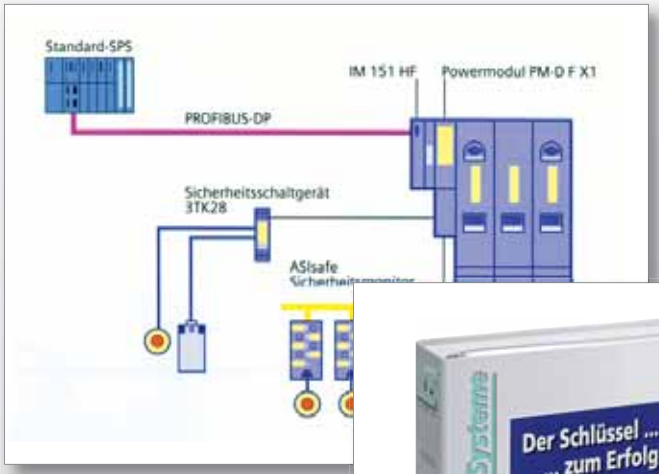
ELABO TrainingsSysteme
Aus- und Weiterbildung GmbH

AS-i Fieldbus Technology

www.elabo-ts.com

From theory to practice



Source: Siemens AG

Source: Siemens AG

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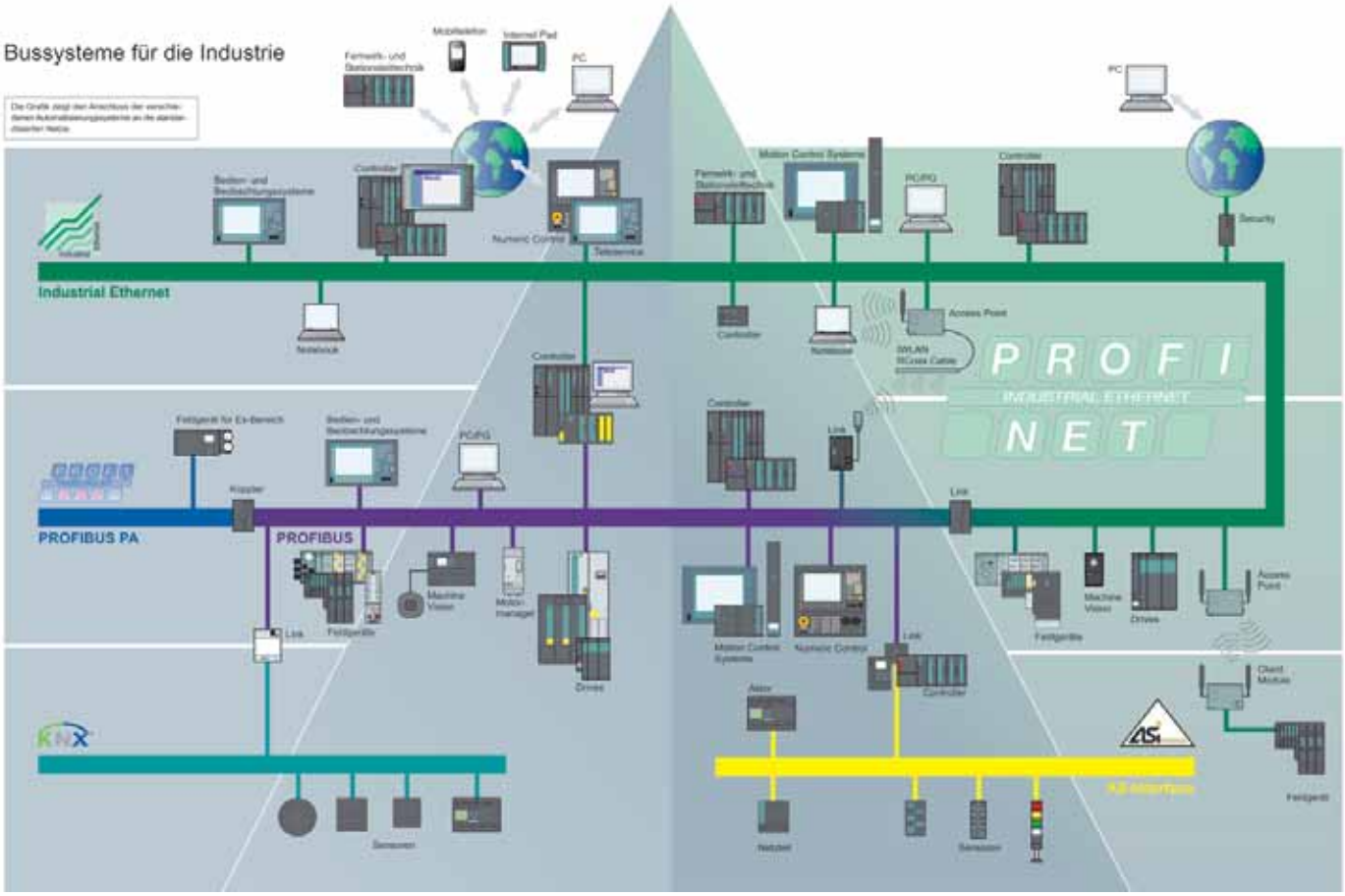
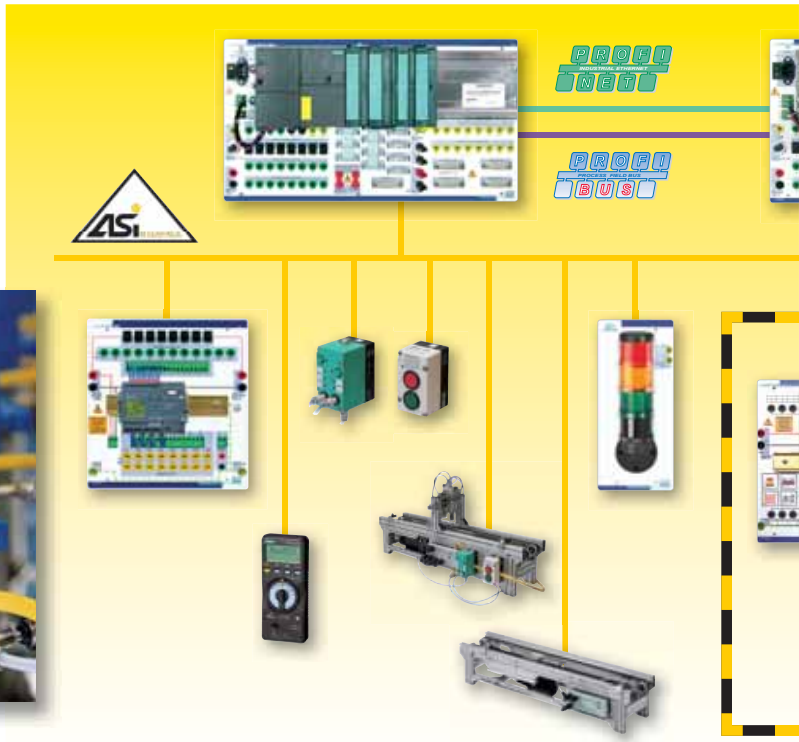
Industrial Communication



From PROFINET and PROFIBUS to the AS-Interface

AS-Interface (Actuator Sensor Interface, AS-i) is a simple way of industrial networking. Due to its simplicity, this bus system is more economic, more flexible and much easier to accomplish than any other conventional parallel wiring. It is mainly used in automation. Digital as well as analogue terminal devices can be connected. No special wiring is necessary, as almost all cable types can be used for this purpose. It is however of advantage to utilize the yellow AS-Interface flat cable as it transfers

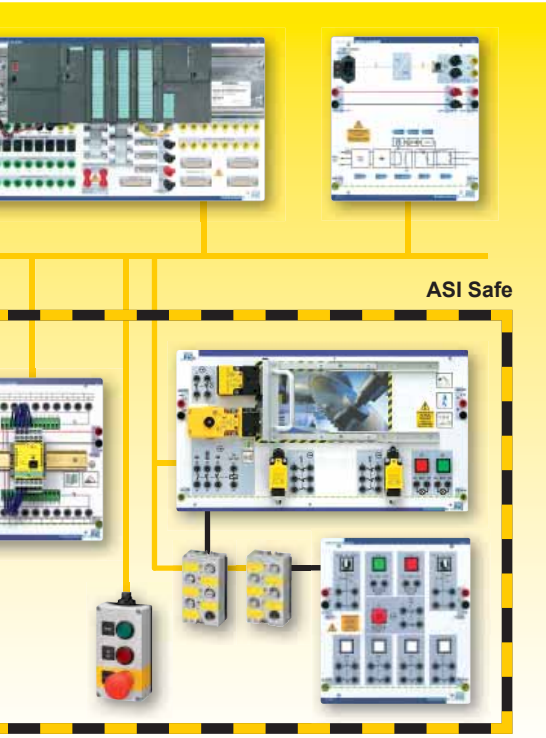
Source: Siemens AG



both power and data. The so-called cable piercing technology allows AS-Interface modules to be installed anywhere on the network without cutting and preparing the cable first. If a module is removed the cable jacket automatically reseals itself and the insulation is restored. The network length is limited to 100 m, it can however be extended to 600 m by implementing repeaters or extenders.
Digital as well as analogue modules can be connected.

