

Trainer e sistemi di simulazione per microcontrollori

Nozioni base sui microcontrollori

ETS DIDACTIC

MICROCOMPUTER TRAINING SYSTEM

Basics of microcontroller technology

another way to care

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www.mydidactstore.it

my
Didact
STORE

mikrocomputer training system
with industrial interface



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Didactic solutions

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peopLe anD tecHnoL ogy – a perFect match

technology to inspire you: understanding – comprehending – applying

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

topics such as industry 4.0, electrical engineering, power electronics, pneumatics, drive technology, automation technology, sensor technology, bus systems, mechatronics, transmission technology and the complete scope of building systems engineering including renewable energies are presented as a training system. With the help of well thought-out learning-oriented hardware and accompanying courseware, the specialist skills are quickly learned, grasped by hands and lead to didactic learning success in a goal-oriented manner.

the service spectrum of ETS DIDACTIC ranges from the provision of didactic hardware, courseware and software to the planning and equipping of the complete training rooms. ets meets all requirements with practice-oriented workshops on the complete spectrum of technical professions for lecturers, trainers and instructors in a specially built modern training center or online.

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.



Welcome to ets DiD actic

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

ETS DIDACTIC 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 are vital factors for the company's efficiency.



Sven Urban
Managing Director



Udo Urban
Managing Director
(Founder)



maDe in germany

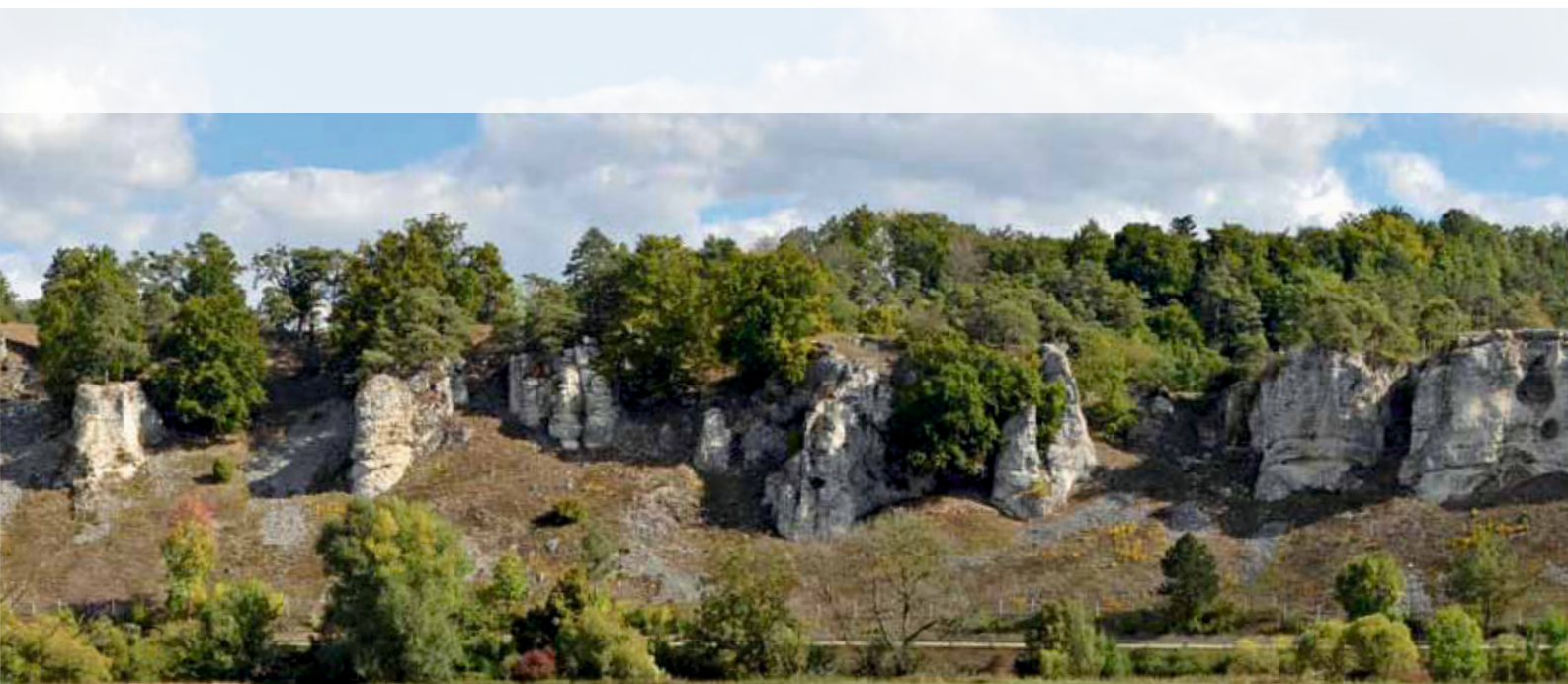
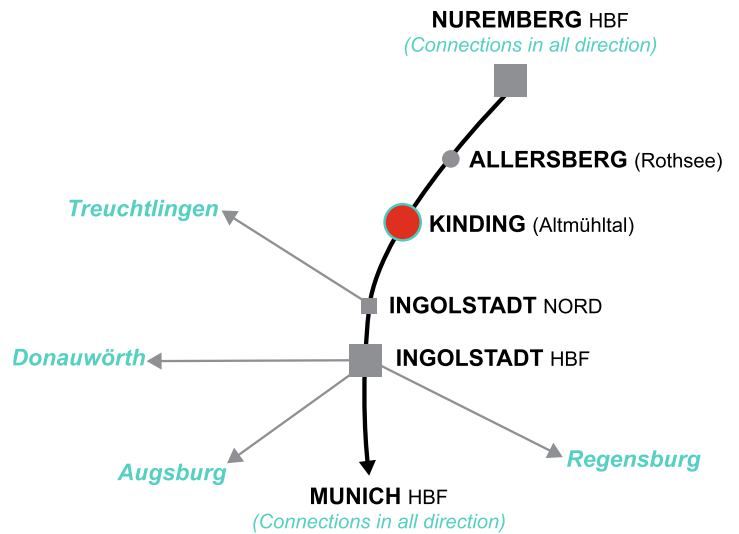
Visit ets in the Valley of river altmühl

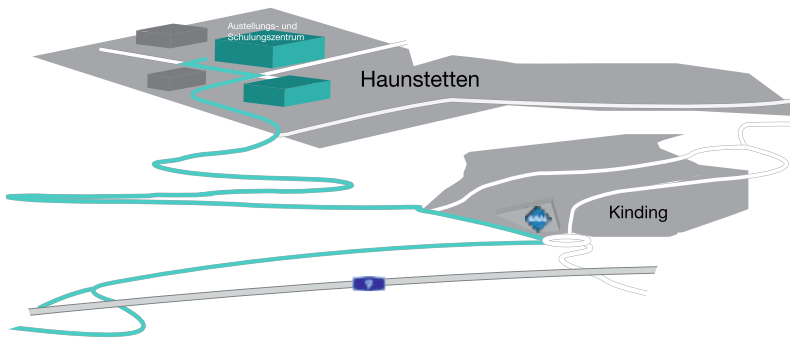
Welcome to Germany - Bavaria

the altmühltal nature park is one of the largest in germany and offers a thousand ideas for families, history fans, cultural discoverers and nature lovers.

you can travel to our workshop in kinding-Haunstetten by train. the regional train station kinging/altmühltal is located directly on the ice route between nuremberg and munich. the regional express trains of Deutsche Bahn stop every two hours. the journey from kinding to ingolstadt takes 17 minutes, to munich 1 hour 15 minutes and to nuremberg only 27 minutes.

Local cab companies are available to take you from kinding to Haunstetten. We will be happy to assist you with the organization.

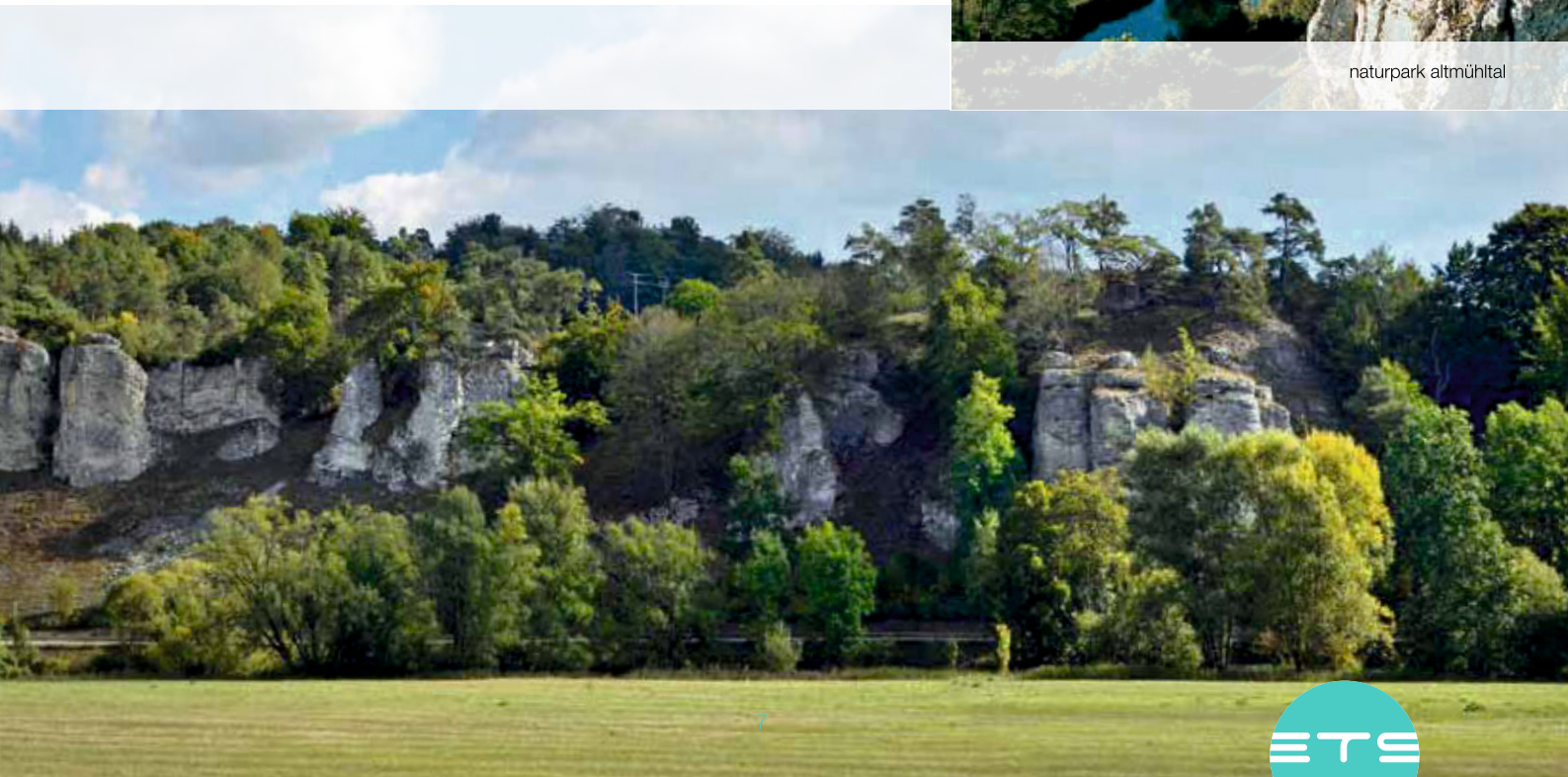




kloster Weltenburg



naturpark altmühltal



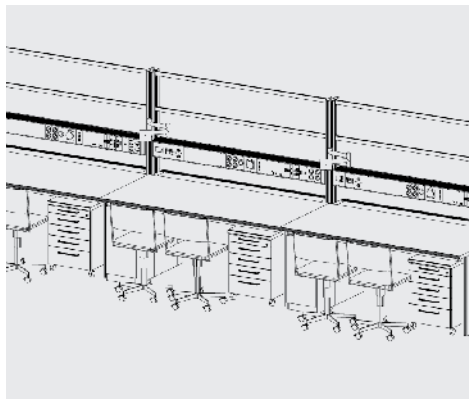
approach and room concept

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 consultants of ets DiDactic 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.



