting to know the creation of additional designations in TN systems (TN-C system; TN-S system; TN-C-S system)
- Effects of protective measures in various systems
- Selection of protective measures and devices suitable for the customer's system
- Consultation of the customer with regard to safety and availability of the electrical installation
- Getting acquainted to the measuring instruments used in the field of protective engineering
- Producing flow charts for the required tests
- Carrying out initial tests according to DIN VDE 0100-600
- Carrying out repeat tests according to DIN VDE 0105 and Addident Prevention Regulations DGUV
- Writing test protocols

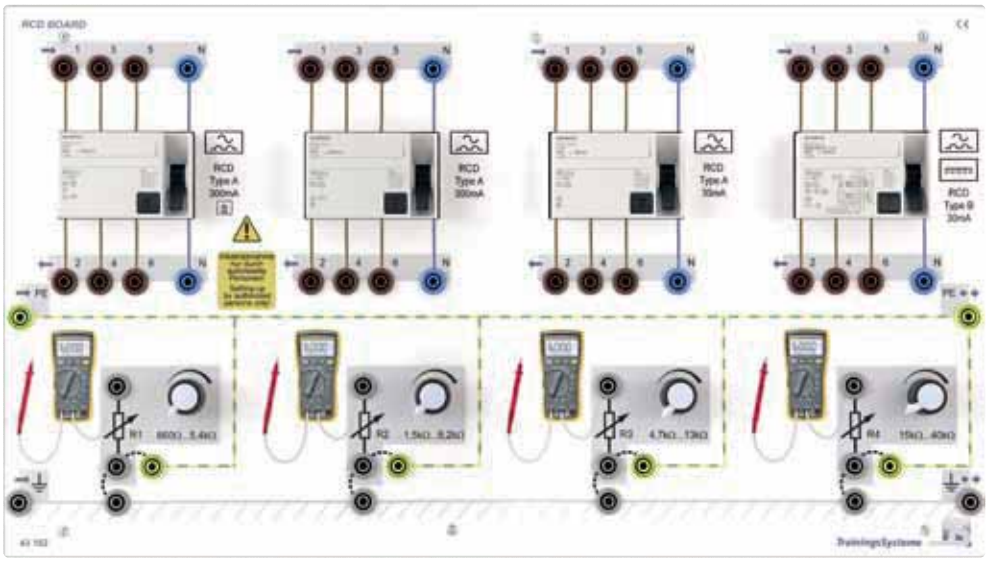
Technical Data

- Simulation of a foundation grounding with various grounding resistances
- Simulation of an external lightning protector (two derivations with disconnection)
- Connector for an earth-resistance probe
- Simulation of a main equipotential bonding
- Simulation of an additional equipotential bonding in the bathroom
- Simulation of mains connection to the house with generation of the various network systems using bridging plugs
- Simulation of the electric meter
- Connection field for subdistributor
- Simple error simulation with rotating switches for:
  - Loop impedance and mains interior resistance
  - Low-resistance connection of protective and equipotential bonding conductors
  - Insulation fault

No.	Designation	Order No.
1	Main Distribution Board	43101

MAINS SYSTEMS AND PROTECTIVE MEASURES

Residual Current Devices - RCDs



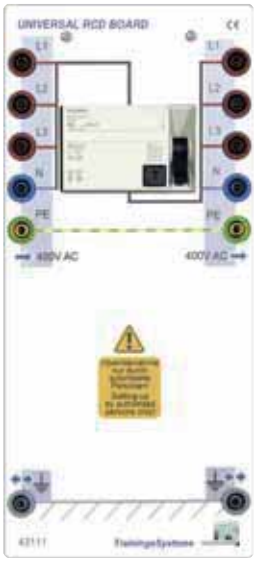
1

Learning objectives

⟩ Getting to know the influence of the rated residual current on circuit-breaking
⟩ Function and application of the residual current protective equipment type A and type B
⟩ Influence of the earthing resistance on the RCD selection in a TT system
⟩ Series circuiting and grouping of several RCDs
⟩ Examining the application of RCDs in the IT system
⟩ Application of type B in classrooms according to DIN-VDE 0100-723
⟩ Application of type B in three-phase circuits
⟩ Measuring AC residual currents

Technical Data (1)

⟩ Selective residual current protective device $I_{\Delta N}$ = 300 mA
⟩ Residual current protective device $I_{\Delta N}$ = 300 mA, Type A
⟩ Residual current protective device $I_{\Delta N}$ = 30 mA, Type A
⟩ Residual current protective device $I_{\Delta N}$ = 30 mA, Type B
⟩ Four different potentiometers for simulation of residual currents



2

No.	Designation	Order No.
1	RCD Board	43102
2	Universal RCD Board	43111

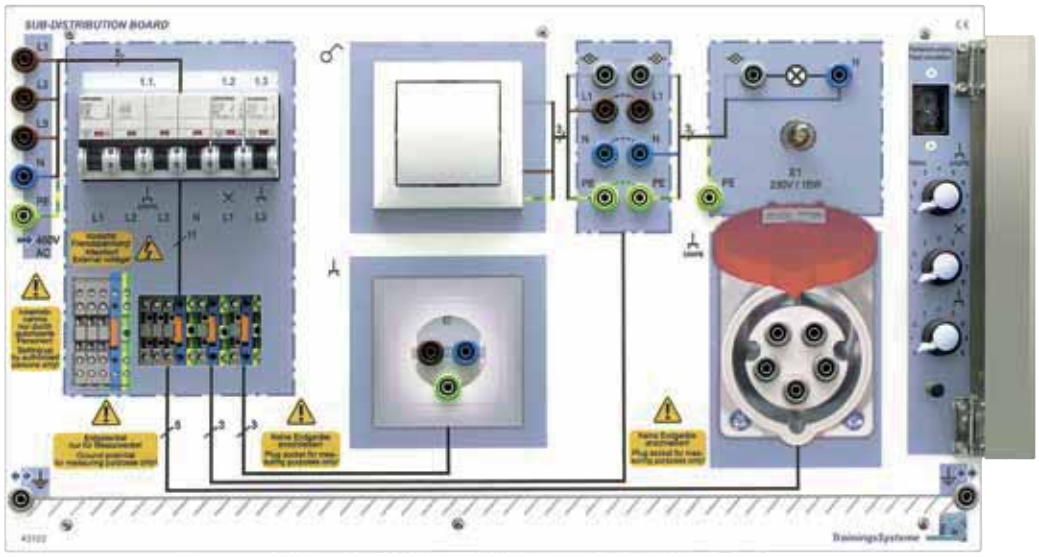
Universal RCD Board (2)

equipped with RCD type A:

⟩ Residual current protective device $I_{\Delta N}$ = 30 mA, Type A

MAINS SYSTEMS AND PROTECTIVE MEASURES

Sub-distribution in a Customer's Home



1

Learning objectives

- Getting acquainted with the functionalities of the protective measures in the different mains systems
- Selection of the protective measures and devices according to the requirements of the customer`s system
- Consultation of the customer with regard to safety and availability of the electrical installation
- Getting acquainted with the measuring instruments used in the field of protective engineering
- Drawing up flow charts for the required tests
- Selecting the required measuring instruments and defining suitable measuring points
- Properly assessing the measuring values with regard to their precision and security
- Describing, planning and executing initial and repeated tests of the electrical installation and writing a test protocol
- Recognizing, describing and measuring fault-caused dangers in the electrical installation and measuring them
- Carrying out systematic fault detection in electrical installations
- Properly assessing and documenting the dangers caused by faulty electrical installation and advising the customer thereof
- Communicating with the customer:
  - upon delivery of the system
  - during the repeated test
  - in the case of failure/breakdown of the electrical installation
  - after successful repair

Technical Data

Sub-distributor with:

- Line circuit breaker: C 16 A; 4-pole
- Line circuit breaker: B 13 A; 1-pole
- Line circuit breaker: B 6 A; 1-pole
- Measuring points available at standard line-up terminals
- Consumers:

- Three-phase consumer:
  Imitation of a 5-pole CEE socket with safety sockets
- AC consumer:
  Lamp operated by a switch with junction box
- Protective AC power socket
- Fault simulator: For simple error simulation with regard to function and protective measure

TRAINING PACKAGE TP 26.1

Mains Systems and Protective Measures

Learning objectives

- Structure of the public supply mains / incoming mains system
- Customer installation of the mains system
- Selection of protective measures according to the requirements of the customer's system
- Selecting and applying measuring instruments according to
  - DIN VDE 0100-410
  - DIN VDE 0100-600
  - DIN VDE 0105-100
  - DIN VDE 0701-0702
  - Accident Prevention Regulations DGUV

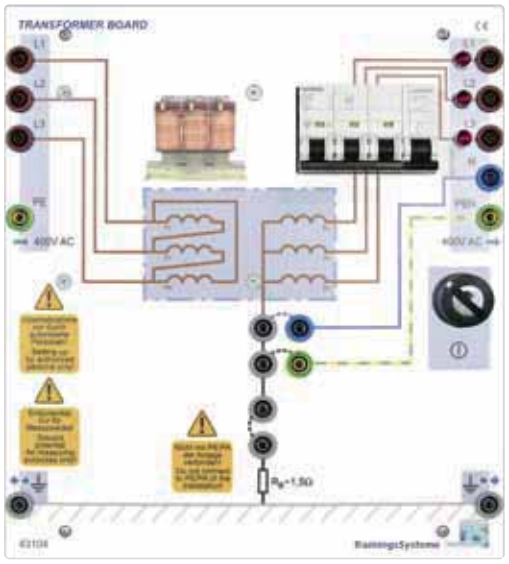
  Interpreting measuring results
- Applying the provisions for the initial and repeated tests and drawing up a flow chart of the required measurements
- Carrying out and describing initial and repeated tests of electrical installations and writing test protocols

No.	Designation	Order No.
1	ELABO Primus One TP 26.1	
2	VDE Power Supply Board	43100
3	Main Distribution Board	43101
4	RCD Board	43102
5	Sub-distribution Board	43103
6	Digital multimeter	90600
7	VDE installation tester	90220


3
5
6
7

MAINS SYSTEMS AND PROTECTIVE MEASURES

IT System: Insulation Monitoring



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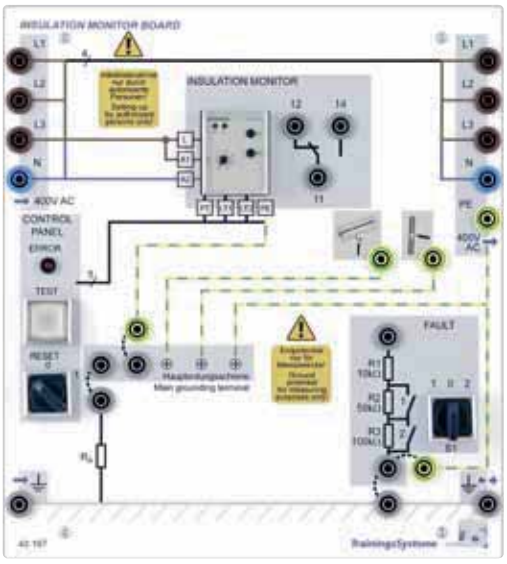


2

Learning objectives

- Introduction of an IT system with insulation monitoring
- Selecting and using measuring and testing instruments and interpreting measuring results
- Proceeding according to regulations of initial and repeated tests and drawing a flow chart of the required measurements
- Checking protective measures in the IT system
- Writing test protocols
- In connection with the RCD-Board (43102): Examining RCD applications in unearthed AC power systems (IT system) with one or three phases

No.	Designation	Order No.
1	Transformer Board	43104
2	Insulation Monitor Board	43107

Technical Data Transformer Board (1)

- Three-phase transformer (400/400 V / 200 VA)
- Line circuit breakers (I_N = 1 A)
- Key-operated switch
- Phase control lamps: L1, L2, L3
- Simple change of mains form via bridging plugs

Technical Data of Insulation Monitor Board (2)

- Insulation monitor for insulation monitoring unearthed AC power supply systems (IT system) with one or three phases
- Supply voltage: 115/230 V AC
- Measuring voltage: up to 500 V AC
- Measuring range: 1 – 110 kΩ
- Pushbutton for resetting of the stored alarm
- Pushbutton for error simulation (external test button)
- Pilot lamp for alarm signal
- Simulation of the building equipotential bonding
- Switchable measuring resistors for generation of insulation errors / earth leakage

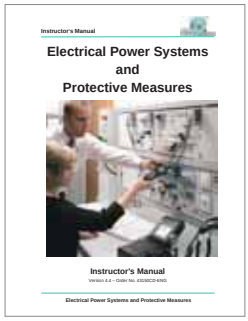
MOBILE LEARNING TRAINER (MLT)

Training Package TP 26.1 / IT System

MAINS SYSTEMS AND PROTECTIVE MEASURES

Courseware

1



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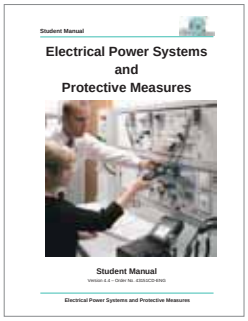

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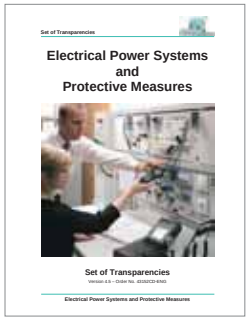
On paper and on CD!



4

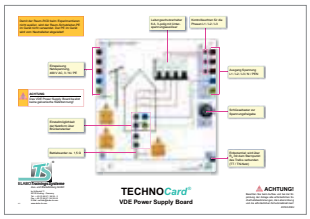
Contents

⟩ 1. Principles
- Mains systems and protective measures
- Providing electric power supply and safety of devices

⟩ 2. Practical measurements
- TN system
- TT system
- IT system

⟩ 3. Inspection of electrical installations
- Initial test
- Repeat test
- Test protocol

Set of TECHOCards® - Mains Systems and Protective Measures



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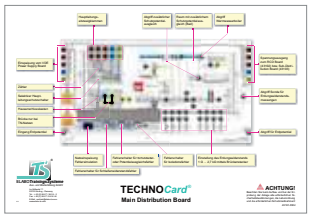

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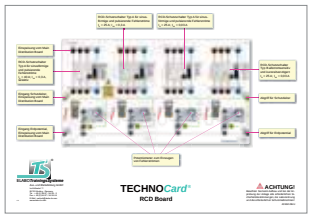

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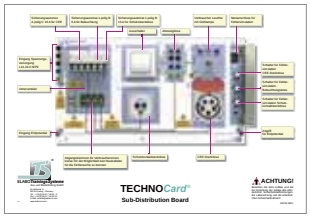

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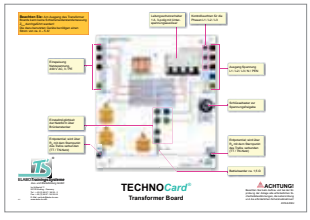

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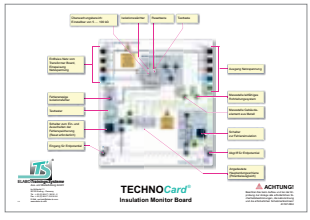

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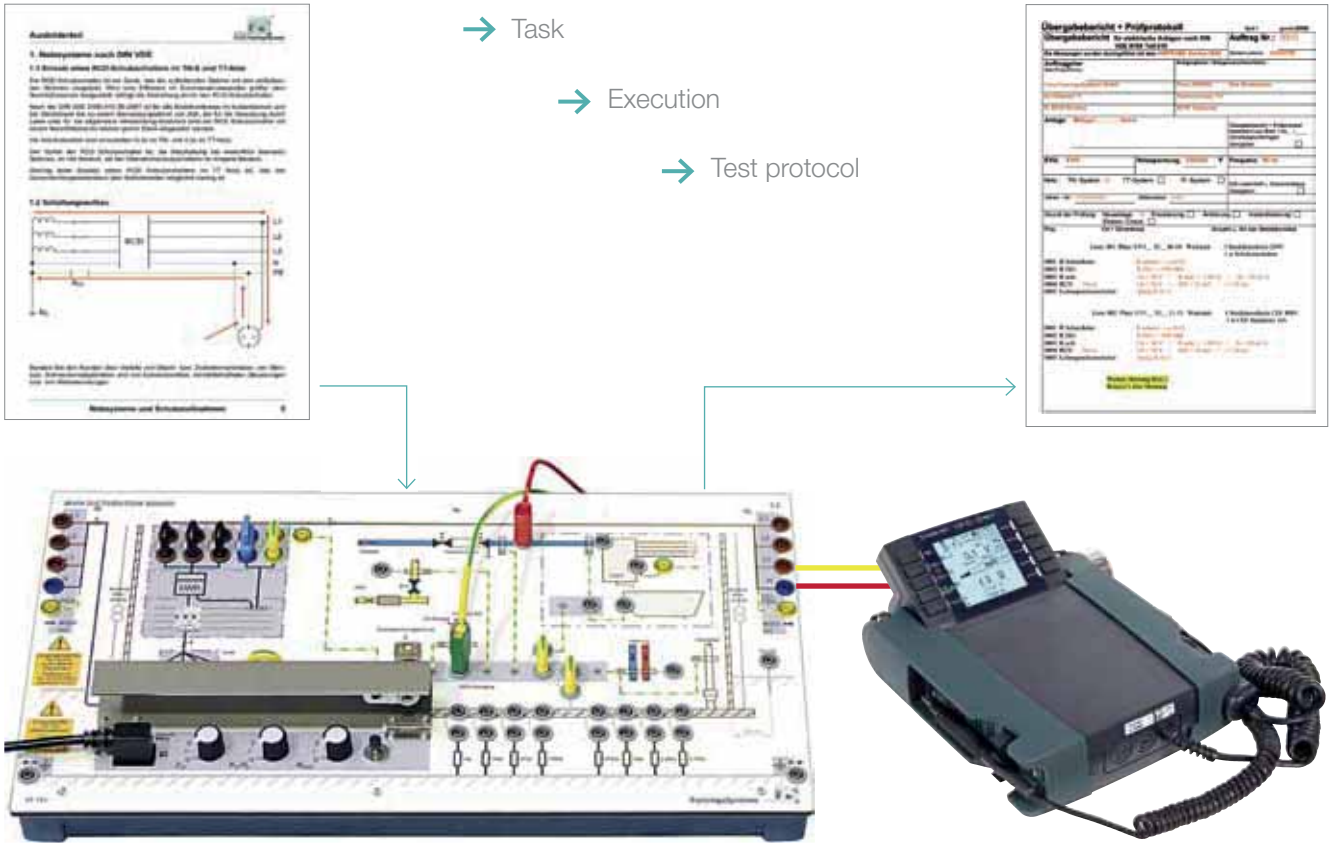
From Principles to Test Protocol...



No.	Designation	Order No.
1	Set of ETS ring binders	91903
2	Mains Systems and Protective Measures – Instructor's Manual	43150CD-ENG
3	Mains Systems and Protective Measures – Student Manual	43151CD-ENG
4	Mains Systems and Protective Measures – Presentation Aids	43152CD-ENG
	Set of TECHNOCards® – Mains Systems and Protective Measures	43153-ENG
5	TECHNOCard® – VDE Power Supply Board	43160-ENG
6	TECHNOCard® – Main Distribution Board	43161-ENG
7	TECHNOCard® – RCD Board	43162-ENG
8	TECHNOCard® – Sub-Distribution Board	43163-ENG
9	TECHNOCard® – Transformer Board	43164-ENG
10	TECHNOCard® – Insulation Monitor Board	43167-ENG
11	Software Protective Measures VDE 0100-600 (optional)	90158

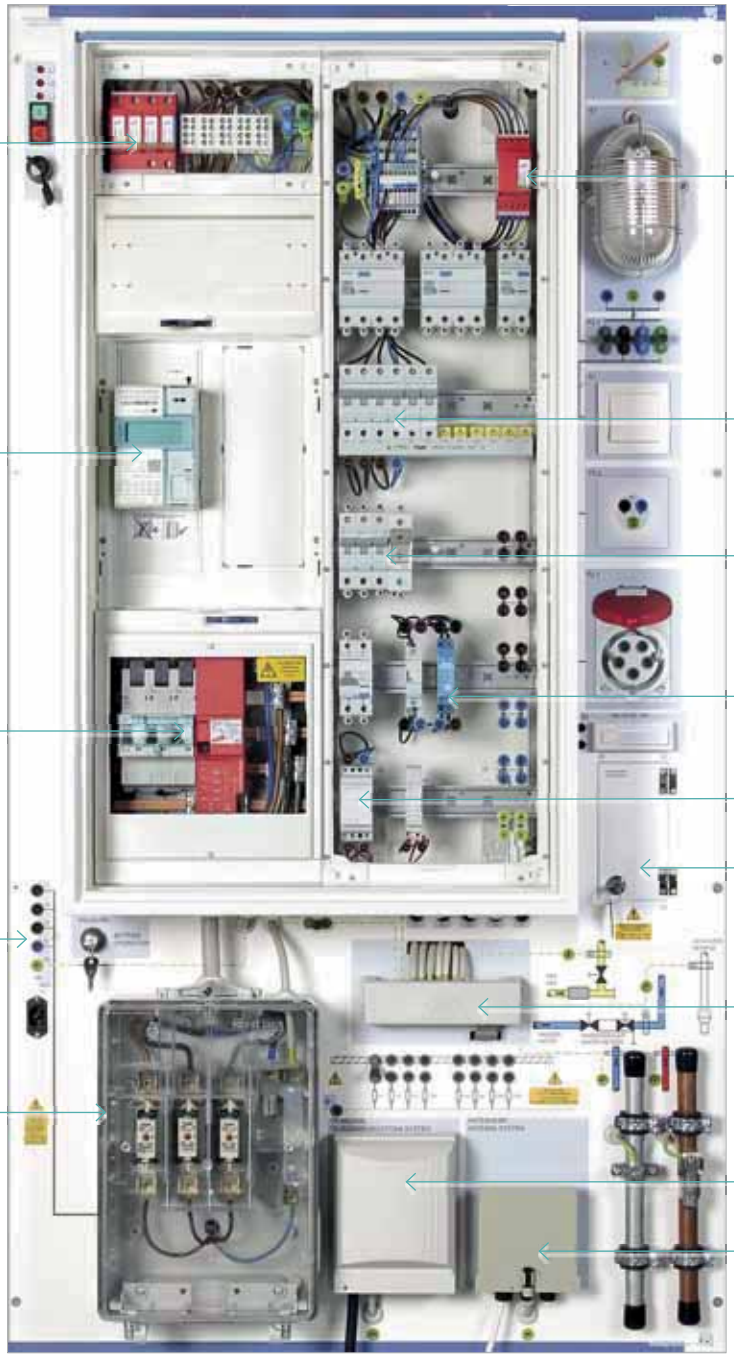
Courseware on Protective Measures
VDE 0100-600 related to the topic of protective measures and testing as well as electrical installations.

- Distribution / feed transformer
- Domestic service connection /
- Earthing installations
- Terminology according to VDE 0100-200
- Hazards from current, hazard diagram
- Protection against direct contact
- Protection against direct and indirect contact
- Protection against indirect contact without PE
- Protection against indirect contact with PE
- Lightning and surge protection
- Tests and measurements in electronic installations
- Device test according to VDE 0701 and VDE 0702

11

VDE 0100 / SERVICE ENTRANCE

BST®–BuildingSystemsTrainer



1

No.	Designation	Order No.
1	BST® Protective Measure (mobile trolley optional)	43503
2	BST® Installation Technologies (mobile trolley optional)	43504

BST® – Mobile – Practical – Safe

Learning Objectives

- Mains of the consumer installation
- Selection of protective measures for a consumer system
- Selecting and applying measuring instruments
  according to:
  DIN VDE 0100-600,
  DIN VDE 0105-1 00 and risk assessment BGV A3
  Interpreting measuring results
- Applying regulations for initial and repeat tests and drawing a flow chart for the required measurements
- Commissioning of a low-voltage system
- Initial and repeat tests of electrical installations and writing a test protocol
- Use of the personal protective equipment
- Planning and executing electrical installations
- Troubleshooting in electrical installations

1

2

The flexible training system for building systems engineering with real components from ETS DIDACTIC. The system is characterized by the holistic approach to knowledge transfer. It is mobile and the workplace can be fitted individually from two sides. The trainee can work and make measurements under real conditions and at the highest possible safety. Apart from troubleshooting, flush-mounted installation, replacement of NH fuses and much more with regard to the training concept is possible.

Courseware

3

4

5

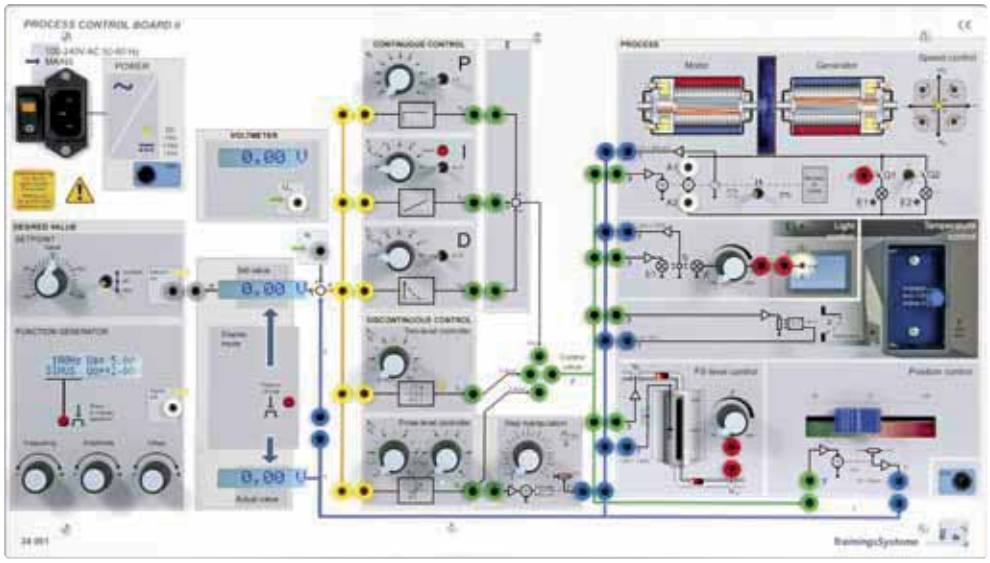
6

On paper and on CD!

No.	Designation	Order No.
3	Set of ETS ring binders	91903
4	Power Supply Systems BST® – Instructor's Manual	43510CD-ENG
5	Power Supply Systems BST® – Student Manual	43511CD-ENG
6	Power Supply Systems BST® – Presentation Aids	43512CD-ENG
n.ill.	Set of TECHNOCards (6 pcs.)	43513-ENG

CONTROL ENGINEERING

Process Control Board II



1

Learning objectives

- ⟩ Difference between continuous and discontinuous controllers
- ⟩ Analysing controlled systems with and without selfregulation and determining the system parameters
- ⟩ Examining the time-dependent behaviour of controllers and controlled systems
- ⟩ Choosing and configuring controllers
- ⟩ Examining control parameters and their correlations
- ⟩ Explaining the function of control circuits and executing measurements

Technical data

Power supply

- ⟩ Wide range input AC 110 V … 230 V, 50 … 60 Hz

Voltage range of all signal inputs and outputs

- ⟩ ± 10 V DC ± 10 %

Test signal generator

- ⟩ Waveforms: DC, sine, triangle, square
- ⟩ Frequency: 0.1 Hz to 1 kHz, setting via incremental encoder
- ⟩ Amplitude U_S = 0 … 10 V, setting via incremental encoder
- ⟩ Offset voltage U_{Offset} = - 5 … + 5 V DC, setting via incremental encoder

Integrated measurement system

- ⟩ … measures the set and actual values (reference input variable and feedback variable) in real time and shows the two quantities in one display each.
- ⟩ The display range can be toggled simultaneously for both displays.
- ⟩ The following selection is available:
  - ± 4000 rpm • ± 80 °C • ± 100 %
  - ± 10.0 V • ± 30 mm
- ⟩ Integrated voltmeter for individual voltage measurements in the range of ±10 V.
- ⟩ Display language: English or German, selectable.

No.	Designation	Order no.
1	Process Control Board II	34001

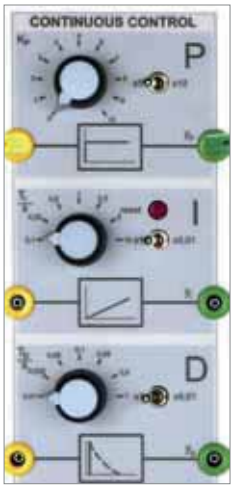
Functional Groups

Controllers

P-element
Adjustment range:
› x 1 K_P = 0 to 10, continuously
› x10 K_P = 0 to 100, continuously

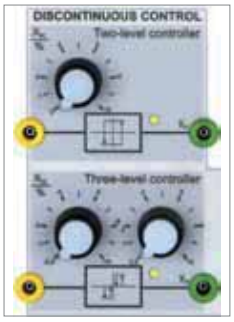
I-element
Can be connected in series or parallel to the P-controller
Adjustment range: T_I = 0.01 to 10 s, in 14 stages

D-element
Can be connected in series or parallel to the P-controller
Adjustment range: T_D = 0.001 s to 1 s, in 14 stages

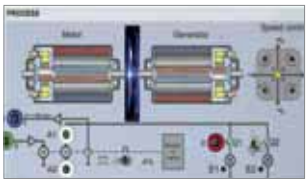


Two-level control
Adjustment range of the hysteresis:
X_H = 0 to 10 %, continuously

Three-level control
Adjustment range of the hysteresis:
+ X_H 0.5 to 10 %, continuously
– X_H 0.5 to 10 %, continuously



Controlled systems



Rotational speed
… consists of a DC motor that is rigidly joined to a generator via the shafts. The manipulated variable is a voltage signal in the range of ± 10 V. The motor reaches rotational speeds of ± 4000 rpm.

Light
… consists of a white LED, which represents the room lighting to be regulated. The manipulated variable is a voltage signal in the range of 0 ... +10 V. The illumination in the room is measured by means of a photo-transistor.

Temperature
… simulates a heating cabinet and consists of two heating elements in a small, limited air volume. The door of the heating cabinet can be opened. The manipulated variable is a voltage signal in the range of 0 ... + 10 V. The temperature in the cabinet is measured by means of a temperature sensor.

Filling level
… simulates a fluid tank with an inlet and outlet valve. The level in the tank is visualised by an LED scrollbar. The manipulated variable is a voltage signal in the range 0 … + 10 V and controls the inflow. The level of the tank is given in %. The output value is a proportional voltage 0 … + 10 V. Two red LED elements in the inflow and outflow visually display the inflow and outflow behaviour.

Position
… is a linear axis. It consists of a small, permanent magnet-excited DC motor, a linear drive and a potentiometer for forming the feedback signal from - 10 V to + 10 V.

Stepmaker
The stepmaker is a special control circuit system for the three-position regulator. The stepmaker represents a motordriven adjusting device, which, upon receiving a positive input signal, for example, opens a valve in steps. In the case of a negative input signal, the valve is once again closed in steps. In case of an input signal of 0 V, the actuating device remains frozen in the momentary state.

CONTROL ENGINEERING

Courseware

1

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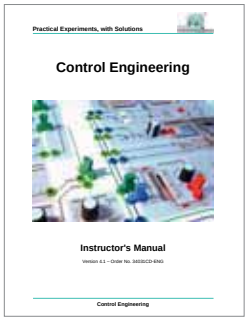

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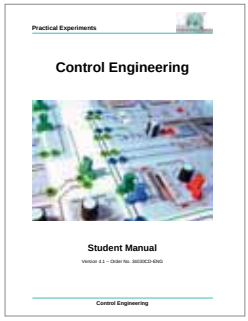

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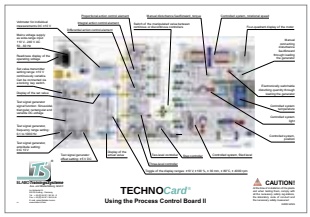
Learning objektives

Exercises:

- Introduction to control technology
- Determining the parameters of the controlled system
- Choose the controller type
- Configuring the control circuit
- Temperature control with PID-controller
- Temperature control with two-level controller
- Position control with continuous control device
- Level control with two-level controller
- Level control with PI-controller
- Rotational speed follower control
- Rotational speed fixed value control
- Light regulation with two-level controller
- Light regulation with PI-controller
- Actuator with three-level control, three-point step controller



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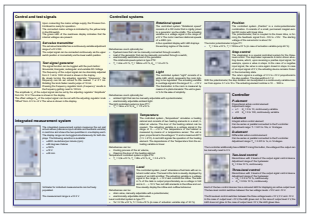

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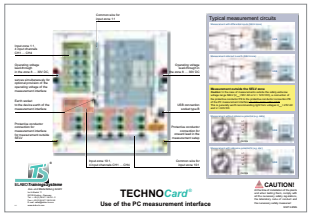

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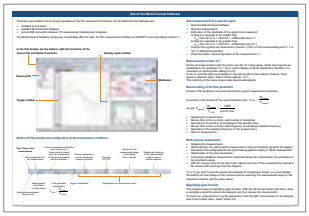

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No.	Designation	Order no.
1	Media Folder Set	9403
2	Control Engineering – Instructor's Manual	34031CD-ENG
3	Control Engineering – Student Manual	34032CD-ENG
4	TECHNOCard® – Using the Process Control Board	34032-ENG
5	TECHNOCard® – Use the PC Measurement Interface	90273-ENG

The TECHNOCards® are a very useful complement 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

PHOTOVOLTAICS

From the Cell to the Module

1

Learning Objectives

- Key solar cell data
- Linking solar cells and modules
- Bypass diodes
- String diodes
- Partial switch-off of cells and modules
- Partial failure of modules
- Solar cell output under different radiation conditions

Technical data PV Board

- 6 solar cells, wired separately, mounted able to rotate and swivel
- 6 diodes, can be used as string or bypass diodes
- 1 dimmable light source, can be swivelled to simulate the sun's path
- Simulation PV-generator U_0 18 V, I_{SC} 2.5 A for connection to real charge controllers
- Voltage, current and power meters with USB interface
- Electronic load, to be set manually and using software

No.	Designation	Order no.
1	PV Board	44100

Off-Grid Charge Controller Board and Series Charge Controller Board

Built-in meters for current, voltage and power

1

2

Built-in meters for current, voltage and power

3

4

Technical data
Off-Grid Charge Controller Board
Off-grid charge controller with display
- With additional integrated meter for current, voltage, power
- PWM-controlled
- System voltage: 12 V DC
- Maximum load current: 10 A

Technical data
Series Charge Controller Board
Off-grid charge controller
- With additional integrated meter for current, voltage, power
- Serial control
- System voltage: 12 V DC
- Maximum load current: 6 A

Technical data
Low-Voltage Consumer Board
- Low-voltage consumers
- LED lamp 1 W
- Fluorescent lamp 7 W
- Halogen lamp 20 W

Technical data
Battery
- Battery 12 V DC
- Lead gel battery with 7.8 Ah
- Built-in fuses
- Integrated, switchable meter for current, voltage, power

Learning Objectives
- Types of charge controllers
- Discharge protection
- Deep discharge protection
- Energy storage
- Operation of consumers at a rechargeable lead gel battery
- Power adaptation

No.	Designation	Order no.
1	Off-Grid Charge Controller Board	44100
2	Series Charge Controller Board	44101
3	Low-Voltage Consumer Board	44106
4	Battery Board	44102

PHOTOVOLTAICS

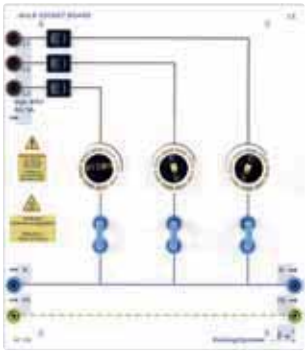
Off-Grid Inverter Board and Bulb Socket Board Extension

1

Technical data

Off-Grid Inverter Board

- Off-grid inverter
- Input voltage: 12 V DC
- Output voltage: 230 V AC / 50 Hz, 275 VA, sinus-shape
- Integrated metering device for current, voltage, effective, apparent and blind power, power factor, energy



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Technical Data

Bulb Socket Board

- Lighting technology board with sockets for 4 bulbs (E27)

3

Set of Bulbs

- Comprising 6 lamps 230 V

4

PV Sun Position Simulation

Mobile frame for carrying out technical measurements on solar modules

- Light source with dimmer, can be rotated and swivelled, for simulating the position of the sun during the day and during the year
- Operating voltage 230 V
- Module holder for the 10W and 50W solar modules from module sets 44121 and 44122, adjustable, for simulating different roof angles, adjustment using a degree scale
- The frame is also suitable for the use of 50W modules outdoors
- The modules are attached using genuine roof attachment material, making the frame suitable for installation practice

Learning Objectives

- Stand-by losses
- Efficiency of inverters
- Start-up behaviour of inverters
- Voltage shape and harmonics
- Load behaviour

No.	Designation	Order no.
1	Off-Grid Inverter Board	44100
2	Bulb Socket Board	44101
3	Set of Bulbs	44106
4	PV Sun Position Simulation	44102

Set-up Variant – DC Off-grid Systems with Off-grid Inverter and AC Load

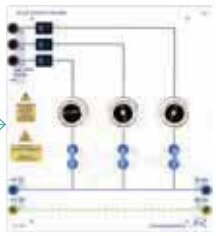
No.	Designation	Order no.
1	PV Sun Position Simulation	44102
2	PV Board	44100
3	Series Charge Controller Board	44106
4	Off-Grid Charge Controller Board	44101
5	Off-Grid Inverter Board	44104
6	Bulb Socket E27 Board	43126
7	Battery Board 12 V DC	44102
8	Solar Modules Set 10 W	44121
9	Solar Modules Set 10 W	44122

1

DC

3

DC



2 4 5 6

DC

7

8

Solar Modules Set 10 W

- The set contains one polycrystalline (10 W) and one amorphous (6 W) solar module
- The modules are equipped with an installation frame and Sun-clix connectors ready for connection

9

Solar Modules Set 50 W

- The set contains one monocrystalline (50 W) and one polycrystalline (45 W) solar module
- The modules are equipped with an installation frame and Sun-clix connectors ready for connection

