

WUEKIRO

Training & Didactic Systems

General Catalog WA2E



WUEKIRO

Training & Didactic Systems

Catalog

WA2E

Equipment for Training and Research
for
Vocational Education Schools
Technical Schools
Technical Colleges
Technical Universities

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➤ PREFACE

The Catalog WA2E contains details of electric equipment for vocational training schools, technical schools, colleges and universities as well as for industrial laboratories and research centers.

Besides the equipment listed in this catalog the WUEKRO production program contains a wide series of further equipment which is used in training establishments. Larger power supply systems are built almost exclusively as special versions to suit particular requirements.

This catalog WA2E is divided in different parts describing the different technologies and the resp. training systems concerned.

Each section can be send as a single catalog on your request.

The large selection of the WUEKRO instruction modules that this system provides means that all the circuits, controls and fundamental experiments common in electrical engineering, electronics, pneumatic control as well as in refrigeration and air-conditioning engineering can be set up quickly and easily and tested in actual practice.

The modules and module sets of this catalog cover the whole range of the WUEKRO Training & Didactic Systems in all technical fields.

The application range covers vocational training centers, technical colleges and technical universities, as well as technical training centers in industry.

The WUEKRO Instruction Systems contain all the necessary standard hardware and training software.

Hardware

- Instruction modules
- Rotating machines
- Training and demonstration models
- Compact training units
- Bench racking and power supply units
- Miscellaneous accessories

Teachware:

- Instruction manuals
- Learning units
- CBT's
(Computer Based Training)

Schweinfurt, Januar 2013

➤ Instruction Modules

Instruction Modules

The design of the instruction modules covers different units such as experimental panels, plug-in modules and plug-in components.

Experimental panels

These are made of plastic and are of pearl-white color similar to RAL 9002. They are 297 mm high and approximately 5 mm thick. The width of the panels is 130 mm or wider by a whole number multiple of 65 mm. The height of 297 mm corresponds to the German paper format DIN A4. Hoods are fitted to the rear sides of the panels with some few exceptions due to the design. The items of equipment are either fitted in the panels or mounted on the rear side. the electrical connections are brought out to 4-mm-safety-sockets or 2-mm-socket-outlets on the front of the panels. Standardized mimic diagrams, unit symbols and inscriptions are marked indelibly on the front of the panels. Switches, screw-in fuses, measuring instruments, etc., can be operated and read off the front of the panels. socket outlets are also fitted on the front to provide additional connections for plug-in modules.

Plug in modules

These contain interconnected assemblies of active or passive components and are mainly used in electronics. They enable complete experimental set-ups to be established. On the underside of the modules there are 4mm plugs arranged on a 19mm grid pattern which are always employed for mechanical attachment. In many cases the electrical power-supply-connections are also brought to these plugs which are then gold-plated. In addition, many modules have 2mm sockets in the top, or also at the sides, for further electrical connections. The casings of the small modules are mainly made of shatterproof plastic which is transparent on the side parts. The non-transparent parts of the casing are black, apart from a few exceptions. The equipment and circuit symbols on the upper side are white.

Plug-in components

It must be possible to change individual resistances and capacitors etc., used primarily in electronics, quickly and easily. These components are therefore fitted in unbreakable transparent plastic housing and connected to external gold-plated 4-mm-plugs.

➤ Experimental Units

We distinguish

- Training and demonstration models
- Compact training units
- Bench units

Training and demonstration models

“Models” are self-contained training units intended for a specific task. The smaller models are set up on benches or are wall-mounted whereas the larger ones stand on the floor and can take up whole rooms.

Compact training units

“Compact training units”, also called “trainers” or “experimenters”, usually come in the form of a carrying case with a handle. When in use they are set up on a bench with the cover removed. Often the cover contains sets of pluggable components for specific applications.

Bench units

“Bench units” are training units which are replaced on benches when used. These units have complete functional systems in sheet steel housings with carry handles, PVC-feet, ventilation slots and a supply connection cable with a SCHUKO or CEKON plug.

➤ Bench racking and power supply units

For working with instruction modules bench racking and power supply devices are needed. The experimental panels are designed to be inserted into frames or into racks with two or three levels which can be mounted on experimental benches or power supply back uprights.

Experimental benches, the related back uprights and power supply units are not described in this catalog. Information on request. Individual experimental frames, are shown in section 10 of this catalog. Most plug-in instruction modules require assembly panels fitted with plug sockets only in a specific arrangement. Some of the sockets will be interconnected.

Universal assembly panels and the associated portable power supply units as listed in section 10 are used most commonly. References to suitable power supplies will be found in the descriptions of the various kits of equipment in the different sections of this catalog.

Miscellaneous accessories

When special accessories are needed for specific fields, they are listed individually in the appropriate chapters.

Normal accessories such as connecting leads, instruction manuals, measuring instrument, etc. are mentioned as part of the kits.

Individual measuring instruments for experimental purposes are listed in section 10 of this catalog.

Experimental manuals and learning units

The appropriate experimental instructions are supplied with each kit of equipment. For instruction modules not contained in an assembly kit, the experimental manuals can be ordered separately.

In addition, there are learning units available for training workshops. These are designed so that trainee courses and examinations in accordance with the requirements of the German professional training standards can be conducted without further preparation. Ask for more information about learning units if necessary.

Experimental manuals are listed in section 18 of this catalog.

Protection against touching live parts

The instruction module system embodies the following measures offering a high degree of protection against touching live parts when working with electric power within the terms of DIN VDE 0100: All individual items of equipment are placed either in or on the rear of plastic panels.

All experimental panels have rear covers. Access to all of the terminals of the equipment can be gained only from the front through insulated sockets. The 4mm sockets are of the safety type unless they are used exclusively in electronic circuits, in which case the low voltages are not dangerous.

Any unfilled stations remaining in experimental frames should always be plugged with dummy modules or unwanted modules. The experimental setup should always be isolated before any changes are made to the circuitry.

The training systems listed in this catalog can be used in all the fields of training, advanced training as well as training in colleges and universities and can be combined due to the resp. teaching aim.

Therefore our modularized training system enables a specific training with a minimum of investment.

Training & Didactic Systems

Fundamentals of Electrical Engineering

Catalog

WA2E/01



➤ Our Services

- Development and production of didactic training systems
- Teachware and documentation
- Project engineering of complete lab's incl. furnitures and lab equipment
- Quotations on customers demand
- Installation, commissioning and training at site

➤ Our Customers

- Vocational training schools, technical schools, colleges and universities...
- Industrial laboratories for vocational education and higher education

➤ Fields of Technology

- Fundamentals of electrical engineering
- Fundamentals of electronics
- Closed loop control technology
- Automation engineering
- Electrical machines / drive control
- Power electronics
- Building management systems
- Protection schemes to VDE 0100
- Radio- and TV technology
- Air conditioning and refrigeration
- Photovoltaic
- Communication technology
- Measuring systems, power supplies, accessories
- Experimental manuals, documentation

For further information please contact:

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➤ Introduction

This range covers experimental panels, accessories and complete kits.

Demonstrations and experiments can be carried out in

- Fundamentals of electrical engineering
- Wiring circuits
- Contactor Controls

The experimental panels are designed for insertion into experimental frames.

Dimensions of the panels

Height 297mm

Width 130mm or wider by whole number multiples of 65mm.

The instruction modules in the following selection table permit experiments to be carried out in any desired arrangement. We recommend that the assembly kits be used if the experiments are to be conducted in accordance with our experimental manuals.

➤ **Measuring Instrument Moduls**



Moving-coil ammeter

- 0,6 DC
- 1,5A DC
- 6A DC
- 15A DC

Order-No. W3411-4A

Order-No. W3411-4B

Order-No. W3411-4C

Order-No. W3411-4D



Moving-coil voltmeter

- 25V DC
- 100V DC
- 150V DC
- 250V DC
- 500V DC

Order-No. W3414-4D

Order-No. W3414-4C

Order-No. W3414-4B

Order-No. W3414-4A

Order-No. W3414-4E



Movin-iron ammeter

- 4A
- 6A
- 15A
- 25A
- 40A

Order-No. W3417-4C

Order-No. W3417-4D

Order-No. W3417-4E

Order-No. W3417-4F

Order-No. W3417-4G

➤ **Measuring Instrument Moduls**



**Movin-iron ammeter
for c.t. connection**

5/1A

Order-No. W3417-4A

25/1A

Order-No. W3417-4H

40/1A

Order-No. W3417-4J



Moving-iron voltmeter

60V

Order-No. W3422-4C

250V

Order-No. W3422-4B

400V

Order-No. W3422-4A

600V

Order-No. W3422-4E

400/100V for c.t. connection

Order-No. W3422-4D



Current transformer

Rated saturation factor $n < 5$

Frequency 40...60Hz

Power 5VA

10/5A

Order-No. W3425-4A

5/1A

Order-No. W3425-4B

10/1A

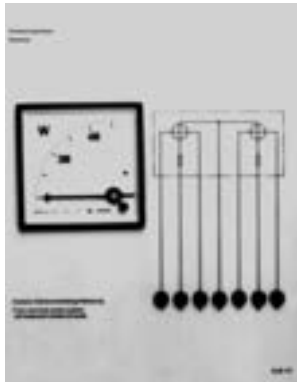
Order-No. W3425-4G

Voltage transformer

400 / 100V AC

Order-No. W3427-4A

➤ **Measuring Instrument Moduls**



W3428-4C

Wattmeter

for 3-phase systems
with balanced loads
5A, 400V AC, 0...4KW

Order-No. W3428-4A

for 3-phase systems
with balanced/unbalanced loads
5A, 400V AC, 0...4KW

Order-No. W3428-4B

for 3-phase systems
with balanced/unbalanced loads
5A, 400V AC, 0...2KW

Order-No. W3428-4F

for 3-phase systems
with balanced/unbalanced loads
1A, 400V AC, 0...0,5KW

Order-No. W3428-4C

for single-phase AC
5A, 230V AC, 0...2kW

Order-No. W3428-4D

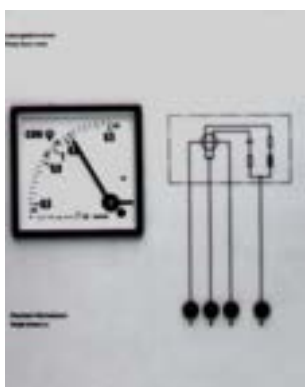
kVar meter

for 3-phase systems
with balanced/unbalanced loads
5A, 400V AC, 0...4kvar

Order-No. W3433-4A

for 3-phase systems
with balanced/unbalanced loads
1A, 400V AC, 0...1kvar

Order-No. W3433-4B



W3435-4A

Power factor meter

for 3-phase systems
with balanced/unbalanced loads
400V AC, 5A

Order-No. W3434-4A

for 3-phase systems
with balanced/unbalanced loads
400V AC, 1A

Order-No. W3434-4B

for single-phase AC
230V AC, 1A

Order-No. W3435-4A

➤ Measuring Instrument Moduls

Frequency meter

47...53Hz, 230V AC

Order-No. W3436-4A

Double- frequency meter

2 x 45...55Hz, 230V AC

Order-No. W3437-4A

2 x 45...55Hz, 400V AC

Order-No. W3452-4A



double voltmeter

2 x 500V AC

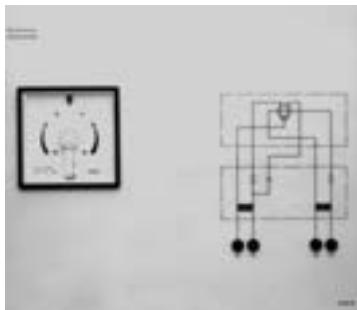
Order-No. W3438-4A

Phase sequency indicator

Voltage 150...500V AC,
Frequency 40...400Hz

Order-No. W3443-4A

W3438-4A



Synchroscope

400V AC

Order-No. W3440-4A

Single-phase kWh meter

230V AC, 10A

Order-No. W3441-4A

W3440-4A

Three-phase kWh meter

400V AC, 10A

Order-No. W3442-4A

➤ **Fundamentals and Wiring Circuits**



W3211-4A



W3212-4A

On/Off switch

single-pole, 250V AC, 10A

Order-No. W3211-4A

On/Off switch

two-pole, 250V AC, 10A

Order-No. W3212-4A

On/Off switch

with orientation glow lamp
1polig, 250V AC, 10A

Order-No. W3211-4B



W3213-4A



W3214-4A

On/Off switch

with pilot lamp,
1polig, 250V AC, 10A

Order-No. W3211-4C

Two-circuit switch

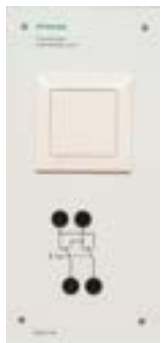
250V AC, 10A

Order-No. W3213-4A

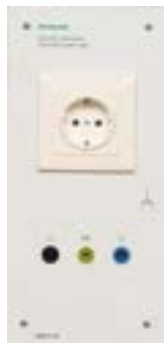
Two-way switch

250V AC, 10A

Order-No. W3214-4A



W3215-4A



W3216-4A

Two-way switch

with orientation glow lamp
250V AC, 10A

Order-No. W3214-4B

Intermediate switch

250V AC, 10A

Order-No. W3215-4A

SCHUKO-socket outlet

250V AC, 16A
250V DC, 10A

Order-No. W3216-4A



W3218-4A



W3220-4A

Junction

Order-No. W3220-4A

Light switch

250V AC, 10A

Order-No. W3217-4A

Light switch with glow lamp

250V AC, 10A

Order-No. W3218-4A

➤ **Fundamentals and Wiring Circuits**



W3218-4B

Dimmer for incandescent lamps

or for resistive load
25...600W, 230V AC, 50Hz

Order-No. W3218-4B



W3218-4E

Dimmer / Potentiometer for electronic ballast dimmable

1-10V / 50mA

Order-No. W3218-4E

Fuse

DIAZED DII 25A, complete with cartridge fuses for 4A, 6A and 10A (discontinued line)

Order-No. W3221-4A

Single fuse element NEOZED D01 16A and cartridge fuses and fittings adapters for 4A, 6A and 10A.

Order-No. W3221-4B

Miniature automatic circuit breaker

B10A, 400V AC, single-pole
B6A, 400V AC, single-pole
B16A, 400V AC, single-pole

Order-No. W3222-4A

Order-No. W3222-4B

Order-No. W3222-4C

2 Miniature automatic circuit breakers

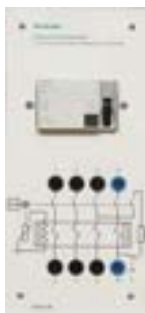
each 10A, 400V AC, single-pole

Order-No. W3223-4A

Miniature automatic circuit breaker with auxiliary switch

1NO + 1NC contact, two-pole, 16A
250V DC, 400V AC

Order-No. W3224-4A



W3225-4B

Current-operated earth-leakage circuit-breaker

25A, $I_{\Delta N} = 500\text{mA}$, 4-pole

Order-No. W3225-4A

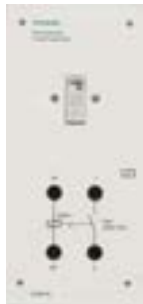
25A, $I_{\Delta N} = 30\text{mA}$, 4-pole

Order-No. W3225-4B

25A, $I_{\Delta N} = 30\text{mA}$, 4-pole

Order-No. W3225-4E

➤ **Fundamentals and Wiring Circuits**



W3226-4A

Current surge relay

operating voltage
230V AC, 50Hz

Order-No. W3226-4A

operating voltage
8V AC, 50Hz

Order-No. W3226-4B

operating voltage
12V AC, 50Hz

Order-No. W3226-4C



W3227-4A



W3228-4A

Automatic staircase lighting control switch

three- and four-wire connection,
230V AC

Order-No. W3227-4A

Priority switch

Order-No. W3227-4B

7-step cooker switch

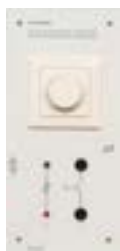
Order-No. W3252-4A

Incandescent lamp socket E27

Order-No. W3228-4A

3 Incandescent lamp socket E27

Order-No. W3228-4B

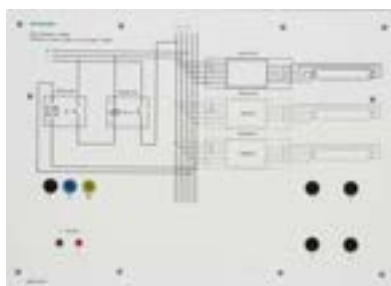


Dimmer for electronic ballast dimmable

Experimental panel with 2mm and 4mm safety-laboratory sockets.
For electronic electronic ballast dimmable for dimming a fluorescent lamp 36W;

1-10V / 50mA
Dimensions (WxHxD)
130x297x65 mm
Weight appr. 1,0kg

Order-No. W3218-4E



Electronic control gear unit dimmable

Experimental panel with 2mm and 4mm safety laboratory sockets.
Technical data: 1x36W

Dimensions (WxHxD)
493 x 297 x 65 mm
Weight approx. 2,0 kg

Order-No. W3218-4F

➤ Fundamentals and Wiring Circuits



W3230-4E



W3230-4B

Fluorescent lamp holder

left

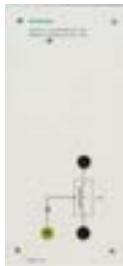
Order-No. W3230-4A

right

Order-No. W3230-4B

left, with starter

Order-No. W3230-4E



Reactor 18W

Order-No. W3231-4A



Reactor 36W

Order-No. W3233-4A

Capacitor



W3235-4C



W3235-4K

3,4 μ F, 420V AC (for 1x18W tandem circuit, 1x36W, series con.)

Order-No. W3235-4C

4,5 μ F, 230V AC (for 1x18W, 2x18W tandem circuit)

Order-No. W3235-4K

7 μ F, 230V AC (for 1x58W)

Order-No. W3235-4E

9 μ F, 230V AC (for 2x36W tandem circuit)

Order-No. W3235-4F

Wire-wound resistors

1m WM 50 0,1mm²

0,5m WM 50 0,1mm²

1m WM 50 0,2mm²

1m Cu 0,1mm²

Order-No. W3242-4C

Wire-wound resistors

2 x 2m Cu 0,5mm \varnothing

2 x 2m Fe 0,5mm \varnothing

2 x 2m Konstantan 0,5mm \varnothing

Order-No. W3242-4B

➤ **Fundamentals and Wiring Circuits**



W3251-4D



W3251-4B

Bell ringing transformer

230V AC,
2V / 6V / 8V, 1A

Order-No. W3251-4A

Door opener 8V

Order-No. W3251-4E

Buzzer 8V

Order-No. W3251-4D

Load simulator

with incandescent lamp

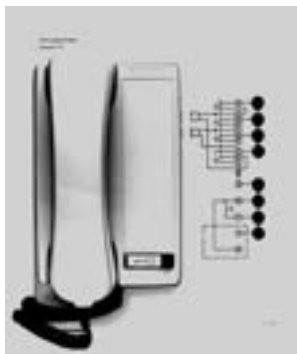
Order-No. W3253-4C

Cooker load simulator

Order-No. W3253-4B

Entrance call point

Order-No. W3251-4L



W3251-4M

Push button

with door opener symbol

Order-No. W3251-4C

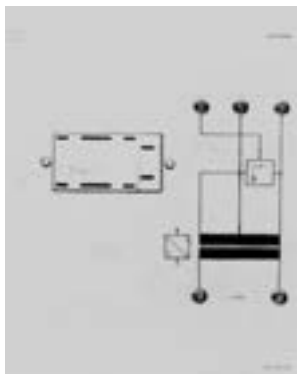
3 bell push buttons

Order-No. W3251-4B

Power supply

Input 230V AC, 50/60Hz
Output 8V, 1A DC
8V, 1A AC

Order-No. W3251-4K



W3251-4K

House call station

with push button and buzzer

Order-No. W3251-4M

➤ Fundamentals of Electrical Engineering

General

The assembly kits are equipped with experimental panels and additional components, as well as laboratory connection leads and the resp. experimental manuals. Assembly kits are available for different sections of electrical engineering.

The experimental panels are designed for insertion into experimental frames. The instruction modules are equipped with 2mm sockets or 4mm safety sockets. The experimental boxes can be inserted into patchboards.

Dimensions of the experimental panels
(H x W) 297x130mm
(or wider by whole number multiples of 65mm)

Assembly kit "Fundamentals of Electrical Engineering"

Order-No. W3202-4A

The following experiments can be carried out

- The electrical circuit, current and voltage measurement
- Ohm's law
- Conductor resistances
- Temperature dependence of resistances
- Series connection of resistances
- Parallel connection of resistances
- Group connection of resistances
- Voltage loss in electrical lines
- Electrical power
- Electrical work
- 7-step cooker switch
- Unloaded voltage divider
- Thermal efficiency
- Inductance with DC and AC voltages
- Series connection of resistive and inductive reactance
- Circuits with capacitors
- Series connection of resistive and capacitive reactance
- Active and reactive power
- Series and parallel resonance
- Three-phase star connection
- Three-phase delta connection
- Three-phase power
- Single-phase transformer, transformation ratio
- Single-phase transformer, no-load current, short-circuit current and short-circuit voltage
- Single-phase transformer, efficiency

➤ **Fundamentals and Wiring Circuits**

Assembly kit "Fundamentals of Electrical Engineering"

Equipment of the assembly kit

Experimental panels	Qty.	Order-No.	see page
3 Fuses elements	1	W3311-4B	20
On/Off switch, 3-pole	1	W3313-4A	22
3 Incandescent lamp holders, E27	1	W3228-4B	11
3 Resistors	1	W3344-4B	22
Four-way switch	1	W3343-4B	22
Two-circuit switch	1	W3213-4A	9
Two-way switch	2	W3214-4A	9
7-step cooker switch	1	W3252-4A	11
SCHUKO socket outlet with earthing contact	1	W3216-4A	9
Wire-wound resistors	1	W3242-4B	12
Potentiometer	1	W3347-4A	22
Potentiometer	1	W3347-4C	22
Bell-ringing transformer	1	W3251-4A	13
Pilot light	1	W3337-4C	21
Capacitor	2	W3235-4D	12
Capacitor	1	W3235-4E	12
Reactor, 40W	1	W3233-4A	12
Single-phase kWh meter	1	W3441-4A	8
On/Off switch	2	W3211-4A	9
Star-delta switch, 3-pole	1	W3315-4A	22
Instruction manual	1	W3010-1A	

Further Components (included in the kit)	Further required equipment (not included in the kit)
W3202-4Z consisting of: 1 Carbon filament lamp 7 Incandescent lamp 1 Hotplate with 3-step switch 1 Stop watch 1 Immersion heater 1 Fast boiling pot 1 Thermometer 1 coil with 400 windings 1 coil with 800 windings 1 coil with 1600 windings 1 U core with yoke	4 Multimeter 1 Power meter 1 Single-knob measuring bridge 20 safety connecting leads 0,5m 10 safety connecting leads 1m

➤ **Wiring Circuits, Basic Equipment**

Assembly kit " Wiring Circuits, Basic Equipment "

Order-No. W3201-4B

**The following experiments
can be carried out**

Opening a circuit with a single-pole switch

Opening a circuit with a single-pole switch and SCHUKO socket outlet with earthing contact

Opening a circuit with a two-pole switch

Series circuit

Two-way circuit

Intermediate circuit

Circuit with current surge relay

Circuits with automatic staircase lighting control switch

- Opening a fluorescent lamp circuit

- Opening a circuit with two fluorescent lamp in lead-lag connection

- Opening a circuit with two fluorescent lamps in tandem connection

- Brightness control of incandescent lamps

- Brightness control of fluorescent lamps

- Current-operated earth-leakage protection

- Conventional protective multiple earthing

- Modern protective multiple earthing

➤ **Wiring Circuits, Basic Equipment**

Assembly kit " Wiring Circuits, Basic Equipment "

Order-No. W3201-4B

Equipment of the assembly kit

Experimental panels	Qty.	Order-No.	see page
On/Off switch, 1-pole	1	W3211-4A	9
On/Off switch, 2-pole	1	W3212-4A	9
Two-circuit switch	1	W3213-4A	9
Two-way switch	2	W3214-4A	9
Intermediate switch	1	W3215-4A	9
SCHUKO outlet with earthing contact	1	W3216-4A	9
Light switch	2	W3217-4A	9
Light switch with glow lamp	1	W3218-4A	9
Dimmer for incandescent lamp	1	W3218-4B	9
Junction box	4	W3220-4A	9
1 Fuse element, 25A	1	W3221-4B	10
Current-operated earth-leakage circuit-breaker	1	W3225-4B	10
Current surge relay	1	W3226-4A	11
Automatic staircase lighting control switch	1	W3227-4A	11
Incandescent lamp socket	3	W3228-4A	11
Fluorescent lamp holder, right	2	W3230-4B	12
Fluorescent lamp holder, left, with starter	2	W3230-4E	12
Reactor, 36W	1	W3233-4A	12
Reactor, 18W	2	W3231-4A	12
Dimmer for electronic ballast dimmable	1	W3218-4E	10
Electronic ballast dimmable 1x36W	1	W3218-4F	10
Fluorescent lamp holder, left, for dimmer circ.	1	W3230-4C	12
Fluorescent lamp holder, right, for dimmer circ.	1	W3230-4D	12
Capacitor, 4,5 µF	1	W3235-4D	12
Capacitor, 3,6 µF	1	W3235-4C	12
Load simulator, with incandescent lamp	1	W3253-4C	13
Potentiometer	1	W3347-4D	22
Experimental manual	1	W3010-0B	

Further Components (included in the kit)	Further required equipment (not included in the kit)
W3201-4Z consisting of: 3 Incandescent lamp E27; 25W 1 Incandescent lamp E27; 100W 1 Fluorescent lamp 36W 2 Fluorescent lamp 18W 1 Stop watch	1 Multimeter 20 Safety-connecting leads 0,5m 15 Safety-connecting leads 1m

➤ **Bell Ringing and Entrance Call Stations**

Supplementary Kit " Bell Ringing and Entrance Call Stations " **Order-No. W3201-4C**

The following experiments can be carried out

- Bell with door opener (1 circuit)
- Bell with door opener (3 circuits)
- 8 V current surge circuit
- Entrance call station with 2 house call stations and door opener

Equipment of supplementary kit

Experimental panels	Qty.	Order-No.	see page
current surge relay	1	W3226-4B	11
Lighting transformer	1	W3251-4A	13
Buzzer	3	W3251-4D	13
Door opener	1	W3251-4E	13
Push button with door opener symbol	3	W3251-4C	13
3 bell push buttons	1	W3251-4B	13
Entrance call point	1	W3251-4L	13
House call staion	2	W3251-4M	13
Power supply	1	W3251-4K	13

➤ **Contactor Controls**

Assembly kit " Contactor Controls "

Order-No. W3201-4D

The following experiments can be carried out

- Trouble-shooting with contactor controls
- Switch-on with contactor
- Switch-on with contactor, trouble shooting
- Contactor control with current surge switch
- Trouble-shooting with contactor controls
- Switch-on with contactor
- Switch-on with contactor, trouble shooting
- Contactor control with current surge switch
- Making up control circuits
- Delayed switch-on and switch-off
- Flashing circuit
- Alarm system
- Traffic light control

Assembly kit "Contactor Controls"

Experimental panels	Qty.	Order-No.	see page
3 Fuses elements	1	W3311-4B	20
Contactor, 3-pole	4	W3321-4A	20
Overcurrent relay	1	W3330-4F	20
Time relay, thermally delayed	2	W3331-4A	20
2 push button switches	2	W3334-4B	21
3 push button switches	1	W3334-4C	21
2 pilot lamps	1	W3337-4B	21
2 limit switches	1	W3340-4B	21
Two-circuit double-interruption switch	1	W3342-4B	22
On/Off switch, 2-pole	1	W3341-4B	22
1 fuse element	1	W3221-4B	10
Current surge relay	1	W3226-4A	11
3-phase asynchronous motor	1	W3365-2A	
Motor shaft protection	1		
Experimental manual	1	W3010-4B	
Further Components			
(not included in the kit)			
25	Safety-connecting leads different lengths and colors		

For further experimental panels, switching gear for control circuits as well as assembly kits "Electrical Machines" we refer to our detailed catalog "Electrical Machines" WA1E/05...

