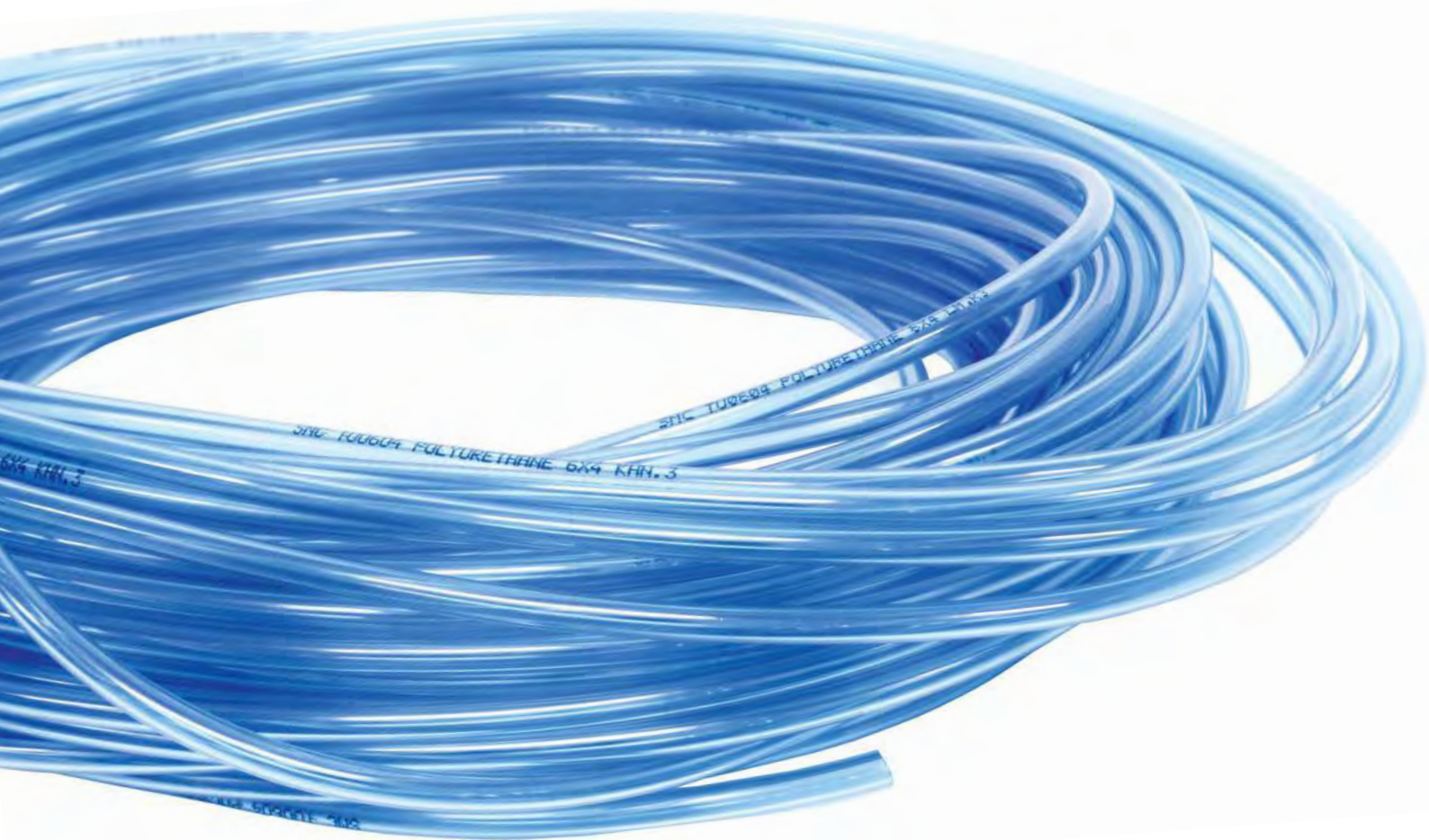


## PNEUMATICS / ELECTROPNEUMATICS

Basic and advanced level





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in  
Germany

# TECHNOLOGY AND THE HUMAN – ONE UNIT TO SUCCESS

## Welcome to **ELABO*TrainingsSysteme***



ELABO*TrainingsSysteme* 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 ELABO*TrainingsSysteme* 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 IHK, HWK or the industry, polytechnics and universities are among the long-standing customers of ELABO*TrainingsSysteme*.

Udo Urban  
**Managing Director**  
ELABO*TrainingsSysteme* GmbH

## Technology that fascinates: understanding – comprehending – applying

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

ELABO *TrainingsSysteme* counts among the leading international manufacturers in the market environment. Located in Kinding, in the beautiful natural reserve of Altmühltal – where the 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 or on fast learning of new technologies by the customers.

The knowledge, experience and the above-average personal involvement of the motivated employees of ELABO *TrainingsSysteme* have been the important contributory factors for the efficiency of the company.



# PNEUMA MEANS BREATH...

## Compressed air and its technical properties

*Pneumatics is the discipline of all technical applications in which compressed air is used to carry out work. Compressed atmospheric air is called compressed air.*

### Uses

Compressed air can be used for many different purposes, for example as active air for conveying materials, e.g. painting, as process air that is integrated in a process, e.g. drying. Therefore, the pneumatics represents only a small part of the overall compressed air applications. Traditional pneumatic systems often work with 6 bar overpressure; which means that the pressure inside them is about 7 times the atmospheric pressure. The pressure level in high-pressure networks for pneumatic applications with a high force requirement can be up to 18 bar. However, in that case, special components, hoses and connectors must be used, which are able to withstand this high pressure. In special cases, such as the manufacture of PET bottles, the pressure level in the compressed air network can be up to 40 bar.

Every compressed air system consists of four sub-systems. Compressed air generation, compressed air preparation, compressed air distribution and the actual application. Compressed air is generated by sucking in and compressing the atmospheric air in a compressor and after the preparation stage, which consists of filtering and drying, it is fed to the application via a compressed air circuit, which consists of the piping and hoses, and there, in the application, it is used technically. In pneumatic applications, the compressed air is used for carrying out work. Usually, it is fed to the desired location via valves. In a pneumatic cylinder, for example, the air is used to have a force act on a cylinder piston and thus, to move it in a particular direction. Pneumatics is considered to be a simple technology that is inexpensive to procure.

### Generating compressed air

Usually, an electric motor generates a mechanical movement that is transferred to a piston or compressor screw. Using the intake and outlet valves suitably, atmospheric air is first compressed and then pushed into the compressed air network or an upstream air tank. Several compressors are often run in combination in systems that have a very high compressed air requirement. Unregulated, large compressors are used for providing the base requirement; the peak load is often covered by an rpm-regulated compressor. A suitable controller coordinates the operation of the complete compressor system and ensures the most efficient possible operation. Depending on the required pressure and the desired discharge quantity, different types of compressors can be used. For example, multi-stage piston compressors are especially suitable



for generating high output pressures with low discharge quantities. On the other hand, screw compressors generate a lower output pressure but the discharge quantity is high. Owing to mechanical and thermodynamic processes, during the compression of the compressed air, a large quantity of heat is generated, which has to be dissipated from the compressed air. In many of the older systems, this waste heat remains unused. However, the overall efficiency of the pneumatic system can be significantly increased if the heat that is generated is used meaningfully, for example, for heating, as process heat or depending on the requirement of cooling, for room air conditioning.

### Compressed air quality

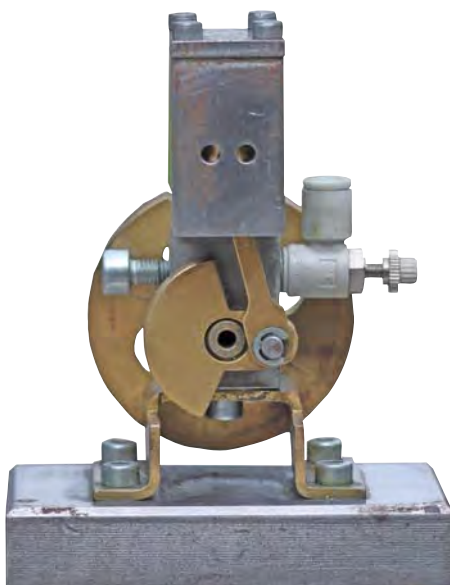
Ensuring the compressed air quality is important, since impurities in the compressed air can hinder the working of the pneumatic components in the application, or can even result in permanent damage. The preparation of the compressed air can be done centrally or in de-centralised fashion. Centralised preparation takes place in the vicinity of the compressor station, before the compressed air is fed to the distribution network. In contrast, the decentralised preparation takes place directly be-



fore application, to ensure the compressed air quality that is required by the components. Suitable filter systems are used for eliminating solid impurities. Refrigerant type dryers, absorption dryers or diaphragm dryers remove moisture from the compressed air. This can ensure that when the temperature is dropping, steam is not swirling around in the components and the surfaces are not damaged by corrosion. Usually, a maintenance unit is placed before the pneumatic application, in which the locally desired compressed air quality can be generated through various filter stages. Most particles can be removed via the filter. Filters, dryers and pressure regulators represent a flow resistance in the pneumatic system. As a result, when there is a flow through them, they cause a drop in pressure, which can be very high particularly when the filters are not cleaned regularly. A pressure loss always has a negative effect on the energy balance of the compressed air system and therefore, must be avoided as far as possible. The compressed air distribution from the compressor to the loads takes place through pipes and is comparable to an energy conductor, such as an electric cable. In addition, it must be ensured that the pipes have a sufficient diameter so that the flow resistance can be kept as low as possible. If the diameter of a pipe is halved, its flow resistance increases. This means that the resistance of a pipe increases as its diameter reduces.