What is AS-Interface?

The topology of an AS-i network is freely selectable. Bus, star, ring or tree structures are possible. Moreover, a new segment can be started at any point of the bus.

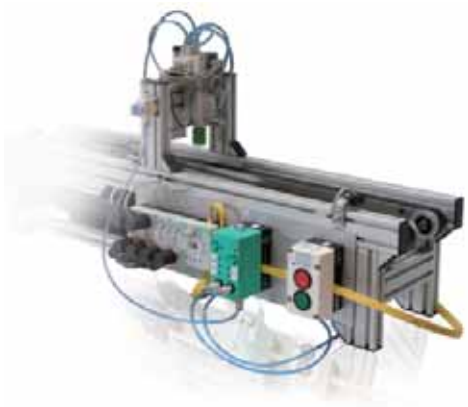


The AS-i Master

The AS-i Master has the control and monitoring functions in an AS-i network. It communicates with the connected modules exchanging all the relevant data with the so-called host. This is most commonly a module connected with the control, as e. g. an AS-i communication processor on a PLC. In the master standard operation, in addition to the slave address 4 bits of output data are transferred to all the Slaves by a Master call during the data exchange phase. The Slave concerned responds to the call transferring 4 bits of input data. The Master call enforces a check of all the Slaves in ascending order of the addresses.
This procedure, which is constantly repeated during the cyclical standard operation of the Master, is referred to as Master-Slave polling. Failing Slaves can be replaced and readdressed by the Master.

The AS-i Slaves

All sensors, actuators and modules, which are integrated in an



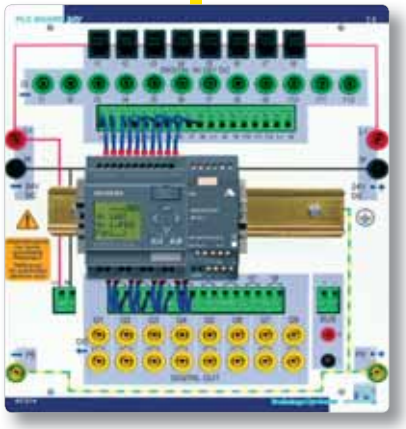
AS-i network, are referred to as Slaves. Up to 62 Slaves can be addressed in a network.
Communication modules, signal lights and motor starters count among the actuators.
The sensors might be capacitive or inductive, light curtains, laser scanners or emergency-stop buttons.

ASI Safe (AS-Interface Safety at Work)

Safety monitors and safe Slaves are used to bring an AS-i network into a safe condition. They are merely connected to the system running on the same cable.
A safe network can thus be integrated in a conventional network or form part of it without any further requirements.

Field Bus Technology – Overview

Automation Board S7-315F-2PN/DP

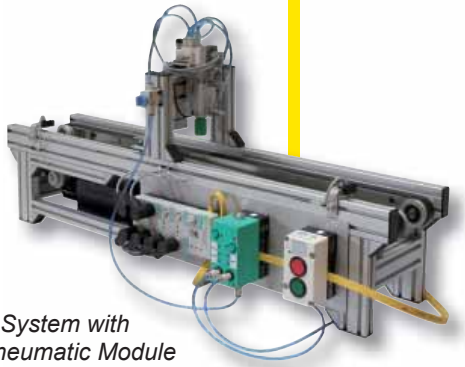


PLC Board 24 V with LOGO! and AS-i Expansion Module

AS-i Pneumatic Module

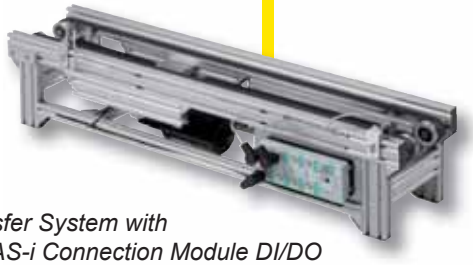
AS-i Command/ Message Module

AS-i Signaling Column



Transfer System with AS-i Pneumatic Module

AS-i Addressing Unit



Transfer System with AS-i Connection Module DI/DO

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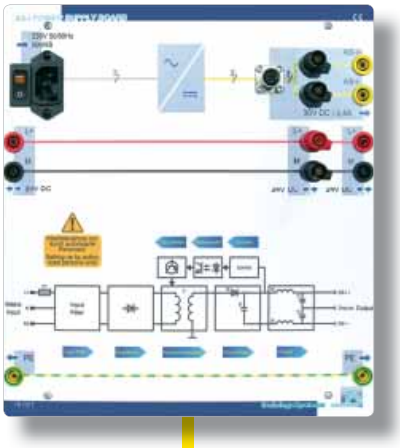
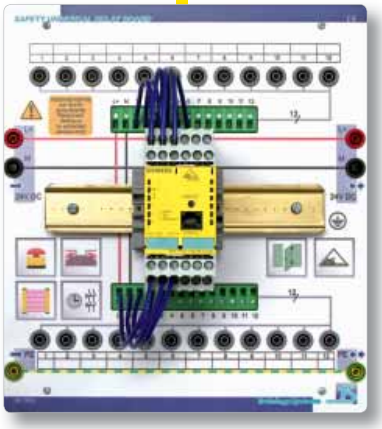
Automation Board S7-314C-2DP with CP343-IT



AS-i Power Supply Board

ASI Safe

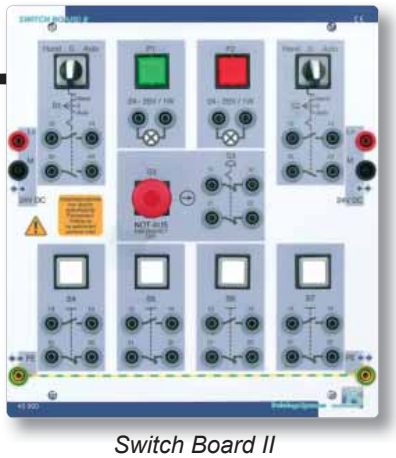


Safety Universal Relay Board with AS-i Safety Monitor

Safety Position Switch Board

Safe AS-i Module

Safe AS-i Module

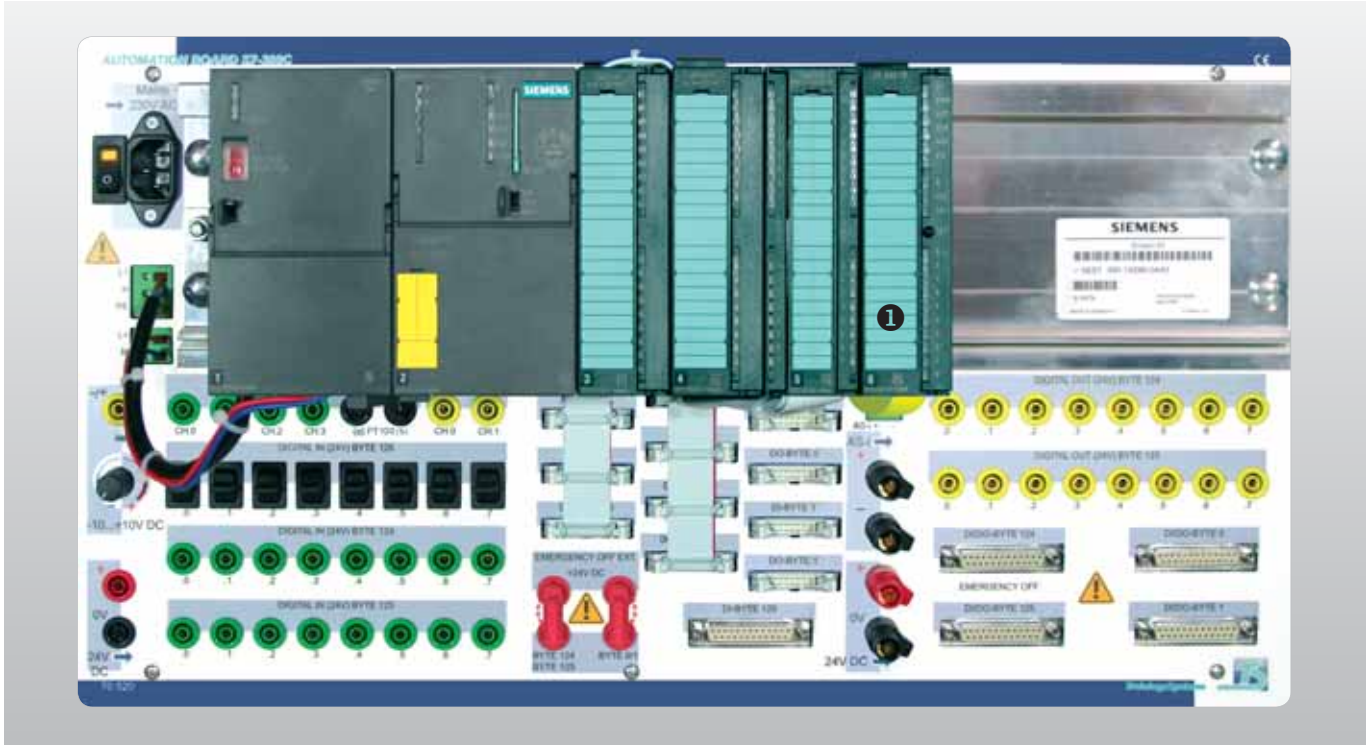


Switch Board II

AS-i Emergency-STOP

AS-Interface Master

Automation Board S7 315F



70 230 Automation Board S7 315F-2PN/DP with
70 007 AS-i communication processor

Learning Objectives:

