ELABO**TrainingsSysteme**
Aus- und Weiterbildung GmbH

Microcontroller Technology

Microcontroller training system with industrial in
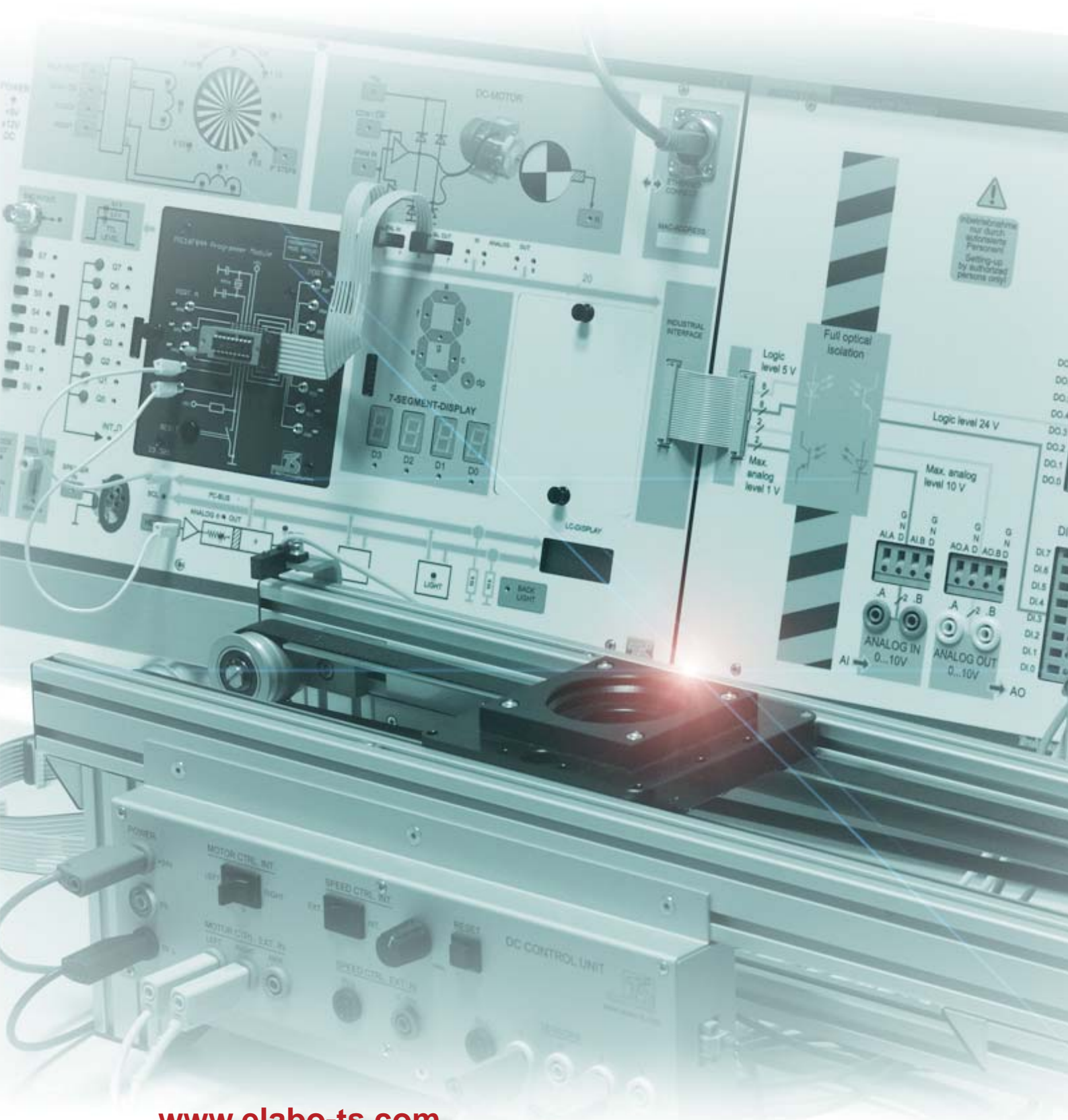
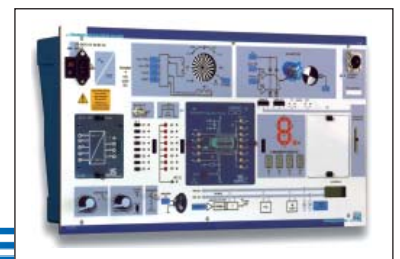www.elabo-ts.com

ELABO*TrainingsSysteme*

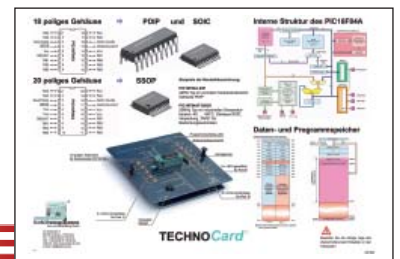**Microcontroller Training System**
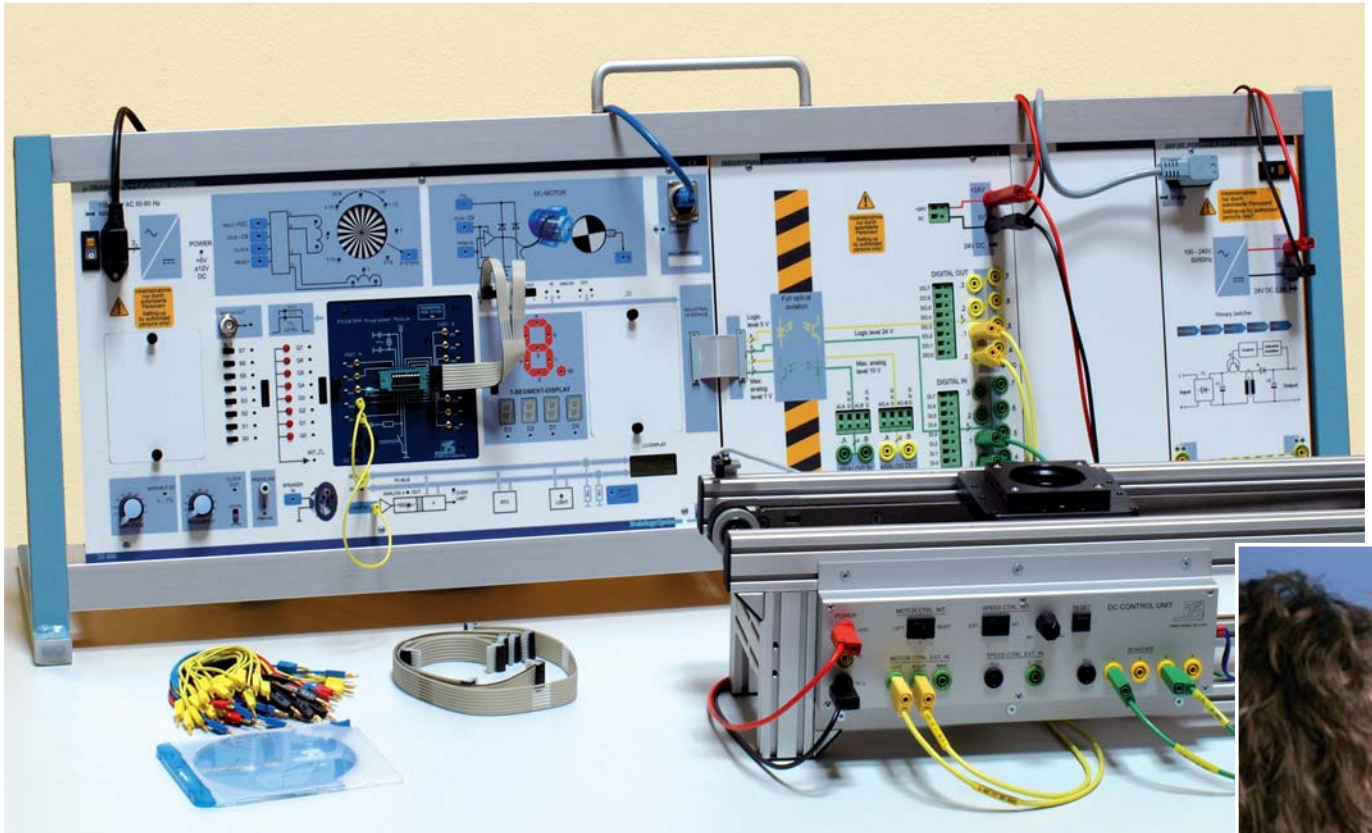
Hardware / Software