### Distribution of the compressed air

Changes in the piping must be taken separately into account, especially if narrow and non-rounded bends are to be used. The flow resistance



in such pipe elements can be considerably bigger than in comparable rectilinear pieces of pipe. The compressed air is distributed through pipe networks. Depending on the arrangement of the building and different requirement profiles, the use of a ring structure or a mixed topology is recommended. During the construction and maintenance of pipe networks, particular attention must be paid to localising and eliminating leaks. Since leakage points in pneumatic systems merely allow compressed air to flow into the surroundings, there is mostly no risk to safety or the environment from the leaks. Nonetheless, leaks must always be conscientiously eliminated, since they can also represent a large component of the total energy consumption. For the planning and dimensioning of compressed air networks, strategically well placed compressed air tanks can have a positive effect on the durability of a compressed air network. This can be of particular use when sporadically occurring loads with high air quantities can have an effect on the pressure stability in the total network, and thus, have a negative effect on the switching behaviour of the compressor station. Compressed air tanks can then smoothen these high consumption quantities in the short term and thus stabilise the network pressure.

# PNEUMATICS, ELECTROPNEUMATICS IN INDUSTRY

## The possibilities of pneumatic systems

### Applications of compressed air-controlled systems

Pneumatic controllers are not sensitive to environmental influences and therefore have an important place in modern control technology. The working of such systems is not affected or limited by impact stress, vibrations or dirt. Radiation-exposed places or corrosive atmospheres, which cannot be served by other controller technologies, are the areas of application of pneumatics.

Compressed air systems are also used in explosion-endangered zones, since air generally does not contribute to an increase in danger.

Furthermore, pneumatic controller systems are relatively inexpensive for industry and artisanry, when compared to the costs of hydraulic systems. Hydraulic systems usually require pumps in the immediate vicinity of the production point. Many operations already have compressed air systems. Moreover, over a certain period of time, the safety of the system from failure is guaranteed if compressed air tanks are used. As against hydraulic systems, no return pipe of the air is required after actuation of the operating element. Even the higher flow speed of the air is an advantage as compared to hydraulically activated systems.

In the paper, textile, metal, and mineral oil industries, in chemical plants, the mining industry and metallurgy, as well as the woodworking and furniture industry, pneumatic control systems are preferred. Very often, pneumatics is also used in the foodstuffs manufacturing industry and in the beverage industry. It covers a wide spectrum of applications when used in these areas. There are other possibilities of application in agriculture and forestry, water supply systems or in some areas of aerospace and nuclear research. Not to forget the fields of mechanical engineering, welding machines, foundry machines, hoists and cranes, and conveyors, printing and paper machines and metal forming machines.

### Disadvantages and limitations of the system

The disadvantages and limitations of the pneumatics systems are in the compressibility of air, which can only cover a limited distance. Moreover, the signal transmission is limited by the speed of sound and therefore, at a disadvantage as compared to electronic systems. The combination of pneumatics and electronics, so-called Electropneumatics, works around this disadvantage and combines the advantages of both the technologies. The energy density is also several times smaller than is the case with hydraulic systems.

"EDUCATION, ALONG WITH ENERGY,  
IS THE GROWTH MARKET OF THE FUTURE"

BEA BESTE, (\*1970)





### Planning pneumatic systems

Circuit diagrams in pneumatics comprise a number of base circuits. Thanks to the modular conceptual structure, even complicated circuit diagrams can be read and constructed relatively easily. The basic rule to be observed here is that when conceiving compressed air controllers, the smallest number of assemblies that are necessary for the required work should be used. This should not just be considered from the financial standpoint of the project; rather, it is also a factor of safety. Often, the integration of fuses intended to help avoid critical circuit states achieves just the opposite. Therefore, systems using a large number of

components are often less safe in their function than the use of simple circuits. Of course, it is also important to be aware of the function of the individual components, as also their possibilities of use and limits.

Most times, pneumatic systems are operated at overpressure, rarely with underpressure. The main components of a compressed air-controlled system are the control system and the activated executing components. The control unit is the decisive factor for the behaviour of the drive components, such as the compressed air cylinders or compressed air motors.



# PNEUMATICS TRAINING PACKAGES

## Properties and system overview



### Efficient teaching

- › Fast construction of the system
- › Fast construction and modification of the experiments
- › Mobile system for fast location changing
- › No additional infrastructure required in the room



### Ergonomics

- › Overseable system components
- › Practically oriented construction
- › Technically matched conception
- › User-friendly design



### Integration of other systems

- › Integration in bus systems
- › High industry standard
- › Automation



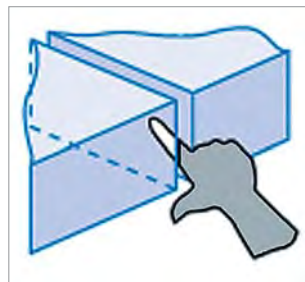
### Courseware

- › 100 % function guarantee
- › Detailed experiment instructions
- › Theory and practice
- › High printing quality
- › Printed and digital



### Storage

- › Perfectly tailored storage system for different room concepts
- › Low space requirement



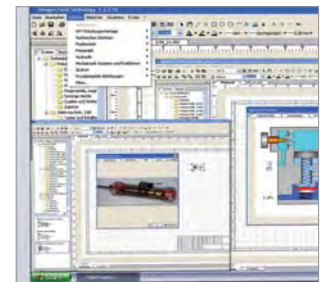
### Safety

- › No danger of injury from crushing by pneumatic components of the system



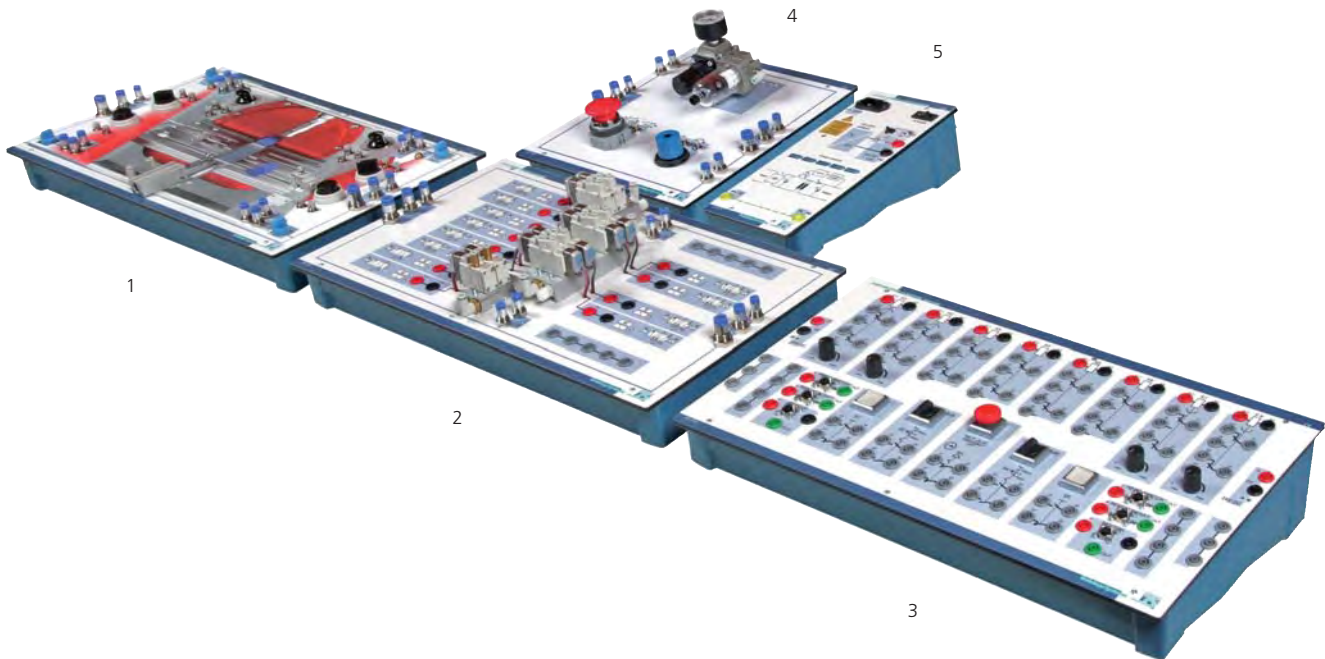
### Economy

- › Separate assembly of components possible
- › Stable and durable components
- › Low material requirement (short piping paths)
- › Energy efficiency



### Simulation

- › GRAFCET
- › Pneumatic circuit diagrams
- › Electropneumatic circuit diagrams
- › Accompanying literature as PDF document
- › Single licenses
- › 15-student classroom licenses