PHOTOVOLTAICS

Courseware

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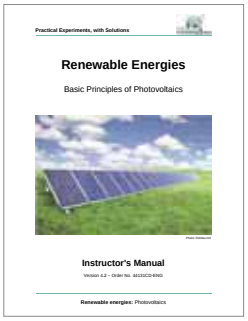

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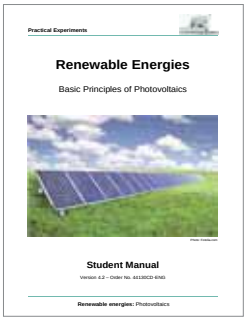

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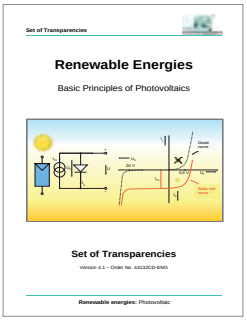

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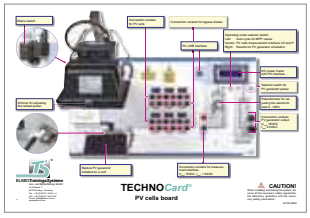

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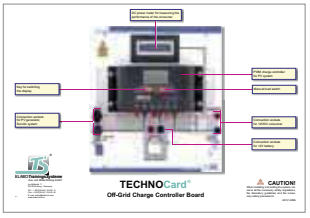

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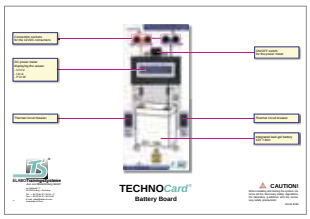

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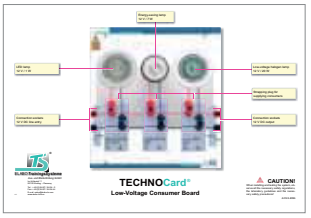

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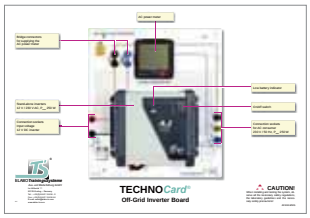

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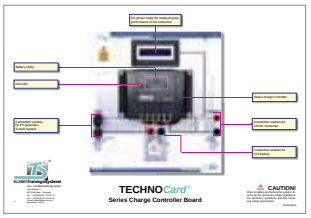

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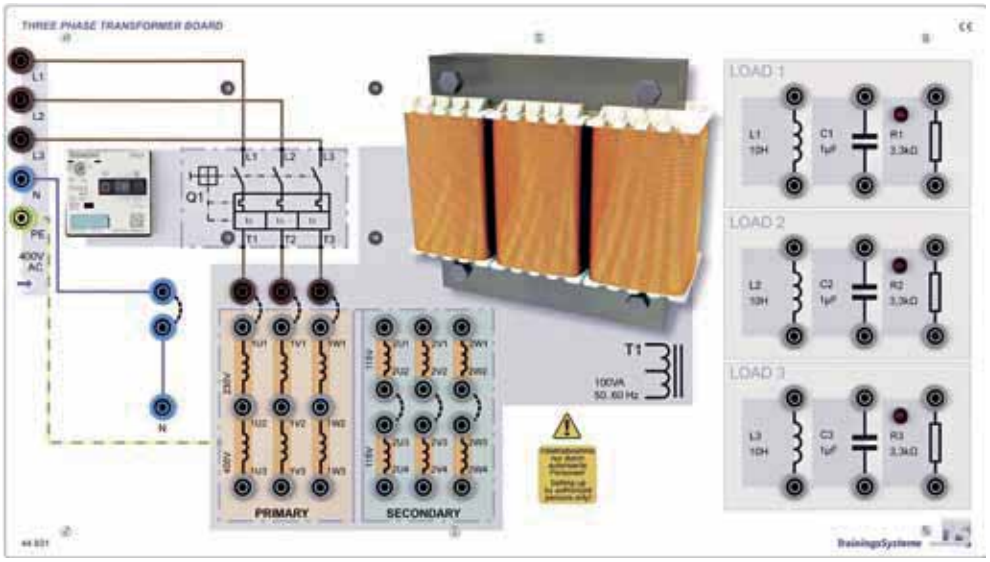
Content

- Exercise 1: Investigating PV cells Open-circuit voltage and short-circuit current with different levels of irradiation
- Exercise 2: Investigating PV cells Influence of temperature
- Exercise 3: Influence of contamination on solar modules
- Exercise 4: Influence of the arrival angle and azimuth angle on the power of a PV cell
- Exercise 5: Wiring solar cells to modules
- Exercise 6: Shading
- Exercise 7: Using bypass diodes
- Exercise 8: Setting up a stand-alone PV system for stand-alone operation
  Stand-alone PV system with DC system storage battery
- Exercise 9: Stand-alone PV system with storage device and inverter

No.	Designation	Order no.
1	Media Folder Set	9103
2	Renewable Energies – Instructor's Manual	44131CD-ENG
3	Renewable Energies – Student Manual	44130CD-ENG
4	Renewable Energies – Set of Transparencies	44132CD-ENG
5	TECHNOCard® – PV Cells Board	44140
6	TECHNOCard® – Off-Grid Charge Controller Board	44141
7	TECHNOCard® – Battery Board	44142
8	TECHNOCard® – Low-Voltage Consumer Board	44143
9	TECHNOCard® – Off-Grid Inverter Board	44144
10	TECHNOCard® – Series Charge Controller Board	44146

1- AND 3-PHASE TRANSFORMERS

Three-Phase Transformer Board



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The Three-Phase Transformer Board is configured through individual wiring of the primary and secondary windings via 4mm safety sockets. The primary connection of the transformer is protected by means of a 3-phase load-break switch against short-circuits and overload.
For simpler and safer experimenting with the 3-phase transformer, there are three load groups integrated, consisting of R, L and C for a nominal voltage of 230 V AC. All the load components are freely connectable via 4mm safety sockets. The dimensioning of L and C allows the mutual compensation. The 3-phase transformer can also be operated as a 1-phase transformer.

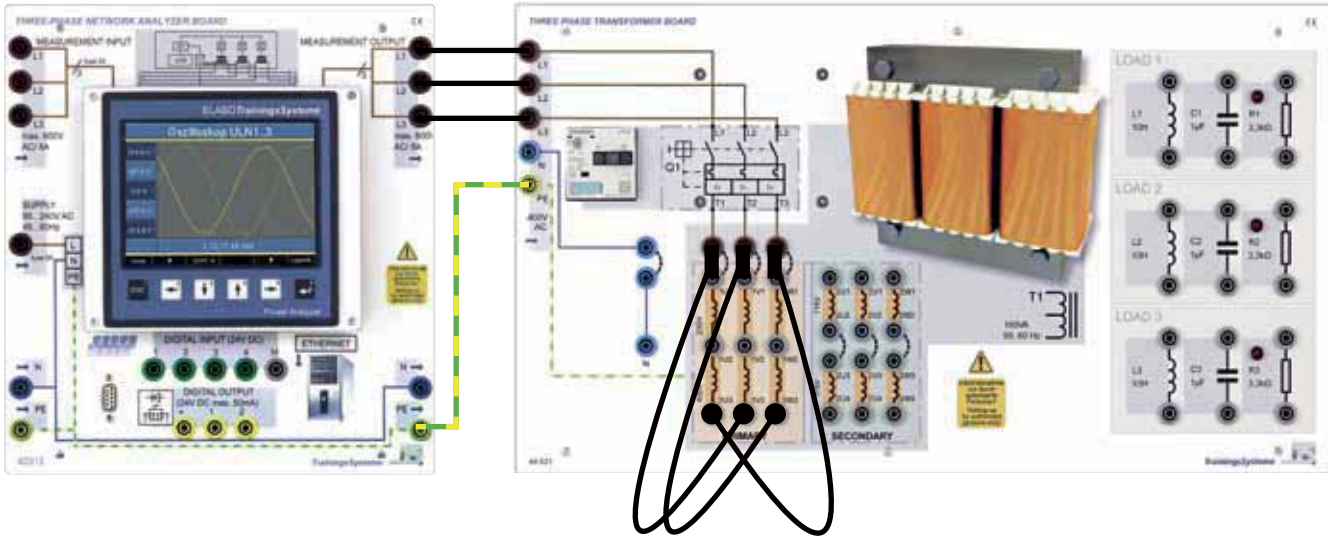
Learning objectives

- ⟩ Transformers and their applications
- ⟩ 1-phase transformer
- ⟩ Construction principle of transformers
- ⟩ Autotransformers
- ⟩ Transformer protection devices
- ⟩ 3-phase transformer
- ⟩ Operational behaviour
- ⟩ Three-phase system
- ⟩ Load types
- ⟩ Circuit types and designations
- ⟩ Compensation
- ⟩ Switching groups
- ⟩ Efficiency

Technical data

- ⟩ Input AC 3 x 230 V, 50 … 60 Hz or AC 3 x 400 V 50 … 60 Hz
- ⟩ Overload limited to 10 … 160 mA
- ⟩ Limited rated motor power 65 W for AC 3 x 400 V
- ⟩ Short circuit triggering at 2.1 A
- ⟩ Primary AC 3 x 400 V, 50 … 60 Hz or AC 3 x 230 V, 50 … 60 Hz
- ⟩ Secondary 3 x (2 x 115 V)
- ⟩ Rated motor power 100 W for AC 3 x 400 V

Investigations on 1-phase and 3-phase Transformers

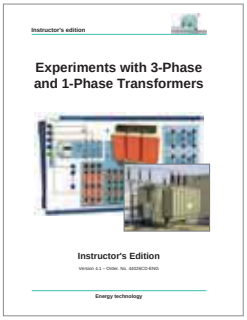


2 1

The Three-Phase Network Analyzer Board (40312) is ideally suited for the investigations on the transformer.

Courseware

3



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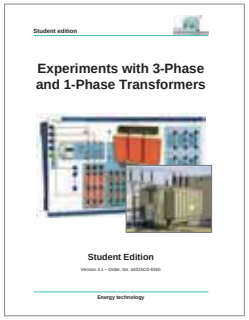

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No.	Designation	Order no.
1	Three-Phase Transformer Board	44021
2	Three-Phase Network Analyzer Board	40312
3	Media Folder Set	9103
4	Experiments wiht 3-Phase and 1-Phase Transformers – Instructor's Manual	44026CD-ENG
5	Experiments wiht 3-Phase and 1-Phase Transformers – Student Manual	44025CD-ENG

REACTIVE POWER COMPENSATION

Reactive Power Controller

1

Learning objectives

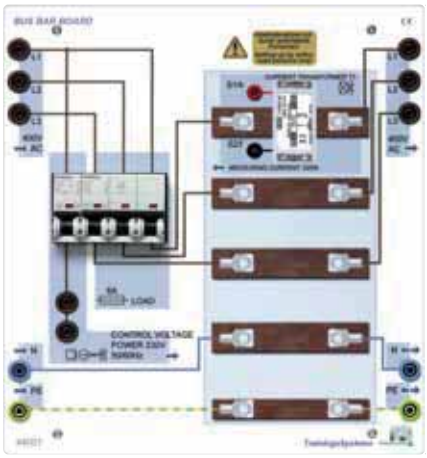
- Designing compensation systems
- Calculation of compensation capacitors
- Connection of capacitors
- Compensation systems and harmonics
- Fixed compensation
- Automatic compensation via reactive power controllers
- Commissioning a reactive power controller
- Measurements on the electrical system

Technical data

- Operating voltage 400 V AC / 50 Hz
- Current input, converter x / 1 A and x / 5 A
- 6 relay outputs 230 V, max. 2 A
- Alarm output 230 V, max. 2 A
- Display of the relative values at the LCD
- Automatic configuration
- Manual configuration
- 6 programmable regulating steps

No.	Designation	Order no.
1	Compensation Control Board	44003
2	Bus Bar Board	44001
3	Compensation Board	44005
4	Compensation Contactor Board	44004
5	3-Phase Motor	57104

An Overview of the System



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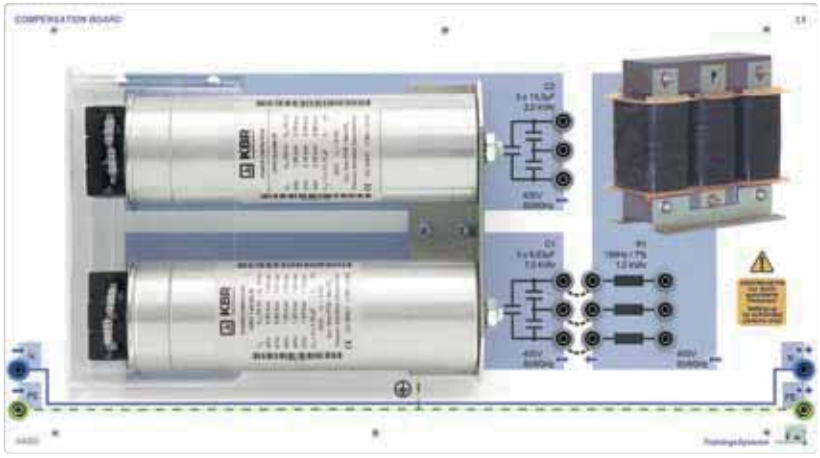

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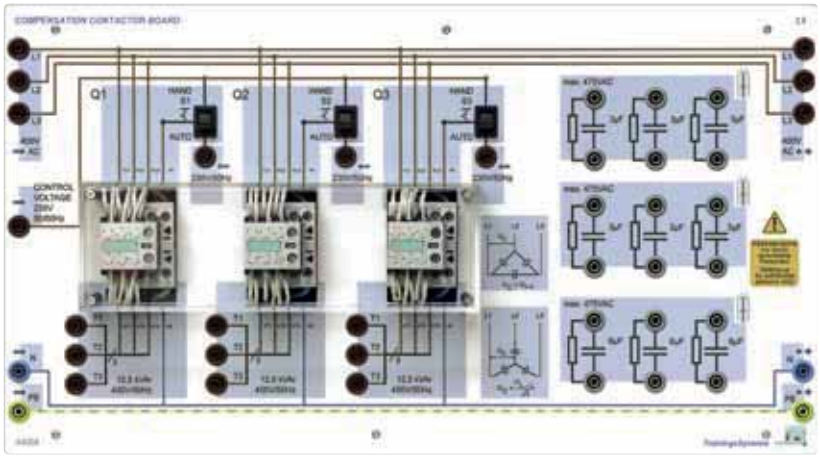

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REGULATED REACTIVE POWER COMPENSATION


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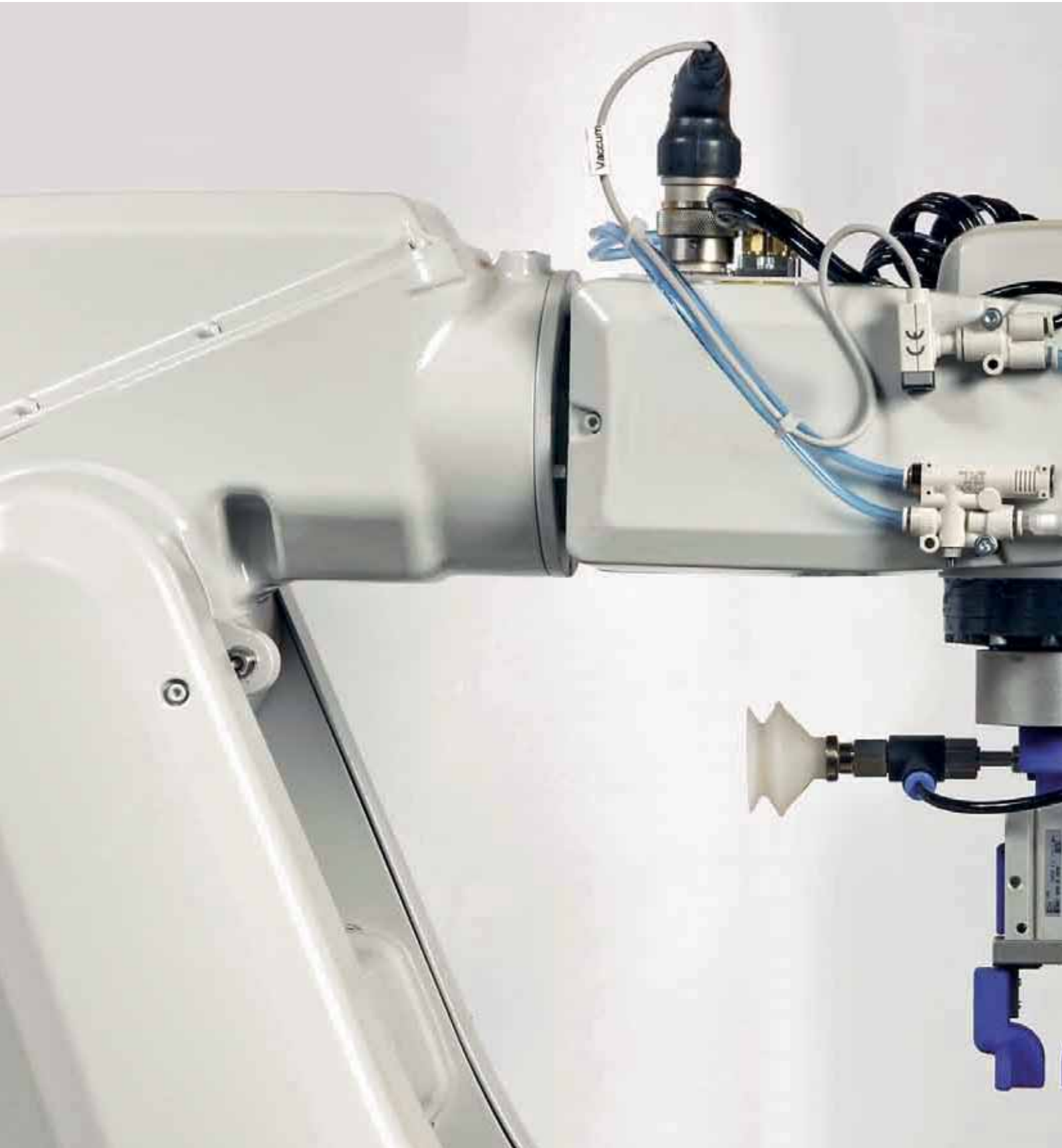

Vacuum

CONTROL TECHNOLOGY AUTOMATION AND MECHATRONICS

Contactor Control Technology

Safety Engineering

Automation

Drive Technology / Power Electronics

Industry 4.0

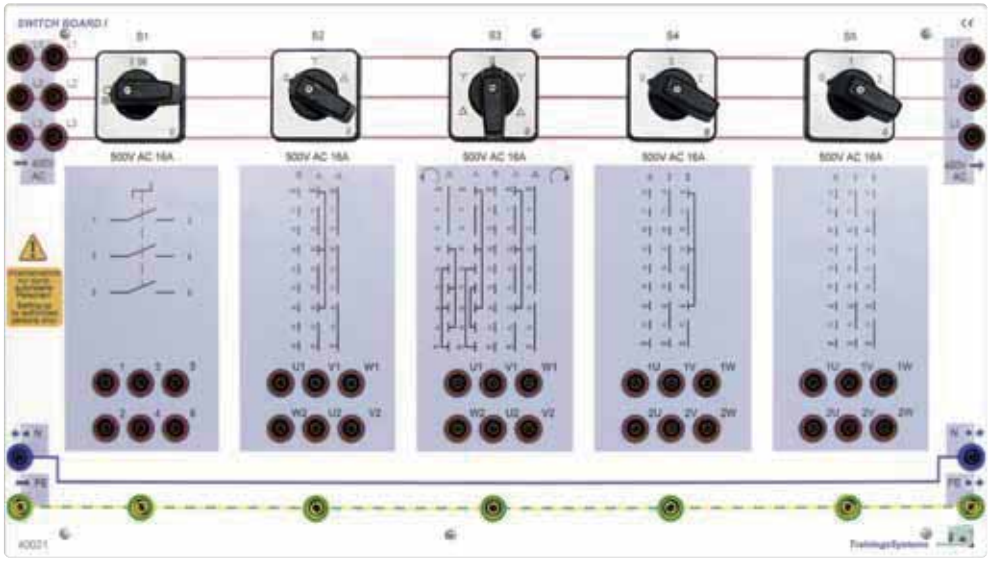
Mechatronics

Robotics

AR – Augmented Reality – tec2*SKILL*®

HAND-OPERATED SWITCHES

Switch Board I



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Learning Objectives

- ⟩ Connecting hand-operated industrial low-voltage switching devices
- ⟩ Function test of start, reversing and step circuits
- ⟩ Troubleshooting and maintenance

Technical Data

- ⟩ Rated voltage 230 – 400 V AC
- ⟩ Rated current 10 A
- ⟩ Frequency 50 / 60 Hz
- ⟩ Breaking capacity 6 kVA

2

Features

- ⟩ 1 on/off switch, 3-pole
- ⟩ 1 star-delta switch
- ⟩ 1 star-delta reversing switch
- ⟩ 1 pole-changing switch for Dahlander circuits
- ⟩ 1 pole-changing switch for separate windings

No.	Designation	Order no.
1	Switch Board I	40021
2	Variable Compound Wound DC Machine	57109
3	Media Folder Set	9103
4	Contactor Control Part 1: Hand-operated switches – Instructor's Manual	40101CD-ENG
5	Contactor Control Part 1: Hand-operated switches – Student Manual	40100CD-ENG
6	Contactor Control Part 1: Hand-operated switches – Set of Transparencies	40102CD-ENG
7	Contactor Control Part 3: Expert Circuits – Set of Transparencies	40301CD-ENG
8	Contactor Control Part 4: Industrial Measuring Instruments – Set of Tr.	40401CD-ENG
9 – 15	Set of TECHNOCards® – Contactor Control Part I	40120-ENG

Courseware

3

Printed and digital

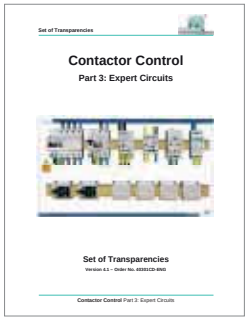
4

5

6

Manual content

- Introduction
- Controlling with control switch ON/OFF
- Controlling with direction of rotation switch
- Controlling with star/delta switch
- Controlling with star/delta reversing switch
- Controlling with pole changing switch
- Controlling with pole changing switch for two seperate windings



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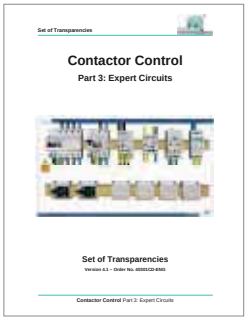

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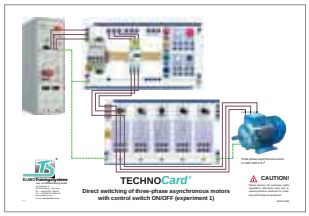

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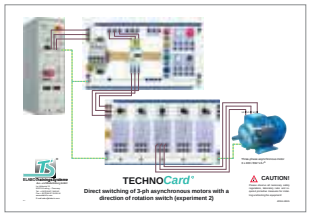

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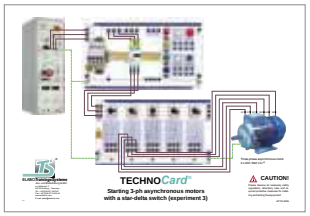

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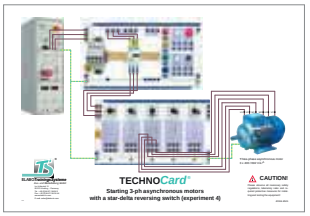

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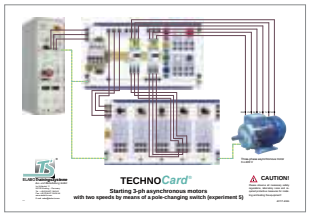

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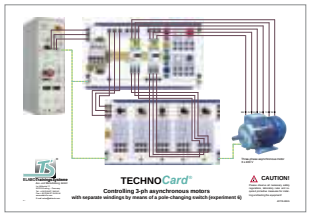

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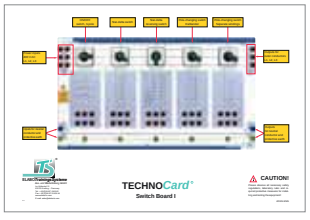
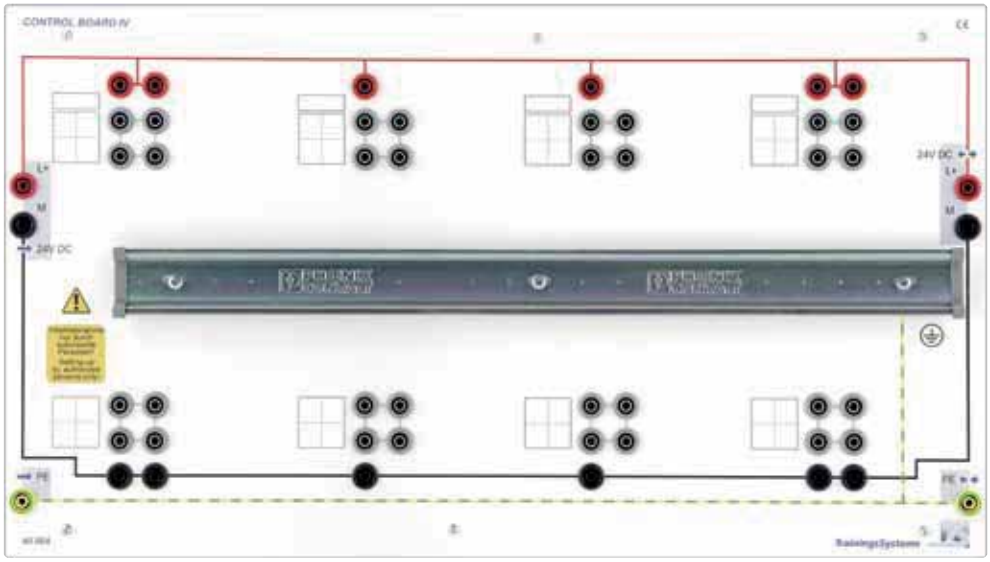


15

CONTACTOR, CONTROL AND INSTALLATION CIRCUITS 24

Control Board IV



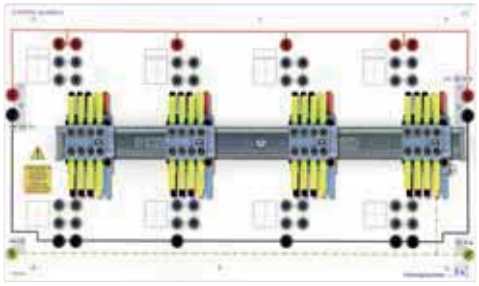
1

Learning objectives

- Practice-oriented setting up and commissioning of contactor, control and installation circuits
- Standard arrangement of main and auxiliary current circuits
- Systematic terminal labelling, function test and troubleshooting
- Setting up safety circuits of all categories with contactors
- Standard arrangement of control, release and load current circuits

Technical data

- Main circuit current 6 A max.
- Control circuit current 24 V DC

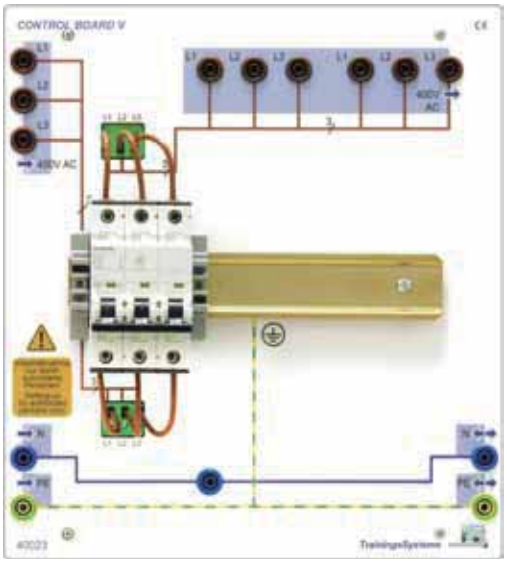


Control Board IV mounted with 4 contactors

No.	Designation	Order no.
1	Control Board IV	40004
2	Control Board V	40023
3	Switch Board II – 24 V	40000

V

Control Board V



2

Learning objectives

- Standard arrangement of a load circuit in a 24 V control circuit
- Getting familiar with line protection devices
- Getting familiar with motor protection devices
- Load circuit structure
- Commissioning and troubleshooting

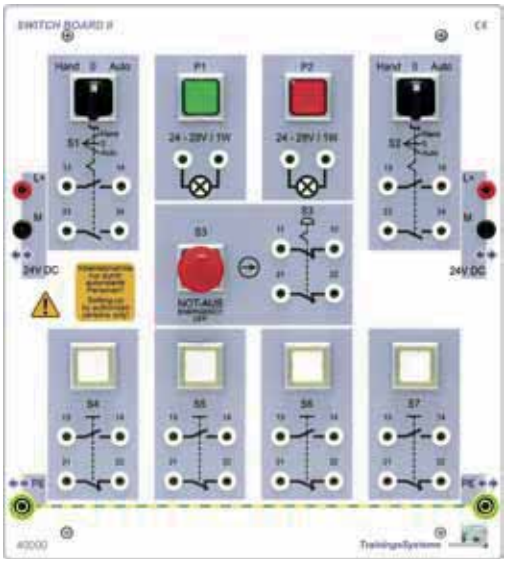
Technical data

- Main circuit voltage 230 – 400 V AC
- Main circuit current 10 A max. Frequency 50/60 Hz Breaking capacity 6 kVA

Features

- 1 circuit breaker, 3-pole, C 10 A
- 2 motor protection switches, 0.6 … 1 A with auxiliary switch

Switch Board II – 24 V



3

Learning objectives

- Setting up and testing a control current circuit
- Superordinate command devices, control buttons, control switches and Emergency-Stop buttons
- Signal lamps

Technical Data

- Rated voltage 24 V DC
- Rated current 5 A

Features

- 1 Emergency-Stop button (2 NC)
- 4 control pushbuttons (NC, NO)
- 2 control switches (hand, 0, automatic, 2 NO)
- 1 signal lamp, 24 V DC, red
- 1 signal lamp, 24 V DC, green

SIMPLY SAFE

Safety Position Switch Board

1

Learning objectives

- Realise control circuits in different control categories 1 – 4 up to Performance Level e
- Plant circuit with controlled separation protective device
- Redundant structure of safety circuits
- Controlled separation protective devices with bolt
- Display of the plant states with an indicator lamp

Functions

- 1 Safety position switch with bolt
- 1 Safety position switch with separate actuator
- 2 Safety position switch with roller lever
- 1 indicator lamp, red, 24 V DC
- 1 indicator lamp, green, 24 V DC

Technical data

- Control circuit voltage 24 V DC
- Rated current 5 A
- Operating voltage of the lamps 24 V DC

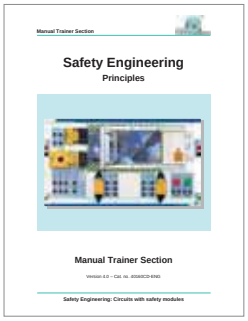
No.	Designation	Order no.
1	Safety Position Switch Board	40052
2	Media Folder Set	9103
3	Safety Engineering / Principles – Instructor's Manual	40160CD-ENG
4	Safety Engineering / Principles – Student Manual	40161CD-ENG
5	Safety Engineering / Principles – Set of Transparencies	40162CD-ENG
6	Safety Engineering / General Information – Set of Transparencies	40167CD-ENG
7	Safety Engineering / Principles – Commissioning and Troubleshooting	40178CD-ENG
8	TECHNOCard® – Emergency stop circuit	40169-ENG
9	TECHNOCard® – Safe two-hand circuit	40170-ENG
10	TECHNOCard® – Safe time circuit	40171-ENG

COURSEWARE

Manual of Safety Engineering “Basic Circuits with Safety Modules”

2

Printed and digital



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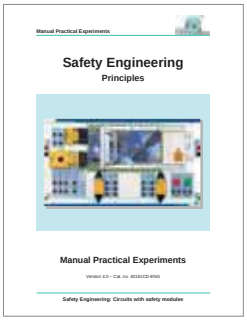

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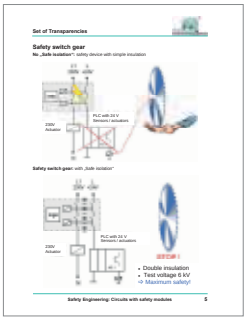

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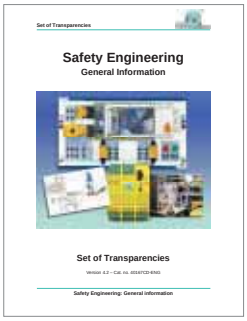

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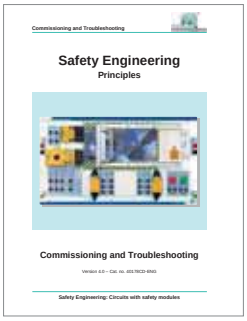


7

Supplementary manual Commissioning and troubleshooting

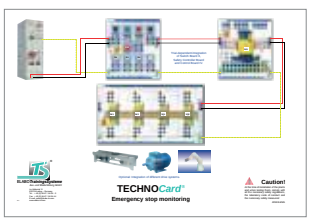
- 1. Handling the safety switchgear
- 2. Sample solutions for the given programs with the basic experiments of emergency-stop monitoring, two-hand operation, safe time function

Manual contents

- 1. Emergency stop monitoring: PL d, controller category 3 with Reset button
- 2. Two-hand operation type 3: PL d, controller category 3
- 3. Safe time function: PL d, controller category 3, safety door opening after a given time with Reset button
- Solution part with extensive theoretical introduction to the subject of safety engineering

On the transparencies, the most important points of machine safety are explained lucidly and different systems are illustrated.

TECHNOCards®



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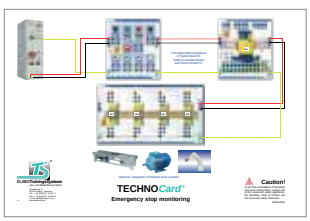

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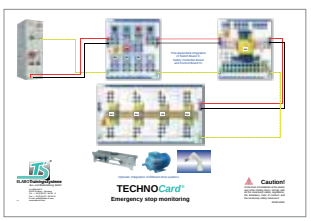


10

MACHINE SAFETY

Optical Protection System

1

Learning objectives

- Constructing and optimising fundamental circuits with safety switchgear in keeping with what is done in practice
- Construction, system behaviour and handling of optical safety switchgear
- Functional operation, cross-circuit safety and error monitoring

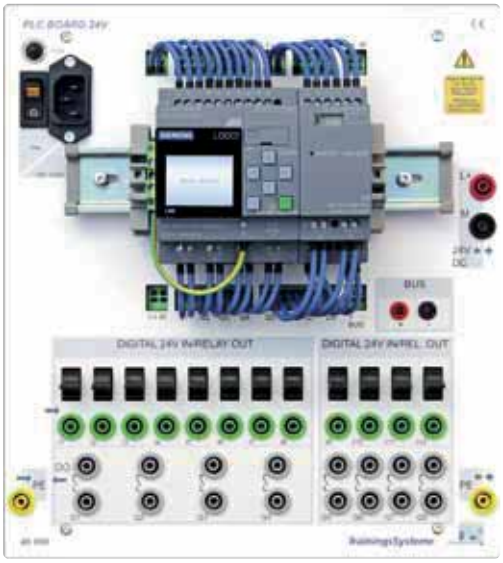
Technical data

- Operating voltage 24 V DC
- Safety light barrier of type 2, 120 mm structural length, transmitter and receiver assembled and wired
- 2 multi-function inputs
- 2 OSSD outputs with LED status indication on the Board
- 2 indicator lamps (24 V DC / LED), red and green

No.	Designation	Order no.
1	Safety Light Curtains Board	40066

AUTOMATION

Programmable Logical Modules



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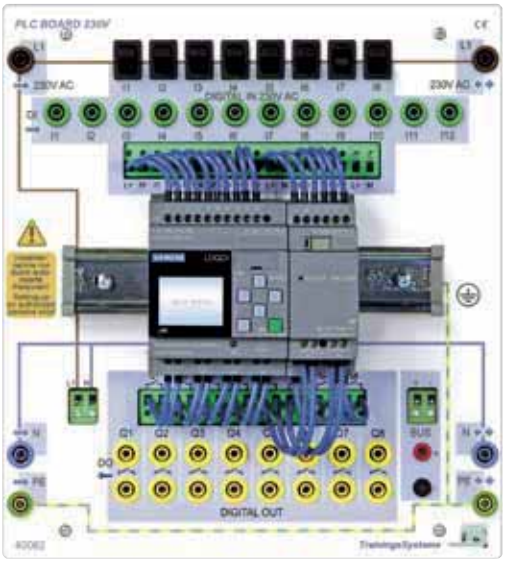


2

Learning Objectives
Programmable Logical Modules / Digital Technology

- Logical operators
- Parameterization of logical modules
- Fundamentals of digital technology
- Programming with the operator elements
- Programming with the PC
- Use of web servers
- Communication

Technical Data (1)
Training system LOGO8! 12/24 RCE

- Integrated backlit display field and operator control panel
- Integrated EEPROM memory
- 8 iputs 0 – 10 V
- 4 relay outputs, 10 A max.
- Short circuit protection by external fusing
- 8 integrated time switches
- Power reserve approx. 480 h
- Expandable with further modules
- Programming via ethernet
- Integrated web server

Expansion module

- 4 digital inputs
- 4 relay outputs 5 A max.
- Short circuit protection by external fusing

mounted on PLC Board 24 V DC (40014)

Technical Data (2)
Training system LOGO8! 230 RCE

- Integrated backlit display field and operator control panel
- Integrated EEPROM memory
- 8 digital inputs
- 4 relay outputs, 10 A max.
- Short circuit protection by external fusing
- 8 integrated time switches
- Power reserve approx. 480 h
- Expandable with further modules
- Programming via ethernet
- Integrated webserver

Expansion module

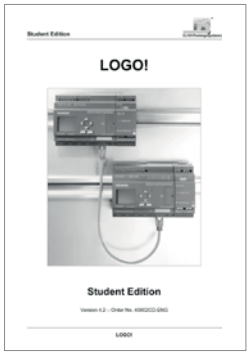
- 4 digital inputs
- 4 relay outputs 5 A max.
- Short circuit protection by external fusing

mounted on PLC Board 230 V AC (40015)

Courseware

3

4



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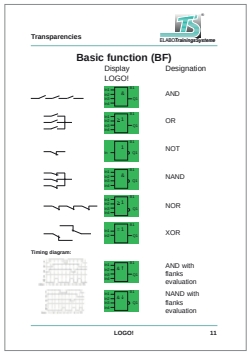
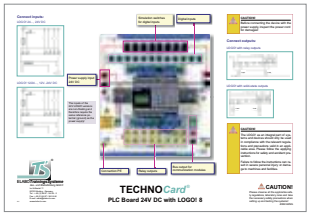


6

Printed and digital



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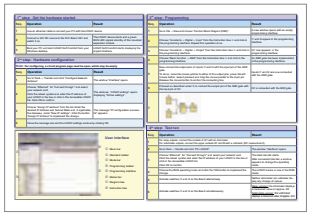


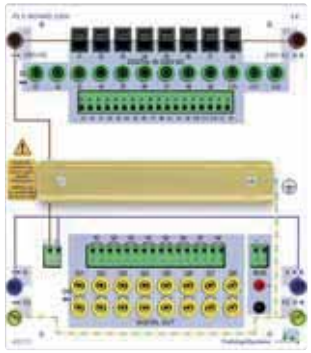
7

Manual contents LOGO!