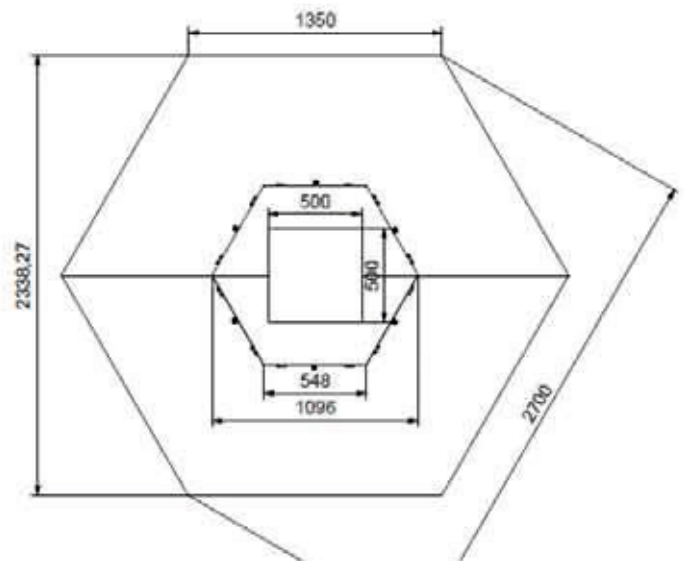
analysis

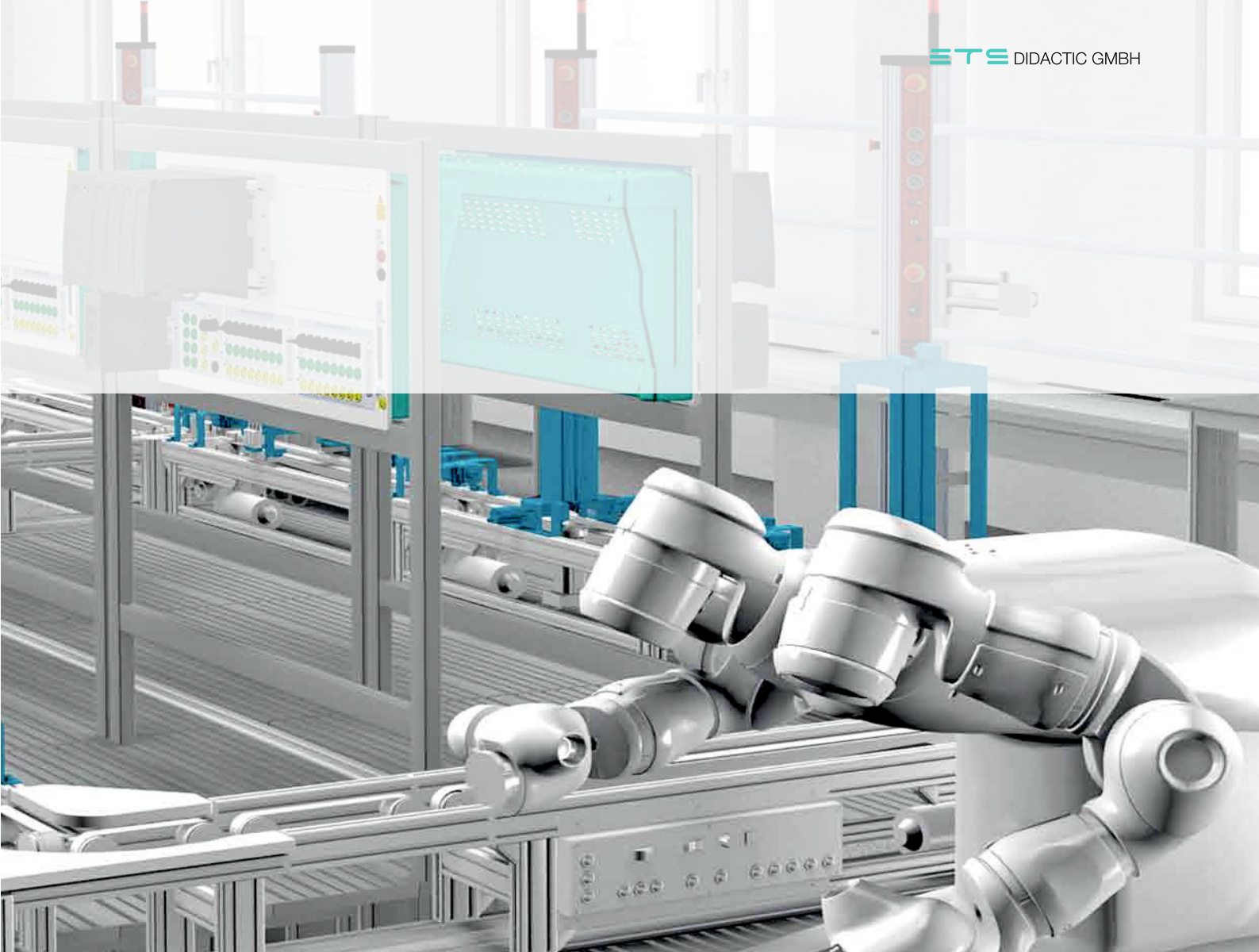


conception



consulting / planning





Design / construction



Workshops

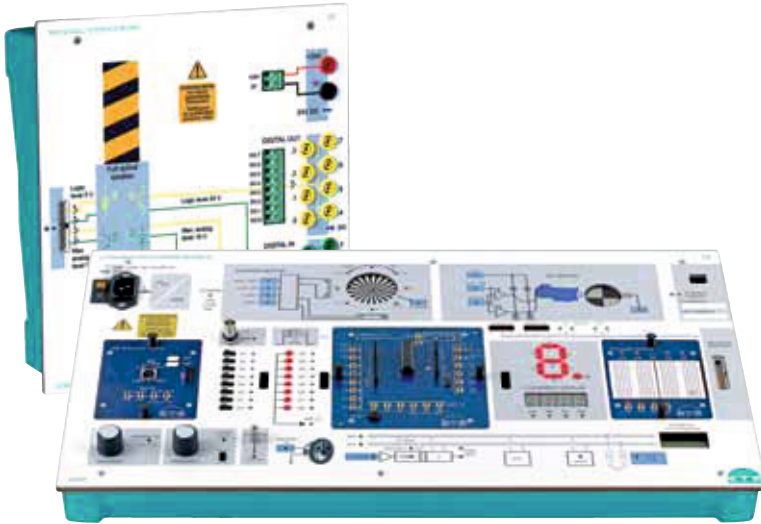


application



people and technology – a perfect match

Didactic and technology result in the ets-concept

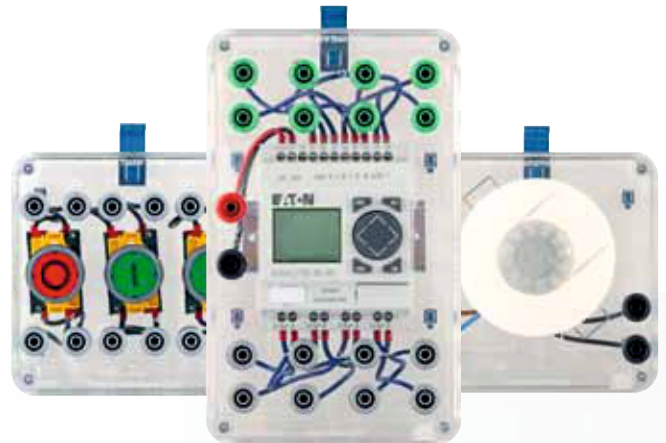


compact Boards

- › their didactical concept makes our training systems in a4 format outstanding.
- › the photorealistic design of their front panels with graphics, pictures, connection details or warning messages assist and guide the experiments - cognitive didactics. Due to the graphics, users comprehend and remember the technologies more easily.
- › the systems can be mounted in an a4 frame or placed directly on a table.

experimental Boxes

- › construct your own experiments. Beside the wiring, the arrangement of the components is focused. With the experimental boxes it's possible to practice basic circuits as well as complex installations
- › always close to practice, fast and safe!
- › Wide range of industrial components.



BST®-BuildingSystemsTrainer

- › The BuildingSystemsTrainer® is a mobile training system that can be taken from one classroom to another and then is ready for use within some minutes.
- › Beside our laboratory equipment with the experimental boards, these flexible training systems represent an independent product line covering many topics as e.g. the VDE protective measures according to VDE 0100 or the KNX building communication sector, communications technology and renewable energies, SmartBuilding and internet-of-things.
- › Boards can also be integrated in the BuildingSystemsTrainer®



WorksHops With ets

always up to Date – training at the Highest Level



Train the trainer – workshops for teachers, trainers and lecturers in the field of electrical engineering, mechatronics and metal technology.

Learn more about the management and the application of various technologies with the support of the ets trainers. Find out more about the didactic concept and learn to teach the material quickly and safe.

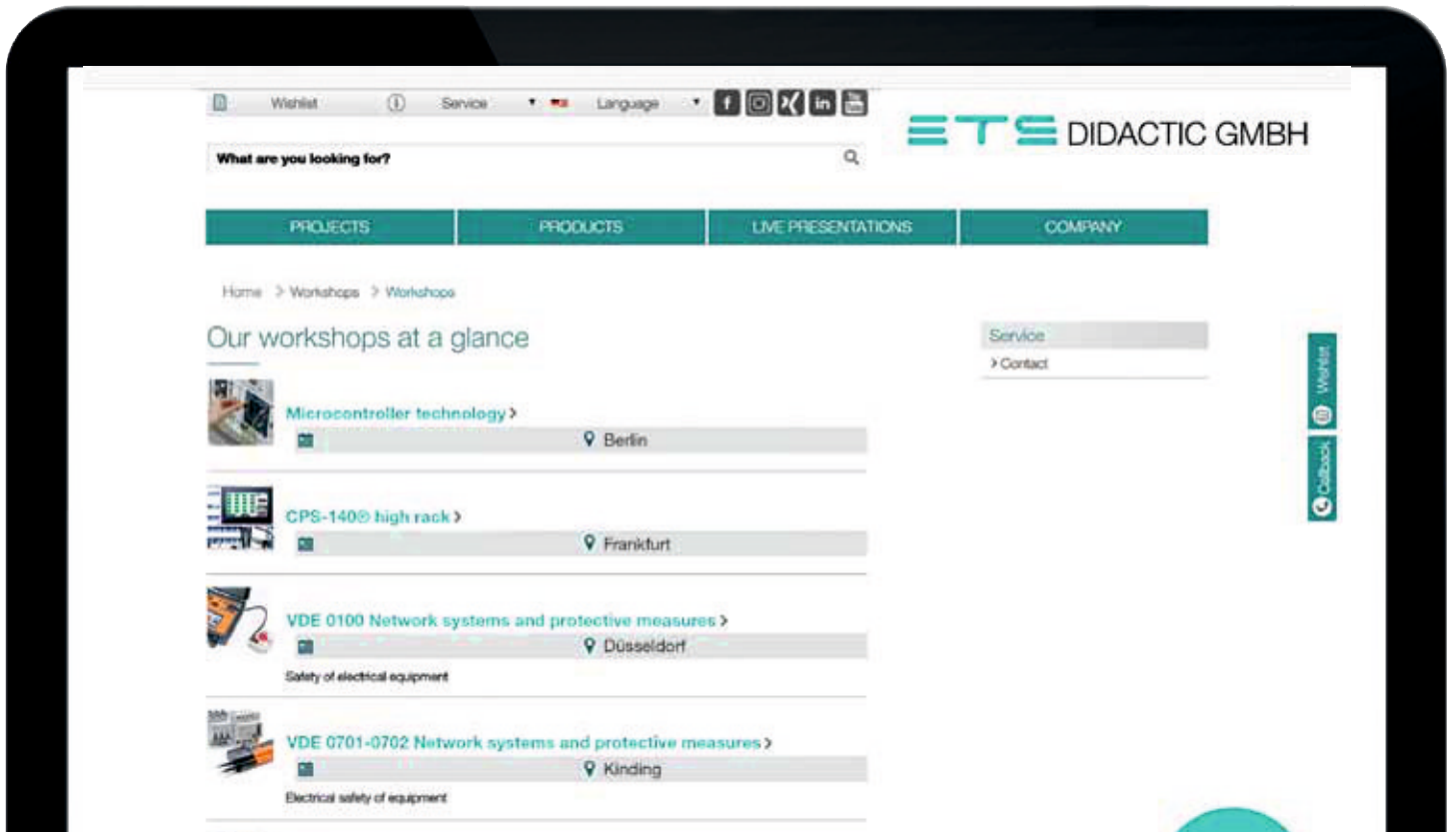
ETS offers a perfect seminar for all groups of products and topics of technical education. scan the Qr code to subscribe in a workshop:



ets-didactic.de/hp584/Workshops.htm



Fast and safe into new technologies



the ets training concept

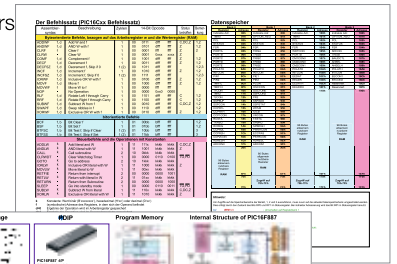
innovative Hardware / perfect courseware

- structure of the manuals
- › ringbinder principle
 - › Dividers
 - › incorporation of personal documents



compact

- techNoCards®
- › Depiction of the parameters in function groups
 - › start-up instructions
 - › safety functions
 - › individual learning help



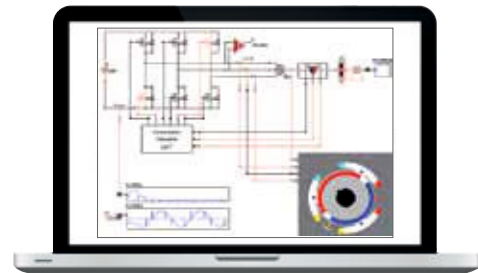
close to practice

- instructor's edition / student edition
- › 100 % function guarantee
 - › High print quality
 - › Digital and on paper
 - › original photographs with practical references
 - › Detailed work instructions



motivating

- simulations software
- › accompanying the courseware
 - › Function simulation
 - › combination of theory and practice



multimedia

- Front panel overlays
- › contents reduced to main focus of the experiment
 - › clear layout
 - › Basic function
 - › Various languages

- Furniture
- › technically matched conception
 - › excellent functionality
 - › ergonomics at the workplace
 - › outstanding design

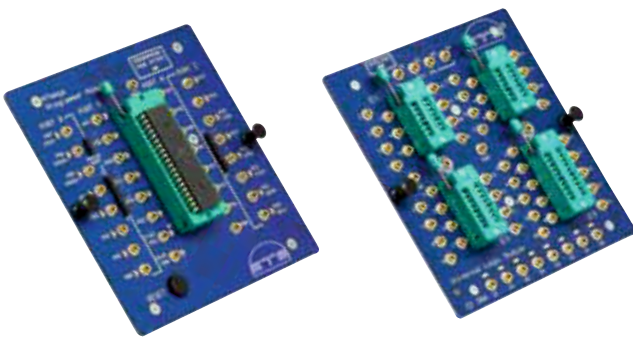
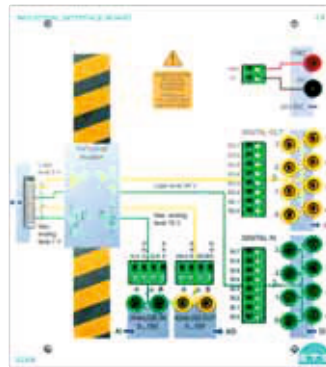
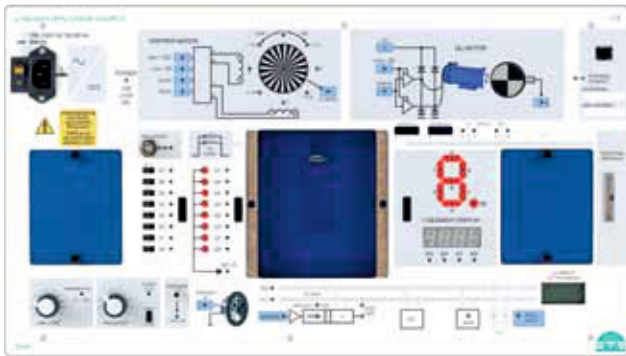
efficient



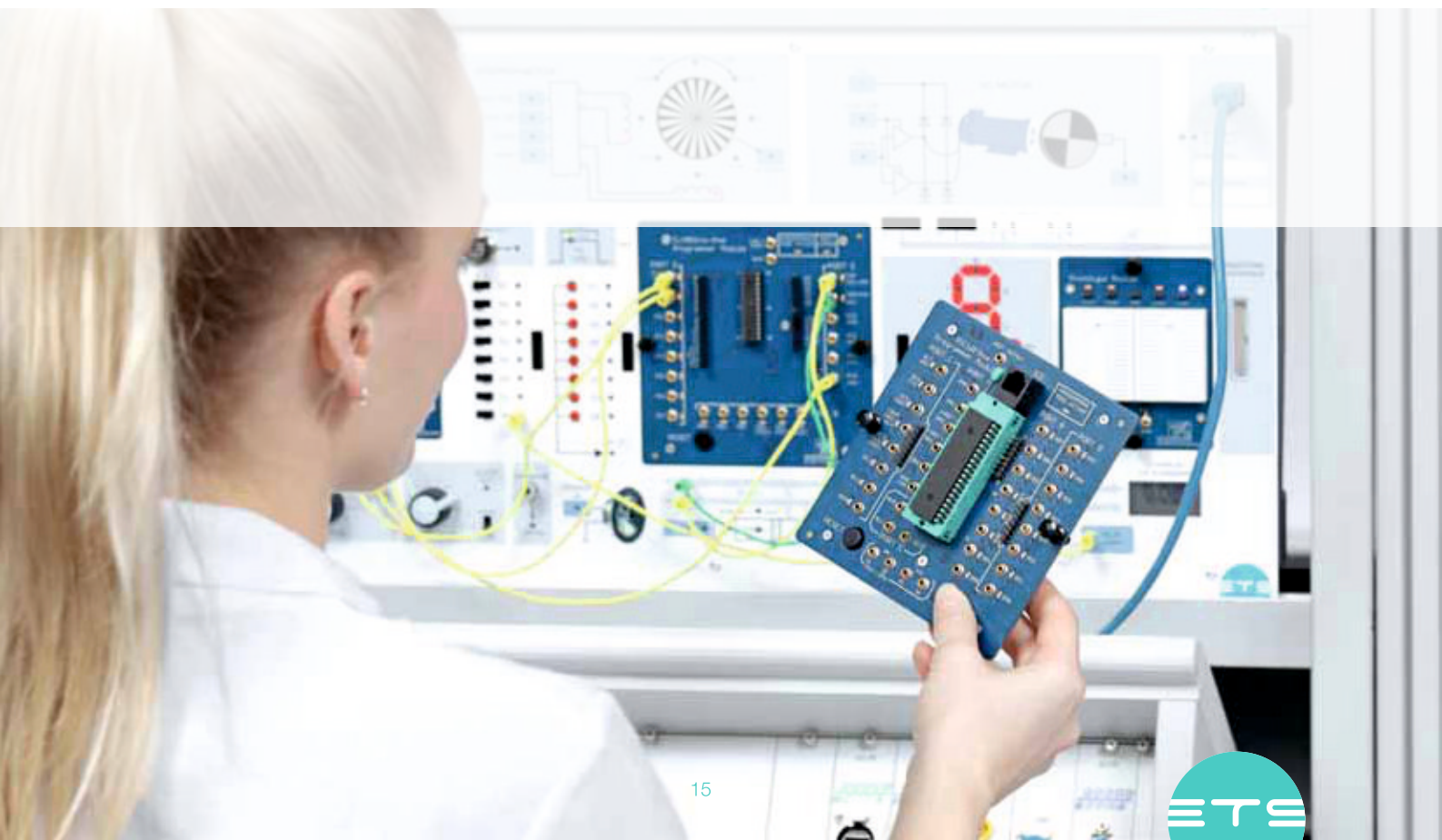
ergonomics



... the system for power electronics



- › state-of-the-art technology
- › easy to operate
- › Didactically prepared courseware
- › safety for people and machine
- › perfect ergonomic workplaces



microcomputer training system

Configuring function groups with hard- and software

The training system for microcomputer technology is designed mainly for use in vocational education.