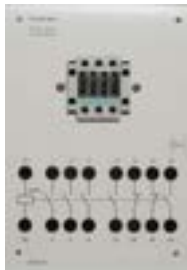
➤ Control Engineering

W3311-4A

3 Fuses elements
with DIAZED cartridges
for 4A, 6A, 10A
Voltage 3 AC 400V/250V DC
(discontinued line)

Order-No. W3311-4A**3 Fuse Elements NEOZED D01**

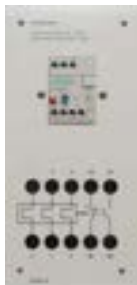
with 4mm safety lab sockets.
With a triple NEOZED D01 fuse
base, cartridge fuses and fittings
adapters for 4A, 6A and 10A.

Order-No. W3311-4B

W3321-4A

Contactor, 3-pole

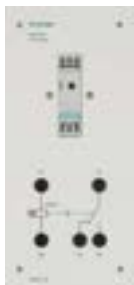
with auxiliary contacts 2NO+2NC
operating voltage
1 AC 230V; 50/60Hz
Voltage 500V AC; Current 16A

Order-No. W3321-4A

W3330-4F

Overcurrent relay

thermally delayed, with auxiliary
switch 1NO, 1NC
setting range 0,4A – 0,63A

Order-No. W3330-4F

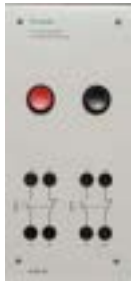
W3331-4A

Time relay

1 changeover contact, delayed
pickup,
operating voltage
1 AC 230V; 50/60Hz
Voltage 230V AC
Current 4A
setting range 1,5 to 30s

Order-No. W3331-4A

➤ **Control Engineering**

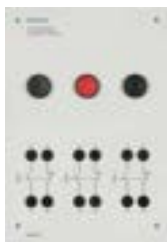


W3334-4B

2 push button switches

"ON" black, with 1NO+1NC,
Voltage 1 AC 500V
Current 10A
"OFF" red with 1NO+1NC,
Voltage 500V AC
Current 10A

Order-No. W3334-4B



W3334-4C

3 push button switches

2x black, 1x red, with each 1NO +
1NC,
Voltage 500V AC
Current 10A

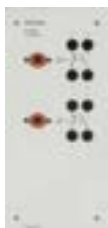
Order-No. W3334-4C



2 pilot lights

with 2 Incandescent
lamps 230V
1 red and 1 green

Order-No. W3337-4B



pilot light

with 1 incandescent lamp 6V, 2W
colour white

Order-No. W3337-4C

W3340-4B

2 limit switch

each 1 NC,
Voltage 400V AC
Current 16A

Order-No. W3340-4B

➤ **Control Engineering**



W3341-4B

On/Off switch, 2-pole

2 pole
 Switch positions 0 - I - 0 - I
 Voltage
 3 AC 400V/220V DC
 Current 16A

Order-No. W3341-4B

Two-circuit double interruption switch

2 pole, switch positions 0 - I - 0 - II
 Voltage 400V AC/230V DC
 Current 16A

Order-No. W3342-4B



W3315-4A

On/Off switch, 3-pole

Voltage 3 AC 500 V
 Current 16 A

Order-No. W3313-4A

Star-Delta switch, 3-pole

Voltage 3 AC 500 V
 Current 16 A

Order-No. W3315-4A

3 Resistors

1 x 100 Ω/1A
 1 x 330 Ω/0,6A
 1 x 1000 Ω/0,3A

Order-No. W3344-4B



W3347-4D

Four-way switch, 2-pole

2 pole, switch positions I-II-III-IV
 Voltage 400V AC / 230V DC
 Current 16A

Order-No. W3343-4B

Potentiometer

160Ω / 1,5A

Order-No. W3347-4A

470Ω / 0,4A

Order-No. W3347-4C

6,8 - 16,8kΩ, 30mA

Order-No. W3347-4D

➤ **Control Engineering**
Compact-panels

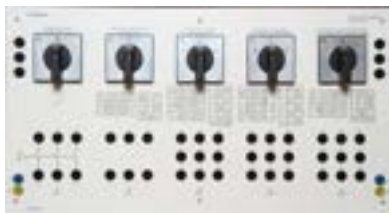
The control-engineering compact panels can either be used hanging in an experimental frame or standing on a table.



The ergonomically formed back-sided hood is made of powderpainted steel sheet with rubber foot gives the console high stability and slim design.



You can combine a smart price and high variability with space saving and practical orientated functionality.



Schalter-Kompakt-Experimentierplatte

Mit 4mm Sicherheitslaborbuchsen, Jeweils rechts und links zusätzlich als Bus-Terminals für die Durchverbindung zu anderen Kompakt-Experimentierplatten für L1, L2, L3, N und PE on the left and right top end also as bus-terminals for drive-through-connection for L1, L2, L3, N and PE to other compact panels.

The following switches are installed:

- 1 On/Off-switch, 3-pin
- 1 Reversing switch 3-pin
- 1 Star-delta switch, 3-pin
- 1 Pole-changing switch 3-pin (Dahlander)
- 1 Pole-changing switch 3-pin (for 2 speeds, 2 separate windings)

With this compact panel you can replace the single experimental panels

- W3313-4A
- W3314-4A
- W3315-4A
- W3317-4A and
- W3318-4A

contact load 16A/500V~ each.

dimensions (WxHxD) approx.
 520x297x110mm
 weight approx.
 4,0kg

Order-No. W3319-4A



Contactor and relay compact panel

with 4mm safety-lab-sockets, on the left and right top end also as bus-terminals for drive-through-connection for L1, L2, L3, N and PE to other compact panels.

The following items are installed:
 1 norm-profilrail for line built-units like contactors, motor protection switches, time relays e.g..
 In total 20 4-folded groups of 4mm safety-lab-sockets for connecting the built-on equipment (not included).

The auxiliary voltage and the neutral conductor can be easily connected through with safety lab jumpers to the next group (not included).

As extension you can get a set of adapters and jumpers seperately.

dimensions (WxHxD) approx.
 520x297x110mm
 weight approx.
 4,0kg

Order-No. W3329-4A



Switch- and control operator panel

with 4mm safety-lab-sockets, on the left and right top end also as bus-terminals for drive-through-connection for L1, L2, L3, N and PE to other compact panels.

The following components are installed:

- 1 emergency stop interlocked mushroom pushbotton with 2 NC
- 3 push-bottons (1x red; 2x black) each 1NO + 1NC
- 1 knob-switch latching with 3 switch positions (I-O-II)
- 5 LED-indicator lamps (1x red, 2x white, 1x yellow, 1x blue)
- 3 mechanical limit switches with 1 make and 1 break contact each

The circuit points are connected to 4mm saffety lab sockets.

The auxiliary voltage and the neutral coductor can be tapped nearby.

With this compact panel you can replace e.g. the single experimental panels
 W3334-4A (-4B, -4C)
 W3334-4N
 W3337-4 X
 W3338-4 X
 W3340-4A (-4B)

dimensions (WxHxD) approx.
 520x297x110mm
 weight approx.
 4,0kg

Order-No. W3339-4A

FAX – response to: +49 (0)9721 - 64691 - 20**Sender:****Receiver:****Company****WUEKIRO GmbH****Dept.**

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E-Mailinfo@wuekro.de**Internet**www.wuekro.de**No. of pages****incl. this page** **Please send the following catalogues to the a.m. address!**

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Remarks:

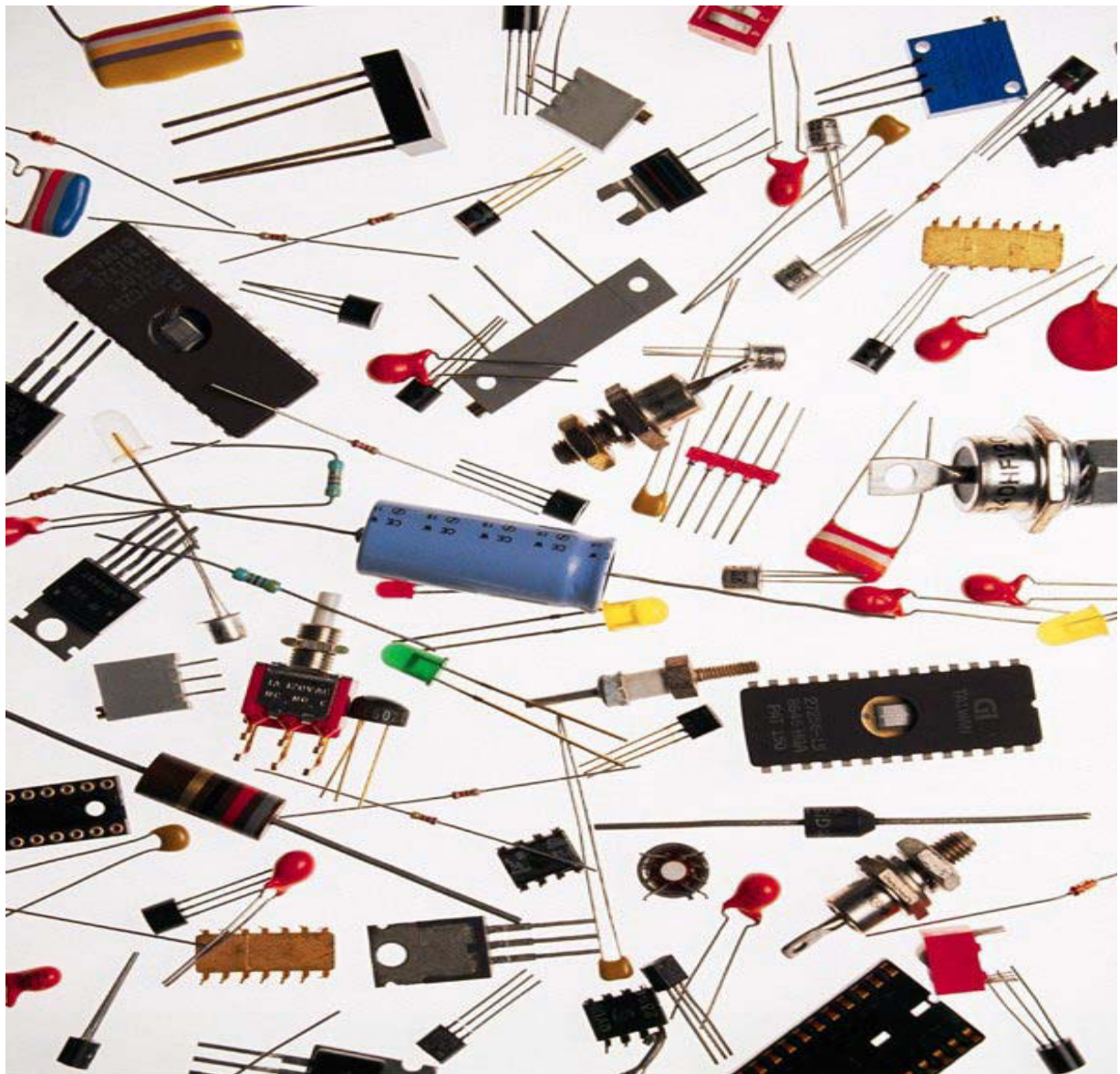


Training & Didactic Systems

Fundamentals of Electronics

Catalog

WA2E/02



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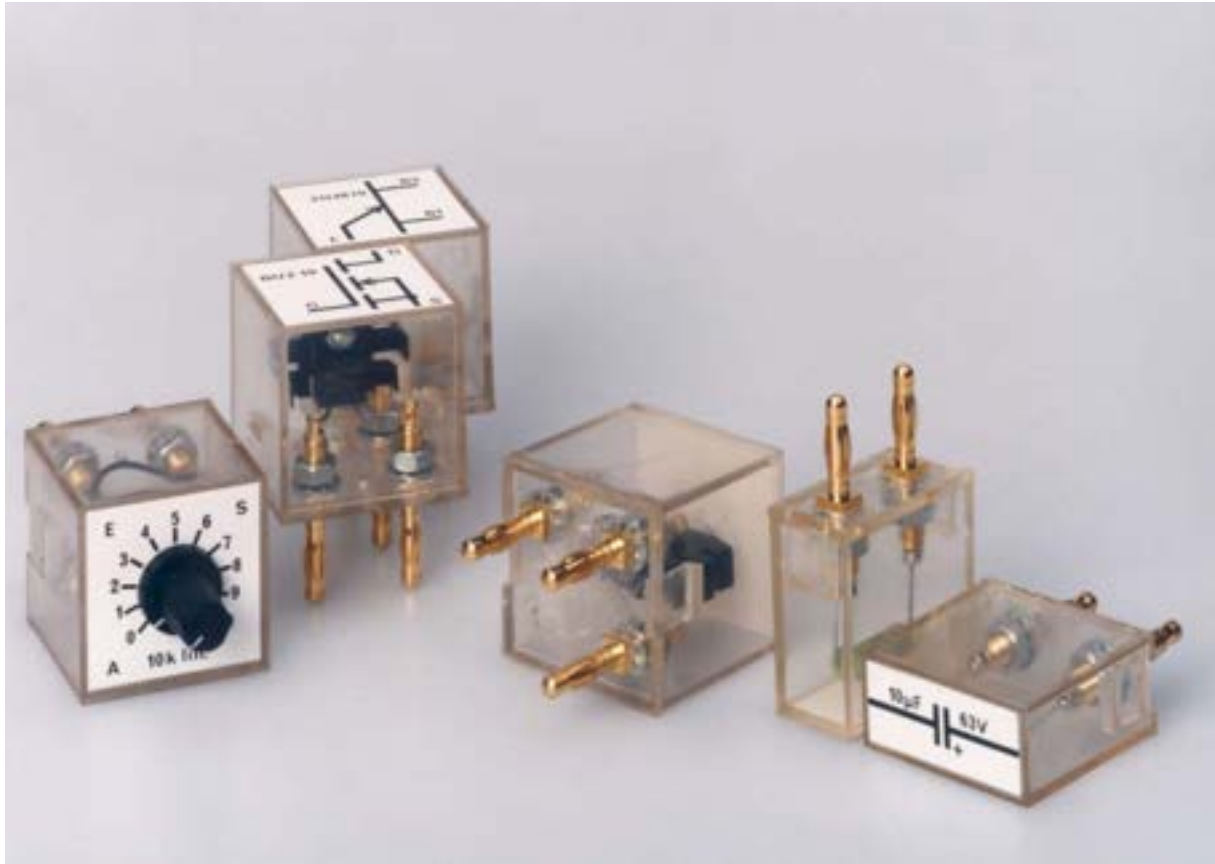
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S30020616P – 12/12

➤ Introduction



Selection of plug-in components

Plug-in components are inserted into universal mounting panels and sometimes – for completing a circuit – also into experimental panels.

Using the instruction modules listed in the following selection tables, experiments can be made in any arrangement desired. If experiments are to be carried out in line with our instructions, we recommend using our assembly kits.

Dimensions of the plug-in components:

For double pin connection

(without plugs)

(WxHxD) 37x35x18 mm

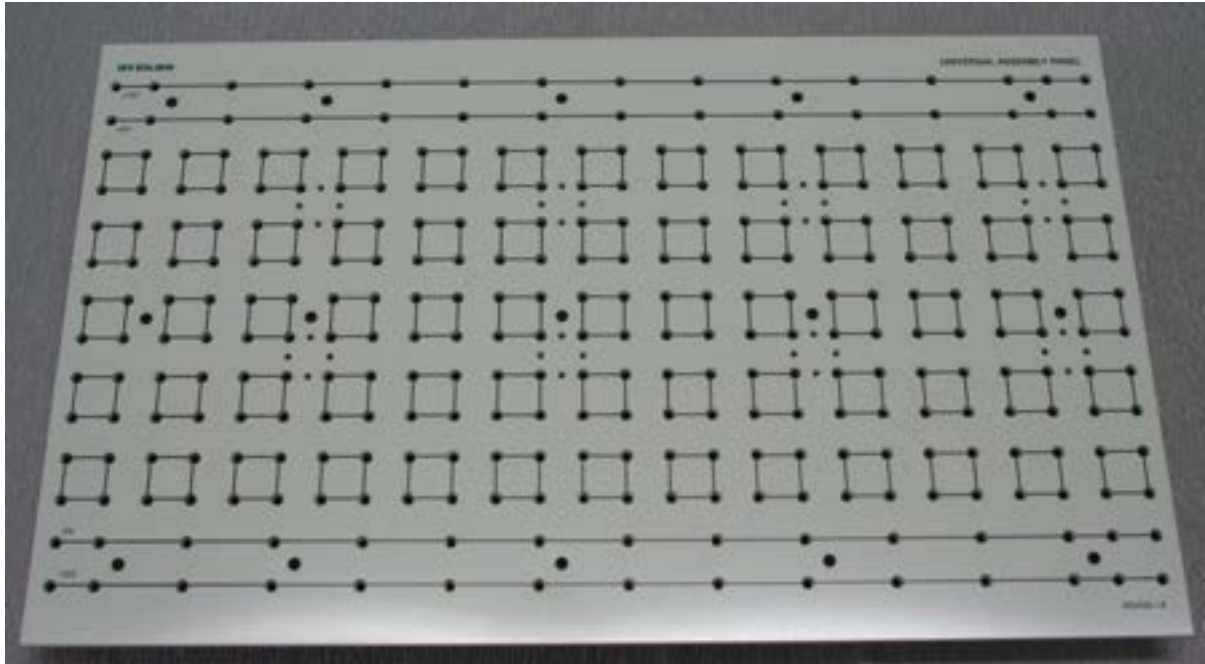
for three- and four pin connection

(without plugs)

(WxHxD) 35x35x35 mm

➤ **Assembly Kit's**

Universal-mounting panel



The universal mounting panel is equipped with 4-mm-sockets arranged in a 19 mm grid (total of 320 sockets). Every four adjacent sockets are interconnected to form a ring. Provision is also made for gold-plated 2-mm-sockets which are used for the power supply of operational amplifiers (8 plug-in stations). When a module is inserted, it is always connected to the supply voltage with the correct polarity.

The two top and the two bottom rows of sockets are through-connected for power supply purposes.

From bottom to top:

- 15 V, ground/0 V, + 5 V, + 15 V.

The universal mounting panel has a cover for protecting the connections on the rear.

For installation on a bench, mounting accessories permitting the panel to be mounted at an angle of 30° is provided on the rear.