- Main switch – switches – consumers
- Hall lighting with surge relay
- Stairway lighting with automatic control
- Setting the time and clock operation
- Linking the LOGO! with the pc via ethernet

No.	Description / Title	Order no.
1	Training system LOGO!8 12/24RCE	40043
2	Training system LOGO!8 230RCE	40082
3	Media Folder Set	91903
4	"LOGO!" – Instructor's Edition	40801CD-ENG
5	"LOGO!" – Student Edition	40802CD-ENG
6	"LOGO!" – Set of Transparencies	40803CD-ENG
7	TECHNOCard® "PLC Board LOGO!8 24 V DC"	40820-ENG
Not ill.	TECHNOCard® "PLC Board LOGO!8 230 V DC"	40814-ENG
8	PLC Board 24 V (optional)	40014
9	PLC Board 230 V (optional)	40015
Not ill.	Power supply 24 V DC (optional)	63526
Not ill.	Power pack (alternatively)	C311010
Not ill.	Industrial ethernet cable	C805152

8



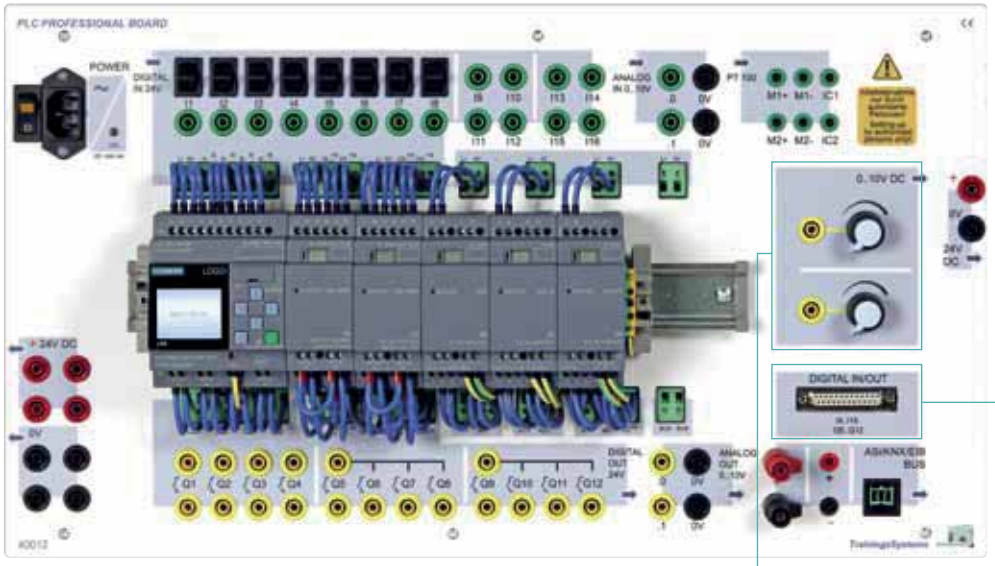
9

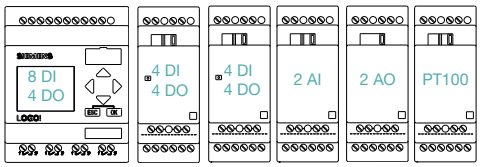
Technical Data of PLC Board 24 V and PLC Board 230 V

- 12 inputs on line-up terminals and safety sockets
- 2 additional outputs
- 8 outputs on line-up terminals
- 2 connectors for bus systems
- 8 push/lock-in switches for input simulation
- Power supply via safety sockets
- Distributive connections for power supply

TRAINING IN PROGRAMMING AND FUNCTION

PLC Professional Board





1

Learning objectives

- Parameterizing of logic modules
- Fundamentals of digital technology
- Programming with operating elements
- Programming with PC
- Analog value processing
- Temperature value recording PT100

Features

- 1 LOGO! 8 24RCE
- 1 DM8 12/24R extension based on:
- PLC Professional Board (40020) attachment of LOGO!- and EASY control systems and additional components with 24V-Power supply
- Including software: LOGO! Soft Comfort

2 x 0...10 V DC
Analog value simulation

Connection of transfer system and automats

No.	Designation	Order no.
1	LOGO!8 Training System Professional Board 24 V DC	44044


SIEMENS
LOGO!
Hello World!
LAN
RUN/STOP
MAC ADDRESS
OUTPUT 4xRELAY/10A

PROGRAMMABLE CONTROLLER

Automation Board S7-1500

1

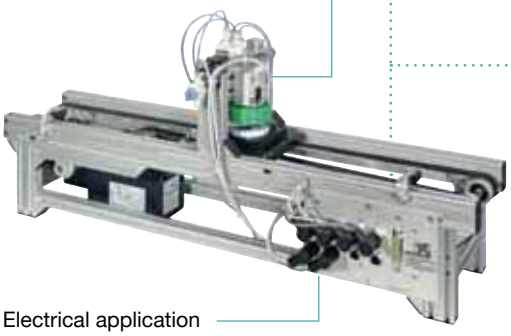
Learning objectives

- Basic functions of GRAFCET programming
- Standards-compliant programming
- Checking for logical errors
- Commissioning in online mode
- Function test on a S7-300 or S7-1200 and S7-1500

2

3

Automatic assembly machine electropneumatic application – step sequence



Electrical application

4

"The key for the production process"

Automation Board S7-1200

4

"*The details make the difference*"

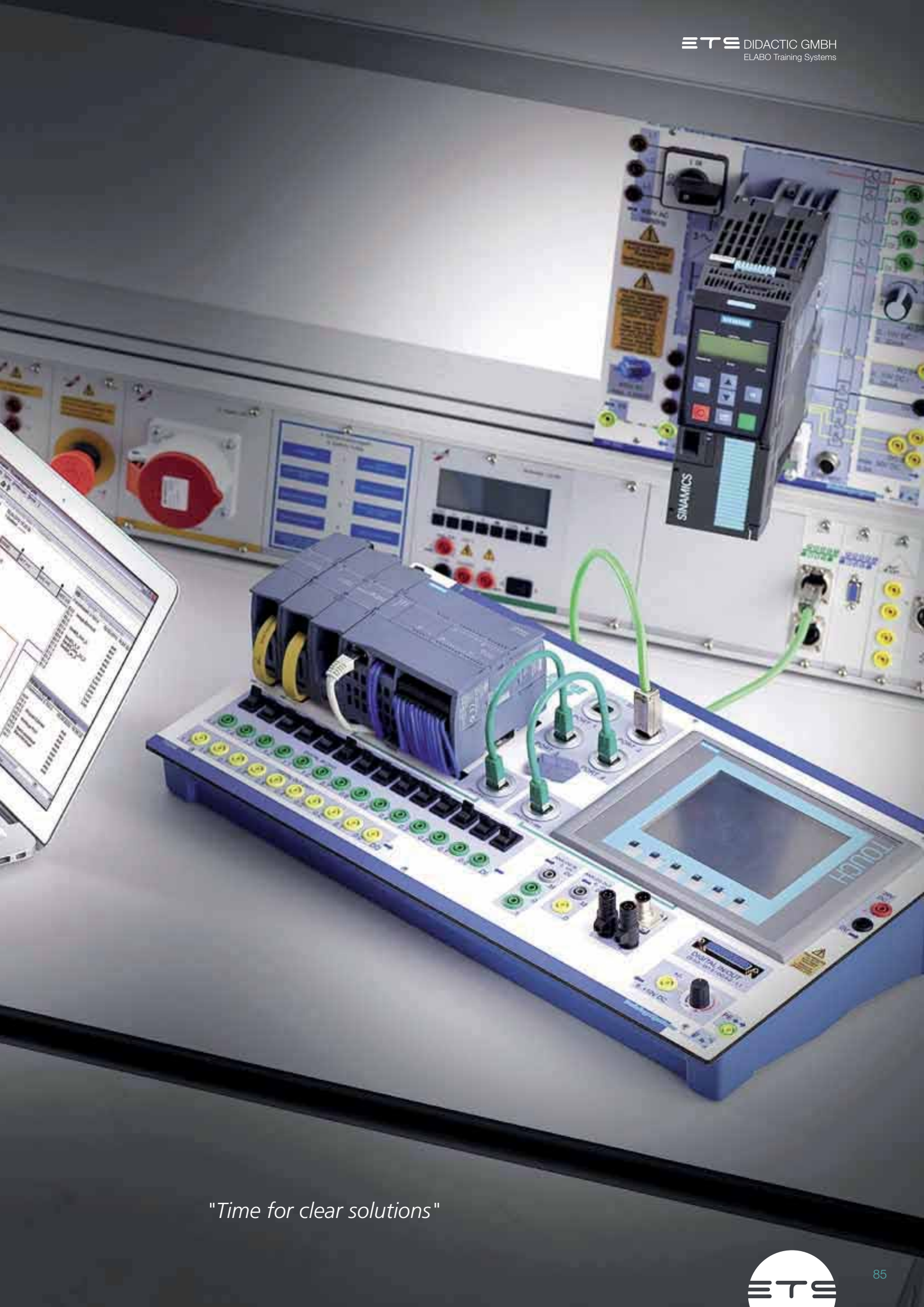
Learning objectives

- Construction and projection of a PLC in the TIA portal
- Commissioning an automation system
- Programming according to international standard IEC1131-3
- Connecting and commissioning field bus systems

Technical data

- Integrated power supply 24 V / 4.5 A
- 14 digital inputs, 10 digital outputs
- 2 analogue inputs, 1 analogue output
- Integrated Profinet switch
- 6-inch Touch Panel with key functions
- Extension box with AS-i and PROFIBUS-DP Master

No.	Designation	Order no.
1	Automation Board Professional (different versions possible)	70280-44231
2	Automation Board S7-300	70280-22001
3	Touch Panel Board	70318
4	Automatin Board S7-1200	70290



"Time for clear solutions"

3-PHASE DRIVE

Motor Fault Simulator

1

Learning objectives

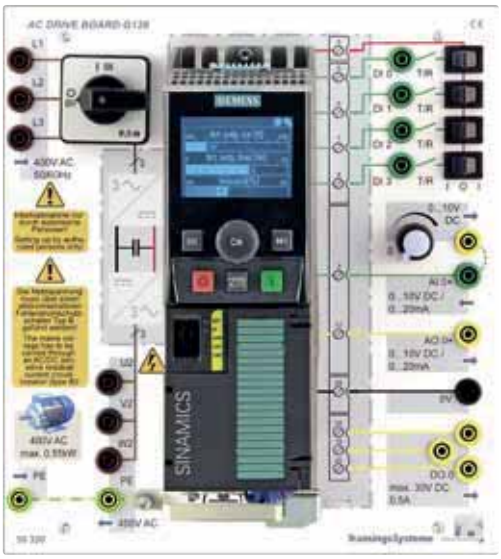
- Troubleshooting in electric motors
- Metrological investigation of three-phase asynchronous motors
- Troubleshooting and documentation

Technical data

- Coil interruption
- Coil short
- Winding short
- Voltage-dependent insulation fault
- Frame short
- Inputs / outputs to 4mm safety sockets
- Terminal boxes with 4-colour printed front layout and connection designations

No.	Designation	Order no.
1	Motor Fault Simulator	57129

Frequency Converter



1

Learning objectives

- Connect and operate an electronic frequency converter, conforming to EMC directives
- Program and test, drive and protection functions
- Interpret fault messages, fault-finding
- Central operation and monitoring from the PC
- Connection to automation systems by way of a PROFINET

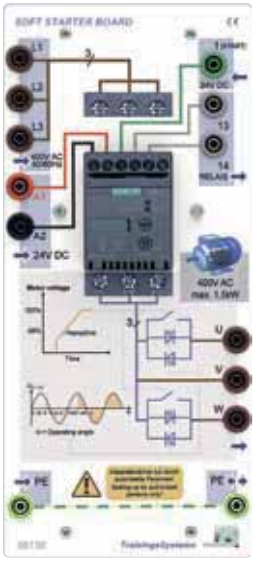
Technical data

- PROFINET and PC interfaces (optional)
- EMC filter, class A
- Connection techniques, conforming to EMC directives
- Digital PI-controller for optional use
- Input voltage: 400 V / 50 ... 60 Hz
- Output voltage: 0 ... 400 V / 0 ... 650 Hz
- Output power: 550 W / 150 % overload capacity
- Protection functions for overload, ground fault and short-circuit

No.	Designation	Order no.
1	AC Drive Board G120	55321

3-PHASE DRIVE

Soft Starter



1

Learning objectives

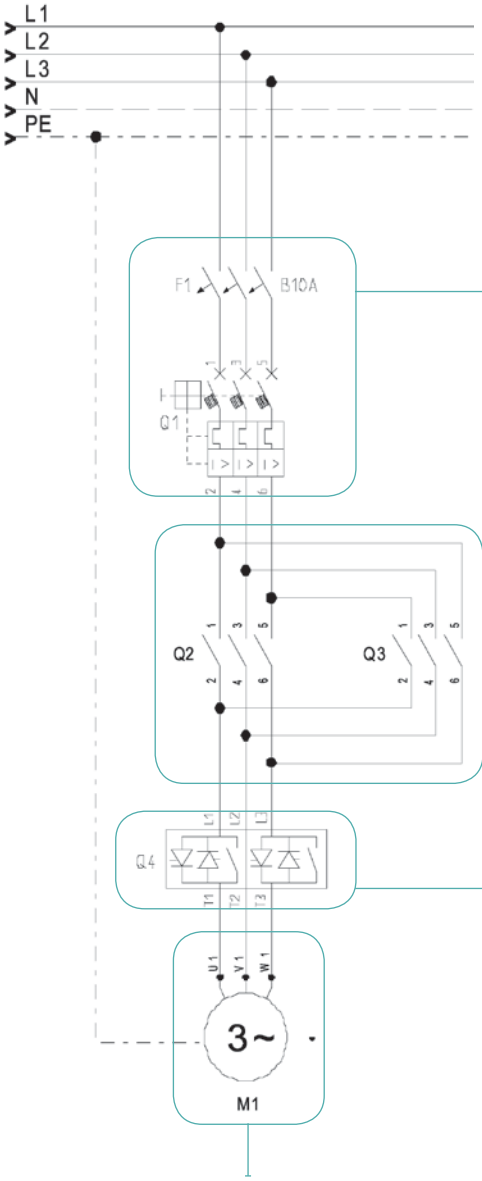
- ⟩ Selection of motor starting techniques
- ⟩ Soft starters instead of devices star-delta combinations
- ⟩ Use of soft-start devices in combination with PLC
- ⟩ Investigation of startup behaviour with and without soft-start device

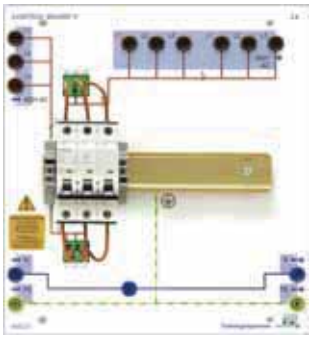
Technical data

- ⟩ Maximum load 1.5 kW
- ⟩ Supply, load 400 V AC
- ⟩ Operating voltage 24 V DC

No.	Designation	Order no.
1	Soft Starter Board	56130
2	Control Board V	40023
3	Three Phase Network Analyzer Board (optional)	40312
4	3-Phase Motor	57104

Configuration Example – Soft Starter





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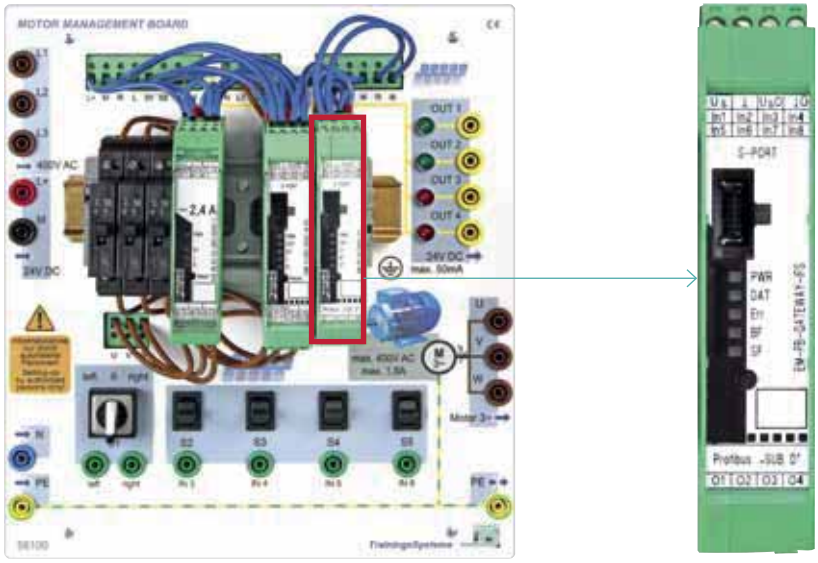
1

4

THREE-PHASE CURRENT DRIVE

Electronic Motor Management



1 2

Learning objectives

- Project planning, assembly, and commissioning for three-phase asynchronous motors
- Realising system and motor protection and protecting them from underload and overload
- Displaying operating data
- Getting introduced to and integrating electronic reverse load relays

Motor Management Board

Motor Management Board in DIN A4 system, consisting of:

- 6 digital inputs on 4mm safety socket and simulation
- 4 digital outputs on 4mm safety sockets and display lights
- Supply power of 24V DC control voltage on 4mm safety sockets
- Supply power and motor output of 400 V AC on 4mm safety sockets
- Prepared for Profibus coupler 56109

PROFIBUS coupler

For integrating the Motor Management Board system with a bus system:

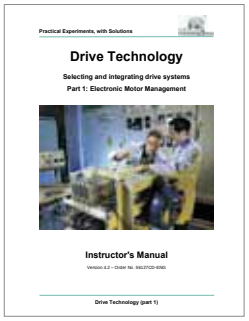
- 24V DC operating voltage
- IFS system interface
- PROFIBUS DP interface
- 4 digital inputs / 4 digital outputs incl. assembly on Board 56110

The device is programmed either by software or directly on the device using display and keyboard. You can set all parameters for operating the drive individually for right- and left-rotation: grid conditions, start delay, switching thresholds, trigger thresholds, reversing impulse, motor protection, feedback outputs, data logging.

Courseware

3

Printed and digital



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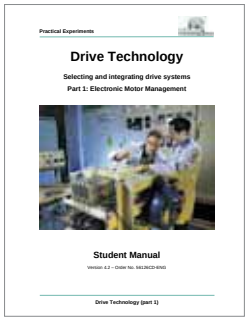

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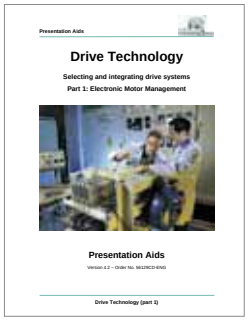

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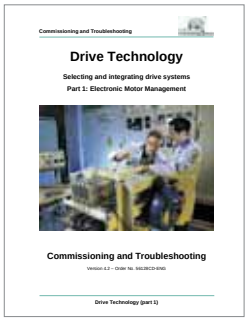


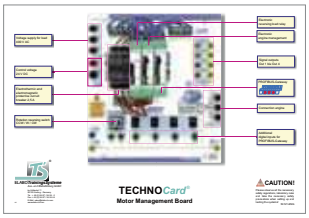
6

Content

- Trial 1:
  Conveyor belt control with electronic motor protection and reversing load relay
- Trial 2:
  Conveyor belt control through an electronic reversing load relay with motor management with automatic reversing pulse upon switching off
- Trial 3:
  Connection of an electronic reversing load relay to the control room with a display of the electrical operating values on a PC

Accessories

9



8

10

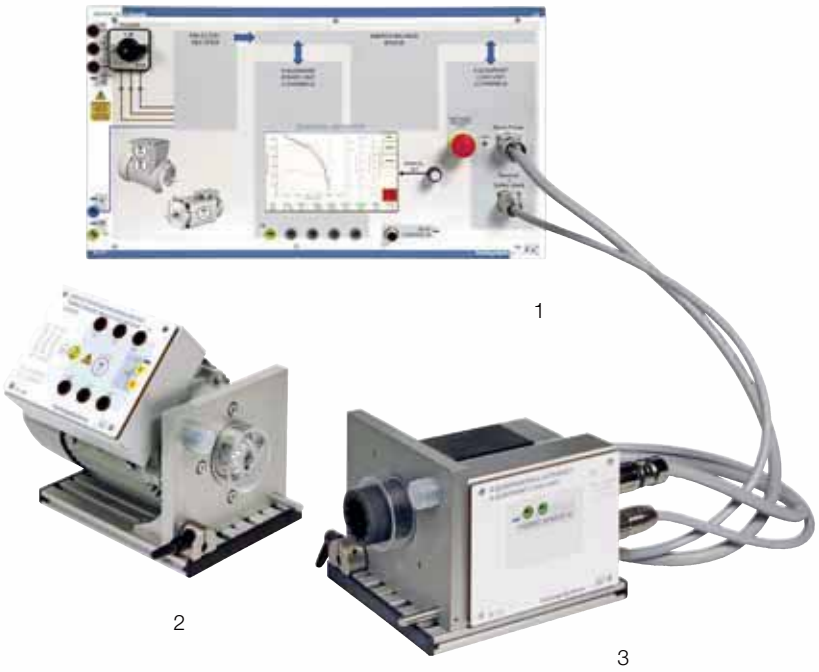
11

No.	Designation	Order no.
1	Motor Management Board with optional PROFIBUS coupler (56109)	56110
2	PROFIBUS coupler	56109
3	Media Folder Set	91903
4	Driver Technology Part 1: Electronic Motor Management – Instructor's Manual	56127CD-ENG
5	Driver Technology Part 1: Electronic Motor Management – Student Manual	56126CD-ENG
6	Driver Technology Part 1: Electronic Motor Management – Commissioning and Troubleshooting	56128CD-ENG
7	Driver Technology Part 1: Electronic Motor Management – Set of Transparencies	56129CD-ENG
8	TECHNOCard® – Motor Management Board	56121-ENG
9	PROFIBUS DP-connection cable	55926
10	Connection cable 3 x 400 V	80606
11	Management software and interface cable	56111

MOTOR TEST BENCH

Measurement Quantities

- Voltage
- Current
- cosϕ
- Active power
- Apparent power
- Speed
- Torque
- Mechanical power
- Efficiency



1

2

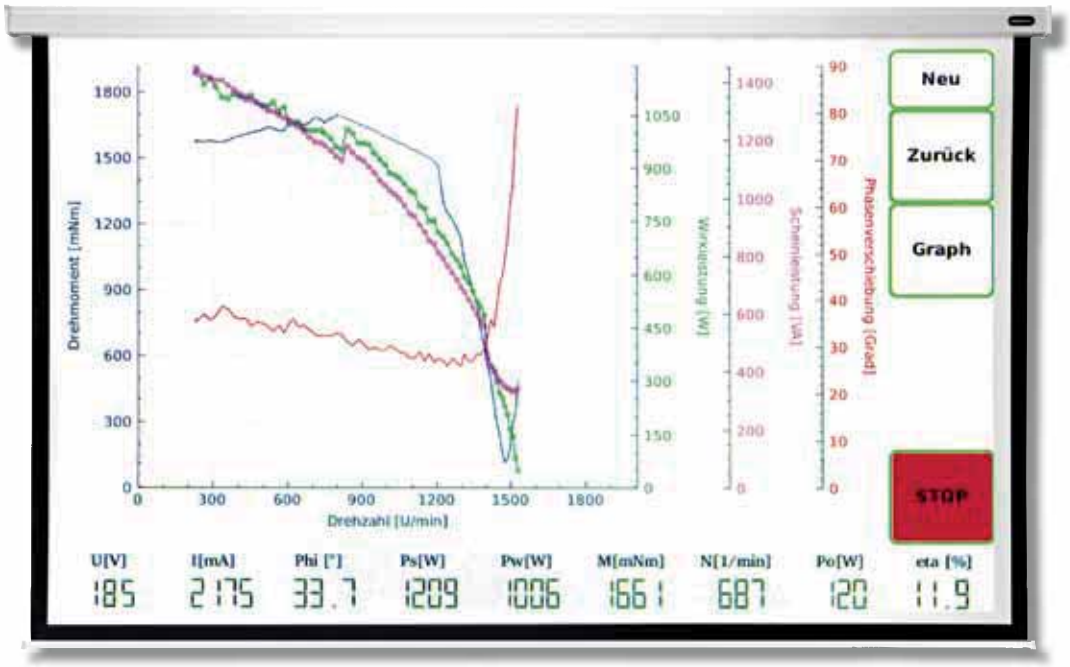
3

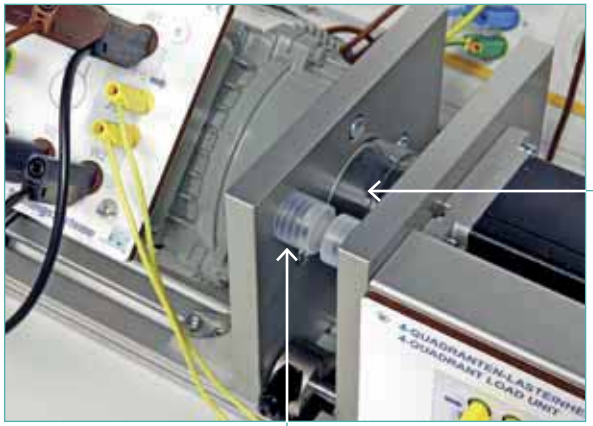
Control unit with 7“ touch panel and webserver

Drives

- Direct current
- Alternating current
- Three-phase current
- Stepper motors
- Brushless DC motors
- Energy Efficiency by IE4 Motor standard

No.	Designation	Order no.
1	Motor Test Board	56200
2	Three-Phase Induction Motor	57200
3	4-Quadrant Load Unit	56210



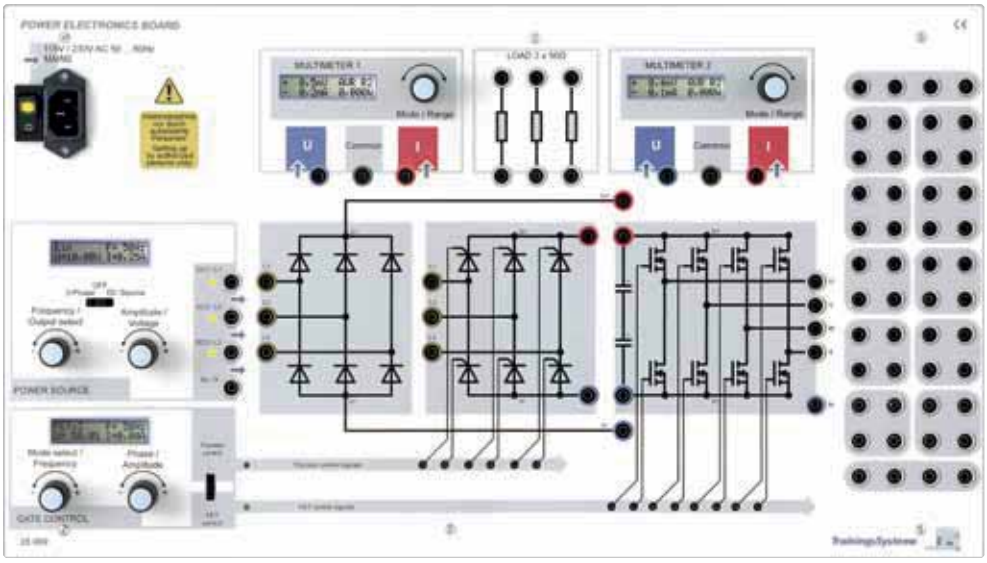


Safety

- RF identification of the machines under test
- Protection of all rotating parts by unremovable covers

POWER ELECTRONICS TRAINING PACKAGE TP 56.2

Training and Practical Experiments over the Entire Power Electronics Sector



1

The Power Electronics Training System can be used for training purposes and practical experiments over the entire power electronics sector.
The system combines the latest technology with ease of use.
In addition to imparting the basic principles of the functions of power electronic components and modules, the system enables investigations of modern drive solutions consisting of frequency converters and motors in a safe low-voltage range.

Lerning Objectives

⟩ Becoming acquainted, understanding and applying power electronics components and their functions in rectifiers and inverters:
resistance, diode, coil, transistor, IGBT, thyristor, MOSFET, optocoupler, power electronics components, rectifier single, rectifier 3-phase, Siebelko full-wave rectifier, rectifier with thyristors, PWM at MOS- FET half bridge, inverter, controlling of smaller motors

Technical Data

Power Electronics Board

⟩ Short circuit proof, feedback-protected DC 60 V, AC 40 V, 60 W

⟩ 3-Channel-DC-Source
- per Output -40 V…+40 V, settable
- max. current per Output 1,5 A
- common ground 0 V

⟩ Alternating current source with setting range
- Phase voltage from…23 V_{eff}
- Max. current per phase...2 A_{eff}
- Common neutral point 0 V
- Frequency settable

No.	Designation	Order no.
1	Power Electronics Board	35000
2	Direct current motor DC 24 V, 34 W, perm. excited	35003
3	3-phase asynchronous motor AC3 23/40 V, 20 W	35004
4	3-phase synchronous motor AC3 23/40 V, 10 W	35005
5	PC Measurement Interface (optional)	90272
6	Set Masks Power Electronics	ETS35000-Z05

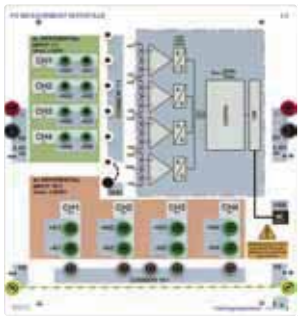
Direct and Alternating Current Motors

2

3

4

Supplementary Measuring Equipment



5

PC Measurement Interface

- A 4-channel measuring instrument with differential intputs. It allows safe measuring of voltages and deduced magnitudes up to 600V AC.
- Display and evaluation of the measuring results on a connected PC by means of a software.

Technical Data

DC Motor (5)

- Nominal voltage 24 V DC
- Nominal rotation speed 3000 U/min

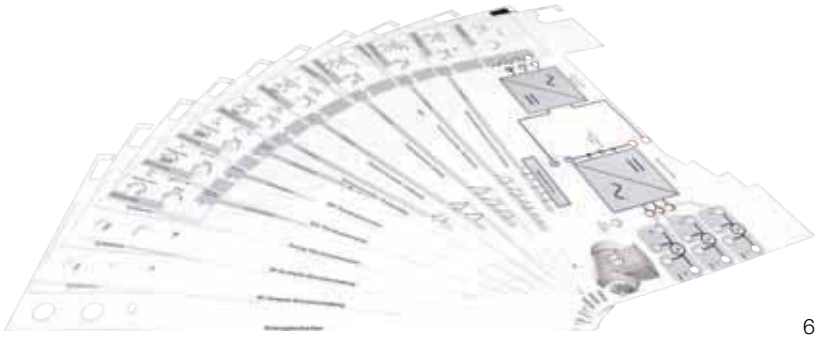
3-Phase Asynchronous Motor (6)

- Star / delta AC3 40/23 V 50 Hz
- Nominal rotation speed 1250 U/min at 50 Hz

3-Phase Synchronous Motor (7)

- Star / delta AC3 40 / 23 V 50Hz
- Nominal rotation speed 1250 U/min at 50 Hz

For all motors: Eddy current break on 4mm safety sockets for applying load to the motor as well as inputs/outputs.



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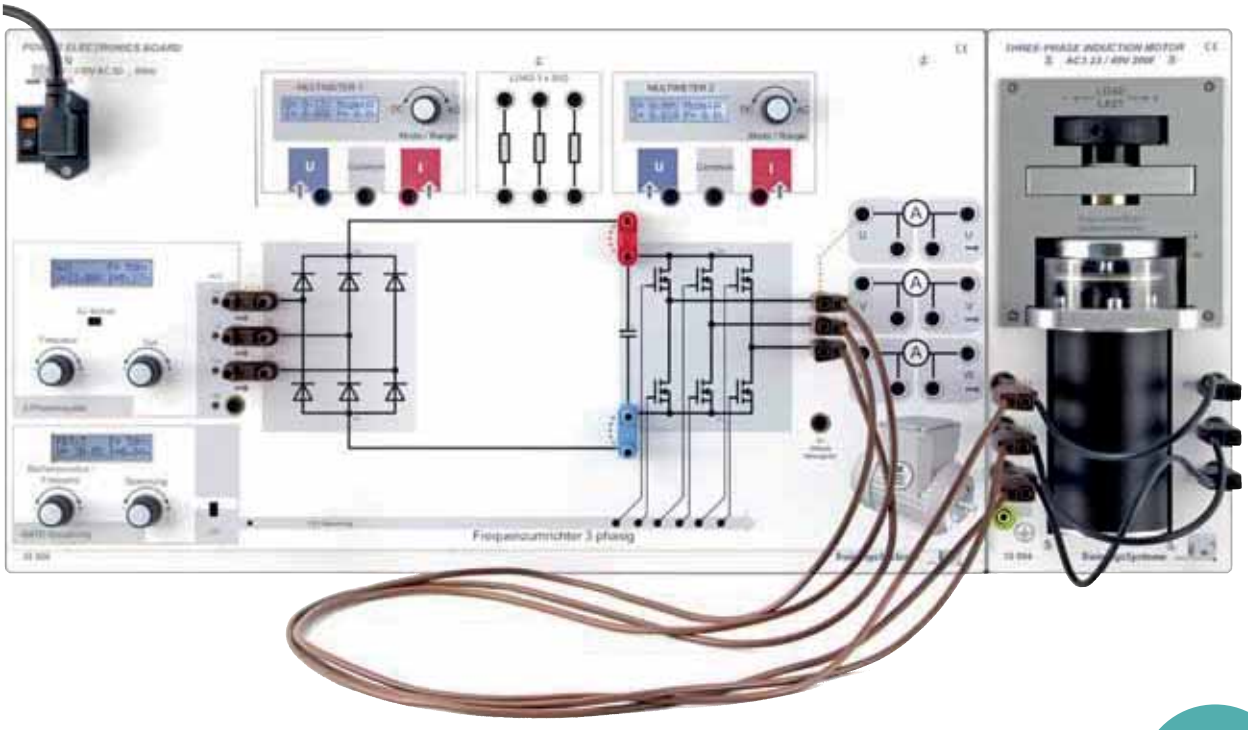
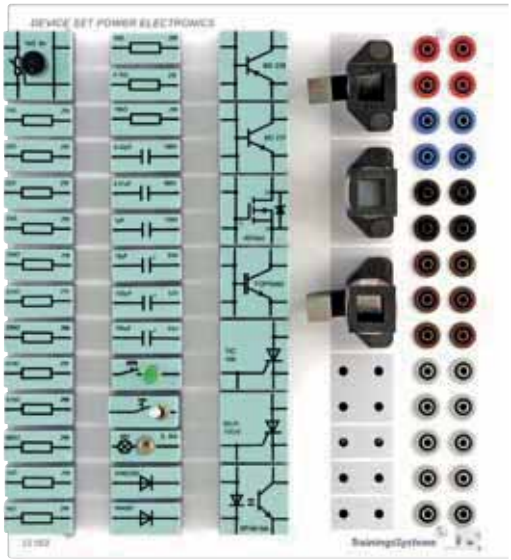


POWER ELECTRONICS TRAINING PACKAGE TP 56.2

Device Set Power Electronics



1

Device Set Power Electronics

For experimenting on fundamentals in power electronics, including storage board for the plug-in components and safety bridging plugs, front panel imprinted with the circuit symbols of the components for plug-in modules and safety bridging plugs.

No.	Designation	Order no.
1	Device Set Power Electronics	35002
2	Set of ring binders	91903
3	Principles and components of power electronics Instructor's Manual	35010CD-ENG
4	Principles and components of power electronics Student Manual	35011CD-ENG
5	Rectifier circuits in power electronics Instructor's Manual	35012CD-ENG
6	Rectifier circuits in power electronics Student Manual	35013CD-ENG
7	TC® – Fundamentals for use Power Electronics Board	35001-ENG
8	TC® – Use of the PC Measurement Interface (optional)	90273-ENG

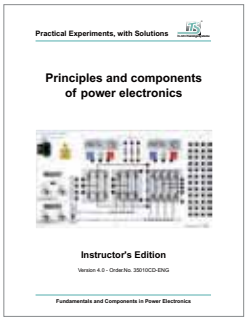
Storage Plate printed and incl. the following plug-in modules:

- 1 film resistor 10Ω / 2W
- 2 film resistors 22Ω / 2W
- 1 film resistor 33Ω / 2W
- 1 film resistor 100Ω / 2W
- 1 film resistor 220Ω / 2W
- 1 film resistor 330Ω / 2W
- 2 film resistors 470Ω / 2W
- 1 film resistor 680Ω / 2W
- 3 film resistors 1kΩ / 2W
- 1 film resistor 4,7kΩ / 2W
- 1 film resistor 10kΩ / 2W
- 1 capacitor 0.22 µF/160 V
- 1 capacitor 0.47 µF/160 V
- 1 capacitor 1 µF/100 V
- 1 electrolytic capacitor 10 µF/63V
- 2 electrolytic capacitors 100 µF/63V
- 1 Schottky diode, 2A
- 1 Si diode, 1A
- 1 transistor BD238 PNP, 80 V/ 25W, base left
- 1 transistor BD237 NPN, 80 V/25W, base left
- 1 thyristor, 3A
- 1 thyristor MCR100-6, 0.8 A
- 1 IGBT, 10A
- 1 power FET, gate left
- 1 optocoupler
- 1 coil N = 300
- 2 coils N = 900
- 1 tape-wound core (1 pair)
- 1 pushbutton
- 1 toggle switch
- 1 lamp, 48V, E10 socket

Courseware

2

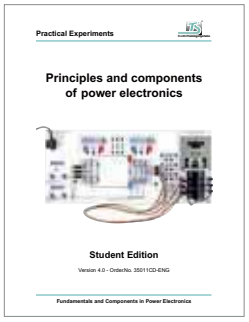
Printed and digital!