- } Fundamentals of digital technology
- } use of graphical programming methods
- } structure and function of microcontrollers, processors ...
- } Data formats and their conversion
- } components of integrated development environments
- } programming in assembler, c, ...
- } Firmware generation
- } measuring of analog values such as voltage, temperature, pressure ...
- } aD and Da converters
- } components with i2c bus like displays, brightness and temperature sensors
- } Dc and stepping motor control

Fundamentals of digital technology

- } methods of digital circuit analysis
- } methods of digital circuit synthesis
- } practical use of logic integrated circuits
- } Designing a circuit with ics
- } Data from integrated circuits
- } measurement devices and methods
- } complex logic circuits and converters

Fundamentals of microcomputer technology

- } microcomputer and microcontroller
- } embedded systems
- } instruction set of the cpu
- } memory components
- } timer and interrupts
- } Bus and ports



Serial asynchronous communication

- › principle of the serial asynchronous transmission
- › eia232 interface
- › usB interface
- › terminal communication
- › testing interfaces
- › controller boot loader
- › programming a controller with boot loader

Using industrial development environments

- › installation
- › Configuration
- › use for programming
- › structured programming
- › program graph
- › Debugging and simulation of programs

Microcontroller integration in appliances

- › Data formats
- › interfaces
- › Bus systems
- › Device types
- › clock generation
- › parallel and serial data transfer

Control of industrial manufacturing systems

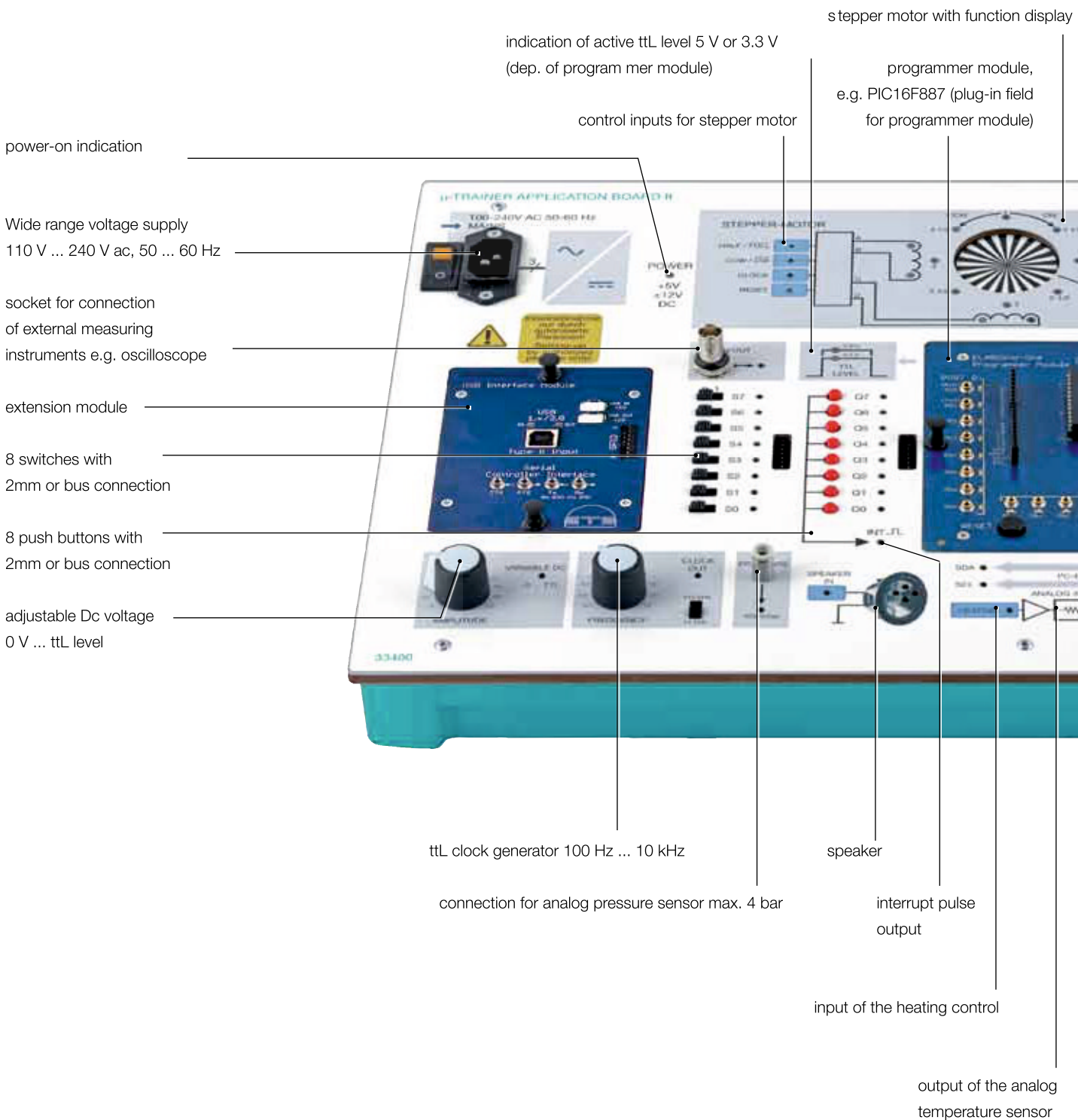
- › the transition from the appliance to a system
- › industrial levels and safety measures
- › control circuits
- › electromechanical and pneumatic components
- › safety of systems through hard- and software

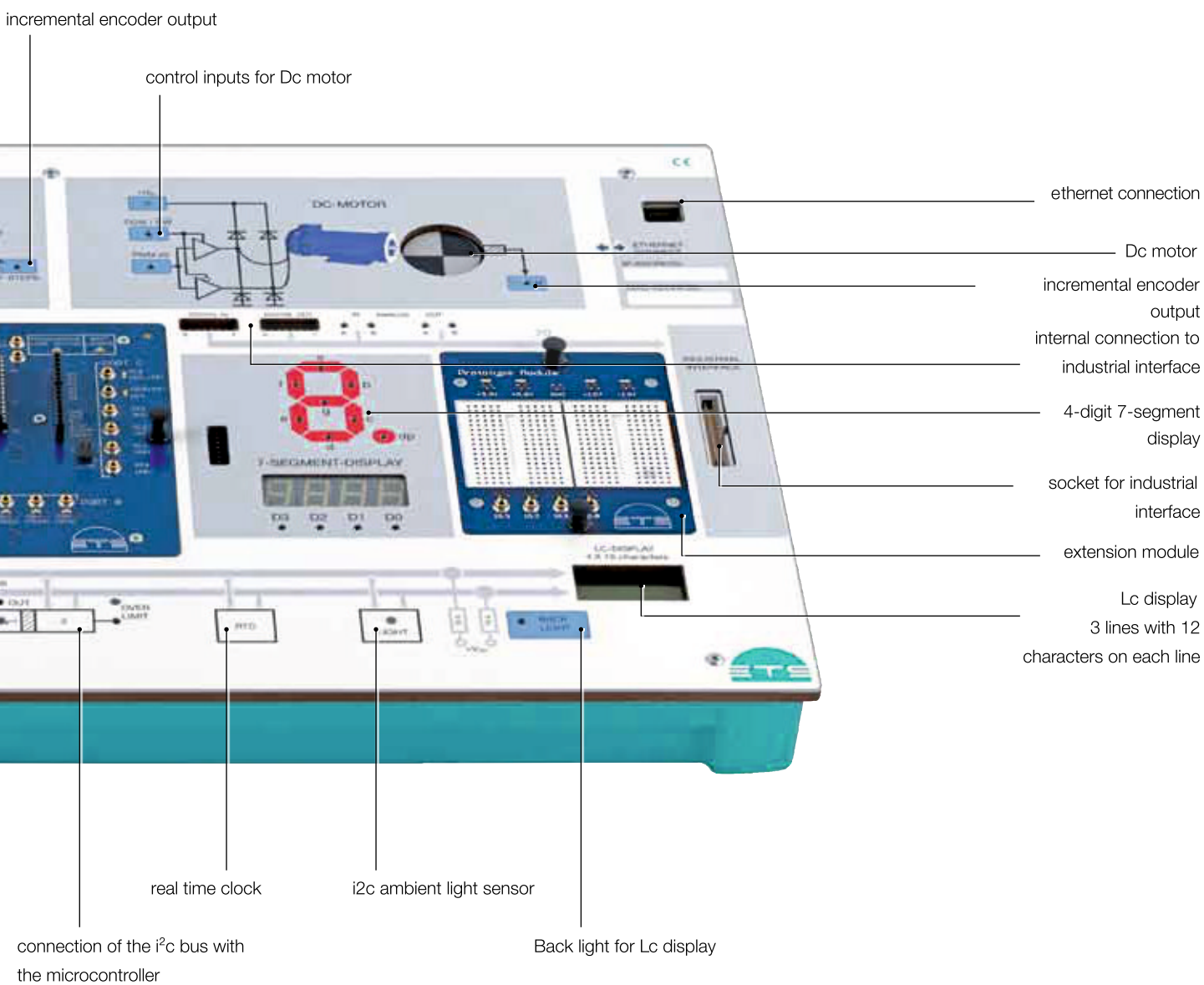
Integration of external peripheral devices

- › analog sensors
- › intelligent sensors
- › Displays
- › small motors



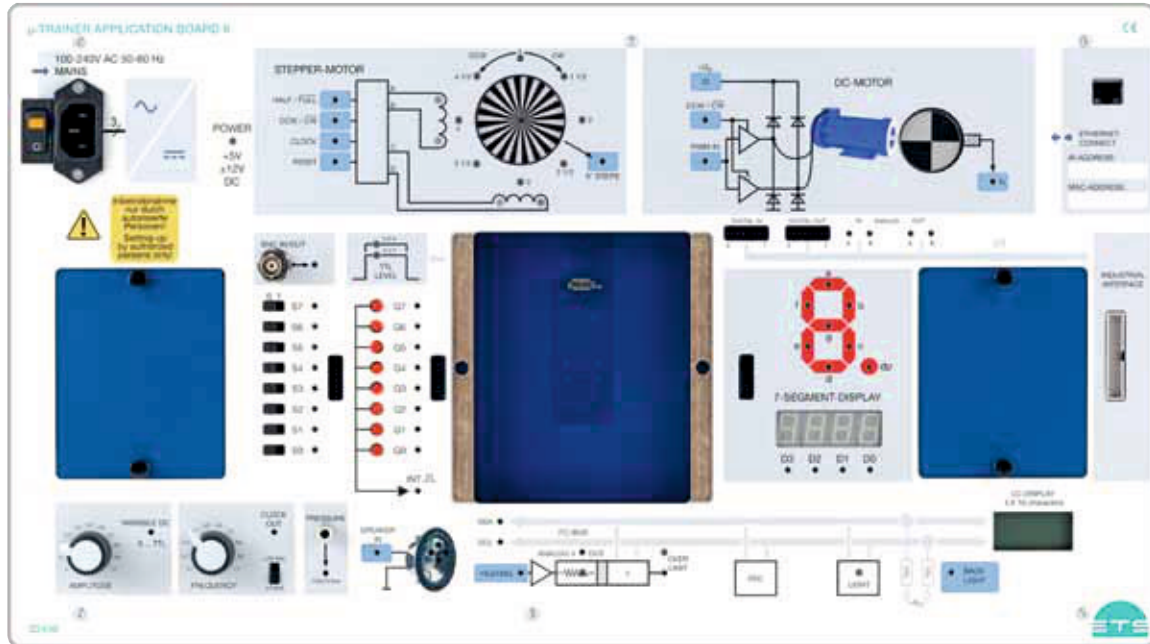
HarDW are μ -trainer ii system





microcomputer - trainingsssystem

µ-trainer application Board ii



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

1

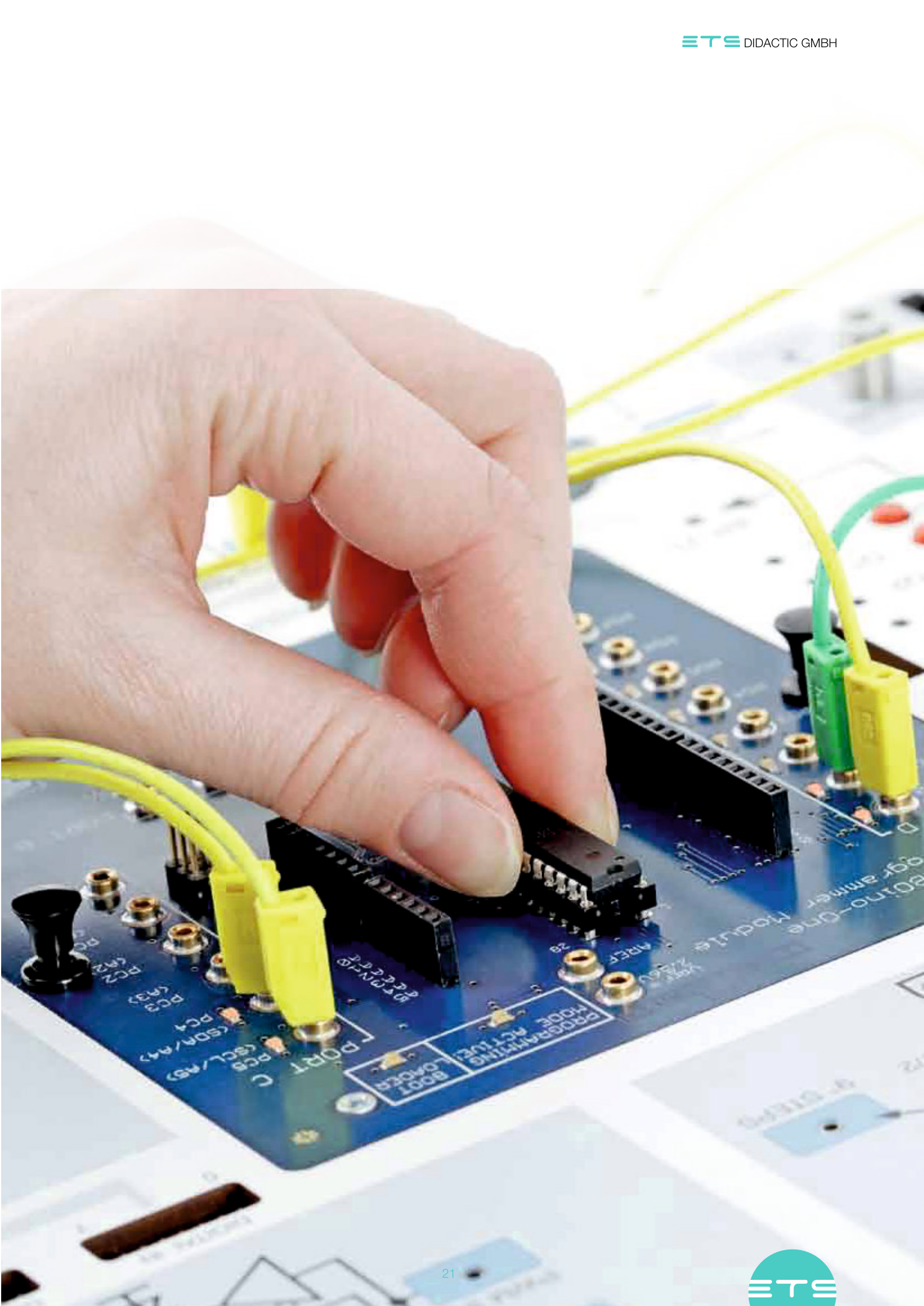
- › 8 on/OFF switches
- › 8 push buttons
- › 1 interrupt output
- › 4 7-segment displays
- › 1 heating module
- › 1 i2c temperature sensor
- › 1 i2c real time clock
- › 1 i2c ambient light sensor
- › 1 i2c L c display with back light
- › 1 analog pressure sensor up to 4 bars
- › 1 analog temperature 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 fi elds 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 e thernet 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
- › Central on/off switch
- › Logic level 3.3 V or 5.0 V
- › Dimensions 532 x 297 x 85 mm
- › Desk housing device

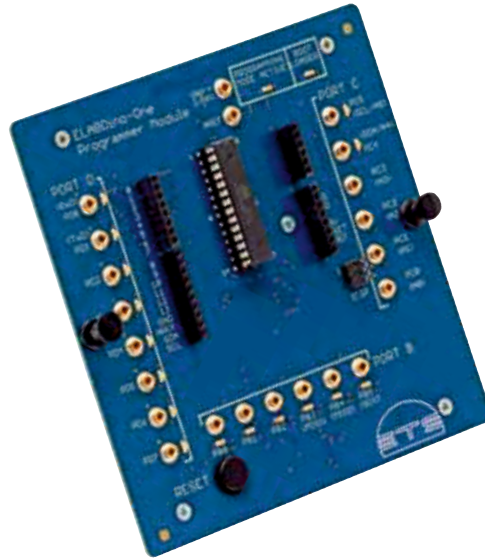
The “µ-Trainer Application Board II” is delivered with: application Board, cD-rom with driver software, power cord, ethernet connecting cable 2 m, 1 bus cable 10 cm, 1 bus cable 20 cm, 1 bus cable 30 cm, 1 bus cable 50 cm, 1 adapter bus cable 20 cm, operating instructions.