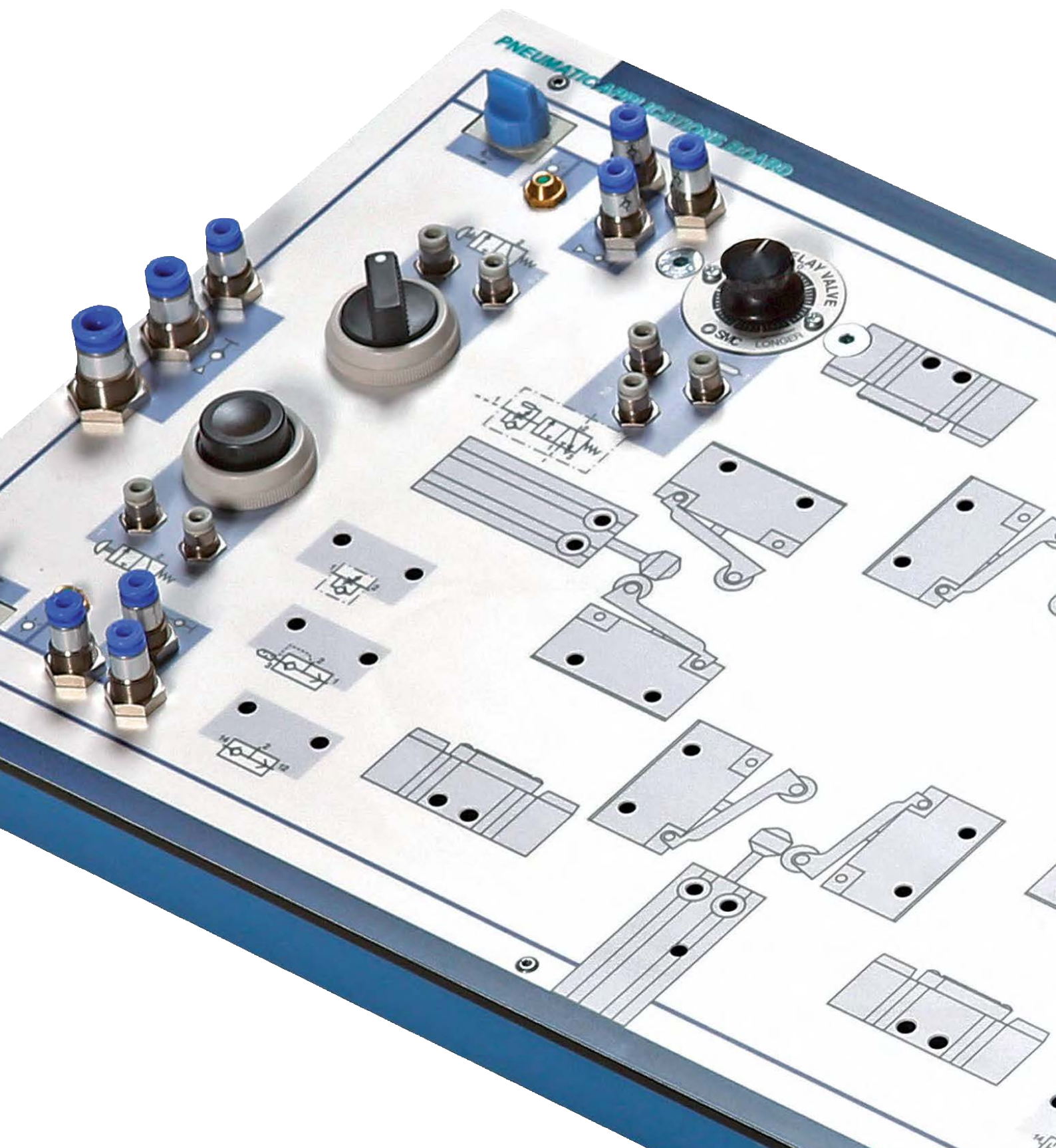
No.	Designation	Order no.
1	Pneumatic Applications Board	40 701
2	Solenoid Valves Board	40 702
3	Pneumatics Control Board	40 703
4	Pneumatics Supply Board	40 700
5	Power supply 24 V DC	63 526

### Teaching of pneumatic and electropneumatic principles

- › Planning, commissioning, maintenance of electropneumatic control systems
- › Generation of circuit diagrams with electropneumatic circuit diagrams and logic diagrams
- › Development of test criteria for function testing

### Technology

- › Exchangeable, photo-realistic applications
- › Products from the market leader
- › Excellent functionality
- › Cognitive learning support (didactics)



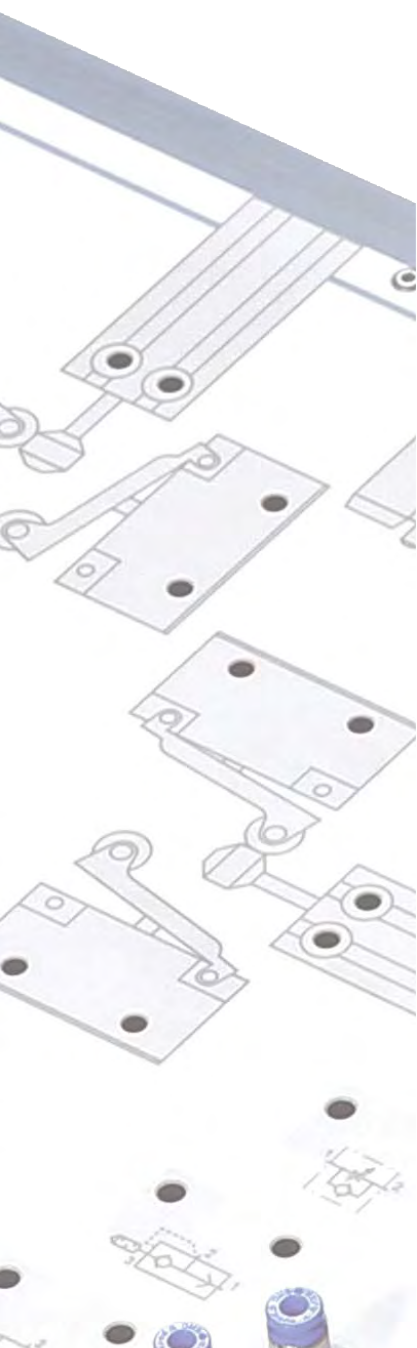
# PNEUMATICS

## Basic level

Training package 50.1

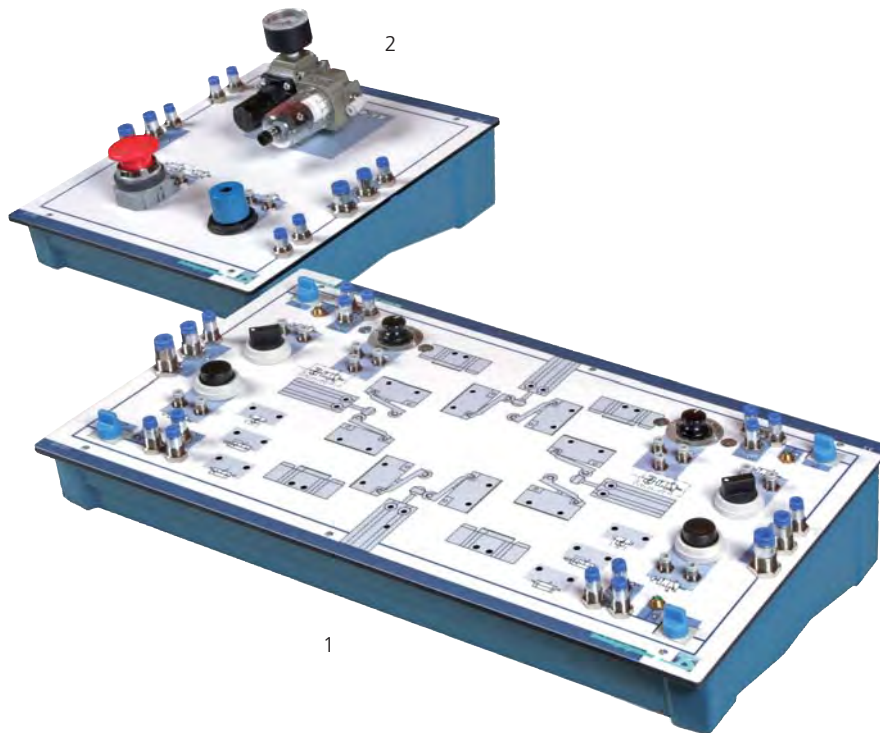
## Advanced level

Training package 50.2



# BASIC LEVEL PNEUMATICS TRAINING PACKAGE 50.1

## System components



### Learning Objectives

#### Pneumatics

- } 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

#### 40 700

##### 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, mono-stable, open in position of rest
- } All connections via 4mm bulkhead connectors

#### 40 701

##### 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
- } 2 time-delay valves with pushbutton, locked in position of rest
- } All component connections via 4mm bulkhead connectors

No.	Designation	Order no.
1	Pneumatic Applications Board	40 701
2	Pneumatics Supply Board (optional)	40 700

40 715

**Pneumatic component assortment BASIC**

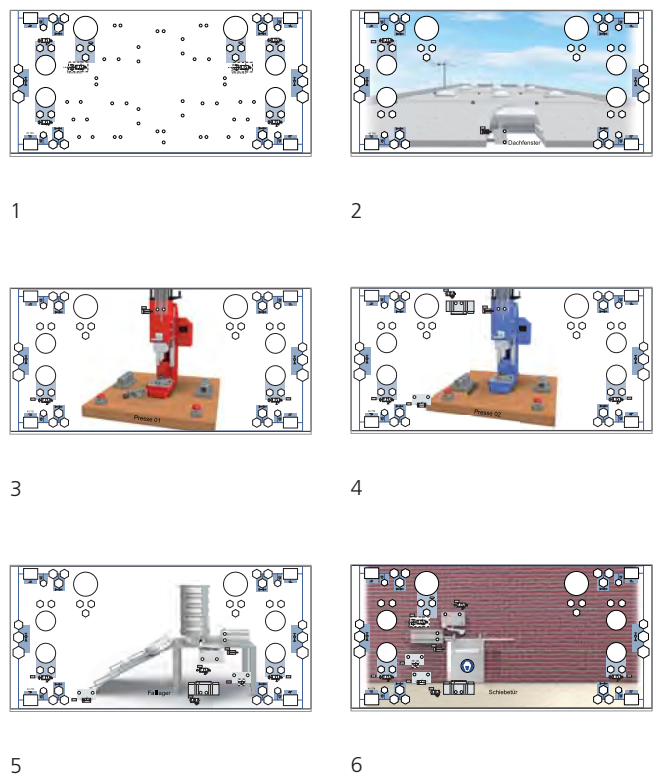
No.	Designation	Quantity	Order no.
1	3/2-directional valve, roller-actuated	2	I02031
2	5/2-directional valve, bi-stable	3	I02034
3	5/2-directional valve, mono-stable	1	I02035
4	Twin-pressure valve with AND function	2	I04048
5	Shuttle valve with OR function	1	I04047
6	Simple-action cylinder	1	I03013
7	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



**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	<b>Pneumatic project, universal transparency</b> For the free design of your own process arrangements (with the help of photographs, drawings of plants)	40 749
2	<b>Pneumatic project, skylight</b> Direct control of a simple-action cylinder	40 750
3	<b>Pneumatic project, press 01</b> Direct control of a double-action cylinder	40 751
4	<b>Pneumatic project, press 02</b> AND operation of a double-action cylinder	40 752
5	<b>Pneumatic project, tin magazine</b> Sequence control: OR function of a double-action cylinder	40 753
6	<b>Pneumatic project, sliding door</b> Time-dependent sequence control of a double-action cylinder	40 754