3

Instructor's Edition

- Principles and components of power electronics
  - Practical Experiments, with Solutions



4

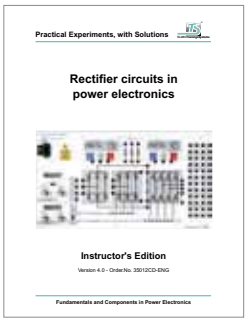
Student Edition

- Principles and components of power electronics
- Practical Experiments

Courseware

2

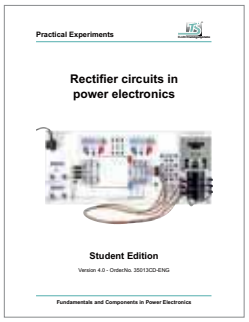
Printed and digital!



5

Instructor's Edition

- Rectifier circuits in power electronics
  - Practical Experiments, with Solutions

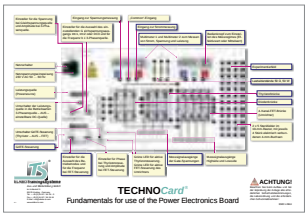


6

Student Edition

- Rectifier circuits in power electronics
- Practical Experiments

TECHNOCards®



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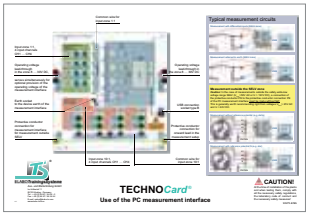


8

FLEXIBLE PRODUCTION SYSTEM

Team Spirit in the Automation System

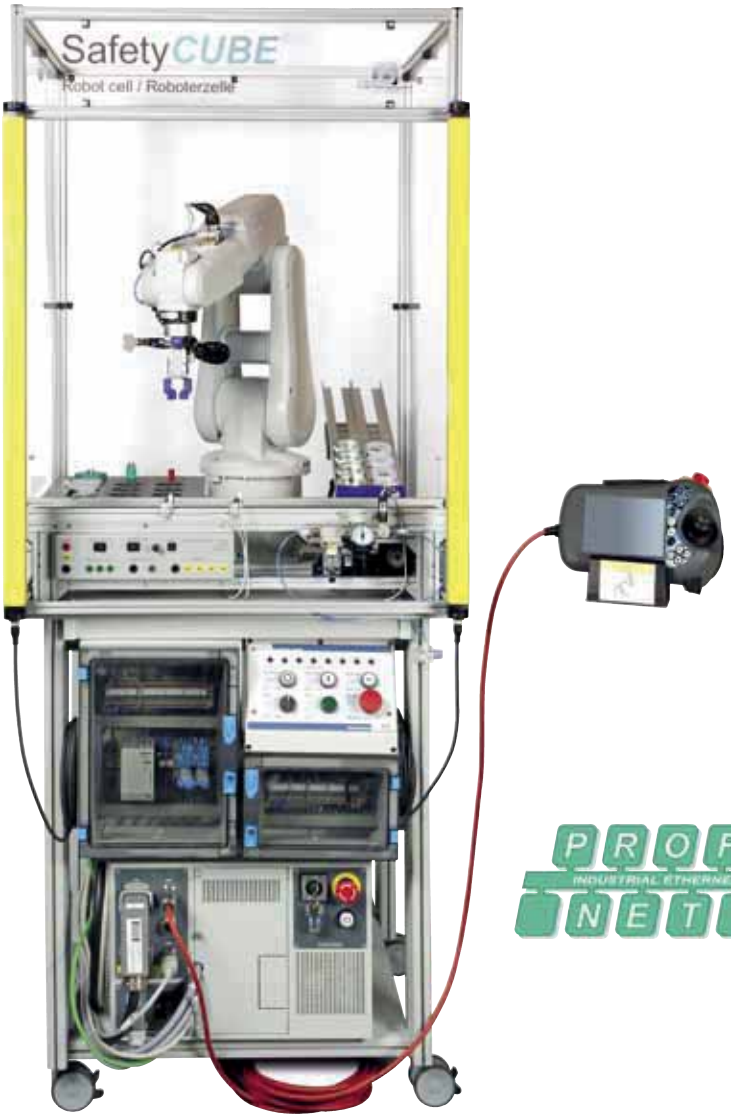
"perfect interplay"

Modular production system with the robot cell SafetyCUBE®


SafetyCUBE
Robot cell / Roboterzelle

ROBOT CELL

Safety*CUBE*®



1

Learning objectives

- Assembling, setting up, operating and programming of robot handling systems
- Analysing movement sequences, determining reference and starting points, optimising track curves
- Installing, programming and testing task-specific control and safety concepts
- Movement sequences with linear interpolation, hinge interpolation and circle interpolation
- Programming true-to-track movements
- Use of different effectors (grippers, suction pads) and tools

Technical data

- Operating voltage 230 V 50 / 60 Hz
- Number of axes 6
- Maximum lifting force 3 kg (4 kg with vertical wrist)
- Maximum speed: 6200 mm/s
- Repeat accuracy ± 0.01 mm
- FlexPendant™ with Touch Screen
- Control device with Ethernet
- 32 digital inputs and outputs
- Emergency stop and light curtain
- Optional: Profinet interface

No.	Designation	Order no.
1	Robot cell SafetyCube®	89991
2	Media Folder Set	91903
3	Robotics Part 1: Basics / Part 2: Programming tasks – Instructor's Manual	89945CD-ENG
4	Robotics Part 1: Basics / Part 2: Programming tasks – Student Manual	89946CD-ENG

Going other Ways

Robot cell

Manual operating and programming device FlexPendant™

and / or

+

Simulation

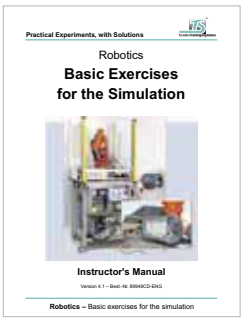
Software

+

Exercises

+

Manual: Robotics, Basic exercises or the simulation

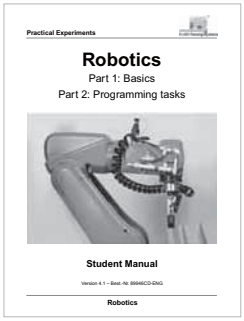


+

Training

2

3

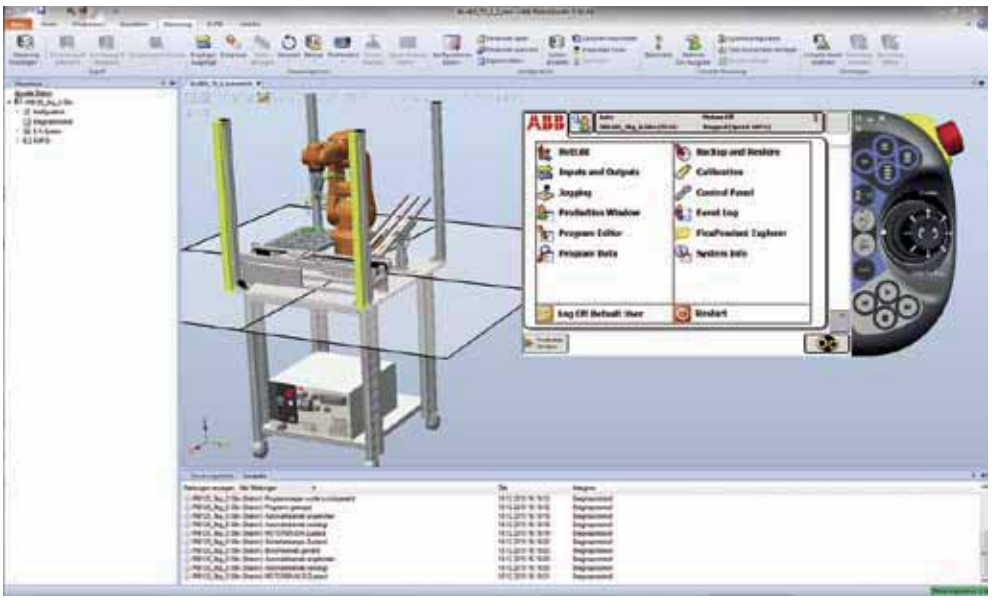


4

Printed and digital

SIMULATION ROBOT

Cell Simultation



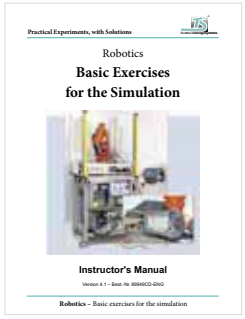
1

The operating and programming device FlexPendant® is available in the simulation software with all its functions.

No.	Designation	Order no.
1	Software for robot control, simulation and programming	89961
2	Media Folder Set	91903
3	Robotics Basic Exercises for the Simulation – Instructor's Manual	89949CD-ENG
4	Robotics Basic Exercises for the Simulation – Student Manual	89948CD-ENG
5	Robotics Part 1: Basics / Part 2: Programming tasks – Instructor's Manual	89945CD-ENG
6	Robotics Part 1: Basics / Part 2: Programming tasks – Student Manual	89946CD-ENG
7	TECHNOCard® – Robot system	89981-ENG
8	TECHNOCard® – Robot system – Flexpendant	89982-ENG
9	TECHNOCard® – Robot system – Robot control	89983-ENG

Courseware

2



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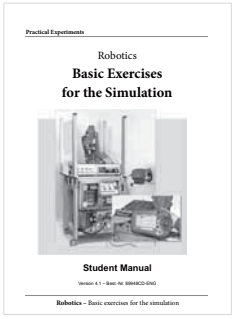

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Printed and digital

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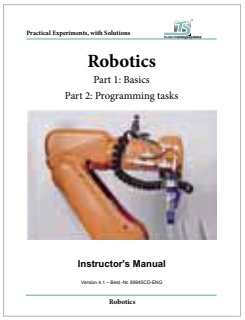

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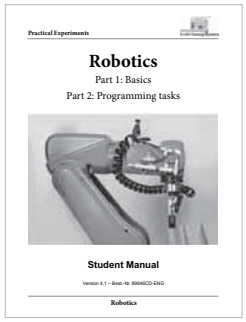

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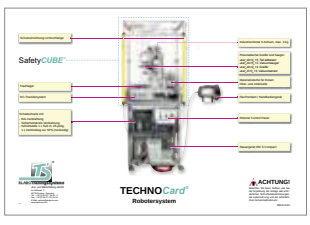

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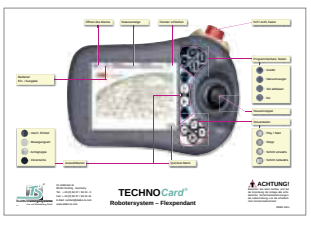

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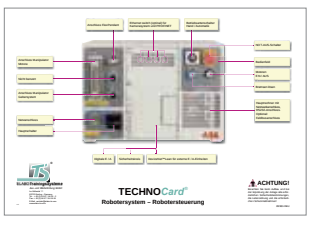


9

Content

Basic exercises for simulation

- Introduction
- Coordinate systems, movement types, tool data
- Programming
- Activating inputs and outputs
- If-then statements, branches, multiple branches
- For loops, repeating programming sequences
- While loop, repeating programming sequences dependent on a condition
- Object coordinate system, user coordinate system, work object
- Modifying points, offset commands
- Programming a trajectory-controlled movement
- Linear movement and circular interpolation
- Circular interpolation, drawing a circle
- Palletising workpieces

Content

Robotics, basic information and programming exercises

Part 1: Basics

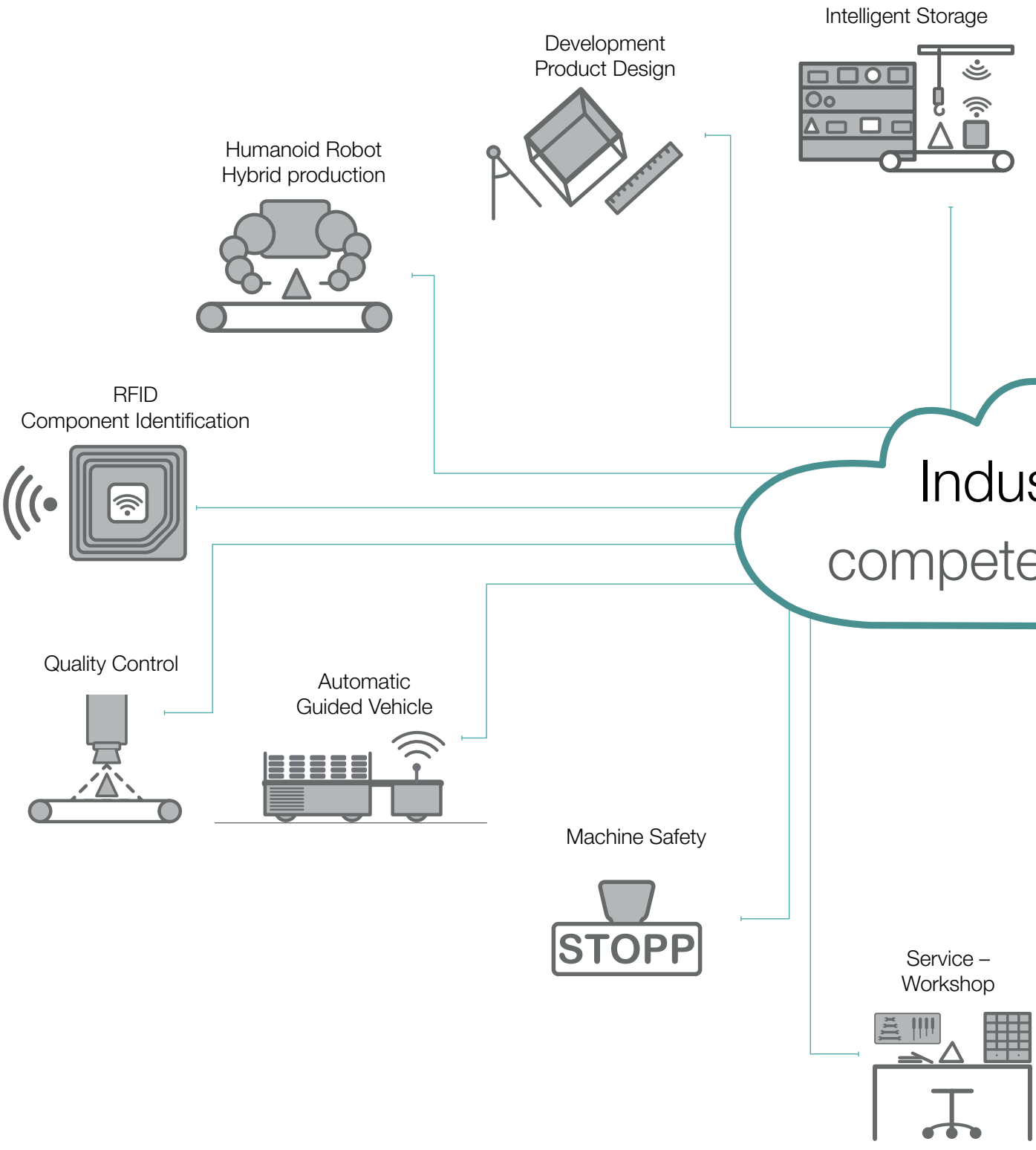
- Basic safety instructions
- Getting started
- Categories of handling systems
- Robot design
- Coordinate systems and operating modes
- Programming industrial robots
- Key programming commands

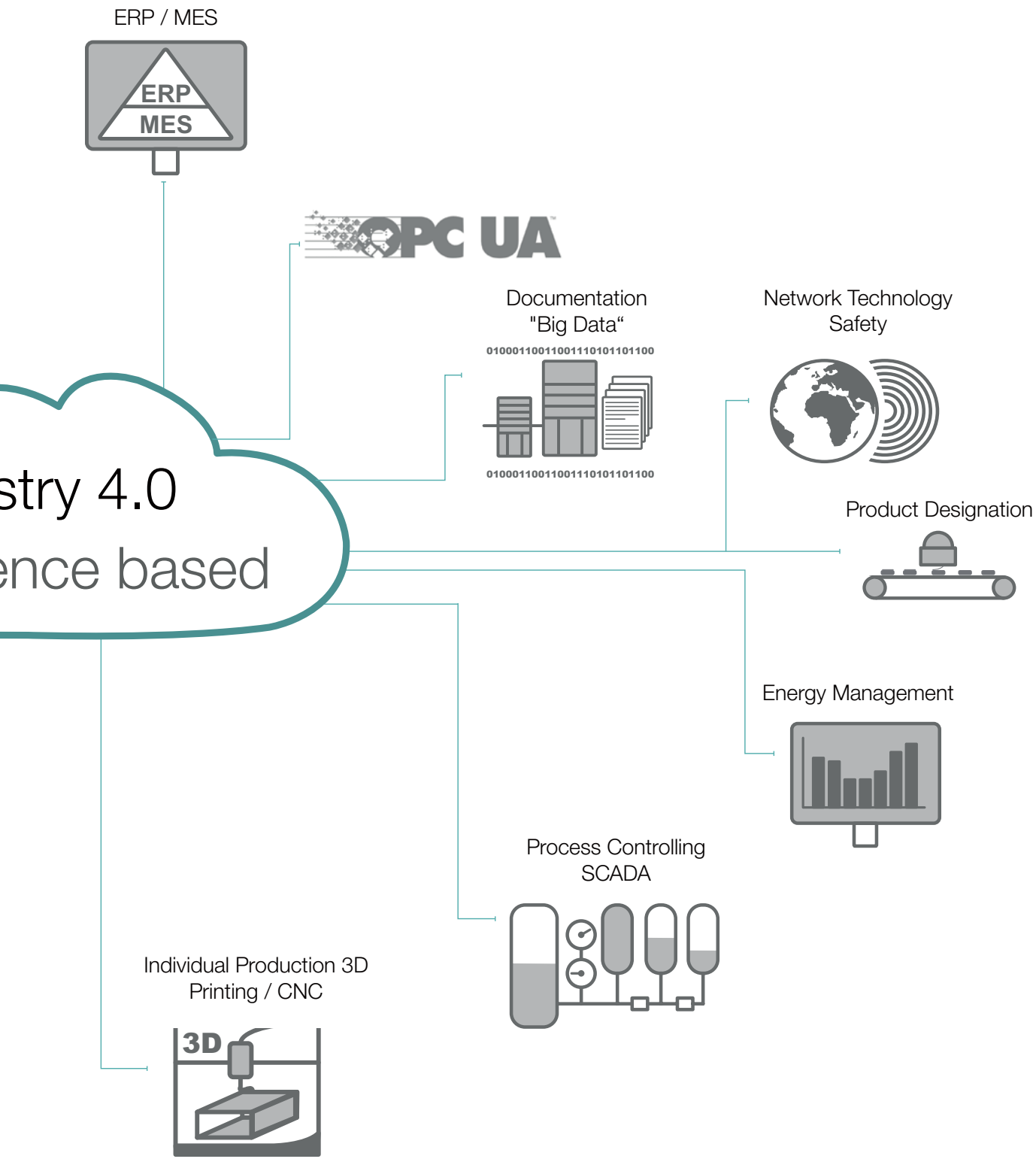
Part 2: Programming tasks

- Moving robots manually
- Teaching points
- Creating a movement program
- Transfer system control
- If-then-else loop

INDUSTRY 4.0

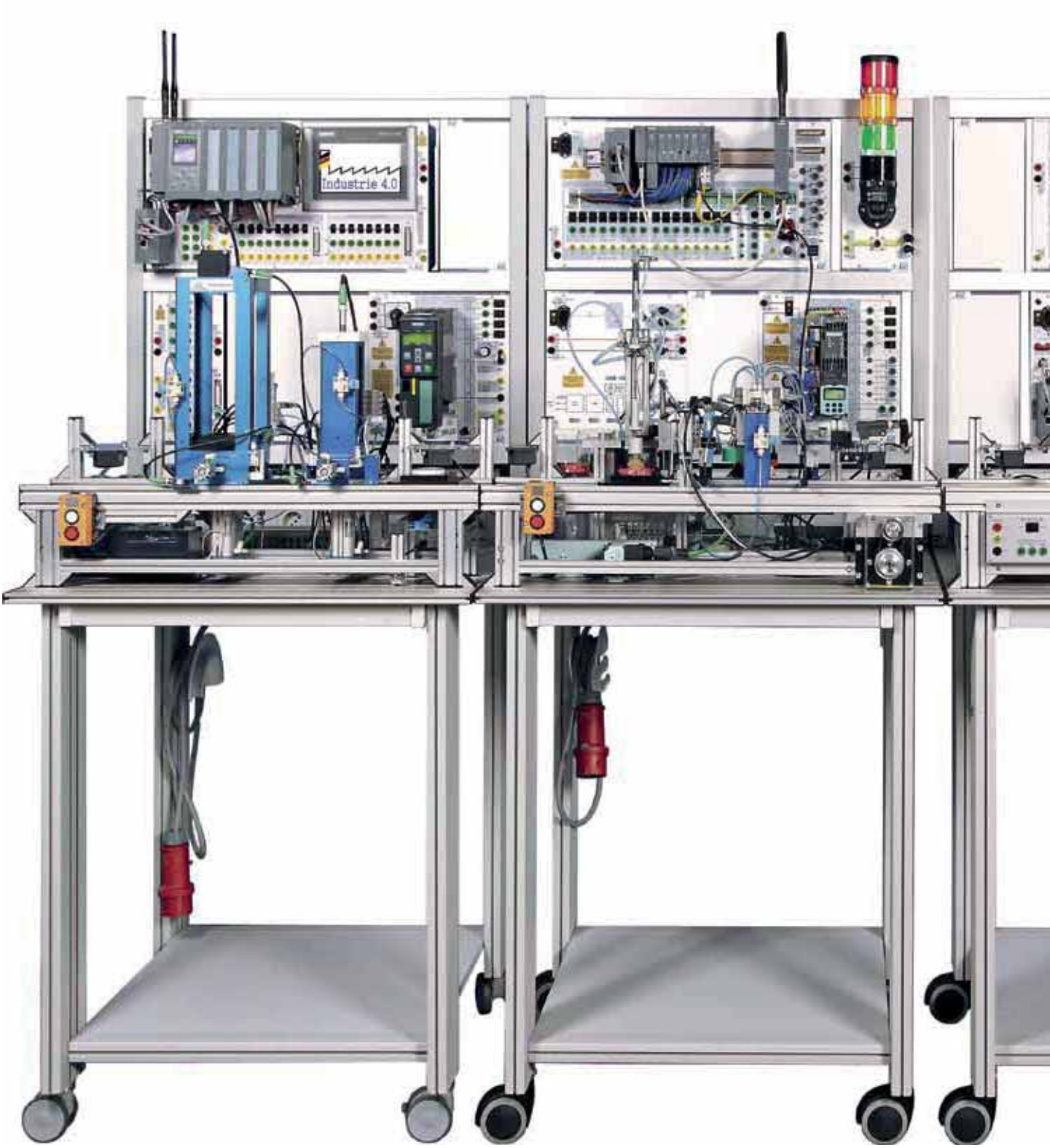
CPS – Cyber-Physical-Systems

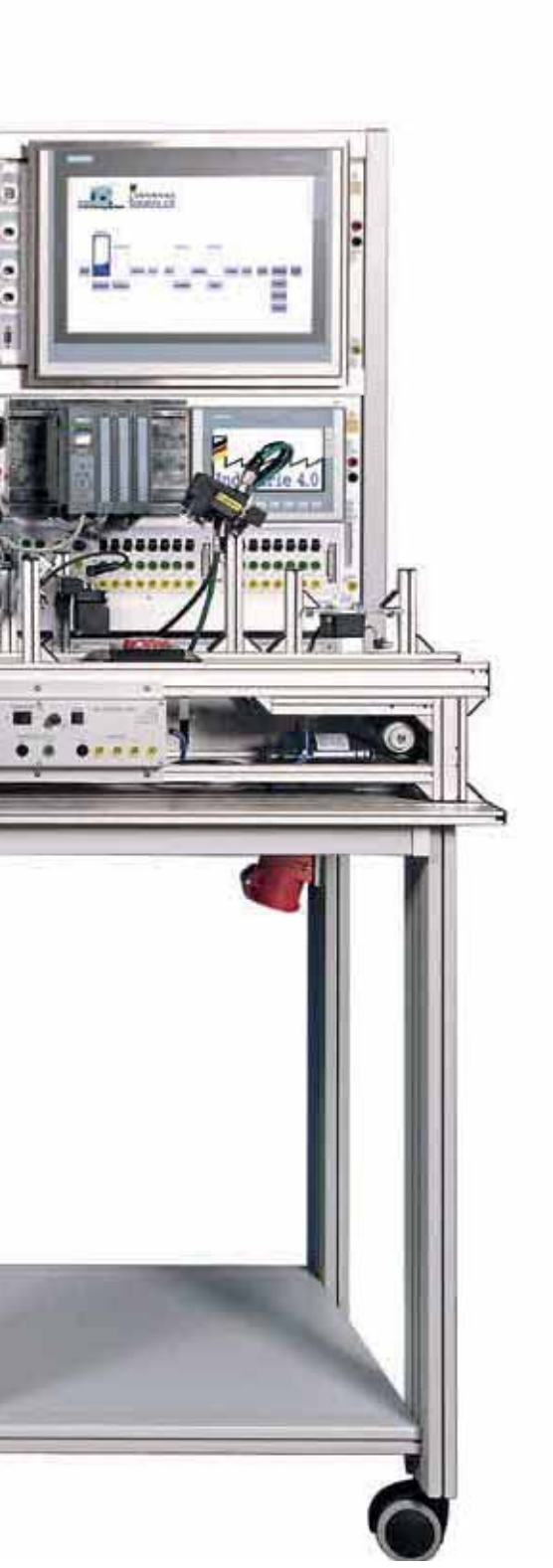



ERP / MES
ERP
MES
OPC UA
Documentation
"Big Data“
0100011001100111010110 1100
0100011001100111010110 1100
Network Technology
Safety
stry 4.0
ence based
Product Designation
Energy Management
Process Controlling
SCADA
Individual Production 3D
Printing / CNC
3D

LEARNING FACTORY 4.0 CPS-i40® CYBER PHYSICAL SYSTEMS

Qualify for the Future – already Today





Industry 4.0-Compact system

- All aspects of modern manufacturing can be displayed using the latest technologies.
- The system is fully networked and offers cable and wireless (industrial WLAN) PROFINET connections. Additionally, connections via PROFIBUS and AS interface can be realised.
  (TIA – Totally Integrated Automation).
- Several bus-compatible traction inverters as well as decentral periphery are available. All stations offer RFID read/write-heads and can file away production data on an RFID tag as well as on a server (e.g. OPC, UA, SQL, ...). While the current production step is checked in each station, a final check is realised by a bus-compatible camera and other sensors in their own station.

CPS-i40® – FUTURE BETWEEN PEOPLE AND ROBOTS

Collaborative Two-arm Robot

Simply genius – modular and safe

⟩ Robots are applied in industrial settings all over the world and represent a new era of really collaborative industrial robots.

⟩ Programming has been simplified for the user to a great extent.

⟩ "Programming by control" allows to enter the individual movements or steps by moving the arms and subsequent saving of individual motion sequences. The robotic system can imitate the motions carried out by the user time-efficiently and is therefore programmed intuitively. Join in robotic programming of tomorrow already today.

⟩ As a matter of course, the standard RAPID programming is supported, too.

⟩ The unique design of the two-arm robot guarantees "inherent safety".

⟩ The arms are padded and there aren't any barriers or housings etc. required. So, people and robot can work together hand in hand. Collaborative robots will play an important role in machine processing when it comes to industrial revolution „Industry 4.0“ or „Internet of things“.

Invest in the future and ensure optimum preparation of your participants for future challanges in practical work by using our training systems.

AUGMENTED REALITY

AR – Augmented Reality – tec2*SKILL*®

Augmented Reality in Companies

Augmented reality is becoming more and more important. The "Internet of Things" and AR are the future. AR applications have been changing daily life and our relations to real things. Especially, they support the learning progress.

Augmented Reality is much more than augmenting the reality with digital information. Augmented realities make it possible to display virtual information within the real field of vision of an observer and to superimpose it over real images. This means: Digital and physical worlds are being merged and brought together with visual perceptions. Augmented reality will change our lives if brought into play in companies.

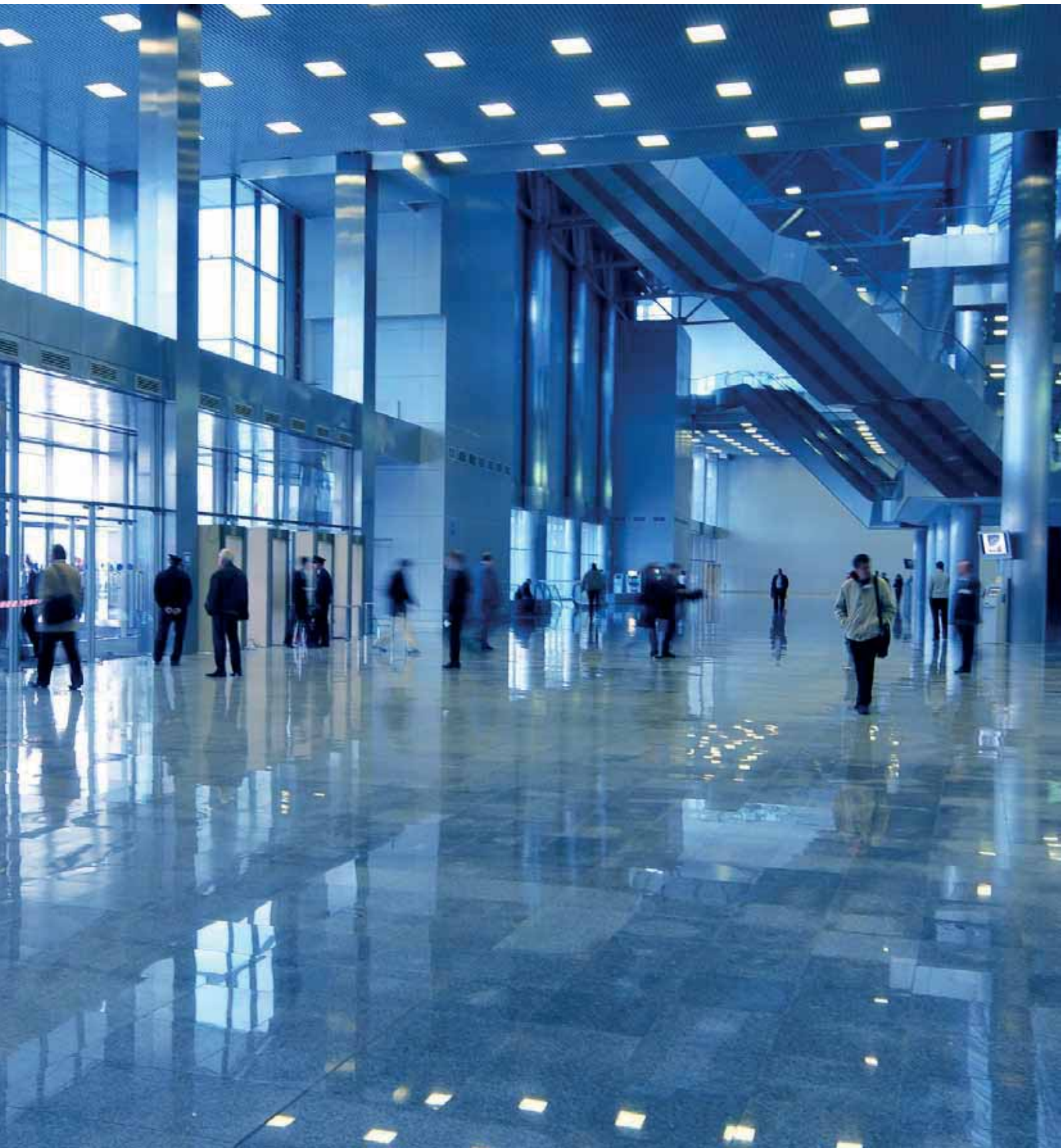
It Is Time for AR

Applications of augmented reality in companies are nearly unlimited. So AR can be used for product development control, even in the early stages of development. Real physical prototypes do not have to be constructed any longer, but a digital twin is created by the developer. Furthermore, products can be fitted with control units which are not directly visible. Likewise, the product use can be improved with the help of AR. User manuals are not necessary any longer – virtual tutorials and assistents come into action for them – as well proposals for operating settings of the product are displayed on the basis of sensor measurements and with regard to the device status analysis.