- Setup and design of a PLC
- Commissioning an automation system
- Programming in accordance with international standard IEC1131-3
- Connecting and commissioning field bus systems

70 230 Automation Board S7 315F-2PN/DP

- 1 power supply 24 V/5 A
- 1 CPU 314C-2DP with the integrated features:
  - fail-safe PLC with PROFINET and PROFIBUS DP communication interfaces
- 24 digital inputs, 16 digital outputs
- 4 analog inputs, 2 analog outputs
- 1 Automation Board S7 / 300C

expanded with:

- 70 007 AS-i communication processor CP 343-2

Automation Board S7 314C

70 204 Automation Board S7 314C-2DP / AS-i

70 204 Automation Board S7 314C-2DP/AS-i

- 1 power supply 24 V/5 A
- 1 AS-i power supply 30 V DC/2.4 A
- 1 AS-i communication processor CP343-2
- 1 CPU 314C-2DP with the integrated features:
  - PROFIBUS DP interface
  - controlled positioning, analog and digital
  - PID controller
  - 24 digital inputs, 16 digital outputs, possible use as
    - 4 rapid counter inputs 60 kHz
    - 4 PWM impulse outputs 2.5 kHz
    - 4 frequency measuring channels
  - 4 analog inputs, 2 analog outputs, 1 PT100

expanded with:

- 70 031 CP343-X Advanced Level communication package ❷

70 007 AS-i communication processor

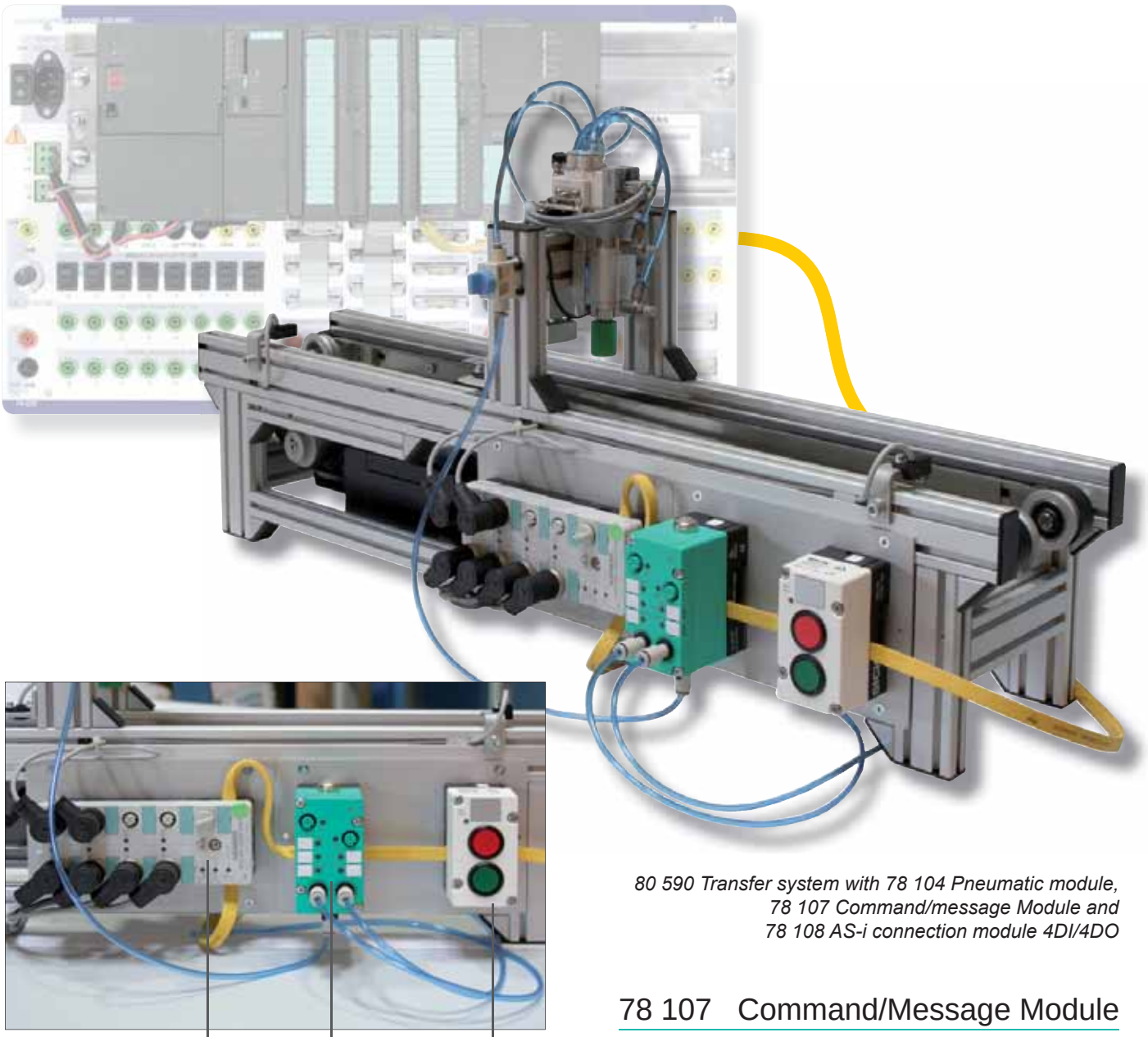
Use in a transfer system

Transfer systems with AS-i modules

80 590 Transfer system 24 V DC with
78 108 AS-i connection module 4DI/4DO

80 590 Transfer System 24 V DC

- 24 V DC gear motor, 2 directions of rotation, locked
- Integrated PWM motor control with overload protection
- Analogue continuous speed control, also by external signal, 0 - 10 V
- Digital control, rapid traverse
- 2 integrated detection modules for end position recognition, with 2-wire sensor, M12 connectors and supporting brackets
- M12 8-fold interface for connection of automatic systems, sensors, actuators, etc. for use as inputs or outputs
  - 8 x M12, double assignment possible
  - 1 x SUB D 25-pin
- System connection SUB D 25-pole to Automation Board S7/300C
  - separate control current circuits of sensors/actuators for safety-relevant functions
- DC control unit:
  Control panel for external tapping/feeding of signals, power supply
- Commissioning by switches, potentiometers on control panel
- 12 x 4 mm safety sockets
- Length = 750 mm, width = 160 mm, track = 120 mm



80 590 Transfer system with 78 104 Pneumatic module, 78 107 Command/message Module and 78 108 AS-i connection module 4DI/4DO