Teachware

Projects

Information / Enquiry

Microcontroller Training System

Configuring function groups with hard- and software

Microcontroller training system with industrial interface

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

✓ 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 microcomputer technology

- Microcomputer and microcontroller

- Embedded systems

- Instruction set of the CPU

- Memory components

- Timer and interrupts

- Bus and ports

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

- Clock generation

- Devices types

- Parallel and serial data transfer

Integration of external peripheral devices

- Analog sensors

- Intelligent sensors

- Displays

- Small motors

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

Hardware/Software

µ-Trainer Application Board
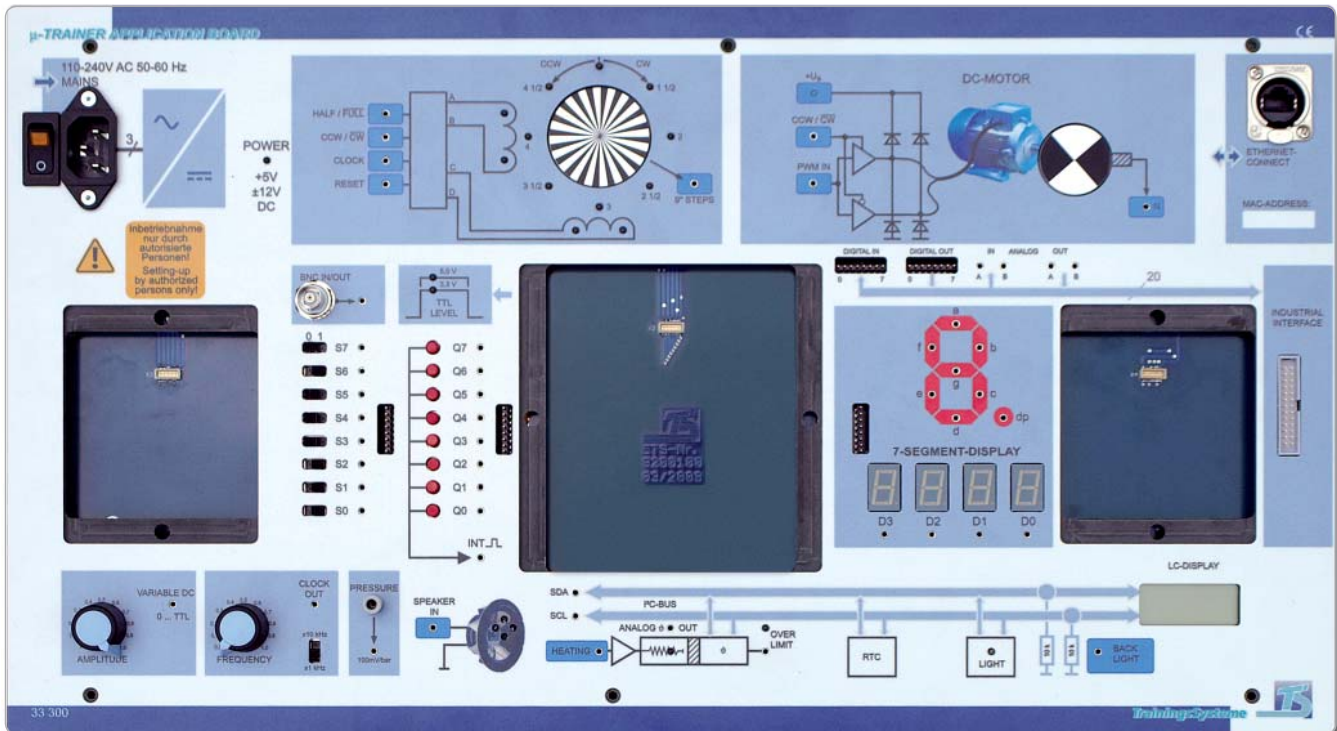
33 300   µ-Trainer Application Board

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

- 8 ON/OFF switches
- 8 pushbuttons
- 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 5 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 function generator 50 Hz … 10 kHz, TTL level
- 1 BNC socket for adapting measuring instrument inputs to 2 mm 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

33 300   µ-Trainer Application Board

- Computer interface via Ethernet
- 2 mm connectors or bus connectors (8-pin, 1:1, ribbon cable)
- Power supply 110 … 240 V AC, 50 … 60 Hz
- Internal operating voltage 3.3 V; 5.0 V; +/-12 V
- Logic level 3.3 V or 5 V
- Central on/off switch
- Dimensions 532 x 297 x 85 mm
- Desk housing device

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

CD-ROM with driver software, power cord, Ethernet connecting cable 2 m, 1 pc. bus cable 10 cm, 1 pc. bus cable 20 cm, 1 pc. bus cable 30 cm, 1 pc. bus cable 50 cm, 1 pc. adapter bus cable 20 cm, operating instructions
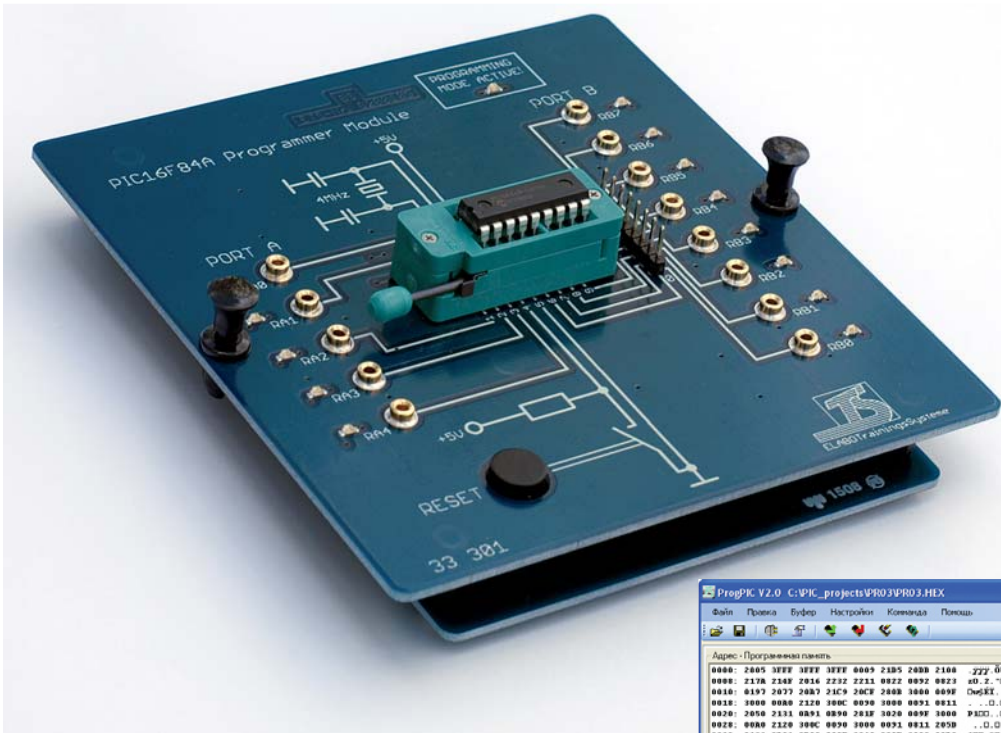
PIC16F84A Programmer Module

The "PIC16F84A Programmer Module" is an integrated test and programming module for the training system "µ-Trainer". It serves for programming of microcontrollers of types PIC16F84A or PIC16F84 and for using the microcontroller in the training system.