Revolution in the Service Sector

The features of AR will change the service sector first of all. Products are becoming more and more complex. The resulting challenges on the professional know-how of effective field service are an extremely high priority for the service providers. AR is destined to be an indispensable contribution to it. Visual instructions are displayed step by step and will replace unhandy manuals and maintenance manuals as well as time-consuming and cost-intensive product training of the service personnel. Direct benefit and visible economic success are the consequences.

tec2SKILL®



BUILDING SYSTEMS TECHNOLOGY

Installation Engineering / Lighting Technology

KNX

Surveillance Systems

Networking Systems (IP)

SMARThome

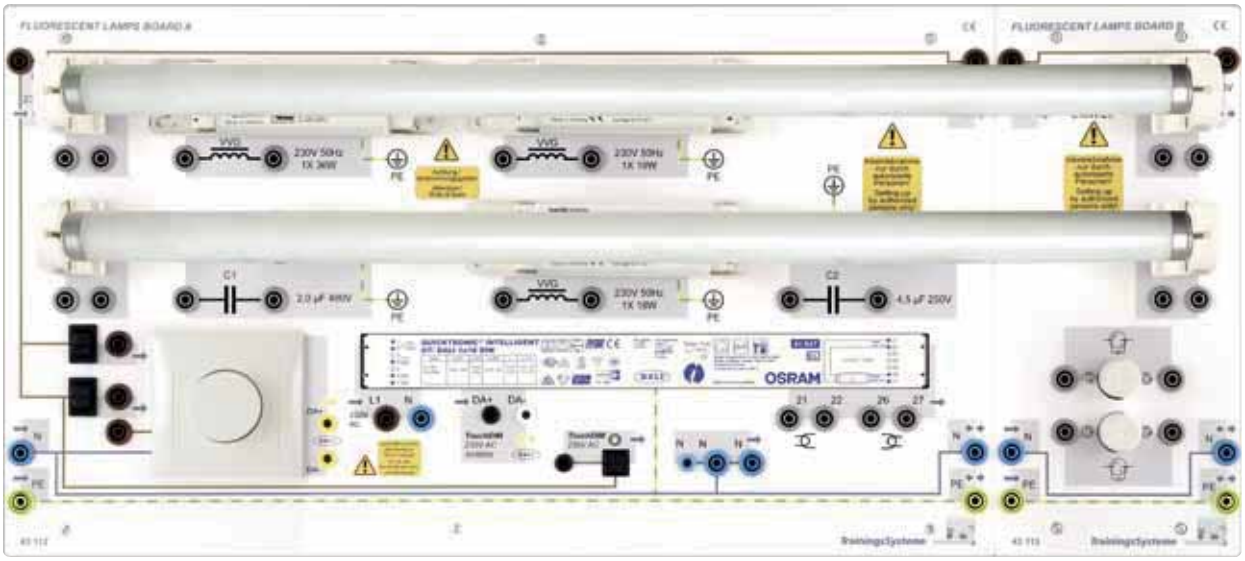
Communication Technology

EV-Charging Station

Augmented Reality – tech2*SKILL*®

INSTALLATION TECHNOLOGY / LIGHTING TECHNOLOGY

Fluorescent Lamp Circuits



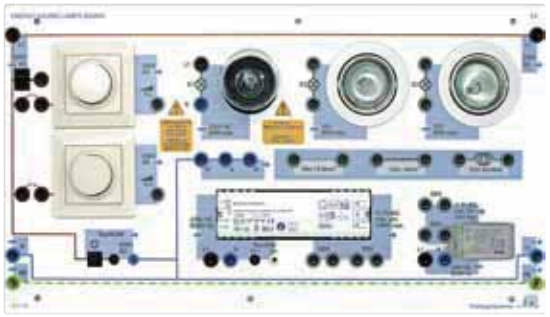
1 2

Learning objectives

- Principles of lighting technology, luminous flux, light intensity, luminous efficacy, light density
- Use of discharge lamps
- Lamp operating devices, low-loss ballast, electronic ballasts
- Circuits of lamp operating devices – series connection, parallel connection (Double / tandem) and their compensation
- Dimming lamps
- Evaluation of applications
- Calculations of lighting systems
- Metrological investigation of lamps
- Networking of operating devices via DALI
- Control and diagnosis of operating devices via DALI

No.	Designation	Order no.
1	Fluorescent Lamps Board A	43112
2	Fluorescent Lamps Board B	43113
3	Energy Saving Lamps Board	43114
4	High Pressure Sodium Lamp Board	43118
5	Metal Halide Lamp Board	43119
6	LED Effect Lighting Board	43117
7	LED Lamps Board	43116
8	Room Controller DALI	41120
9	KNX /DALI Gateway	41226
10	LED Control Board	43121
11	Lamp case	43125
12	Storage case for lamps	43124

An Overview of the System



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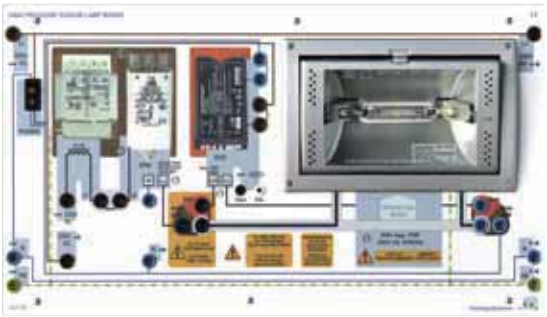

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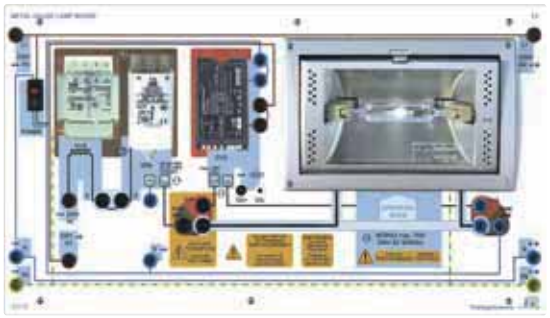

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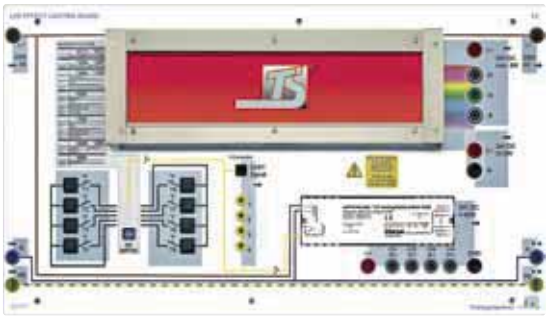

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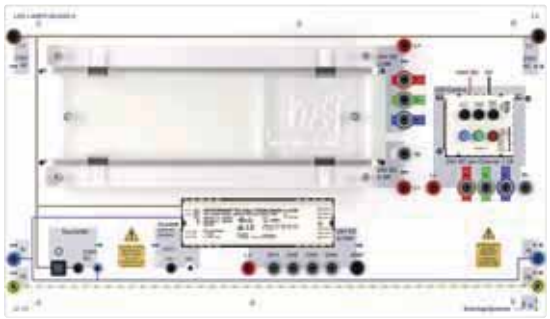

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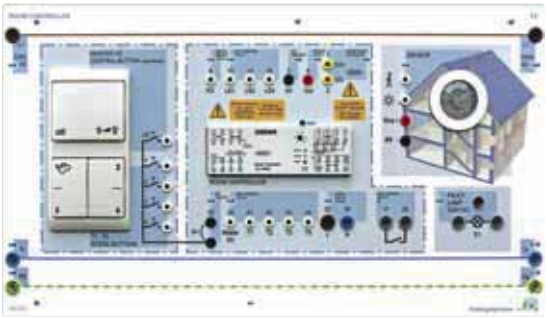

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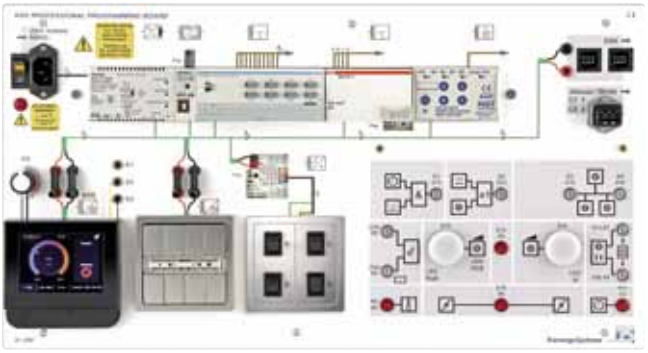
BASIC LEVEL KNX TRAINING PACKAGE 22.20

System Components



1

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Learning objectives KNX

- Planning and configuring of KNX systems
- Commissioning and trouble-shooting
- Documentation and maintenance

Professional Programming Board KNX

- 1 power supply
- 1 USB programming interface
- 1 binary input 4-x with 4 simulation switches
- 1 8-x switching-blind actuator
- 1 4-x switching actuator with switching and heating functions
- 1 4-x LED dimming actuator
- 1 4-x multi-function pushbutton sensor with BTM
- 1 Touch room operation uinit
- 12 x indicator lamps
- 1 LED module white
- 1 LED module RGB
- Sockets for onward connection to other KNX Boards

KNX Color Touch Panel

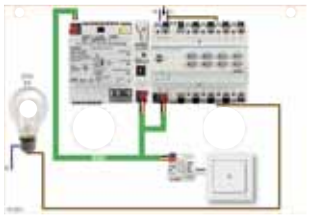
- KNX Color touchpanel 5.7" color TFT
- Mains and an bus voltage connection
- 10 control pages
- Up to 60 realizable additional functions
- Up to 64 scenes can be stored
- 16 alarm/event objects are available

KNX Weather Station

- Power supply 12 V DC
- Rain simulation button
- Continuously variable wind simulation
- Weather station with
  - Rain sensor
  - Wind sensor
  - Temperature sensor
  - DCF 77 receiver
  - Light sensor
  - Facade control
  - Logic function/timer

Overlay masks (applications)

Masks for simulation of room constellations indoors or outdoor areas of various buildings.



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KNX applications

- Disconnection application
- Heating control application
- Office building application
- Residential house application

7

No.	Designation	Order no.
1	KNX Professional Programming Board	41220
2	KNX Color Touch Panel	41227
3	KNX Weather Station	41022
4	Disconnection application	41251
5	Heating control application	41252
6	Office building application	41253
7	Residential house application	41254

BASIC LEVEL KNX TRAINING PACKAGE 22.20

Courseware

Content

⟩ 1. Principles
⟩ 2. KNX-Tool-Software Version 5.x
⟩ 3. Tests for basic building functions
⟩ 4. Projects
– Project 1: Breaker circuit, button switched line, dimming and blind function
– Project 2: Extension with a time function
– Project 3: Breaker circuits, dimming, blind control with central OFF, use of feedback objects – Project 4: Controlling building functions in a re-creation centre – lighting control, blind control, dimming, logical interlinking and time function
– Project 5: Office building with safety function for the blind and logical linking OR

1

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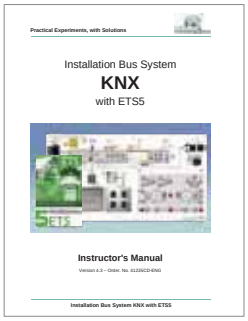

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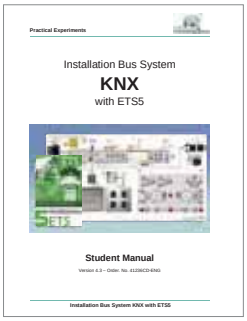
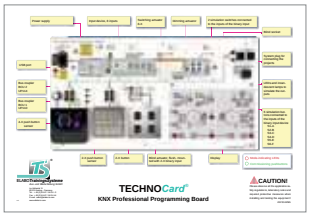


3

Set of Transparencies

⟩ Basics
⟩ Applications
⟩ KNX Toolsoftware
⟩ Example solutions
⟩ Components

4



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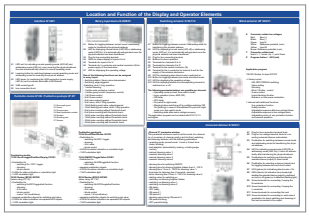

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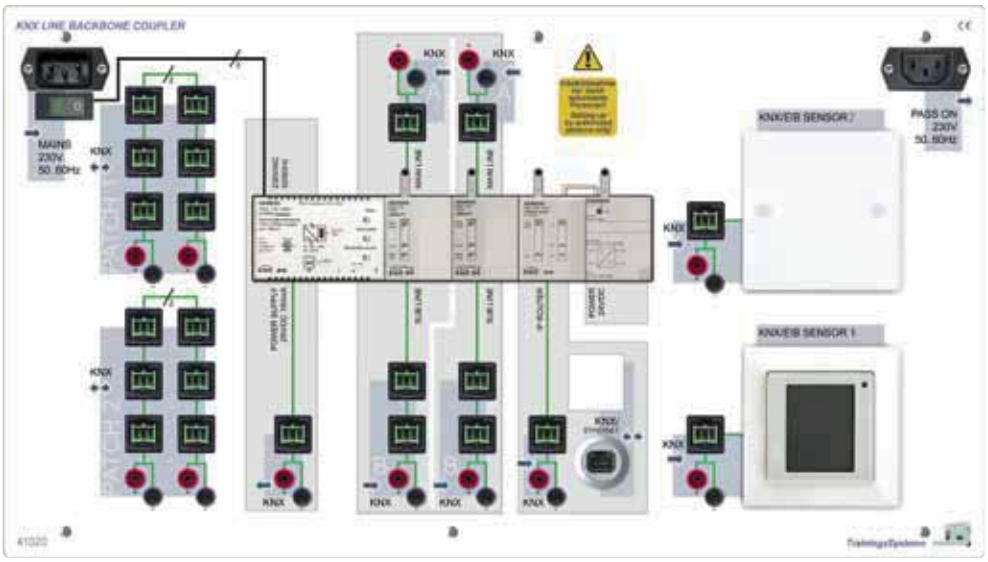
No.	Designation	Order no.
1	Media Folder Set	91903
2	Installation Bus System with KNX ETS5 – Instructor's Manual	41235CD-ENG
3	Installation Bus System with KNX ETS5 – Student Manual	41236CD-ENG
4	Installation Bus System with KNX ETS5 – Set of Transparencies	41237CD-ENG
5	TECHNOCard® – KNX Professional Programming Board	41233

KNX-NETWORKING

KNX Network Coupler



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Learning objectives

- Using line / area couplers
- Parameterising line / area couplers
- Using filter tables
- Evaluating routing counter contents
- Commissioning and trouble-shooting
- Line/area coupling via IP
- Programming via IP

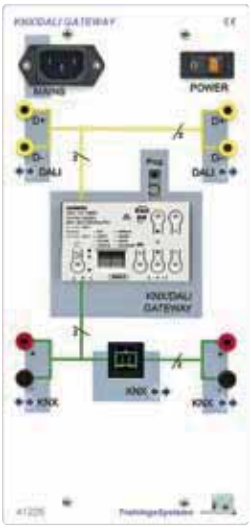
Technical data

- KNX Power supply
- 2 line / area couplers
- 1 IP router
- Power supply 24 V DC
- Push button sensor with LCD display and timer function
- Distribution panels for lines A and B
- Free mounting space for additional sensor

No.	Designation	Order no.
1	KNX network coupler	41020

KNX GATEWAY

KNX Gateway



1

Functions

- Time functions:
  - Timer mode
  - Night mode
  - Warning of impending OFF
- Dimming:
  - Brighter/darker
  - Brightness limitation
  - Adjustable dimming time
- Switching:
  - On/Off
  - On/Off via dimming
- Emergency lighting:
  - Control of self-contained luminaires
  - Support of obligatory test sequences
- Status:
  - short-circuit
  - power supply
  - Status outputs
  - Status groups
  - Status electronic ballast

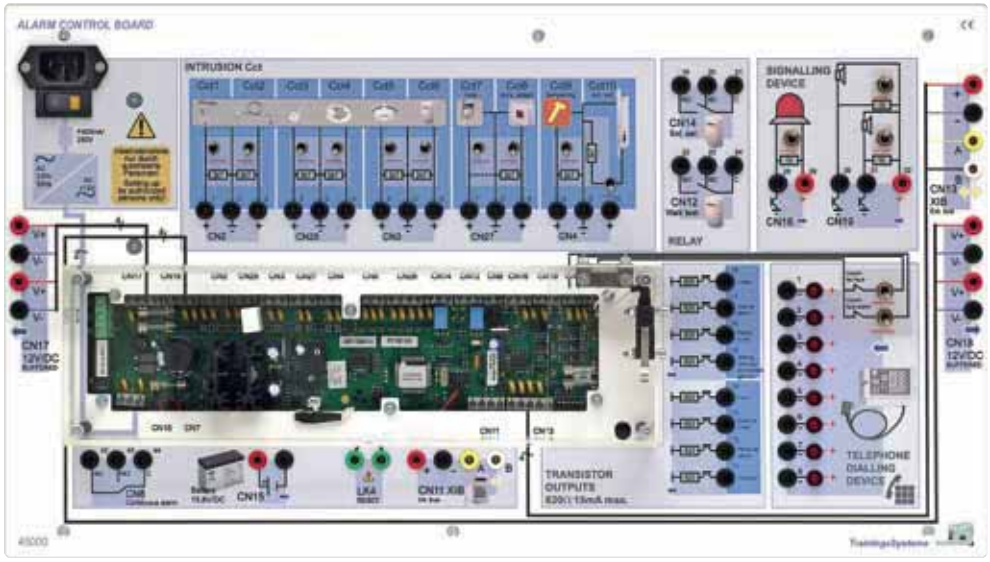
Technical data

- interface for integrating of up to 64 devices
- bus voltage: approx. 19 V DC
- KNX-bus connection
- Mains voltage: 110 – 240 V AC, 50 / 60 Hz
- Connection of all inputs and outputs via safety sockets (2 mm)

No.	Designation	Order no.
1	KNX Gateway	41226

ALARM MANAGEMENT SYSTEM

Alarm Control Centre



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Learning objectives

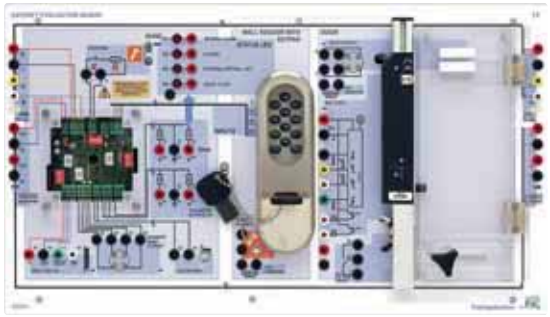
- Construction and commissioning of an alarm management system
- Taking into consideration the applicable VDE- and VdS-regulations
- Selection of suitable detectors and sensors
- Programming the danger detecting system via an LCD or via a PC
- Carrying out maintenance work
- Inspecting the detectors used
- Use of different activating devices, selection according to the VdS classes
- Putting into operation an access control system

Technical data

- 10 detector groups
- 2 relay outputs, programmable
- 1 relay output for continuous alarm
- 1 internal safety bus
- 1 external safety bus
- 1 transistor output for a strobe light
- 2 transistor outputs for sirens
- 8 transistor outputs for e.g. a dialling device
- 1 input for an emergency power supply
- 1 input for telephone dialer Fault
- 1 input for telephone dialer Alarm
- VdS approval: Class A, B, C in accordance with DIN VDE 0833 parts 1&3

No.	Designation	Order no.
1	Alarm Control Board	45000
2	SafeKey Evaluation Board (Access control and activation)	45004
3	Technical Alarm Board	45006
4	Burglar Passive Alarm Board	45007
5	Fire Detector Board	45008
6	Circuits Extension Board	45005
7	LCD Keypad	45002
8	LAN Interface Board	45009
9	KNX Interface Board	45010

An Overview of the System



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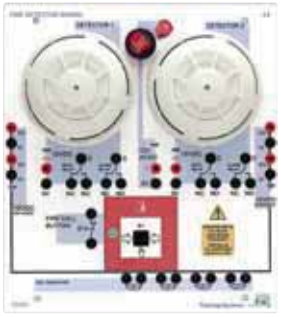

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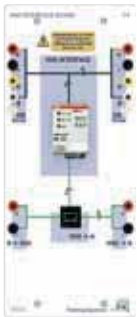


9

NETWORKING SYSTEMS

Voice over IP

1

2

Due to the increasing digitization of our environment, sound knowledge of network technology comes more and more into focus. The state of the art in the field of „INDUSTRY 4.0“ – „Internet of Things“ is becoming more and more important as a key technology for trainees and future skilled workers as well as for students.

Learing objectives

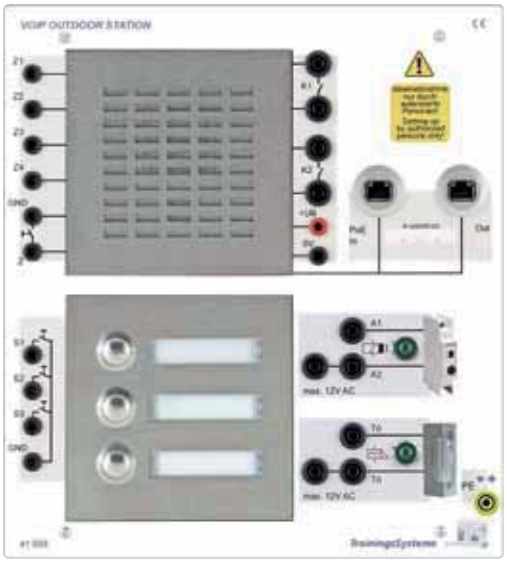
- Installation and wiring of telecommunications systems
- Parameterization of telecommunications systems
- IP telephone configuation
- Installation of a private branch exchange
- Creation of acceptance reports
- Troubleshooting in installations
- Connection to home intercoms in IP-Technik
- Installation of IP telephones
- Installation of SIP, VoIP telephones

Technical Data
Communication Center (1)

- Analog private branch exchange with SIP telephone
- 1 S0 bus extern
- 1 DSL connection extern
- 2 a/b connections
- 4 Ethernet connections RJ45
- 2 USB interfaces
- 1 DECT basis station for 6 participants
- 1 Integrated anwering machine
- 1 Dual WLAN N
- 1 integrated switch, 4 x Gigabit LAN
- 1 Media server
- 1 NAS (network attached storage)
- Telephone connection analog: RJ12 respectively TAE
- ISDN connection: RJ45
- Network connections: RJ45

Technical Data
Communication Server (2)

- IP intercom server providing the required SIP registrar (SIP server). Power supply is realized via the internal power supply unit respectively via PoE (Power over Ethernet). Integration into a user network is possible.
- Integrated switch, 4 port gigabit
- SIP registrar
- Power supply unit 28 V DC for the supply of PoE devices
- Power supply unit 12 V AC for door opener and lighting
- Commissioning via web interface
- The connections of the components operated with AC are designed as 4mm **safety sockets**
- The home intercom connections are designed as 2mm **safety sockets**
- 4 call groups with 9 clients each



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Technical Data
VoIP Audio Outdoor Station (3)

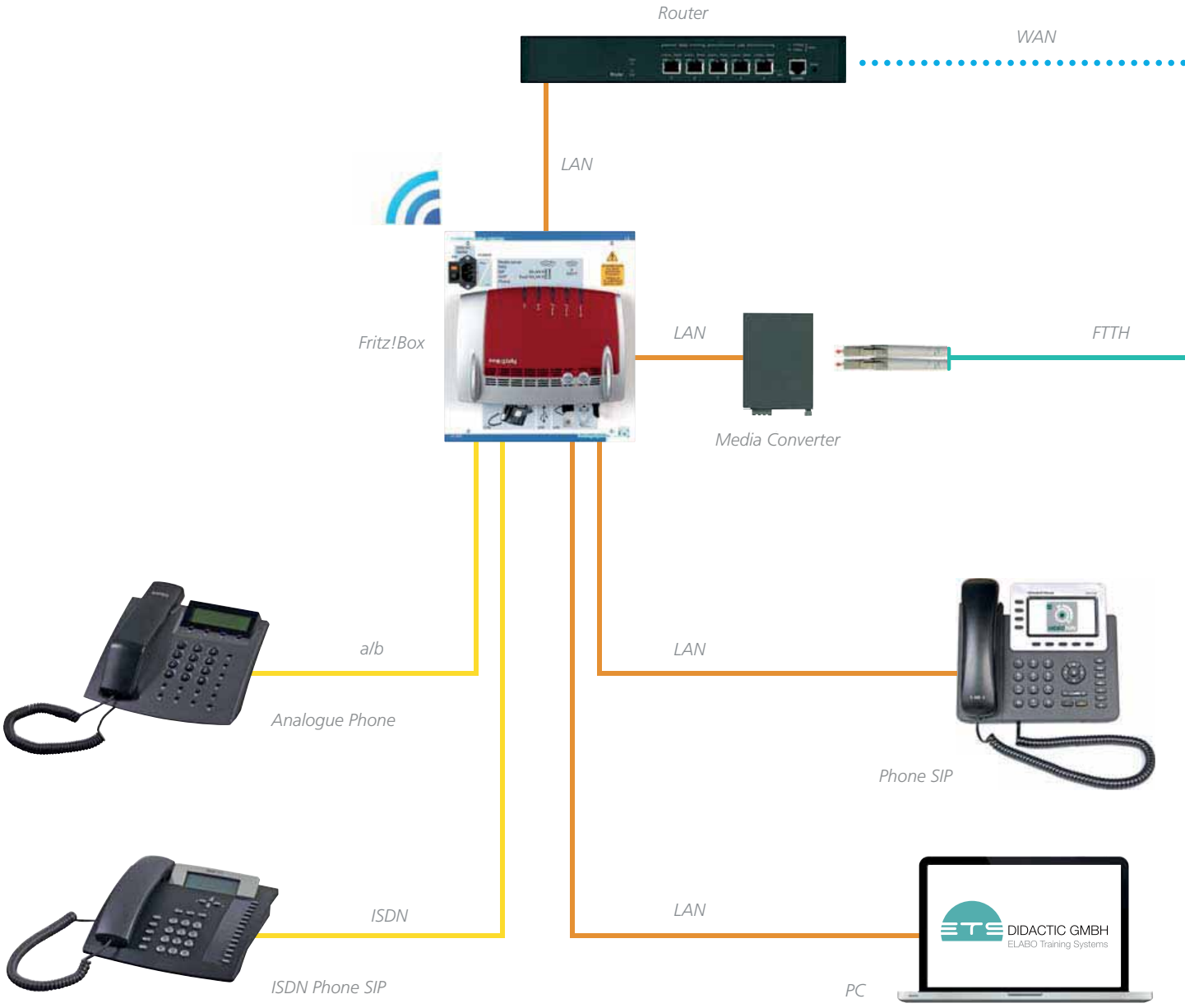
- Home intercom outstation in IP technology
- VoIP loudspeaker module with interface for 4 call buttons and 2 relays for door opener and lighting
- Call button moduls with 3 call buttons
- LED for door opener in 12 V / AC design
- LED for lighting function in 12 V /AC design
- The connections of the components operated with AC are designed as 4mm safety sockets
- The home intercom connections are designed as 2mm safety sockets

Technical Data
IP Video Outdoor Station (4)

- Home intercom outstation in IP technology
- IP color video camera
- Color camera module on IP basis with Ethernet interface
- Motion JPEG color picture with maximum of 640 x 480 (VGA)
- Aperture angle: 83° horizontal / 65° vertical
- IR lighting for operation at night (automatic mode)
- Ethernet interface (100BaseTX)
- Simple configuration via integrated webserver
- Display of camera picture in web browser in VGA (640 x 480), QVGA (320 x 240) and QQVGA (160 x 120) or custom size in display window setting
- Video / single picture shift, adjustable compression rate, up to 4 times digital zoom, picture can be rotated in 90°steps
- JPEG and motion JPEG compatible to AXIS VAPIX
- Power supply via PoE (802.3af)

NETWORKING SYSTEMS

Everything Tends towards IP-based Communication



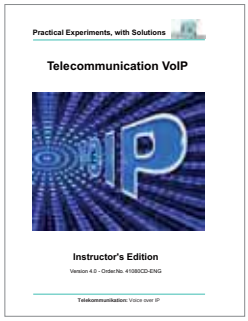
DHCP Dynar
NAS Netwo
ISDN Integr

mic Host Configuration Protocol	*FTTH Fiber To The Home*
ork Attached Storage	*SIP Session Initation Protocol*
ated Services Digital Network	*PoE Power over Ethernet*

NETWORKING SYSTEMS

Courseware

1



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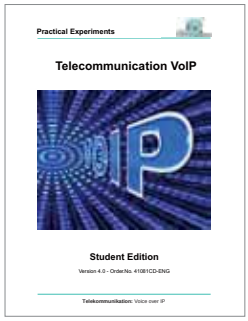


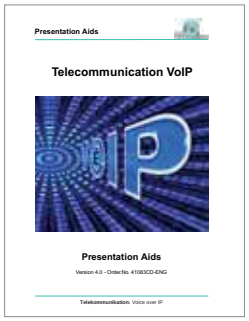
3

4

Printed and digital

Contents

- Basics of VoIP connections
- SIP protocol
- Project 1: Installation of telephone and internet connections
- Project 2: Installation of an IP based telephone box
- Project 3: Extension of an IP based telephone box



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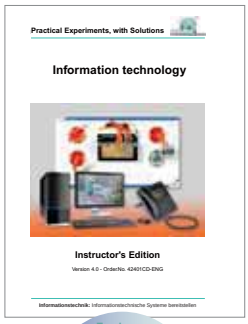

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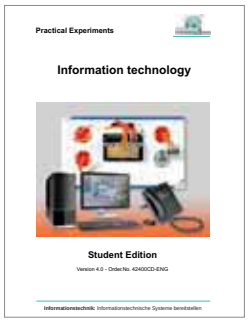

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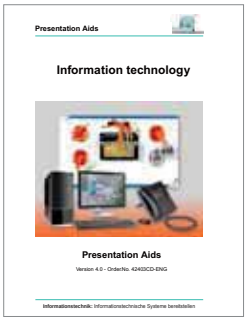
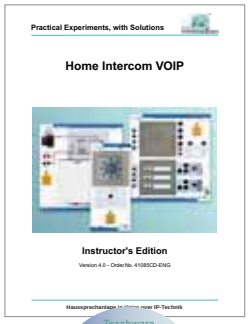


9

Printed and digital

Contents

- Project 1: Installation of small networks
- Project 2: Installation of small networks
- Project 3: Extension of small networks
- Project 4: Extension of small networks



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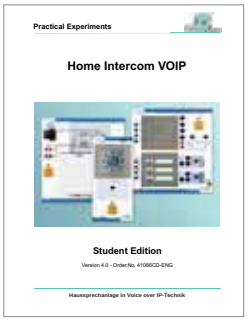

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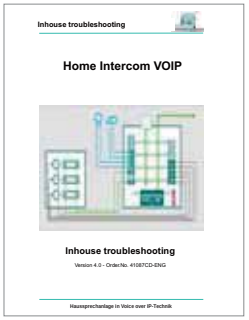

12

13

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Contents

- Basics of VoIP connections
- SIP protocol
- Project1: Installation of an IP based home intercom
- Project 2: Integration of an IP based home intercom into a user network
- Project 3: Integration of an IP based home intercom into a user network or telephone installation

No.	Designation	Order no.
1	Set of ETS ring binders	91903
2	Telecommunication VoIP – Instructor's manual	41080CD-ENG
3	Telecommunication VoIP – Student manual	41081CD-ENG
4	Telecommunication VoIP – Inhouse troubleshooting	41082CD-ENG
5	Telecommunication VoIP – Presentation Aids	41083CD-ENG
6	Information technology – Instructor's manual	42401CD-ENG
7	Information technology – Student manual	42400CD-ENG
8	Information technology – Inhouse troubleshooting	42402CD-ENG
9	Information technology – Presentation Aids	42403CD-ENG
10	Home intercom VoIP – Instructor's manual	41085CD-ENG
11	Home intercom VoIP – Student manual	41086CD-ENG
12	Home intercom VoIP – Inhouse troubleshooting	41087CD-ENG
13	Home intercom VoIP – Presentation Aids	41088CD-ENG

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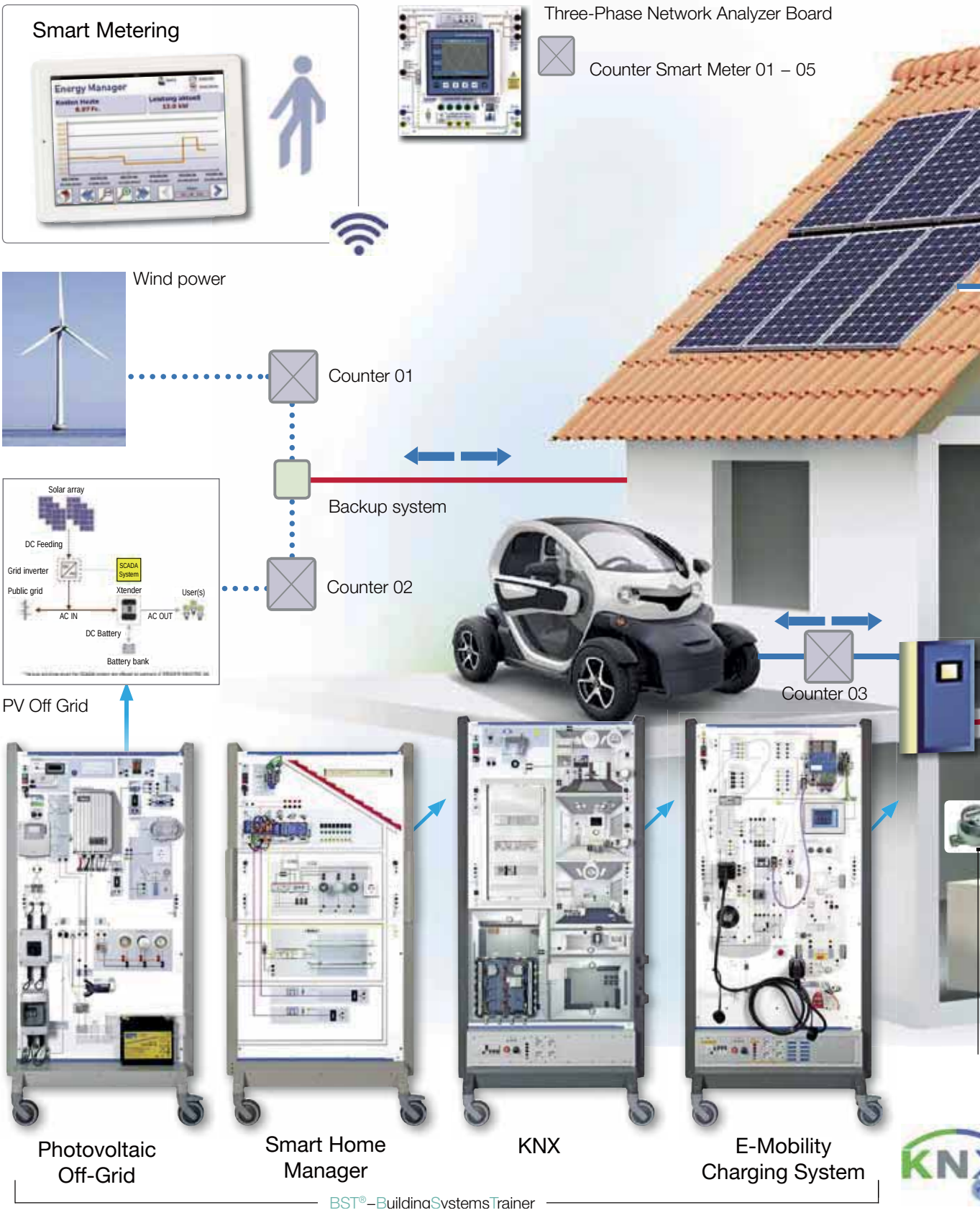


Photovoltaic module

Photovoltaic On-Grid

BST®–BuildingSystemsTrainer

Solar battery

Protective Measures

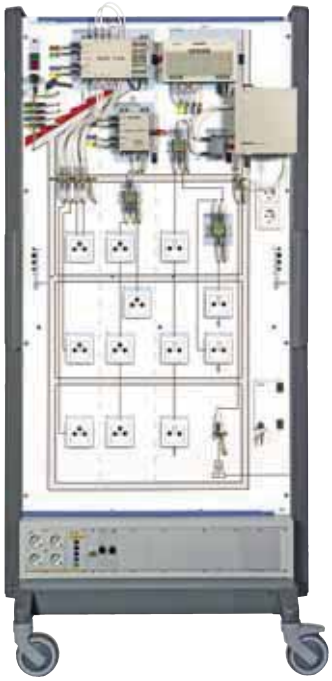
BST®–BuildingSystemsTrainer

M-Bus Modbus BACnet EEBUS SMART grid

GOING OTHER WAYS

BST®–BuildingSystemsTrainer

1



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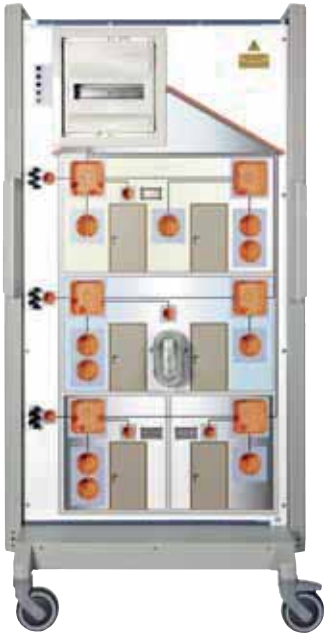

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8

Mobile – Practical – Safe

4

5

BST® – the flexible training system from ETS DIDACTIC GMBH for building automation – based on real components.

The flexible training system from ETS DIDACTIC GMBH for building systems engineering, with real components, such as the meter cabinet, complying with the safety regulations. The system is characterised by the holistic approach to knowledge transfer. It is mobile and the workplace can be fitted individually from two sides. The trainee can work and make measurements with the highest possible safety under real conditions.

9

No.	Designation	Order no.
1	BST® Communication Technologies I	43560
2	BST® Communication Technologies II	43561
3	BST® Protective Measure	43503
4	BST® E Mobility Charging System	43580
5	BST® KNX Technology	43540
6	BST® Smart Manager	43630
7	BST® Installation Technologies	43504
8	BST® PV Off Grid System	43521
9	BST® PV On Grid System	43520

COMMUNICATIONS TECHNOLOGY I

BST®–BuildingSystemsTrainer

1

Learning objectives

- Creating building services systems to meet customer requirements
- Inspecting and testing building services systems
- Becoming acquainted with networked IT systems
- Installing devices and systems, connecting and modifying them to existing grids
- Troubleshooting on building services systems

The system consists of

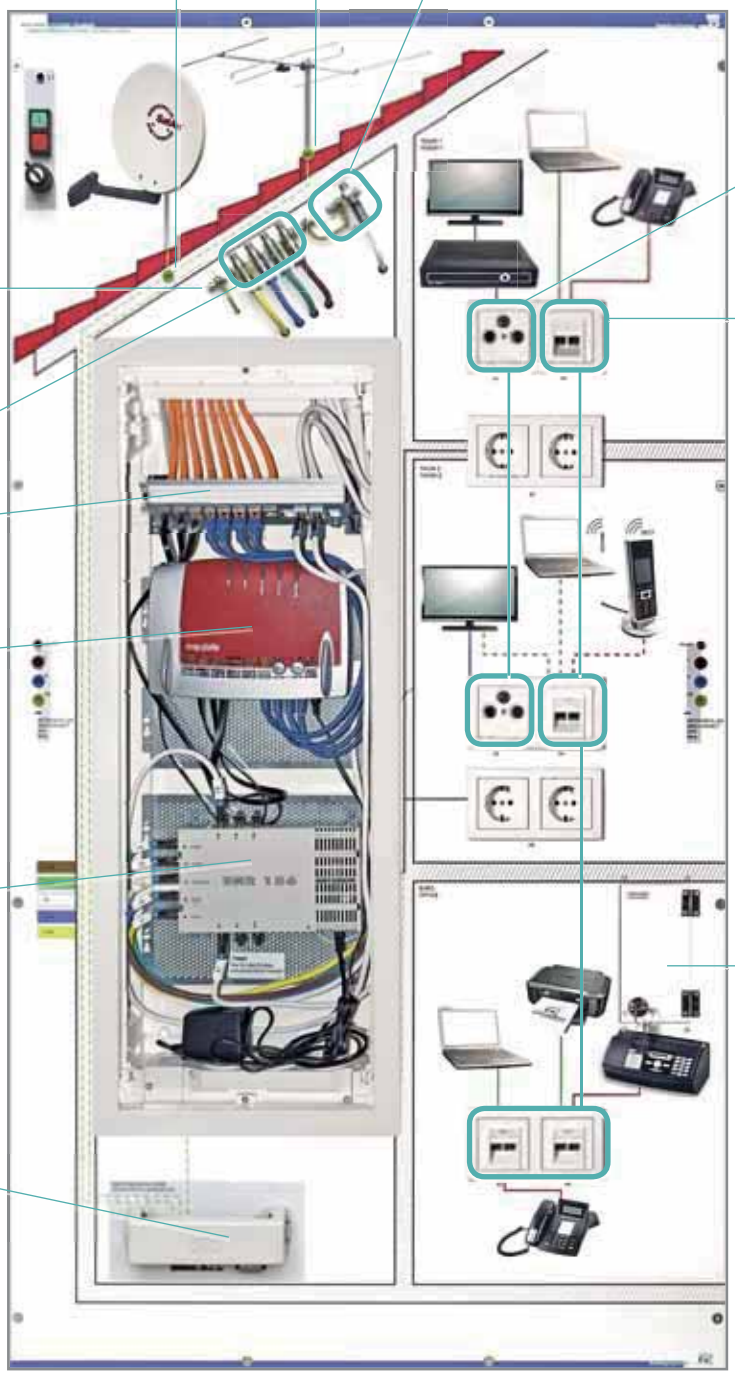
- Connection for DVB-S antenna with Universal Quad LNB
- 8-fold patch field RJ45
- FRITZ!Box (2 x analog connections, 1 x ISDN, 4 x LAN, WLAN)
- Multiswitch for DVB-T and DVB-S-signal for up to 6 terminals
- Fault simulator
- Structured cabling
- Multimedia sub-distributor
- JR45 sockets
- Antenna sockets
- Equipotential bonding

Advantages

- The Building Systems Trainer Communications Technology I includes the topics of satellite reception (DVB-S), telecommunications and network technology.
- The telecommunications and network cabling is run as structured cabling. A FRITZ!Box is used as a „Central“ element through which the topics of telecommunications (analog, ISDN and DECT) and the network technology LAN and WLAN are covered.