78 107 Command/Message Module

- 2 buttons with integrated signal lamps, green and red, 2DI/2DO

78 108 AS-i Connection Module 4DI/4DO

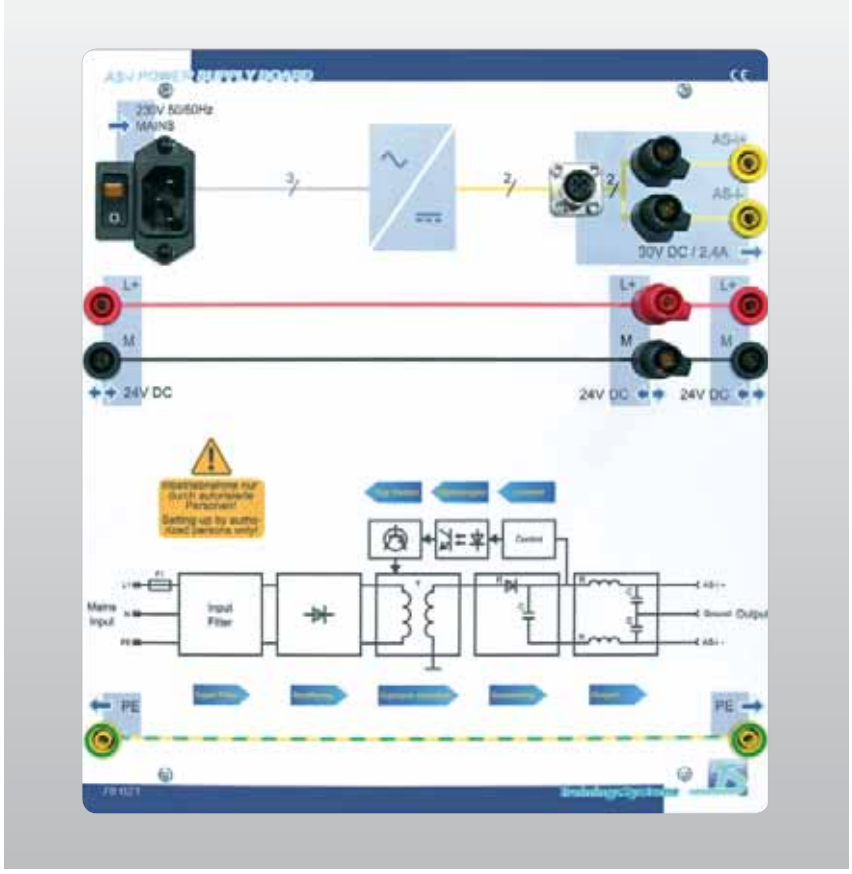
- 4 inputs 24 V DC
- 4 outputs 2 A, 24 V DC

78 104 Pneumatic Module 2PO

- 2 inputs DI 24 V
- 2 pneumatic outputs (2 3/2-way valves)
- Inputs for 2- and 3-wire sensors
- Function display for bus, in- and outputs
- Direct connection of pneumatic cylinders

Fail-safe field bus AS-i

AS-i Power Supply Board



78 021 AS-I Power Supply with Data Decoupling

78 021 AS-i Power Supply

- M12 connection for AS-i slaves
- Looping-through and contacting of the 24 DC load supply via 4 mm safety jacks or pole terminals
- Output voltage: 30 V AS-i
- Output current: 2.4 A max.
- Output power: 72 W
- Input voltage: 230 V, 50/60 Hz

Accessories

40 076 Safe AS-i Emergency-STOP

- 1 emergency-stop pushbutton via separate fail-safe slave, 2 FDI
- 2 pushbuttons, illuminated, via separate slave, 2DI/2DO

Simple direct connection of proven operating elements to ASI Safe

40 076 Safe AS-i Emergency-STOP

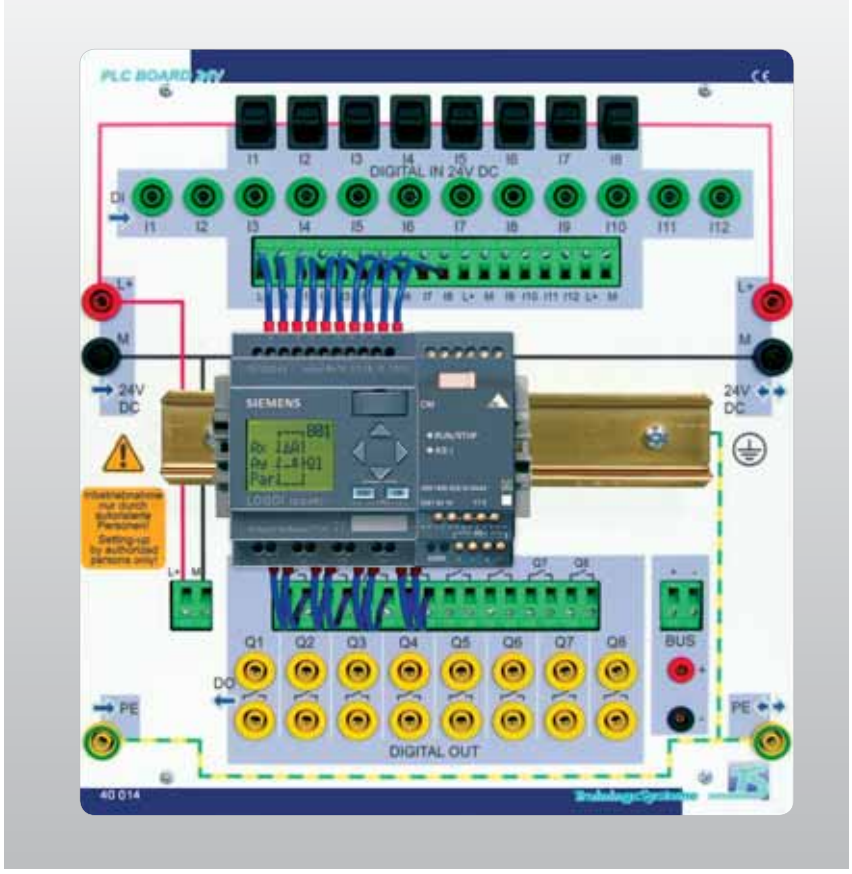
40 078 Safe AS-i Slave

- 2 fail-safe inputs, 2FDI
- 2 digital outputs, 2DO, 24 V/2 A

Mounted on holding plate

40 078 Safe AS-i Slave

PLC Board 24 V



40 016 PLC Board 24 V with LOGO! and
40 025 AS-i Expansion Module

40 016 PLC Board 24 V

equipped with LOGO! 12/24RC

- 12 inputs, 8 outputs
- 2 connections for bus systems
- 8 push/lock-in switches for input simulation
- 2 additional outputs for 24 V power supply of add-on components

LOGO! 12/24RC

- Integrated backlit display field and operator control panel
- Integrated EEPROM memory for control program and internal setpoint values
- 8 integrated time switching clocks
- 4 relay outputs 10 A max.
  - 10 A (with resistive load)
  - 3 A (with inductive load)
- Short circuit protection by external fusing
- 8 inputs

Learning Objectives:

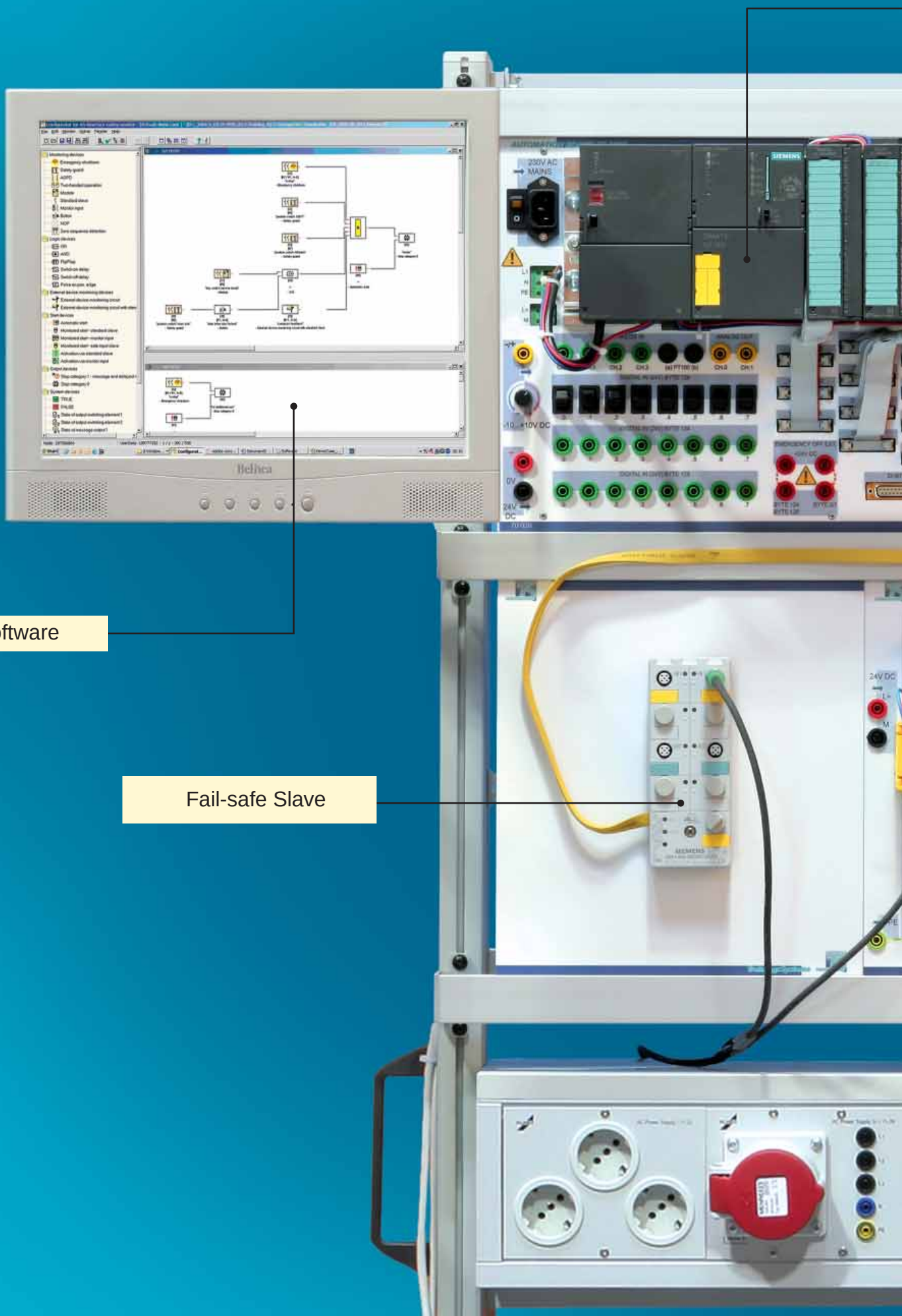
- Parameterization of logical modules
- Fundamentals of digital technology
- Programming with the operator elements
- Programming with the PC