No.	Designation	Order No.
1	µ-trainer application Board ii	33400



eLaBoino

eLaBoino-one programmer module / at mega 328p



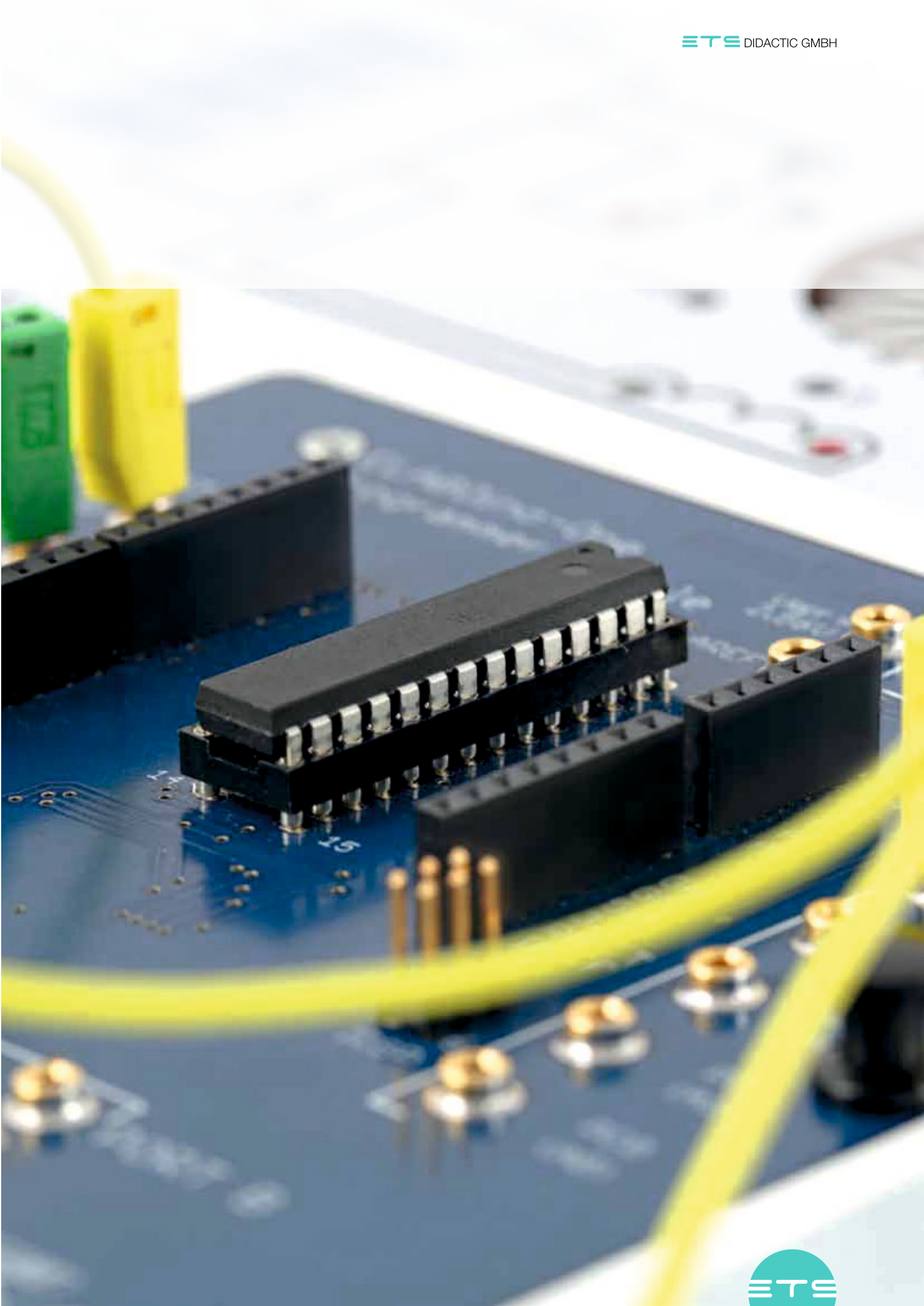
Technical data

- } ic socket 28-pin to accept the controller atmega328p (alternatively atmega48a/pa or 88a/pa or 168a/pa)
- } controller atmega328p
- } clock generation internal 128kHz, 1MHz and 8mHz or external Quarz 16mHz
- } connectors port B (0 ... 5), c (0 ... 5) and port D (0 ... 7) are connected to 2mm connectors and additionally to platinum connectors
- } integrated aDu (port c) 6 channel usable, 10 bit, internal and external reference voltage
- } external reference source 2,56V
- } onchip-Debugging interface Debug Wire
- } LeD per port pin on ports B, D and partially c show the logic level at the corresponding port pin
- } program circuit serial isp or alternatively via Boodloader

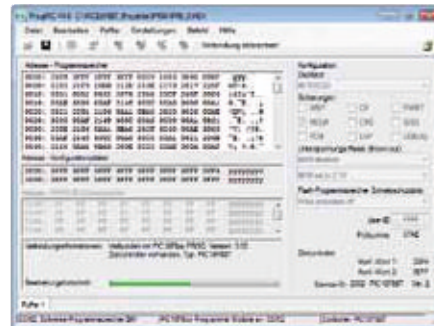
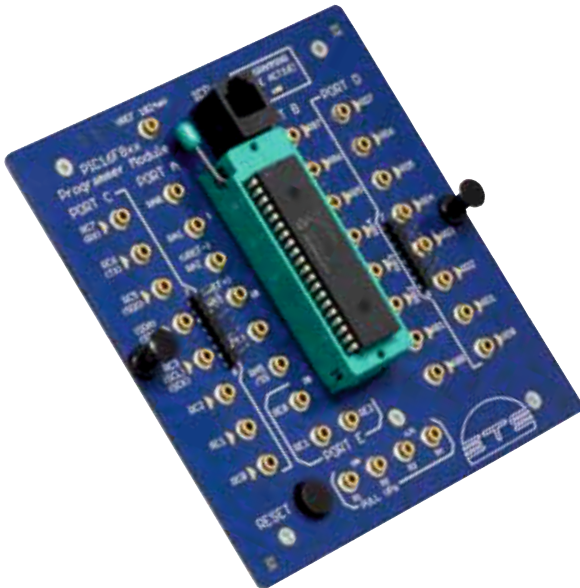
Special version for μ -Trainer II

the eLaBoino-one programmer modul is a self-contained test and programming module for the microcomputer training system " μ -Trainer" and contains the following functional elements and parameters.

No.	Designation	Order No.
1	eLaBoino-one programmer module	33413



pic16F8xx p rogramming module



*s system requirements:
Windows Xp sp2,
Frame network 4.x,
Windows Vista sp1,
Windows 7 (32 Bit/64 Bit)



* Windows is a registered trademark of the microsoft corporation.
** software also in russian language available

the pic16F8xx p rogrammer module is an integrated test and programming module for the training system "µ-Trainer". It serves for programming of PIC16F8xx microcontrollers with 40-pin pDip housing and for using the microcontroller in the training system.

Technical data

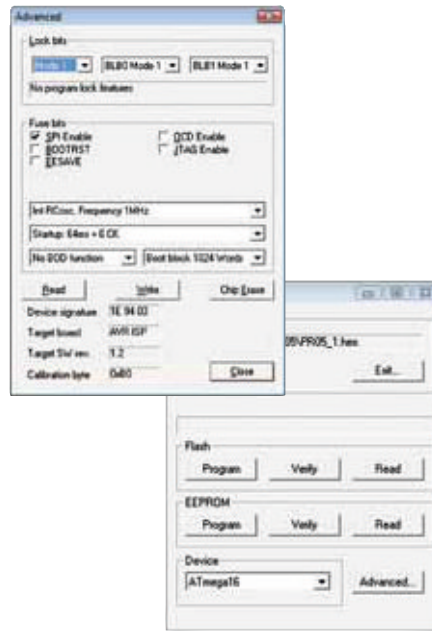
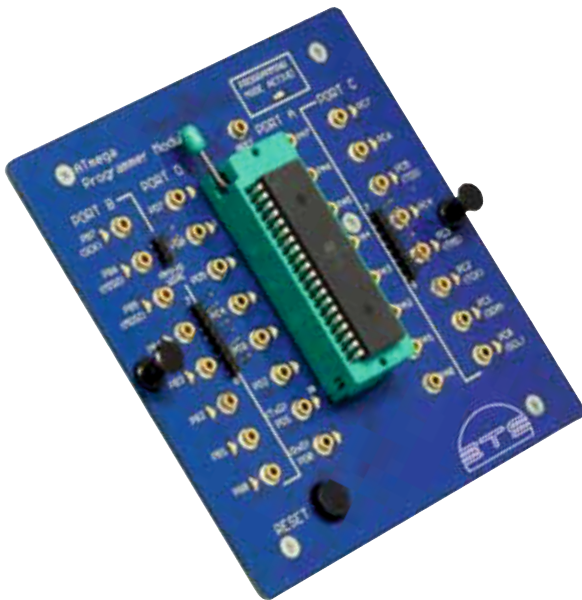
- } ZIF socket, 40-pin, for inserting the controller pic16F887 (optional: pic16F884, pic16F877, pic16F874)
- } clock generation, external with quartz 16 MHz (oscillator type Hs)
- } clock generation, internal up to 8 MHz
- } ports a, B, c, D and p ort e have 2mm connectors
- } ports B, c and D have bus connectors in addition
- } LeD per port pin at the ports B, c and D indicating the logical level
- } integrated aDc (p ort a, B and e) 14 channels, 10 Bit
- } internal and external reference voltage
- } reference voltage source $u_{ref} = 1024 \text{ mV}$
- } programmer circuit, in series, isp
- } in circuit Debugging interface over isp interface
- } programming voltage +12 V
- } internal operating voltage: +5 V / +5 V logical level

Delivery scope:

6F8xx programmer module, cD-rom with programming software** and industrial software developing environment (project management, source code editor, assembler, c-compiler, simulator), operating instructions.

No.	Designation	Order No.
1	pic16F8xx p rogrammer module	33402

atmega p rogramming module



* system requirements:
Windows Xp sp2,
Frame network 4.x,
Windows Vista sp1,
Windows 7 (32 Bit/64 Bit)

* Windows is a registered trademark of the microsoft corporation.

the atmega p rogrammer module is an integrated test and programming module for the training system "µ-Trainer". It serves for programming of ATmega controllers with 40-pin PDIP housing (ATmega16, ATmega32 or atmega8535). the microcontrollers are programmed and used in the training system.

Technical data

- › ZIF socket, 40-pin, for inserting the controller at -mega16 (optional: atmega32 or atmega8535)
- › clock generation internal 1 MHz, 2 MHz, 4 MHz and 8 MHz or external with quartz 16 MHz
- › ports a, B, c and p ort D (0 ... 7) have 2mm connectors, ports B and c have bus connectors in addition
- › LeD per port pin at the ports B, c and D indicating the logical level
- › integrated aDc (p ort a) 8 channels, 10 Bit, internal and external reference voltage
- › external reference voltage input for the aDc up to $U_{REF} = 5 V$
- › on-chip-Debugging interface Jtag and Debug Wire for future applications
- › programmer circuit, in series, isp
- › internal operating voltage: +5 V
- › +5 V logical level
- › Dimensions 125 x 120 x 35 mm

Delivery scope:

atmega p rogrammer module, cD-rom with programmer software and industrial software developing environment (project management, source code editor, assembler, simulator), c-compiler, operating instructions.

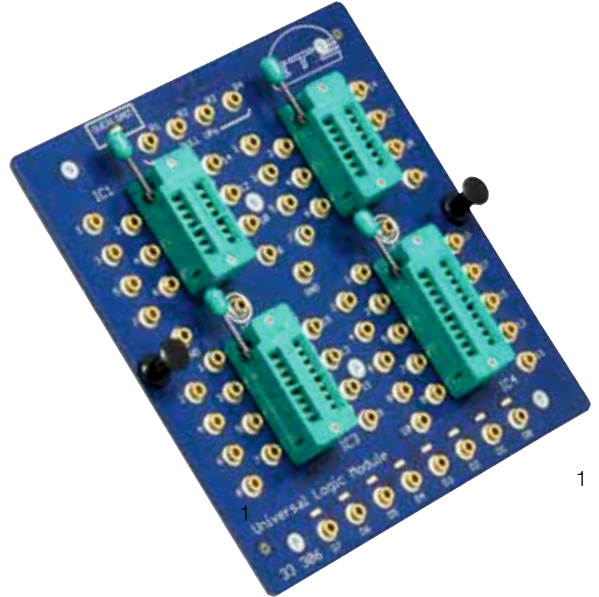
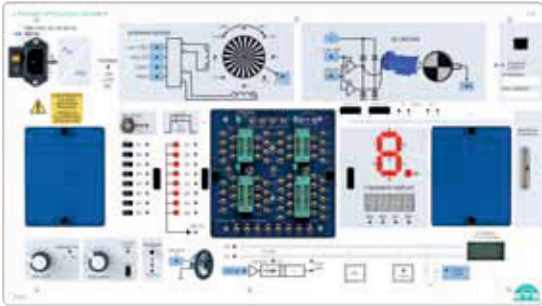
No.	Designation	Order No.
1	atmega p rogrammer module	33403





microcomputer / Digital technology

universal Logic module



Technical data

- › 4 ZiF sockets, all pins can be optionally connected via 2mm sockets,
 - 2 x ZiF sockets 14 pin
 - 1 x ZiF socket 16 pin
 - 1 x ZiF socket 20 pin
- › 8 x LeD with separate inputs for display of logic levels, buffered
- › 4 x Pull-Up resistors 10 kΩ
- › Logic level: +5 V TTL
- › operating voltage, short-circuit protected, $i_{max} \leq 1,3 \text{ A}$
- › overload display by bright blue LeD
- › Dimensions 125 x 120 x 30 mm

Component set „Logic Integrated Circuits“



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

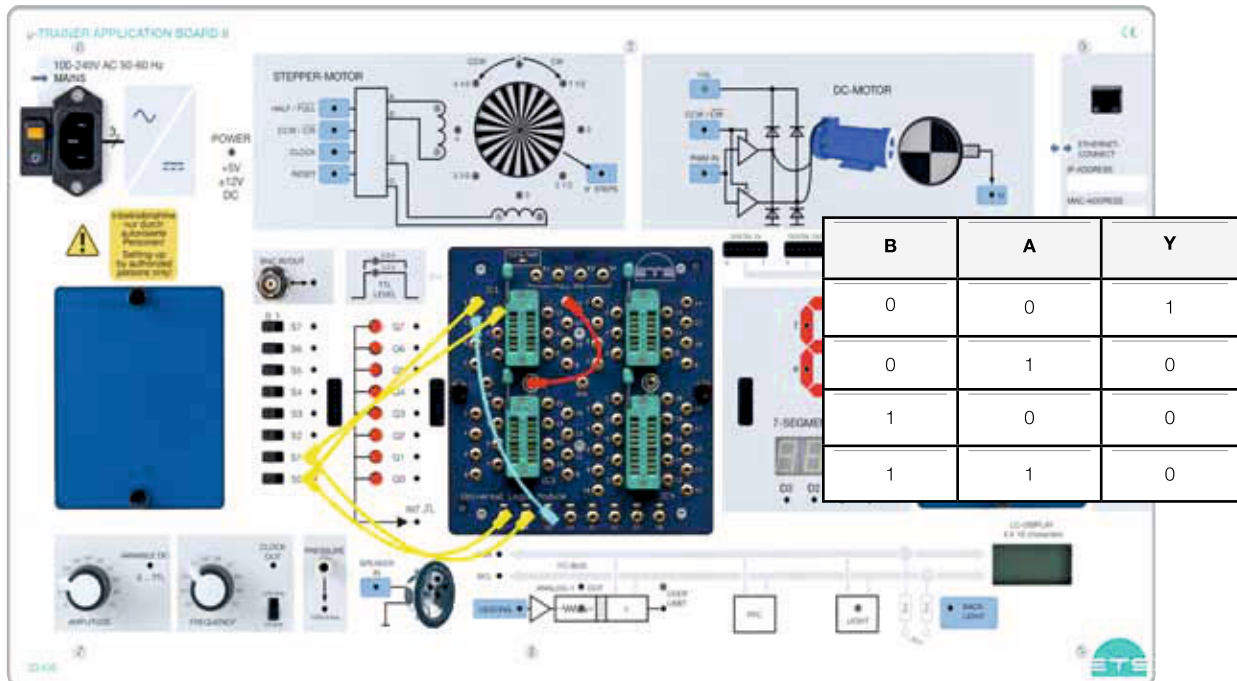
the universal Logic module (33 406) is a complete extension module to microcomputer training system "µ-Trainer" for free experimenting and examination of logical integrated circuits.