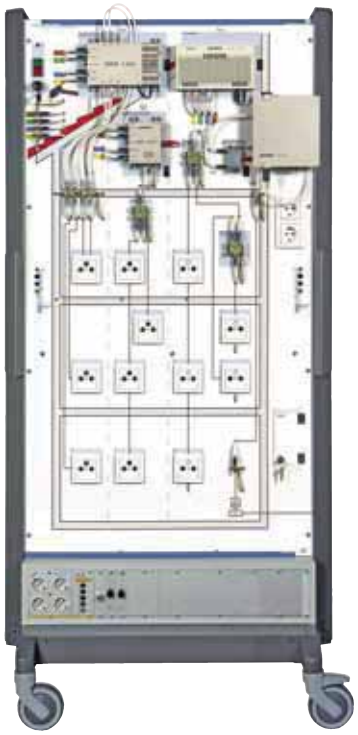
No.	Designation	Order no.
1	BST® Communication Technoligies I	43560

BST®–BuildingSystemsTrainer Communications Technology I



COMMUNICATIONS TECHNOLOGY II

BST®–BuildingSystemsTrainer



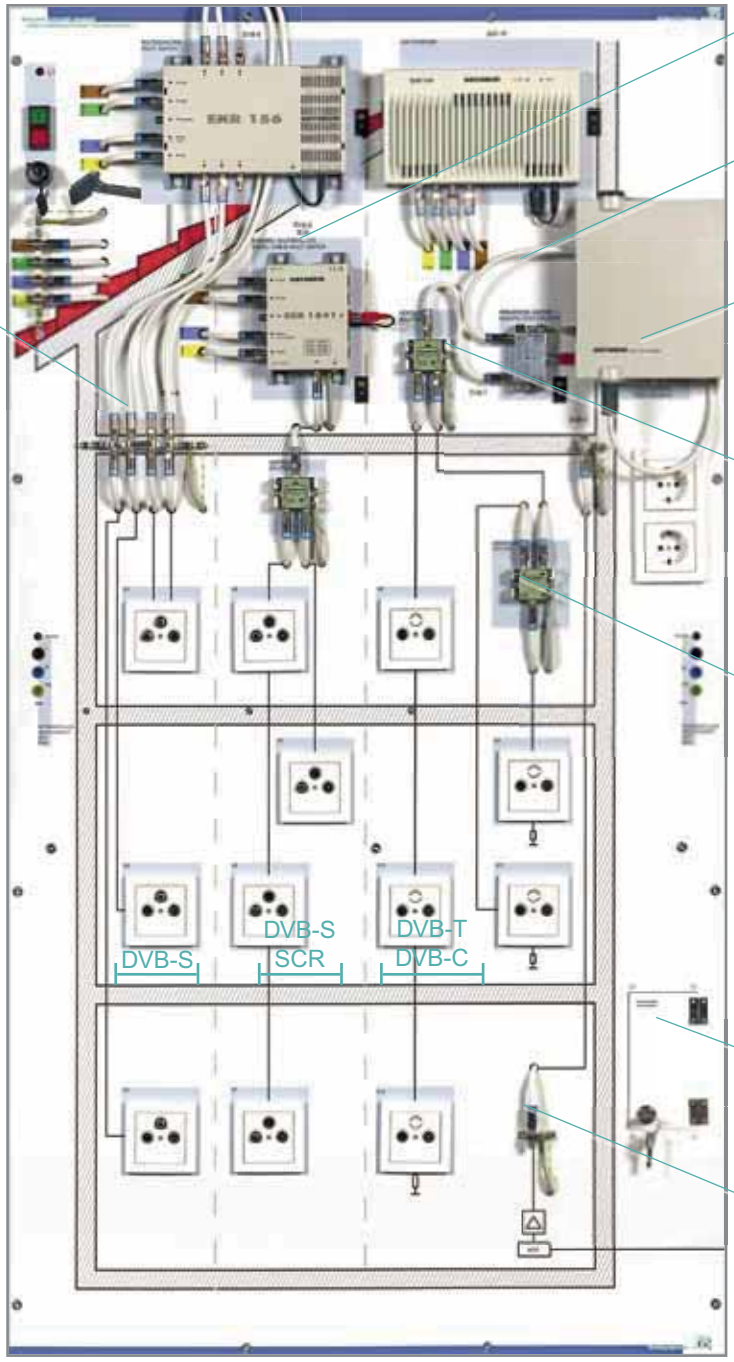
1

The system consists of

- Connection for DVB-S antenna with Universal Quad LNB
- 8-fold patch field RJ45
- FRITZ!Box (2 x analog connections, 1 x ISDN, 4 x LAN, WLAN)
- Multiswitch for DVB-T and DVB-S-signal for up to 6 terminals
- Fault simulator
- Structured cabling
- Multimedia sub-distributor
- JR45 sockets
- Antenna sockets
- Equipotential bonding

No.	Designation	Order no.
1	BST® Communication Technoligies II	43561

BST®–BuildingSystemsTrainer Communications Technology II



ELECTRIC VEHICLE CHARGING SYSTEM

BST®–BuildingSystemsTrainer

1

Learning objectives

- Project managing energy management systems with an interface to eMobility
- Implementing charging stations in smart metering and smart grid solutions
- Installing and commissioning measuring, control and regulation units
- Visualising energy systems and their energy flows
- Maintaining and servicing automation units integrated in the building
- Checking and ensuring the electrical safety of energy management systems

The system consists of

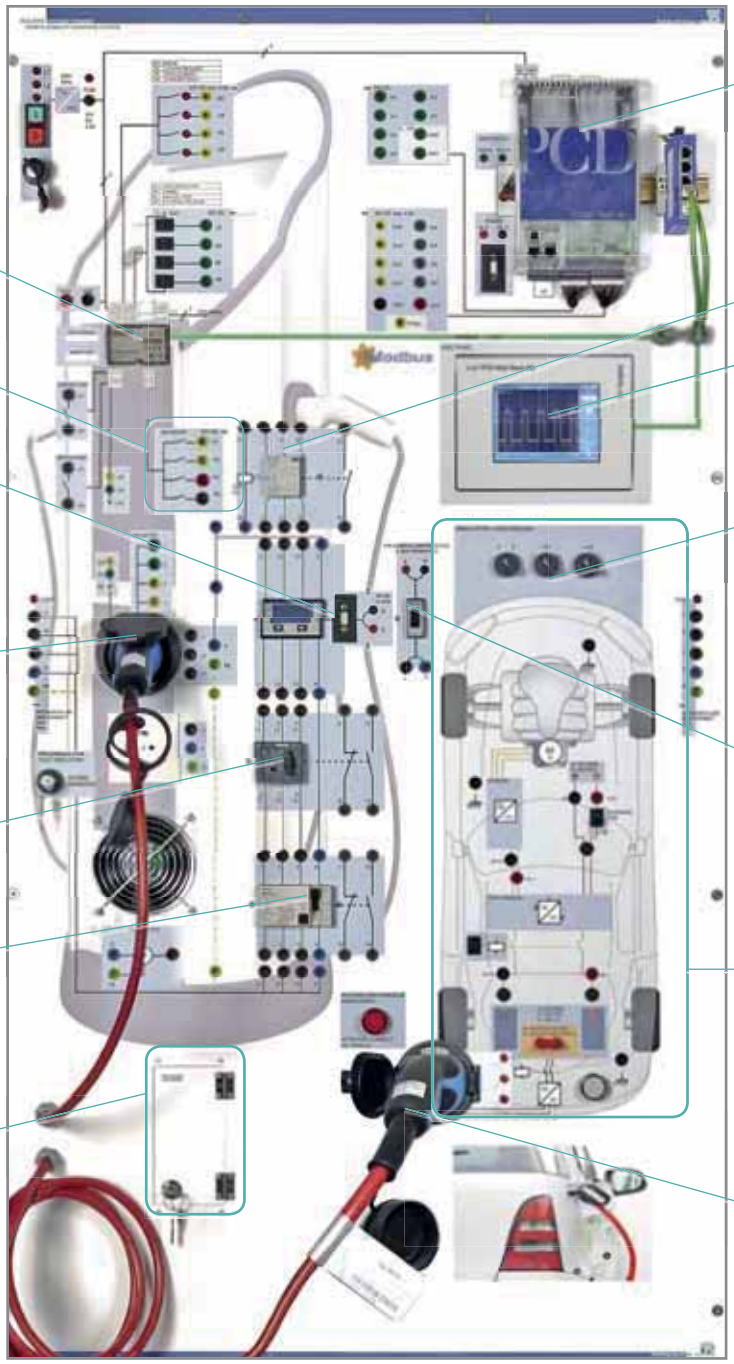
- Protective devices: RCD, cable protection
- Charge controller for e-vehicles with Modbus interface
- Fault simulator
- PLC incl. Modbus TCP/Ethernet/KNX communication
- Touch panel, Ethernet switch
- Terminating resistor for RS485 bus system
- Load contactor
- Type 2 charger in accordance with ISO/TS 18949 (Mennekes)
- 3-phase AC meter, MID-compliant with RS485 interface
- Relay outputs on charge controller on 4 mm safety sockets
- Simulation switch for the individual charging levels
- RCD circuit breaker type B
- Motor protection switch
- Vehicle simulation, displaying a vehicle with the essential functional units for the charging process.

Advantages

- The Building Systems Trainer Communications Technology I includes the topics of satellite reception (DVB-S), telecommunications and network technology.
- The telecommunications and network cabling is run as structured cabling. A FRITZ!Box is used as a „Central“ element through which the topics of telecommunications (analog, ISDN and DECT) and the network technology LAN and WLAN are covered.

No.	Designation	Order no.
1	BST® Electric Vehicle Charging System	43580

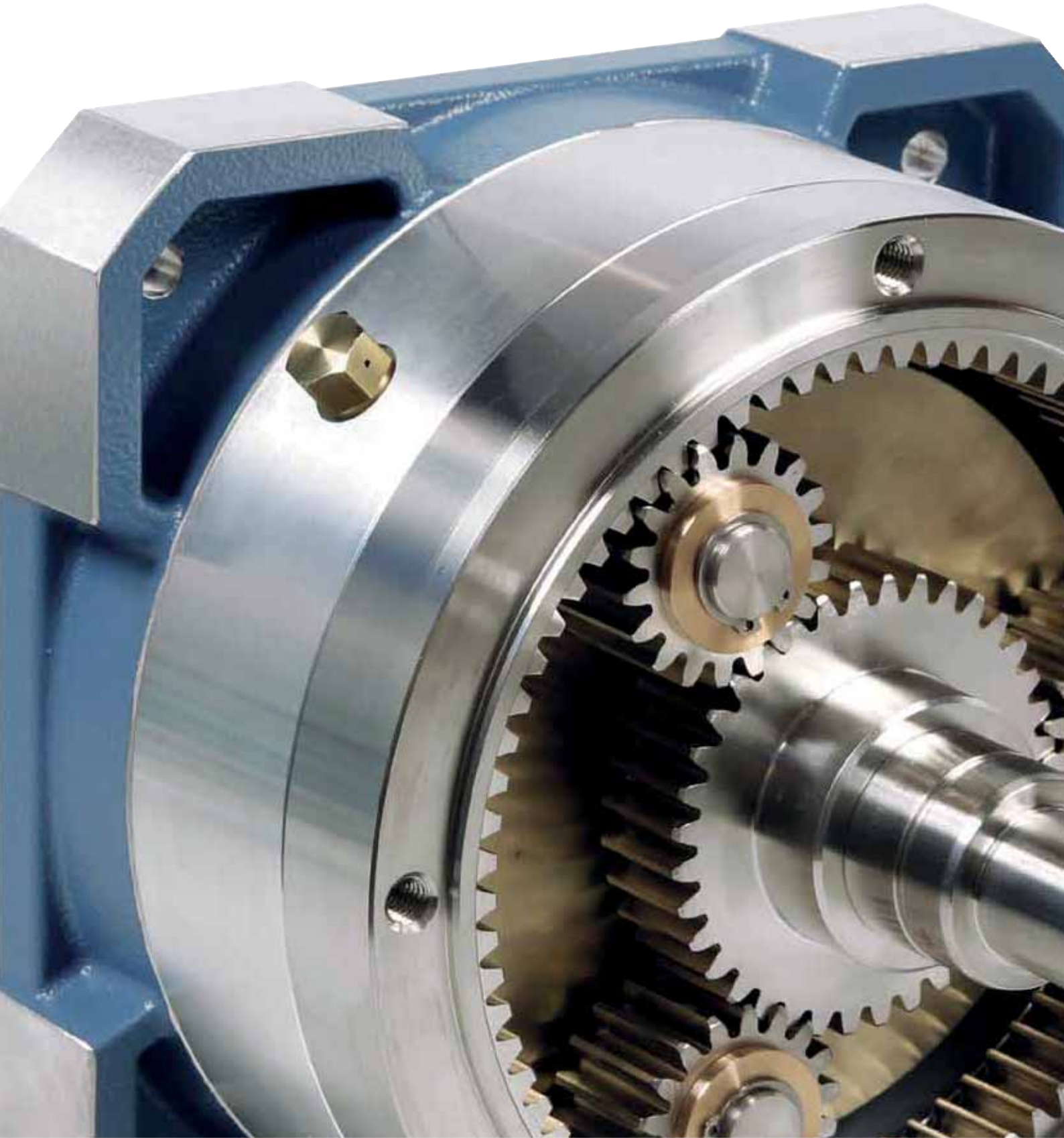
BST®–BuildingSystemsTrainer Electric Vehicle Charging SystemI



WEATHER-DEPENDENT BLIND CONTROL

BST®–BuildingSystemsTrainer

"Offering the entire spectrum"



MECHANICAL ENGINEERING

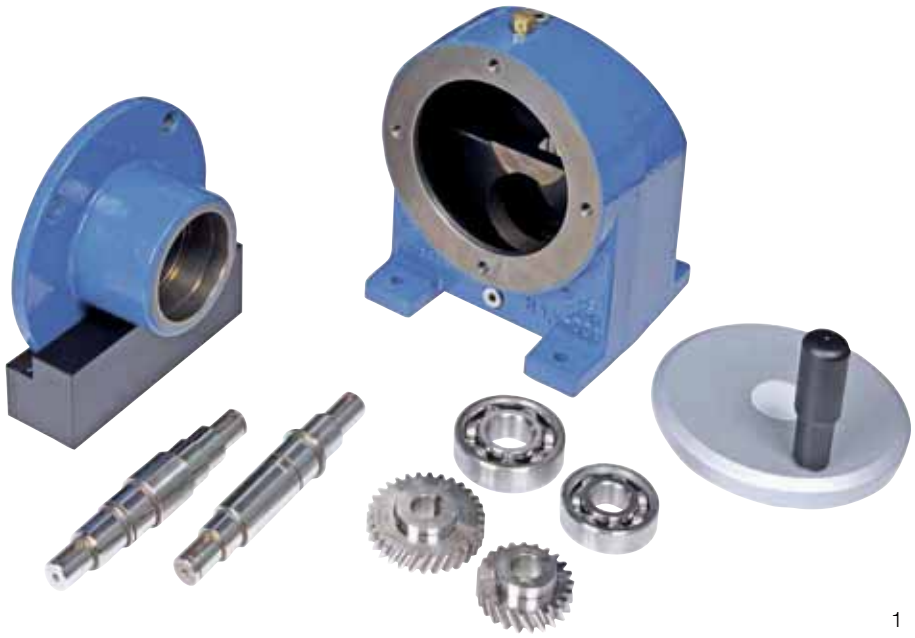
Gear Units

Bearings

Pneumatics / Electropneumatics

HELICAL GEAR SINGLE-STAGE ETS1 – TRAINING PACKAGE

Mechanical Components for Hands-on Training



1

Learning Objectives

Helical gear ETS1

- Assess assembly drawings, layout plans, and parts lists
- Select suitable test equipment and create test reports
- Create assembly plan for proper assembly and disassembly
- Develop test criteria for functional tests
- Plan maintenance including evironmentally-friendly disposal of material and operating fluids
- Analyze faults and determine components to be replaced
- Assemble technical subsystems with subsequent function check
- Convert existing systems according to customer request
- Select tools and resources by means of function plans and design drawings
- Analyze, plan, and organize workflows (assembly, disassembly and preventive maintenance measures)

No.	Designation	Order no.
1	Helical gear unit ETS1, single-stage, in system case	57345
2	Tool set for helical gear unit, in system case	57306
3	Caster for gear unit system case	57307
Not ill.	Rubber mat 800 mm x 500 mm	57308

81.3-5

Storage and Accessories

2

1

3

2

Overview

- Educational gear self-assembly kit
- Modified fits – assembly and disassembly possible without press-in or injection tools
- No use of lubricants (oil, grease) – clean workplace
- Corrosion-resistant components: all components are either made from stainless materials (e.g., stainless steel bearings) or surface-treated (painted / powder-coated housing

Storage system

- Individual parts are clearly arranged in high-quality foam inserts
- Missing parts can be detected immediately
- Stored in a space-saving plastic case and covered from dust
- Roller unit (optional) for easy and quick transportation

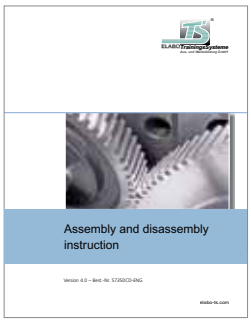
Self-assembly kit

The gear self-assembly kit for the single-stage helical gear has a modi-fied fit system so no special tools such as presses or pullers are required for assembly. Using mechanical drawings or detailed assembly instructions, learners can assemble the gear independently and perform a function test using the hand wheel. This allows apprentices to experience the functionality of a single-stage helical gear and to better understand its mechanical sequences.

HELICAL GEAR SINGLE-STAGE ETS1 – TRAINING PACKAG

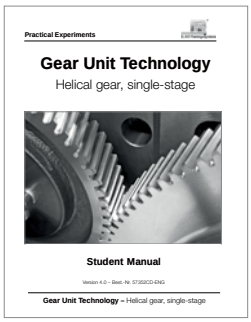
Courseware

1



2

3



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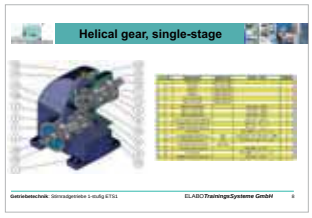
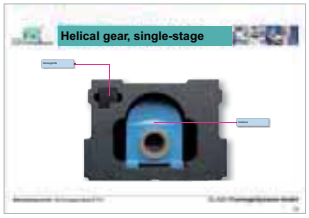
Printed and digital





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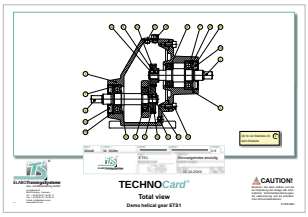

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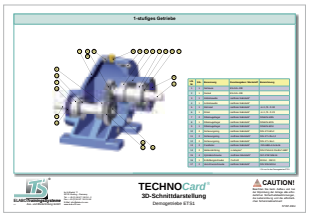


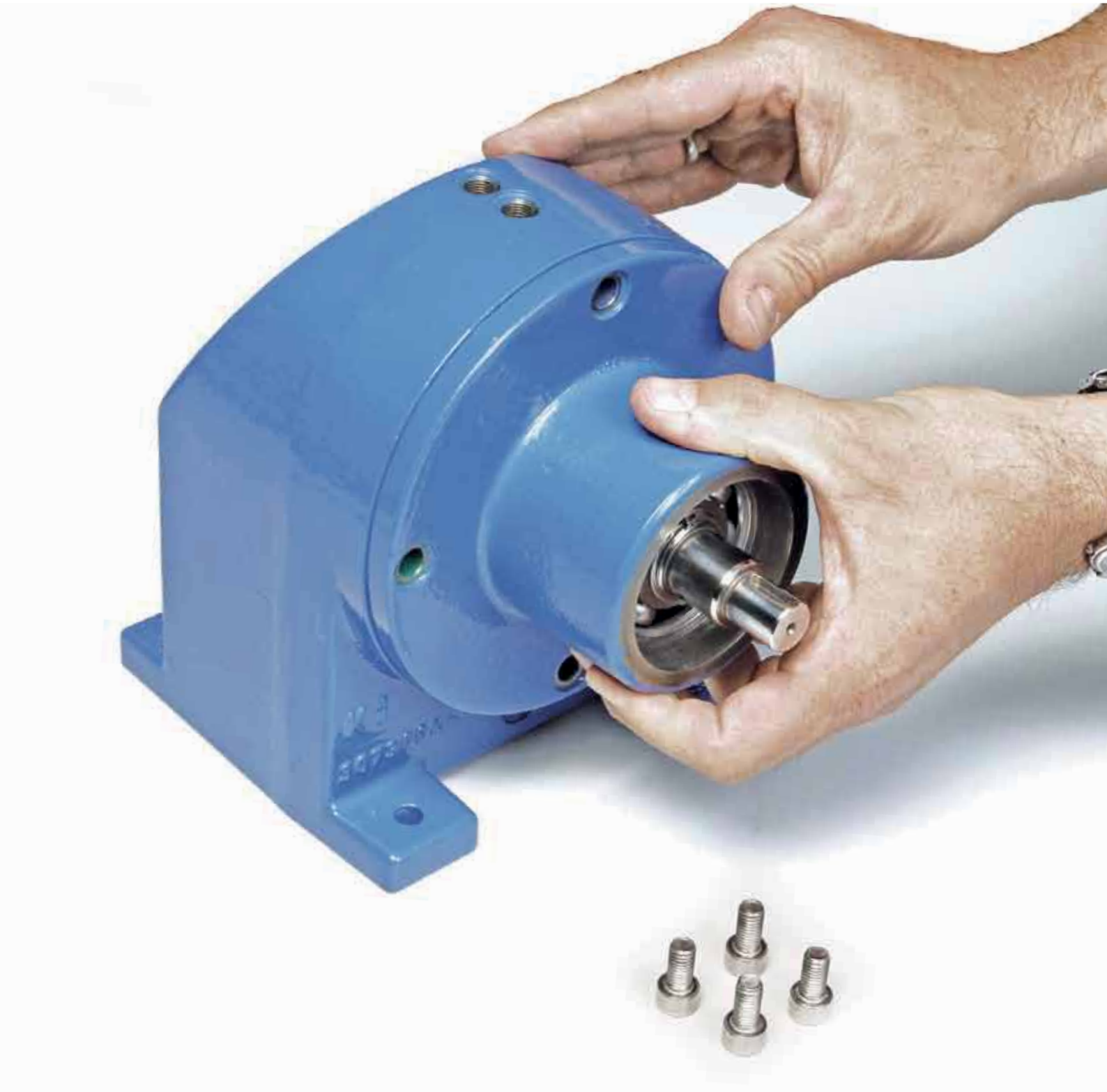
6

Manual
Helical gear ETS1
Practical, detailed manual using the ETS1 single-stage helical gear to explain gear theory as well as maintenance and quality assurance.

- ⟩ Technical communication
- ⟩ Transmission
- ⟩ Gear wheels and toothed gearing
- ⟩ Assembly and disassembly
- ⟩ Servicing and maintenance
- ⟩ Quality assurance

No.	Designation	Order no.
1	Media Folder Set	91903
2	Assembly and disassembly instruction ETS1	57350CD-ENG
3	Gear Unit Technology, Helical gear, single-stage – Indstructor's Manual	57351CD-ENG
4	Gear Unit Technology, Helical gear, single-stage – Student Manual	57352CD-ENG
5	Gear Unit Technology, Helical gear, single-stage – Set of transparencies	57353CD-ENG
6	Set of TECHNOCards® ETS1	57354-ENG
Not ill.	Videoclips ETS1	57347CD
Not ill.	CAD data ETS1	57348CD

GE 81.3-5



HELICAL GEAR 2/3-STAGE ETS2 – TRAINING PACKAGE 81.3

Mechanical Components for Hands-on Training

1

Learning Objectives

2/3 stage Helical Gear ETS2

- Assess assembly drawings, layout plans, and parts lists
- Select suitable test equipment and create test reports
- Create assembly plan for proper assembly and disassembly
- Develop test criteria for functional tests
- Plan maintenance including environmentally-friendly disposal of material and operating fluids
- Analyze faults and determine components to be replaced
- Assemble technical subsystems with subsequent function check
- Convert existing systems according to customer request
- Select tools and resources by means of function plans and design drawings
- Analyze, plan, and organize workflows (assembly, disassembly and preventive maintenance measures)

No.	Designation	Order no.
1	Helical gear unit ETS2, 2/3-stage, in system case	57305
2	Tool set for helical gear unit, in system case	57306
3	Caster for gear unit system case	57307
Not ill.	Rubber mat 800 mm x 500 mm	57308

-2

Storage and Accessories

2

1

3

2

Overview

- Educational gear self-assembly kit
- Modified fits – assembly and disassembly possible without press-in or injection tools
- No use of lubricants (oil, grease) – clean workplace
- Corrosion-resistant components: all components are either made from stainless materials (e.g., stainless steel bearings) or surface-treated (painted / powder-coated housing

Storage system

- Individual parts are clearly arranged in high-quality foam inserts
- Missing parts can be detected immediately
- Stored in a space-saving plastic case and covered from dust
- Roller unit (optional) for easy and quick transportation

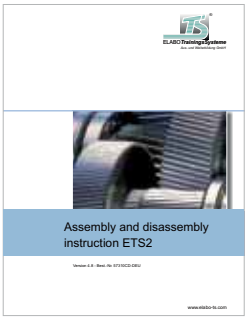
Self-assembly kit

The gear self-assembly kit for the double-/triple-stage helical gear has a modified fit system so no special tools such as presses or pullers are required for assembly. Using mechanical drawings or detailed assembly instructions, learners can assemble the gear independently and perform a function test using the hand wheel. This allows apprentices to experience the functionality of a multi-stage helical gear and to better understand its mechanical sequences.

HELICAL GEAR 2/3-STAGE ETS2 – TRAINING PACKAGE

Courseware

1



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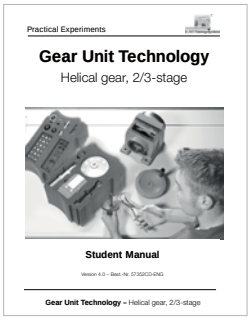
3



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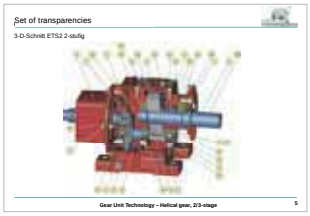
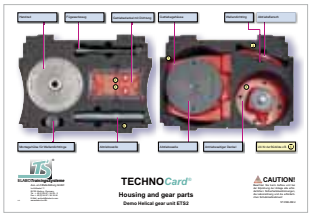
Printed and digital

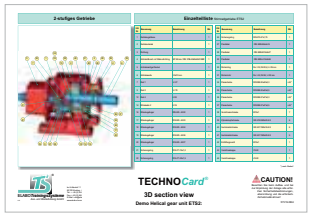


5

Manual
Helical gear ETS2
Practical, detailed manual using the dual-/triple-stage helical gear to explain gear theory.

- Gear wheels and toothed gearing
- Geometry of gear wheels
- Gear unit construction
- Drive engineering
- Assembly and disassembly
- Servicing and maintenance





6

No.	Designation	Order no.
1	Media Folder Set	91903
2	Assembly and disassembly instruction ETS2	57310CD-ENG
3	Gear Unit Technology, Helical gear, 2/3-stage – Instructor's Manual	57311CD-ENG
4	Gear Unit Technology, Helical gear, 2/3-stage – Student Manual	57312CD-ENG
5	Gear Unit Technology, Helical gear, 2/3-stage – Set of Transparencies	57313CD-ENG
6	Set of TECHNOCards® ETS2	57314K-ENG
Not ill.	Videoclips ETS2	57323CD

81.3-2

BEVEL GEAR ETS3 – TRAINING PACKAGE 81.3-3

Mechanical Components for Hands-on Training

1

Learning Objectives

Bevel gear ETS3

- Assess assembly drawings, layout plans, and parts lists
- Select suitable test equipment and create test reports
- Create assembly plan for proper assembly and disassembly
- Develop test criteria for functional tests
- Plan maintenance including environmentally-friendly disposal of material and operating fluids
- Analyze faults and determine components to be replaced
- Assemble technical subsystems with subsequent function check
- Quality assurance, incl. theory of the Gaussian (normal) distribution and the Pareto distribution and design drawings
- Select tools and resources by means of function plans and design drawings
- Analyze, plan, and organize workflows (assembly, disassembly and preventive maintenance measures)

No.	Designation	Order no.
1	Bevel gear unit ETS3, in system case	57325
2	Tool set for helical gear unit, in system case	57306
3	Caster for gear unit system case	57307
Not ill.	Rubber mat 800mm x 500mm	57308

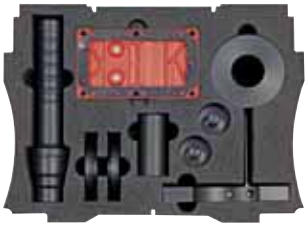
Storage and Accessories

2

1

3

2



Overview

- Educational gear self-assembly kit
- Modified fits – assembly and disassembly possible without press-in or injection tools
- No use of lubricants (oil, grease) – clean workplace
- Corrosion-resistant components: all components are either made from stainless materials (e.g., stainless steel bearings) or surface-treated (painted / powder-coated housing

Storage system

- Individual parts are clearly arranged in high-quality foam inserts
- Missing parts can be detected immediately
- Stored in a space-saving plastic case and covered from dust
- Roller unit (optional) for easy and quick transportation

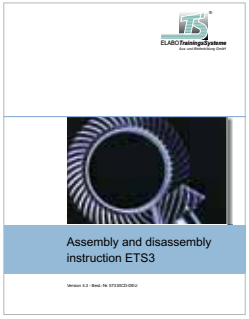
Self-assembly kit

The gear self-assembly kit for the bevel gear has a modified fit system so no special tools such as presses or pullers are required for assembly. Using mechanical drawings or detailed assembly instructions, learners can assemble the gear independently and perform a function test using the hand wheel. This allows apprentices to experience the functionality of a bevel gear and to better understand its mechanical sequences.

BEVEL GEAR ETS3 – TRAINING PACKAGE 81.3-3

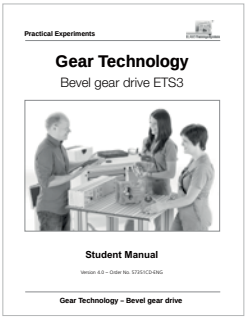
Courseware

1



2

3



4

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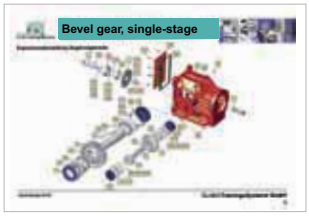
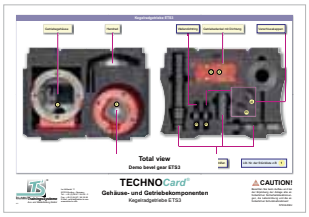
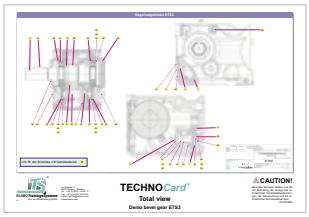


5

Manual
Bevel gear ETS3
Practical, detailed manual using the ETS3 bevel gear to explain gear theory as well as maintenance and quality assurance.

- ⟩ Gear wheels and toothed gearing
- ⟩ Gear wheel geometry
- ⟩ Toothed gearing construction
- ⟩ Drive technology
- ⟩ Assembly and disassembly
- ⟩ Quality assurance
- ⟩ Servicing and maintenance





6

NEW! With Chapter Quality assurance

- ⟩ The quality concept
  - Quality testing
  - Quality management
  - Statistical analysis
  - Standard deviation
  - The Pareto method

No.	Designation	Order no.
1	Media folder set	91903
2	Assembly and disassembly instruction ETS3	57330CD-ENG
3	Gear Unit Technology, Bevel gear – Instructor's Manual	57331CD-ENG
4	Gear Unit Technology, Bevel gear – Student Manual	57332CD-ENG
5	Gear Unit Technology, Bevel gear – Set of transparencies	57333CD-ENG
6	Set of TECHNOCards® ETS3	57334-ENG
Not ill.	Videoclips ETS3	57335CD

PLANETARY GEAR ETS4 – TRAINING PACKAGE 81.3-6

Mechanical Components for Hands-on Training

1

Learning Objectives

Planetary gear ETS4

- Assess assembly drawings, layout plans, and parts lists
- Select suitable test equipment and create test reports
- Create assembly plan for proper assembly and disassembly
- Develop test criteria for functional tests
- Plan maintenance including environmentally-friendly disposal of material and operating fluids
- Analyze faults and determine components to be replaced
- Assemble technical subsystems with subsequent function check
- Convert existing systems according to customer reques
- Select tools and resources by means of function plans and design drawings
- Analyze, plan, and organize workflows (assembly, disassembly and preventive maintenance measures)

Self-assembly kit

The gear self-assembly kit for the planetary gear has a modified fit system so no special tools such as presses or pullers are required for assembly. Using mechanical drawings or detailed assembly instructions, learners can assemble the gear independently and perform a function test using the hand wheel. This allows apprentices to experience the functionality of a planetary gear and to better understand its mechanical sequences.

No.	Designation	Order no.
1	Planetary gear unit ETS4, in system case	57365
2	Tool set for helical gear unit, in system case	57306
3	Caster for gear unit system case	57307
4	Gauges suitcase	90299
Not ill.	Rubber mat 800mm x 500mm	57308

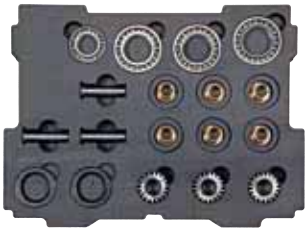
Storage and Accessories

2

1

3

2



Overview

- Educational gear self-assembly kit
- Modified fits – assembly and disassembly possible without press-in or injection tools
- No use of lubricants (oil, grease) – clean workplace
- Corrosion-resistant components: all components are either made from stainless materials (e.g., stainless steel bearings) or surface-treated (painted / powder-coated housing

Storage system

- Individual parts are clearly arranged in high-quality foam inserts
- Missing parts can be detected immediately
- Stored in a space-saving plastic case and covered from dust
- Roller unit (optional) for easy and quick transportation

Dial gauge case

for measuring and adjusting the axial play, consisting of:

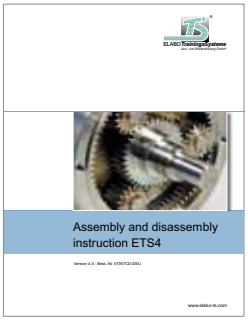
- Tripod with dovetail dial-gauge holder
- Magnetic base
- Lever gauge
- Dial gauge
- Open-ended wrench

4

PLANETARY GEAR ETS4 – TRAINING PACKAGE 81.3-6

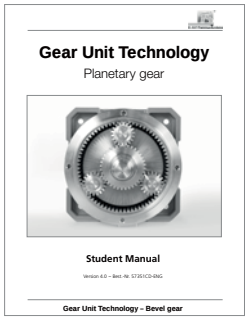
Courseware

1



2

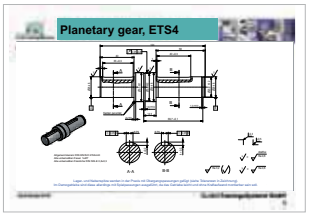
3



4

Manual
Planetary gear ETS4
Practical, detailed manual using the ETS4 planetary gear to explain gear theory.

- Technical communication
- Transmission
- Gearwheels and toothed gearing
- Assembly and disassembly
- Servicing and maintenance



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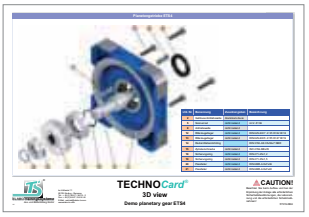
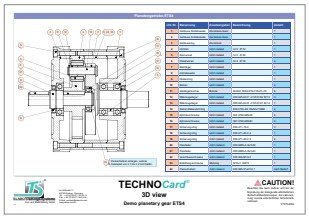




6

No.	Designation	Order no.
1	Media folder set	91903
2	Assembly and disassembly instruction ETS4	57367CD-ENG
3	Gear Unit Technology, Planetary gear – Instructor's Manual	57368CD-ENG
4	Gear Unit Technology, Planetary gear – Student Manual	57369CD-ENG
5	Gear Unit Technology, Planetary gear – Set of Transparencies	57370CD-ENG
6	Set of TechnoCards® ETS4	57373-ENG
Not ill.	Videoclips Planetary gear ETS4	57371CD
Not ill.	CAD data for Planetary gear unit ETS4	57372CD

WORM GEAR ETS5

Mechanical Components for Hands-on Training

1

Learing objectives

Worm gear ETS5

- Assess assembly drawings, layout plans, and parts lists
- Select suitable test equipment and create test reports
- Create assembly plan for proper assembly and disassembly
- Develop test criteria for functional tests
- Plan maintenance including environmentally-friendly disposal of material and operating fluids
- Analyze faults and determine components to be replaced
- Assemble technical subsystems with subsequent function check
- Modification of existing installations according to customers' specifications
- Select tools and resources by means of function plans and design drawings
- Analyze, plan, and organize workflows (assembly, disassembly and preventive maintenance measures)
- Contact pattern check

Overview

- Self-assembly kit considering didactic aspects
- Modified fits – assembly and disassembly possible without press-in or injection tools
- No use of lubricants (oil, grease) – clean workplace
- Corrosion-resistant components: all components are either made from stainless materials (e.g., stainless steel bearings) or surface-treated (painted / powder-coated housing

3

No.	Designation	Order no.
1	Worm gear unit ETS5 in system case	57302
2	Caster for the gear unit system case	57307
3	Assembly instructions – Worm gear ETS5	57383CD-ENG
n. ill.	Rubber mat 800 mm x 500 mm	57308

Storage and Accessories

1

2

Self-assembly kit

The gear self-assembly kit for the worm gear has a modified fit system so no special tools such as presses or pullers are required for assembly. Using mechanical drawings or detailed assembly instructions, learners can assemble the gear independently and perform a function test using the hand wheel. This allows apprentices to experience the functionality of a worm gear and to better understand its mechanical sequences.