40 025 AS-i Expansion Module

- 4 virtual digital in- and outputs

40 025 AS-i Expansion module

Application example: Experiment setup ASI Safe



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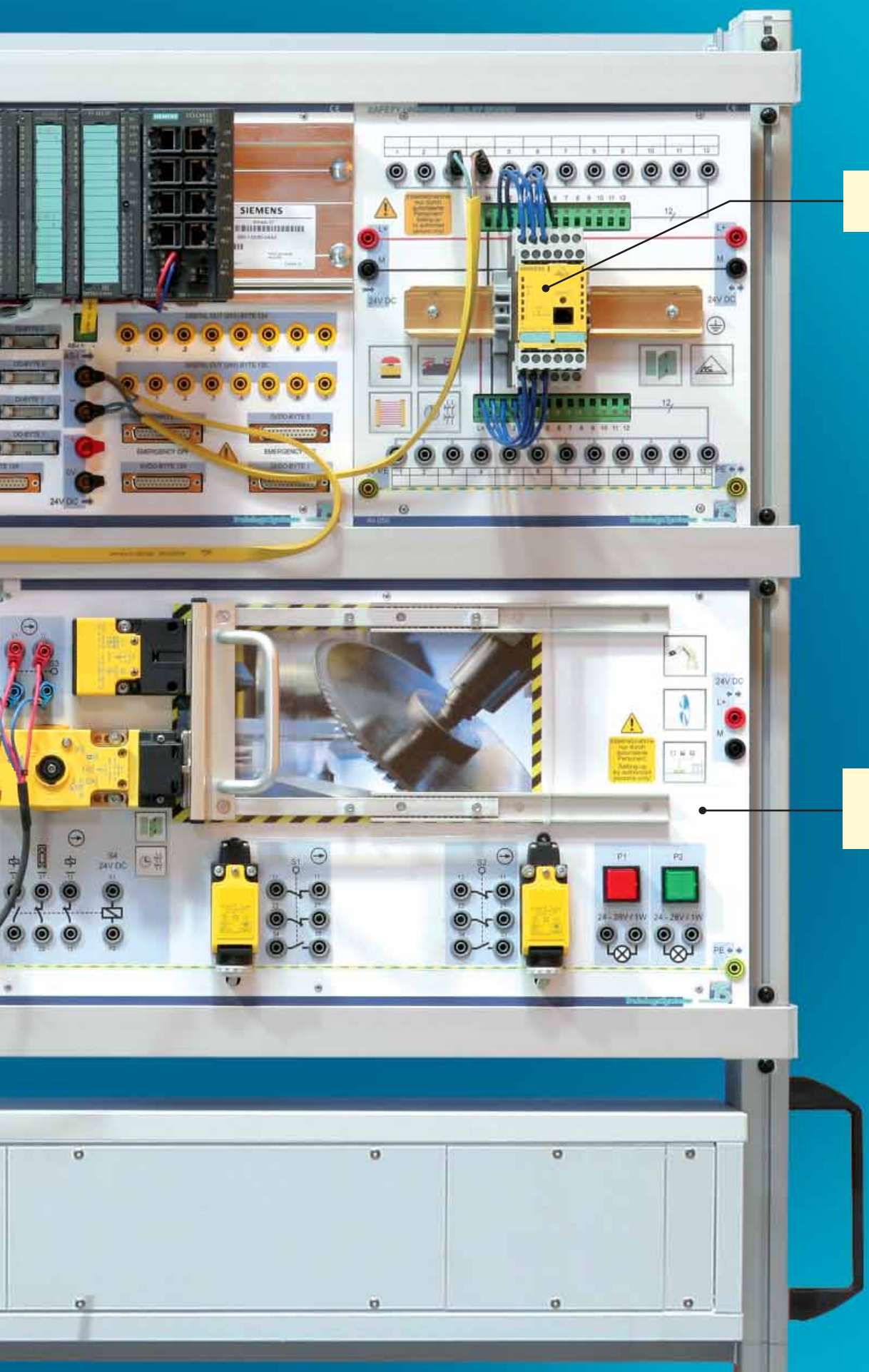


Fail-safe field bus AS-i

AS-i Addressing Unit

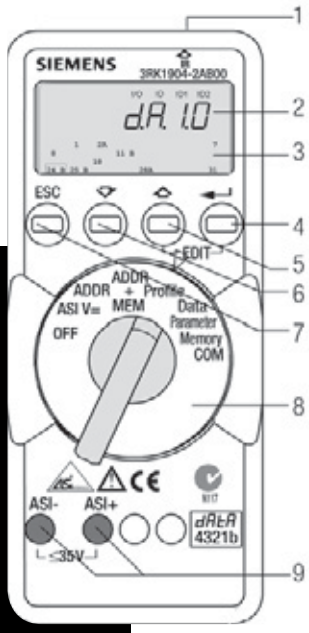
78 140 AS-i Addressing unit

78 140 AS-i Addressing Unit

incl. addressing line

- Manual addressing of all stations of the AS-Interface network
- Reading out the I/O codes of the slaves
- Parameterization of the slaves
- Allows direct writing to outputs and reading from inputs of a slave
- Measuring of the AS-Interface voltage
- Storage of complete system configurations

Operating/display elements and symbols



1. Infrared interface
2. Main display window
3. Address field: display of assigned addresses
4. Acknowledge entered value
5. Increase value
6. Decrease value
7. Return / Escape
8. Rotary function selector switch
9. Sockets for connection to AS-i bus

Source: Siemens AG

Accessories

AS-i Shaped Cables

100 m each

- Protection against reverse polarity due to trapezoidal shape
- Optimized material allows use in various ambient conditions
- Rapid exchange and connection to AS-Interface with piercing technology
- Self-sealing: protection class IP67, even after disconnecting

78 050
AS-i Shaped Cable, Yellow
(data)

80 051
AS-i Shaped Cable, Black
(power)

80 703 Set of Fastening Material for Sensors

- 2 slot nuts
- 2 M4 threaded screws

80 704 Sensor Mounting System

Profile girder for setting up test stations at any free place on the transfer system

78 109 Top-hat Rail Mounting Plate for Compact Modules

incl. mounting kit

80 150 AS-i Proximity Switch, Ind.

- Switching distance: 5 mm
- Diameter: 18 mm
- Switching function: NC/NO

78 052 AS-i Branch

to connect slaves with M12 cables

80 053 M12 Connecting Cable

to connect e.g. AS-i proximity switch

- Length: 0.5 m

40 077 M12/4 mm Connecting Cables

2 adapter cables with M12 jack at one, 4 mm safety jacks at the other end

- Length: 0.5 m

78 103 Analog Output Module 2 AO

incl. aluminium exchange cassette and fastening material

- 2 AO 0…10 V

Teachware

Manual

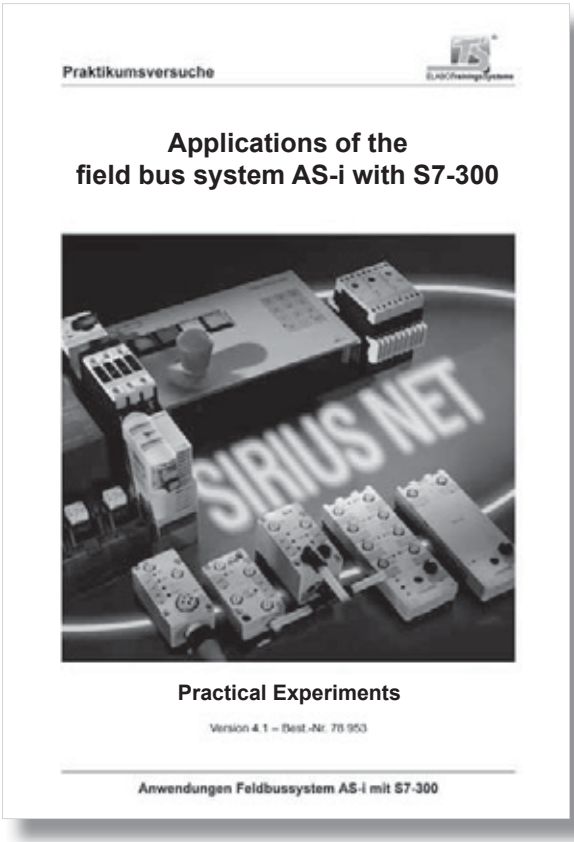
Printed and digital!