# BASIC LEVEL PNEUMATICS TRAINING PACKAGE 50.1

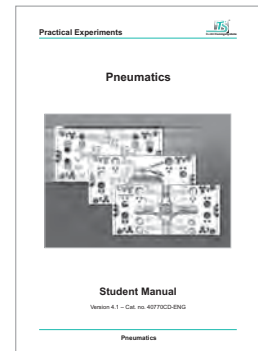
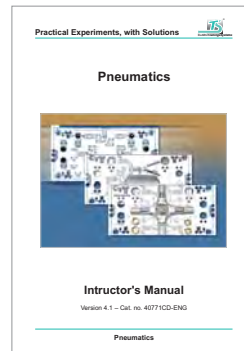
## Courseware / Storage

### Manual "Pneumatics"

printed and on CD

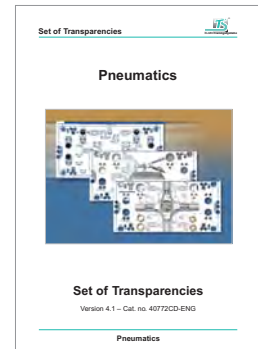
- } Generating compressed air
- } Control technology
- } Types of controls
  - Logic controls
  - Sequence controls
  - Time-dependent sequence controls
  - Process-dependent sequence controls
  - Hard-wired programmed controls
  - Programmed logic controllers
  - Components of controllers
- } GRAFCET
- } 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



### 91 903

- Set of media folders
- 40771CD-ENG**  
Instructor's Manual
- 40770CD-ENG**  
Student Manual
- 40772CD-ENG**  
Set of Transparencies



### 40772CD-ENG

#### Set of Transparencies

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

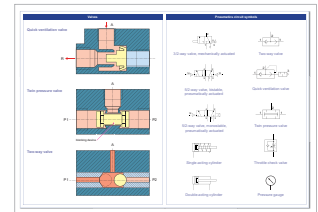
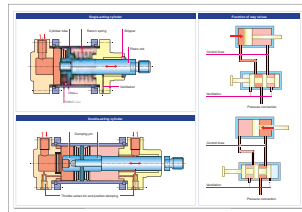
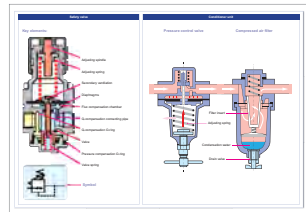
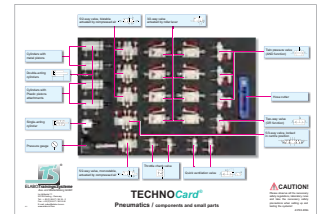
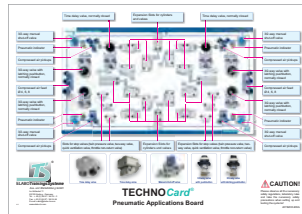
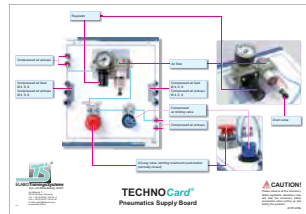


**40780-ENG**  
**Set of TECHNOCards®**  
**Pneumatics**

Laminated, colour-printed charts made of tough material.

Set consisting of:

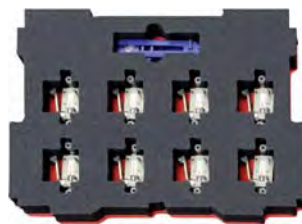
- 40781-ENG**  
Pneumatics Supply Board
- 40782-ENG**  
Pneumatic Applications Board
- 40783-ENG**  
Pneumatics / components and small parts



**40 794**  
**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

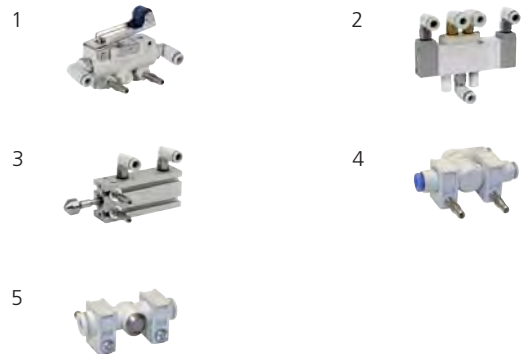


# ADVANCED LEVEL, PNEUMATICS TRAINING PACKAGE 50.2

## System components / Accessories

### 40 716 Range of components - advanced level, pneumatics

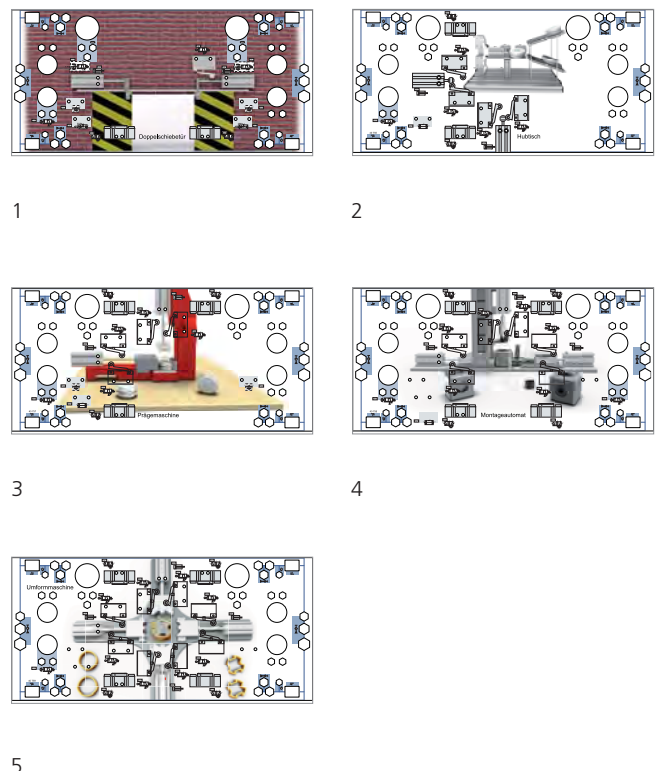
No.	Designation	Quantity	Order no.
1	3/2-directional valve, roller-actuated	6	I02031
2	5/3-directional valve, bi-stable	1	I02044
3	Double-action cylinder	3	I03012
4	Twin-pressure valve with AND function	1	I04047
5	Quick exhaust valve	1	I04049



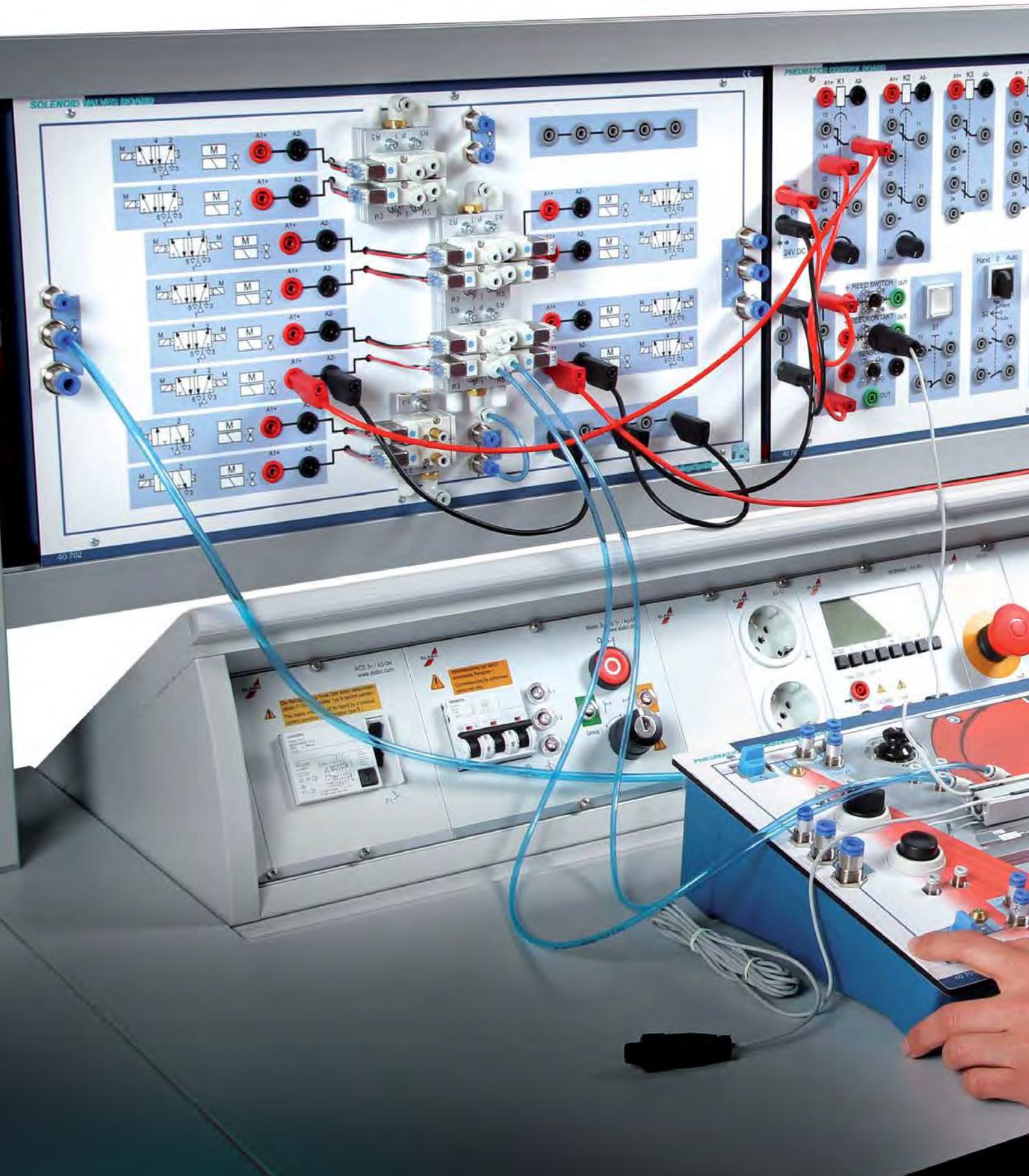
### Applications – Advanced level, pneumatics