33 301   PIC16F84A Programmer Module
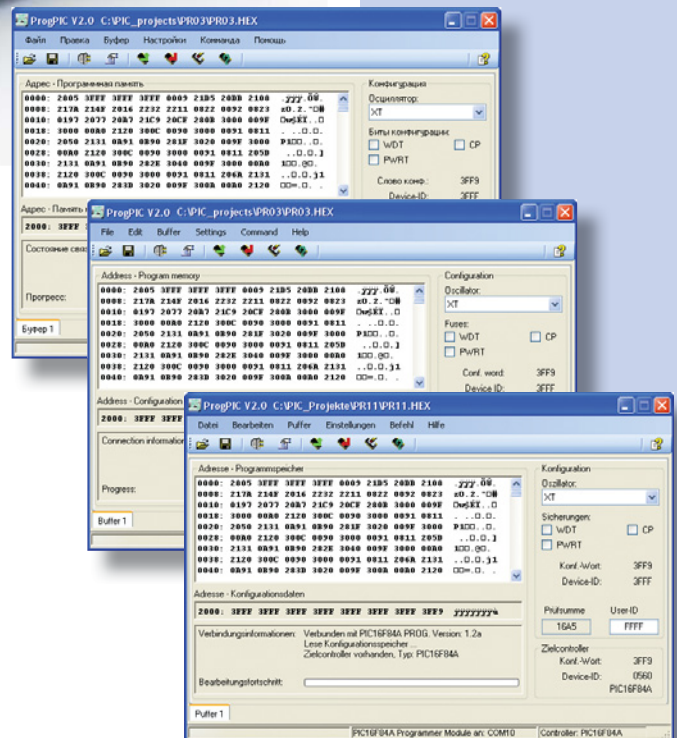
Technical Data

33 301   PIC16F84A Programmer Module

- ZIF socket, 18-pin, for inserting the controller PIC16F84A (PIC16F84)
- Clock generation with quartz 4 MHz
- Ports A (0 … 4) and ports B (0 … 8) have 2 mm connectors, ports B have bus connectors in addition.
- LED per port pin indicating the logical level
- Programmer circuit, in series, ISP
- Internal operating voltage: +5 V (VDD)
- +5 V logical level
- Dimensions 125 x 120 x 32 mm

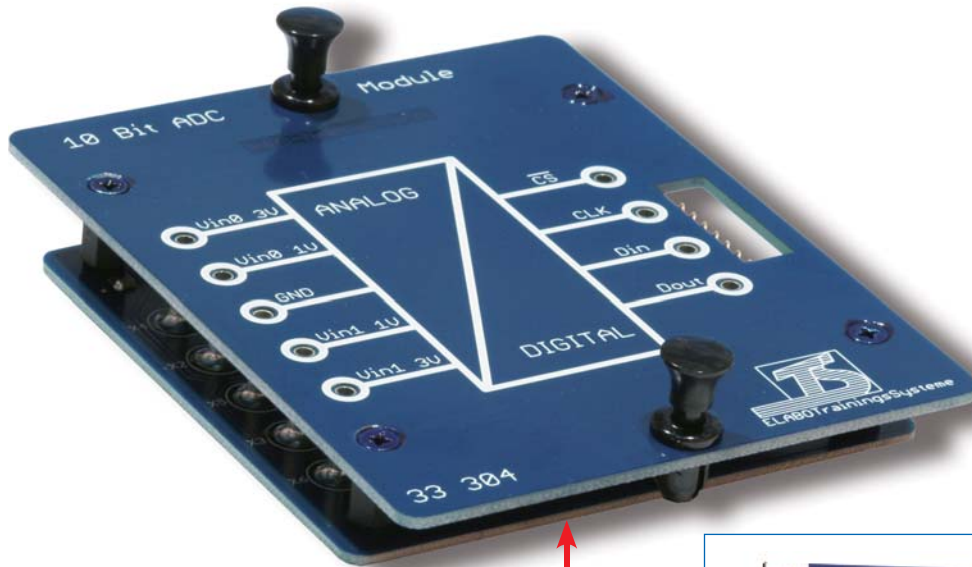**The "PIC16F84A Programmer Module" is delivered with:**

CD-ROM with programmer software (D, GB, RUS) and industrial software developing environment (project management, source code editor, Assembler, Simulator, GB), operating instructions

*System requirements:
Windows XP SP2,
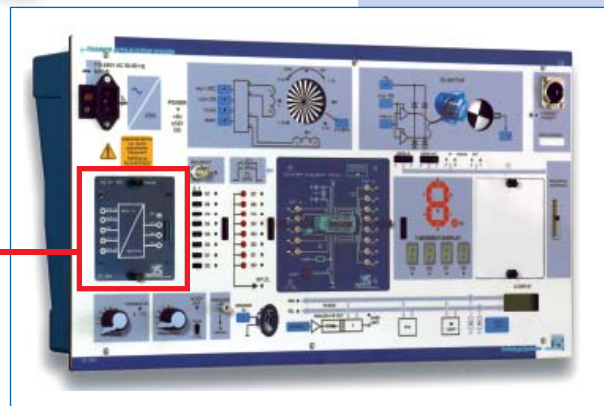Windows Vista SP1,
Frame Network 3.5

Hardware/Software

10 Bit ADC Module

The "10 Bit ADC Module" is an integrated extension module for the training system "µ-Trainer" containing a 2-channel analog digital converter with a 10-bit resolution.

33 304   10 Bit ADC Module

Technical Data

33 304   10 Bit ADC Module

- 2-channel analog digital converter

- Reference voltage 1 V or 3 V

- Maximum conversion speed 250 ksample*s^{-1}

- Recommended maximum conversion speed of the module 25 ksample*s^{-1} while using 2 mm cables for connecting the SPI interface