Storage system

Individual parts are clearly arranged in high-quality foam inserts

- Missing parts can be detected immediately
- Stored in a space-saving plastic case and covered from dust
- Roller unit (optional) for easy and quick transportation


WÄLZLAGER

ANTI-FRICTION BEARING ASSEMBLY–TRAINING PACKAGE

Training Systems for Assembly and Disassembly of Anti-friction Bearings

Learning objectives

- Mechanical assembly and disassembly of anti-friction bearings
- Hydraulic assembly and disassembly of anti-friction bearings
- Conditions of rotation
- Creating assembly plans for expert assembly and disassembly
- Developing test criteria for functional checks
- Assembling technical sub-systems followed by functional check

The innovation –
Separating dummy and workpiece intake

- Mobile, lightweight, and compact dummy fitting
- Can be used in any type of vice
- Depending on assembly situation, only the relevant dummy is installed
- Easy design of activity-focused learning circles
- Perfectly suited also for larger groups,
- Teams split into sub-teams at the stations
- Encourages independent activity
- Helps the teacher / trainer

TP 81.2-1

Inner Ring Hammer Assembly

2

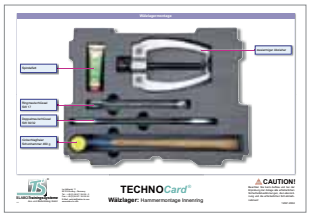
1

Learning objectives

Inner ring hammer assembly

- Assembling a grooved ball bearing on a shaft extension
- Handling industrial assembly tools
- Observing conditions of rotation
- Disassembling using a two-armed puller

TECHNOCards®



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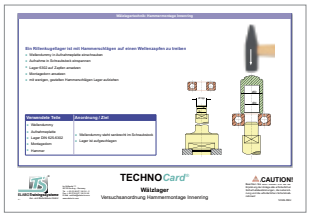

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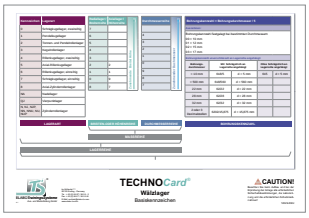

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Inner ring hammer assembly

Mechanical assembly and disassembly of grooved ball bearings across the inner ring, consisting of:

- Shaft extension
- Grooved ball bearing DIN 625-6302
- Striking sleeve with removable strike ring
- Soft-head hammer
- Two-arm, self-aligning puller
- Disassembly aid
- Open-ended wrench
- Combination wrench
- Support plate

No.	Designation	Order no.
1	Inner ring hammer assembly	12010
2	Roller unit for plastic case	57307
3	TECHNOCard® – Inner ring hammer assembly	12021-ENG
4	TECHNOCard® – Inner ring test assembly	12026-ENG
5	TECHNOCard® – Anti-friction bearing base symbol	12029-ENG
Not ill.	Rubber mat, 800 mm × 500 mm	57308

Outer Ring Hammer Assembly

2

1

Learning objectives

Outer ring hammer assembly

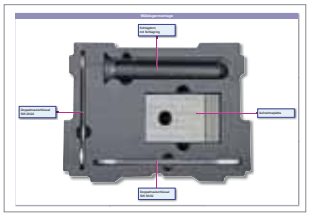
- Assembling a grooved ball bearing in a housing
- Assembly using and industrial tool
- Observing conditions of rotation
- Disassembly using internal extractors and support brace

Outer ring hammer assembly

Training system in a plastic case. Mechanical assembly and disassembly of grooved ball bearings across the outer ring, consisting of:

- Housing dummy
- Bore hole nut
- Grooved ball bearing DIN 625-6206
- Striking sleeve with removable strike ring

TECHNOCards®



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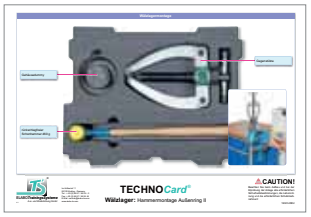

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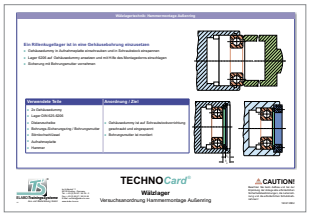

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- Soft-head hammer 460 g
- Face pin wrench size 5
- Internal bearing extractor
- Support brace compatible with internal extractor 30–39
- Open-ended wrench SW 30/32
- Open-ended wrench SW 14/15
- Open-ended wrench SW 20/22
- Support plate

No.	Designation	Order no.
1	Outer ring hammer assembly	12011
2	Roller unit for plastic case	57307
3	TECHNOCard® – Outer ring hammer assembly I	12022-DEU
4	TECHNOCard® – Outer ring hammer assembly II	12023-DEU
5	TECHNOCard® – Outer ring test assembly	12027-DEU
Not ill.	TECHNOCard® – Anti-friction bearing base symbol	12029-DEU
Not ill.	Rubber mat, 800 mm × 500 mm	57308

Shaft Press-in Assembly – Housing

2

1

5

Learning objectives

Shaft press-in assembly – housing

- Assembling a simple shaft on bearings in a housing
- Assembling grooved ball bearings using a press
- Sealing the assembly using a rotary shaft seal

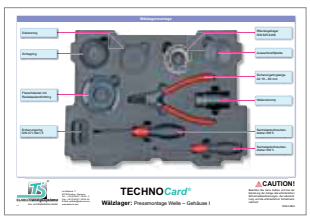
Shaft press-in assembly – housing

Training system for mechanical assembly and disassembly of a shaft on bearings in the housing; inside a plastic case, consisting of:

- Shaft extension
- Housing dummy
- Spacer ring
- Flange cover
- Ejector pin plate
- Spacer
- Bearing DIN 625-6206
- Locking ring
- Rotary shaft seal
- Circlip pliers
- Strike ring
- Allen key
- Two-arm puller
- Open-ended wrench
- Combination wrench
- Support plate

No.	Designation	Order no.
1	Shaft press-in assembly – housing	12012
2	Roller unit for plastic case	57307
3	TECHNOCard® – Shaft press-in assembly – Housing I	12024-ENG
4	TECHNOCard® – Shaft press-in assembly – Housing II	12025-ENG
5	Arbor press	10009
Not ill.	TECHNOCard® – Press-in assembly test assembly	12028-ENG
Not ill.	TECHNOCard® – Anti-friction bearing base symbol	12029-ENG
Not ill.	Rubber mat, 800 mm × 500 mm	57308

TECHNOCards®



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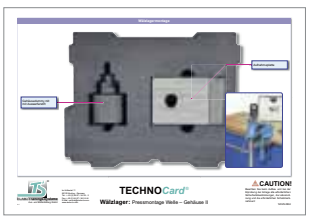

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Anti-friction Bearing Assembly—Hydraulic Tapered Press Fit

2

1

Learning objectives

Anti-friction bearing assembly

Hydraulic tapered press fit

- Assembling a self-aligning roller bearing with tapered bore hole on tapered shaft using hydraulic nut
- Choosing suitable measuring equipment
- Checking that bearing fits correctly
- Disassembling using hydraulic – using oil to free the tapered press fit

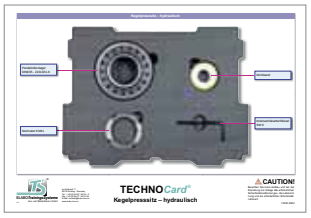
Anti-friction bearing assembly

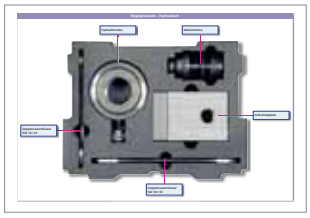
Hydraulic tapered press fit

Training system for hydraulic assembly and disassembly of a self-aligning roller bearing with tapered bore hole in a plastic case, consisting of:

- Support plate
- Tapered shaft dummy, 1:12
- Self-aligning roller bearing DIN 635-21311E1-K
- Hydraulic nut
- 1x groove nut KM11
- Allen key
- Open-ended wrench
- Open-ended wrench
- 12m Teflon tape

TECHNOCard®





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No.	Designation	Order no.
1	Anti-friction bearing assembly – hydraulic tapered press fit	12014
2	Roller unit for plastic case	57307
3	TECHNOCard® – Hydraulic tapered press fit	12030-ENG
Not ill.	Oil injector	12015
Not ill.	2-stage manual hydraulic pump, 700 bar	12016
Not ill.	Rubber mat, 800 mm × 500 mm	57308
Not ill.	Dial gauge case	90299

Anti-friction Bearing Assembly—Mechanical Tapered Press Fit

2

1

Learning objectives

Anti-friction bearing assembly

Mechanical tapered press fit

- Assembling a self-aligning roller bearing with tapered bore hole on tapered shaft using groove nut
- Choosing suitable measuring equipment
- Checking that bearing fits correctly
- Disassembling using hydraulic – using oil to free the tapered press fit

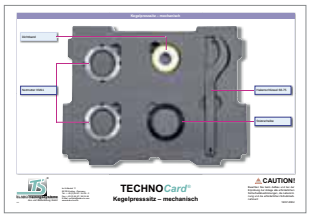
Anti-friction bearing assembly – mechanical tapered press fit

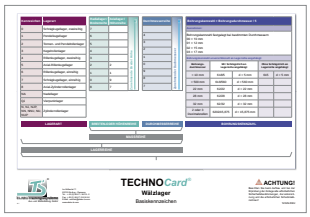
Training system inside a plastic case: Mechanical assembly of a self-aligning roller bearing onto a tapered shaft fit and hydraulic disassembly, including

- Self-aligning roller bearing DIN 635-21311E1-K
- Support plate
- Tapered shaft dummy
- 2× groove nut
- Hook wrench
- Supporting disc
- Open-ended wrench
- Teflon tape

No.	Designation	Order no.
1	Anti-friction bearing assembly – mechanical tapered press fit	12013
2	Roller unit for plastic case	57307
3	TECHNOCard® – Mechanical tapered press fit	12031-ENG
4	TECHNOCard® – Anti-friction bearing base symbol	12029-ENG
Not ill.	Oil injector	12015
Not ill.	2-stage manual hydraulic pump, 700 bar	12016
Not ill.	Rubber mat, 800 mm × 500 mm	57308

TECHNOCards®





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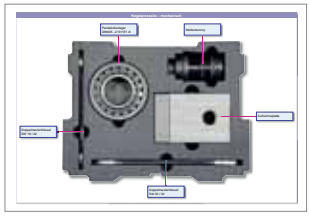

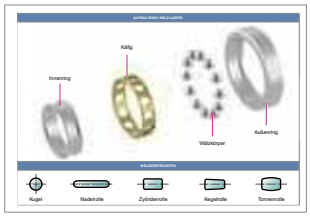

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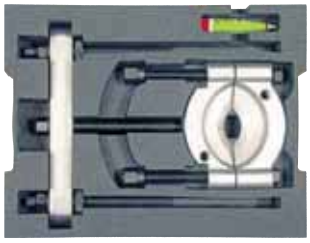
Roller Bearing Mounting – Angular Contact Ball Bearing Arrangement



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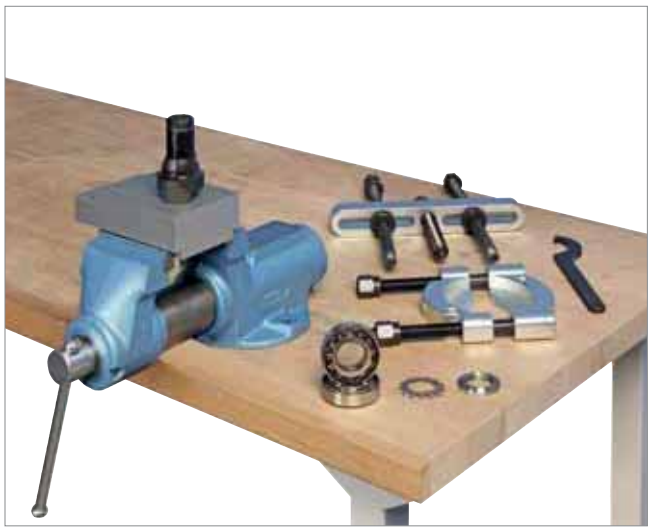


Learing objectives
Roller bearing mounting of angular contact ball bearing arrangement

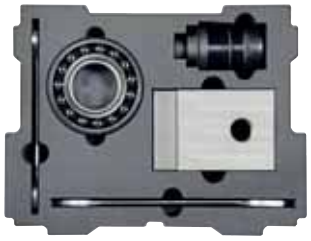
- Mounting of a self-aligning roller bearing with tapered bore hole on a tapered shaft Hydraulikmutter
- Selection of suitable measuring instruments
- Check correct seat of bearing
- Hydraulic dismantling – Lösen des tight fit with Öl

Roller bearing mounting
Angular contact ball bearing arrangement
Training system in plastic case for mechanical mounting of two angular contact ball bearing on a shaft and for separating the bearing rings using a separator

- Mounting plate
- Shaft dummy
- 2 Angular contact ball bearing
- Locking plate
- Groove nut
- Hook wrench
- Separator
- Mounting tools

No.	Designation	Order no.
1	Angular contact ball bearing arrangement	12017
2	Roller unit for plastic case	57307
Not ill.	Rubber mat, 800 mm × 500 mm	57308

Roller Bearing Mounting – Thermal Mounting on Shaft



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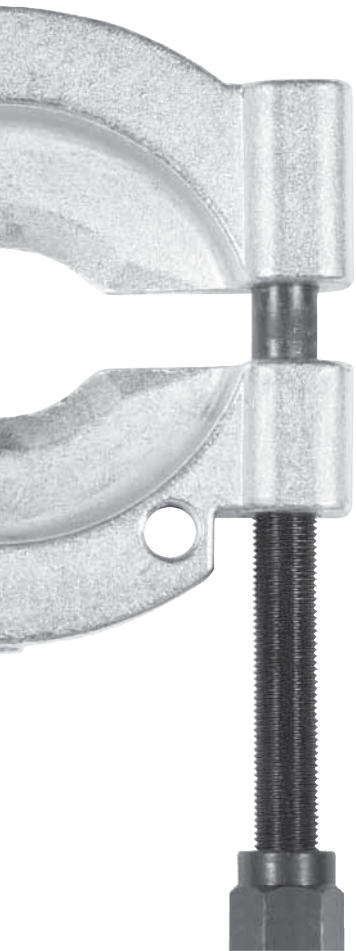


Learing objectives
Roller bearing mounting
Thermal mounting
on shaft

- Mounting of a self-aligning roller bearing on a shaft by heating of bearings
- Heating of bearings (max. temperature, handling heating device)
- Dismantling with industrial standard tool

Roller bearing mounting
Thermal mounting
on shaft

- Self-aligning roller bearing DIN 635-21311E1-K
- Mounting plate
- Shaft dummy, tapered
- 2 x Groove nut
- Hook wrench
- Support disk
- Open-end wrench
- Teflon tape

No.	Designation	Order no.
1	Thermal mounting on shaft	12018
2	Roller unit for plastic case	57307
3	Induction heating device	12019
Not ill.	Rubber mat, 800 mm × 500 mm	57308

Induction Heating Device

1

Induction heating device for warming up roller bearings

- Temperature and time control
- Fast and efficient warming up of bearings
- Consistant, controlled warming up
- Automatic demagnetization
- Safe operation
- Workpiece weight of max. 10 kg
- Teflon tape

Technical Data

- Power supply: 230 V
- Current consumption: 10 A
- Clear width / clear height: 65 mm / 100 mm
- Length x width: 24 cm x 20 cm
- Weight: 7 kg

Contents

- Induction heating device
- 3 ledges for bearings with bores >= 15 mm
- Temperature sensor
- Protective gloves

No.	Designation	Order no.
1	Induction heating device	12019

ACCESSORIES

Optional

57348
ETS1 helical gear spare parts kit

57301
ETS2 helical gear spare parts kit

57327
ETS3 bevel gear spare parts kit

57326
ETS3 bevel gear wear parts kit

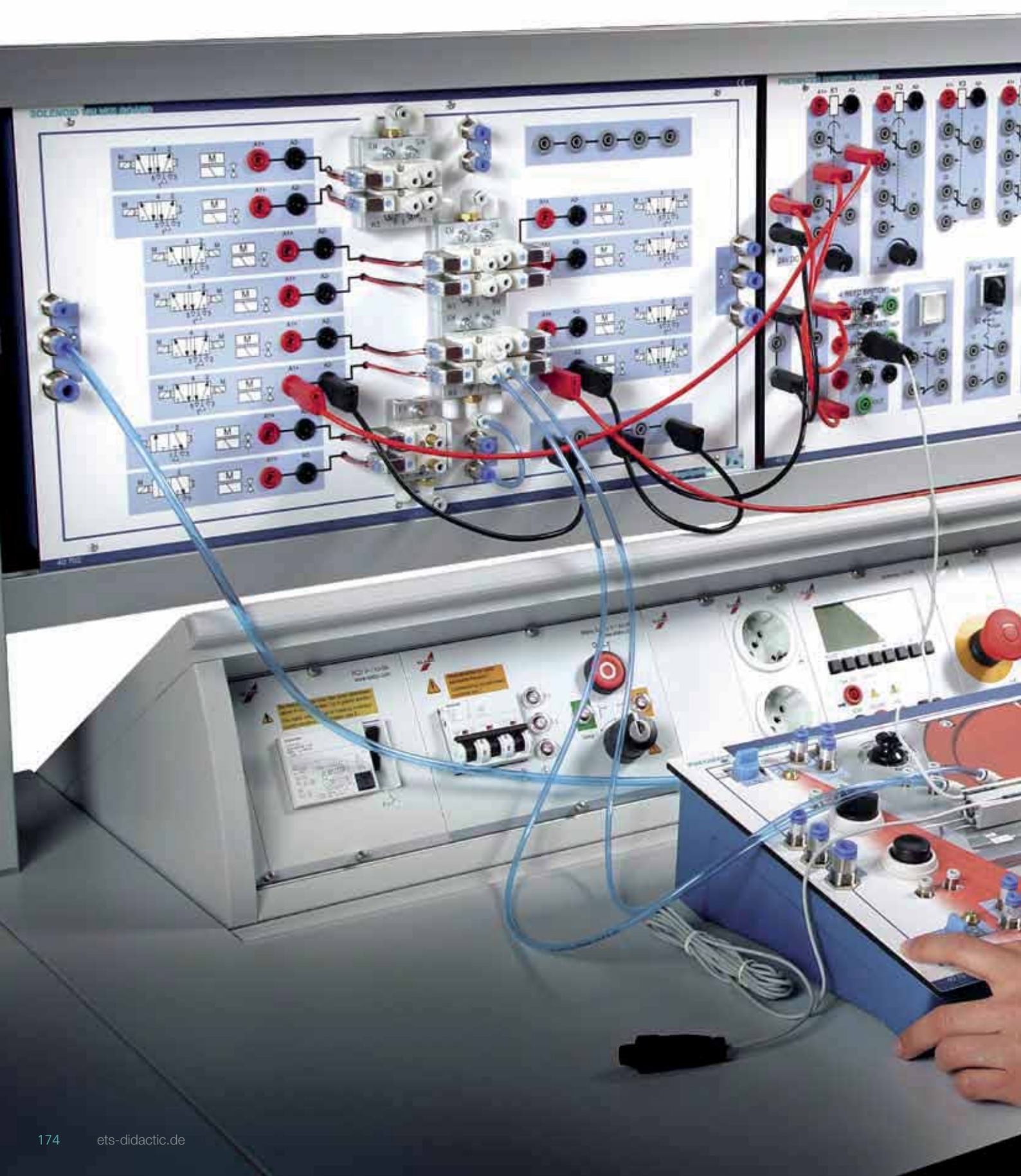
57366
ETS4 planetary gear spare parts kit

57308
Rubber mat
800 mm × 500 mm

12015
Oil injector (with case)

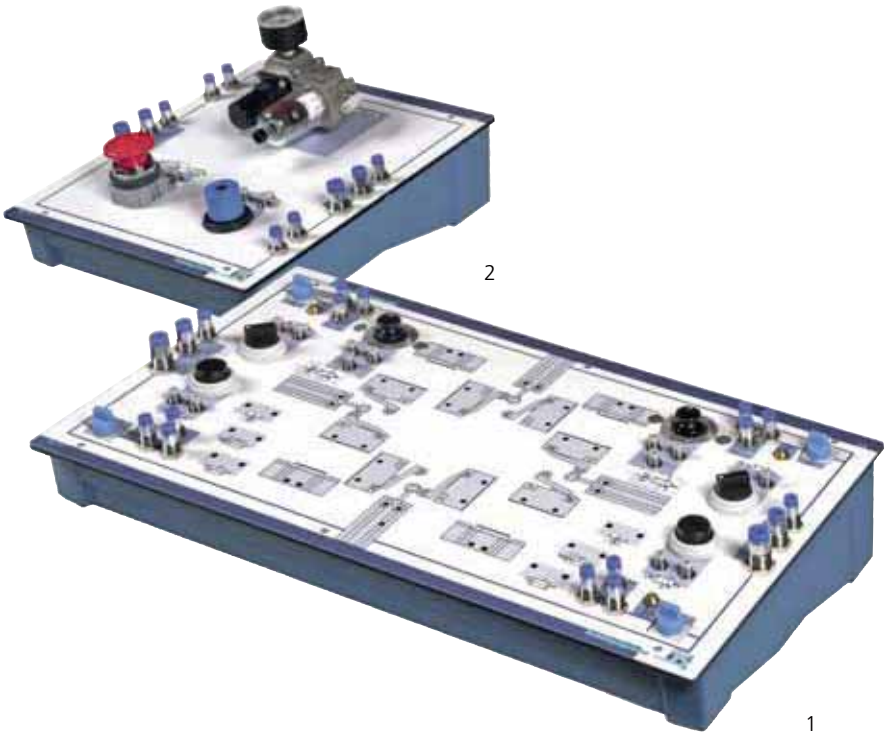
12016
Hydraulic hand pump, two-stage, 700 bar

10009
Arbor press



BASIC LEVEL PNEUMATICS TRAINING PACKAGE 50.1

System Components



Learning Objectives

- Mode of operation of pneumatic components
- Determining elements for different pneumatic control solutions
- Assembling pneumatic elements with subsequent functional control
- Planning, installation, commissioning and maintenance of pneumatic control systems
- Generation of pneumatic circuit diagrams and logic diagrams
- Development of test criteria for function testing, analysis and determination of errors

Pneumatics Supply Board

- 1 Maintenance unit
- 1 pressure reducing valve
- 1 3/2-directional valve with push-lock and turn-reset button
- 1 3/2-directional valve, monostable, open in position of rest
- All connections via 4mm bulkhead connectors

Pneumatic Applications Board

- 2 triple compressed air supplies / distributions in the nominal bores NB4, NB6 and NB8
- 4 valve islands with compressed air display for each of 3 NB4 bulkhead connections with ball non-return function
- 2 3/2-directional valves with pushbutton, locked in position of rest
- 2 3/2-directional valves with pushbutton switches, locked in position of rest
- 2time-delay valves with pushbutton, locked in position of rest
- All component connections via 4mm bulkhead connectors

No.	Designation	Order no.
1	Pneumatic Applications Board	40701
2	Pneumatics Supply Board (optional)	40700

40715 Pneumatic compontent assortment BASIC

No.	Designation	Quantity	Order no.
1	3/2-directional valve, roller-actuated	2	I02031
2	5/2-directional valve, bi-stable	3	I02034
3	5/2-directional valve, mono-stable	1	I02035
4	Twin-pressure valve with AND function	2	I04048
5	Shuttle valve with OR function	1	I04047
6	Simple-action cylinder	1	I03013
7	Double-action cylinder	1	I03012
8	Quick exhaust valve	1	I04049
9	Throttle non-return valve	2	I04004
10	Manometer	1	I05003
11	Hose cutter	1	W00028

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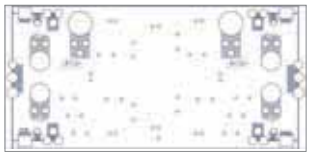
11 

Applications – basic level, pneumatics

The application overlays are put on the Pneumatic Applications Board. As a result, the component sockets that are not relevant for the task at hand are covered, with the task-relevant ones remaining clear and carrying wiring symbols. The application overlays are designed photo-realistically with 3D graphics, to promote sustained understanding and to ensure application-relevant processing of the assigned task.

No.	Designation	Order no.
1	**Pneumatic project, universal transparency** For the free design of your own process arrangements (with the help of photographs, drawings of plants)	40749
2	**Pneumatic project, skylight** Direct control of a simple-action cylinder	40750
3	**Pneumatic project, press 01** Direct control of a double-action cylinder	40751
4	**Pneumatic project, press 02** AND operation of a double-action cylinder	40752
5	**Pneumatic project, tin magazine** Sequence control: OR function of a double-action cylinder	40753
6	**Pneumatic project, sliding door** Time-dependent sequence control of a double-action cylinder	40754



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BASIC LEVEL PNEUMATICS TRAINING PACKAGE 50.1

Courseware / Storage

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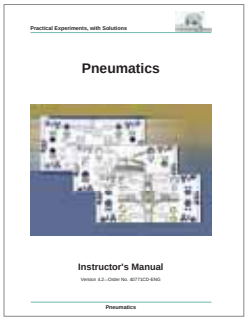

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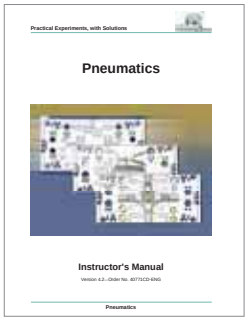

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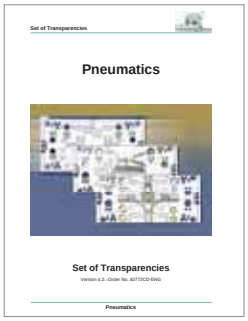


4

Content Manual

- ⟩ Generating compressed air
- ⟩ Control technology
- ⟩ Types of controls
- Logic controls
- Sequence controls
- Time-dependent sequence controls
- Process-dependent sequence controls
- Hard-wired programmed controls
- Programmed logic controllers
- Components of controllers
- ⟩ GRAFCET
- ⟩ Pneumatic components
- Double-action cylinder
- Simple-action cylinder
- 3/2-directional valve (mechanical actuation)
- 3/2-directional valve (pneumatic actuation)
- AND-valve (non-return valve)
- OR-valve (non-return valve)
- Throttle non-return valve (non-return valve)
- Pressure reducing valve (pressure valve)
- Time delay valve
- Quick exhaust valve (shut-off valve)
- Pneumatic indicator
- 5/2-directional valve, bi-stable
- ⟩ Tasks

Content Set of Transparencies

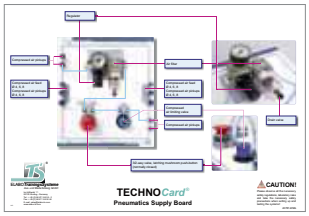
- ⟩ Generating compressed air
- ⟩ Control technology
- ⟩ Logic controls
- ⟩ Sequence controls
- ⟩ Time-dependent sequence controls
- ⟩ grafcetMANAGER
- ⟩ Pneumatic components
- ⟩ Tasks

No.	Designation	Order no.
1	Media Folder Set	91903
2	Pneumatics – Instructor's Manual	40771CD-ENG
3	Pneumatics – Student Manual	40770CD-ENG
4	Pneumatics – Set of Transparencies	40772CD-ENG
5	TECHNOCard® – Pneumatics Supply Board	40781-ENG
6	TECHNOCard® – Pneumatic Applications Board	40782-ENG
7	TECHNOCard® – Pneumatics / components and small parts	40783-ENG
8	Plastic case for pneumatic components	40794

40780-ENG

Set of TECHNOCards®

Laminated, colour-printed charts made of tough material.



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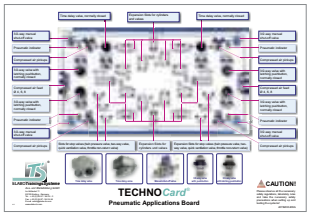

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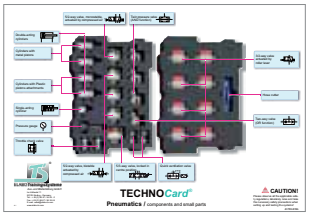

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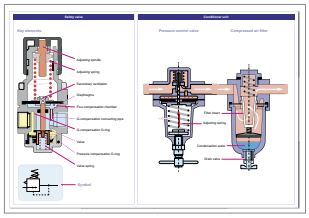
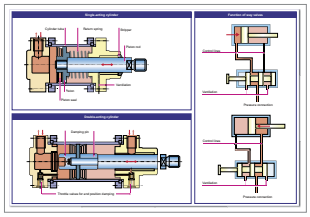
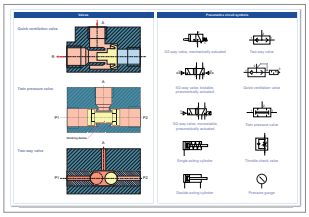






Plastic case for pneumatic components

- With foam inserts for reception of the pneumatic components
- System case with fold-away handle, can be linked with the electropneumatic component case

Case dimensions:
(w x h x d)
400 x 105 x 300 mm

8

ADVANCED LEVEL, PNEUMATICS TRAINING PACKAGE 50

System Components / Accessories

40716 Range of components - advanced level, pneumatics

No.	Designation	Quantity	Order no.
1	3/2-directional valve, roller-actuated	6	I02031
2	5/3-directional valve, bi-stable	1	I02044
3	Double-action cylinder	3	I03012
4	Twin-pressure valve with AND function	1	I04047
5	Quick exhaust valve	1	I04049

1

2

3

4

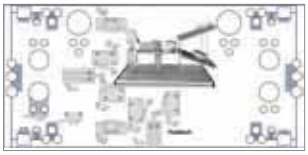
5

Applications – Advanced level, pneumatics

The application overlays are put on the Pneumatics Applications Board. As a result, the component sockets that are not relevant for the task at hand are covered, with the task-relevant ones remaining clear and carrying wiring symbols. The application overlays have photo-realistic 3D graphics on them to promote permanent, sustained understanding. The components are arranged in the same manner as would be the case in reality.

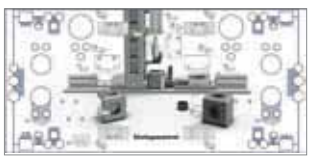
No.	Designation	Order no.
1	**Pneumatic project - double sliding door** Time-dependent sequence control of two double-action cylinders	40755
2	**Pneumatic project - lifting table** Sequence control of two double-action cylinders	40756
3	**Pneumatic project - embossing machine** Cascade control of two double-action cylinders	40757
4	**Pneumatic project - automatic assembly machine** Cascade control of three double-action cylinders	40758
5	**Pneumatic project - metal forming machine** Sequence control of four double-action cylinders	40759

1



2

3



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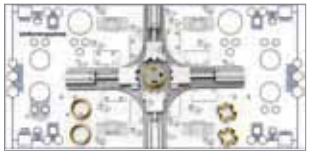

5

.2

BASIC LEVEL ELECTROPNEUMATICS TRAINING PACKAGE 50.3

System Components

Learning Objectives Electropneumatics

- Function of electropneumatic components
- Determining components for solving different electropneumatic controls
- Assembly of electropneumatic elements followed by a function check
- Drawing of current circuit diagrams, electropneumatic circuit diagrams and logic diagrams
- Installing and commissioning electropneumatic control systems
- Development of test criteria for function checks
- Determination and analysis of errors

Solenoid Valves Board

- 2 triple compressed air supplies / distributors in the nominal widths NB4, NB6 and NB8 (with ball non-return function) for individual use
- 4 bulkhead connections NB4 with ball non-return function for compressed air supply to the solenoid valves
- 2 3/2-way directional valves, monostable, closed in position of rest
- 2 5/2-way directional solenoid valves, monostable, closed in position of rest
- 3 5/2-way directional solenoid valves, bi-stable, closed in position of rest
- 1 5/3-way directional solenoid valve, bi-stable, closed in the middle position
- Graphical depiction of the circuit symbols on the front panel
- All pneumatic component connections via 4mm bulkhead connectors
- All electrical inputs and outputs as well as supply connections via 4 mm safety laboratory sockets

Pneumatics Control Board

- 4 relays, 24 V DC
- 2 switch-on delayed relays, 24 V DC, 0..30 sec
- 2 switch-off delayed relays, 24 V DC, 0..30 sec
- 2 control switches manual/0/auto, 2NO
- 1 EMERGENCY STOP button, 2NC
- 2 buttons NO/NC
- Connection areas for reed contacts and sensors
- All electrical inputs and outputs as well as supply connections via 4 mm safety laboratory sockets

No.	Designation	Order no.
1	Solenoid Valves Board	40702
2	Pneumatics Control Board	40703

1

2

3

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6

7

8

Applications – Basic level, electropneumatics

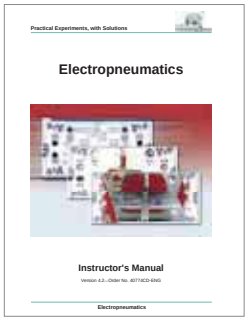
The application overlays are put on the Pneumatic Applications Board. As a result, the component sockets that are not relevant for the task at hand are covered, with the task-relevant ones remaining clear and carrying wiring symbols. The application overlays have photo-realistic 3D graphics on them to promote permanent, sustained understanding. The components are arranged in the same manner as would be the case in reality.

No.	Designation	Order no.
1	**Electropneumatic project - safety door** Time-dependent control of a double-action cylinder	40760
2	**Electropneumatic project - pallet lift** Basic circuit of a double-action cylinder	40761
3	**Electropneumatic project - disassembly** AND operation of a double-action cylinder	40762
4	**Electropneumatic project - assembly** Sequence control of a double-action cylinder	40763
5	**Electropneumatic project - workpiece lift** OR operation of a double-action cylinder	40764
6	**Electropneumatic project - clamping device** Time-dependent sequence control of a two double-action cylinder	40765
7	**Electropneumatic project - pneumatic feeder** Sequence control of a double-action cylinder	40766
8	**Electropneumatic project - dip tank** Sequence control with lock of a double-action cylinder	40767

BASIC LEVEL ELECTROPNEUMATICS TRAINING PACKAGE

Courseware / Storage

1



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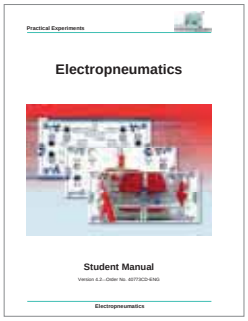

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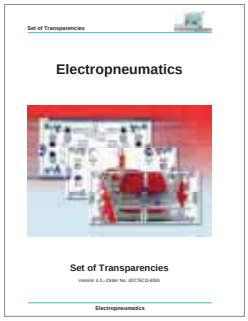


4

Printed and digital

Content Set of Transparencies

⟩ Generating compressed air
⟩ Control technology
⟩ Logic control
⟩ Sequence control
⟩ Time-dependent sequence controls
⟩ grafcetMANAGER
⟩ Electropneumatic components
⟩ Pneumatic components
⟩ Tasks

Content Manual

⟩ Generating compressed air
⟩ Control technology
⟩ Types of controller
- Logic controllers
- Sequence control
- Time-dependent sequence controls
- Process-dependent sequence controls
- Hard-wired programmed controllers
- Stored-program controllers

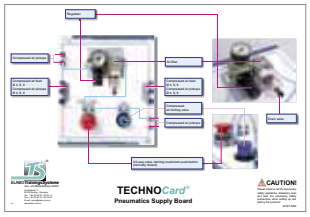
⟩ Components of controllers
⟩ GRAFCET
⟩ Electropneumatic components
- Binary sensors
- Inductive sensors
- Capacitive sensors (reed contacts)
- Optical sensors (light sensors)

⟩ Pneumatic components
- Double-action cylinder
- Simple-action cylinder
- 3/2-directional valve (mechanical actuation)
- 3/2-directional valve (pneumatic actuation)
- AND-valve (non-return valve)
- OR-valve (non-return valve)
- Throttle non-return valve (non-return valve)
- Pressure reducing valve (pressure valve)
- Time delay valve
- Quick exhaust valve (shut-off valve)
- Pneumatic indicator
- 5/2-directional valve, bi-stable

⟩ Tasks

No.	Designation	Order no.
1	Media Folder Set	91903
2	Electropneumatics – Instructor's Manual	40774CD-ENG
3	Electropneumatics – Student Manual	40773CD-ENG
4	Electropneumatics – Set of Transparencies	40775CD-ENG
5	TECHNOCard® – Pneumatics Supply Board	40781-ENG
6	TECHNOCard® – Pneumatic Applications Board	40782-ENG
7	TECHNOCard® – Solenoid Valves Board	40785-ENG
8	TECHNOCard® – Pneumatics Control Board	40786-ENG
9	TECHNOCard® – Electropneumatics /Components and small parts	40787-ENG
10	Plastic case for electropneumatic components	40796
11	Set of safety connections, 4 mm	90028
12	Reed contacts	40731

50.3



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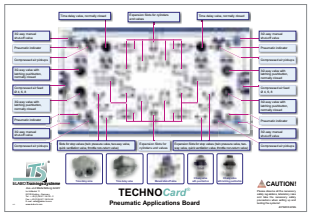

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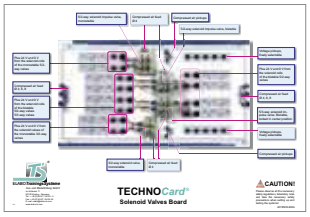

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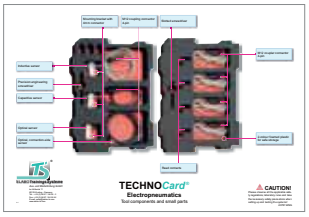
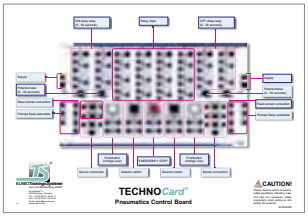


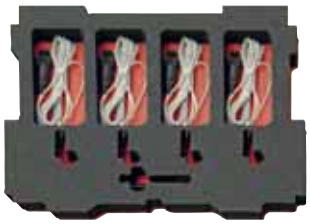
8

40784-ENG Set of TECHNOCards®
Laminated, colour-printed charts made of tough material.