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	<b>Pneumatic project - double sliding door</b> Time-dependent sequence control of two double-action cylinders	40 755
2	<b>Pneumatic project - lifting table</b> Sequence control of two double-action cylinders	40 756
3	<b>Pneumatic project - embossing machine</b> Cascade control of two double-action cylinders	40 757
4	<b>Pneumatic project - automatic assembly machine</b> Cascade control of three double-action cylinders	40 758
5	<b>Pneumatic project - metal forming machine</b> Sequence control of four double-action cylinders	40 759

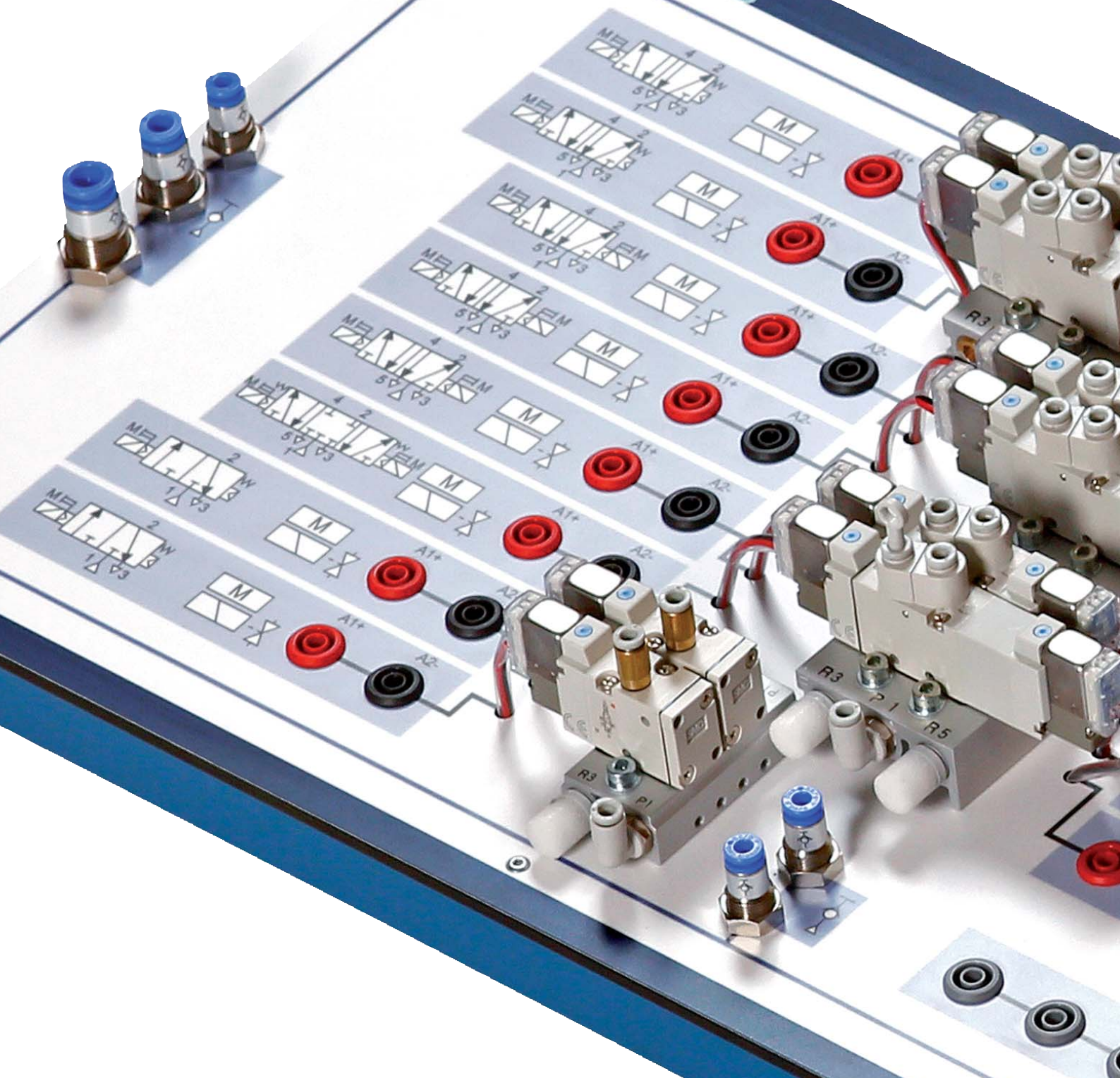








# SOLENOID VALVES BOARD



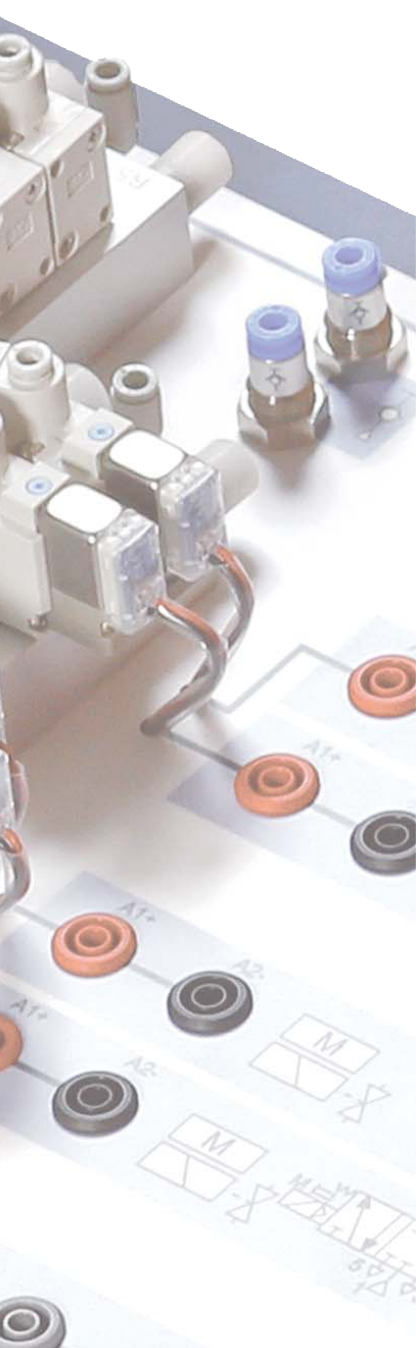
# ELECTROPNEUMATICS

## Basic level

Training package 50.3

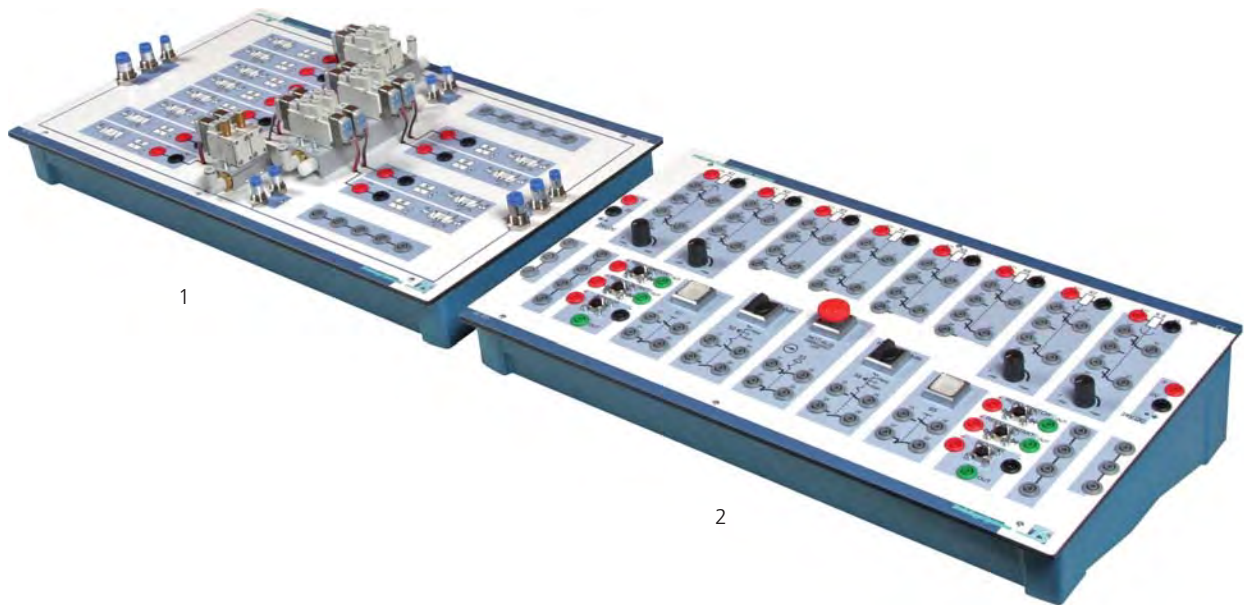
## Advanced level

Training package 50.4



# 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

#### 40 702

##### 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

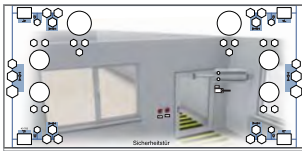
#### 40 703

##### 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	40 702
2	Pneumatics Control Board	40 703

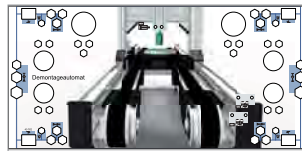




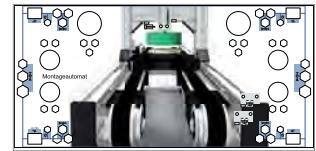
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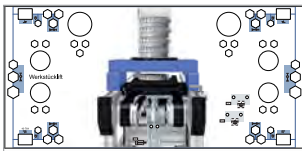
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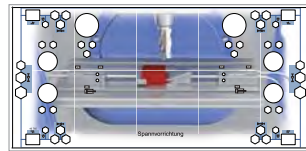
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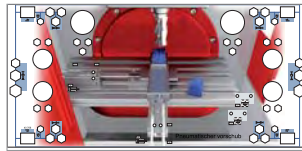
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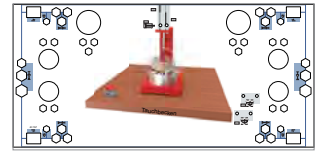
5