- Analog inputs with 2 mm sockets

- Outputs with 2 mm sockets and additional bus connector

- SPI controller interface

- +3.3 V or +5 V logic level in dependence of programmer module

- Dimensions 78 x 97 x 30 mm

- Delivered with operating instructions

Industrial Interface
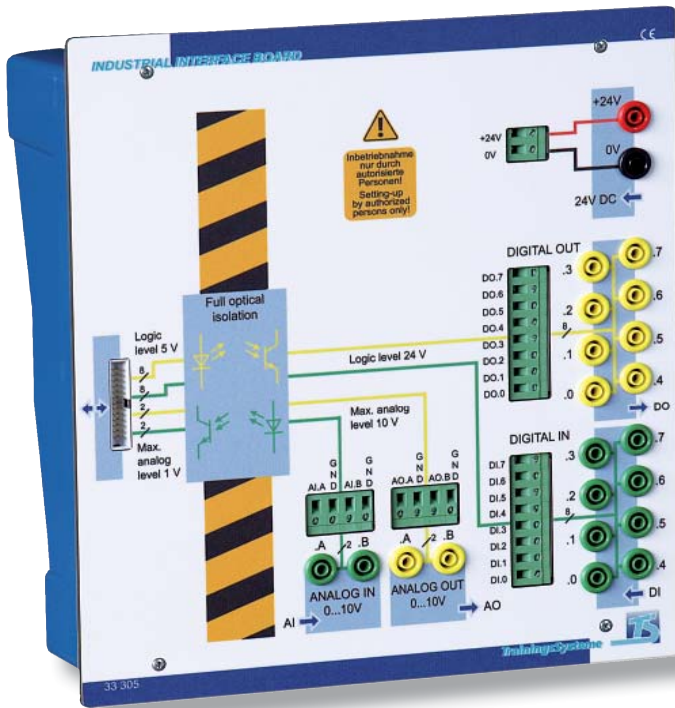
The "Industrial Interface Board" adapts and couples industrial peripheral devices to the "µ-Trainer Application Board". It converts device levels to industrial levels and provides device safety and nonexistence of electronic potential by complete optical decoupling of all signals.
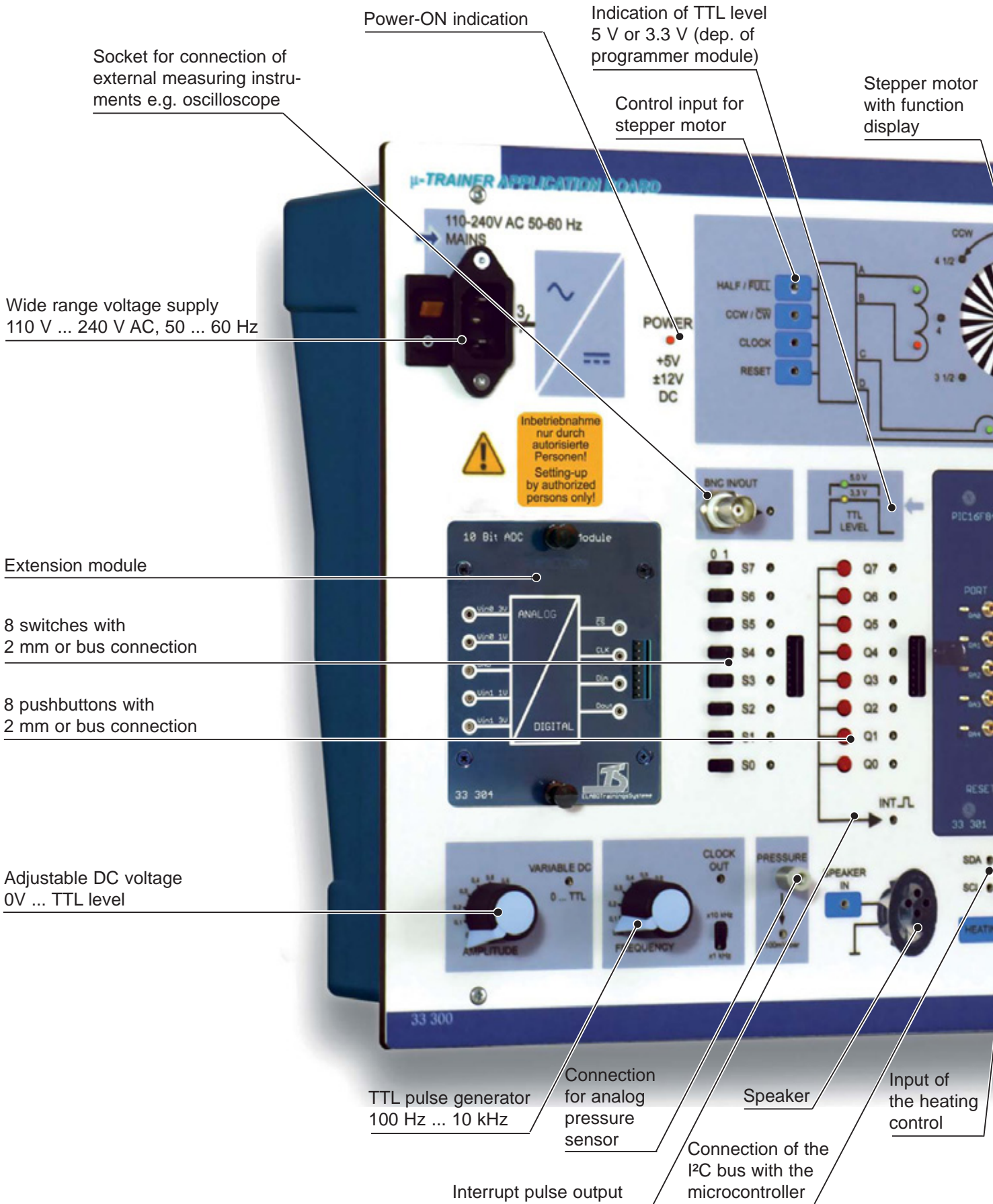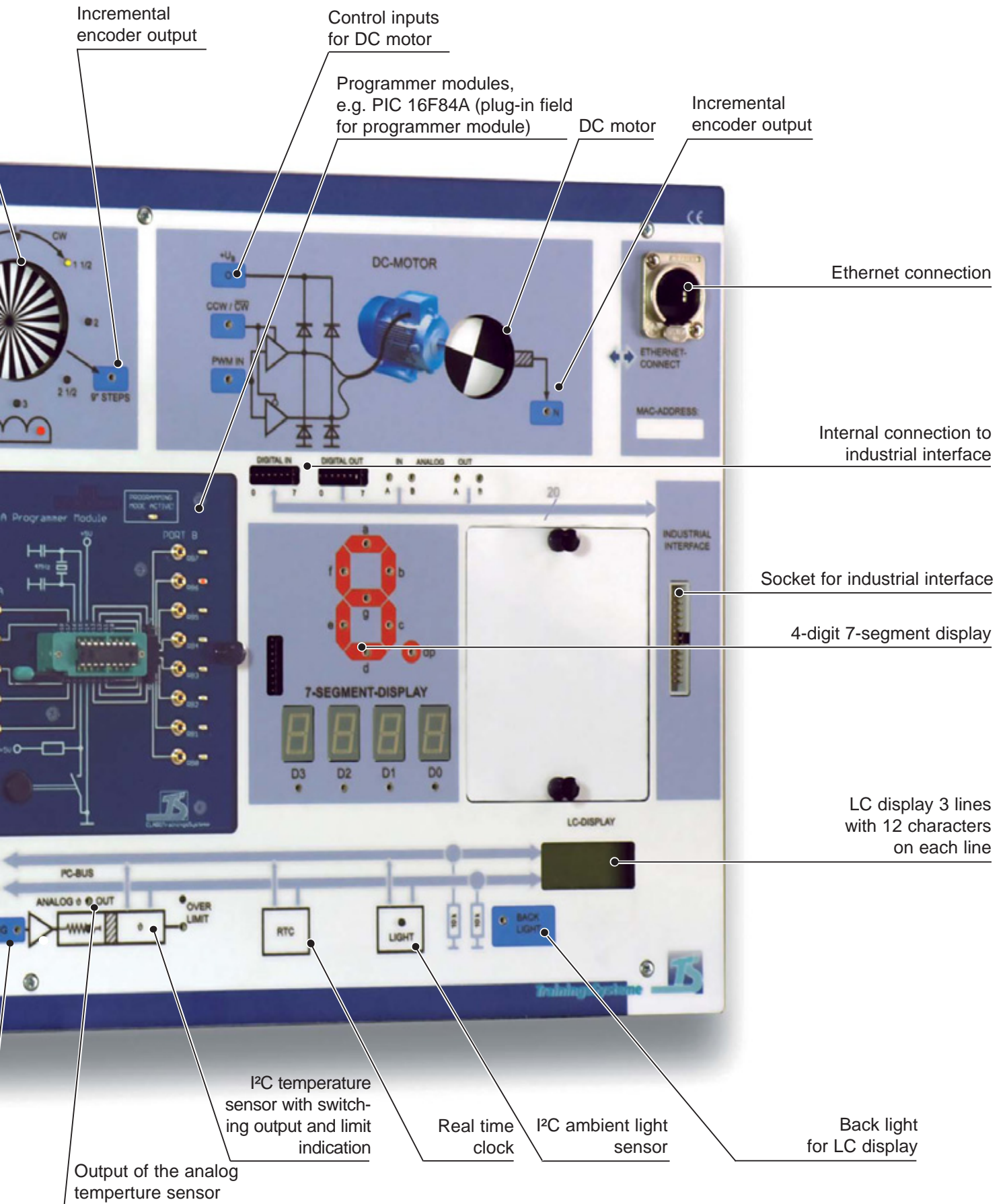
33 305   Industrial Interface Board

Technical Data

33 305 Industrial Interface Board

- 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 +/- 1V (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