Technical data

- › 2 pcs. 4xnanD gate, each with 2 inputs
- › 2 pcs. 2xnanD gate, each with 4 inputs
- › 2 pcs. 2xanD gate, each with 4 inputs
- › 2 pcs. 4xnor gate, each with 2 inputs
- › 2 pcs. 4xor gate, each with 2 inputs
- › 2 pcs. 4xXor gate, each with 2 inputs
- › 2 pcs. 6xinverter
- › 2 pcs. 2xD-flipflop
- › 2 pcs. 2xJK-flipflop
- › 2 pcs. 2xJK-flipflop with preset and delete
- › 2 pcs. synchronous 4-bit counter BcD
- › 2 pcs. up-down counter, binary
- › 1 pc. gaL programmed as a 7-segment decoder
- › 1 pc. gaL programmed as a divider

No.	Designation	Order No.
1	universal Logic module	33406
2	Basic set Logic ics	33390

Fundamentals of and experiments in Digital technology



1

Learning objectives

- › introduction in digital technology
- › Basic logic circuits
- › Logic ics in practice
- › Boolean switching algebra
- › De morgan's Laws
- › circuit synthesis
- › Disjunctive normal form
- › conjunctive normal form
- › karnaugh map
- › codes and code converters
- › adder and subtractor
- › comparators
- › Flipflops
- › monostable multivibrators
- › astable multivibrators
- › counters
- › shift registers
- › multiplexer and demultiplexer
- › analog-to-digital converter
- › Digital-to-analog converter



2,3

The manuals

- › Description of theory and guided practical experiments
- › edition for trainees or students with tasks
- › edition for the teacher with solutions and method leads
- › unrestricted copying license for educational institutions
- › manual incl. cD-rom

No.	Designation	Order No.
1	µ-trainer application Board ii	33400
2	Fundamentals of and experiments in Digital technology – tasks	33100cD-eng
3	Fundamentals of and experiments in Digital technology – solutions	33101cD-eng

DC-Motor



Ethernetanschluss
- beide LED aus / keine Verbindung
- rechte LED grün / 100 MBit
- linke LED grün / aktive Verbindung

Inkrementalgeberausgang

Interner Anschluss zur
Industrieschnittstelle

Anschlussbuchse für
Industrieschnittstelle

4-stellige
7-Segmentanzeige

PC-Umgebungslichtsensor
Adresse: 0101001

LC-Display
4 Zeilen à 16 Zeichen
Adresse: 0111100

Hintergrundbeleuchtung
für LC-Display,
Analog 0...TTL / PWM

Echtzeituhr
Adresse: 1101000

Ausgang und Limitarzeige

! ACHTUNG!

Beachten Sie beim Aufbau und bei der Erprobung der Anlage alle erforderlichen Sicherheitsmaßnahmen, die Lebensordnung und die entsprechenden Schutzmaßnahmen!

240V AC 50-60 Hz



POWER
+5V
±12V
DC



Inbetriebnahme
nur durch
autorisierte
Personen!
Setting-up
by authorized
persons only!

STEPPER-MOTOR

- HALF / FULL
- CCW / CW
- CLOCK
- RESET

BNC IN/OUT



- 0 1
- S7
- S6
- S5
- S4
- S3
- S2
- S1
- S0

USB Interface Module

USB 1.x/2.0

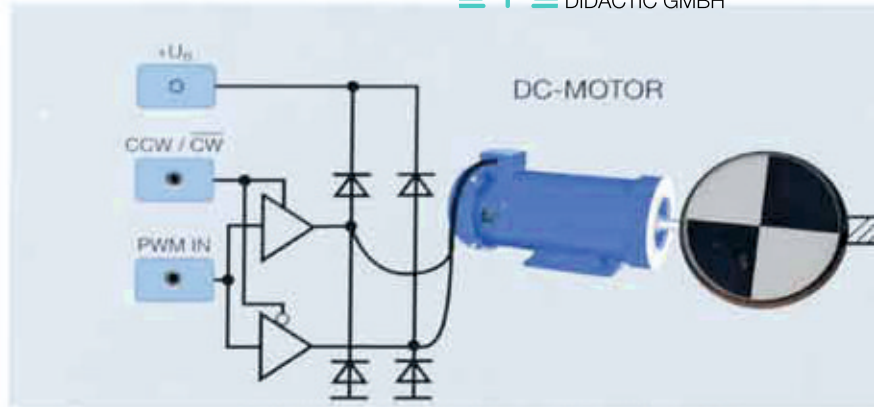
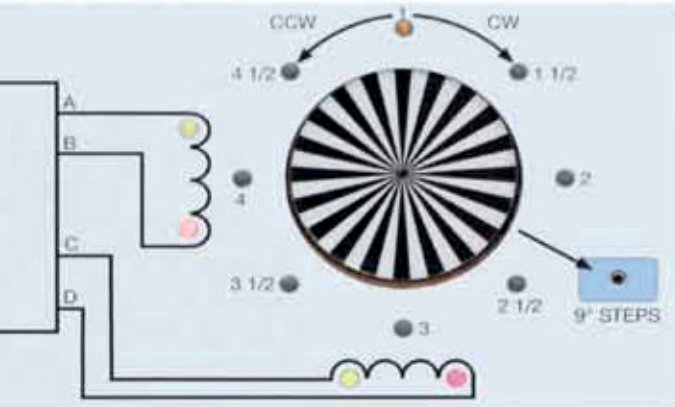
GPIO

Control Interface

VAR. BLE DC

CLOCK

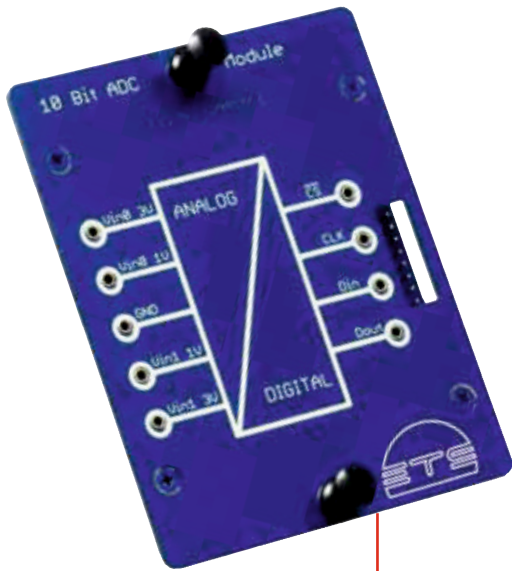
PRESS-RE



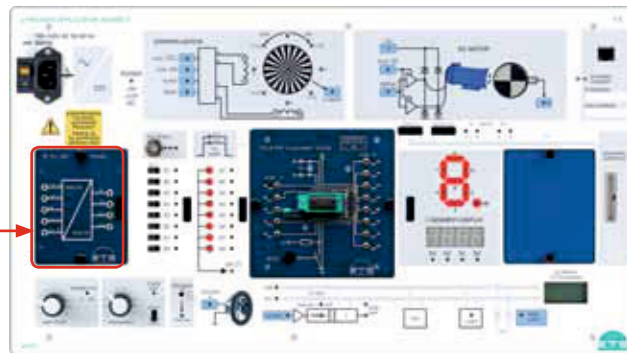
Main experimental board featuring an ELABino-One Programmer Module. The board includes a 7-SEGMENT-DISPLAY with segments labeled a through g and a decimal point (dp). The display shows the number 8888. The board also has a PORT D (PD0-PD7) and PORT C (PC0-PC7) with various pins. A hand is shown pressing the RESET button. Other components include a TTL LEVEL section with Q1-Q7 LEDs, a DIGITAL IN/OUT section, an ANALOG IN/OUT section, and a BACKLIGHT section. The board is connected to a power supply and a ground.

analog / Digital - conversion

10 Bit aDc module



the 10 Bit aDc module is an integrated extension module for the Microcomputer Training System “μ-Trainer” containing a 2-channel analog-to-digital converter with a 10-bit resolution.



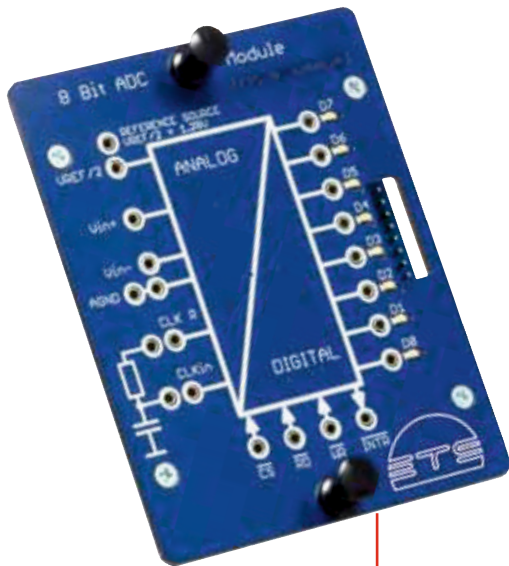
Technical data

- } 2-channel analog-to-digital converter
- } reference voltage 1 V or 3 V
- } maximum conversion speed up to 250 ksample · s⁻¹
- } recommended maximum conversion speed of the module 25 ksample · s⁻¹ while using 2mm cables for connecting the spi interface
- } analog inputs with 2mm sockets
- } output with 2mm sockets and additional bus connector
- } spi controller interface
- } +3.3 V or +5 V logic level depending on the settings of the programmer module
- } Dimensions 78 x 97 x 30 mm
- } Delivered with operating instructions

No.	Designation	Order No.
1	10 Bit aDc module	33404

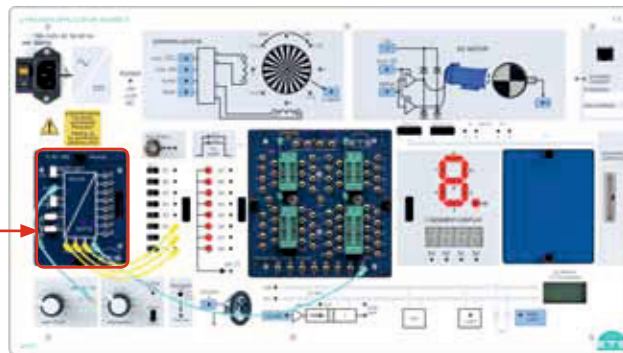
eXtension moDuLe

8 Bit aDu module



the 8 Bit aDc module is a complete extension module for the Microcomputer Training System "µ-Trainer".

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



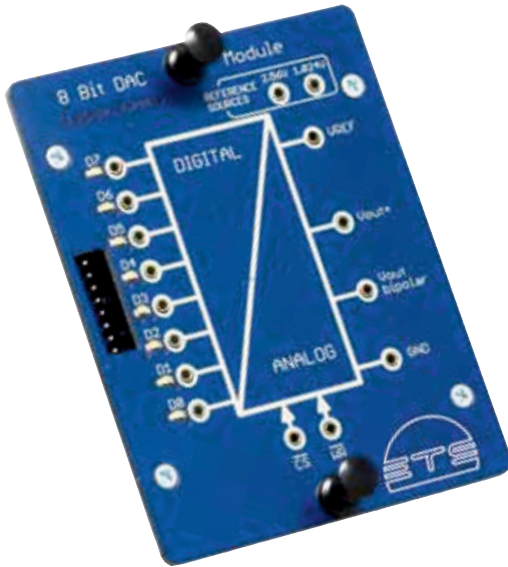
Technical data

- › 1-channel analog-to-digital converter
- › reference voltages: 2.56 V, Vcc internal or external, upto max. 5 V. note: the reference voltage input level is $0.5 \times V_{ref}$!
- › Differential input at 2mm sockets
- › 8 outputs at 2mm sockets and bus connector
- › 4 control inputs and outputs at 2mm sockets
- › Logic level: +3.3 V or +5 V depending on the settings of the programmer module
- › Dimensions 78 x 95 x 32 mm
- › Delivered with programming examples on cD-rom and operating instructions

No.	Designation	Order No.
1	8 Bit aDc module	33407

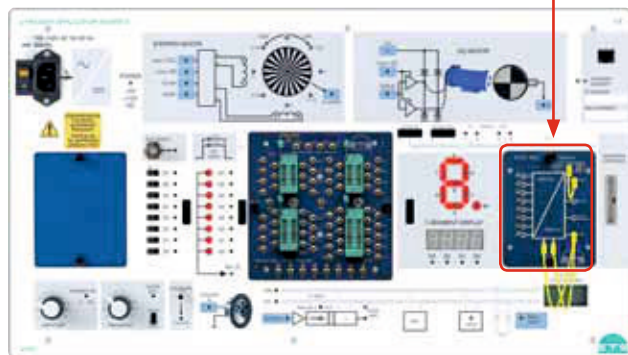
eXtension moDuLe

8 Bit Dau module



the 8 Bit D ac module is a complete extension module for the Microcomputer Training System "µ-Trainer".

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



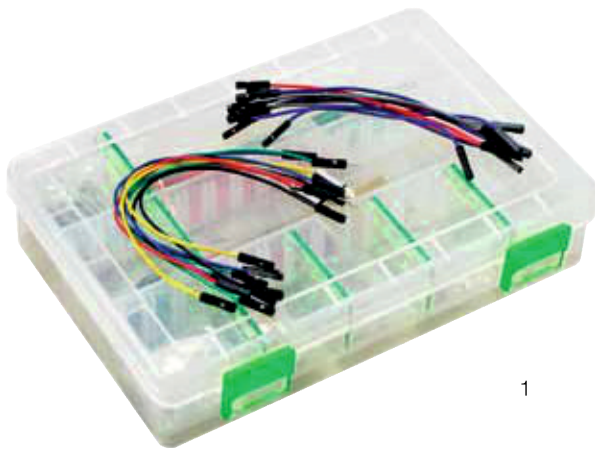
Technical data

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

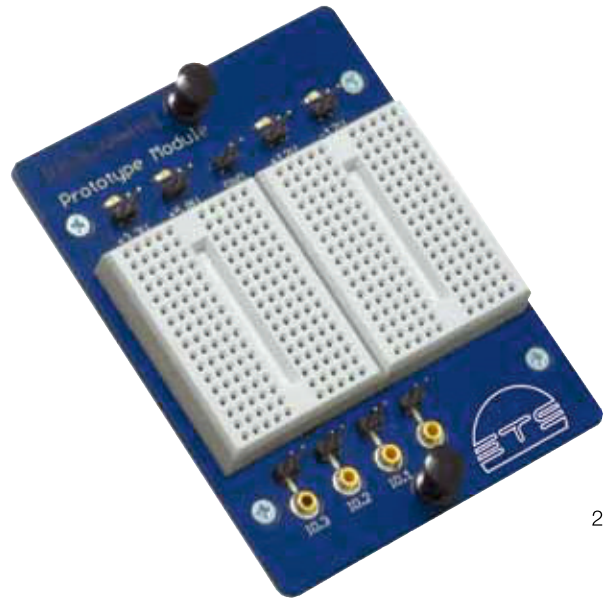
No.	Designation	Order No.
1	8 Bit Dau module	33408

microcomputer/Digital technology

prototype module



1



2

33391 Breadboard Wiring Set
A useful complementary equipment to the Prototype module

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

Technical data

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

No.	Designation	Order No.
1	Breadboard Wiring set	33391
2	prototype module	33410

microcomputer / Digital technology

serial interface module



Technical data

- › eia232 interface, 9-pole, Dce socket
- › 9 control inputs and outputs on the controller side, at 2mm sockets
- › Logic level: +3.3 V or +5 V depending on the settings of the programmer module
- › Dimensions 78 x 95 x 32 mm
- › Delivered with programming examples, computer applications and tools on cDrom and operating instructions

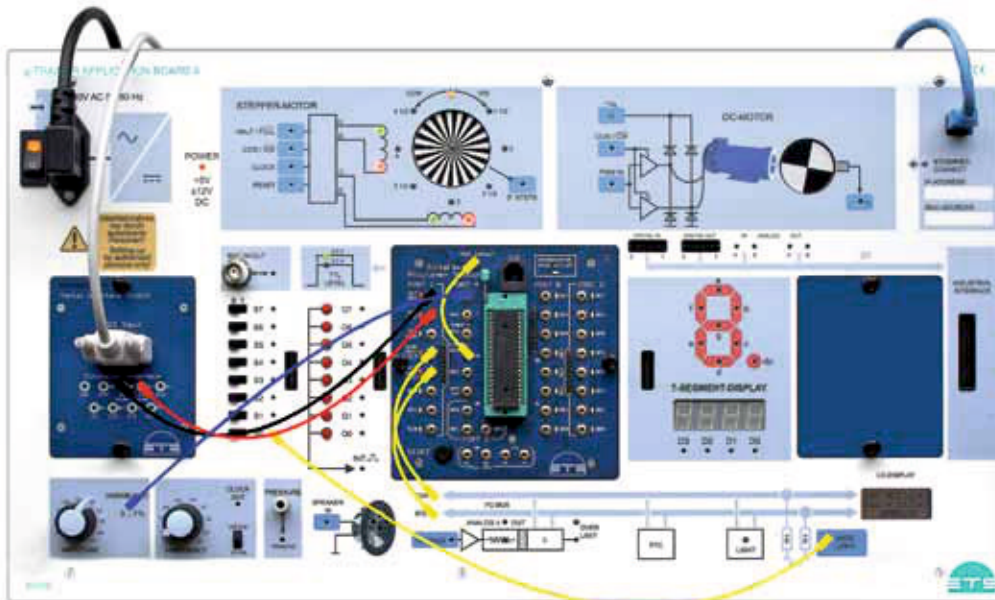
the serial interface module is a complete extension module for the Microcomputer Training System “ μ -Trainer”.

the serial interface can be used either with static control signals or via microcontroller to examine the functional principle of the communication between controller and pc via the eia232 interface.