Contents

1. Task
2. Required components
3. Setup plan
4. Programming the slave
5. Configuring or expanding and testing the AS-i network
6. Connecting sensors/actuators
7. Programming the PLC
7.1 Background
7.2 Creating a project
7.3 Designing a program
8. Testing the program
9. Optimizing the program

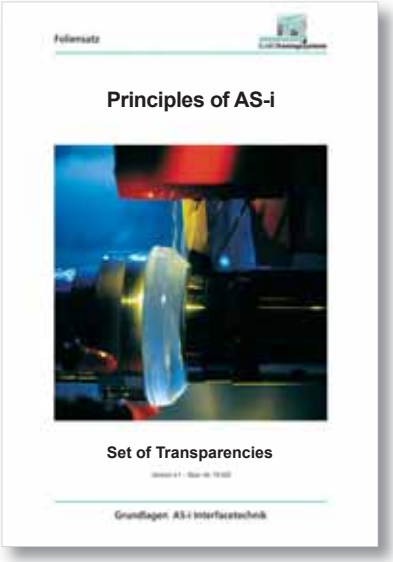
Project 1: Sensor-controlled belt drive
Project 2: Button-controlled belt drive
Project 3: Material detection
Project 4: Use of a stop cylinder
Project 5: Analogue value processing

E78 952CD *Manual Trainer Section*
Applications of the field bus system AS-i with S7-300

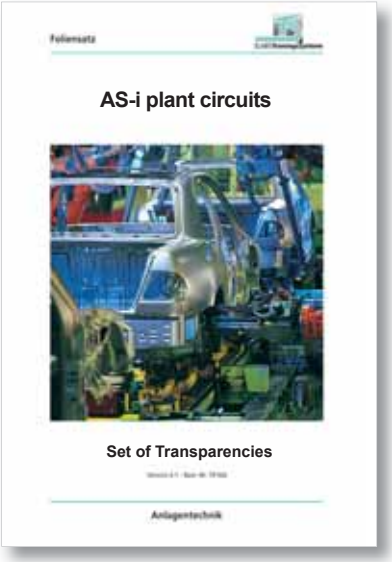


E78 953CD *Manual Practical Experiments*
Applications of the field bus system AS-i with S7-300

Set of transparencies



E78 925CD *Set of colour transparencies*
Principles of AS-i (24 transparencies)



E78 926CD *Set of colour transparencies*
AS-i plant circuits (19 transparencies)

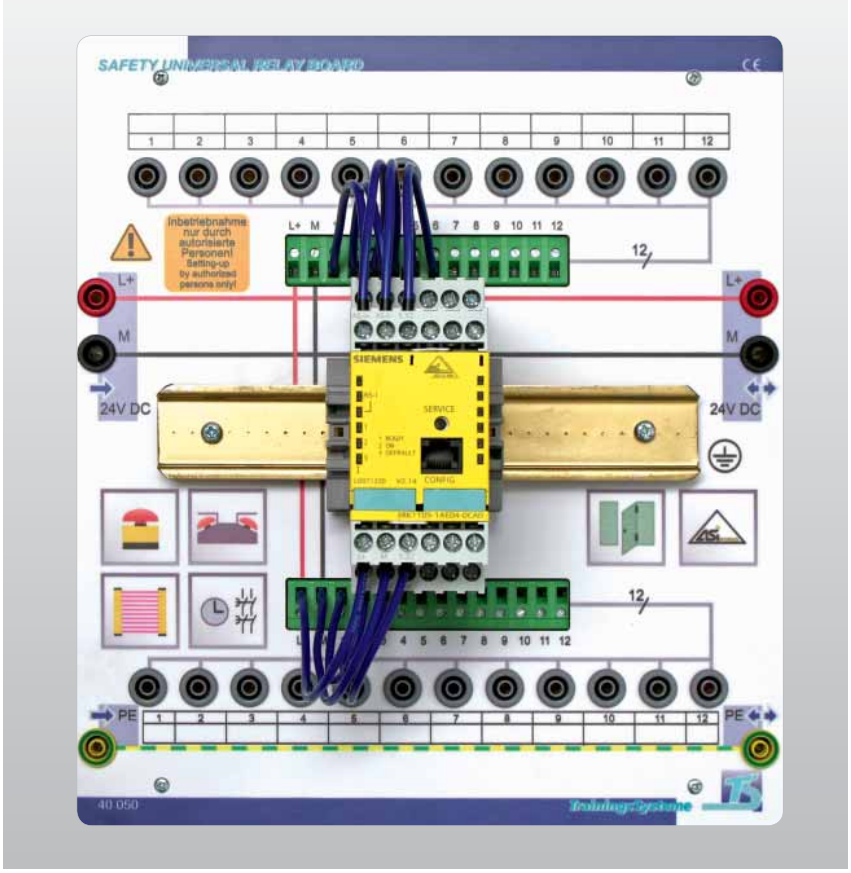
E78 927CD *Set of colour transparencies*
AS-i components (21 transparencies)

Contents

- Network hierarchy in automation technology
- Why AS-Interface?
- AS-Interface properties
- AS-Interface system structure
- AS-Interface cable extension with repeater and extender
- Technical data of the AS-Interface
- AS-Interface cable concept
- AS-Interface connection with penetration technique
- AS-Interface master function
- AS-Interface S7-200 Master for different target systems
- Repeater / Extender
- DP/AS-Interface Link 20
- AS-Interface LOGO! as AS-Interface slave
- AS-Interface addressing device
- Intelligent field device
- Encapsulated operator station with integrated AS-Interface
- Evolution in automation technology
- Trends in the field
- Conveyor technology in a conventional layout
- Conveyor technology with distributed consumer branches
- Distributed motor starter on the AS-interface
- AS-interface motor starter
- AS-interface compact starter
- AS-interface motor starter, electromechanical
- Manual control unit
- Distributed motor starter on the PROFIBUS
- Distributed peripheral device ET 200 X
- Integration of pneumatic actuators
- The totally integrated solution: AS-interface pneumatic modules
- Distributed pneumatics in application
- Compact module I, Compact module II, Compact module III, Compact module IV
- Compact module: fast mounted!
- Compact module: world champion in handling
- Compact module, digital
- Compact module, analogue
- Motor starter 24V DC
- Compact module, pneumatic
- User module 2I/1O-230V: the plug in IP 67
- Module 4I/4O, IP 20
- AS-interface module 16I, IP 20
- AS-interface module 16I, IP 20: functionality
- I/O module Slim-Line, IP 20
- 4I/4O module Slim-Line, IP 20
- Counter module Slim-Line, IP20
- Module to ground recognition
- Communication-capable consumer branches

Fail-safe field bus AS-i

Safety Universal Relay Board



40 050 Safety Universal Relay with AS-i Safety Monitor

40 050 Safety Universal Relay Board

- 24 terminals on 4 mm safety jacks for free wiring
- Top-hat rail for mounting the relays
- Input voltage: 24 V DC
- Current: max. 6 A

For mounting of:

- Emergency-stop relay
- Safety door monitoring relay
- Time function relay
- Two-hand control relay
- Light curtain relay

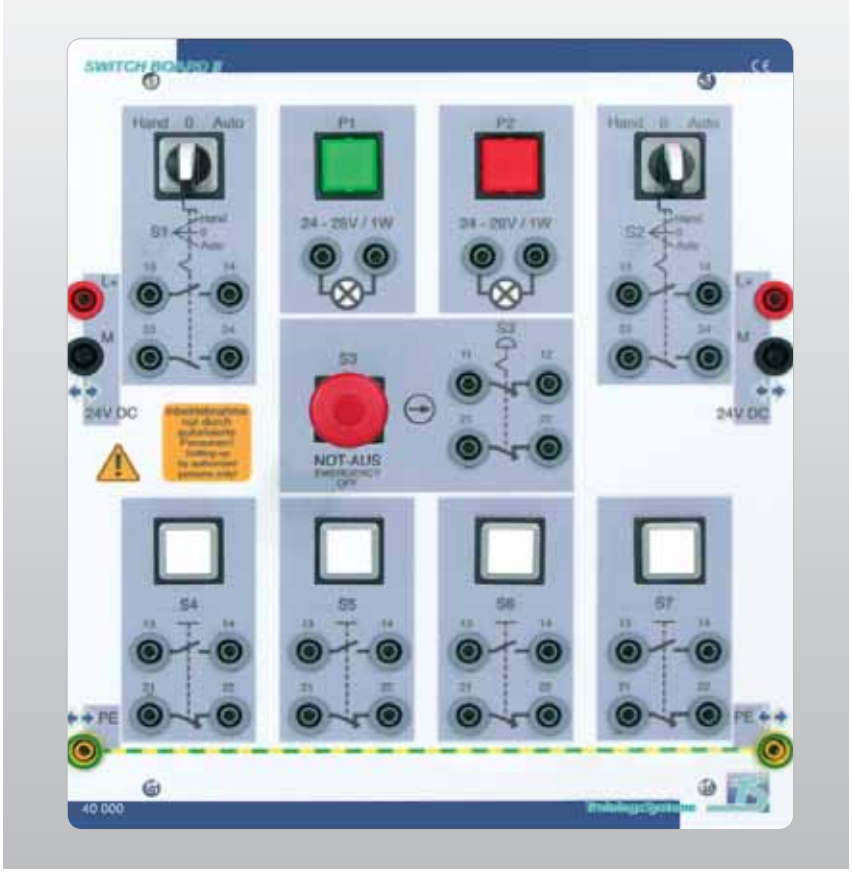
40 072 AS-i Safety Monitor

The AS-i Safety Monitor allows configuring complex protective processes such as emergency-stop, two-hand operation and door interlocking.
It monitors safe nodes and connects safe inputs.