Dimensions (WxH) 493 x 297 mm
Weight approx. 4 kg

Order-No. W5430-1A

➤ Assembly kit "Fundamentals of Electrical Engineering"

The following experiments can be carried out

- | | |
|---|---|
| <ul style="list-style-type: none"> The electric circuit Ohm's law Series connection of ohmic resistors Parallel connection of ohmic resistors Group connection of ohmic resistors Voltage dividers Delta-star transformation Voltage sources Electrical energy, electric power, efficiency | <ul style="list-style-type: none"> • Power matching • Capacitors • Series and parallel connection of capacitors • Electromagnetism • Conductor circuit and magnetic circuit • Theory of alternating current • AC resistors • AC circuits • Three-phase current |
|---|---|

Contents of the assembly kit:

Resistors

1	1	Ω
1	10	Ω
2	22	Ω
1	47	Ω
2	82	Ω
1	100	Ω
1	120	Ω
1	150	Ω
2	220	Ω
1	330	Ω
1	470	Ω
1	680	Ω
3	1	kΩ
2	1.5	kΩ
1	2.2	kΩ
1	3.3	kΩ
1	4.7	kΩ

Resistors

1	6.8	kΩ
2	10	kΩ
1	22	kΩ
1	33	kΩ
1	47	kΩ
1	68	kΩ
1	82	kΩ
1	100	kΩ
1	1	MΩ

Capacitors

1	10nF
1	0.1μF
1	0.47μF
1	1μF
1	2.2μF
2	2200μF

Potentiometer

1	100	Ω linear
1	1	kΩ linear
1	10	kΩ linear

Reactors

1	10	mH
1	200	mH

Plug-in modules

1	On/Off switch single pin
1	Selector switch single pin
1	W5101-2D 3-phase current source

Order-No. W5101-8H

Experimental manual "Fundamentals of Electrical Engineering"

Order-No. W3025-7B

Set of connecting leads and plugs, consisting of:

20	connector plugs, 19 mm	10	4-mm connecting leads 25 cm	2	2-mm connecting leads 30 cm
4	adapter plugs	10	4-mm connecting leads 50 cm	4	2-mm connecting leads 15 cm
3	adapter plugs				

Order-No. W3901-8H

Required equipment to carry out the experiments:

1	Universal mounting panel	Alternatively: Universal-Experimenter IV
1	Function Generator	Alternatively: Universal-Experimenter IV
1	Power supply	Alternatively: Universal-Experimenter IV
1	Oscilloscope	i.e. 20 MHz/2-channels
3	Multimeter	

➤ Assembly Kit "Electronic Components and Fundamentals of Analog Technology"

The following experiments can be carried out:

Electronic components

Resistors

- Linear resistors
- Potentiometers
- Non-linear resistors
- PTC resistors
- NTC resistors
- Varistors

Capacitors

- Types of design
- Electrolytic capacitors
- Metallized-paper capacitors
- Plastic-film capacitors
- Ceramic capacitors
- Connections of capacitors to resistors

Semiconductor diodes

- Doping of semiconductors
- Diodes
- Application of diodes

Bipolar transistors

- Input characteristic
- Output characteristic
- Short-circuit forward current transfer
- Reverse voltage transfer ratio characteristic
- Four-quadrant family of characteristics of a transistor

Unipolar transistors

- Transistor in constant-current source

Components with triggering characteristic

- Unijunction transistors
- Thyristors

Optoelectronic components

- Extrinsic photoelectric effect
- Intrinsic photoelectric effect
- Photo-Voltaic effect
- Photo-Resistors
- Photodiodes
- Phototransistors
- Optocouplers

Fundamentals of analog technology

Basic diode connections

- One-way rectifier connection
- Center-tap rectifier connection
- Bridge connection
- Voltage stabilization via Zener diodes for varying input voltage
- Voltage stabilization via Zener diodes for varying load impedance
- Diode as switch
- Voltage doubler connection
- Voltage multiplier connection

Basic transistor connections

- Common-collector connection
- Common-emitter connection
- Darlington connection
- Switching transistor
- Alternating voltage amplifier
- Direct voltage amplifier

Oscillator circuits with transistors

- Wien-bridge generator
- RC phase-shifting generator
- Colpitts oscillator

Operational amplifiers

- Adjusting the balance of an operational amplifier
- Operational amplifiers in power supply
- Operational amplifiers as impedance transformers
- Operational amplifiers as adders
- Operational amplifiers as difference amplifier
- Operational amplifiers as inverting alternating voltage amplifiers
- Operational amplifiers in astable flipflop circuits
- Operational amplifiers in an oscillator circuit

High pass, low pass and band pass

- Integrator
- Differentiator
- High pass
- Band pass

Application of components with triggering characteristic

- Unijunction transistor as pulse generator
- Generalized phase control

Application of optoelectronic components

- Light barrier
- Photo-electric lighting controller

➤ Assembly Kit "Electronic Components and Fundamentals of Analog Technology"

Contents of the kit:

Resistors

1	10	Ω
1	22	Ω
1	47	Ω
2	100	Ω
1	220	Ω
1	330	Ω
1	470	Ω
4	1	kΩ
1	2.2	kΩ
1	3.3	kΩ
1	4.7	kΩ
4	10	kΩ
1	22	kΩ
1	33	kΩ
1	47	kΩ
2	100	kΩ
1	220	kΩ
1	330	kΩ
1	470	kΩ
1		1 MΩ

Capacitors

1	1	nF/400V
1	4.7	nF/400V
2	10	nF/400V
1	47	nF/400V
3	0.1	μF/160V
1	0.47	μF/160V
1	1	μF/100V
2	10	μF/63V
1	100	μF/40V
1	470	μF/25V
4	1000	μF/25V

Potentiometers

1	100	Ω linear
2	1	kΩ linear
2	10	kΩ linear
1	100	kΩ linear

Diodes

4	1N4004
2	1N4148
1	AA 118
1	ZD 4,7V
1	ZPD 5.1V
1	ZPD 9.1V
1	ZF 10V
1	Photodiode
1	LED red
1	LED green

Single layer semi conductors

1	Photo Resistor
1	NTC Resistor
1	PTC Resistor
1	VDR Resistor

Transistors

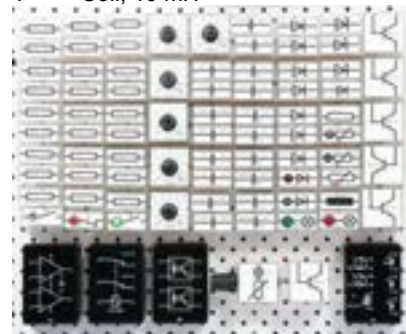
2	BC 141 left
1	BC 161 left
1	BC 237 left
1	BC 237 right
1	BF 240 left
1	Photo Transistor BPY 62

Plug-in modules

1	W5101-6C
	Relay with 2 changeover contacts
1	W5101-4J
	2 OP's UA741
1	W5101-6K
	2 optocouplers
1	W5101-4L
	equipped with:
	1 field-effect transistor
	1 unijunction transistor
	1 thyristor
	1 Zener diode 10V
	2 Si diodes

Further components

1	Lamp, red
1	Lamp, green
1	Lamp, adjustable
1	Toggle switch
1	Pushbutton, 1 NC contact
1	Pushbutton, 1 NO contact
1	Coil, 10 mH



Order-No. W5101-8F

Experimental manual "Electronic Components"

Experimental manual "Fundamentals of Analog Technology"

Order-No. W3025-2B

Order-No. W3025-3B

set of connecting leads and plugs, consisting of:

40	connector plugs, 19-mm	10	4-mm connecting leads 25 cm	10	2mm connecting leads 15 cm
4	connector plugs, 38 mm	10	4-mm connecting leads 50 cm	6	2mm connecting leads 30 cm
10	adapter plugs	2	4mm connecting leads 100 cm		
4	adapter plugs				

Order-No. W3901-8F

Required equipment to carry out the experiments:

1	Universal mounting panel	Alternatively: Universal Experimenter V
1	Function generator	Alternatively: Universal Experimenter V
1	Power supply	Alternatively: Universal Experimenter V
3	Multimeter	
1	Oscilloscope	i.e. 20 MHz/2-Channels

➤ **Assembly Kit "Basic Digital Circuits"**

The following experiments can be carried out:

Basic logic operations

- AND operation
- OR operation
- NOT operation
- NAND operation
- NOR operation
- ExOR operation
- ExNOR operation

Flipflop circuits

- Astable flipflop
- Monostable flipflop
- Bistable flipflop
- Schmitt trigger circuit

Contents of the kit

Plug-in Modules

- 2 W5101-4M
4 toggle switch (L-H input)
- 2 W5101-4N
4 LED displays
- 1 W5101-4W
2 AND/NAND arrays, 2 inputs
- 1 W5101-4V
2 OR/NOR arrays, 2 inputs
- 1 W5101-5C
4 inverter
- 1 W5101-5D
4 EX-OR gates, 2 inputs
- 1 W5101-5B
4 AND/NAND gates, 2 inputs
- 1 W5101-5H
1 D flipflop
- 2 W5101-5K
2 JK flipflop
- 1 W5101-5V
2 digital chopper

Digital flipflops

- RS flipflop
- D flipflop
- Master-slave flipflop
- JK flipflop

Counters and registers

- Asynchronous dual up counters
- Asynchronous dual down counters
- Asynchronous reversible counters
- Parallel dual up counters
- Ring counters
- Registers

Plug-in Modules

- 1 W5101-4P
1 clock-pulse generator
0 - 10 kHz
- 1 W5101-5A
4 OR/NOR gates, 2 inputs
- 1 W5101-4U
1 AND/NAND gates, 4 inputs
- 1 W5101-4T
1 OR/NOR gates, 4 inputs
- 1 W5101-6D
IC socket 14 pin
- 1 W5101-6E
IC socket 16 pin
- 1 W5101-4B
9 resistors
- 1 W5101-4C
9 resistors
- 1 W5101-4J
2 operational amplifier
- 1 W5101-5M
1 binary/decimal up/down counter

Logic algebra

- Boolean algebra
- Karnough map
- Examination of a digital circuit with the logic analyzer

Logic level comparison

- Integrated circuits
- Logic family
- Logic level

Digital applications

- Time and frequency measurement
- Digital measurement of period length

Plug-in Modules

- 1 W5101-5E
2 hexadecimal displays
 - 1 W5101-4F
9 capacitors
 - 1 W5101-4Q
1 monostable flipflop
- Plug-in components**
- 1 Zener diode ZD 4,7V
 - 1 Diode 1N4004
 - 1 Potentiometer, 1kΩ linear



Order-No. W5101-8D

Experimental manual "Basic Digital Circuits"

Order-No. W3025-4B

set of connecting leads and plugs, consisting of:

- | | | |
|---------------------------|---------------------------------|--------------------------------|
| 20 connector plugs, 19 mm | 2 4-mm connecting leads 50 cm | 10 2-mm connecting leads 30 cm |
| 4 connector plugs, 38 mm | 2 4-mm connecting leads 100 cm | 4 2-mm connecting leads 50 cm |
| 10 adapter plugs | 10 2-mm connecting leads 7,5 cm | |
| 4 adapter plugs | 10 2-mm connecting leads 15 cm | |

Order-No. W3901-8D

Required equipment to carry out the experiments:

- | | |
|----------------------------|--|
| 1 Universal mounting panel | Alternatively: Universal Experimenter IV |
| 1 Function generator | Alternatively: Universal Experimenter IV |
| 1 Power supply | Alternatively: Universal Experimenter IV |
| 3 Multimeter | |
| 1 Oscilloscope | i.e. 20 MHz/2-channel oscilloscope |

➤ Assembly Kit "Digital Data Processing"

The following experiments can be carried out:

Encoders, decoders, code converters

- Octal-to-binary conversion
- Binary-to-hexadecimal conversion
- BCD-to-decimal conversion
- Decimal-to-binary conversion
- Binary-to-BCD conversion

Counters and counter applications

- Decimal counters
- Decimal counters with set inputs
- Hexadecimal counters
- Hexadecimal counters with set inputs

Contents of the kit

Plug-in modules

- 1 W5101-4U
1-AND/NAND gates, 4 inputs
- 1 W5101-5B
4-AND/NAND gates, 2 inputs
- 1 W5101-4W
2-AND/NAND gates, 2 inputs
- 3 W5101-4T
1-OR/NOR gates, 4 inputs
- 1 W5101-4V
2-OR/NOR gates, 2 inputs
- 1 W5101-5A
4-OR/NOR gates, 2 inputs
- 1 W5101-5D
4-EX/OR gates, 2 inputs
- 3 W5101-4M
4-toggle switches (L-H input)
- 3 W5101-4N
4-LED displays
- 1 W5101-4P
1 clock-pulse generator
0 to 10 kHz
- 1 W5101-4D
2 R/2R network

Registers and its applications

- Shift registers as memory
- 8-bit shift registers
- Parallel input - serial output
- Serial input - parallel output

Analog-to-digital conversion

- Analog-to-digital conversion
- Digital-to-analog conversion
- Digital-to-analog conversion with R/2R network

Multiplexers, demultiplexers

- Multiplexers
- Demultiplexers
- Serial data transmission with multiplexers and demultiplexers

Plug-in modules

- 1 W5101-5C
4 inverters
- 2 W5101-5K
2-JK flipflop
- 1 W5101-5E
2 hexadecimal displays
- 1 W5101-5P
1 BCD/decimal decoder
- 1 W5101-5M
1 binary/decimal up/down counter
- 1 W5101-5Q
1 binary/BCD decoder
- 2 W5101-5L
1 shift register
- 1 W5101-5T
1 analog/digital converter
- 1 W5101-5U
1 digital/analog converter
- 1 W5101-5R
1 multiplexer
- 1 W5101-5S
1 demultiplexer

Digital arithmetic-logic units

- Addition of two single-digit dual numbers
- Half-adders
- Addition of multi-digit dual numbers
- Full adders
- Subtraction of dual numbers
- Half subtractor
- Subtraction of multi-digit dual numbers
- Full subtractors
- Multiplication of dual numbers

Basic circuits phase-locked loop

- PLL in captured range
- PLL as pulse generators

Plug-in modules

- 1 W5101-6A
1 PLL circuit
- 1 W5101-4E
3 potentiometers

Plug-in components

- 1 resistor 10kΩ
- 1 resistor 22kΩ
- 1 resistor 220kΩ

Capacitors

- 1 capacitor 4,7 nF
- 1 capacitor 10 nF
- 1 capacitor 0,1 nF



Order-No. W5101-8E

Order-No. W3025-5B

- 10 2-mm connecting leads 30 cm
- 4 2-mm connecting leads 50 cm

Order-No. W3901-8E

Experimental manual "Digital Data Processing"

Set of connecting leads and plugs, consisting of:

- 20 connector plugs, 19 mm
- 4 connector plugs, 38 mm
- 10 adapter plugs
- 4 adapter plugs
- 2 4-mm connecting leads 50 cm
- 2 4-mm connecting leads 100 cm
- 10 2-mm connecting leads 7,5 cm
- 10 2-mm connecting leads 15 cm

Required equipment to carry out the experiments:

- 1 Universal mounting panel
- 1 Function generator
- 1 Power supply
- 3 Multimeter
- 1 Oscilloscope
- Alternatively: Universal Experimenter V
- Alternatively: Universal Experimenter V
- Alternatively: Universal Experimenter V
- i.e. 20 MHz/2-channel oscilloscope

➤ **Assembly Kit "Components of Power Electronics"**

The following experiments can be carried out

- Investigation of semiconductor components such as diodes, Z diodes, bipolar transistors, field-effect transistors, diacs, unijunction transistors, thyristors, triacs
- Amplifier circuits such as low-signal amplifiers and push-pull power amplifiers
- DC power supply circuits such as voltage stabilization circuits and constant-current source
- Circuits for pulse generation such as pulse generation with diac and unijunction transistor
- Investigation of passive components

Contents of the kit

Resistors

2	1	Ω/2W
1	10	Ω/2W
2	22	Ω/2W
1	47	Ω/2W
4	100	Ω/2W
1	150	Ω/2W
1	220	Ω/2W
2	330	Ω/2W
2	470	Ω/2W
1	1	kΩ/2W
1	3,3	kΩ/2W
1	4,7	kΩ/2W
2	10	kΩ/2W
1	22	kΩ/2W
1	47	kΩ/2W
2	100	kΩ/2W
1	1	MΩ/2W

Switches

1	NC contact
2	NO contact

Capacitors

2	10	nF
1	0,1	μF
1	0,15	μF
1	0,47	μF
1	1	μF
1	470	μF

Potentiometers

1	1	kΩ linear/1W
1	10	kΩ linear/1W
1	100	kΩ linear/1W

Diodes

1	AA 118
1	1N4004
1	1N4148
1	BY 299
1	ZPD 6,2
1	ZPD 9,1
1	LED green
1	LED red

Transistores

1	BC 141
1	BC 161
1	BC 237
1	BUZ 10, MOS-FET N-channel
1	2N4870, Unijunction

Diac

1	Diac ER 900
---	-------------

Triac

1	Triac TIC 206
---	---------------

Thyristores

2	Thyristores TIC 106
---	---------------------

Signal elements

1	Incandescent lamp 30 V/85 mA
---	---------------------------------

Order-No. W5101-8L

Experimental manual "Components of Power Electronics"

Order-No. W3007-5B

Set of connecting leads and plugs, consisting of:

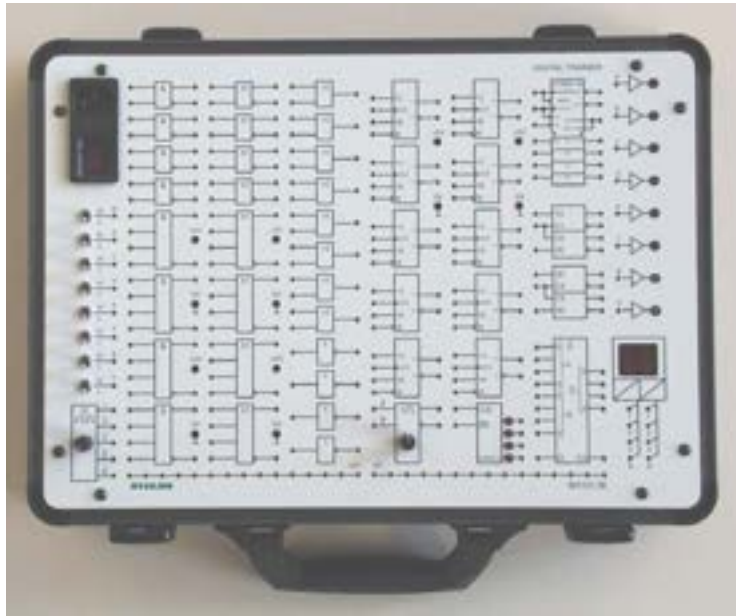
25	connector plugs, 19 mm	6	4-mm connecting leads 25 cm	2	4-mm connecting leads 100 cm
4	connector plugs, 38 mm	4	4-mm connecting leads 50 cm		

Order-No. W3901-8L

Required equipment to carry out the experiments:

1	Universal mounting panel	Alternatively: Universal Experimenter V
1	Function generator	Alternatively: Universal Experimenter V
1	Power supply	Alternatively: Universal Experimenter V
3	Multimeter	
1	Oscilloscope	i.e. 20 MHz/2-channel oscilloscope

➤ Digital - Trainer



The Digital-trainer is a compact teaching and experimenting unit for training in digital technology. Simple logical combinations and even complex digital circuits can be realized using connecting leads with 2-mm plugs. Blank IC sockets with any required number of poles and capable of free wiring according to requirements, can be plugged into three positions thus ensuring that the digital trainer is suitable for universal use (the IC sockets can be supplied as additional accessories). The mains voltage is fed in at the front panel through a 3-pole plug. The detachable cover can be used as a storage tray for the connecting leads.

The Trainer includes:

- | | |
|--|---|
| 1 stabilized short-circuit proof power supply unit + 5V DC/2A | 4 inverters |
| 1 variably adjustable clock pulse generator, 0 to 10kHz, with subsequent divider by 2/4/8/16 | 10 JK-master-slave flipflops |
| 8 bounce-suppressed L/H toggle switches | 1 4 bit full adder |
| 8 LED displays | 1 decimal counter with visual indicator |
| 4 AND/NAND gates each 2 inputs | 1 forward/reverse 4 bit binary counter |
| 4 AND/NAND gates each 4 inputs | 2 2 bit buffers with release function |
| 4 OR/NOR gates each 2 inputs | 1 variably adjustable monoflop, 10 s, with positive or negative input, Q and Q-not output |
| 4 OR/NOR gates each 4 inputs | 2 hexadecimal indicators with built-in decoder indications 0 to 9 and A, B, C, D, E, F |
| 8 Ex/OR gates each 2 inputs | 3 plug-in positions for blank IC sockets |
| | 1 multi-terminal busbar, + 5 V and 0 V |

Storage tray for connecting leads in the cover containing.

Technical Data:

Mains supply 1 AC 230 V, 50/60 Hz
 Dimensions (W x D) 400x290 mm
 Height (without cover) 50 mm
 Cover depth: 50mm
 Total weight approx. 3,8kg

Additional recommended equipment (not included in Trainer)

1 IC-socket 14-pin

1 IC-socket 16-pin

1 IC-socket 20-pin

1 IC-socket 24-pin

1 IC-socket 28-pin

1 IC-socket 40-pin

The IC-sockets (Textool) are used for experiments with IC-circuits. They are mounted on a plastic housing, which is plugged to the front panel of the digital training unit via 2-mm plugs. The IC-socket connectors are connected to 2-mm jacks and numbered.

Set of Connecting Leads (five colours), consisting of:

- 10 4-mm connecting leads 50 cm
- 10 4-mm connecting leads 30 cm

Order-No. W5101-3E

Order-No. W5101-3F

Order-No. W5101-3G

Order-No. W5101-3H

Order-No. W5101-3J

Order-No. W5101-3K

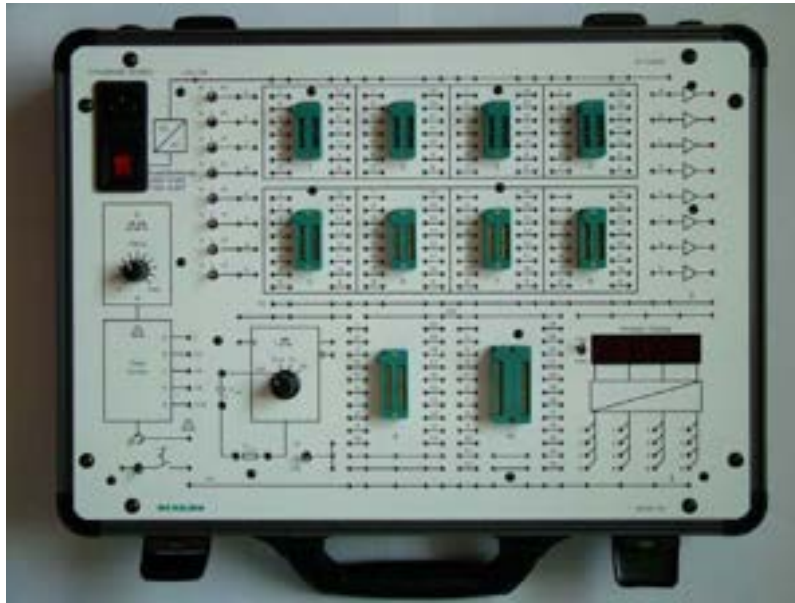
Order-No. W5101-3L

20 4-mm connecting leads 15 cm

20 4-mm connecting leads 10 cm

Order-No. W5101-3V

➤ **IC - Trainer**



The IC-trainer is a universally applicable unit for carrying out exercises in digital technology. It can be used in schools and institutes for training and further education and in the training centers of the industry. Each IC socket terminal is numbered and equipped with two 2-mm measurement sockets. All blank IC sockets are fitted with a tensioning facility to enable effortless insertion of ICs.

The mains voltage is fed on top through a 3-pole plug. The detachable cover can be used as a storage tray for the connecting leads.

The Trainer includes:

- | | |
|---|--|
| 1 stabilized short-circuit proof power supply unit + 5V DC/1A | 1 combined pushbutton/toggle switch with Q-output |
| 1 variably clock pulse generator, 0,5Hz to 10kHz, with subsequent frequency divider by 2/4/8/16 reset key, single pulse | 4 hexadecimal indicators with built –in decoder indicators from 0 to 9, A, B, C, D, E, F |
| 1 monoflop with Q and Q-not outputs | 4 blank IC sockets, 14-pole |
| 1 rotary switch for 0,1s, 1s and 3s pulse width and switch setting for external wiring of the monoflop | 4 blank IC sockets, 16-pole |
| 8 bounce-suppressed L/H toggle switches | 1 blank IC sockets, 20-pole |
| 8 LED displays | 1 blank IC sockets, 24-pole |
| 1 toggle switch can be wired freely | 1 multi-terminal busbar, + 5V and 0V |
| | 9 different multi-terminal busbars |

Storage tray for connecting leads in the cover.

Technical Data:

Mains supply 1 AC 230 V, 50/60 Hz
 Dimensions
 (W x D) 400x290mm
 Height (without cover) 50mm
 Cover depth: 50mm
 Total weight approx. 3,8kg

All IC sockets are Textool sockets

Set of Connecting Leads (five colours), consisting of:

- | | |
|--------------------------------|--------------------------------|
| 10 4-mm connecting leads 50 cm | 20 4-mm connecting leads 15 cm |
| 10 4-mm connecting leads 30 cm | 20 4-mm connecting leads 10 cm |

Order-No. W5101-3D

Order-No. W5101-3V

➤ Universal-Experimenter V – Basic Unit



Universal-Experimenter V W5101-0A (with universal mounting panel W5101-1J)

Compact, portable training and experimental unit for electrical engineering applications

The universal experimenter V is a compact training unit.

The top cover is adapted for experimental panels and / or plug-in-components.

The experiments are carried out with plug-in-components or experimental panels. The additional assembly kits or experimental panels have to be ordered separately (according to your needs).

The basic unit has the following built-in components:

Section A) Power supply and signal generator:

1. Input supply: 230V, AC 50/60Hz. with IEC power connector and micro fuse holder.

2. Power switch: on/off, 2-pole with illumination

3. Power supply AC:

10 Veff AC, 0,1 A,

24 Veff AC, 0,1 A

4. Power supply DC: isolated +/-15 V DC, 1 A stabilized, short-circuit-proof against ground/0V + 5 V DC stabilized, short-circuit-proof against ground/0V

0 ... 30V; 0,3 ... 1A; (the current depends on the voltage adjustment) All outputs are brought to 2mm sockets

All DC and AC voltages shown with LED's.

5. 3-phase source

Output voltage: Ueff: approx. 8,5V

AC (rms) (1,73); L1/L2/L3 against N

Output voltage: Ueff: approx. 14V

AC (rms); L1 gegen L2/L3

Output current max. 100mA

Frequency: approx. 50 Hz.

Overload or short circuit will be signed with LED's

6. 1 plug panel for storing connectors

7. 4 Potentiometer for free wiring and as reference value encoder.

1 x 100 k, 1 x 10 k, 1 x 1 k, 1 x 100

OhmThe Universal

8. 1 Signal generator

. Sinus, U_{PP} 0...20V, f=20 Hz – 100kHz

. Rectangle positive (TTL) U_P 0...8V, f=20Hz – 20kHz

. Rectangle symmetrical U_{PP} 0...16V, f=20Hz – 20kHz

. Triangle U_{PP} 0...20V, f=20 – 20KHz

9. 1 Potential divider depending on tapping, division by 10, 100, 1000.