- 4 mm 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"
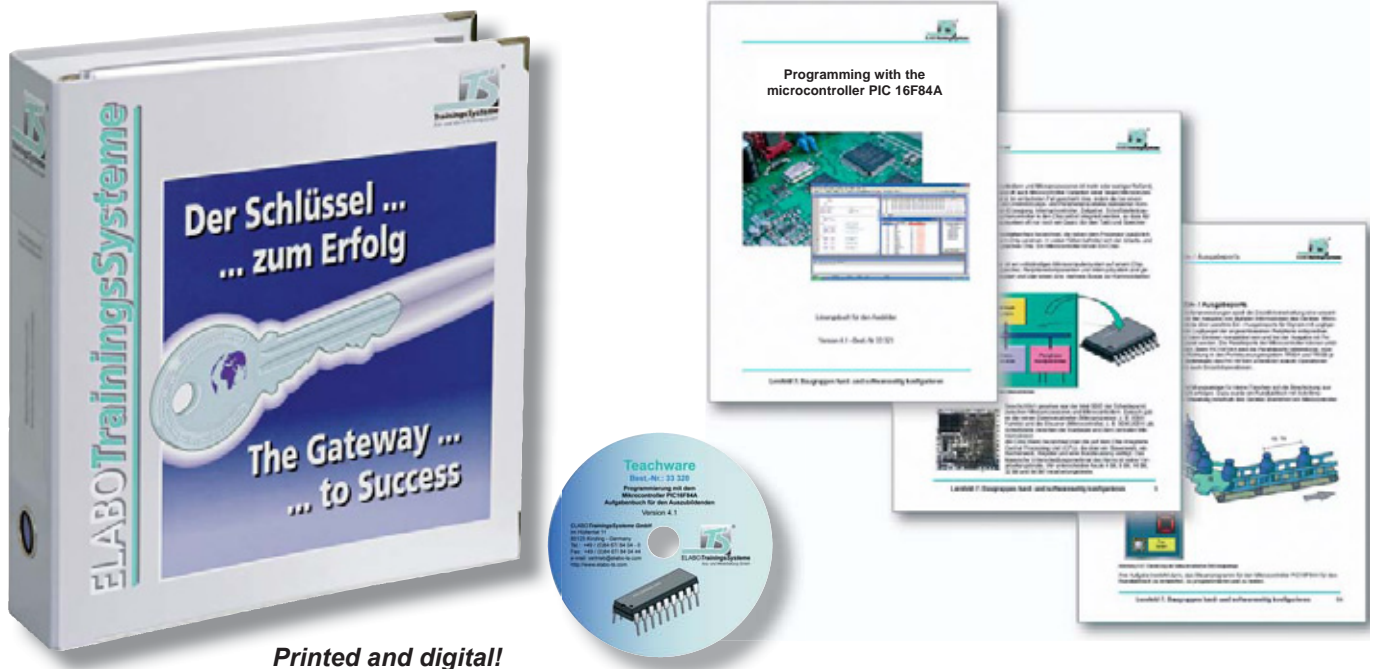
Hardware/Software

Power-ON indication

Indication of TTL level 5 V or 3.3 V (dep. of programmer module)

Socket for connection of external measuring instruments e.g. oscilloscope

Control input for stepper motor

Stepper motor with function display

Wide range voltage supply 110 V ... 240 V AC, 50 ... 60 Hz

Extension module

8 switches with 2 mm or bus connection

8 pushbuttons with 2 mm or bus connection

Adjustable DC voltage 0V ... TTL level

TTL pulse generator 100 Hz ... 10 kHz

Connection for analog pressure sensor

Speaker

Input of the heating control

Interrupt pulse output

Connection of the I²C bus with the microcontroller

Incremental
encoder output

Control inputs
for DC motor

Programmer modules,
e.g. PIC 16F84A (plug-in field
for programmer module)

DC motor

Incremental
encoder output

Ethernet connection

Internal connection to
industrial interface

Socket for industrial interface

4-digit 7-segment display

LC display 3 lines
with 12 characters
on each line

I²C temperature
sensor with switch-
ing output and limit
indication

Real time
clock

I²C ambient light
sensor

Back light
for LC display

Output of the analog
temperture sensor

Teachware

Manual

Printed and digital!

All the source code listings from the examples and for the exercises are to be found on the teachware CD-ROM!

Learning Objectives

Part 1

- Microcomputers, introduction

- Introduction to the industrial developing environment

- Working with the development tools Editor, Assembler, Simulator, Programmer

- Structure and function of microcontrollers (internal structure)

- The programming interface

- The periphery of a microcontroller (ports, clock, timing, 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

- Editing values to LED lines and 7-segment display

- Timer and interrupt

- Control of stepping and DC motors

Part 2

- Serial data transmission

- SPI Interface

- I^2C bus

- Measuring of analog values

- Transferring values to an I^2C display

- Voltage measurement

- Temperature measurement

- Pressure measurement

- Measuring of temperature and brightness with intelligent sensors

- Date and time recording with RTC

Technical Data

E33 320CD   Manual Microcontroller Technology PIC16F84A "Configuring function groups with hard- and software"

Tasks for trainees or students

- Description of theory and guided practical experiments

- Edition for trainees/students with tasks

- Unrestricted copying license for educational institutions

- Grayscale print

- 122 pages

- Manual incl. CD-ROM

E33 334CD   Manual Microcontroller Technology PIC16F84A part 2 "Extended peripherals"

- 65 pages

E33 321CD   Manual Microcontroller Technology PIC16F84A "Configuring function groups with hard- and software"

Solutions for teachers

- Description of theory and guided practical experiments

- Edition for the teacher with solutions and method leads

- Color print

- 166 pages incl. documentation of the components

- Manual incl. CD-ROM

E33 335CD   Manual Microcontroller Technology PIC16F84A part 2 "Extended peripherals"

- 111 pages incl. documentation of the components

TechnoCards

The integrated development environment MPLAB® from "Microchip"