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	<b>Electropneumatic project - safety door</b> Time-dependent control of a double-action cylinder	40 760
2	<b>Electropneumatic project - pallet lift</b> Basic circuit of a double-action cylinder	40 761
3	<b>Electropneumatic project - disassembly</b> AND operation of a double-action cylinder	40 762
4	<b>Electropneumatic project - assembly</b> Sequence control of a double-action cylinder	40 763
5	<b>Electropneumatic project - workpiece lift</b> OR operation of a double-action cylinder	40 764
6	<b>Electropneumatic project - clamping device</b> Time-dependent sequence control of a two double-action cylinder	40 765
7	<b>Electropneumatic project - pneumatic feeder</b> Sequence control of a double-action cylinder	40 766
8	<b>Electropneumatic project - dip tank</b> Sequence control with lock of a double-action cylinder	40 767

# BASIC LEVEL ELECTROPNEUMATICS TRAINING PACKAGE 50.3

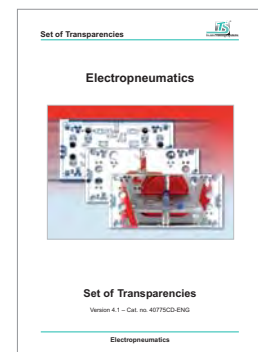
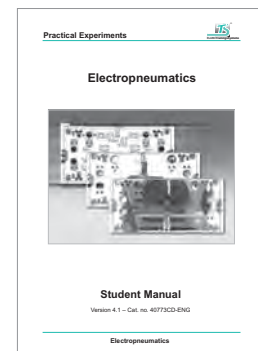
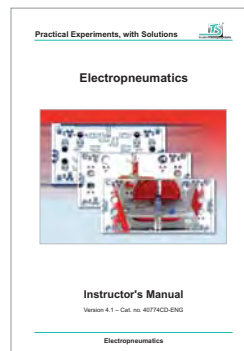
## Courseware / Storage

### Manual "Electropneumatics"

printed and on CD

- } 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



**40774CD-ENG**  
Instructor's Manual  
**91 903**  
Set of media folders

**40773CD-ENG**  
Student Manual  
**40775CD-ENG**  
Set of Transparencies

### 40775CD-ENG

#### Set of Transparencies

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

### 40 793

#### 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

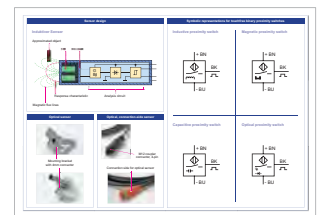
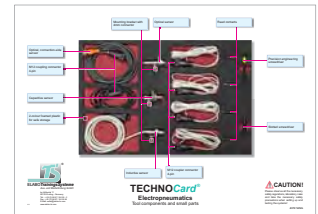
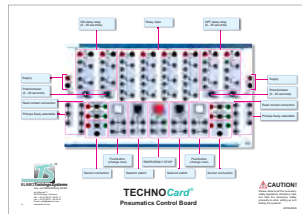
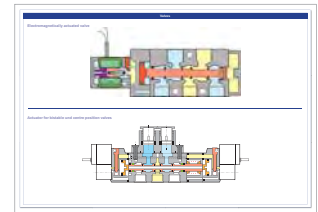
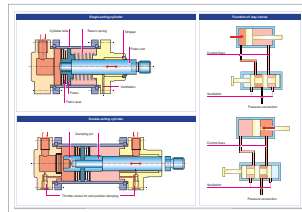
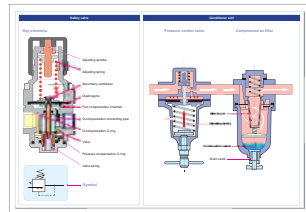
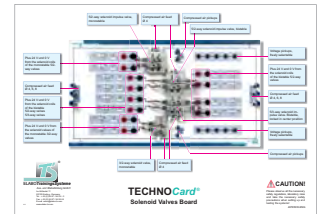
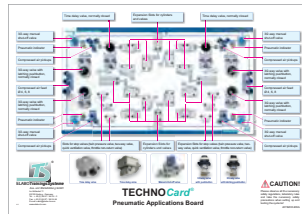
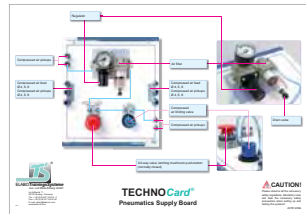


**40784-ENG**  
**Set of TECHNOCards®**  
**Electropneumatics**

Laminated, colour-printed charts made of tough material.

Set consisting of:

- 40781-ENG**  
Pneumatics Supply Board
- 40782-ENG**  
Pneumatic Applications Board
- 40785-ENG**  
Solenoid Valves Board
- 40786-ENG**  
Pneumatics Control Board
- 40787-ENG**  
Electropneumatics /  
Components and small parts



**90 028**  
**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

**40 731**  
**Reed contacts**

including connecting cable and  
 M12 plug



# ADVANCED LEVEL ELECTROPNEUMATICS TRAINING PACKAGE

## System components / Accessories

### 40 733

#### Set of sensors

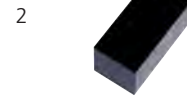
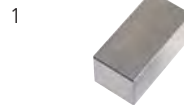
No.	Designation	Quantity
1	Inductive sensor	1
2	Capacitive sensor	1
3	Optical sensor	1
4	Connecting cable, M12, 4-pole	2



### 40 732

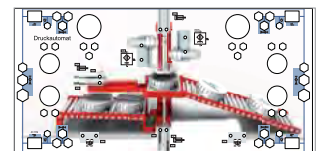
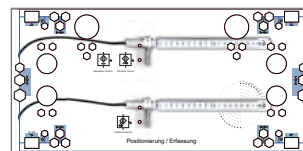
#### Set of test bodies, Electropneumatics