Section B) Plug-in position for experimental panels and output-interfaces.

In the center part experimental panels and output-interfaces can be inserted with coupling devices.

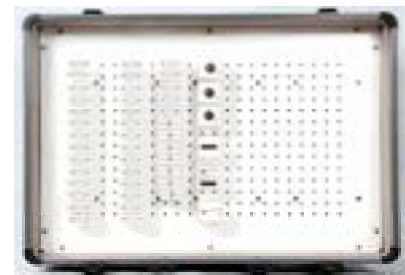
The plug-and-socket connections for the maintenance with operating voltage for the experimental panels are protected against

reverse polarity and have a overload protection with auto recovery.

Dimensions (without top cover) approx 515 x 390 x 75 mm (W x D x H)

Height of the top cover: 100 mm

Weight approx. 9 kg



Storage field in the case top cover

W5101-1J

Universal assembly experimental panel for Universal-Experimenter V (for the installation space section B of the universal experimenter V)

The assembly panel is equipped with 324 4mm-sockets which are arranged in a 19mm grid.

Each 4 safety lab sockets are connected with ringlike.

On the left side are 4 (with 2mm sockets equipped) linear potentiometers with 100 Ohm, 1 kOhm, 10 kOhm and 100 kOhm and also a little resistance-network arranged.

The sockets at the top and on the bottom of the experimental panel are through-connected for power-supplying.

Dimensions: (W x D) 375 x 370 mm

Weight : approx. 2 kg



Storage case for plug-in modules.

Consisting of 2 shells the bottoms of which are equipped with 10 mm grid panels.

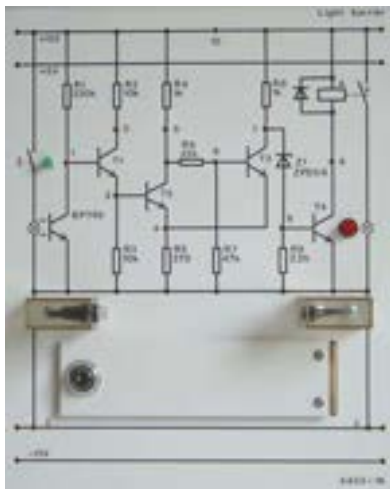
Capacity

- 80 2-pin plug-in modules
- and
- 42 4-pin plug-in modules

Dimensions (BxTxH) 400x300x80 mm
 Weight approx. 1 kg

Order-No. W5101-2Y

➤ **Fault Simulators**



Light barrier

Assembled from 4 NPN transistors, receiver: photo-transistor, light source can be switched off by toggle switch. Output with relay whose make contact controls a pilot lamp with non-specified socket. 10 faults are incorporated and can be operated by covered switches.

Supply voltage + 15 V DC
 Dimensions (HxW) 297x226 mm
 Weight approx. 1,5 kg

Order-No. W5433-1K

Thermal circuit breaker

By actuating a pushbutton switch, a reference temperature is produced in a heating resistor.

This temperature acts on an NTC resistor which in turn activates a differential amplifier. At the output a relay is operated by a transistor stage. The make contact of the relay actuates a visual display. 10 faults are incorporated and can be operated by covered switches.

Supply voltage + 15 V DC
 Dimensions (HxW) 297x226 mm
 Weight approx. 1,5 kg

Order-No. W5433-1L

➤ FAX – response to: +49-9721 - 64691 - 20

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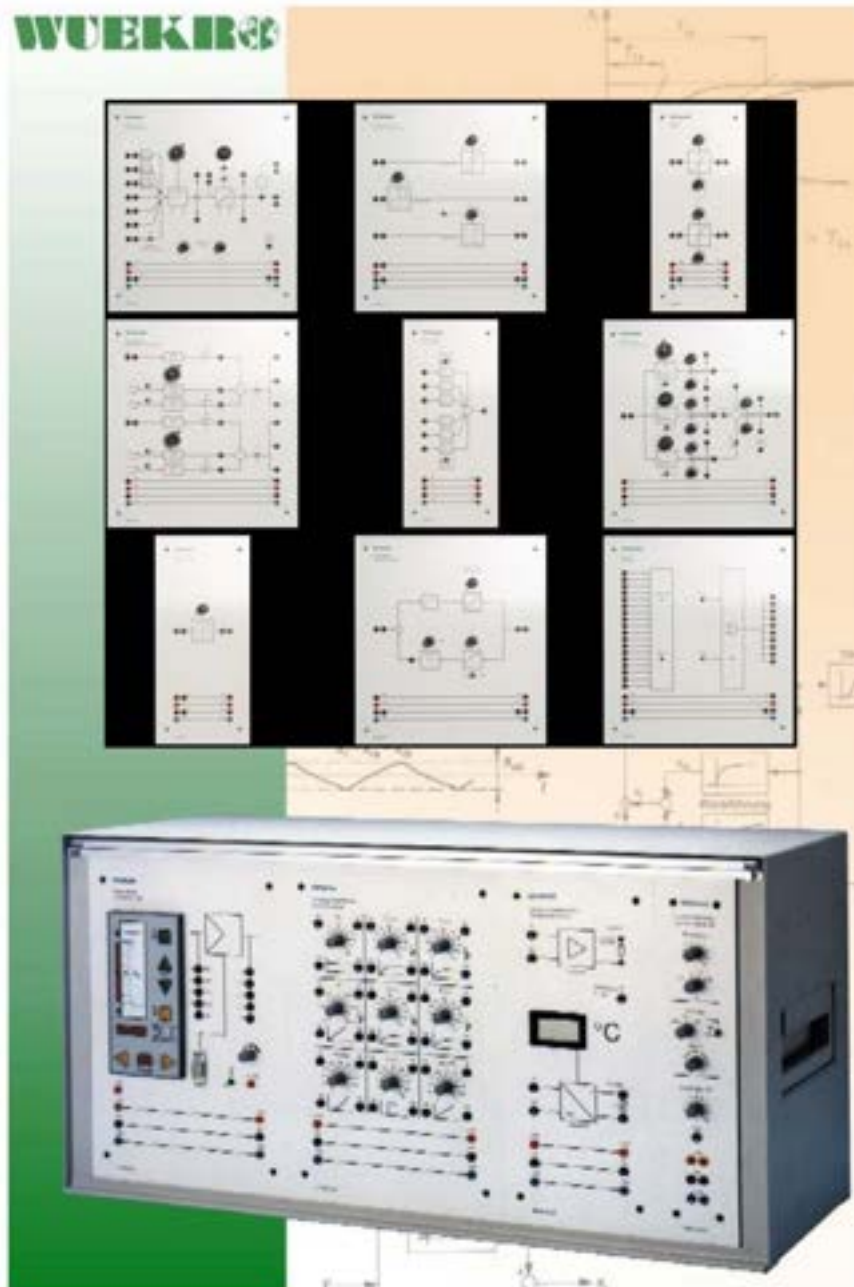


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Control Technology

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WA2E/03



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➤ Introduction

Closed-loop control equipment is of central significance covering many technical disciplines. This applies particularly in mechanical and electrical engineering, in production and process technology, in plant and systems technology where such equipment is indispensable.

In the automation field, important optimization tasks would be quite impossible to solve without closed-loop control technology. In line with its increasing importance, closed-loop control has become a basic subject in professional training and further education for many professions.

In the newly formulated training curricula, this technology has been given a role covering a number of subjects in the syllabuses for training in industry and the crafts.

➤ **Experimental panels Control Technology**

General

Demonstrations and experiments ranging from simple closed-loop control circuits up to complicated control systems can be carried out. Different combinations of experiments can be carried out with the instruction modules in the following selection table. We recommend that the following kits be used if the experimental program is to be carried out in accordance with our instruction manual.

The panels are designed for insertion in experimental frames. Storage cabinets or drawer inserts are available for accommodating un-used panels. For all panels the operating voltage is ± 15 V DC, and the signal voltage ± 10 V DC.

The power 2-mm supply connection sockets are approx. 20 mm from the upper edge and the under edge interconnected. The power supply can be realized by means of connection plugs if the experimental panels are located side by side.

Dimensions of the panels
 Height 297 mm
 Width 130 mm or integral multiples thereof 65mm.

Linear controlled system 1



Technical data

Input circuit:
 1 Enable input
 "0" signal path enabled
 "1" signal path blocked

3 Inputs with smoothing circuit,
 $T_{gl} = 1$ ms
 3 Inputs without smoothing circuit
 1 Switched disturbance input
 Proportional element G_p :
 $G_p = 0$ to 10, stepless adjustable and
 VZ_1 delay/integral element:
 Switch selectable between integral element and VZ_1 delay T_i or $\tau = 0$ to 500 ms selectable in 8 steps
 Selectable time factor $\times 1$ or $\times 0,01$

Limiting circuits B^+ and B^- :
 Positive and negative limiting, steplessly adjustable between 0 and + 100 %
 Common to G_p and VZ_1 /integral element LED display to indicate operation of limiting circuit
 Output circuit:
 1 Inverting output
 1 Non-inverting output

Dimensions
 (WxHxD) 260x297x65 mm
 Weight approx. 1 kg

Order-No. W5302-2A

Linear controlled system 2

Input circuit:
 1 Enable input
 "0" signal path enabled
 "1" signal path blocked
 3 Inputs with input smoothing circuit,
 $T_{gl} = 1$ ms
 3 Inputs without smoothing circuit
 1 Switched disturbance input
 Proportional element G_p :
 $G_p = 0$ to 10, stepless adjustable and

VZ_1 delay/integral element:
 Switch selectable between integral element and VZ_1 delay
 T_i or $\tau = 0$ to 5 s selectable in 8 steps
 Selectable time factor: $\times 1$ or $\times 0,01$
 Limiting circuits B^+ and B^- :
 Positive and negative limiting, steplessly adjustable between 0 and +100 %

Common to G_p and VZ_1 /integral element LED display to indicate operation of limiting circuit
 Output circuit:
 1 Inverting output
 1 Non-inverting output

Dimensions
 (WxHxD) 260x297x65 mm
 Weight approx. 1 kg

Order-No. W5302-2B

➤ Experimental panels Control Technology

Linear controlled system 3

Input circuit:

1 Enable input

"0" signal path enabled

"1" signal path blocked

3 Inputs with smoothing circuit,

$T_{gl} = 1 \text{ ms}$

3 Inputs without smoothing circuit

1 Switched disturbance input

Proportional element G_p :

$G_p = 0$ to 10, stepless adjustable

and VZ_1 delay/integral element:

Switch selectable between integral

element and VZ_1 delay T_i

or $\tau = 0$ to 5 s selectable in 8 steps

Selectable time factor: $\times 1$ or $\times 0,01$

Limiting circuits B^+ and B^- :

Positive and negative limiting,

steplessly adjustable

between 0 and +100 %

Common to G_p and VZ_1 delay/ integral

element

LED display to indicate operation of limiting circuit

Output circuit:

1 Inverting output

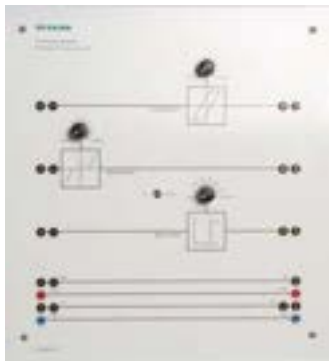
1 Non-inverting output

Dimensions

(WxHxD) 260x297x65 mm

Weight approx. 1 kg

Order-No. W5302-2C



Non-linear controlled systems

Hysteresis:

Hysteresis steplessly adjustable

between 10 and 100 %

Dead zone:

Dead zone steplessly adjustable

between 10 and 100 %

Dead time:

Dead time selectable in 8 steps,

$T_1 = 5/10/20/40/60/80/100/200 \text{ ms}$

Selectable time factor: $\times 1$ or 100

Sampling time selectable in 8 steps,

$T_A = 0,5/1/2/4/6/8/10/20 \text{ ms}$

Minimum value of sampling time:

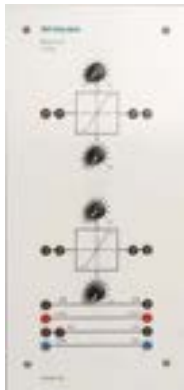
$0,01 \times T_1$

Dimensions

(WxHxD) 260x297x65 mm

Weight approx. 1 kg

Order-No. W5302-2D



Limiters

Positive and negative limiting of

output signal:

Steplessly adjustable between

0 and +100 % and between

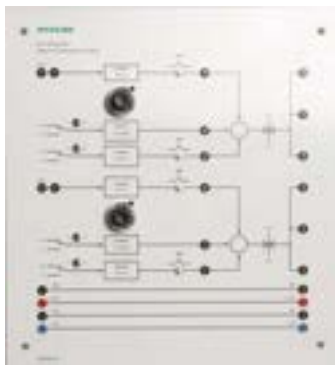
0 and -100 %

Dimensions

(WxHxD) 130x297x65 mm

Weight approx. 1 kg

Order-No. W5302-2E



Setpoint/disturbance value

The reference and disturbance

variables are set with a 10-turn

potentiometer with reversible

polarity:

Steplessly adjustable between

0 and 100 % with selector switch

\pm polarity

Keying in small changes:

Change = 10 % of nominal value

Change = 10 % of an external quantity

Keying of changes via pushbutton

Setpoint/disturbance value output

limited to the maximum/minimum

value.

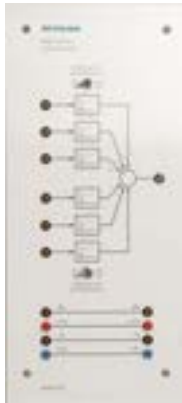
Dimensions

(WxHxD) 130x297x65 mm

Weight approx. 1 kg

Order-No. W5302-2F

➤ **Experimental panels Control Technology**



Control deviation

The control deviation is formed at a summation point.

The smoothing circuits at the input can be switched in or out.

Smoothing time constant: $T_{gl} = 5 \text{ ms}$

Inputs:

3 Non-inverting inputs

3 Inverting inputs

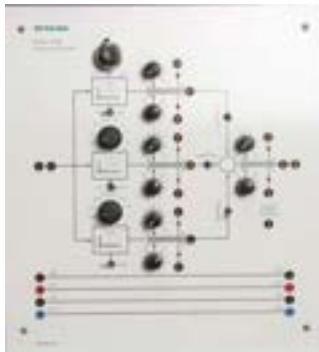
Output: Sum of inputs

Dimensions

(WxHxD) 130x297x65 mm

Weight approx. 0,5 kg

Order-No. W5302-2G



Continuous-action controllers

The controllers comprise the following components:

P component

Gain steplessly adjustable between 0 and 10 and can additionally be changed by factor 0,1.

The output variable can be steplessly limited between 0 and + 100 %, and between 0 and - 100 %.

LEDs indicate the limiting action.

I component

The introgression time is adjustable in 8 steps between 0,1, 0,2, 0,3, 0,5, 1, 2, 5 and 10 s or reduced to 0,01 times the value.

The output variable is continuously adjustable between 0 and + 100 %, and between 0 and - 100 %.

LEDs indicate the limiting action.

D component

The differential time is adjustable in 8 steps between 0,01, 0,02, 0,03, 0,05, 0,1, 0,2, 0,5 and 1 s or reduced to 0,01 time the value.

The output variable is continuously adjustable between 0 and + 100 %, and between 0 and - 100 %.

LEDs indicate the limiting action.

Each of the three components can be switched in at the summation point. The common output is continuously adjustable between 0 and + 100 %, and between 0 and - 100 %.

LEDs indicate the limiting action.

The limits of the individual functions cannot be larger than the summation limit.

The function switches keep the functions at zero in the OFF state.

The enable input blocks the controllers at signal '1' and enables them at signal '0.'

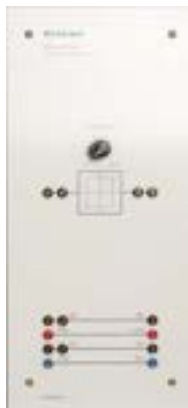
Dimensions

(WxHxD) 260x297x65 mm

Weight approx. 1 kg

Order-No. W5302-2H

➤ Experimental panels Control Technology

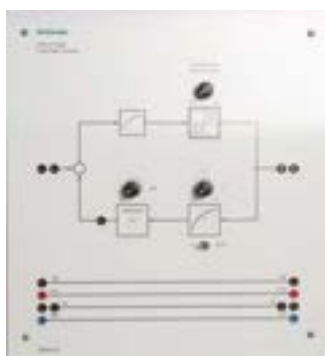


Two-step controller

The two-step controller only accepts the +100 %, 0% and -100 % values at its output. Its operating values can be set by an hysteresis which is continuously adjustable between 0 % and ± 50 % of the rated input value.

Dimensions
(WxHxD) 130x297x65 mm
Weight approx. 1 kg

Order-No. W5302-2J



Three-step controller

The three-step controller accepts the +100 %, 0% and -100 % values at its output depending on the sign of its input.

The controller operating values are continuously adjustable between 0,5 % and 50 % of the input value. The hysteresis is dynamic in each direction in order to prevent fast activation and deactivation if the input signal approaches the set operating value.

The line-side smoothing element prevents operation in the case of signal peaks at the input.

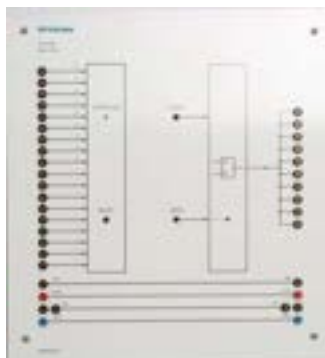
A smoothing element is also provided in the feedback loop to allow for follow-up effects.

The smoothing constant T_{gl} is adjustable between 0,5 and 2 s, and can be reduced to 0,01 times the value.

The feedback action is continuously adjustable between 0 and 100 % via gain factor G_p .

Dimensions
(WxHxD) 260x297x65 mm
Weight approx. 1 kg

Order-No. W5302-2K



Overload/start module

The experimental panel contain 9 positive and 9 negative inputs for overload indication of the process elements connected (10 LED outputs).

Also installed is a START/ZERO feature which, when activated, discharges the capacitors connected.

Dimensions
(WxHxD) 260x297x65 mm
Weight approx. 1 kg

Order-No. W5302-2L

➤ **Assembly kit Control Technology**

Assembly kit "Fundamentals of control technology"

(Experimental panels)

Order-No. W5302-8A

The following experiments can be carried out

Fixed-value control

- Voltage regulation
- Level control
- pH control
- Temperature control

Follow-up control

- Rotational speed control
- Current control
- Position control
- Velocity control

Cascade control

- with secondary current control
- with secondary flow control
- with secondary level control

The controlled systems may have the following transfer functions:

Linear transfer functions

- Proportional element with gain
- Proportional element with first-order delay
- Integral element
- Characteristics

Not-linear transfer functions

- Dead time
- Hysteresis
- Dead band

Higher-order controlled systems can be configured by interconnecting several function units.

The controllers may have the following transfer functions:

Linear transfer functions

- P controller
- I controller
- D controller
- PI controller
- PD controller
- PID controller

Non-linear transfer functions

- Two-step controller
- Three-step controller

The following equipment is necessary to carry out these experiments:

1	Linear system 1	Order-No. W5302-2A
1	Linear system 2	Order-No. W5302-2B
1	Linear system 3	Order-No. W5302-2C
1	non-linear system	Order-No. W5302-2D
1	Limiter	Order-No. W5302-2E
1	Setpoint/disturbance variable	Order-No. W5302-2F
1	Control deviation	Order-No. W5302-2G
2	Continuous-action controller	Order-No. W5302-2H
1	Two-step controller	Order-No. W5302-2J
1	Three-step controller	Order-No. W5302-2K
1	Overload/start module	Order-No. W5302-2L

Further components (included in the kit)

- 1 Experimental manual "Fundamentals of Control Technology" W3021-7B

Additional equipment required (not included in the kit)

- 2 Multimeter with center zero
- 1 20-MHz/2-channel-oscilloscope
- 1 Set of measuring leads and plug connectors.
- 1 Compensograph X-T or
- 1 Compensograph X-T with time offset compensation

Training System for closed-loop control technology



General

This is the state-of-the-art training unit containing really everything needed for practice-oriented and continuing education and training in closed-loop control technology.

SIPART DR 21 compact controller experimental panel with serial communications interface (e.g. for PC, programmable controllers)

The following components form an integral unit in one casing:

- Experimental panel function generator
- Experimental panel power supply unit for controlled-system simulators
- Replaceable experimental panels with controlled-system simulators

The SIPART DR 21 compact controller experimental panels and the controlled-system simulators (board size DIN A4) can also be inserted in experimental frames.

➤ Closed-Loop Control Technology with Controller SIPART DR21

Compactly packaged digital control technology, without programming knowledge

Combination of continuous and step-action controllers

The core of the WUEKRO DR 21 system is the SIPART DR 21 controller. This represents the compact packaging of the industrial experience gathered in digital control technology.

An additionally integrated limit value module makes two controllers out of one. Thus, WUEKRO DR 21 is an ideal combination of the two main controller types available in practice:

The continuous controller providing a continuous output current signal (output voltage signal), used mainly for pneumatic and hydraulic actuators.

The step-action controller with a stepping output which is optionally programmable as a three-step controller for electrical actuators or as a two-step controller (e.g. for cooling and heating).

Operating, programming, configuring

A large number of off-the-shelf controller functions are already stored in the program memory of the SIPART DR 21. Without the operator having any special programming knowledge, the desired functions can be selected, combined to form a task-related program and stored safe from the effects of, for example, a power fail. The changeover from operator control to the programming or configuring level takes place in steps. It is possible to change directly from the programming level to process operation and via programming from the configuring level.

And for all this, no special programming unit is required, neither is any special software knowledge.

Flexible configuration for training

The SIPART DR 21 controller is configurable for many operating modes, such as:

- Fixed setpoint control
- Fixed setpoint control with feed-forward control at the input or output
- Follow-up control
- Synchronized control
- Ratio control
- Feed forward control with function generator (pulse, sine wave, square wave)
- System identification (step function, step response).

But SIPART DR 21 has even more to offer: it is configurable as a P, PI, PID or PD controller and its control algorithm can also be switched off.

The unit can then be used as:

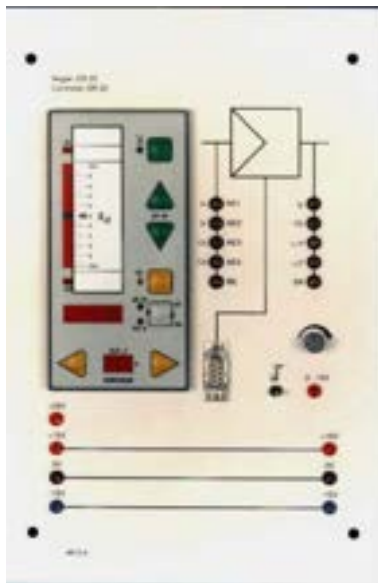
- Ratio station
- Process indicator
- Automatic and manual control unit



DR 21 controller

External controlled systems provide a direct link with practice. The Training unit DR 21 enables you to install controlled-system simulators on DIN A4 experimental panels into the housing or the directly connect separate control models (For order numbers see overview)

➤ Experimental panels Control Technology with Controller SIPART DR21



SIPART DR 21 controller

Continuous (K) or switching (S) mode
 Serial interface V.24 (RS-232C)
 2 additional voltage inputs
 Controllable DC voltage 0 to 10 V, built in an experimental panel, height 297 mm for insertion into a compact unit or experimental frame.

All connections are brought out to 2-mm-sockets:

- Continuous output 0 – 20 mA or
- 0 – 10 V
- External setpoint variable and Setpoint generator as current or voltage
- Binary in/output
- serial interface for connection to PC or superordinated system

The process controller is programmable as:

- Constant value controller
- Constant value controller with disturbance variable addition at the in- and output
- DDC-back-up Constant value controller
- Follow-up controller with or without internal / external changeover
- Synchronizing controller
- Ratio controller

Furthermore, the unit is suitable as ratio-station, Master-controller and process indicator.

An additional adjustable DC voltage supply 0 – 10 V with step-function is integrated in the experimental panel.

Dimensions

(W x H x D) 195x297x300 mm

Weight approx. 2 kg

Order-No. W4610-4A



Power supply

designed as experimental panel height 297 mm for insertion into a compact unit or experimental frame.

All connections are brought out to 2-mm-sockets.