Use of the Application Board

TECHNO*Card*®
Microcontroller PIC16F84A
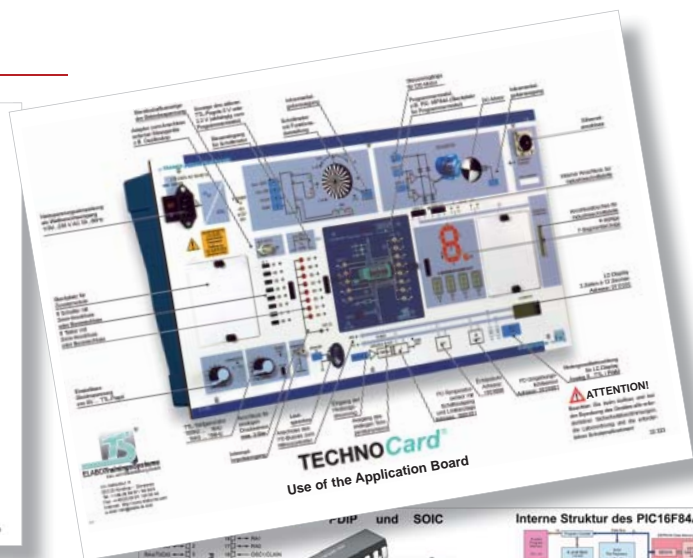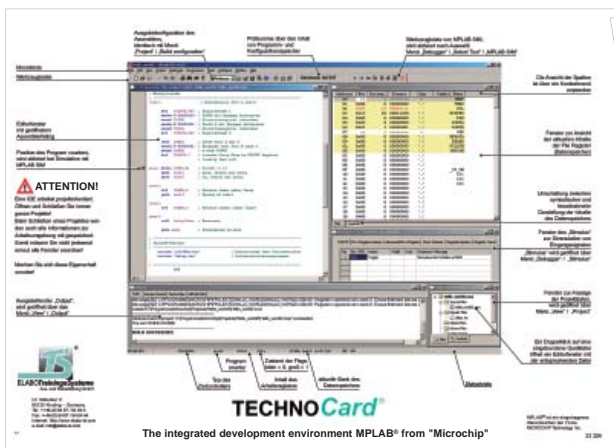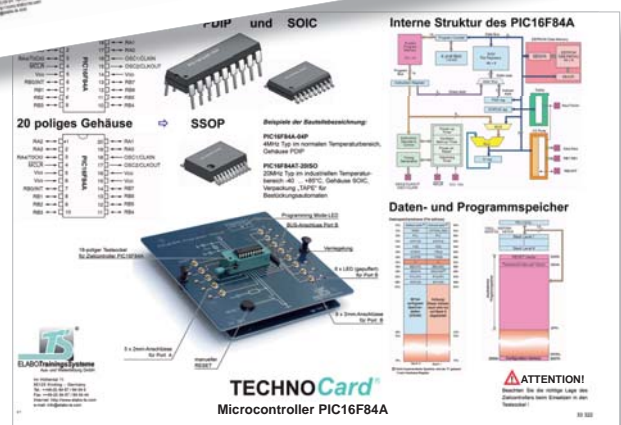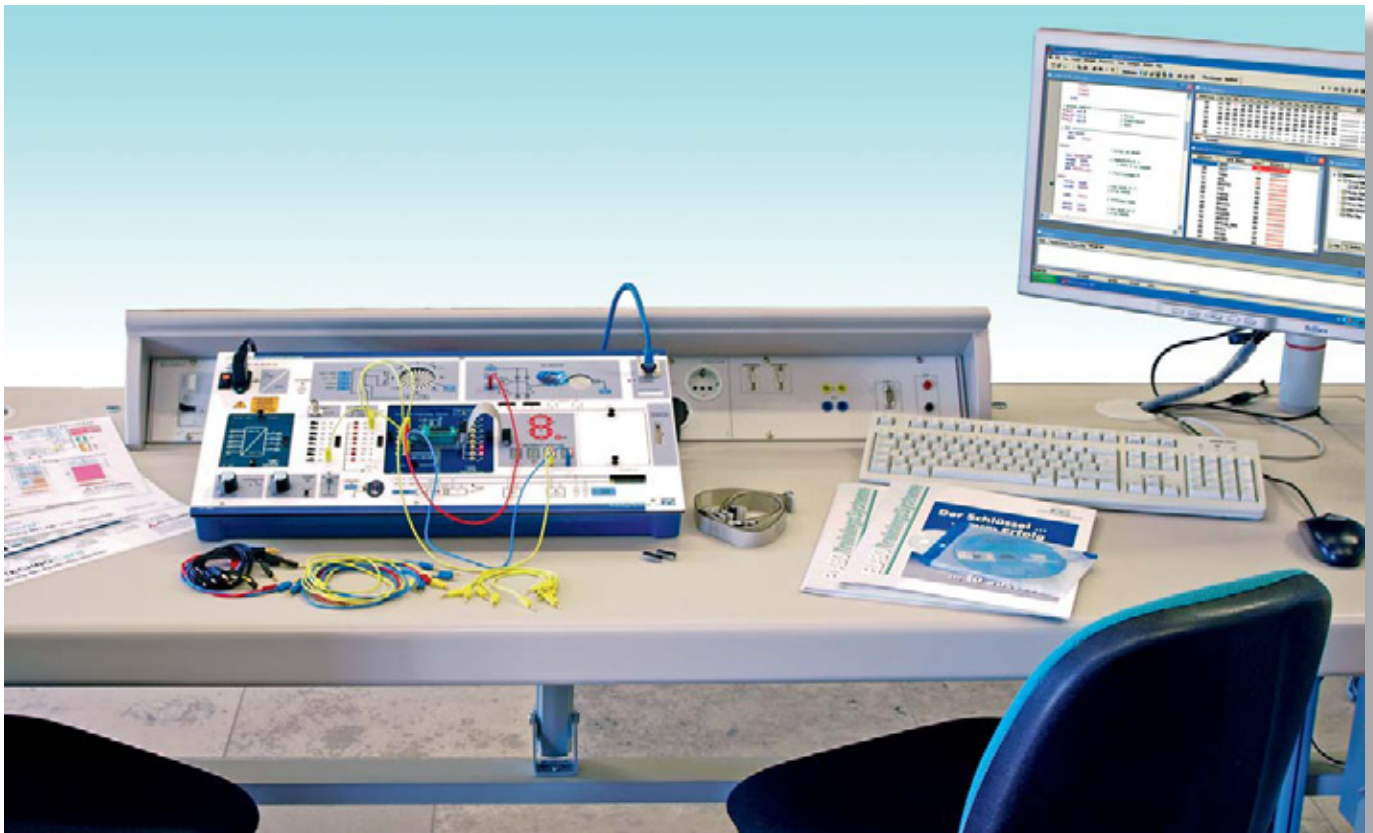
Technical Data

E33 333   Set of TechnoCards

- PIC16F84A (E33 322)

- Use of the Application Board (E33 323)

- The integrated development environment MPLAB from "Microchip" (E33 324)

Projects

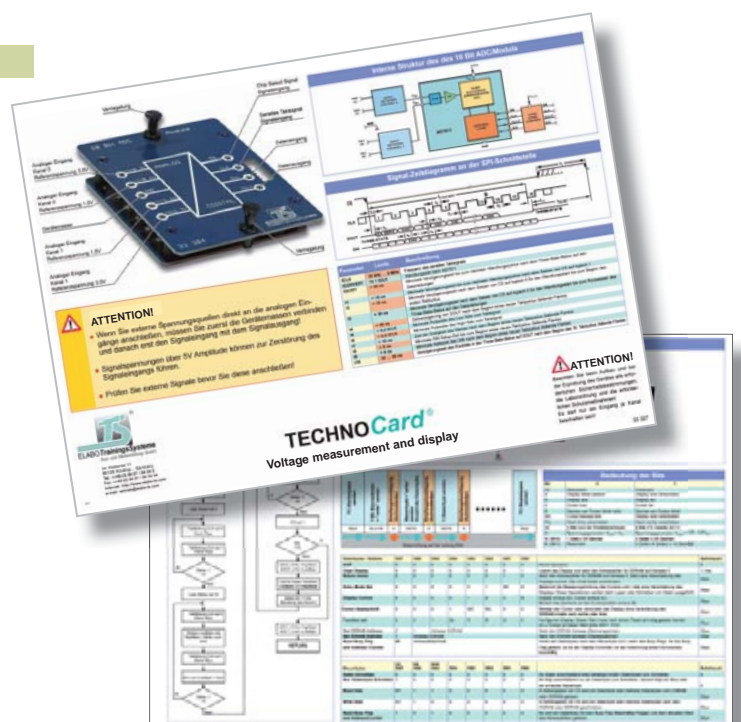

Project "Voltage measurement and display"

- Project task

- Analysis and structure draft
  - required periphery
  - connections
  - block diagram
  - circuit diagram

- Step-by-step implementation of the program sections
  - Connection of AD converter
  - Voltage calculation
  - Cyclical output of the measured values
  - Integration of the I²C bus
  - Display on LCD
  - Analysis and presentation

- Instructions for realization / summary

E 33 327 TechnoCard "Voltage measurement and display"

E33 325CD   Tasks for trainees or students

- Instructions for project work with theoretical explanations and prepared documentation

- Unrestricted copying license for educational institutions

- Edition for trainees/students with tasks

- Grayscale print

- 51 pages

- Manual incl. CD-ROM

E33 326CD   Solutions for teachers

- Instructions for project work with theoretical explanations and prepared documentation