No.	Designation	Quantity
1	Stainless steel	1
2	Plastic	1

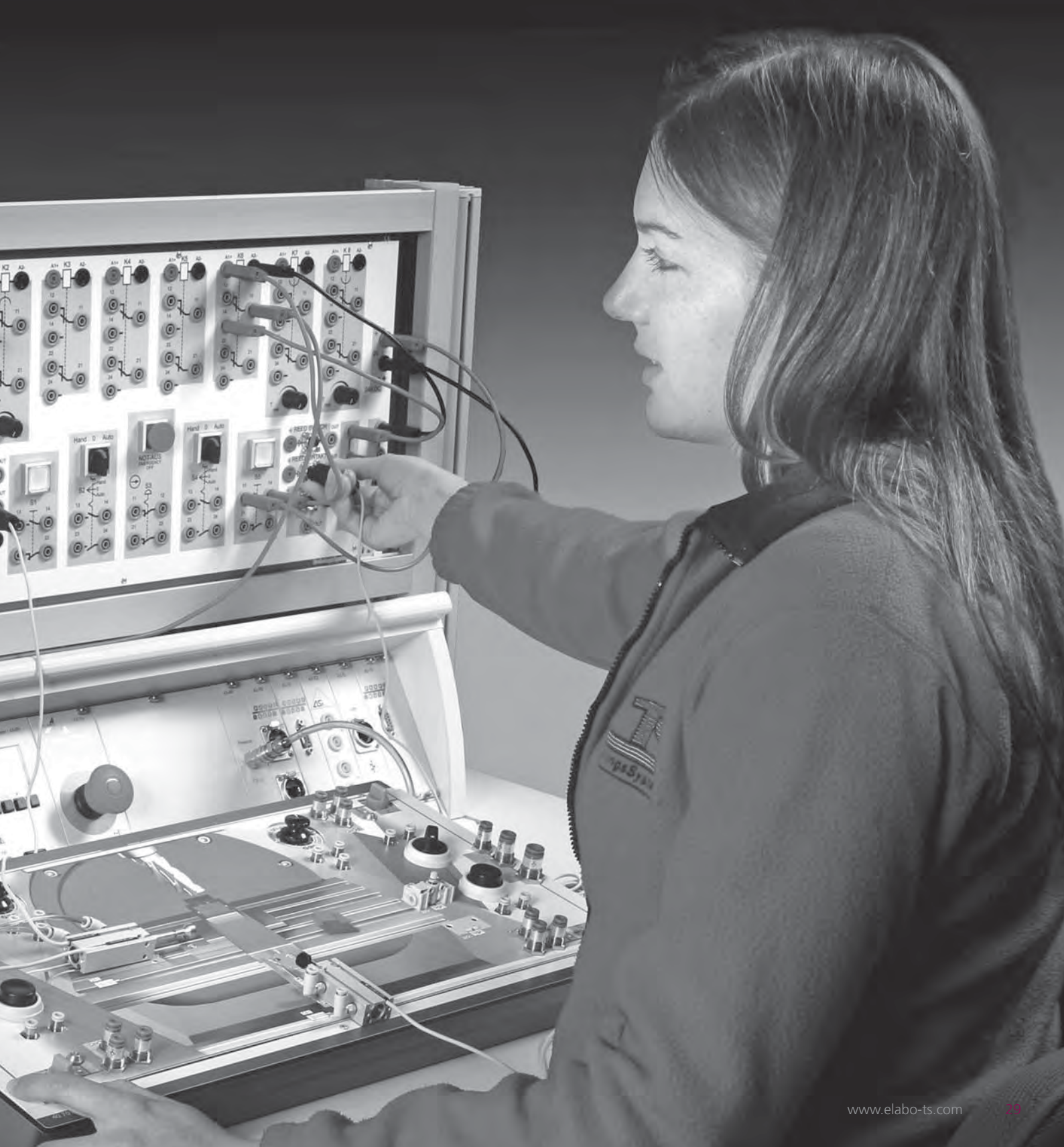


### Applications – Advanced level, electropneumatics

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



50.4



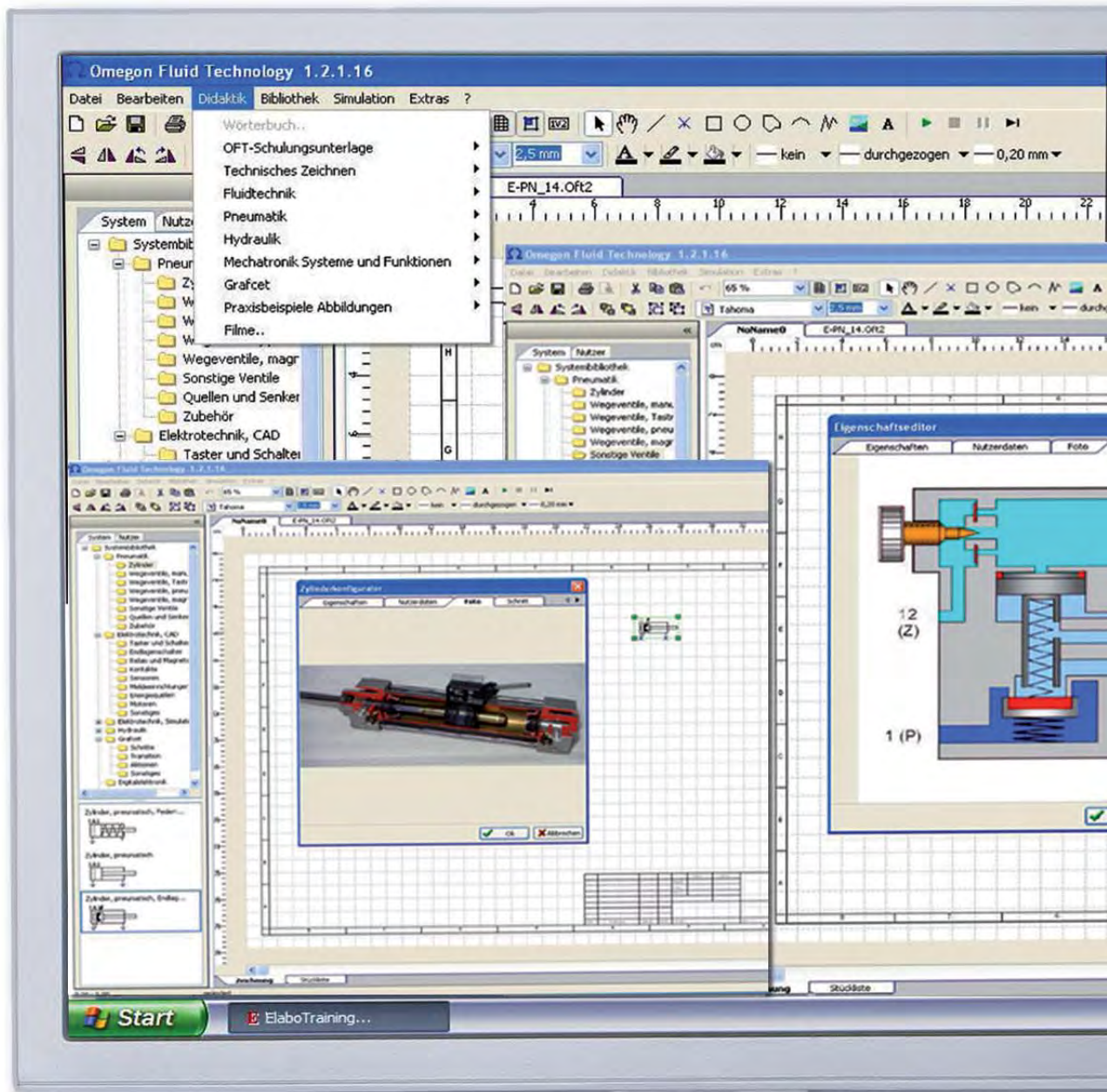
# PNEUMATICS / ELECTROPNEUMATICS

Perfect interplay





*"Achieving goals systematically"*

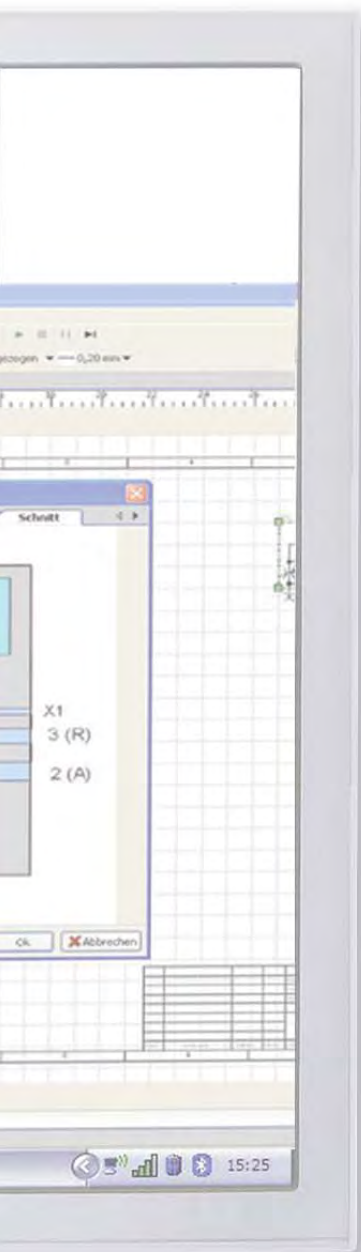




# PNEUMATICS ELECTROPNEUMATICS

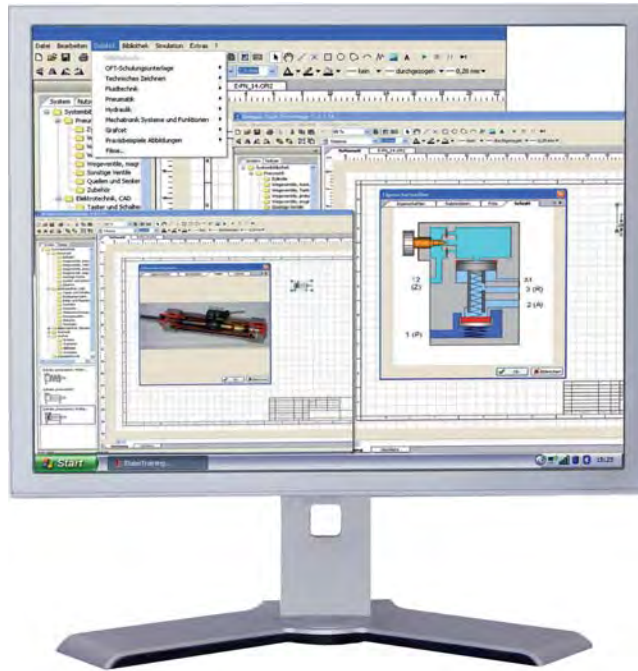
Simulation

grafcetMANAGER



# PNEUMATICS / ELECTROPNEUMATICS

## Simulation



1 / 2 / 3

### Brief description

- } Circuit diagrams with hydraulic, pneumatic, electric and logic symbols can be created quickly and with ease and printed in various formats – even with a company logo and additional instructions.
- } The surface of the OFT software is easy to operate, so that generally, user training is not required.
- } There is a free hotline at your service at all times.
- } Symbols are created clearly in libraries. New symbols can be easily generated by the user, and saved in a separate user library.
- } An additional library for automobile symbols is included.
- } A parts list of all the placed symbols is generated automatically.
- } A double-click on the symbol opens a properties selection menu.
- } A sectional view or a photograph of the component can also be called.

### Software program

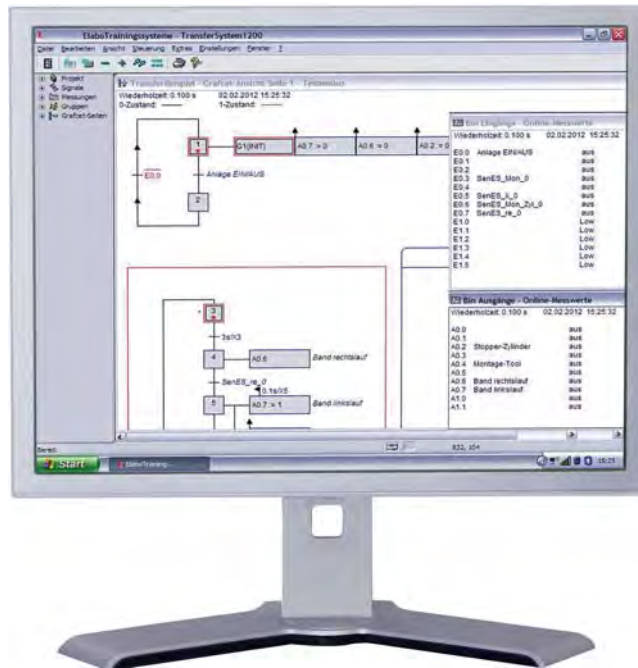
with electronic technical manuals and exercises and solutions booklets

No.	Designation	Order no.
1	<b>OFT2-CAD and simulation software</b> Single license, pneumatics, electrics, logic, grafcetMANAGER	40 790
2	<b>OFT2-CAD and simulation software</b> 10-user license, pneumatics, electrics, logic, grafcetMANAGER	40 791
3	<b>OFT2-CAD and simulation software</b> 15-user license, pneumatics, electrics, logic, grafcetMANAGER	40 792



# THE INTERPLAY OF LOGO! – PLC – ELECTROPNEUMATICS

grafcetMANAGER®



## Learning Objectives

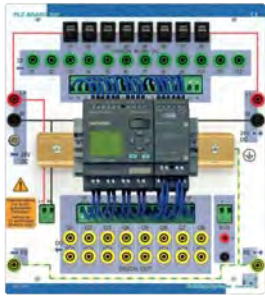
- › Basic functions of the grafcetMANAGER programming
- › Standard compliant programming
- › Checking for logical errors
- › Commissioning with online mode
- › Function test on a S7-300 or S7-1200

## System requirements

- › min. 500 MHz processor with 32 or 64-bit
- › min. 512 MB RAM
- › min. 20 MB hard disk
- › XP®, Vista®, Windows 7® or Windows 8®

® Registered trademarks of Microsoft Corporation

No.	Designation	Order no.
1	PLC Board 24 V with LOGO!	40 014
2	Automation Board S7-300	70 020
3	Automation Board S7-1200	70 260
2	Solenoid Valves Board	40 702



LOGO!