Input voltage 1 AC 230 V
 50/60 Hz

Output voltages +15 V / 1,5 A
 -15 V / 1,5 A
 24 V / 0,5 A

Dimensions

(WxHxD) 65x297x200 mm

Weight approx. 3 kg

Order-No. W4610-4N

➤ **Experimental panels Control Technology with Controller SIPART DR21**



Function generator

designed as experimental panel height 297 mm for insertion into a compact unit or experimental frame. All connections are brought out to 2mm sockets.

Frequency range 0,1...1 KHz
 Signal forms DC voltage with step function, sine and square wave, offset control
 Amplitude 0...10 V

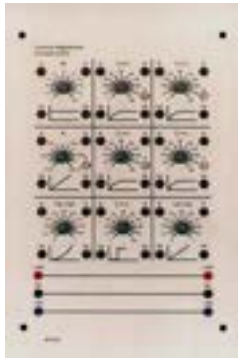
Dimensions (WxHxD) 130x297x565 mm
 Weight approx. 0,3 kg

Order-No. W4610-4F

Set connection leads

with 2 mm plugs for the compact unit SIPART DR 20

Order-No. W4610-1M



Universal controlled system

equipped with:
 1 Proportional-action element
 1 Integral-action element
 4 First-order time delay elements
 1 Linear valve characteristic element
 1 Equal-percentage value characteristic element prepared for lag element W4610-2C

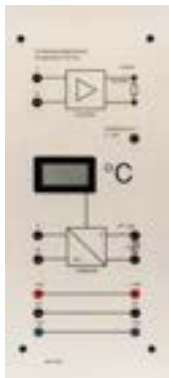
Dimensions (WxHxD) 195x297x65 mm
 Weight approx. 1,0 kg

Order-No. W4610-4C

Lag-element

Adjustable from 1 to 60 s
 Applicable only in connection with W4610-4C

Order-No. W4610-2C



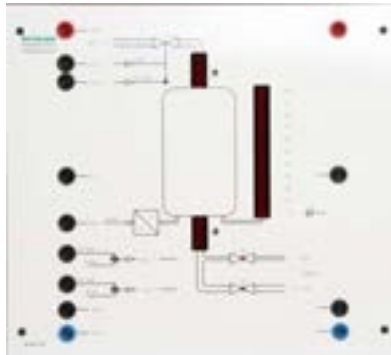
Temperature control

Including heater and Pt 100 temperature sensor.

Dimensions (WxHxD) 130x297x65 mm
 Weight approx. 0,6 kg

Order-No. W4610-4D

➤ Experimental panels Control Technology with Controller SIPART DR21



Technology simulator Filling level controller

This simulator is the electronic model of a level control system in which the volume discharged in a particular time depends on the level (PT₁-system).

Technical data	
Supply voltage	± 15 V
Inputs-	
Binary	0/24 V or 0/5 V
Analog	0 ... 10 V
Outputs	
	0 ... 10 V actual value
Filling level	0 ... 10 V actual value
	discharge rate
Dimensions	
(WxHxD)	260x297x65 mm
Weight approx.	0,6 kg

Order-No. W4760-1M

➤ Complete Training with Controller SIPART DR21



SITRAIN DR21 compact unit with controlled-system simulators

Dimensions	
(WxHxD)	650x320x280 mm
Weight approx.	14 kg

Order-No. W4610-2K

Compact unit SIPART DR 21 consisting of desk-top housing with the following experimental panels installed:

1	Process controller SIPART DR 21	Order-No. W4610-4A
1	Power supply unit	Order-No. W4610-4N
1	Function generator	Order-No. W4610-4F
1	Universal controlled system	Order-No. W4610-4C
1	Lag element	Order-No. W4610-2C
1	Controlled system for temperature	Order-No. W4610-4D
1	Experimental manual V246 "Control Technology with SIPART DR 21"	Order-No. W3024-6A

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No. of pages

incl. this page

Please send the following catalogues to the a.m. address!

- Fundamentals of electrical Engineering
 - Installation circuits
 - Bell ringing and entrance call stations
 - Contactor control / Control technology
 - Measurement and control of non-electrical variables
- Fundamentals of electronics
 - Analog technology
 - Digital technology
 - Microprocessing technology
- Closed loop control technology
 - Analog closed loop control
 - Digital closed loop control
- Automation engineering
 - SIMATIC S7-200/300/400, Software
 - Technology simulators / Models
 - Process control engineering PCS7
 - AS-Interface
 - Profibus DP
 - Process simulation-software SIMIT
 - LOGO!
 - Mechatronical technology stations
 - Courses on Automation
- Electrical machines / Drive controls
 - Electrical Machines 300W
 - Electrical Machines 1000W
 - Electrical Machines 5kW
 - Electrical drive control systems 300W/ 1kW
 - Electrical drive control systems 5kW
 - Networked drive systems
 - Cutaway Models
 - Transformers, Rectifiers and Reactive Power Compensation
 - Courses on drive systems
- Power electronics
 - extra low voltage (24V)
 - low voltage (230/400V)
- Building management systems
 - KNX / EIB
- VDE 0100 safety measures
- Radio- and Television engineering
 - AM/FM – Technology
 - TV Engineering
 - Satellite – Technology
- Cooling and air conditioning
- Photovoltaic cell technology
- Communication technology
 - Modulation -/demodulation
 - Fiber optic
 - ISDN trainer (HICOM)
 - ISDN
- Measuring systems
- Power supply units
- Experiment instructions, manuals
- Training courses

Remarks:

Training & Didactic Systems

Automation Technology with SIMATIC S7

Catalog

WA2E/04.01



➤ Our Services

- Development and production of didactic training systems
- Teachware and documentation
- Project engineering of complete lab's incl. furniture and lab equipment
- Quotations on customer's demand
- Installation, commissioning and training at site

➤ Our Customers

- Vocational training schools, technical schools, colleges and universities...
- Industrial laboratories for vocational education and higher education

➤ Fields of Technology

- Fundamentals of electrical engineering
- Fundamentals of electronics
- Closed loop control technology
- Automation engineering
- Electrical machines / drive control
- Power electronics
- Building management systems
- Protection schemes to VDE 0100
- Radio- and TV technology
- Air conditioning and refrigeration
- Photovoltaic
- Communication technology
- Measuring systems, power supplies, accessories
- Experimental manuals, documentation

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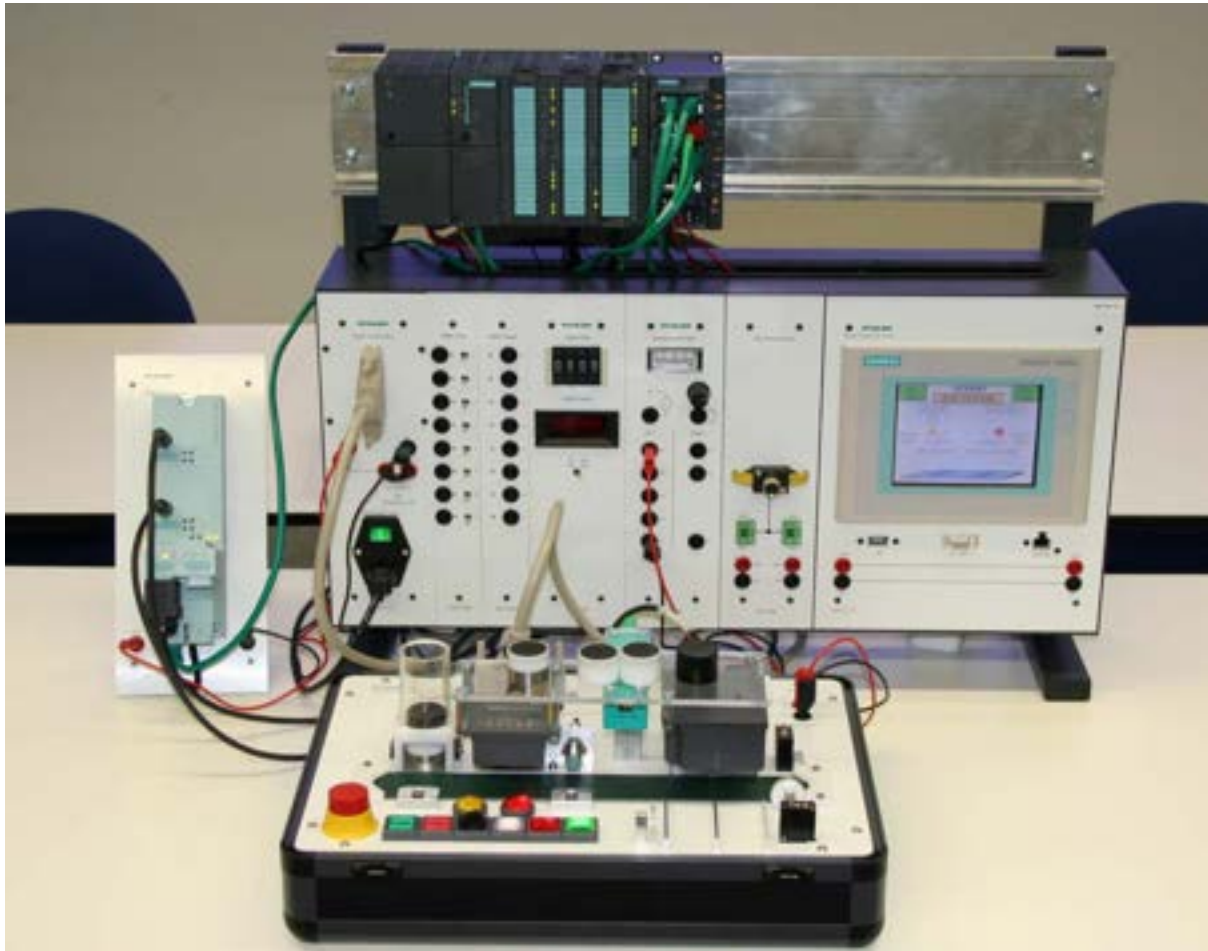
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E04051624M – 05/16

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➤ Training System Automation Technology



Educational Systems – Allocation – Target Groups

Study projects							
Dissertations							
Specialized practical training							
College/University							
Basic practical training							
College/University							
Master craftsman/technician							
Further education (Chamber of Industry and Commerce)							
Skilled worker training							
Fundamentals							
Training/education							
	SIMATIC S7 - Experimenters		Programmable controllers, programming, industrial models	New technologies	Industrial bus systems		Automation systems

➤ **Introduction**

Learning targets

are reached with our training systems.

- Structure of numerical systems
- Declaration of variables
- Methods of PLC representation with FBL, LAD, STL, Graph 7, SCL according to standard IEC 1131-3
- Getting to know program execution procedures
- Getting to know the function groups of a PLC and their principles of operation according to standard IEC 1131-1,2
- Basic logic operations with a PLC
- Logic controls with dynamic responseCounters and comparators with/without storage function
Sequential controls with mode sectionSequencers
Operating status messages process- or time-oriented
- Analog value processing
- Word processing
- Digital closed-loop control
- Autonomous modules
- Drive/position control
- Startup, maintenance
- Industrial networking
- Fundamentals of open communications
- Process visualization/control
- Fault diagnostics without/with visualization systems

The concept

The aim of the new IEC 1131 standard is to attain a worldwide unified system in the field of PLC technology. The programming languages are standardized in part 3. The standard encompasses the ladder diagram (LAD), function block language (FBL), sequence language (SL), statement list (STL), and structured text (ST). PLC systems are an integral component of automation today. SIMATIC S7 has taken the lead by offering a basic system for the entire field of automation.

SIMATIC S7 is the platform for

- PLC
- Man-machine interface
- Industrial networking
- Process control engineering
- Automation computers
- Measurement and control
- DP and Profinet applications

A great advantage for the user is the fact that this knowledge, once attained, can also be put to use in the other fields of technology.

The goal of our training concept for the different fields of automation is to provide

- Vocational schools
- Colleges
- Universities
- Places of training and further education

with the theoretical and practical prerequisites leading to trainees' and students' complete understanding of modern automation technology.

In general, there are two ways in which you can fulfill your training needs:

1. By working with the low-cost experimenter consoles and the technology simulators.
2. By working with the modular rack system, the technology simulators and models.

Here you can choose from the modules which are tailored to your curriculum.

Our program is rounded off with the model industrial bus system, the modular automation system aimed at engineering schools and colleges/universities.

Practical experiment instructions

Experiment instruction manuals on the individual modules, which have been compiled by specially trained and qualified employees, are available for use.

In general, the experiment instructions consist of three parts:

Part 1 Introduces the training needs and provides the basic theory.

Part 2 Contains the programming and test tasks.

Part 3 Contains solutions to part 2. This keeps the time for test preparations to a minimum and offers a way of checking the results.

➤ **Experimenter with LOGO! –0BA8**



Order-No. W4724-4A

Experimenter E with integrated universal simulator electrical engineering

Order-No. W4724-4B

Experimenter M with integrated universal simulator metal engineering

Basic configuration

Industrial equipment

- 1 Micro SPS LOGO! 8 12/24RCE with Ethernet interface
- 1 LOGO! DM8 extension 4Di/4DO

Simulation

12 digital inputs DI lead to momentary-contact / maintained-contact switch and to 4-mm-safety sockets.
 8 digital outputs lead to 4-mm-safety sockets, additionally signal statuses by LED.
 Power supply output 24V DC lead to 4mm safety lab sockets.
 The ethernet connection is easy to reach on the front panel.

Measurements (W x H x D)
 420 x 150 x 300mm
 Weight approx. 5 kg

Experimenter E with integrated universal simulator electrical engineering

This Experimenter is especially convenient for PLC basic education in electrical engineering. The experiments are worked out curriculum based. The Experimenter is equipped with the Micro-PLC LOGO! –0BA8 and an integrated universal simulator with different overlay-masks. The in- and outputs from the LOGO! are internally connected to the simulationfield-matrix from the experimenter and additionally lead to 4mm safety lab sockets as well as to a 37-pin D-SUB-socket. Included are 11 different overlayer-masks mit exercises up from an easy logic control to a sequential control.

- Fan control
- Tank filling device
- Star-delta-starting-up
- Gate control
- Roadworks traffic light
- Pump control
- Furnace door controller
- Traffic light control
- Starter control
- Embossing machine
- Buffer store

By exchanging the different text overlays, only the LED'S, which are assigned to a specific exercise, are uncovered..

Training concepts:

- Cyclic program processing
- Logic circuits
- Interlocking circuit
- Sequential circuit
- Different memories
- Pulse generator, edge evaluation
- Clock generator
- ON/OFF delay
- Counters and comparators
- Up/down counter
- BCD coding pulse count store
- Signal preprocessing
- Initializing pulse generator/pulse contact
- Structured programming
- Status diagram
- Process and timed sequence control system
- Mode sections
- Sequencers
- Step enabling conditions
- Word output

➤ **Experimental panel with LOGO! –BA08**



Basic configuration:

Industrial equipment

- 1 Micro SPS LOGO! 8 12/24RCE with Ethernet interface
- 1 LOGO! DM8 extension 4Di/4DO
- 12 digital inputs DI lead to momentary-contact / maintained-contact switch and to 4-mm-safety sockets.
- 8 digital outputs lead to 4-mm-safety sockets, additionally signal statuses by LED.
- Power supply output 24V DC lead to 4mm safety lab sockets as well as to a 37-pin D-SUB-socket.
- The ethernet connection is easy to reach on the front panel.

Order-No. W4452-1A

Experimental panel with DIN-A4-height for hang-up in experimental frames or laying on an ergonomical console hood to the table work surface

Simulation module:

DI-module:

12 digital inputs (thereof 4 useable as analog inputs) are connected on momentary-contact/ maintained-contact switch and to 4mm safety lab sockets.

DO-module:

8 digital outputs are connected to 4 mm MC-safety sockets, signal statuses by LED

PS-module:

inlet connector for non-heating apparatus, short circuit protection, fuse and illuminated on-off switch
24V / 2,5A on 4 mm MC-safety sockets
37-pin D-SUB connector interconnected to LOGO! modules with 12 DI and 8 DO

Also included:

supply connection cable 2m, operator's guide
1 inlet connector for non-heating apparatus, short circuit protection fuse and illuminated on-off-switch for mains-voltage-connection 230V, Measurements (W x H x D)

290x297x130mm

Weight approx. 2kg

Bestell-Nr. W4452-1B

Same as W4452-1A but with extension module LOGO! AM2 with 2 analog outputs, lead to 4mm safety lab sockets.

Bestell-Nr. W4452-1P

Wie W4452-1A jedoch zusätzlich mit Erweiterungsmodul LOGO! AM2 RTD mit 2 PT100 Analogeingängen, herausgeführt auf 4mm SI-Laborbuchsen

Bestell-Nr. W4452-1U



SIMATIC HMI Touchpanel KTP400 for LOGO!8. 4" TFT Display, 65536 Farben und 4 Funktionstasten on a DIN-A4 experimental panel. Power supply 24VDC with 4mm safety-lab-sockets. USB- and Profinet connection lead to front panel.

Bestell-Nr. W4452-2B



Extension module for connecting the LOGO! 8 with the KNX-bus (see our KNX experimental panels in catalog WA02/07)

Experimental panel with enwrapped mounted LOGO! 8 communication module KNX CMK2000.

Transparent thermoformed plastic hood.

Dimensions (WxHxD)

130x297x65mm

Weight approx.

0,5kg

Bestell-Nr. W4724-1Z



Extension-panel with 5-fold switch SIMATIC XB005

➤ Experimenters with SIMATIC S7-1200



General

The experimenters have a compact design and are conceived according to the motto "set up, switch on, training". This makes a mobile use in multiple locations possible. All cases are equipped with a mains plug with fuse for external connection to the mains voltage of 230 V and a mains connecting lead (approx. 2 m).

22 (14 onboard, 8 extension) digital inputs DI in total; 14 digital inputs DI brought out to momentary-contact/maintained-contact switches and 4-mm safety lab sockets

18 (10 onboard, 8 extension) digital outputs DO in total; 10 digital outputs DO brought out to 4-mm safety lab sockets, indicated with LED.

The inputs and outputs of the SIMATIC S7-1214C are also internally wired to the simulation panel matrix of the experimenter.

24-V power supply brought out to 4-mm safety lab sockets;

all this in- and outputs and power supply additionally to a 37pin D-SUB-jack..

The Ethernet-interface is brought out to a front-socket.

Two analogue values (0 ... 10V DC) can be simulated with 2 Potentiometers wired to 4mm safety sockets.

Also supplied are 11 different overlays with examples for training, from the straightforward logic control to sequential control.

Experimenters for Electrical Engineering with SIMATIC S7-1200

Basic equipment

Industrial components

- 1 Micro PLC SIMATIC S7-1214C, 50 KByte RAM, Onboard 14DI DC /10DO Relais

Simulation panel

22 (14 onboard, 8 extension) digital inputs DI in total; 14 digital inputs DI brought out to momentary-contact/maintained-contact switches and 4-mm safety lab sockets
 18 (10 onboard, 8 extension) digital inputs DI in total; 10 digital outputs DO brought out to 4-mm safety lab sockets
 24-V power supply brought out to 4-mm safety lab sockets.
 The Ethernet-interface is brought out to a front-socket.

Dimensions (W x H x D) 420x150x300 mm
 Weight approx. 5 kg

Experimenter E with integrated universal simulator Electrical Engineering

This experimenter is especially suited for fundamental PLC training in the vocational field electrical engineering. The experiments have been aligned with the curriculum. The experimenter is equipped with the Micro-PLC SIMATIC S7-1214C and an integrated universal simulator with overlays. The inputs and outputs of the SIMATIC S7-1214C are internally wired to the simulation panel matrix of the experimenter, brought out to 4-mm safety lab sockets and additionally to a 37pin D-SUB-jack. Also supplied are 11 different overlays with examples for training, from the straightforward logic control to sequential control.

- Starter control
- Furnace door control
- Embossing machine
- Pump control
- Star-delta start-up
- Fan control
- Roadwork traffic light
- Traffic light control
- Gate control
- Buffer store
- Tank filling device

Training content:

- Cyclic program processing
- Logic operators
- Interlock circuit
- Sequence control
- Storage types
- Pulse generators, edge evaluation
- Clock generator
- ON/OFF delay
- Counters and comparators
- Up/down counter
- BCD coding/pulse count memory
- Signal preprocessing
- Initializing pulse generator/pulse contact
- Structured programming
- Status diagram
- Process-oriented/time-oriented sequential control
- Mode sections
- Sequencers
- Step enabling conditions
- Word messages

By replacing the overlays, the LEDs assigned to the respective exercise become visible.

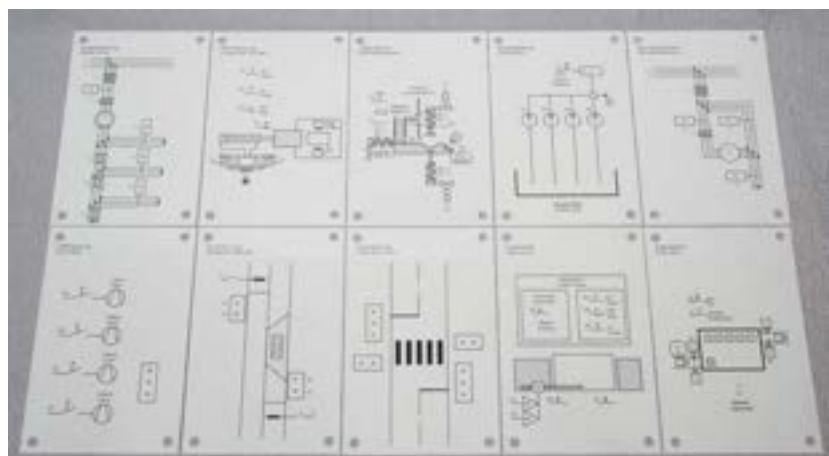
Order-No. W4724-4A

Overlays

11 overlays are part of delivery

- Starter control
- Furnace door control
- Embossing machine
- Pump control
- Star-delta start-up
- Fan control
- Roadwork traffic light
- Traffic light control
- Gate control
- Buffer store

Tank filling device to be seen on the picture of W4724-4A above.



Experimenters for Metal Engineering with SIMATIC S7-1200

Basic equipment

Industrial components

- 2 Micro PLC SIMATIC S7-1214C, 50 KByte RAM, Onboard 14DI DC /10DO Relais

Simulation panel

22 (14 onboard, 8 extension) digital inputs DI in total;
 14 digital inputs DI brought out to momentary-contact/maintained-contact switches and 4-mm safety lab sockets
 18 (10 onboard, 8 extension) digital inputs DI in total;
 10 digital outputs DO brought out to 4-mm safety lab sockets
 24-V power supply brought out to 4-mm safety lab sockets.
 The Ethernet-interface is brought out to a front-socket.

Experimenter M with integrated universal simulator Metal Engineering

This experimenter is especially suited for fundamental PLC training in the vocational field Metal Engineering. The experiments have been aligned with the curriculum and contain training subjects in the field of electropneumatics.

The experimenter is equipped with the Micro-PLC SIMATIC S7-1214C and an integrated universal simulator with overlays.

The inputs and outputs of the SIMATIC S7-1214C are internally wired to the simulation panel matrix of the experimenter brought out to 4-mm safety lab sockets and additionally to a 37pin D-SUB-jack
 The scope of supply includes 11 different overlays with examples, ranging from simple logic control to sequential control.

- Parcel lifting
- Sorting unit
- Allotment device
- Quality testing device
- Silo control for 2 bulk goods
- Stamp device
- Press with protection cage
- Parcel lifting with sorter
- Positioning unit
- Shaping station
- Distribution unit

By replacing the overlays, the LEDs assigned to the respective exercise become visible.