No.	Designation	Order No.
1	serial interface module	33480

eXtension moDuLe

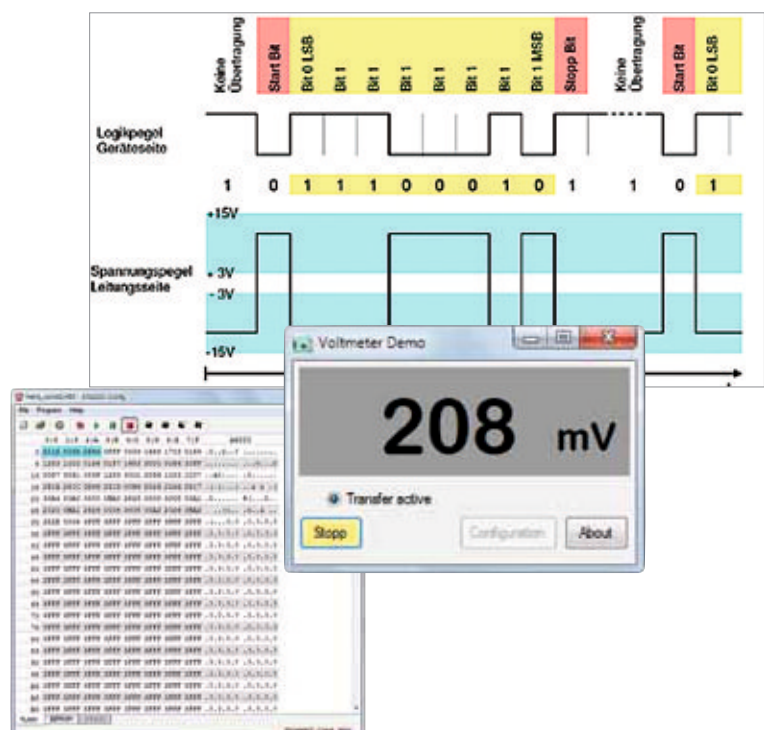
serial asynchronous communication between controller and pc



1

Learning objectives

- > principle of the serial asynchronous transmission
- > eia232 interface
- > terminal communication
- > testing interfaces
- > Data communication between controller and pc
- > controller boot loader
- > programming pic16F887 or atmega16 controllers with boot loader via eia232



microcomputer / Digital technology

usb interface module



Technical data

- › usB standard 1.0/2.0
- › usB connection type B
- › 4 inputs and outputs on the controller side, at 2mm sockets
- › parallel input and output via 8-bit bus connection
- › Optional display of data traffic via 2 LEDs
- › Logic level: +3.3 V or +5 V depending on the settings of the programmer module
- › system requirements: Win Xp, Vista, Windows7 (32 bit / 64 bit)
- › Dimensions 78 x 95 x 32 mm
- › Delivered with programming examples, computer applications, drivers and tools on cD-rom and operating instructions

the usB interface module is a complete extension module for the microcomputer Training System “μ-Trainer”.

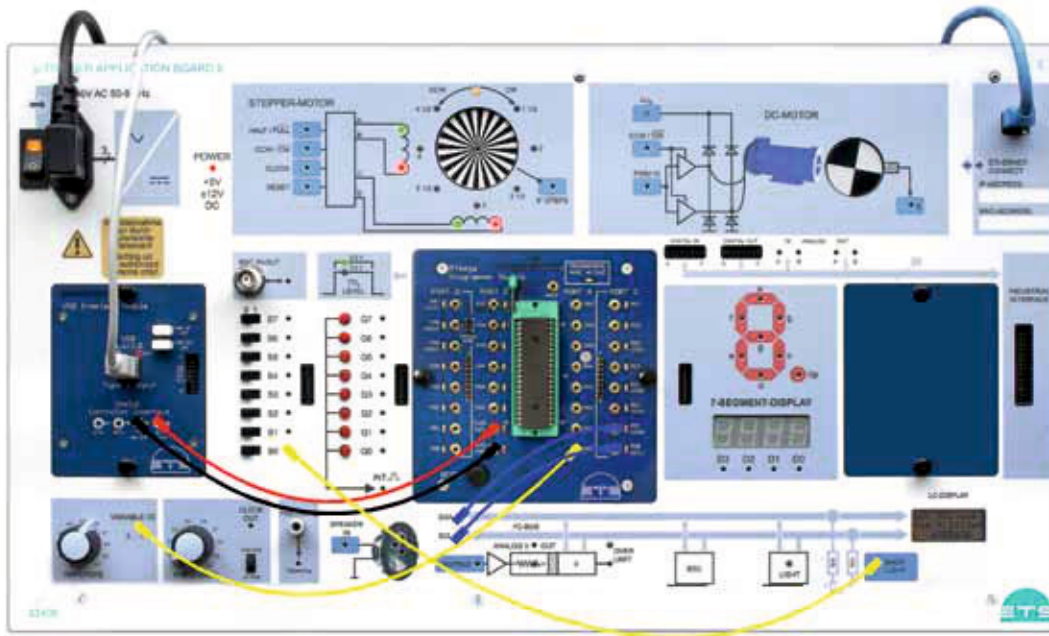
the usB interface can be used either independently or via microcontroller to examine the functional principle of usB communication.

The USB interface is freely configurable and allows communication as a real usB 1.0 or usB 2.0 interface or as a serial port emulator via software driver.

No.	Designation	Order No.
1	usB interface module	33481

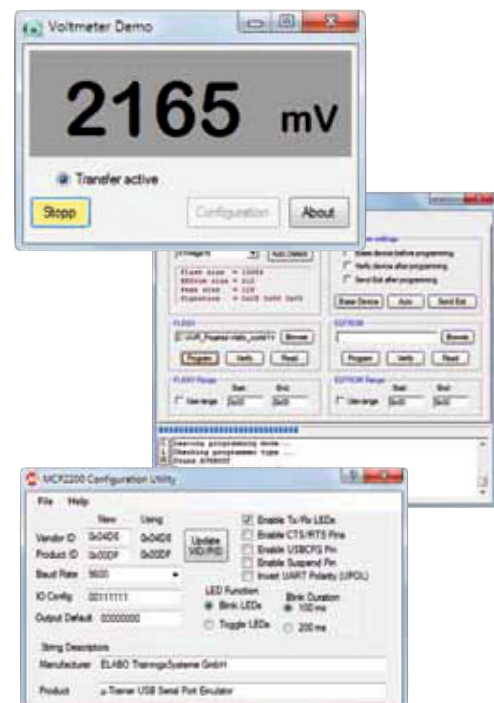
eXtension moDuLe

usB communication between controller and pc



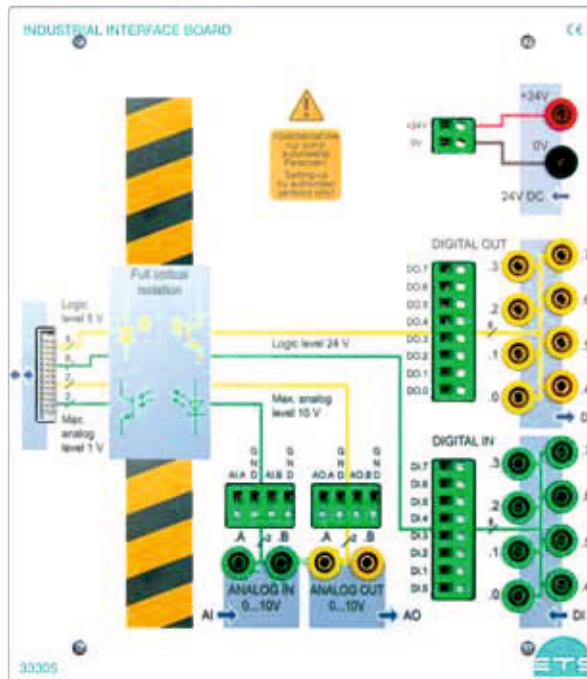
Learning objectives

- > principle of the serial asynchronous transmission
- > usB interface
- > Adaptation and configuration
- > emulation of an eia232 interface
- > terminal communication
- > testing usB interfaces
- > Data communication between controller and pc
- > controller bootloader
- > programming pic16F887 or atmega16 controllers with bootloader via usB



inDustrial interF ace

industrial interface



1

Technical data

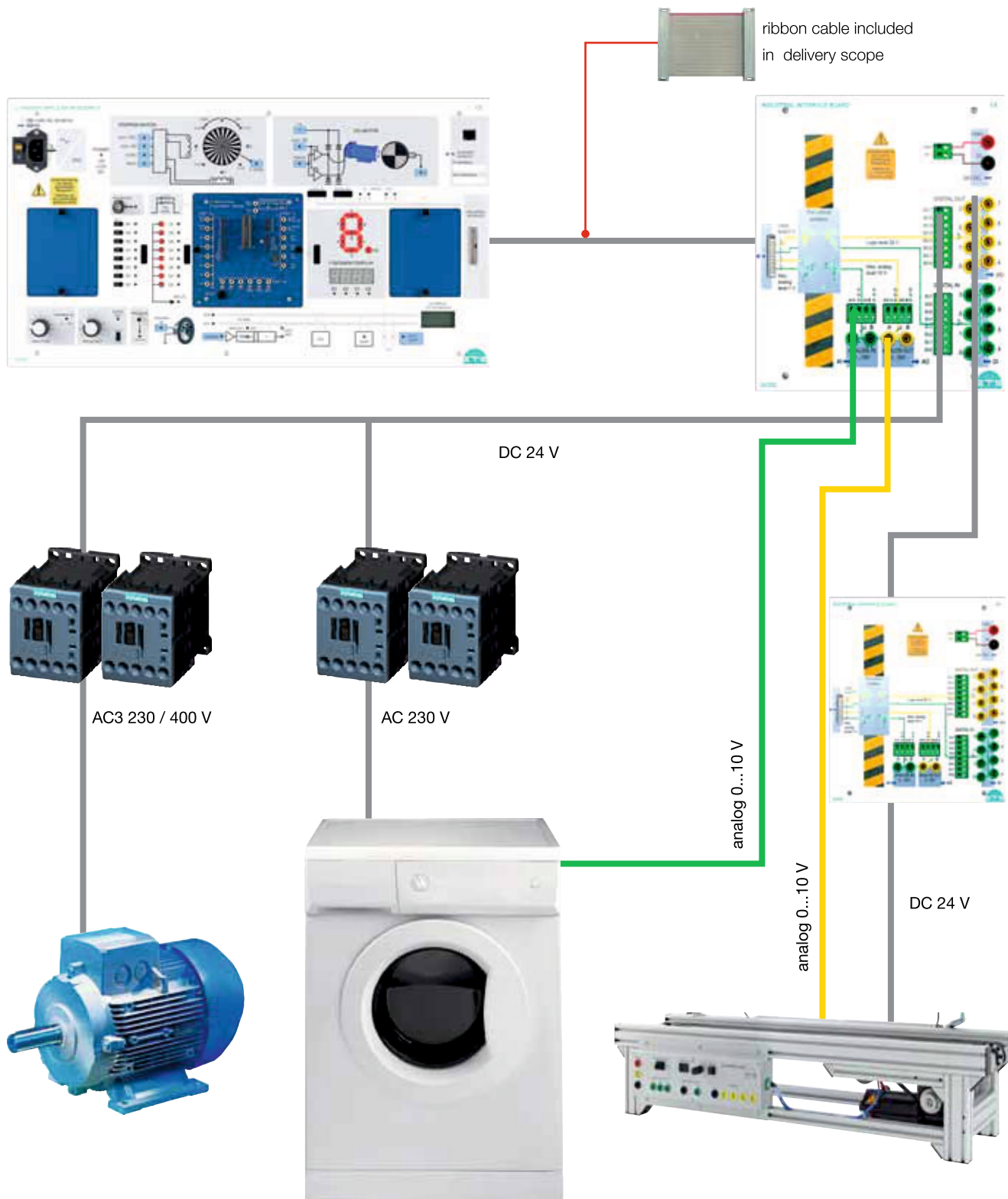
- › absolute optical decoupling of all in- and outputs
- › Level conversion of the digital signals from ttl to +24 V
- › Level conversion of the analog signals from +/-1 V (amplitude) to +/-10 V
- › 8 digital outputs, for loads up to 0.5 a per output
- › permissible total load of the digital outputs ≤ 2 A
- › 8 digital inputs
- › 2 analog outputs
- › 2 analog inputs
- › external operating voltage: +24 V
- › 4mm safety socket and industrial phoenix screw terminal connection per in- and output

- › Dimensions 266 x 297 x 85 mm
- › Desk housing device
- › Delivered with operating instructions, connection cable to "µ-Trainer Application Board"

the industrial interface Board adapts and couples industrial peripheral devices to the "µ-Trainer Application Board". It converts device levels to industrial levels and provides device safety and nonexistence of electronic potential by complete optical decoupling of all signals.