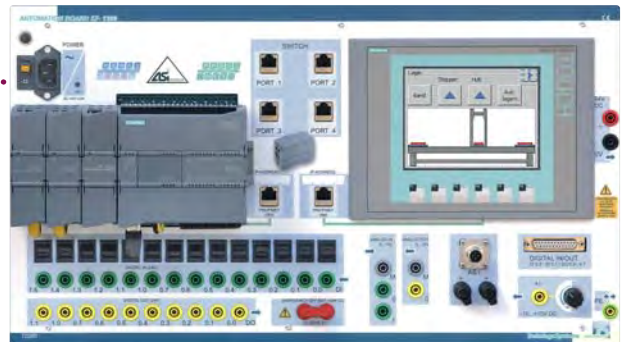
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S7-300



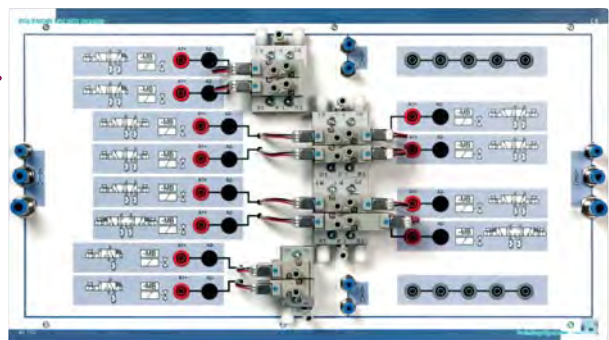
2

S7-1200



3

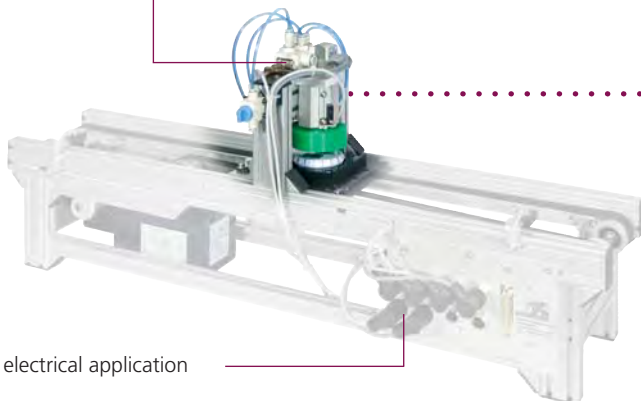
Electropneumatics



4

**Automatic assembly machine**

Electropneumatic application – batch sequence



electrical application





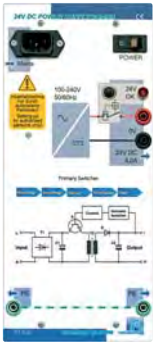
# PNEUMATICS ELECTROPNEUMATICS

Accessories

Storage

# PNEUMATICS / ELECTROPNEUMATICS

## Accessories / Storage



**63 526**  
**Power supply 24 V DC**  
 } primary: 230 V  
 } secondary: 24 V/4.0 A  
 with overload protection



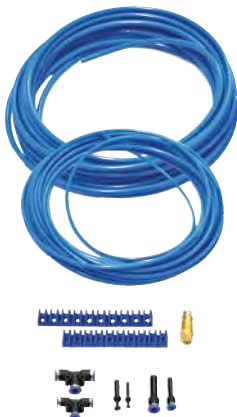
**40 700**  
**Pneumatics Supply Board**  
 For regulation of the operating pressure.  
 Firmly integrated function units:  
 } 1 maintenance unit  
 } 1 pressure reducing valve  
 } 1 3/2-directional valve with push-lock and turn-reset button  
 } 1 3/2-directional valve, mono-stable, open in position of rest  
 } All connections via 4mm bulkhead connectors



**40 738**  
**Pneumatic compressed air tank**  
 The pneumatic compressed air tank is fitted on an A4 plate (133 x 297 mm) for optional use in an experiment frame.  
 With NB4 bulkhead connections, manual shut-off valve and additional test valve for alternative filling by means of an air pump.  
 } Volume: 1 litre  
 } Operating pressure: 11 bar  
 } Test pressure: 15.73 bar  
 } Temperature:  
 min -10° C  
 max. +60° C



**80 999**  
**Laboratory compressor**  
 } Type 4-15  
 } Voltage frequency: 230/50 Hz  
 } Motor HP/KW: 0,25/0,18  
 } Intake capacity l/min: 44  
 } Max. pressure: 8 bar  
 } Noise emission db(A) 1 m: 48  
 } Reserve oil  
 w x h x d: 325 x 300 x 295 mm  
 incl. set of accessories, pressure reducer, adapter set



**80 998**  
**Set of pneumatics accessories**  
 Consisting of:  
 } 1 spout 26SFKO06MXX  
 } 10 T-connectors 6 mm PM0206E  
 } 10 reducers 6/4 PM060604E  
 } 10 T-connectors 4 mm PM0204E  
 } 1 reducer B/6 PM060806E  
 } 2 closing plug 4 mm PM0804R  
 } 2 closing plug 6 mm PM0806R

} 1 tube strip MPL-4  
 } 1 tube strip MPL-6  
 } 10 m PU tube 6 x 4 x 1 mm, blue  
 } 10 m PU tube 4 x 2 x 1 mm, blue



**40 795**  
**Set of pneumatic tubes**  
 } 100 m pneumatic tube 6 mm, blue  
 } 100 m pneumatic tube 8 mm, blue

**40 796**  
**Pneumatic tube 4 mm**  
 } blue, length: 100 m



**40 710**

**Pneumatic Storage Board**

A4 storage board (532 x 297 mm) for parts of the pneumatic component assortment BASIC. Plug-in positions pre-defined by printing



**91 801**

**Experiment case**

) For fitting 532 mm-wide experiment and storage boards.

) Strong aluminium frame case with ventilation slots at the sides and a large storage compartment for small parts and wires



**89 199**

**Roll container "Pneumatics / Electropneumatics"**

w x h x d: 620 x 420 x 636 mm fitted with:

- ) 4 steel plate drawers, each with a telescopic drawer runner
  - 2 drawers with foam inserts for pneumatic and electropneumatic components
  - 2 drawers for hoses and cables
- ) 1 pull-out tray
  - Safety lock
  - 4 castors, two of which with parking brake



# QUALITY IS THE MEASURE OF ALL SUCCESS

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ELABO **TrainingsSysteme** is a symbol of high quality and outstanding flexibility. This means that machines from ELABO **TrainingsSysteme** 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.

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The solutions from ELABO **TrainingsSysteme** can be matched to individual customer requirements to a great extent. Customers of ELABO **TrainingsSysteme** are supported and accompanied in the successful implementation of their training objectives by a comprehensive range of services.





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Information and Consulting



**We accompany you and are at your side with active advice.**

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**Contact us – we would be happy to help:**

ELABO *TrainingsSysteme GmbH*  
Service-Center  
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  
www.elabo-ts.com



**Customer-oriented solutions**

- › Presentation, product demonstrations and on-site consultancy
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- › Working out room concepts
- › Designing ergonomic workstations

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- › 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

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



## YOUR INQUIRY

## Fax

## 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, function

Company / Institution / Government agency

Street, Post box

Post code, place

Telephone

Fax

E-mail

## We would like:

- To be contacted by telephone
- Information on seminar dates
- On-site consultancy
- Quotation for ....

Qty.	Description	Order no.
	Pneumatics Applications Board	40 701
	Power supply 24 V DC	63 526
	Range of components – Basic level pneumatics	40 715
	Pneumatic project universal transparency	40 749
	Pneumatic project, skylight	40 750
	Pneumatic project, press 01	40 751
	Pneumatic project, press 02	40 752
	Pneumatic project, storage facility`	40 753
	Pneumatic project, sliding door	40 754
	Manual of pneumatics, instructor's manual	40 771
	Manual of pneumatics, student manual	40 770
	Manual of pneumatics, set of transparencies	40 772
	Set of TECHNOCards® Pneumatics	40 780
	Plastic case, pneumatics	40 794
	Range of components – advanced level, pneumatics	40 716
	Pneumatic project - double sliding door	40 755
	Pneumatic project - lifting table	40 756
	Pneumatic project - embossing machine	40 757
	Pneumatic project - automatic assembly machine	40 758
	Pneumatic project - metal forming machine	40 759
	Solenoid Valves Board	40 702
	Pneumatics Control Board	40 703
	Electropneumatic project - Safety door	40 760
	Electropneumatic project - pallet lift	40 761
	Electropneumatic project - Dismantling	40 762
	Electropneumatic project - Assembly	40 763
	Electropneumatic project - Workpiece lift	40 764
	Electropneumatic project - Clamping fixture	40 766
	Electropneumatic project Pneumatic feed	40 766
	Electropneumatic project - Dip tank	40 767
	Manual of Electropneumatics, trainer's part	40 774
	Manual of Electropneumatics, practical experiments	40 773
	Manual of Electropneumatics, set of transparencies	40 775
	Plastic case, Electropneumatics	40 793
	Set of TECHNOCards® Electropneumatics	40 784
	Set, safety joining technology, 4 mm	90 028
	Reed contacts	40 731
	Set of sensors	40 733
	Set of test bodies, Electropneumatics	40 732
	Electropneumatic project positioning, acquisition	40 768
	Electropneumatic project - automatic pressure machine	40 769
	Pneumatics Supply Board	40 700
	Pneumatic compressed air tank	40 738
	Laboratory compressor	80 999
	Set of pneumatics accessories	80 998
	Pneumatic hose 4 mm / 100 m	40 796
	Set of pneumatic hoses 6 and 8 mm / 100 m	40 795
	Pneumatic Storage Board	40 710
	Experiment case	91 801
	Roll-Container Pneumatics / Electropneumatics	89 199



**DIDACTIC GMBH**  
ELABO Training Systems

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

Made  
in  
Germany