Training content:

- Electropneumatics
- Electropneumatic signal flow chart
- Safety conditions in installations with electropneumatics
- Logic operators
- Interlock circuit
- Process-oriented/time-oriented sequential control
- Storage types
- Counters and comparators
- Structured programming
- Status diagram
- Step enabling conditions

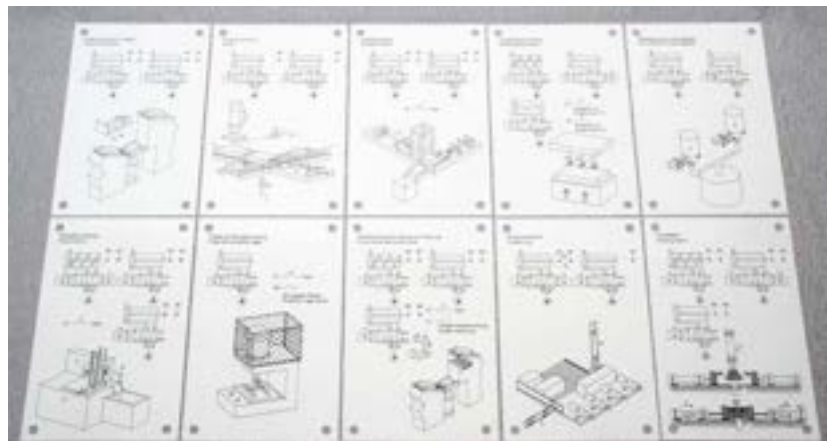
Dimensions (W x H x D) 420x150x300 mm
 Weight approx. 5 kg

Overlays

Part of delivery of W4724-4B

- Parcel lifting
 - Sorting unit
 - Allotment device
 - Quality testing device
 - Silo control for 2 bulk goods
 - Stamp device
 - Press with protection cage
 - Parcel lifting with sorter
 - Positioning unit
 - Shaping station
- Distribution unit not illustrated

Order-No. W4724-4B



➤ **Experimental console with SIMATIC S7-1200**



Order-No. W4724-1H

Industrial components:

- 1 Power supply 230V AC;
DC 24V/2,5A
- 1 central unit CPU 1214C,
50 Kbyte RAM, 14DI, 10DO, 2AI
0-10V oder 0-20mA, Profinet
interface
- 1 Signal module SM1223, DC 24V;
8DI/8DO, isolated
- 1 Signal module SB1232,
1AO +/- 10VDC oder 0-20mA

Simulation control panel:

DI-module:

22 digital inputs, therefrom 14 DI
lead to 14 4mm safety lab sockets
with momentary-contact /
maintained-contact switch and 16 DI
lead to 37-pin D-SUB-system
connector, diode decoupled,

DO-Modul:

18 digital outputs, therefrom 10
DO lead to 4mm safety lab
sockets with status led and 16
digital outputs lead to 37-pin D-
SUB-system connector, diode
decoupled,

AI/AO-Module:

- 2 AI, lead to 4mm safety lab sockets
- 1 AO, lead to a 4mm safety lab
socket

Basis-module:

1 inlet connector for non-heating
apparatus, shor circuit protection
fuse and illuminated on-off-switch for
mains-voltage-connection 230V,
Power supply 24V/2A additionally
lead to 4mm safety lab sockets,
System female socket 37pin D-SUB,
diode decoupled mit 16 digital in-
and outputs each and 24V DC
voltage for external connection of
models.
Support connection cable 2m,
operator's guide

General:

The experimental panels are drafted
modular and can be hinged in an A4
experimental frame or disposes with
the stabile metal console hood on the
laboratory table.

Basic equipment

- 1 experimental panel completely
wired
- 1 Sturdy metal casing with
non-slip feet
- 1 Mains connecting lead
- 1 Instruction manual

Order No. W4724-1Z



Extension experimental panel with 5-
fold switch XB 005.

Order No. W4751-1U



SIMATIC HMI Touchpanel KTP700
7" TFT Display, 65536 colors and 8
function keys on a DIN-A4
experimental palen. Poser supply
24VDC with 4mm safety lab sockets.
USB- and Profinetsocket are lead to
the front panel.

➤ **Training Units with SIMATIC S7-300 in Rack Design**

Racks in general

The training units in rack design have a semimodular structure and can be retrofitted with expansion modules. The number of possible expansions depends on the basic configuration of the rack.

The racks are especially suited for an individual arrangement. They may be retrofitted with communications processors for PROFIBUS or AS-Interface or also with special function modules (FM).

The width of the simulation module depends on the SIMATIC S7-300 module above and corresponds to:
1 WU = 40 mm

By default, the training racks are equipped with 4-mm safety lab sockets.

Basic configuration of training unit with S7-300

- 1 Training rack, completely wired, out of steel sheet with scratch-resistant powder coating
- 1 Mains connecting lead
- 1 Mounting channel
- 1 Signal routing module I/O Switch
- 1 Operating instructions



SIMATIC Experimental Rack W4734-1H

CPU 314C-2PN/DP, 24DI, 16 DO, 5 AI, 2AO, Word

The training-set is equipped with:
Industrial components:

- 1 Power supply unit 115/230 VAC (47-63Hz); DC 24V
- 1 Central processing unit S7-300 CPU 314C-2PN/DP, Working memory 192KB RAM, 24 Digital Inputs, 16 Digital Outputs, 5 Analog Inputs, 2 Analog Outputs, High speed counters
- 1 Signal Module SM323 16DI/16DO
- 1. Interface PROFINET
- 2. Interface Profibus DP
- 1 Micro-Memory-Card 512 kbyte

Digital-connections:

32 digital inputs are connected on momentary-contact/ maintained-contact switch and to 4-mm-safety sockets, signal statuses by LED

16 digital outputs are connected to 4-mm-safety sockets, signal statuses by LED

Analog connections:

- 4 analog inputs, are connected to 4-mm-safety sockets. Internal or external voltage infeed individually per channel choosable
- 4 potentiometer ±10V steplessly adjustable for infeed of analogue values,
- 1 Analog Input for Resistance or PTP connected to 4-mm-safety sockets.
- 2 analog output connected to 4-mm-safety sockets,
- 1 LCD measuring device for all AI individually switchable onto each input;
- 1 LCD measuring device for all AO individually switchable onto AO1 or AO2

Word-module:

16 DI on numerical setter, BCD encoded and
16 DO are connected to 5digit 7-segment display, BCD encoded digit display 0 –9, A-F switch for decimal or hexadecimal display
on-off switch (to avoid mistakes between DI/DO in-/outputfiles and word processing)

PS-module:

inlet connector for non-heating apparatus,
short circuit protection, fuse and illuminated on-off switch
24 V on 4-mm-safety sockets for external use
1 x 37-pin D-SUB connector interconnected to S7 modules with 16 DI and 16 DO each
power supply connection cable

WxDxH approx. 50x22x54 cm

Order No. W4734-1H

➤ **Training Units with SIMATIC S7-300 in Rack Design**

Racks in general

The training units in rack design have a semimodular structure and can be retrofitted with expansion modules. The number of possible expansions depends on the basic configuration of the rack.

The racks are especially suited for an individual arrangement. They may be retrofitted with communications processors for PROFIBUS or AS-Interface or also with special function modules (FM).

The width of the simulation module depends on the SIMATIC S7-300 module above and corresponds to:
1 WU = 40 mm

By default, the training racks are equipped with 4-mm safety lab sockets.

Without picture

Basic configuration of training unit with S7-300

- 1 Training rack, completely wired, out of steel sheet with scratch-resistant powder coating
- 1 Mains connecting lead
- 1 Mounting channel
- 1 Signal routing module I/O Switch
- 1 Operating instructions

SIMATIC Experimental Rack W4734-1H-TP

CPU 314C-2PN/DP, 24DI, 16 DO, 5 AI, 2AO, Word ,Touchpanel

The training-set is equipped with:
Industrial components:

- 1 Power supply unit 115/230 VAC (47-63Hz); DC 24V
- 1 Central processing unit S7-300 CPU 314C-2PN/DP, Working memory 192KB RAM, 24 Digital Inputs, 16 Digital Outputs, 5 Analog Inputs, 2 Analog Outputs, High speed counters
- 1 Signal Module SM323 16DI/16DO
- 1. Interface PROFINET
- 2. Interface Profibus DP
- 1 Micro-Memory-Card 512 kbyte

Digital-connections:

- 32 digital inputs are connected on momentary-contact/ maintained-contact switch and to 4-mm-safety sockets, signal statuses by LED
- 16 digital outputs are connected to 4-mm-safety sockets, signal statuses by LED

Analog connections:

- 4 analog inputs, are connected to 4-mm-safety sockets. Internal or external voltage infeed individually per channel choosable
 - 4 potentiometer ±10V steplessly adjustable for infeed of analogue values,
 - 1 Analog Input for Resistance or PTP connected to 4-mm-safety sockets.
 - 2 analog output connected to 4-mm-safety sockets,
 - 1 LCD measuring device for all AI individually switchable onto each input;
 - 1 LCD measuring device for all AO individually switchable onto AO1 or AO2
- Word-module:
16 DI on numerical setter, BCD encoded and
16 DO are connected to 5digit 7-segment display, BCD encoded digit display 0 –9, A-F
switch for decimal or hexadecimal display
on-off switch (to avoid mistakes between DI/DO in-/outputfiles and word processing)

Touchpanel SIMATIC TP700:

RJ45 Ports are lead to front panel, USB connections are lead to front panel
MPI/Profibus DP Interface is lead to front panel to 9-pin D-SUB female connector.
Additionally included:
1 x Engineering-, options- and runtimesoftware SW and licence WinCC Advanced V13 SP1

PS-module:

inlet connector for non-heating apparatus,
short circuit protection, fuse and illuminated on-off switch
24 V on 4-mm-safety sockets for external use
1 x 37-pin D-SUB connector interconnected to S7 modules with 16 DI and 16 DO each
power supply connection cable

WxDxH approx. 66x22x54 cm

Order No. W4734-1H-TP

➤ Training Units with SIMATIC S7-300 in Rack Design

Racks in general

The training units in rack design have a semimodular structure and can be retrofitted with expansion modules. The number of possible expansions depends on the basic configuration of the rack.

The racks are especially suited for an individual arrangement. They may be retrofitted with communications processors for PROFIBUS or AS-Interface or also with special function modules (FM).

The width of the simulation module depends on the SIMATIC S7-300 module above and corresponds to:
1 WU = 40 mm

By default, the training racks are equipped with 4-mm safety lab sockets.

Basic configuration of training unit with S7-300

- 1 Training rack, completely wired, out of steel sheet with scratch-resistant powder coating
- 1 Mains connecting lead
- 1 Mounting channel
- 1 Signal routing module I/O Switch
- 1 Operating instructions



SIMATIC Experimental Rack W4734-1E

CPU 314C-2PN/DP, 24DI, 16 DO, 5 AI, 2AO

The training-set is equipped with:

Industrial components:

- 1 Power supply unit 115/230 VAC (47-63Hz); DC 24V
- 1 Central processing unit S7-300 CPU 314C-2PN/DP, Working memory 192KB RAM, 24 Digital Inputs, 16 Digital Outputs, 5 Analog Inputs, 2 Analog Outputs, High speed counters
- 1 Signal Module SM323 16DI/16DO
- 1. Interface PROFINET
- 2. Interface Profibus DP
- 1 Micro-Memory-Card 512 kbyte

Digital-connections:

32 digital inputs are connected on momentary-contact/ maintained-contact switch and to 4-mm-safety sockets, signal statuses by LED

16 digital outputs are connected to 4-mm-safety sockets, signal statuses by LED

Analog connections:

- 4 analog inputs, are connected to 4-mm-safety sockets. Internal or external voltage infeed individually per channel choosable
- 4 potentiometer $\pm 10V$ steplessly adjustable for infeed of analogue values,
- 1 Analog Input for Resistance or PTP connected to 4-mm-safety sockets.
- 2 analog output connected to 4-mm-safety sockets,
- 1 LCD measuring device for all AI individually switchable onto each input;
- 1 LCD measuring device for all AO individually switchable onto AO1 or AO2

PS-module:

inlet connector for non-heating apparatus, short circuit protection, fuse and illuminated on-off switch
24 V on 4-mm-safety sockets for external use
1 x 37-pin D-SUB connector interconnected to S7 modules with 16 DI and 16 DO each
power supply connection cable

WxDxH approx. 50x22x54 cm

Order No. W4734-1E

➤ **Training Units with SIMATIC S7-300 in Rack Design**

Racks in general

The training units in rack design have a semimodular structure and can be retrofitted with expansion modules. The number of possible expansions depends on the basic configuration of the rack.

The racks are especially suited for an individual arrangement. They may be retrofitted with communications processors for PROFIBUS or AS-Interface or also with special function modules (FM).

The width of the simulation module depends on the SIMATIC S7-300 module above and corresponds to:
1 WU = 40 mm

By default, the training racks are equipped with 4-mm safety lab sockets.

Basic configuration of training unit with S7-300

- 1 Training rack, completely wired, out of steel sheet with scratch-resistant powder coating
- 1 Mains connecting lead
- 1 Mounting channel
- 1 Signal routing module I/O Switch
- 1 Operating instructions



SIMATIC Experimental Rack W4734-1D

CPU 314C-2PN/DP, 24DI, 16 DO

The training-set is equipped with:
Industrial components:

- 1 Power supply unit 115/230 VAC (47-63Hz); DC 24V
- 1 Central processing unit S7-300 CPU 314C-2PN/DP, Working memory 192KB RAM, 24 Digital Inputs, 16 Digital Outputs, 5 Analog Inputs, 2 Analog Outputs, High speed counters
- 1 Signal Module SM323 16DI/16DO
- 1. Interface PROFINET
- 2. Interface Profibus DP
- 1 Micro-Memory-Card 512 kbyte

Digital-connections:

- 32 digital inputs are connected on momentary-contact/ maintained-contact switch and to 4-mm-safety sockets, signal statuses by LED
- 16 digital outputs are connected to 4-mm-safety sockets, signal statuses by LED

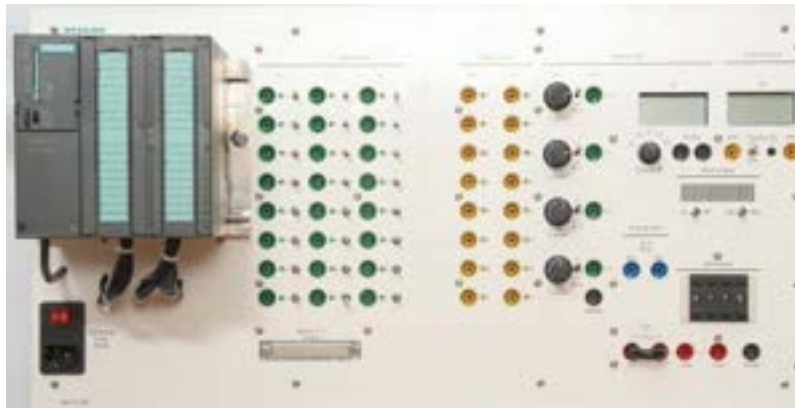
PS-module:

- inlet connector for non-heating apparatus,
- short circuit protection, fuse and illuminated on-off switch
- 24 V on 4-mm-safety sockets for external use
- 1 x 37-pin D-SUB connector interconnected to S7 modules with 16 DI and 16 DO each
- power supply connection cable

WxDxH approx. 50x22x54 cm

Order No. W4734-1D

➤ **Experimental consoles with SIMATIC S7-300**



General:

The experimental panels are drafted modular and can be hinged in an A4 experimental frame or disposed with the stable metal console hood on the laboratory table.

Basic equipment

- 1 experimental panel completely wired
- 1 Sturdy metal casing with non-slip feet
- 1 Mains connecting lead
- 1 Instruction manual

Industrial components:

- 1 Power supply 230V AC; DC 24V/5A.
- 1 central processing unit CPU 314C-2PN/DP, 24DI/16DO, 4AI/2AO, 192 KByte RAM,
- 1 Micro-Memory-Card 512 kB,
- 2 front connectors for simulation device 40pol.,
- 1 system profile-rail

Simulation control panel:

Digital-connection:

- 24 digital inputs, lead to simulation panel with momentary-contact / maintained-contact switch and 4-mm-safety lab sockets, status-led, and 16 DI lead to 37-pin D-SUB-system connector, diode decoupled.
- 16 digital outputs lead to simulation panel with 4mm safety lab sockets with status led and 16 DO lead to 37-pin D-SUB-system connector, diode decoupled,

Analog connections:

- 4 analog inputs, are connected to 4-mm-safety sockets. Internal or external voltage infeed individually per channel choosable
- 4 potentiometer $\pm 10V$ steplessly adjustable for infeed of analogue values,
- 1 Analog Input for Resistance or PTP connected to 4-mm-safety sockets.
- 2 analog output connected to 4-mm-safety sockets,
- 1 LCD measuring device for all AI switchable onto each input;
- 1 LCD measuring device for all AO individually switchable onto AO1 or AO2

Word-module:

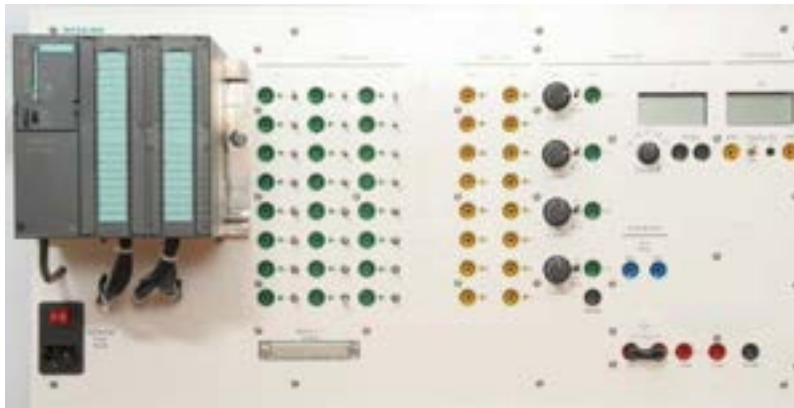
- 16 DI on numerical setter, BCD encoded and
- 16 DO are connected to 5digit 7 – segment display, BCD encoded digit display 0 –9, A-F, switch for decimal or hexadecimal display on-off switch (to avoid mistakes between DI/DO in-/outputfiles and word processing)

Basis-module:

- 1 inlet connector for non-heating apparatus, shor circuit protection fuse and illuminated on-off-switch for mains-voltage-connection 230V, Power supply 24V/2A additionally lead to 4mm safety lab sockets, System female socket 37pin D-SUB, diode decoupled mit 16 digital in- and outputs each and 24V DC voltage for external connection of models.
- Support connection cable 2m, operator's guide

Order No. W4734-2H

➤ **Experimental consoles with SIMATIC S7-300**



General:

The experimental panels are drafted modular and can be hinged in an A4 experimental frame or disposed with the stable metal console hood on the laboratory table.

Basic equipment

- 1 experimental panel completely wired
- 1 Sturdy metal casing with non-slip feet
- 1 Mains connecting lead
- 1 Instruction manual

Industrial components:

- 1 Power supply 230V AC; DC 24V/5A.
- 1 central processing unit CPU 314C-2PN/DP, 24DI/16DO, 4AI/2AO, 192 KByte RAM,
- 1 Micro-Memory-Card 512 kB,
- 2 front connectors for simulation device 40pol.,
- 1 system profile-rail

Simulation control panel:

Digital-connection:

- 24 digital inputs, lead to simulation panel with momentary-contact / maintained-contact switch and 4-mm-safety lab sockets, status-led, and 16 DI lead to 37-pin D-SUB-system connector, diode decoupled.
- 16 digital outputs lead to simulation panel with 4mm safety lab sockets with status led and 16 DO lead to 37-pin D-SUB-system connector, diode decoupled,

Analog connections:

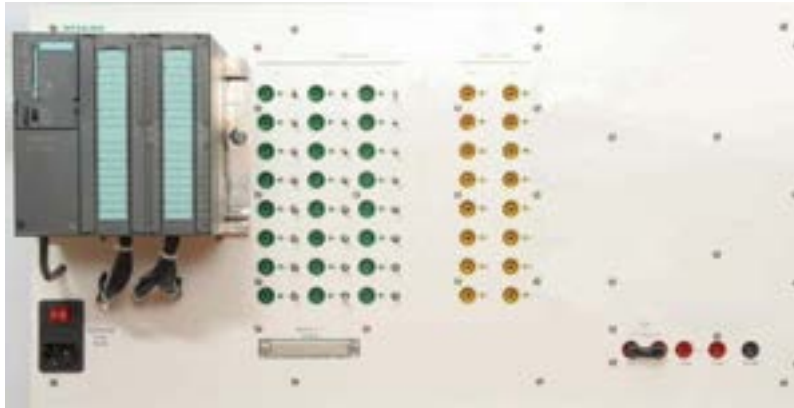
- 4 analog inputs, are connected to 4-mm-safety sockets. Internal or external voltage infeed individually per channel choosable
- 4 potentiometer $\pm 10V$ steplessly adjustable for infeed of analogue values,
- 1 Analog Input for Resistance or PTP connected to 4-mm-safety sockets.
- 2 analog output connected to 4-mm-safety sockets,
- 1 LCD measuring device for all AI switchable onto each input;
- 1 LCD measuring device for all AO individually switchable onto AO1 or AO2

Basis-module:

- 1 inlet connector for non-heating apparatus, shor circuit protection fuse and illuminated on-off-switch for mains-voltage-connection 230V, Power supply 24V/2A additionally lead to 4mm safety lab sockets, System female socket 37pin D-SUB, diode decoupled mit 16 digital in- and outputs each and 24V DC voltage for external connection of models.
- Support connection cable 2m, operator's guide

Order No. W4734-2E

➤ **Experimental consoles with SIMATIC S7-300**



Industrial components:

- 1 Power supply 230V AC; DC 24V/5A.
- 1 central processing unit CPU 314C-2PN/DP, 24DI/16DO, 4AI/2AO, 192 KByte RAM,
- 1 Micro-Memory-Card 512 kB,
- 2 front connectors for simulation device 40pol.,
- 1 system profile-rail

Simulation control panel:

Digital-connection:

- 24 digital inputs, lead to simulation panel with momentary-contact / maintained-contact switch and 4-mm-safety lab sockets, status-led, and 16 DI lead to 37-pin D-SUB-system connector, diode decoupled.
- 16 digital outputs lead to simulation panel with 4mm safety lab sockets with status led and 16 DO lead to 37-pin D-SUB-system connector, diode decoupled,

Basis-module:

- 1 inlet connector for non-heating apparatus, shor circuit protection fuse and illuminated on-off-switch for mains-voltage-connection 230V, Power supply 24V/2A additionally lead to 4mm safety lab sockets, System female socket 37pin D-SUB, diode decoupled mit 16 digital in- and outputs each and 24V DC voltage for external connection of models.
- Support connection cable 2m, operator's guide

Order No. W4734-2D

Experimental panel SIMATIC CSM1277

Experimental panel with Compact Switch Modul CSM1277 to connect up to 3 external components via industrial Ethernet bus with 10/100MBit/s. 2 safety lab sockets 4mm for 24V DC power supply are led out to the frontside of the panel with protection against polarity reversal.

Dimensions 130x297x65mm



Bestell-Nr. W4724-1Z

General:

The experimental panels are drafted modular and can be hinged in an A4 experimental frame or disposes with the stabile metal console hood on the laboratory table.

Basic equipment

- 1 experimental panel completely wired
- 1 Sturdy metal casing with non-slip feet
- 1 Mains connecting lead
- 1 Instruction manual

Budget priced Touch Panel SIMATIC HMI KTP700 Basic for SIMATIC S7-CPU's with WINCC Basic V13/Step7 Basic V13 software.

One Profinet- and one USB Interface, connected to the front panel gives easy bus access.

Universal Color-Panel for standards with PROFINET; 7" WIDESCREEN - TFT-Display (LED display dimmable), 65536 Colours resolution 800 x 480 Pixel ; Resistive analog touch RAM: 10 MB

Power supply via 4mm Si-Lab sockets 24VDC.