No.	Designation	Order No.
1	industrial interface Board	33305

industrial application



courseware

programming with microcontrollers

Learning objectives Part 1

- › microcomputers, introduction
- › introduction to the industrial developing environment
- › Working with the development tools editor, assembler, c-compiler, simulator and programmer
- › structure and function of microcontrollers (internal structure)
- › the programming interface
- › the periphery of a microcontroller (ports, clock, timing, aDc, reset)
- › How does a microcontroller work (register, aLu, i/o ports)

- › memory structure and instruction set of the microcontroller
- › programming of a microcontroller in assembler
- › parallel i/o ports
- › BcD coding
- › Displaying values to LeD lines and 7-segment display
- › timer and interrupt
- › control of stepping and Dc motors

Learning objectives Part 2

- › serial data transmission
- › i2c bus
- › aDc and measuring of analog values
- › transferring values to an i2c display
- › Voltage measurement
- › temperature measurement
- › pressure measurement
- › measuring of temperature and brightness with intelligent sensors

- › Date and time recording with rtc
- › on-chip debugging

No.	Designation	Order No.
o.a.*	µ-trainer application Board ii	33400
o.a.*	satz messleitungen 2 mm	90049
o.a.*	pic16F8xx programmer module	33402
o.a.*	atmega programmer module	33403

* not illustrated



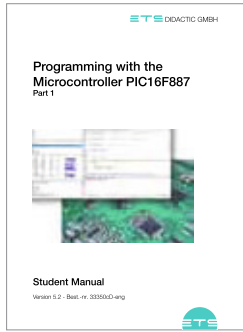


courseW are

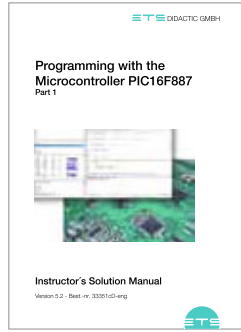


printed and digital

1



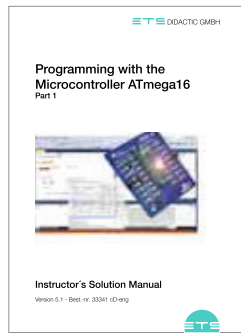
2



3



4



5

Structure of the manuals Inter-optional tasks

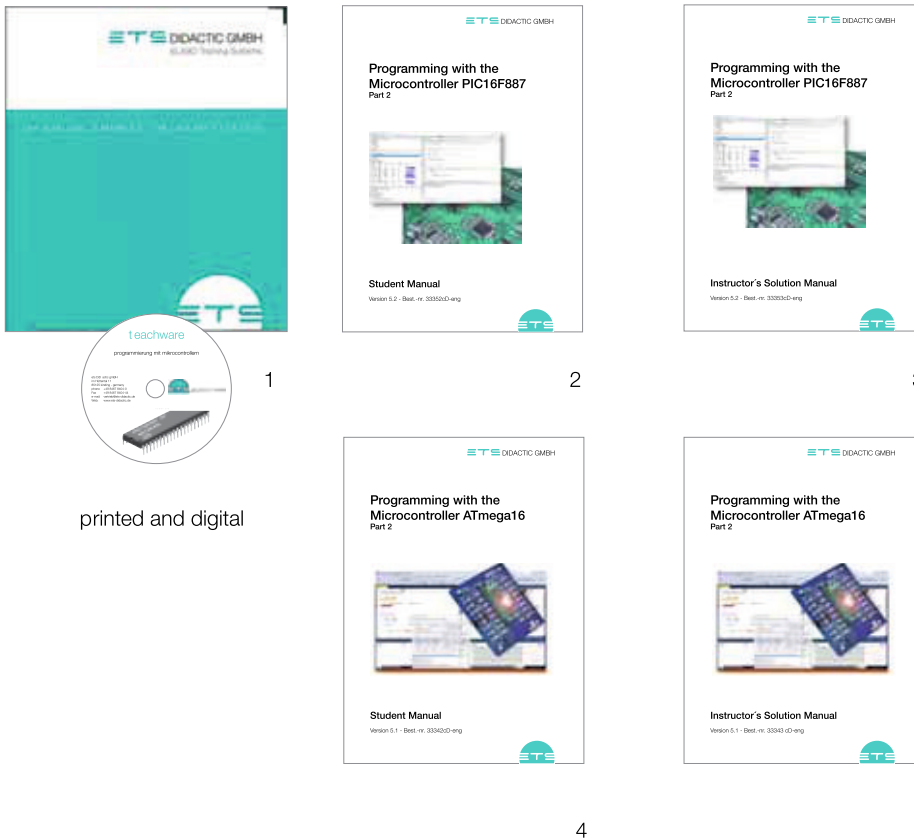
- › Description of theory and instructed practical experiments in book form
- › task part for the trainee/student
- › unlimited copy license for the training institution
- › grayscale format
- › manual incl. cD-rom

Intercompany solutions

- › Description of theory and guided practical experiments in book form
- › solution book for the teacher/trainer with methodical hints
- › illustrated in color
- › manual incl. cD-rom

No.	Designation	Order No.
1	set of ets ring binders	91903
2	"programming with microcontrollers" part 1 tasks pic16F887	33350cD-eng
3	"programming with microcontrollers" part 1 solutions pic16F887	33351cD-eng
4	"programming with microcontrollers" part 1 tasks atmega16	33340cD-eng
5	"programming with microcontrollers" part 1 solutions atmega16	33341cD-eng

all program source texts for the examples and experiments are included on the courseware cD-rom!



printed and digital

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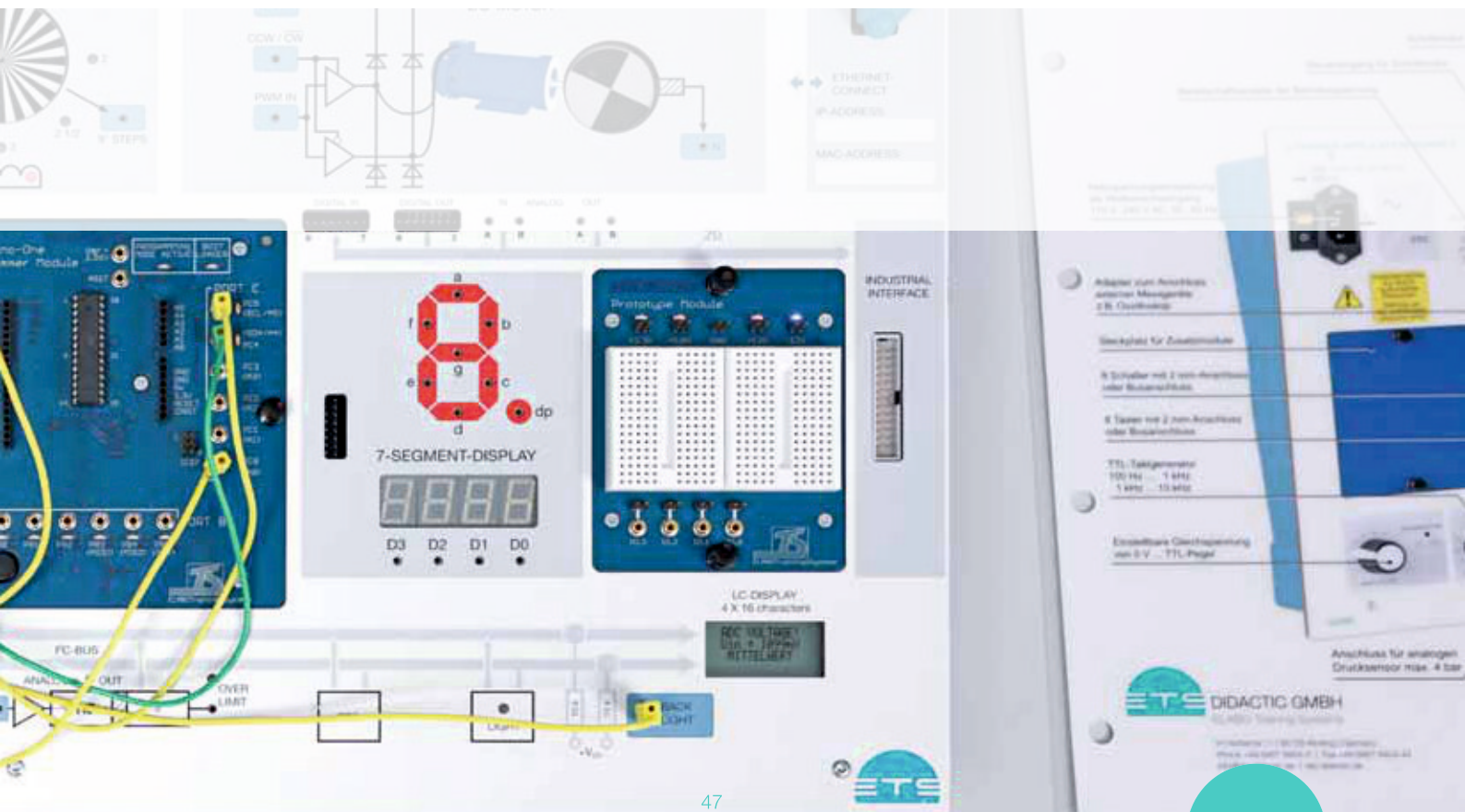
No.	Designation	Order No.
1	set of ets ring binders	91903
2	"programming with microcontrollers" part 2 tasks pic16F887	33352cD-eng
3	"programming with microcontrollers" part 2 solutions pic16F887	33353cD-eng
4	"programming with microcontrollers" part 2 tasks atmega16	33342cD-eng
5	"programming with microcontrollers" part 2 solutions atmega16	33343cD-eng

all program source texts for the examples and experiments are included on the courseware cD-rom!



use for...

TECHNO	PIC16F887	ATmega16	Logic Module
Digital technology with the μ -Trainer Application Board (33103)			✓
use of the application Board ii (34423)	✓	✓	✓
the integrated development environment mpLaB® from microchip (33324)	✓		
microcontroller pic16F887 (33354)	✓		
special function registers of the pic16F887 (33355)	✓		
the controller atmega16 (33345)		✓	
the a Vr instruction set (33346)		✓	
the integrated development environment a Vr s tudio® from atmel (33347)		✓	
Voltage measurement and display (33327)			
industrial control with microcontrollers (33330)	✓	✓	



accessories

Useful helpers for fault finding



1

the on-chip Debug s ystem is a development tool for atmega controllers to debug on-chip via ieee1149.1 compatible Jtag interface or DebugWire.

- › software control and display is fully integrated in development environment
- › Full emulation of all analog and digital controller functions
- › support of multiple controllers in daisy chain
- › connection via serial or usB interface
- › support of assembler and high level languages
- › on-chip-Debug interface Jtag and DebugWire
- › Breakpoints for program and data storage
- › all operations are real-time operation including external reset

the in-circuit Debugger s ystem is a development tool for microchip controllers for debugging on-chip via isp interface.

- › software control and display fully integrated in development environment
- › emulation of the analog and digital functions of the controllers
- › connection via serial or usB interface
- › support of assembler and high-level languages
- › in circuit Debug interface isp
- › Breakpoints for program memory



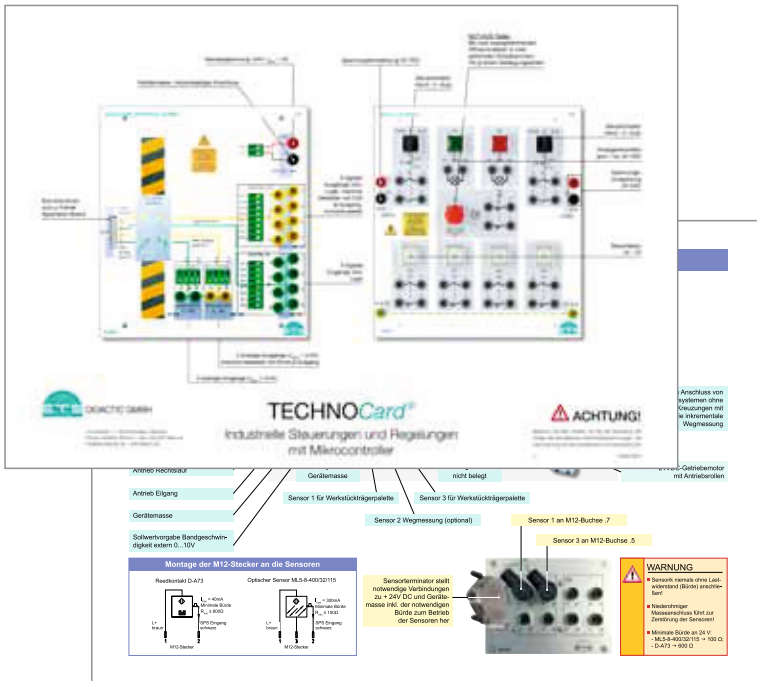
2

No.	Designation	Order No.
1	on-chip Debug s ystem for atmega controller	33311
2	in-circuit-Debugger s ystem for pic16Fxxx controller	33313



projects

project: industrial control with microcontrollers



1

Hardware overview for programming with microcontrollers and the programmer module of your choice:

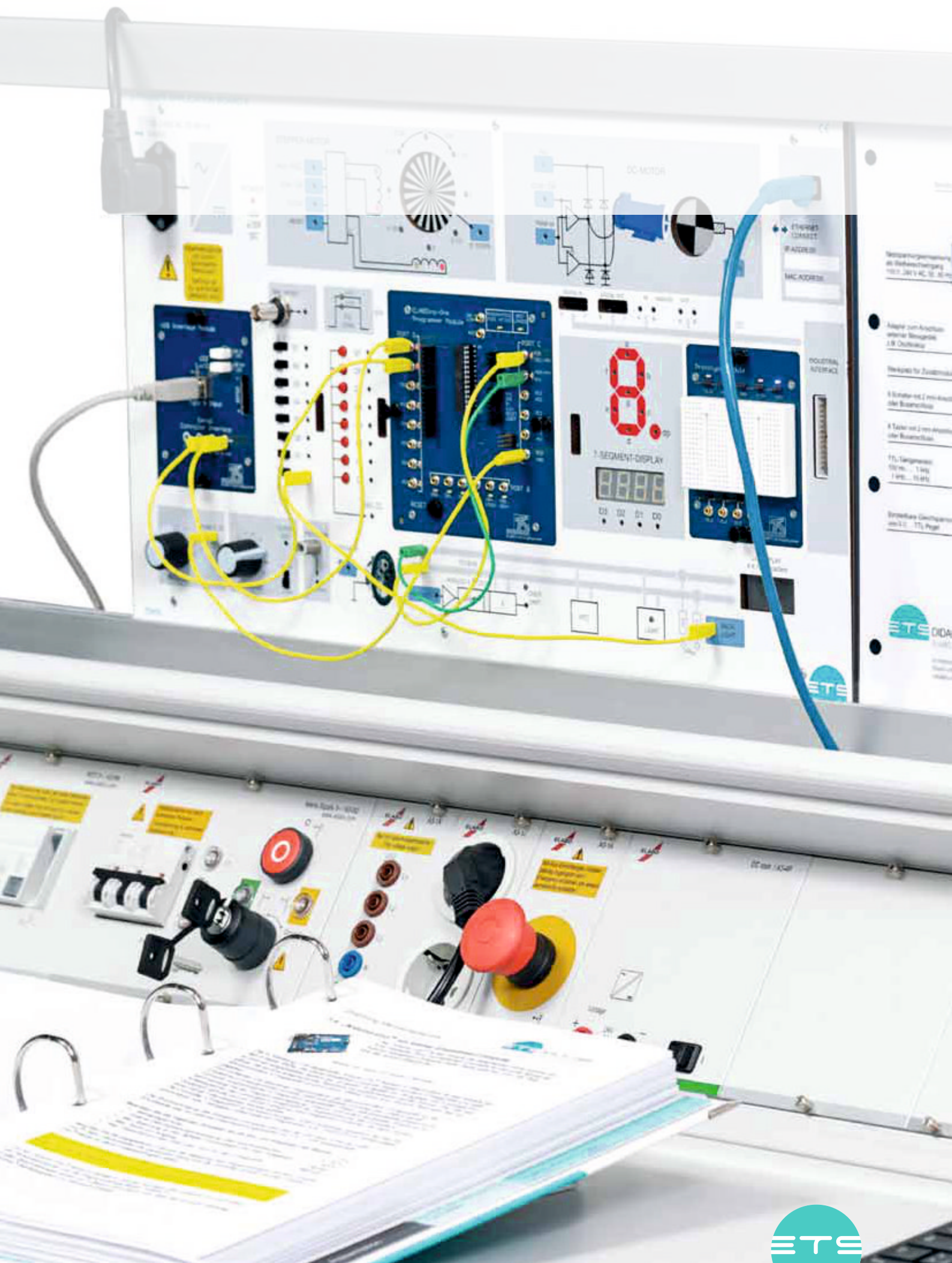
project environment on request!