- Enabling circuit
- Input: reset
- Input: contactor control
- Signalling output
- Configuration interface

40 072 AS-i Safety Monitor

Switch Board II



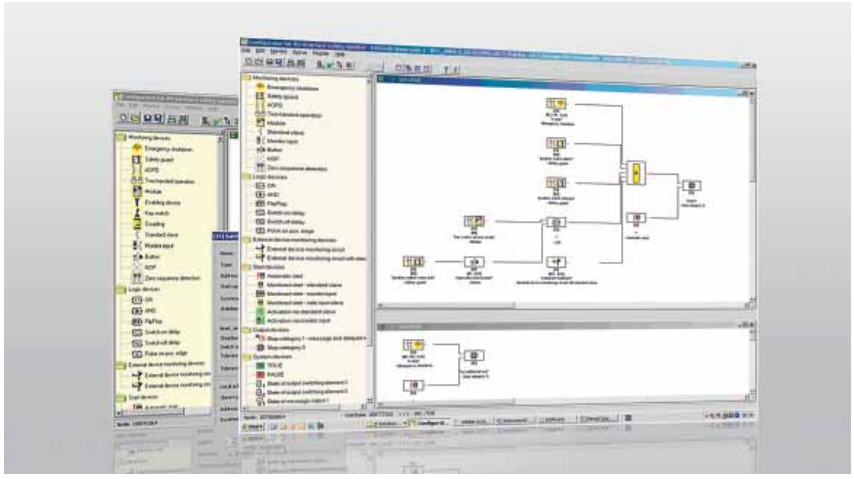
40 000 Switch Board II

40 000 Switch Board II

- 1 emergency-stop button (2 NC)
- 4 control buttons (NO, NC)
- 2 control switches (manual, 0, automatic, 2 NO)
- 1 signal lamp, red, 24 V DC
- 1 signal lamp, green, 24 V DC
- Rated voltage: 24 V DC
- Rated current: 5 A

Learning Objectives:

- ✔ Configuring and testing a control current circuit
- ✔ Integrating superordinate command devices, control buttons, control switches and emergency-stop buttons in the control
- ✔ Using signal lamps for status display



Source: Siemens AG

40 073 Parameterization Software

for the AS-i safety monitor

- Single licence

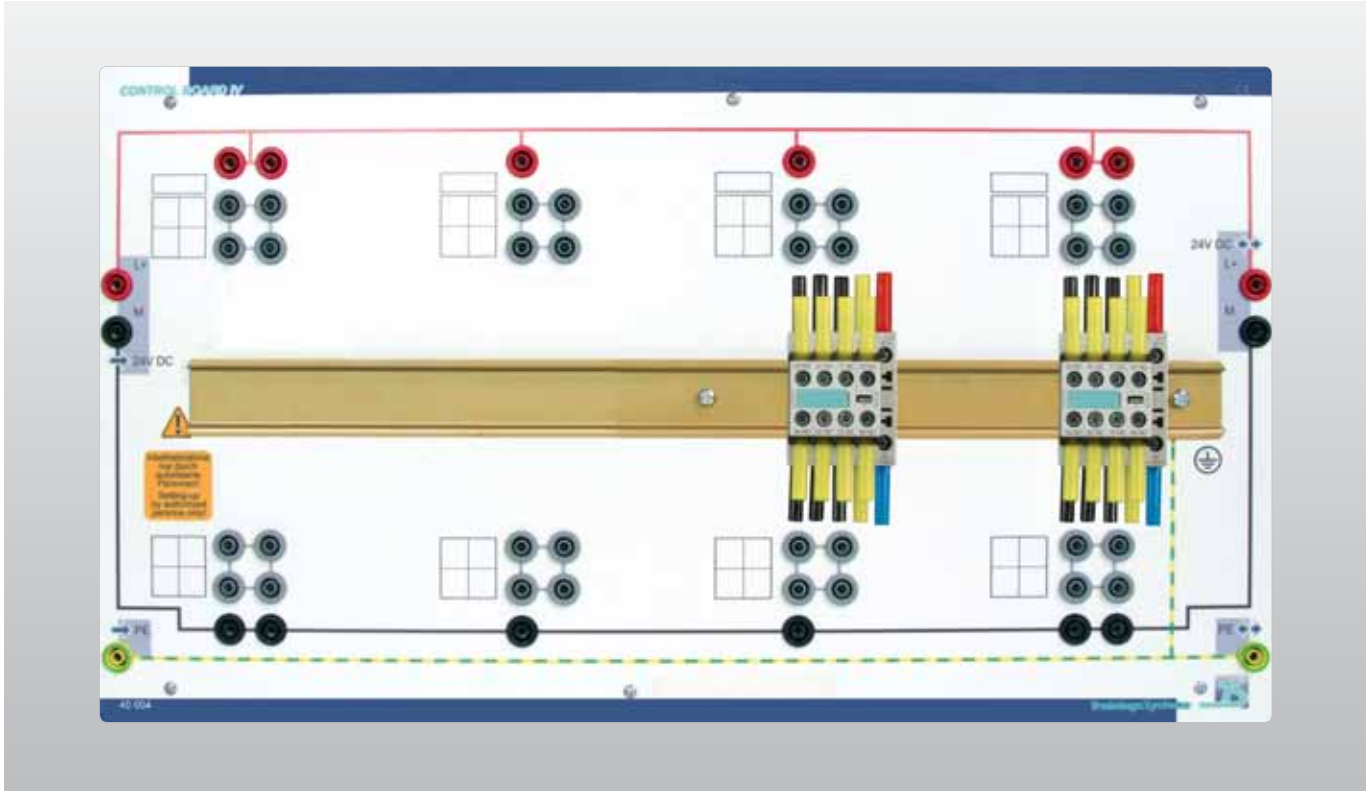
40 074 System Cable for Parameterization Software

RS232 to device interface

40 073 Parameterization software

Fail-safe field bus AS-i

Control Board IV



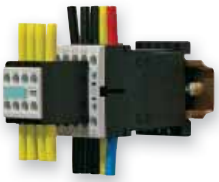
40 004 Control Board IV with 2 Load Contactor Units 40 070

78 139 Signaling Column, 3 elements

40 004 Control Board IV

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

40 070 Safety Load Contactor Unit DC 24 V/3 kW



- Contactor AC-3 3 kW/400 V, coil 24 V DC
- Auxiliary contacts 3NO/2NC
- In- and outputs on 4 mm safety sockets

78 139 Signaling Column, 3 elements

incl. assembly adapter and AS-Interface

Safety Position Switch Board

40 052 Safety Position Switch Board

Learning Objectives:

- Setting up control circuits in the control categories 1- 4
- Installation circuits with control guard
- Redundant setup of safety circuits
- Control guards with interlocking
- Indication of installation states by signal lamps

40 052 Safety Position Switch Board

- 1 safety position switch with interlocking
- 1 safety position switch with separate actuator, catetory 2
- 2 safety position switches with roll lever, category 1
- 2 signal lamps, red/green, 24 V DC
- In- and outputs on 4 mm safety sockets
- Control circuit voltage : 24 V DC
- Rated current: 5 A
- Operating voltage of lamps: 24 V DC

Teachware

Manual

Printed and digital!