Inclusive Open Source Software

Dimensions (experimental panel): 260x297x65mm (WxHxD) Weight appr. 2 kg



Bestell-Nr. W4751-1U

➤ **Training Units with SIMATIC S7-1500 in Rack Design**



SIMATIC Experimental Rack W4715-1K
CPU 1512C-1PN, 32DI, 16DO, 5AI, 2AO

Industrial components:

- 1 Power supply unit 85-264 VAC (47-63Hz); DC 24V
- 1 Central processing unit S7-1500 CPU 1512C-1 PN, Working memory 250KB for program, 1MB for Data.
- 32 Digital Inputs
- 32 Digital Outputs
- 5 Analog Inputs, 2 Analog Outputs
- 6 High speed counters
- 1. Interface PROFINET IRT mit 2 Port Switch; 48ns Bit-Performance
- 1 Micro-Memory-Card 24 MB
- 2 Front connectors
- 1 SIMATIC S7-1500 system rail

Digital-connections:

24 digital inputs are connected on momentary-contact/ maintained-contact switch and to 4-mm-safety sockets, signal statuses by LED

16 digital outputs are connected to 4-mm-safety sockets, signal statuses by LED

Analog connections:

- 4 analog inputs, are connected to 4-mm-safety sockets. Internal or external voltage infeed individually per channel choosable
- 1 analog input for R/RTD for resistance/resistance thermometer measurement.
- 4 potentiometer $\pm 10V$ steplessly adjustable for infeed of analogue values,
- 1 Analog Input for Resistance or PTP connected to 4-mm-safety sockets.
- 2 analog output connected to 4-mm-safety sockets,
- 1 LCD measuring device for all AI individually switchable onto each input;
- 1 LCD measuring device for all AO individually switchable onto AO1 or AO2

Basic configuration of training unit with S7-1500

- 1 Training rack, completely wired, out of steel sheet with scratch-resistant powder coating
- 1 Mains connecting lead
- 1 Mounting channel
- 1 Signal routing module I/O Switch
- 1 Operating instructions

Word-module:

16 DI on numerical setter, BCD encoded and
16 DO are connected to 5digit 7-segment display, BCD encoded digit display 0 –9, A-F switch for decimal or hexadecimal display
on-off switch
selection switch for bit- or wordwise use (to avoid mistakes between DI/DO in-/outputfiles and word processing)

PS-module:

inlet connector for non-heating apparatus, short circuit protection, fuse and illuminated on-off switch
24 V on 4-mm-safety sockets for external use
1 x 37-pin D-SUB connector interconnected to S7 modules with 16 DI and 16 DO each power supply connection cable

WxDxH approx. 50x22x57 cm

Order No. W4715-1K

➤ **Training Units with SIMATIC S7-1500 in Rack Design**



SIMATIC Experimental Rack W4715-1K-TP

CPU 1512C-1PN, 32DI, 16DO, WORT, 5AI, 2AO, Touchpanel

Industrial components:

- 1 Power supply unit 85-264 VAC (47-63Hz); DC 24V
- 1 Central processing unit S7-1500 CPU 1512C-1 PN, Working memory 250KB for program, 1MB for Data.
- 32 Digital Inputs
- 32 Digital Outputs
- 5 Analog Inputs, 2 Analog Outputs
- 6 High speed counters
- 1. Interface PROFINET IRT mit 2 Port Switch; 48ns Bit-Performance
- 1 Micro-Memory-Card 24 MB
- 2 Front connectors
- 1 SIMATIC S7-1500 system rail
- 1 SIMATIC HMI TP700 Comfort panel 7"

Digital-connections:

- 24 digital inputs are connected on momentary-contact/ maintained-contact switch and to 4-mm-safety sockets, signal statuses by LED
- 16 digital outputs are connected to 4-mm-safety sockets, signal statuses by LED

Analog connections:

- 4 analog inputs, are connected to 4-mm-safety sockets. Internal or external voltage infeed individually per channel choosable

- 1 analog input for R/RTD for resistance/resistance thermometer measurement.
- 4 potentiometer $\pm 10V$ steplessly adjustable for infeed of analogue values,
- 1 Analog Input for Resistance or PTP connected to 4-mm-safety sockets.
- 2 analog output connected to 4-mm-safety sockets,
- 1 LCD measuring device for all AI individually switchable onto each input;
- 1 LCD measuring device for all AO individually switchable onto AO1 or AO2

Word-module:

- 16 DI on numerical setter, BCD encoded and
- 16 DO are connected to 5digit 7-segment display, BCD encoded digit display 0 –9, A-F switch for decimal or hexadecimal display
- on-off switch (to avoid mistakes between DI/DO in-/outputfiles and word processing)

Basic configuration of training unit with S7-1500

- 1 Training rack, completely wired, out of steel sheet with scratch-resistant powder coating
- 1 Mains connecting lead
- 1 Mounting channel
- 1 Signal routing module I/O Switch
- 1 Operating instructions

- 1 Touchpanel TP700: RJ45 ports connected to RJ45 socket on the front USB port connected to USB socket on the front; MPI/Profibus DP Interface connected to 9-in D-SUB socket.

PS-module:

- inlet connector for non-heating apparatus,
- short circuit protection, fuse and illuminated on-off switch
- 24 V on 4-mm-safety sockets for external use
- 1 x 37-pin D-SUB connector interconnected to S7 modules with 16 DI and 16 DO each
- power supply connection cable

WxDxH approx. 66x22x57 cm

Order No. W4715-1K-TP

➤ **Training Units with SIMATIC S7-1500 in Rack Design**



Basic configuration of training unit with S7-1500

- 1 Training rack, completely wired, out of steel sheet with scratch-resistant powder coating
- 1 Mains connecting lead
- 1 Mounting channel
- 1 Signal routing module I/O Switch
- 1 Operating instructions

SIMATIC Experimental Rack W4715-1F
CPU 1512C-1PN, 32DI, 16DO, 5AI, 2AO

Industrial components:

- 1 Power supply unit 85-264 VAC (47-63Hz); DC 24V
- 1 Central processing unit S7-1500 CPU 1512C-1 PN, Working memory 250KB for program, 1MB for Data. 32 Digital Inputs 32 Digital Outputs 5 Analog Inputs, 2 Analog Outputs 6 High speed counters 1. Interface PROFINET IRT mit 2 Port Switch; 48ns Bit-Performance
- 1 Micro-Memory-Card 24 MB
- 2 Front connectors
- 1 SIMATIC S7-1500 system rail

Digital-connections:

24 digital inputs are connected on momentary-contact/ maintained-contact switch and to 4-mm-safety sockets, signal statuses by LED

16 digital outputs are connected to 4-mm-safety sockets, signal statuses by LED

Analog connections:

- 4 analog inputs, are connected to 4-mm-safety sockets. Internal or external voltage infeed individually per channel choosable
- 1 analog input for R/RTD for resistance/resistance thermometer measurement.
- 4 potentiometer $\pm 10V$ steplessly adjustable for infeed of analogue values,
- 1 Analog Input for Resistance or PTP connected to 4-mm-safety sockets.
- 2 analog output connected to 4-mm-safety sockets,
- 1 LCD measuring device for all AI individually switchable onto each input;
- 1 LCD measuring device for all AO individually switchable onto AO1 or AO2

PS-module:

inlet connector for non-heating apparatus, short circuit protection, fuse and illuminated on-off switch 24 V on 4-mm-safety sockets for external use 1 x 37-pin D-SUB connector interconnected to S7 modules with 16 DI and 16 DO each power supply connection cable

WxDxH approx. 50x22x57 cm

Order No. W4715-1F

➤ **Training Units with SIMATIC S7-1500 in Rack Design**



Basic configuration of training unit with S7-1500

- 1 Training rack, completely wired, out of steel sheet with scratch-resistant powder coating
- 1 Mains connecting lead
- 1 Mounting channel
- 1 Signal routing module I/O Switch
- 1 Operating instructions

SIMATIC Experimental Rack W4715-1F
CPU 1512C-1PN, 32DI, 16DO, 5AI, 2AO

Industrial components:

- | | |
|---|---|
| <ul style="list-style-type: none"> 1 Power supply unit 85-264 VAC (47-63Hz); DC 24V 1 Central processing unit S7-1500 CPU 1512C-1 PN, Working memory 250KB for program, 1MB for Data. 32 Digital Inputs 32 Digital Outputs 5 Analog Inputs, 2 Analog Outputs 6 High speed counters 1. Interface PROFINET IRT mit 2 Port Switch; 48ns Bit-Performance 1 Micro-Memory-Card 24 MB 2 Front connectors 1 SIMATIC S7-1500 system rail | <ul style="list-style-type: none"> 16 digital outputs are connected to 4-mm-safety sockets, signal statuses by LED <p>PS-module:</p> <ul style="list-style-type: none"> inlet connector for non-heating apparatus, short circuit protection, fuse and illuminated on-off switch 24 V on 4-mm-safety sockets for external use 1 x 37-pin D-SUB connector interconnected to S7 modules with 16 DI and 16 DO each power supply connection cable |
|---|---|

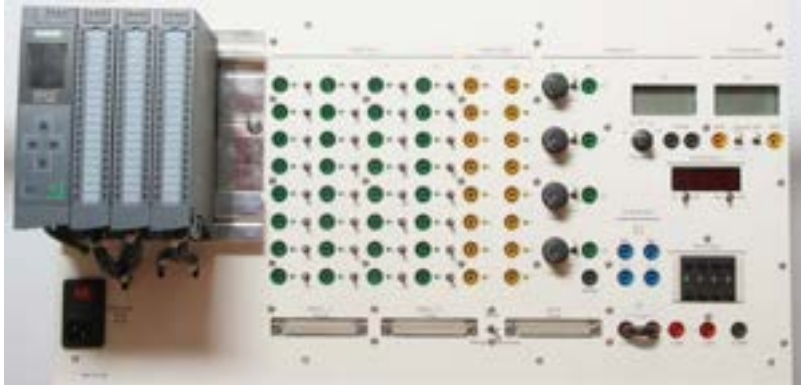
WxDxH approx. 50x22x57 cm

Digital-connections:

24 digital inputs are connected on momentary-contact/ maintained-contact switch and to 4-mm-safety sockets, signal statuses by LED

Order No. W4715-1C

➤ **Experimental consoles with SIMATIC S7-1500**



SIMATIC - Experimental Console
CPU 1512C-1PN, 32DI, 16DO, 5AI,
2AO WORD, ANALOG

The SIMATIC-Compactpanel is a space-saving and for the practice for vocational purposes optimized for exercises with SIMATIC S7-1500 with various bus-systems.

The compact-panel ist completely wired and equipped with a trovidur frontpanel for mounting in a DIN-A4 experimental frame and a backsided cover hood of sheet steel mit scartchproof paint.

The training-set is equipped with:

Industrial components:

- 3 Power supply unit 85-264 VAC (47-63Hz); DC 24V
- 4 Central processing unit S7-1500
CPU 1512C-1 PN, Working memory 250KB for program, 1MB for Data.
32 Digital Inputs, 32 Digital Outputs
5 Analog Inputs, 2 Analog Outputs
6 High speed counters
- 5 Interface PROFINET IRT mit 2
Port Switch; 48ns Bit-Performance
- 6 Micro-Memory-Card 24 MB
- 7 Front connectors
- 1 SIMATIC S7-1500 system rail

Digital-connections:

32 digital inputs are connected on momentary-contact/ maintained-contact switch and to 4-mm-safety sockets, signal statuses by LED

32 digital outputs, of which 16 are connected to 4-mm-safety sockets, signal statuses by LED

Analog connections

4 analog inputs, are connected to 4-mm-safety sockets, free choosable for voltage or currency measurements. Internal or external voltage infeed individually per channel choosable
4 potentiometer ±10V steplessly adjustable for infeed of analogue values, 1 analog input for R/RTD for resistance/resistance thermometer measurement.
2 analog output connected to 4-mm-safety socket,
1 LCD measuring device for all AI individually switchable onto each input;
1 LCD measuring device for all AO individually switchable onto AO1 and AO2:

Basic equipment

- 1 experimental panel completely wired
- 1 Sturdy metal casing with non-slip feet
- 1 Mains connecting lead
- 1 Instruction manual

Word-module:

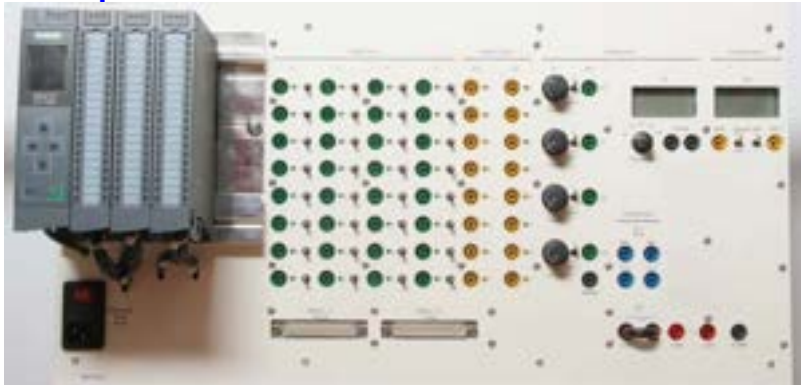
16 DI on numerical setter, BCD encoded and
16 DO are connected to 5digit 7-segment display, BCD encoded digit display 0 –9, A-F, switch for decimal or hexadecimal display on-off switch, selection switch for bit- or wordwise use (to avoid mistakes between DI/DO in-/outputfiles and word processing)

PS-module:

inlet connector for non-heating apparatus, short circuit protection, fuse and illuminated on-off switch
24 V on 4-mm-safety sockets for external use
3 x 37-pin D-SUB connector interconnected to S7 modules with 16 DI and 16 DO each
power supply connection cable
operator's guide

Order No. W4715-2K

➤ Experimental consoles with SIMATIC S7-1500



SIMATIC - Experimental Console
CPU 1512C-1PN, 32DI, 16DO, 5AI,
2AO, ANALOG

The SIMATIC-Compactpanel is a space-saving and for the practice for vocational purposes optimized for exercises with SIMATIC S7-1500 with various bus-systems.

The compact-panel ist completely wired and equipped with a trovidur frontpanel for mounting in a DIN-A4 experimental frame and a backsided cover hood of sheet steel mit scartchproof paint.

The training-set is equipped with:

Industrial components:

- 1 Power supply unit 85-264 VAC (47-63Hz); DC 24V
- 1 Central processing unit S7-1500 CPU 1512C-1 PN, Working memory 250KB for program, 1MB for Data. 32 Digital Inputs, 32 Digital Outputs 5 Analog Inputs, 2 Analog Outputs 6 High speed counters
- 1. Interface PROFINET IRT mit 2 Port Switch; 48ns Bit-Performance
- 1 Micro-Memory-Card 24 MB
- 3 Front connectors
- 1 SIMATIC S7-1500 system rail

Digital-connections:

32 digital inputs are connected on momentary-contact/ maintained-contact switch and to 4-mm-safety sockets, signal statuses by LED

32 digital outputs, of which 16 are connected to 4-mm-safety sockets, signal statuses by LED

Analog connections

4 analog inputs, are connected to 4-mm-safety sockets, free choosable for voltage or currency measurements. Internal or external voltage infeed individually per channel choosable 4 potentiometer $\pm 10V$ steplessly adjustable for infeed of analogue values, 1 analog input for R/RTD for resistance/resistance thermometer measurement.

2 analog output connected to 4-mm-safety socket,

1 LCD measuring device for all AI individually switchable onto each input;

1 LCD measuring device for all AO individually switchable onto AO1 and AO2:

Basic equipment

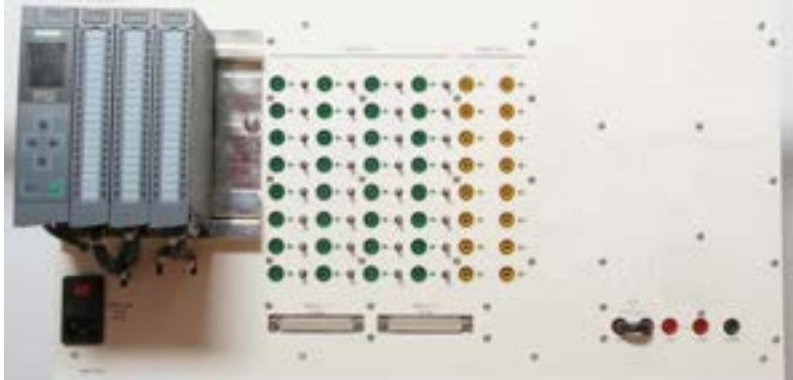
- 1 experimental panel completely wired
- 1 Sturdy metal casing with non-slip feet
- 1 Mains connecting lead
- 1 Instruction manual

PS-module:

inlet connector for non-heating apparatus, short circuit protection, fuse and illuminated on-off switch 24 V on 4-mm-safety sockets for external use 3 x 37-pin D-SUB connector interconnected to S7 modules with 16 DI and 16 DO each power supply connection cable operator's guide

Order No. W4715-2F

➤ **Experimental consoles with SIMATIC S7-1500**



SIMATIC - Experimental Console
CPU 1512C-1PN, 32DI, 16DO, 5AI, 2AO, ANALOG
The SIMATIC-Compactpanel is a space-saving and for the practice for vocational purposes optimized for exercises with SIMATIC S7-1500 with various bus-systems.
The compact-panel ist completely wired and equipped with a trovidur frontpanel for mounting in a DIN-A4 experimental frame and a backsided cover hood of sheet steel mit scartchproof paint.

The training-set is equipped with:

Industrial components:

- 1 Power supply unit 85-264 VAC (47-63Hz); DC 24V
- 1 Central processing unit S7-1500 CPU 1512C-1 PN, Working memory 250KB for program, 1MB for Data. 32 Digital Inputs, 32 Digital Outputs 5 Analog Inputs, 2 Analog Outputs 6 High speed counters
- 1. Interface PROFINET IRT mit 2 Port Switch; 48ns Bit-Performance
- 1 Micro-Memory-Card 24 MB
- 3 Front connectors
- 1 SIMATIC S7-1500 system rail

Digital-connections:

32 digital inputs are connected on momentary-contact/ maintained-contact switch and to 4-mm-safety sockets, signal statuses by LED

32 digital outputs, of which 16 are connected to 4-mm-safety sockets, signal statuses by LED

Analog connections

4 analog inputs, are connected to 4-mm-safety sockets, free choosable for voltage or currency measurements. Internal or external voltage infeed individually per channel choosable 4 potentiometer ±10V steplessly adjustable for infeed of analogue values, 1 analog input for R/RTD for resistance/resistance thermometer measurement.

2 analog output connected to 4-mm-safety socket,

1 LCD measuring device for all AI individually switchable onto each input;

1 LCD measuring device for all AO individually switchable onto AO1 and AO2:

Basic equipment

- 1 experimental panel completely wired
- 1 Sturdy metal casing with non-slip feet
- 1 Mains connecting lead
- 1 Instruction manual

PS-module:

inlet connector for non-heating apparatus, short circuit protection, fuse and illuminated on-off switch 24 V on 4-mm-safety sockets for external use 3 x 37-pin D-SUB connector interconnected to S7 modules with 16 DI and 16 DO each power supply connection cable operator's guide

Order No. W4715-2C



Experimental panel with Touchpanel TP700 Comfort

Profibus DP (9-pin D-SUB socket), USB (2) and Ethernet (2)-connection is lead to the front panel. 24V DC power supply connection throught 4mm safety lab sockets.

Also included: 1 x Engineering-, Option- and Runtimesoftware with full Licence WinCC Advanced V13 SP1

Order No. W4751-1T

➤ SIMATIC - Experimental case



SIMATIC – Experimental case with CPU S7-1516, 32DI, 16DO, WORD, ANALOG with integrated Touchpanel TP700 and universal simulator.

The SIMATIC universal case is a compact, portable training and experimental unit for PLC and HMI applications.

The training-set is equipped with:

Industrial components

- 1 power supply module PM1507, 120/230 VAC; DC 24V/8A,
- 1 Central Processing Unit SIMATIC S7-1500 CPU 1516-3 PN/DP, 1MB RAM for programme, 5MB RAM for data.
- 1st Interface: PROFINET with 2 port switch
- 2nd Interface: ETHERNET
- 3rd Interface: PROFIBUS
- 1 SIMATIC S7-1500 Digital Input Module 32DI
- 1 SIMATIC S7-1500 Digital Output Module 32DO, DC24V/0,5A
- 1 SIMATIC S7-1500 Analog Input Module 8AI
- 1 SIMATIC S7-1500 Analog Output Module 4AO
- 1 Micro-Memory-Card 24 MB
- 4 front-plugs for SM 40pin
- 1 rail
- 1 SIMATIC HMI TP700 COMFORT, COMFORT PANEL 7" with PROFINET and MPI/PROFIBUS DP INTERFACE (Panel with integrated switch with 2x RJ45 Port)

Simulation module:

- DI-module:
32 digital inputs connected on momentary-contact/ maintained-contact switch and to 4 mm MC-safety sockets, signal statuses by LED
- DO-module:
32 digital outputs of which 16 are connected to 4 mm MC-safety sockets, signal statuses by LED

Word-module:

- 16 DI on numerical setter, BCD encoded and
- 16 DO are connected to 4digit 7-segment display, BCD encoded digit display 0 –9, A-F, switch for decimal or hexadecimal display on-off switch

AI/AO-module:

- 8 analog inputs, are connected to 4-mm-safety sockets,
- 2 potentiometer $\pm 10V$ steplessly adjustable for infeed of analogue values,
- 4 analog output connected to 4-mm-safety socket,
- 2 measuring device $\pm 10V$ with zero point center

Touchpanel TP700:

- RJ45 ports connected to RJ45 socket on the front
- USB port connected to USB socket on the front
- MPI/Profibus DP Interface connected to 9-in D-SUB socket.
- Also included in package:
1 x Engineering-, Options- and Runtimesoftware SW und Licence WinCC Advanced V13 SP1

Universal simulator

The inbuilt universal simulator is especially suitable for the basic PLC training in the professional field of electrical engineering. The experiments are tailored for the curriculum of vocational education. The inputs and outputs are internally wired to the simulation field matrix of the case. The universal simulator is equipped with an operator panel and the simulator with text overlays . So it can also used for Digital Technique and Microprozessor Technique.

Design:

The 5 digital inputs for the simulator are brought out to 4 mm safety sockets.

Delivery includes 11 different text overlays with exercises dealing with the simple logic control as well as with the more difficult sequence control system.

- Fan control
- Tank filling device
- Star-delta starting up
- Gate control
- Roadworks traffic light
- Pump control
- Starter control
- Furnace door controller
- Traffic light control
- Buffer store
- Embossing machine

By exchanging the different text overlays, the LED'S, which are assigned to a specific exercise, are uncovered.

Training concepts in combination with

SIMATIC Experimenter console:

- Cyclic program processing
- Logic circuits
- Interlocking circuit
- Sequential circuit
- Different memories
- Pulse generator, edge evaluation
- Clock generator
- ON/OFF delay
- Counters and comparators
- Up/down counter
- BCD coding pulse count store
- Signal preprocessing
- Initializing pulse generator/pulse contact
- Structured programming
- Status diagram
- Process and timed sequence control system
- Mode sections
- Sequencers
- Step enabling conditions
- Word output

inlet connector for non-heating apparatus,

short circuit protection, fuse and illuminated on-off switch

24V / 5A on 4 mm MC-safety sockets

37-pin D-SUB connector interconnected to S7 modules with 16 DI and 16 DO supply connection cable 2m, operator's guide

Measures:

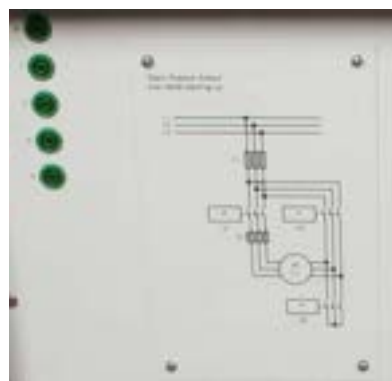
Case bottom 545 x 395 x 150 mm (b x h x t)

Case cover 545 x 395 x 125 mm (b x h x t)

Case closed 545 x 395 x 235 mm (b x h x t)

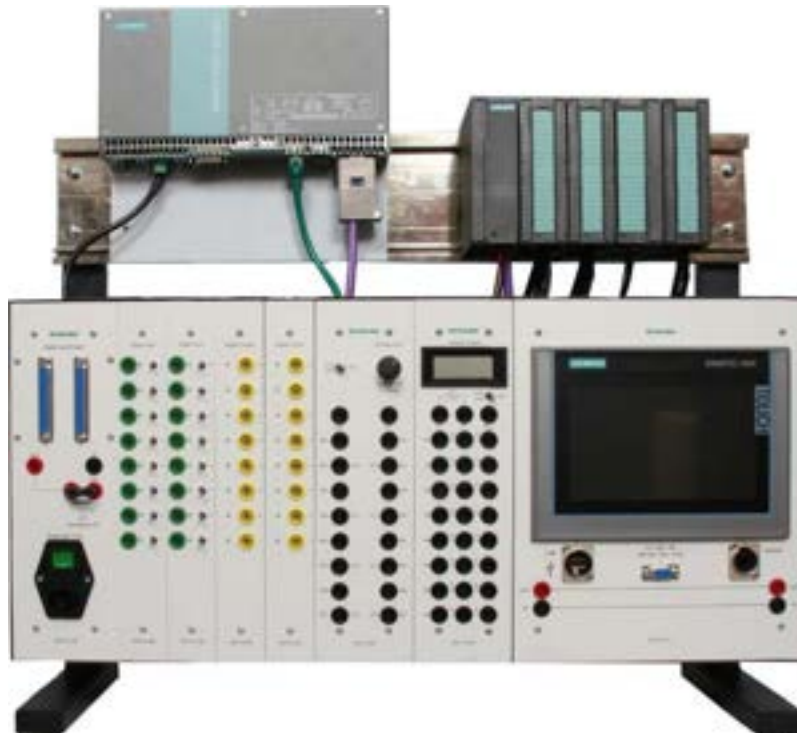
Weight:

13,5 kg



Order No. W4715-0A

➤ **Programmable Logic Control**



**SIMATIC PCS7 Microbox 427C
ET200M, 2x DI/DO, ANALOG-
I/O-Module**

Equipment

- 1 SIMATIC PCS 7 AS RTX
AUTOMATION SYSTEM
BASED ON IPC427C, CORE2
DUO 1.2 GHZ, 800 MHZ FSB, 3MB
SLC, 2 GB DDR3 1066 SODIMM
RAM, 4 GB COMPACT-FLASH
CHANGEABLE, CP5611
ONBOARD, WINDOWS
EMBEDDED STANDARD 2009,
WINAC RTX 2010 SOFTWARE
CONTROLLER, RUNTIME
LICENSE AS PO100
PREINSTALLED FOR PCS 7
OPERATING, APPLICABLE EX
PCS 7 V7.1 SP2 OR HIGHER
- 1 Digital-Input SM 321, 32 DI;
DC 24V
- 1 Digital-Output SM 322, 32 DO;
DC 24V;0,5A
- 1 Analog-Input SM 331, 8 AI; 14
Bit;
U/I/Resistor/PT 100
- 1 Analog-Output SM 332, 8 AO,
11/12 Bit, U/I
- 1 DP Slave Interface Module
IM153-2
- 1 Power Supply module PS 407,
10A,
AC 120/230V, DC 5V/10A
- 1 SITOP, PSU100M, Basic Line,
DC 24 V / 20 A
- 1 backup battery 3,6 V/2,3 Ah

Simulation modules:

DI-module:

32 digital inputs, of which 16 DI are connected on momentary-contact/ maintained-contact switch and to 4 mm MC-safety sockets, signal statuses by LED

DO-module:

32 digital outputs, of which 16 DO are connected to 4 mm MC-safety sockets, signal statuses by LED

AI - module:

8 analog inputs, are connected to 4mm safety-sockets,
1 potentiometer steplessly adjustable, voltage +/-10V or current 4 -20mA

AO - module:

8 analog outputs, are connected to 4mm safety-sockets , 1 digital measuring device, voltage +/-10V or current 0 -20mA,

PS-module:

Inlet connector for non-heating apparatus 230 V AC , short circuit protection, fuse and illuminated on-off switch 24 V / 5A on 4 mm safety-sockets

32 DI on 37-pin D-SUB connector
32 DO on 37-pin D-SUB connector

Touchpanel TP700:

SIMATIC HMI TP700 Comfort touch panel, 7" widescreen TFT display

Supply connection cable ,

Operator's guide english

**Order-No. W4748-1D-
PCS7**

➤ **Simulation Modules for older WUEKRO SIMATIC S7-300 Experimenter Consoles and Racks**

Simulation modules for experimenter consoles

The simulation modules are 297 mm high and correspond to 1 or 2 width units (except for basic module)
1 WU = 40 mm

The material of the front plate is of rigid, non-transparent PVC. The printing is scratch- and solvent-resistant.