9

Plastic case for electropneumatic components
- With foam inserts for reception of the electropneumatic components
- System case with fold-away handle, can be linked with the pneumatic component case
- Case dimensions: (w x h x d) 400 x 105 x 300 mm



10

Set of safety connections, 4 mm
- for electropneumatics circuits, 40 parts, consisting of:

Safety measurement conductors:
- 6 x green 50 cm
- 10 x black 25 cm
- 4 x black 50 cm
- 1 x black 150 cm
- 11 x red 25 cm
- 6 x red 150 cm

Jumpers
- 1 x red with tapping
- 1 x black with tapping

11

Reed contacts
- including connecting cable and M12 plug

12

ADVANCED LEVEL ELECTROPNEUMATICS TRAINING PAC

System Components / Accessories

40733 Set of sensors

No.	Designation	Quantity
1	Inductive sensor	1
2	Capacitive sensor	1
3	Optical sensor	1
4	Connecting cable, M12, 4-pole	2

1 

3 

2 

4 

40732 Set of test bodies, Electropneumatics

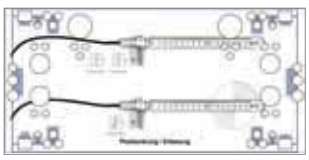
No.	Designation	Quantity
1	Stainless steel	1
2	Plastic	1

1 

2 

Applications – Advanced level, electropneumatics

No.	Designation	Order no.
1	**Electropneumatic project - positioning, detection** Testing sensors (inductive, capacitive, optical) with two test bodies	40 768
2	**Electropneumatic project - automatic printing machine** Sequence control of three double-action cylinders	40 769



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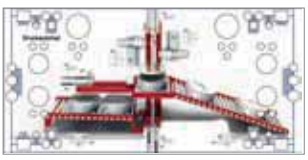
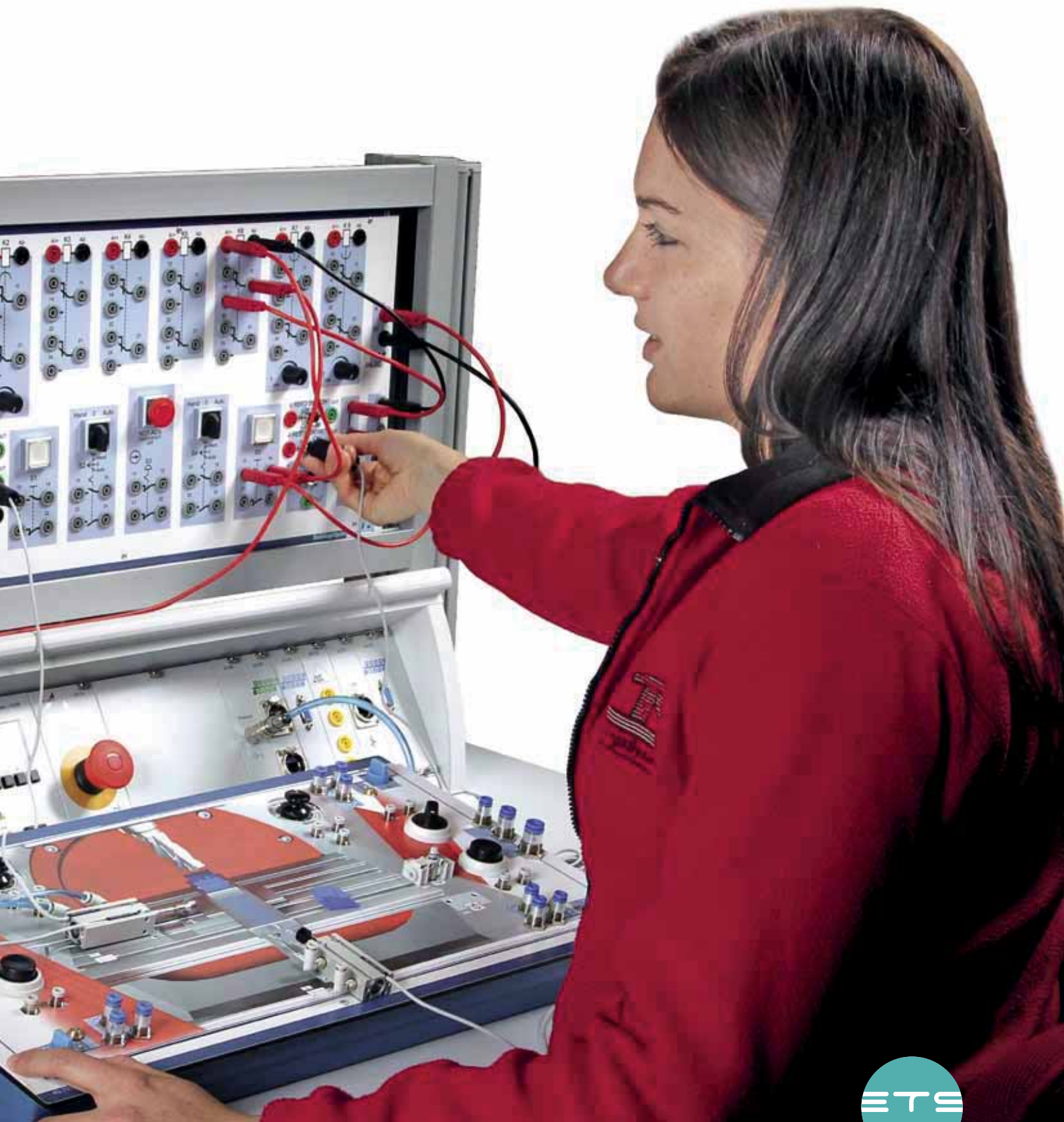
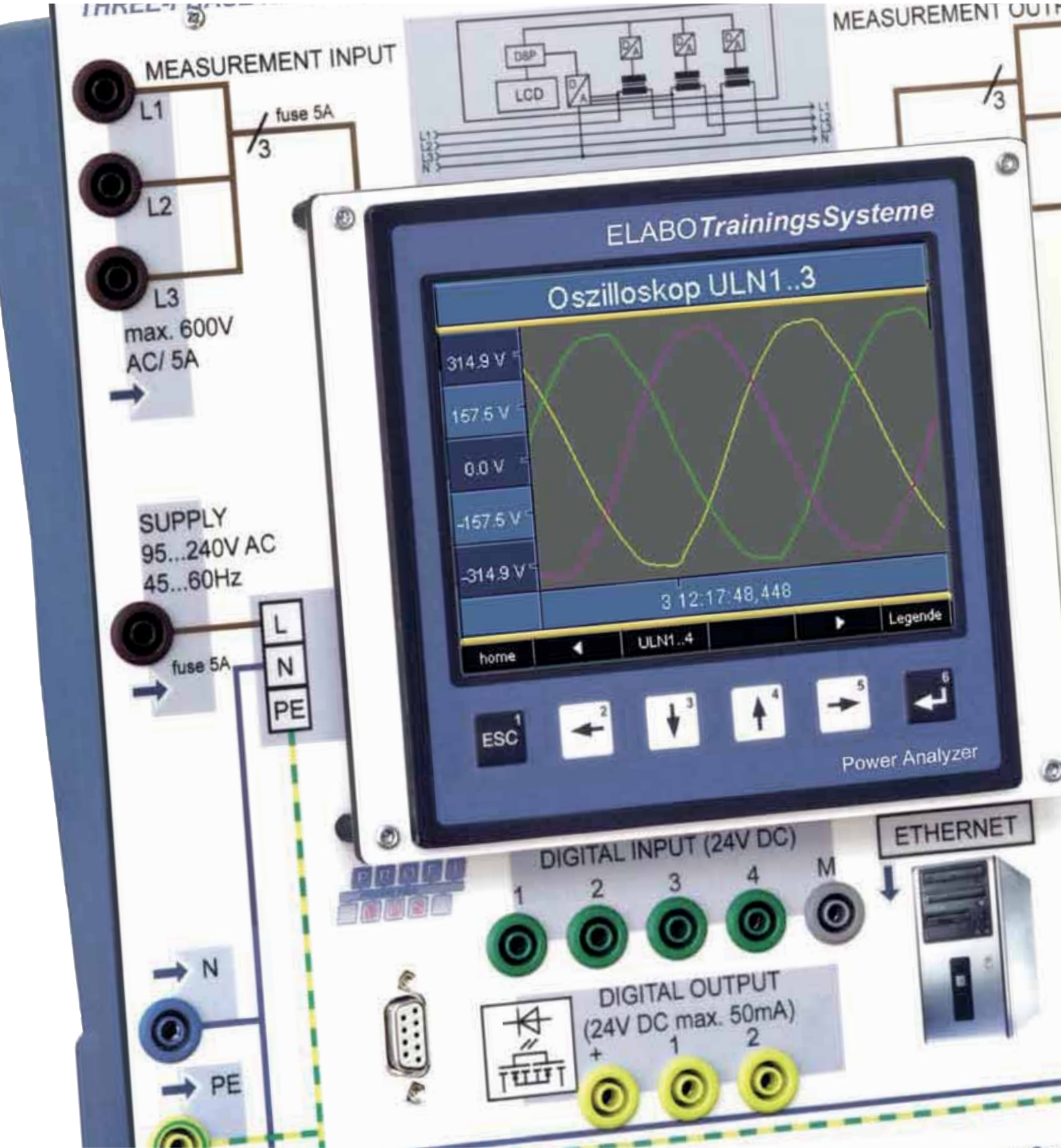


2

KAGE 50.4




MEASUREMENT INPUT
L1
L2
L3
max. 600V
AC/ 5A
fuse 5A
3
DSP
LCD
ELABO TrainingsSysteme
Oszilloskop ULN1..3
314.9 V
157.5 V
0.0 V
-157.5 V
-314.9 V
3 12:17:48,448
home
ULN1..4
Legende
ESC
Power Analyzer
SUPPLY
95...240V AC
45...60Hz
fuse 5A
L
N
PE
DIGITAL INPUT (24V DC)
1
2
3
4
M
ETHERNET
DIGITAL OUTPUT
(24V DC max. 50mA)
+
1
2
N
PE

MEASUREMENT TECHNOLOGY

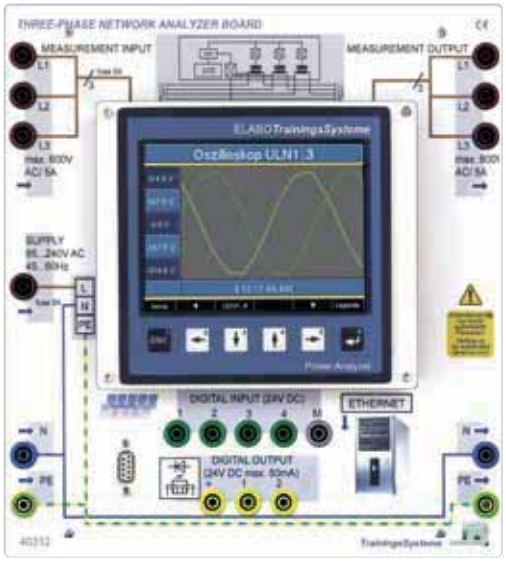
Three Phase Network Analyzer

Energy Measurement Technology

Webserver integrated

INTELLIGENT METROLOGY AND INSTRUMENTATION

Watt Meter / Network Analysis Device



1

Learning objectives

- Determining important electrical parameters like active power, apparent power and reactive power (e.g. in the case of lamps)
- Measurements of harmonic distortion in grid systems (3-phase depiction)
- Measurements of the power factor lambda and cosφ
- Determining the electrical quantities of electric motors
- Deployment and use of energy meters
- Energy-related investigation of different consumers
- Vector depiction of the three-phase system

Technical data

- Measurement voltage 0 – 600 V AC, max. 5 A
- Operating voltage 230 V AC
- LAN interface for integrated webserver
- Profibus interface
- 4 digital inputs, 2 digital outputs, freely programmable
- Integrated oscilloscope function

No.	Designation	Order no.
1	SMART Metering Bundle eco, contains 40312, Accesspoint, network cable, iPad Air, 32 GB (Wifi)	40312B
1	contains 40312, Accesspoint, network cable, iPad Air 2, 64 GB (Wifi+4G)	40312B-3G

Webserver for the Visualisation of the Measurement Values

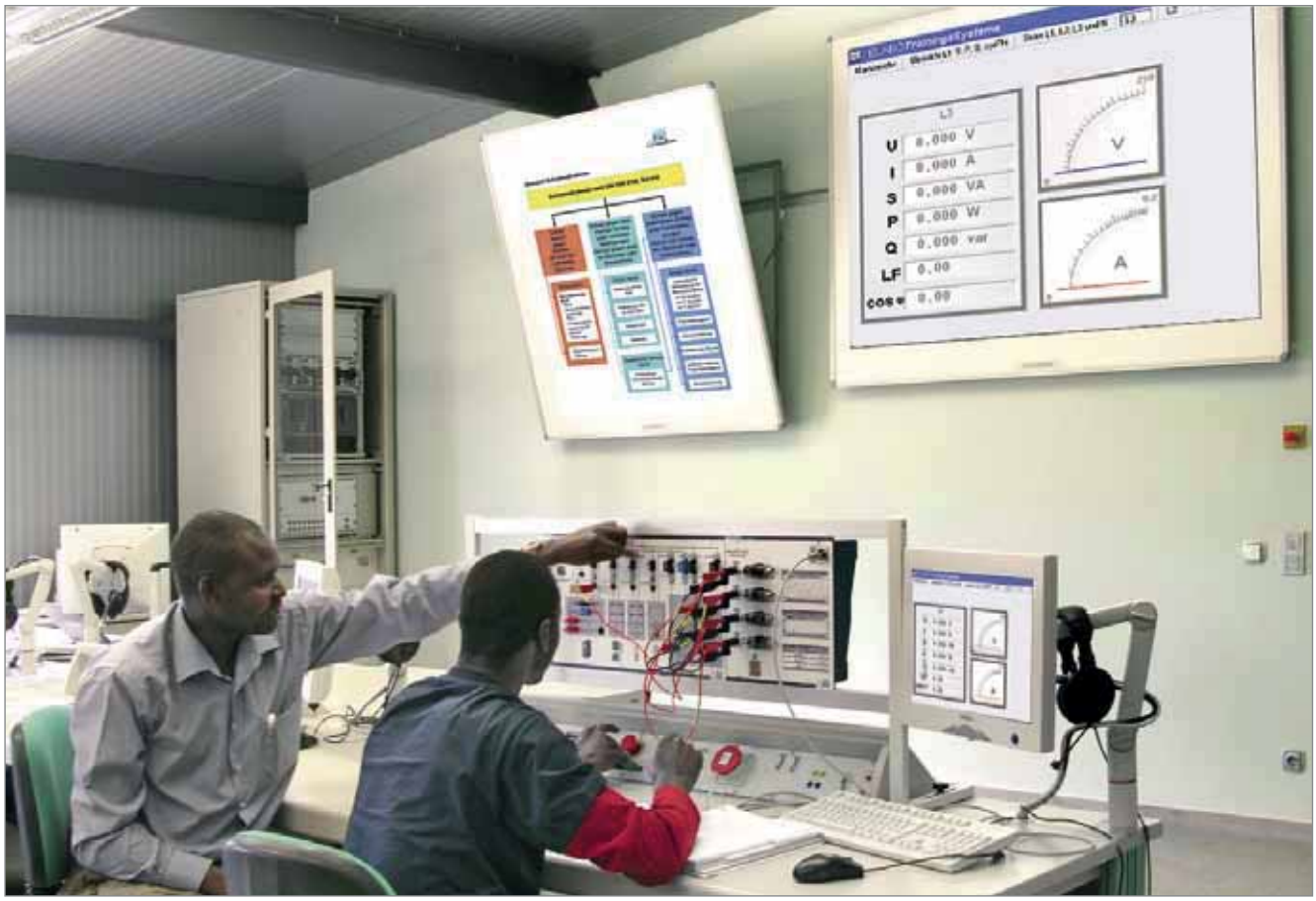
› With the webserver, the relevant magnitudes of the Three-phase Network Analyzer can be displayed and stored on:

› PC
› printer
› beamer

in the form of tables, measurement values and bar charts. The difficult relationships between currents, voltages, powers (apparent, active, reactive), cosφ and harmonics are graphically explained with common consumers.

› The measuring instrument is mainly used in our experiment manuals on the subject of :

› Lighting technology
› Transformers
› Electrical drives etc.



MEASURING INSTRUMENTS

Multimeter / Color Digital Oscilloscope / Leakage Current Clamp Meter

1

2

3

4

Functions Digital multimeter (1)

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

Functions Analog multimeter (2)

Compact basic analog multimeter for use in education and vocational training

- 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

Functions Color digital oscilloscope 30 MHz (3)

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

Functions Leakage current clamp meter (4)

- AC current up to 100 A 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

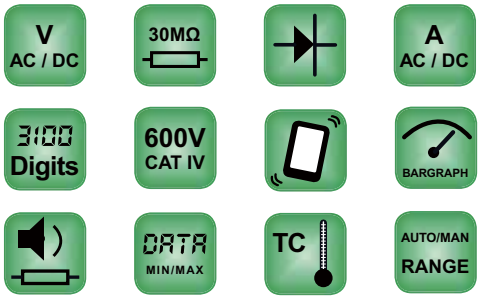
No.	Designation	Order no.
1	Digital multimeter	90600
2	Analog multimeter	90200
3	Color digital oscilloscope 30 MHz	90266
4	Leakage current clamp meter	90604

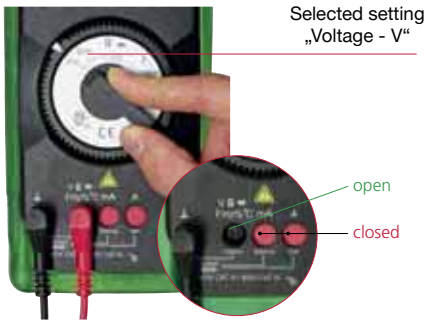
High protection! Ideal for training

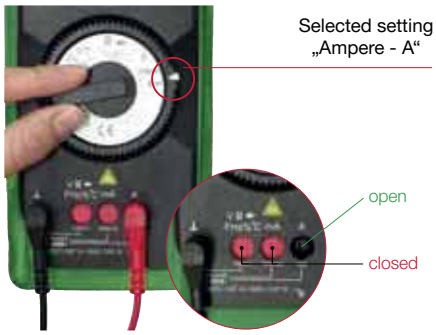
DIGITAL MULTIMETER

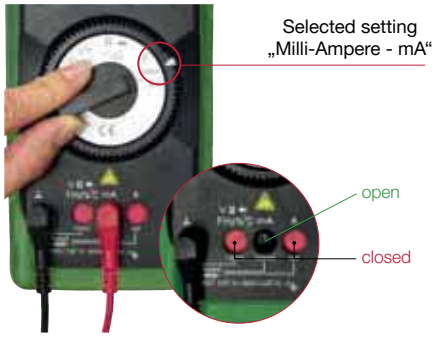
Professional Digital Multimeter for up to 1000 V AC/DC and CAT IV Safety Level

Mechanical protection against faulty operation
Operator errors due to false measurement settings often result in safeguard destruction of the protective device. With the help of integrated mechanical protection against faulty operation such operator errors occurring time and again in professional training are prevented. This can save trouble and expensive spare fuses.









Functional principle of the mechanical protection against faulty operation

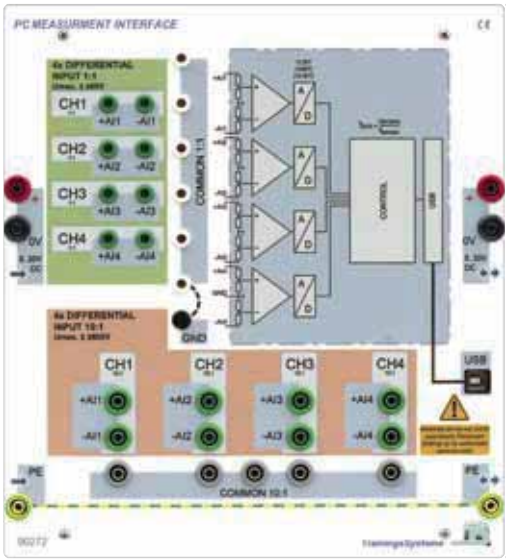
After selecting the measurement and connecting the measuring cable, the setting dial is automatially arrested.

The selected dial position with the appropriated measuring method ensures that only the correct connection jack can be used thus providing „mechanical protection against faulty operation“. The other two jacks are mechanically closed by a faceplate preventing faulty connections.
Simultaneously, the dial is arrested to prevent accidental shifting.

Your advantage: 600 V AC / directly measurable / 4 channels

PC MEASUREMENT INTERFACE

4-channel Measurement Interface with Differential Inputs



1

Technical data

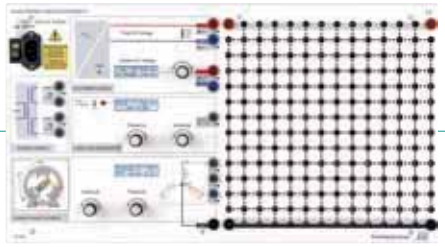
- ⟩ 4 analogue input channels with differential input
- ⟩ 5 MHz bandwidth (5,000,000 samples/s)
- ⟩ Sampling rate of up to 5 MHz per channel
  - 16 bits up to 195 kHz
  - 14 bits up to 3.125 MHz
  - 12 bits up to 5 MHz
- ⟩ Input 1:1
  - Measurement ranges from ± 200 mV to ± 80 V (peak value)
  - maximum input voltage ≤ 200 V AC
  - 2mm-safety sockets
- ⟩ Input 10:1
  - Measurement ranges from ± 2 V to ± 800 V (peak value)
  - maximum input voltage ≤ 600 V AC
  - 4mm safety sockets
- ⟩ All inputs contact-safe 600 V, CATII
- ⟩ All inputs clearly configurable through 19mm bridge connectors
- ⟩ 4 measuring instruments in one device 12 … 16 bit 4-channel oscilloscope
  - Spectrum analyser
  - Transient recorder
  - Voltmeter (average value, true RMS value, …)
- ⟩ Spectrum analyser with distortion factor calculation
- ⟩ Extensive trigger function
- ⟩ Fast transient recorder from 0.01 s to 500 s sampling time
- ⟩ USB 2.0 high speed (480 MBit/s)
- ⟩ Optional operating voltage: 8 …30 V DC
- ⟩ Dimensions 266 x 297 x 85 mm
- ⟩ Device shape: desktop housing

The PC Measurement Interface is a four-channel measuring instrument with differential inputs that allows safe measurement of voltages and quantities deriving from them up to 600 V AC.
The depiction and evaluation of the measurement results is done by software via a connected PC.

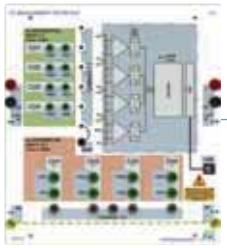
No.	Designation	Order no.
1	PC Measurement Interface	90272

Application Examples

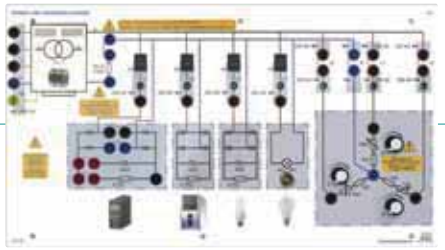
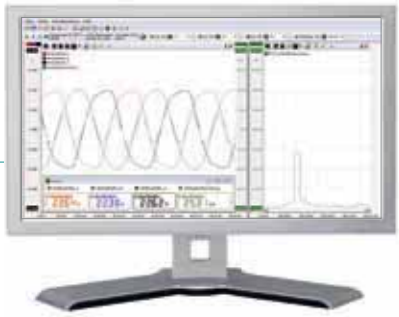
Principles of electrical engineering and electronics

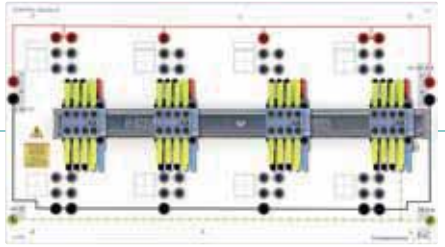

Control engineering

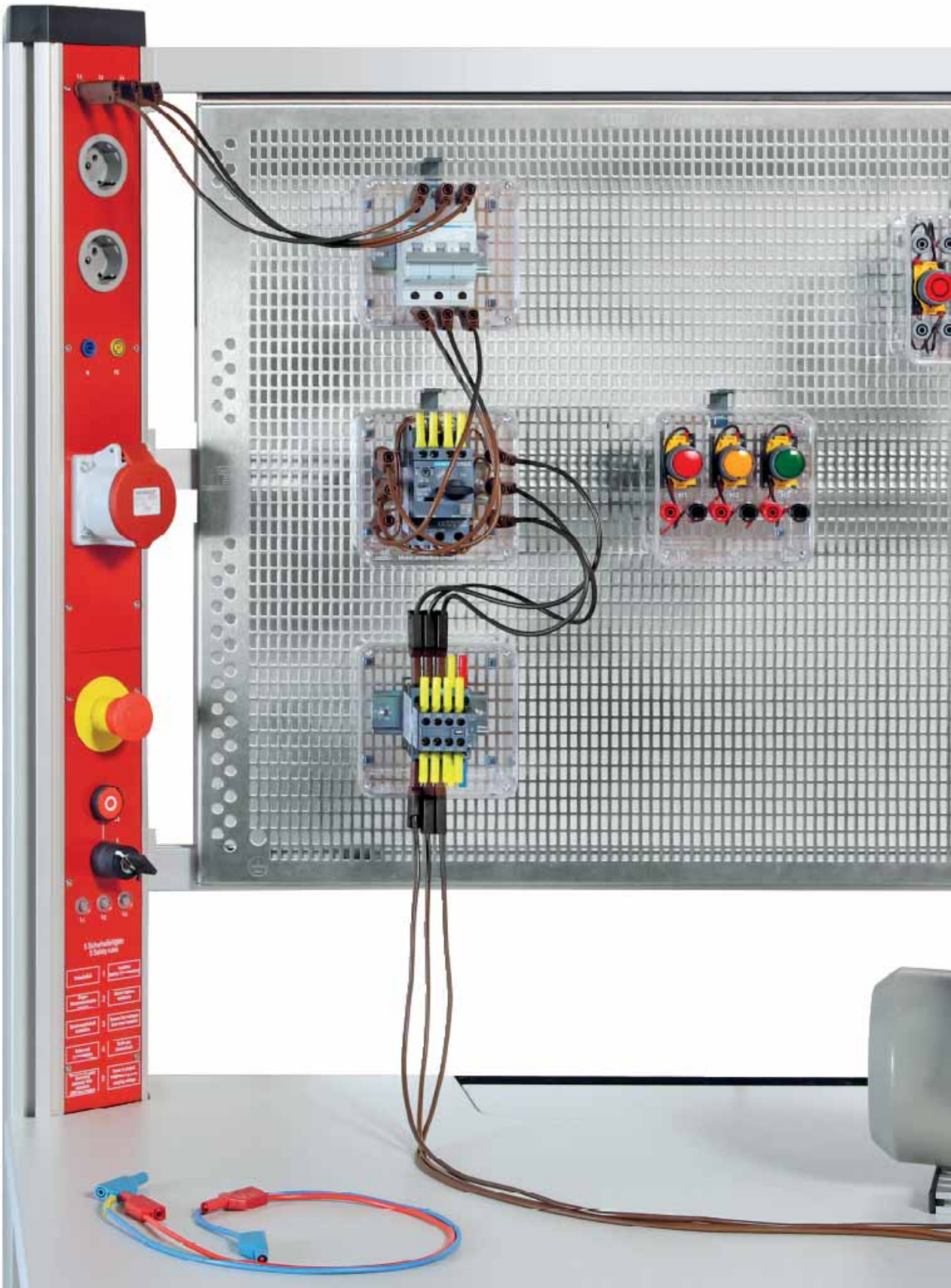


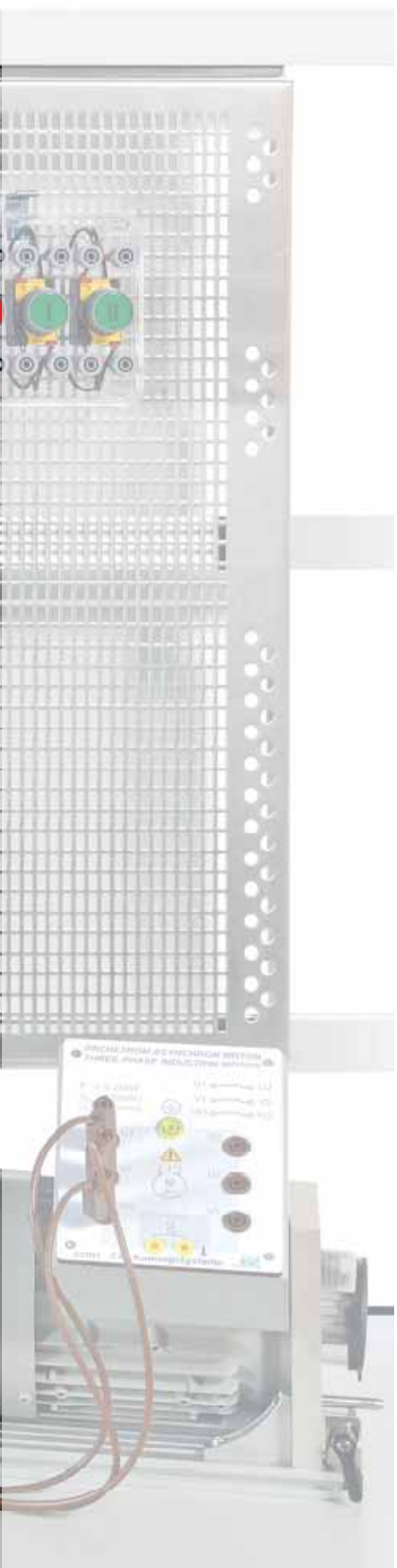
AC technology – 1-phase- and 3-phase technology

Control / drive technology



LAB FURNITURE
FOR PROFESSIONAL TRAINING

Primus One® Professional
Building Automation

Primus One® Professional
Industrial Automation and Drives

LAB FURNITURE

Primus One®

All of this is the Primus One® alone

ELABO goes on with the revolution of workstation systems. Primus One® incorporates all the knowledge and experience of ELABO. Additional new features of Primus One® contribute to its outstanding role. It is a systematic further development of the successful InForm series. This new technical workstation comprises all Elabo is best at and that have been proven reliable over many years. With many additional and enhanced functions: multifunctional, flexible, high quality and conceptionally mastered down to the smallest detail.

Features of Primus One®

This technical workplace is top quality and fulfills important DIN stardards. It is extremely robust and resistant against weak acids and caustics as well as against benzin and oil. The tabletop consists of high pressure laminate (HPL) and the welded square tubes are made of quality steel.

- Ergonomically perfect design meeting all demands, extremely user-friendly and very clearly arranged
- Timeless and modern design
- Protection against ESD according to DIN EN 61340-5-1
- High surface load according to DIN EN 13150:2001-12
- 30 mm thick tabletop, with 0.8 mm HPL coating
- Shortly heat-resistant
- Non-reflective and wear-resistant according to DIN EN 438
- Optimal cable routing, also above the storage elements
- Individual configuration due to modular system
- Perfectly arranged operating and connection elements turned towards the user for fast and easy workflow
- More work surface due to lowerable cable flap
- Flexible height
- Efficient electrification with individual electrical installation for integration in table leg
- More space due to enhanced orga panel
- Lighting of the workplace with individually colored light
- 19" integration for ELABO and third-party devices (version 6HE), smooth and flush placement in each position
- Integration of 3HE devices

Functionality and Aesthetics in Harmony

As high as possible.
Sitting or standing:
Table height adjustment for functional and ergonomc work – also for retrofit.

Reinforced profiles.
More stability than ever in proven ELABO quality. Variable table edge. Modern optical design and replacable.

Desks in line.
In a long table formation, the cables are nearly invisible. They can be lead in the cable tray from one table to the other instead of placing them on the ground.

Ergonomics at its best side.
The front table legs can be recessed to provide more legroom. Primus One® is designed for direct and flush placement at the wall. There is no problem with base rails.

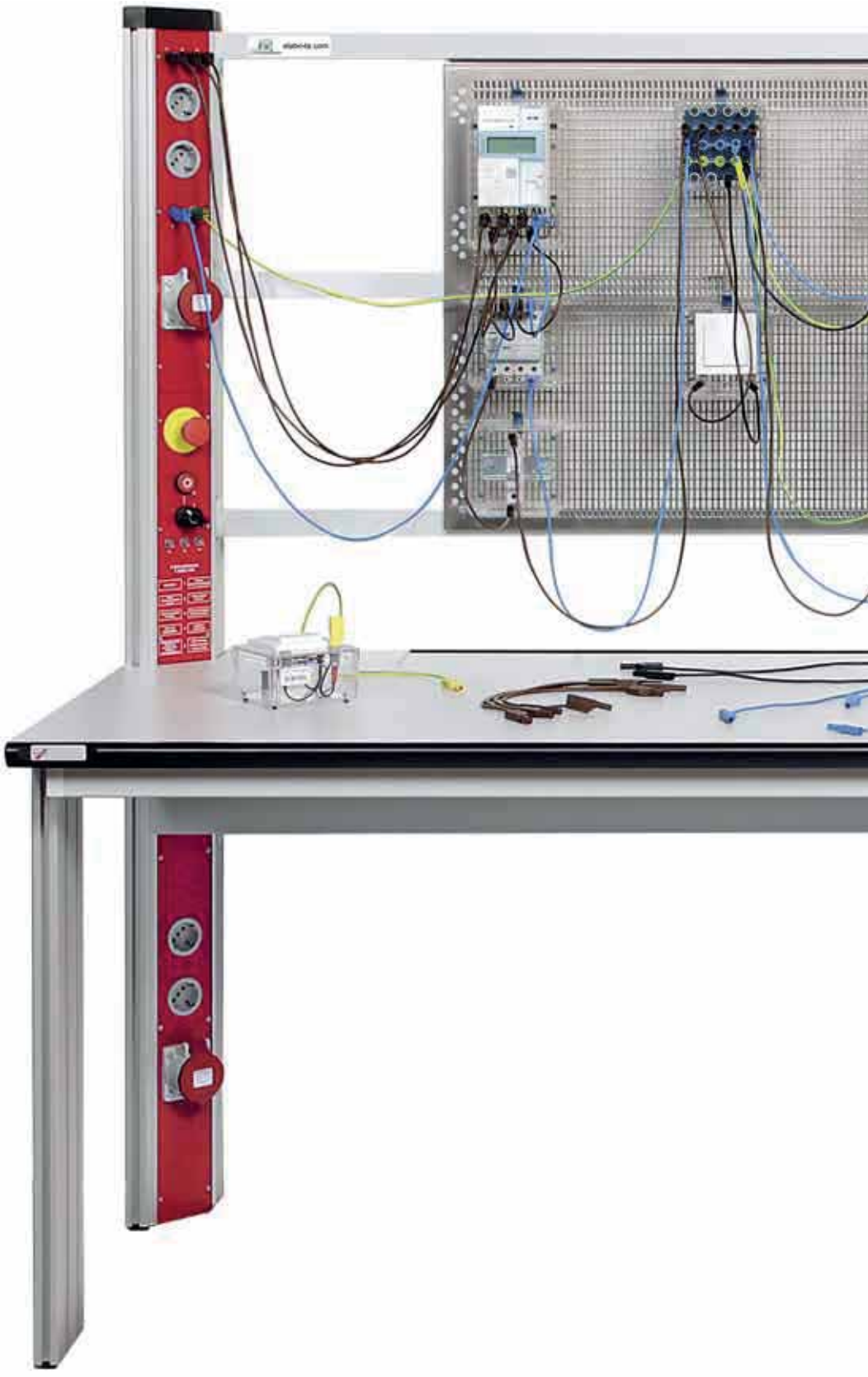
LAB FURNITURE

Primus One® – Building Automation

LAB FURNITURE

Primus One®

Building Automation



LAB FURNITURE

Primus One® Professional – Industrial Automation and Drives

LAB FURNITURE

Primus One® Professional

Industrial Automation and Drives

QUALITY IS THE MEASURE OF ALL SUCCESS

Inspiring Technologies

ETS DIDACTIC GMBH is a symbol of high quality and outstanding flexibility. This means that machines from ETS DIDACTIC GMBH are convertible, they can – thanks to the modular conception and the versatile range of accessories – be quickly and efficiently matched to changed requirements and extended almost without limits.

Our high quality standards refer not only to the products from ETS DIDACTIC GMBH, but especially also to the quality of the training that customers achieve thanks to the use of ETS DIDACTIC GMBH products. And in this, we also include the process quality: ETS DIDACTIC GMBH supports procedures during the training that are as problem-free as possible.

The solutions from ETS DIDACTIC GMBH can be matched to individual customer requirements to a great extent. Customers of ETS DIDACTIC GMBH are suppored and accompanied in the successful implementation of their training objectives by a comprehensive range of services.


QUALITY

WE ARE HAPPY TO HELP

Information and Consulting

We accompany you and are at your side with active advice.
Whether you need information, or some advice in advance of making an investment, or have questions regarding the daily use of the products:

Contact us –
we would be happy to help:

ETS DIDACTIC GMBH
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85125 Kinding / Germany

Phone +49 8467 8404-0
Fax +49 8467 8404-44

sales@ets-didactic.de
www.ets-didactic.de

Customer-oriented solutions
- Presentation, product demonstrations and on-site consultancy
- Support in the selection of educational systems according to the syllabus requirements
- Matching of the training systems to customer requirements
- Working out room concepts
- Designing ergonomic workstations

Experience
- Comprehensive range of innovative products
- Systems and solutions from our own (in-house) production
- Development and design, technical training systems
- Quality right from the consultancy up to delivery and onward
- Trainer seminars / In-house training
- References world-wide
  - Industrial educational institutions
  - Vocational schools / technical schools
  - Chambers of crafts
  - Technical colleges / Universities

We support you
- Installation and commissioning of the systems on-site
- Technical support
- Warranty and repairs
- Instruction and training
- Further education, training, seminars
- Comprehensive product documentation
- Courseware for instructors and trainees

Subject to technical modifications and further developments 03 /2017

DIDACTIC GMBH
ELABO Training Systems

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