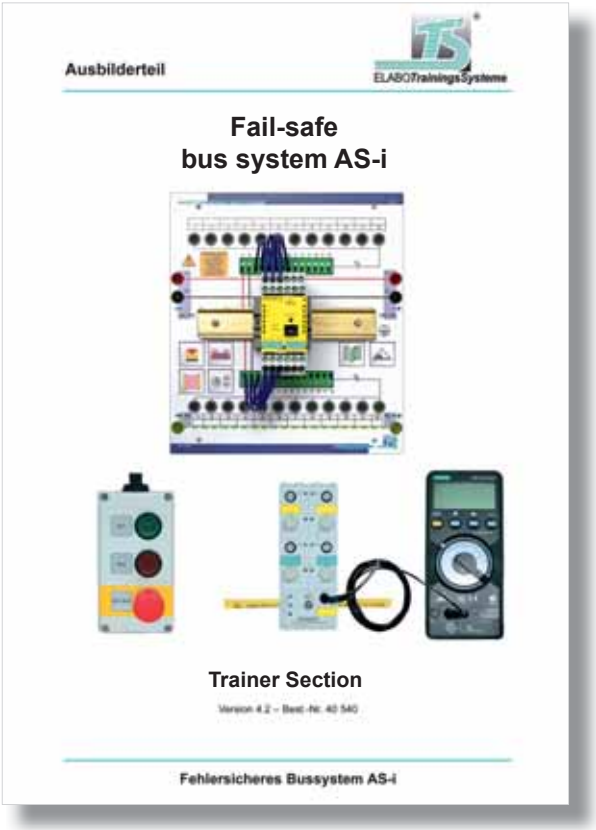
Contents

Introduction: The fail-safe bus system AS-i

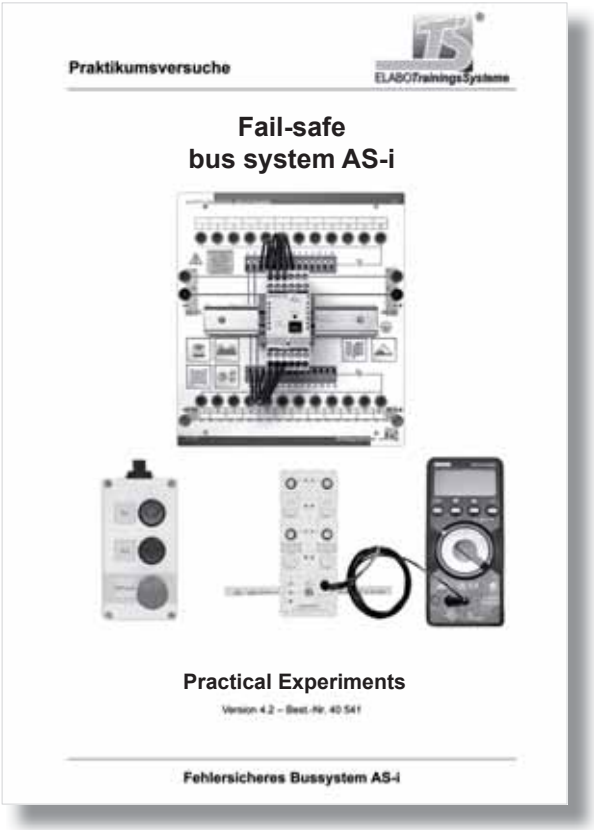
1. Principles of the system
2. Transmission-relevant hardware structure of the bus users
3. Data transfer of the fail-safe slaves
4. Function and operating modes
5. Master evaluation of the data provided by the AS-i fault monitor
6. Display and operating elements
7. Configuration software
8. System components
9. Diagnostics options
10. Evaluation of the configured components (time and function)
11. Technical data

Applications

Emergency-Stop monitoring / Safety door monitoring / documentation



E40 540CD — *Manual Trainer Section Fail-safe bus system AS-i*



E40 541CD — *Manual Practical Experiments Fail-safe bus system AS-i*

Set of transparencies

E40 542CD Set of transparencies Fail-safe bus system AS-i

- The principle I
- The principle II
- The concept
- Principle structure I
- Signification of the master call and slave response bits
- Principle structure II
- Principle structure III
- Principle structure IV
- Safety monitor I
- Safety monitor II
- Display and operating elements
- Terminal array / block diagram
- Setup with external supply
- Configuration software
- Evaluation process of the configured components
- System components
- Online diagnosis
- Benefit of using a fail-safe AS-i bus system
- Emergency-stop monitoring, control category 4
- Safety door monitoring, control category 2
- Safety door monitoring, control category 4
- Functional expansion
- Technical data

Set of transparencies

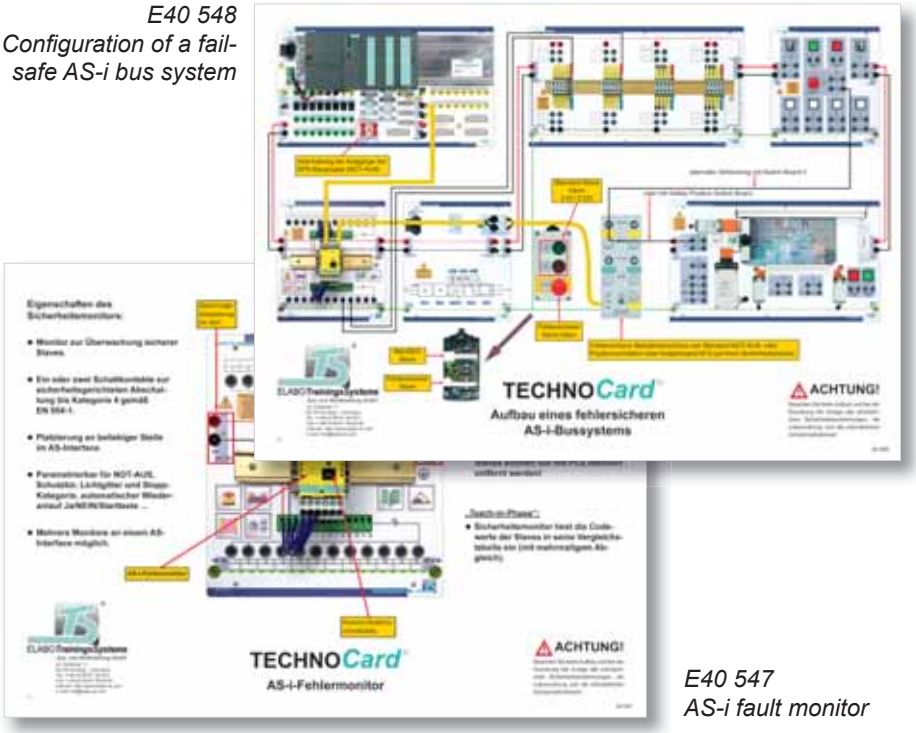
- E40 503CD Set of transparencies Safety technology – General Information

E40 503CD Set of transparencies Safety technology – General Information

TechnoCards

- E40 546 Set of TechnoCards, consisting of

E40 548 Configuration of a fail-safe AS-i bus system



E40 547 AS-i fault monitor

Information and consultation

We will support you ...

- **in all questions concerning the equipment for vocational and higher technical education**
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- **over the telephone**

Contact

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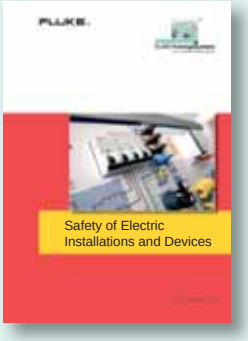

☐ *Safety of Electric Installations and Devices*

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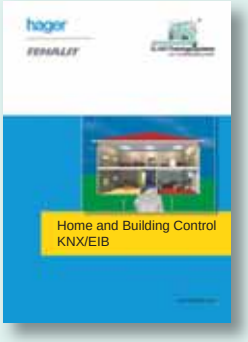
☐ *Practical Training in Sensor Technology*

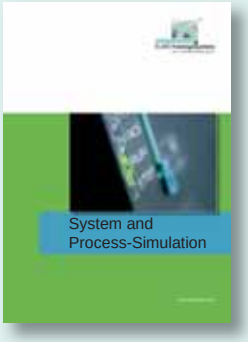
☐ *Control Technology*

☐ *Drive Technology*



☐ *Home and Building Control KNX/EIB*

☐ *Microcontroller Technology*



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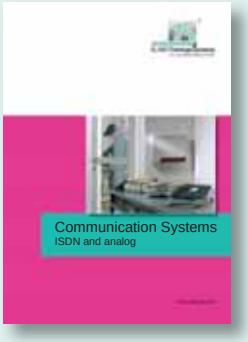
☐ *Trainer Packages The solution*

☐ *Gear Unit Technology*



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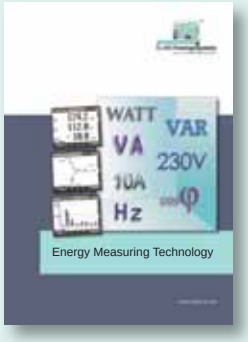
☐ *Operator Control and Monitoring*

☐ *Electrical Engineering Electronics / Digital Technology*



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Subject to technical modifications and further developments 09/2009.

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