Learning objectives

- project task
 - introduction to automated production systems
 - control systems with controllers
 - catching sensor signals with polling and interrupt
 - pWm generation with timer
 - speed control (open and closed loop)
- analysis and structure draft
 - required periphery
 - connections
 - block/circuit diagram
- solution
 - Display on LcD
 - Function keys and display of function
 - soft start and braking
 - control of direction
 - positioning
 - safety of machinery
 - risk analysis
 - emergency stop integration
- summary
 - analysis and presentation

No.	Designation	Order No.
n.ill.*	µ-t rainer application Board ii	33400
n.ill.*	industrial interface	33305
n.ill.*	set of test leads 2 mm	90049
n.ill.*	pic16F8xx p rogrammer module	33402
n.ill.*	atmega p rogrammer module	33403
1	tecHnoc ard® – industrial control and regulation with microcontrollers	33330

* not illustrated

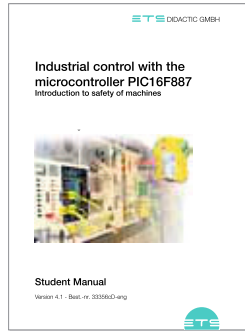


courseW are manual

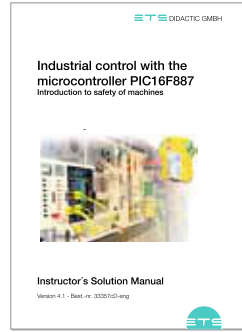


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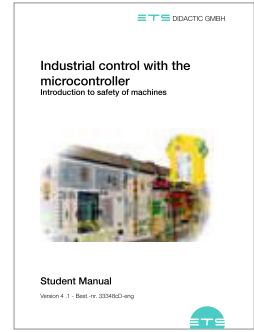
1



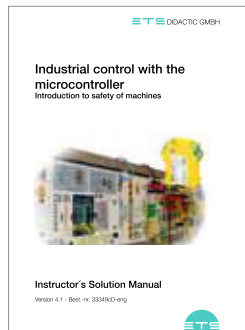
2



3



4



5



6



7

Structure of the manuals Inter-optional tasks

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- › grayscale format
- › manual incl. cD-rom

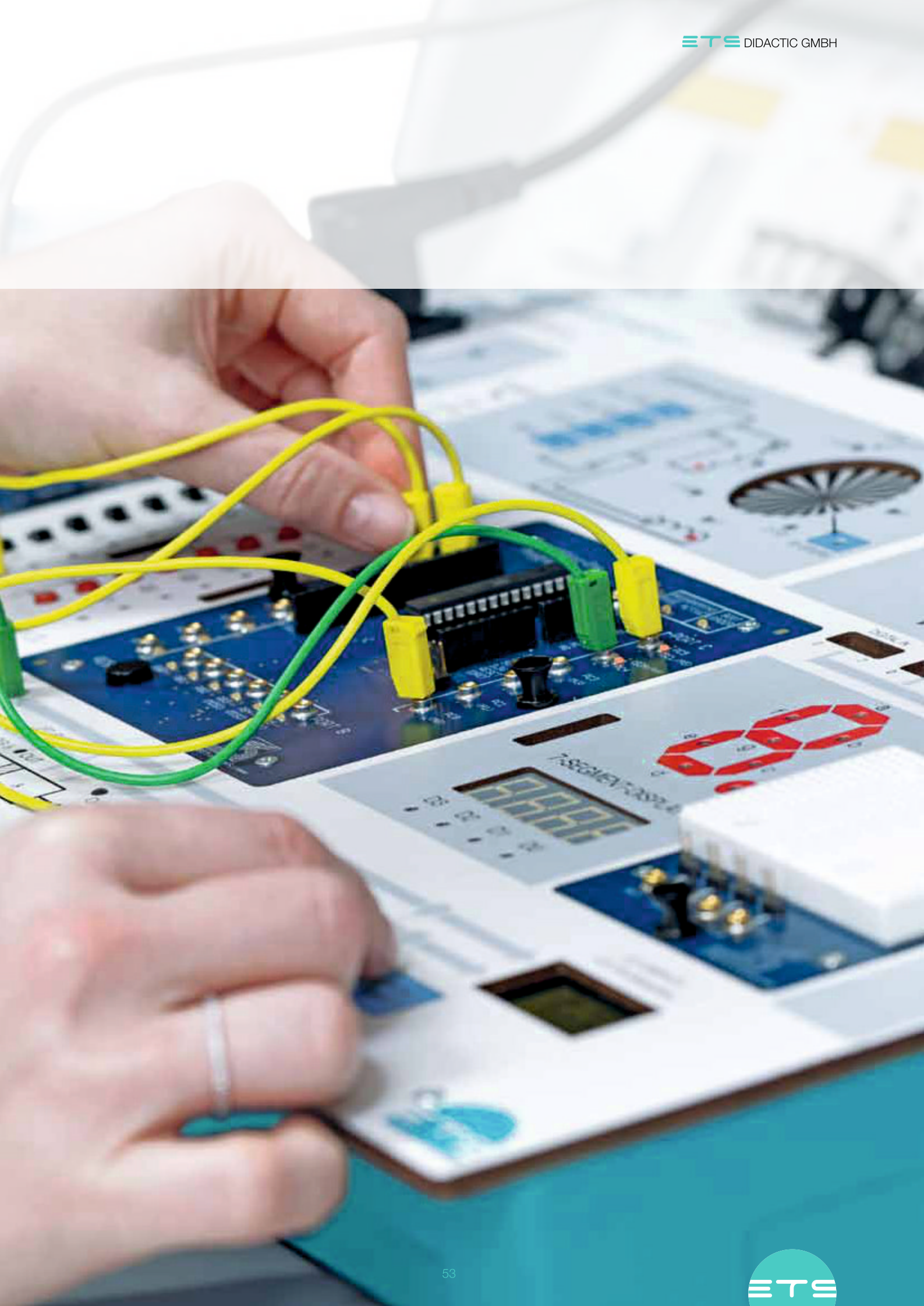
PowerPoint presentation on the project

- › template for the trainees to present their work results
- › unlimited copy license for the training institution
- › extent: 26 slides
- › on cD-rom

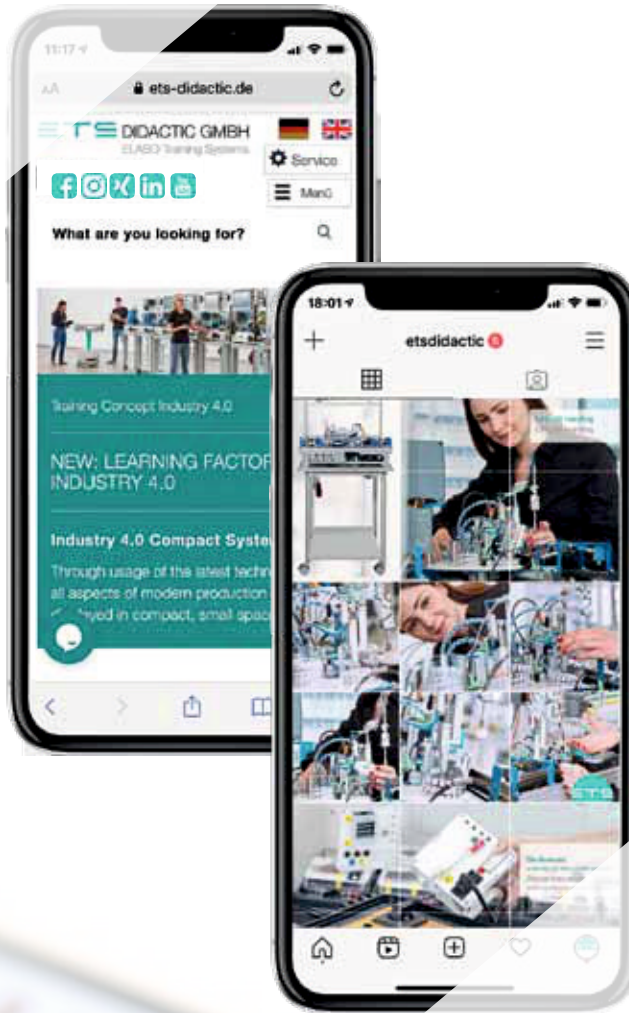
Intercompany solutions

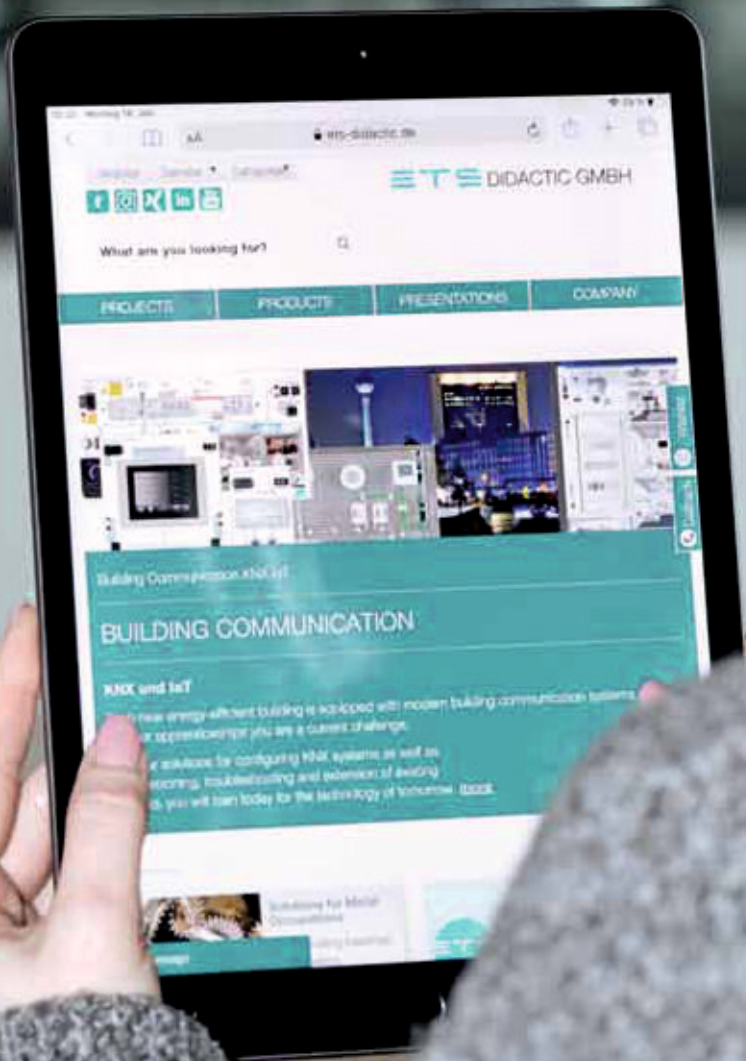
- › Description of theory and guided practical experiments in book form
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2	"industrial control with the microcontroller" t asks pic16F887	33356cD-eng
3	"industrial control with the microcontroller" solutions pic16F887	33357cD-eng
4	„industrial control with the microcontroller“ t asks	33348cD-eng
5	„industrial control with the microcontroller“ solutions	33349cD-eng
6	„industrial control with the microcontroller“ t asks pic16F887	33358
7	„industrial control with the microcontroller“ t asks	33344



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catalog „electrical engineering/electronics/Digital t echnology“





catalog "cyber security – it security of production networks"

ETS DIDACTIC GMBH



Cyber Security



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inspiring technologies

ETS DIDACTIC GMBH is a symbol of high quality and outstanding flexibility. This means that ETS DIDACTIC products 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 nearly without limits.

our high quality standards refer not only to the products from ets DiD actic, but especially also to the quality of the training that customers achieve thanks to the use of ets Di Dactic products. and in this, we also include the process quality: ets DiD actic supports procedures during the training that are as problem-free as possible.

The solutions offered by ETS DIDACTIC can be matched to individual customer requirements to a great extent. customers of ets DiD actic are supported and accompanied in the successful implementation of their training objectives by a comprehensive range of services.





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email: sales@ets-didactic.de

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Fax +49 8467 8404-44

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



Customer-oriented solutions

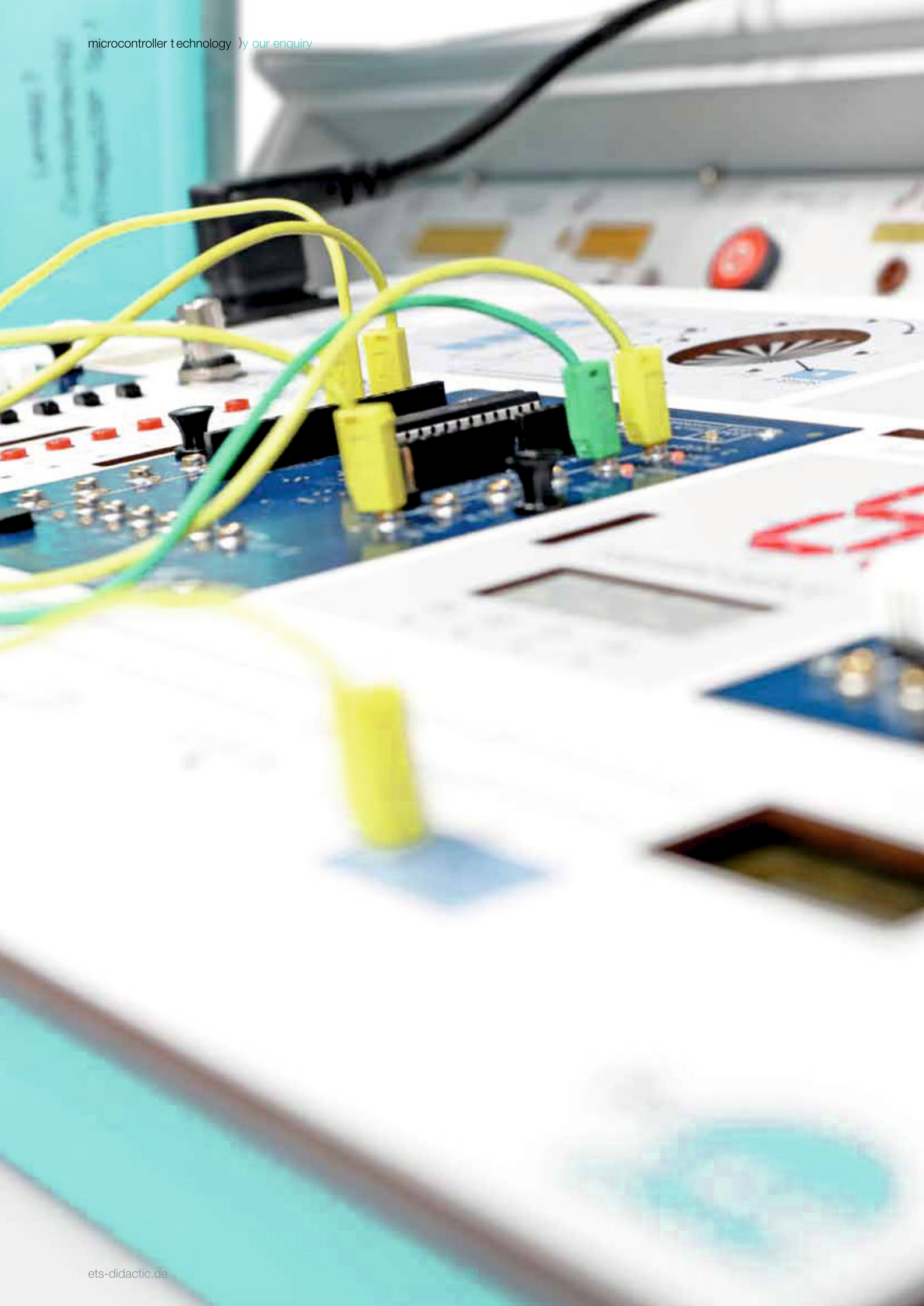
- › presentation, product demonstrations and on-site consultancy
- › support in the selection of educational systems according to the syllabus requirements
- › matching of the training systems to customer requirements
- › Working out room concepts
- › Designing ergonomic workstations

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 workshops / in-house training / Webinars
- › 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



your enQuery

ets is looking forward to you

You can use the following QR code to fill out the enquiry form
Download the completed form and send it to ets by email or fax



Qty	Description	Order No.	Qty	Description	Order No.
	Microcomputer - Trainingsystem			TECHNOcast	
	"Programming with Microcontroller"			"Thema Application Board	30100-ENG
	Part 1 Tasks ATmega16	3034000-ENG		and Application Board (1)	34200-ENG

Qty	Description	Order No.	Qty	Description	Order No.
	Microcomputer - Trainingsystem			Serviceinterface Module	33480
	16-Port Application Board (1)	33400		20-Port Module	33481
	Module			Set of Tools 2-ner	90040
	ELABO-one-Programme-Module	33413		Industrial Interface	
	PC1684A-Programmer-Module	33401		Industrial Interface Board	33506
	PC1684B-Programmer-Module	33402		Manuals	
	ATmega-Programme-Module	33403		Fundamentals of and Experiments in	
	Interfaced Module	33405		Digital Technology - Tasks	301000-ENG
	Basic Set Logic DS	33406		Fundamentals of and Experiments in	
	Additional modules			Digital Technology - Experiments	301000-ENG
	16-Port KOC-Module	33404		Set of TS-Englender	91000
	16-Port KOC-Module	33407		"Programming with Microcontroller"	
	16-Port DAU-Module	33408		Part 1 Tasks PC1684B	303000-ENG
	Interfaced Wiring Set	33409		"Programming with Microcontroller"	
	Printer-Module	33410		Part 1 Solutions PC1684B	303000-ENG

your Enquiry

Microcomputer Trainingsystem – The basics in detail

ETS DIDACTIC GMBH
 Im Hühnerfeld 11
 85125 Kinding | Germany
 Phone +49 8907 8004-0
 Fax +49 8907 8004-44

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