- Edition for the teacher with solutions and method leads

- Color print

- 102 pages incl. documentation of the components

- Manual incl. CD-ROM

Printed and digital!
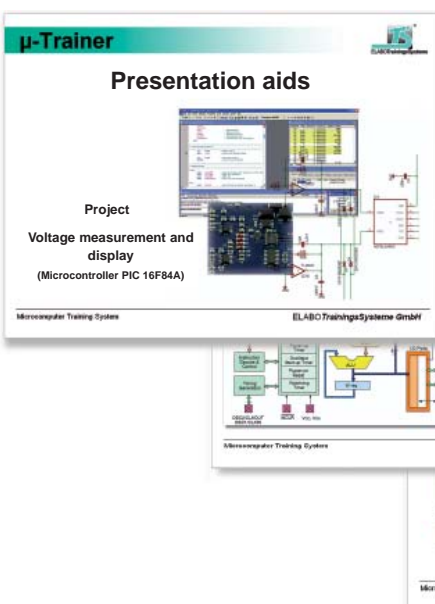
E33 331 Presentation aids
Project "Voltage measurement and display"
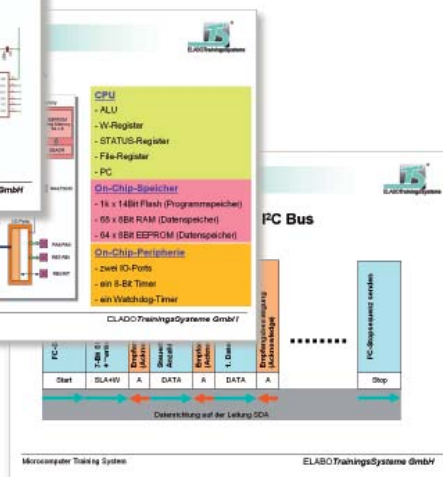
PowerPoint presentation for the project

- Templates for the students for presenting their work results

- Unlimited copying license for educational institutions

- 23 transparencies

- On CD-ROM

Projects
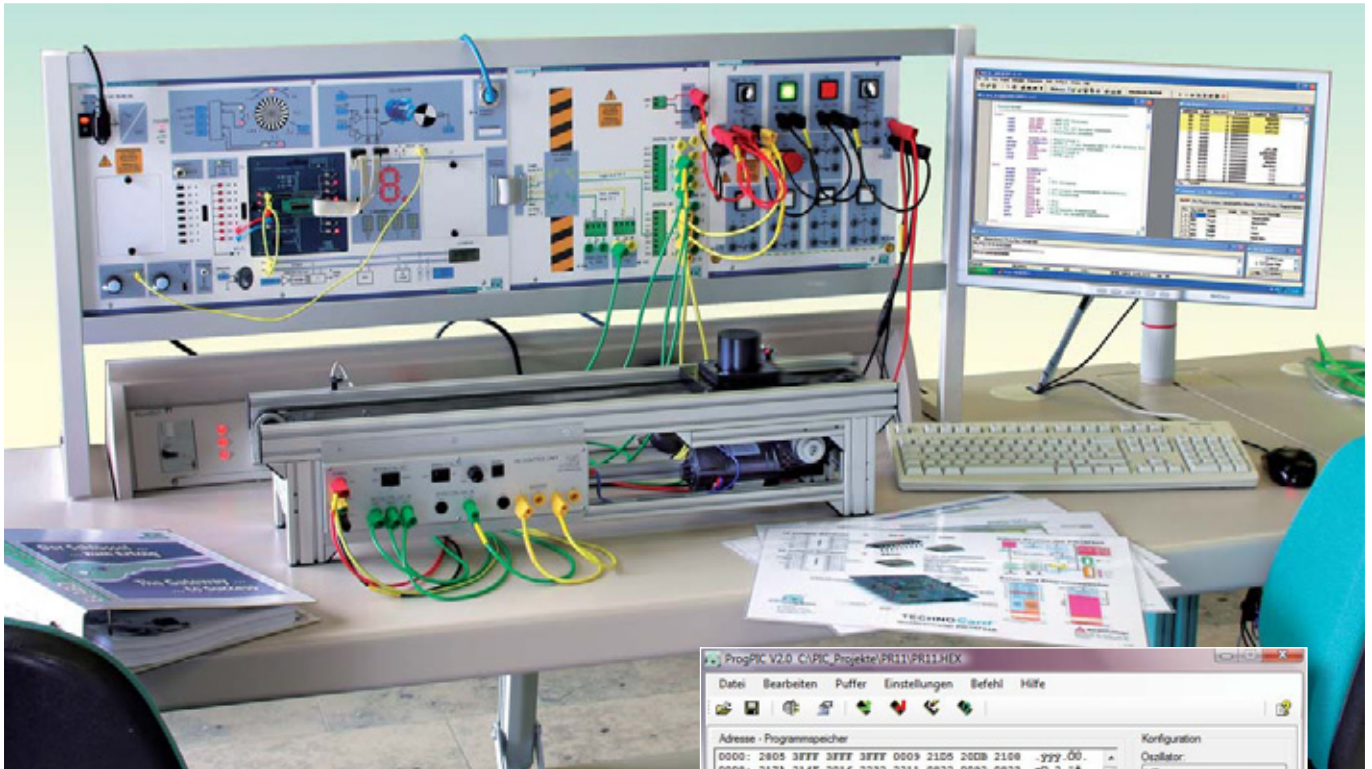
## Project "Industrial control with the microcontroller PIC16F84A"

- Project task
  - Introduction to automated production system
  - Control systems with controllers
  - Acquiring sensor signals with polling and interrupt
  - PWM generation with timer
  - Speed control (open and closed loop)

- Analysis and structure draft
  - required periphery
  - connections
  - block diagram / circuit diagram

- Solution
  - Display on LCD
  - Function keys and display of function
  - Speed control
  - Soft start and braking
  - Control of direction
  - Positioning
  - Safety of machinery
  - Integration of an emergency stop

- Summary
  - Analysis and presentation
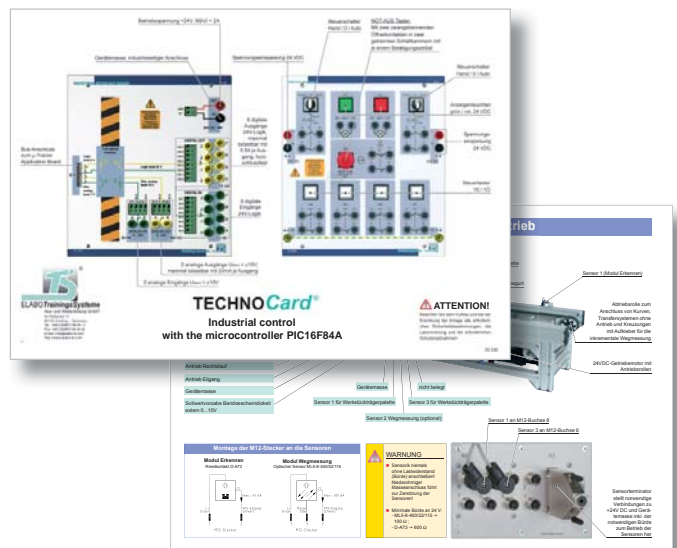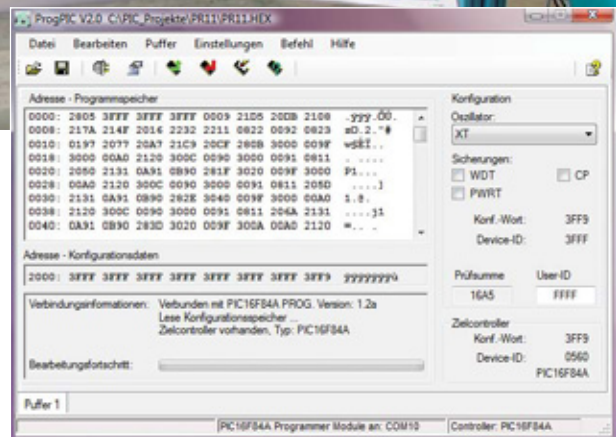
33 330   TechnoCard "Industrial control with the microcontroller PIC16F84A"

## E33 328CD   Tasks for trainees or students

- Instructions for project work with theoretical explanations and prepared documentation

- Edition for trainees/students with tasks

- Unrestricted copying license for educational institutions

- Grayscale print

- 70 pages

- Manual incl. CD-ROM
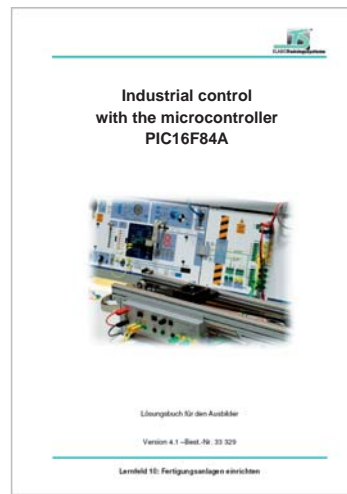
E33 329CD   Solutions for teachers

- Instructions for project work with theoretical explanations and prepared documentation

- Edition for the teacher with solutions

- Color print

- 84 pages incl. documentation of the components

- Manual incl. CD-ROM

Printed and digital!

Industrial control with the microcontroller PIC16F84A
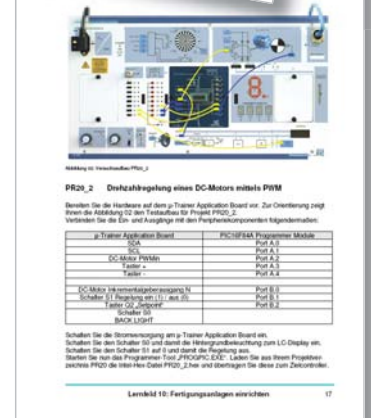
E33 332   Presentation aids
Project "Industrial control with the microcontroller PIC16F84A"
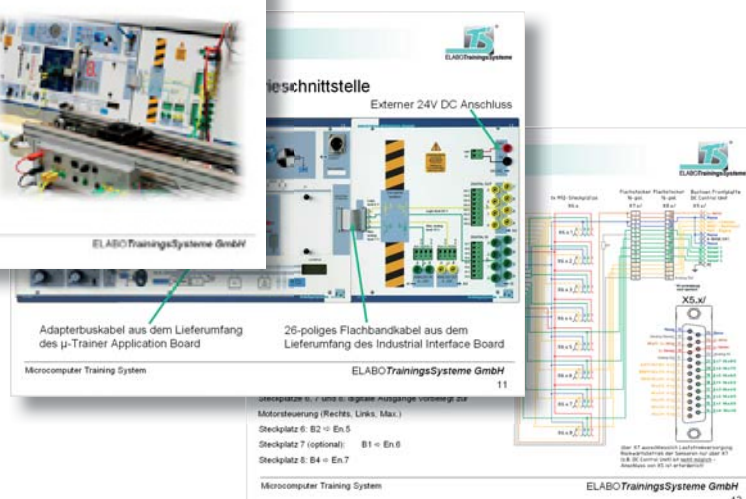
µ-Trainer

Presentation aids

Project

Industrial control with the microcontroller PIC16F84A

PowerPoint presentation for the project

- Templates for the students for presenting their work results

- Unlimited copying license for educational institutions

- 26 transparencies

- On CD-ROM

Information and consultation

▶ **in all questions concerning equipment for vocational and higher technical education**

▶ **on site**

▶ **over the telephone**

Contact

ELABO*TrainingsSysteme GmbH*

Servicecenter

Im Hüttental 11

85125 Kinding / Germany

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

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

sales@elabo-ts.com

http://www.elabo-ts.com

Where this catalogue ends, we start consulting ....

Consultancy

▶ Selection of products complying with syllabuses

▶ Comprehensive system determination

▶ Servicecenter - we will call you back and support you in planning and project development

▶ Classroom layout concepts

▶ Ergonomic workplace design

▶ Custumized offers

▶ Information about our products / manuals

▶ Planning of seminars

Experience

▶ Comprehensive range of innovative products, systems and solutions

▶ Quality service from first consultation to delivery and beyond

▶ Trainer seminars / Inhouse trainings

Projects and references

▶ Industrial training institutions

▶ Vocational schools / technical colleges

▶ Chambers of commerce

▶ Academies / Universities

Your enquiry

ELABO*TrainingsSysteme*
Aus- und Weiterbildung GmbH

Im Hüttental 11

85125 Kinding - Germany

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

Name, Occupation / Position

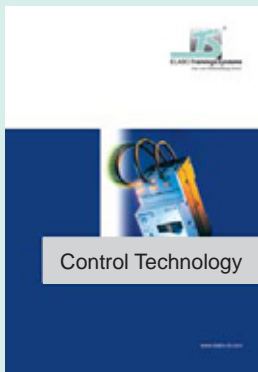Company / Institution / Authority / School

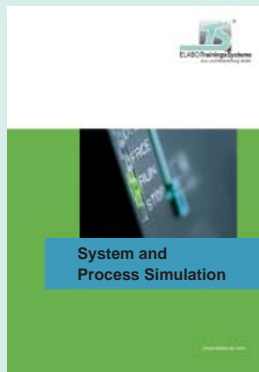Street, PO Box

Postcode, Town/City, Country
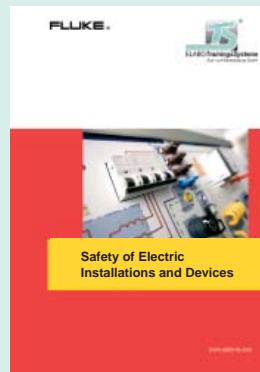
Telephone   Telefax   E-mail

Please send us the following catalogue(s):

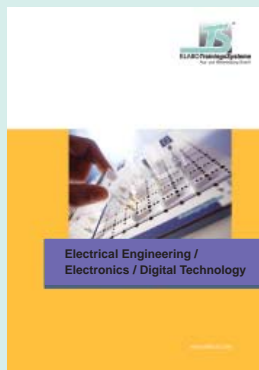☐ *Control Technology*

☐ *System and Process Simulation*
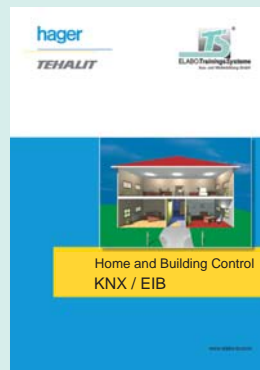
☐ *Safety of Electric Installations and Devices*
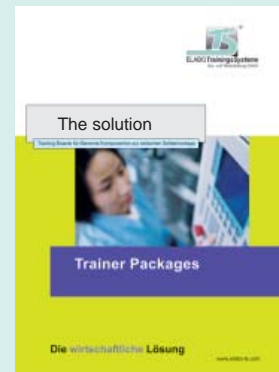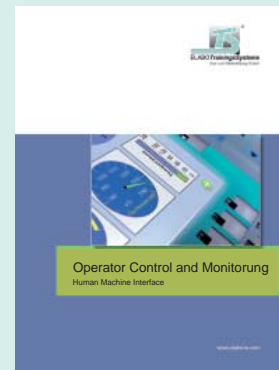
☐ *Trainer Packages The solution*
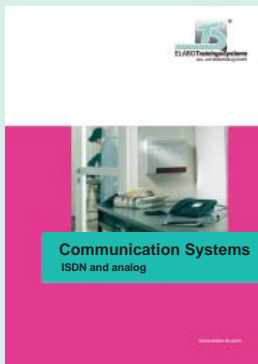
☐ *Practical Training in Sensor Technology*

☐ *Electrical Engineering / Electronics/Digital Technology*

☐ *KNX/EIB*

☐ *Operator Control and Monitoring*

☐ *Communication Systems ISDN and analog*

☐ *Drive Technology*

☐ *Bus-capable Intercoms*

☐ *Bildungsprogramm 2009 (German)*

Copy and fax

Subject to technical modifications and further developments   06/2009

ELABO*TrainingsSysteme*
Aus- und Weiterbildung GmbH

ELABO*TrainingsSysteme GmbH*

Im Hüttental 11

85125 Kinding / Germany

Tel.:   + 49 (0) 84 67 / 84 04 - 0
Fax: + 49 (0) 84 67 / 84 04 44
E-mail: sales@elabo-ts.com
Internet: www.elabo-ts.com