All simulation modules are equipped with 4-mm safety lab sockets. High-quality momentary-contact/maintained-contact switches with over 100,000 possible switching operations guarantee durability.



Basic module

- Power supply unit PS307-1B AC 230V; DC 24V/2A
- Mains plug, short-circuit protection, fuse and illuminated ON/OFF switch
- 37-pin D-Sub socket connected to S7 modules with 16 digital inputs and 16 digital outputs, also connected to 24-V power supply
- Power supply unit 24 V/2 A at 4-mm safety lab sockets
- MPI interface wired to 9-pin D-Sub socket
- Rear cover out of plexiglass in console shape

Order-No. W4710-0A



PS module

- Power supply unit PS307 AC 230 V; DC 24 V/5 A
- Mains plug, short-circuit protection, fuse and illuminated ON/OFF switch
- 37-pin D-Sub socket connected to S7 modules with 16 digital inputs and 16 digital outputs, also connected to 24-V power supply
- 24-V power supply unit, brought out to 4-mm safety lab sockets
- fitting SITOP power module additionally available as an option

Order-No. W4710-1B



PS module

- Power supply unit PS307 AC 230 V; DC 24 V/5 A
- Mains plug, short-circuit protection, fuse and illuminated ON/OFF switch
- 37-pin D-Sub socket connected to S7 modules with 16 digital inputs and 16 digital outputs, also connected to 24-V power supply
- 24-V power supply unit, brought out to 4-mm safety lab sockets
- fitting SITOP power module additionally available as an option

Order-No. W4710-1B

➤ Simulation Modules for older WUEKRO SIMATIC S7-300 Experimenter Consoles and Racks



DI module

Simulation panel for digital input

- 8 digital inputs wired to momentary-/maintained-contact switches and to 4-mm safety lab sockets
- LED status indication for digital inputs

Order-No. W4710-0B



DO module

Simulation panel for digital output

- 8 digital outputs wired to 4-mm safety lab sockets
- LED status indication for digital outputs

Order-No. W4710-0C



Word module

Simulation panel for digital input or output, equipped with

- Numerical setter for word input (2 bytes), numerical input 0 – 9, BCD coded
- 7-segment display for word output (2 bytes), numerical display 0 – 9, BCD coded
- ON/OFF switch (required for simultaneous use of the DI/DO modules)

Order-No. W4710-0D



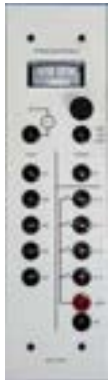
Analog module

Simulation panel for analog input or output, equipped with

- Meter ± 10 V with zero point in middle
- 10-turn potentiometer ± 10 V
- 4 analog inputs at 4-mm safety lab sockets
- 2 analog outputs at 4-mm safety lab sockets

Order-No. W4710-0E

➤ **Simulation Modules for older WUEKRO SIMATIC S7-300 Experimenter Consoles**



Analog module

Simulation panel for analog input or output, equipped with

- Meter ± 10 V with zero point in middle
- 10-turn potentiometer ± 10 V
- 4 analog inputs at 4-mm safety lab sockets
- 2 analog outputs at 4-mm safety lab sockets

4 digital inputs (special channels for integrated functions:

(Sonderkanäle für integrierte Funktionen: Zähler, Frequenzmessung, Alarmeingänge, Positionieren) herausgeführt auf Simulationsfeld mit 4-mm-Sicherheitslaborbuchsen

Nur für Verwendung in Verbindung mit CPU 314C

Order-No. W4710-0L



Analog module with SM 334

- Analog module SM334 with 4 AI and 2 AO with measuring ranges 0 to 10 V and 0 to 20 mA

Simulation panel for analog input or output, equipped with

- Meter ± 10 V with zero point in middle
- 10-turn potentiometer ± 10 V
- 4 analog inputs at 4-mm safety lab sockets
- 2 analog outputs at 4-mm safety lab sockets

Order-No. W4710-2E



PS module

- Power supply unit PS307 AC 230 V; DC 24 V/5 A
- Mains plug, short-circuit protection, fuse and illuminated ON/OFF switch
- 37-pin D-Sub socket connected to S7 modules with 16 digital inputs and 16 digital outputs, also connected to 24-V power supply

- 24-V power supply unit, brought out to 4-mm safety lab sockets

Order-No. W4710-1B

➤ **Programming Software**

**STEP 7 Software for Training
STEP 7 Professional**

To be used only for industrial schools and training centers

1 x Combo-license for interchangeable usage TIA PORTAL of: SIMATIC STEP 7 PROFESSIONAL 2010/V13 SP1 COMBO STEP 7 PROFESSIONAL V13 or STEP 7 PROFESIONAL 2010 SR4,

DISTRIBUTED SAFETY V5.4, S7-TECHNOLOGY V4.2, FLOATING LICENSE FUER 1 USER SW AND DOCU ON DVD, CLASS A 6 LANGUAGES: GE,EN,IT,FR,SP,CH; EXECUTABLE UNDER WINDOWS 7 (32 BIT, 64 BIT);

For configuration of SIMATIC S7-1500/1200/300/400/WINAC, SIMATIC Basic Panels. FOR EDUCATIONAL PURPOSES ONLY.

**SIMATIC S7 Trainer Package
12 Classroom-Licence**

!!! To be used only for non-industrial training centers !!!

12 classroom licenses STEP 7 Professional V13 SP1 with STL, FBD and AD:

12 x Combo-Lizenz for usage either of SIMATIC STEP 7 Professional V13 (KOP, FUP, AWL), S7-GRAPH, S7-SCL, S7-PLCSIM or SIMATIC STEP 7 Professional 2010 SR4; STEP 7 V5.5 SP4 (KOP, FUP, AWL), S7-GRAPH V5.3 SP7, S7-SCL V5.3 SP6, S7-PLCSIM V5.4 SP5

also 12 x Combo-Lizencences for changeable usage of SIMATIC STEP 7 Safety Advanced V13 SP1 or SIMATIC S7-Distributed Safety 5.4 SP5 Update 1

12 x SINAMICS Startdrive V13 SP1* für SINAMICS G120 CONTROL UNIT CU240E-2 CU250S-2 (mit Firmware V4.6)
1x SIMIT SIMULATION FRAMEWORK Demoversion V8.1
Licences only for STEP 7 Professional 2010 SR4
12 x SIMATIC S7-IMAP V3.0 SP3
12 x SIMATIC S7-Technology V4.2 SP3

Order-No. W4700-5B

3 x 20 Software for Students, SIMATIC STEP 7 Prof., valid for 1 year from first usage

For configuration of SIMATIC S7-1500/1200/300/400/WINAC, SIMATIC Basic Panels.

FOR EDUCATIONAL PURPOSES ONLY

Executable under Windows 7 (32bit, 64bit)

all contents are identical to the industrial version STEP7 Professional

Order-No. W4700-5A

SIMATIC S7 Trainer Package UPGRADE

Upgrade from STEP7 Prof. <2010 & <V12

!!! To be used only for non-industrial training centers !!!
For the upgrade of already existing former versions of the SIMATIC S7 trainer Package

12 classroom licenses STEP 7 Professional V13 SP1 with STL, FBD and AD:
12 x Combo-Lizenz for usage either of SIMATIC STEP 7 Professional V13 (KOP, FUP, AWL), S7-GRAPH, S7-SCL, S7-PLCSIM

or
SIMATIC STEP 7 Professional 2010 SR4; STEP 7 V5.5 SP4 (KOP, FUP, AWL), S7-GRAPH V5.3 SP7, S7-SCL V5.3 SP6, S7-PLCSIM V5.4 SP5 also 12 x Combo-Lizences for changeable usage of SIMATIC STEP 7 Safety Advanced V13 SP1
or
SIMATIC S7-Distributed Safety 5.4 SP5 Update 1
12 x SINAMICS Startdrive V13 SP1* für SINAMICS G120 CONTROL UNIT CU240E-2 CU250S-2 (mit Firmware V4.6)
1x SIMIT SIMULATION FRAMEWORK Demoverision V8.1

Lizences only for STEP 7 Professional 2010 SR4
12 x SIMATIC S7-IMAP V3.0 SP3
12 x SIMATIC S7-Technology V4.2 SP3
3 x 20 Software for Students, SIMATIC STEP 7 Prof., valid for 1 year from first usage

For configuration of SIMATIC S7-1500/1200/300/400/WINAC, SIMATIC Basic Panels.

FOR EDUCATIONAL PURPOSES ONLY

Executable under Windows 7 (32bit, 64bit)
all contents are identical to the industrial version STEP7 Professional

Order-No. W4700-5U

SIMATIC S7 SoftwareSTEP 7 BASIC V13

SIMATIC S7, STEP 7 BASIC V13 SINGLE LICENSE, E-SW, Software and documentation on DVD, licence Key on USB-Stick,

multi-lingual (DE,EN), runs under Windows7 (32/64Bit) and Windows8 SP1 (64Bit)

W4700-5C

Programming Software – Manuals/Accessories

PC adapter USB

for connection of PC with S7-300/-400, C7, M7 for PC with free USB slot incl . USB-cable (5m) suitable with WIN2000 or XP

Order-No. W4700-4M

➤ **Programming Devices**

SIMATIC FIELD PG M4

SIMATIC Field PG M4: The benchmark in compactness, robustness and performance Mobile engineering in the industrial environment.

The Field PG is perfect for harsh industrial applications because of its rugged yet attractive industrial design. Powerful processors and high-speed RAM provide this rugged laptop with high performance among the most demanding applications. You also benefit from wireless technology, a brilliant display, and other carefully designed features.

Overview

The mobile, industry-compatible programming device with powerful Intel Core i processor technology. Optimal for commissioning, service and maintenance of automation systems. Industrial notebook with wireless technology, large 15.6" widescreen display, long battery service life, high-speed RAM, and integral data backup concept. With all commonly used interfaces for industrial applications.

Application

The Field PG M3 is the optimal tool for automation engineering. It can be used in the commissioning, service and maintenance of automation systems. Thanks to its outstanding specifications, it can also be used in the office area.

Design

All the interfaces required are directly available on the device; no external connection components (I-Cable, I-Box) are necessary 5 integral USB interfaces, 1 interface can be used as high current in each interface block; external hard disks with a high starting current are easy to connect. DDR3 memory technology with 1066 MHz system cycle;

for significantly faster access to data. 15.6" widescreen display (16:9 format), LED backlighting, non-reflective with high luminance for the perfect overview even with numerous windows; the brightness can be adapted to the ambient lighting conditions using hotkeys. Powerful integrated graphics; also ideally suited to applications with demanding graphics. Integral WLAN with antennas specially designed for the Field PG M3. The integrated wireless LAN is approved for operation in Europe (CE), USA, (FCC), Canada (IC) and China (CCC). For operation outside these countries, the relevant national regulations must be observed.

Hard disk with serial ATA interface (150 Mbit/s) and high speed (5400 rpm); easily replaced to support rapid changeover between different software versions or operating systems. Powerful lithium ion rechargeable battery (71 Wh) for several hours of operation Keyboard with hotkeys; fast access to display settings, setting the computer in standby or hibernate mode, adjusting the loudspeaker and disabling the computer, etc. Built-in loudspeakers User-friendly touchpad Rugged magnesium injection-molded enclosure. New, dark coloration; significantly less sensitive to dirt

Scope of delivery/accessories

Pre-installed operating system: Windows XP Professional English MultiLanguage (32-bit) or Windows 7 Ultimate, 32-bit (Eng., Ger., Fr., Sp., It. selectable) or Windows 7 Ultimate, 64-bit (Eng., Ger., Fr., Sp., It. selectable); Note: STEP 5 and STEP 7-Micro/Win are not pre-installed and do not run under Windows 7 Pre-installed software STEP 7 Professional, STEP 7 Professional (TIA Portal), WinCC flexible Advanced, WinCC Advanced (TIA Portal), STEP 7 Micro/Win and STEP 5

Note:

The software is activated via the license keys to be purchased separately.

Function

Integral WLAN with antennas specially designed for the Field PG M3. The integral wireless LAN is approved for operation in Europe (CE), USA (FCC), Canada (IC), and China (CCC). For operation outside these countries, the relevant national regulations must be observed. Bluetooth. Dual display technology; supports the extended desktop with two screens with separate resolutions.

Programming Devices



Field PG Programming Device Premium

The Field PG's have a continued update cycle.

Please ask for the newest technical specs and software configurations.

This order number always entitles the actual premium full equipped field PG with the faster processor and full software equipped.

Order-No. W4781-5A

Field PG Programming Device Standard

The Field PG's have a continued update cycle.

Please ask for the newest technical specs and software configurations.

This order number always entitles the actual full equipped field PG with the slower processor and full software equipped.

Order-No. W4781-5C

Field PG Programming Device Premium + standard software configuration

The Field PG's have a continued update cycle.

Please ask for the newest technical specs and software configurations.

This order number always entitles the actual full equipped field PG with the faster processor and standard software configuration equipped.

Order-No. W4781-5B

Field PG Programming Device Standard + standard software configuration

The Field PG's have a continued update cycle.

Please ask for the newest technical specs and software configurations.

This order number always entitles the actual full equipped field PG with the slower processor and full software equipped.

Order-No. W4781-5D

➤ Accessories – Leads and Plugs

Connecting lead	32 A/250 V, black, 100 cm long, with 4-mm safety plug	Order-No. W3907-3E
Connecting lead	32 A/250 V, red, 100 cm long, with 4-mm safety plug	Order-No. W3907-3F
Adapter	4-mm plug/2-mm socket for the connection of 2-mm connecting leads	Order-No. W3942-2A
Connecting lead	37-pin D-SUB plugs on both sides, 1.5 m long, for the connection of technology simulators to SIMATIC S7 training devices	Order-No. W4760-8A
Connector plug for PROFIBUS	up to 12 Mbit/s, 90-degree cable attachment, terminating resistor with disconnecting function, without PG socket	Order-No. W3947-1A
Connector plug for PROFIBUS	up to 12 Mbit/s, 90-degree cable attachment, terminating resistor with disconnecting function, with PG socket	Order-No. W3947-1B
PROFIBUS lead	Bus lead 2-wire, shielded, special design for quick assembly, length: 20 m	Order-No. W3947-2A
PROFIBUS lead	Bus lead 2-wire, shielded, special design for quick assembly, length: 50 m	Order-No. W3947-2B
PROFIBUS lead	Bus lead 2-wire, shielded, special design for quick assembly, length: 100 m	Order-No. W3947-2C
Accessories – Manuals		
Manual collection on CD, multilingual	Includes S7-200/300/400, M7- 300/400, C7, Step7, engineering software, SIMATIC DP, SIMATIC HMI, SIMATIC NET	Order-No. W3048-3C

➤ **Experiment Instructions**

Practical experiment instructions



Experiment instruction manuals for all SIMATIC training systems, which have been compiled by specially trained and qualified employees, are available for use.

In general, the experiment instructions consist of three parts:

Part 1: Fundamentals
Introduces the training needs and provides the basic theory

Part 2: Experiments
Contains the experiments like programming and test tasks

Part 3: Solutions
Contains solutions to Part 2, offers ways of checking the results and thus reduces the time for preparation

Experiment instructions

V173	SIMATIC S7-300	Order-No. W3017-3B
V174	Digital Control II with SIMATIC S7	Order-No. W3017-4B
V175	Digital Control I with SIMATIC S7	Order-No. W3017-5B
V178	PROFIBUS DP	Order-No. W3017-8B
V179	Universal Simulator Electrical Engineering	Order-No. W3017-9B
V186	S7-SIM Programming Course 1	Order-No. W3018-6B
V187	Universal Simulator Digital/Analog Technology	Order-No. W3018-7B
V189	Universal Simulator Metal Engineering	Order-No. W3018-9B

➤ **System Introduction for SIMATIC S7**



**Basic training
SIMATIC S7**

3-5 days training
8 learning units each (45 min)
incl. training documentation

In the practical programming exercises available simulators and applications are integrated.

Individual quotation upon request.
If required also on site.

Training contents:

1. System information about SIMATIC S7 and about STEP7 / TIA-Portal
 - Scope of application → function within SIMATIC automation family
 - Method of operation and functions
 - Setup
 - Startup
 - Bus interfacing via MPI and Profibus
 2. Introduction to STEP7 / TIA-Portal programming based on an easy example
 - Setting up a project
 - Configuring the SIMATIC station
 - Writing program block OB1
 - Testing and storing program block OB1
 3. Programming language STEP7 / TIA-Portal with programming exercises
 - Directory structure and general notes
 - Archiving and documenting the program
 - Addressing and program representation (LAD, SFC and STL)
 - Program structure
 - Program blocks (OB, FB, FC and DB)
- Basic logic operations:
AND, OR, exclusive OR
Storage elements, R-S FF
Edge operations
Direct processing of RLO
Loading and transfer operations
Counting and comparison operations
Timing functions and integrated clock memory
Program organization and jump functions

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E-Mail	info@wuekro.de
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Please send the following catalogues to the a.m. address!

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| <input type="checkbox"/> Fundamentals of electronics <ul style="list-style-type: none"><input type="checkbox"/> Analog technology<input type="checkbox"/> Digital technology<input type="checkbox"/> Microprocessing technology | <input type="checkbox"/> Building management systems <ul style="list-style-type: none"><input type="checkbox"/> _____ KNX / EIB |
| <input type="checkbox"/> Closed loop control technology <ul style="list-style-type: none"><input type="checkbox"/> Analog control technology<input type="checkbox"/> Digital control technology | <input type="checkbox"/> Protection schemes to VDE 0100 |
| <input type="checkbox"/> Automation engineering <ul style="list-style-type: none"><input type="checkbox"/> SIMATIC S7-200/300/400, Software<input type="checkbox"/> Technology simulators / Models<input type="checkbox"/> Process control technology PCS7<input type="checkbox"/> AS-Interface<input type="checkbox"/> Process simulation-software PROSIM 95<input type="checkbox"/> LOGO! | <input type="checkbox"/> Radio- and TV technology <ul style="list-style-type: none"><input type="checkbox"/> AM/FM - Technology<input type="checkbox"/> TV Technology<input type="checkbox"/> Satellite - Technology |
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Remarks:

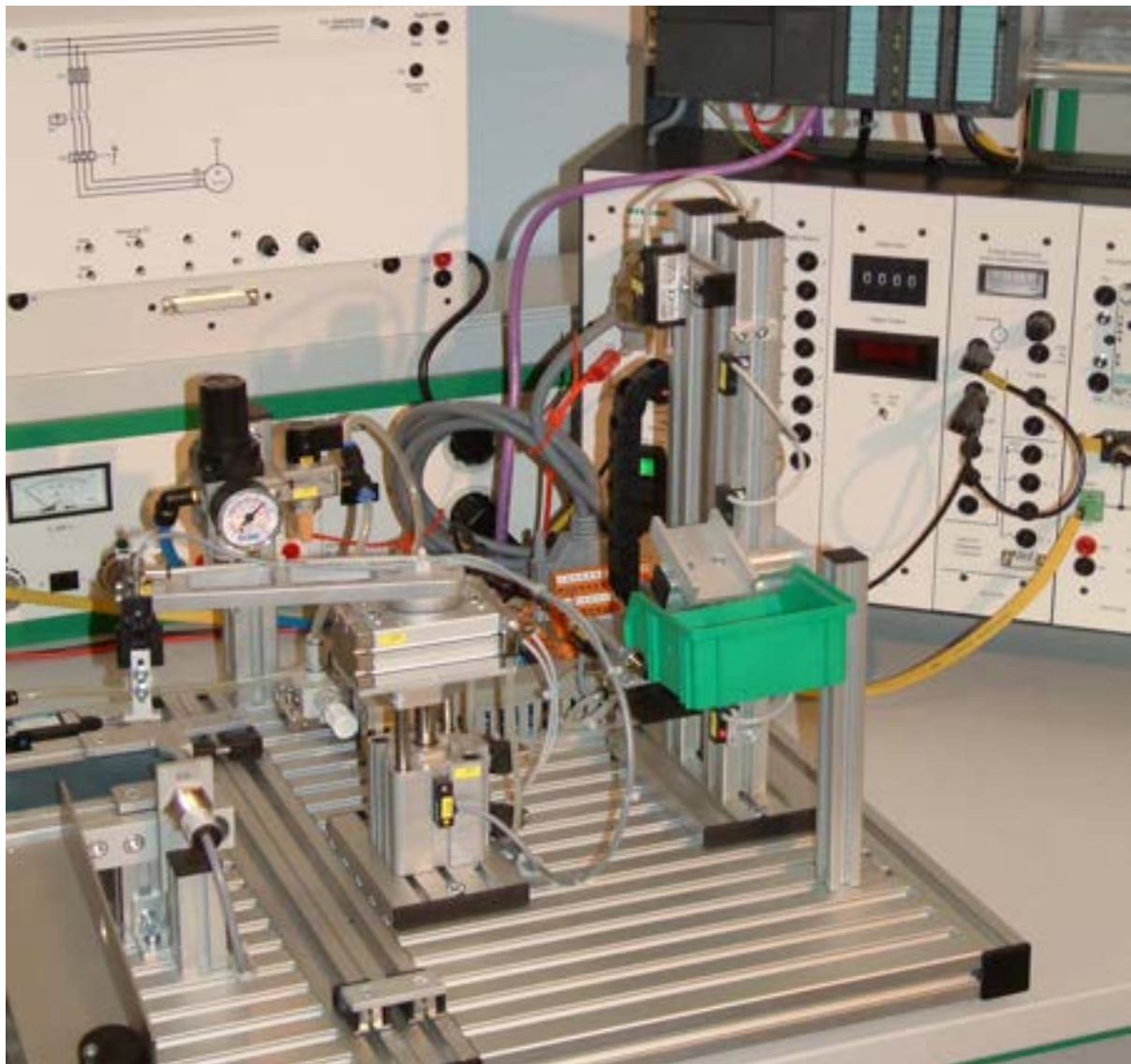


Training & Didactic Systems

Automation Technology with SIMATIC S7 Technology Stations/Simulators/Models

Catalog

WA2E/04.02



➤ Our Services

- Development and production of didactic training systems
- Teachware and documentation
- Project engineering of complete lab's incl. furniture and lab equipment
- Quotations on customer's demand
- Installation, commissioning and training at site

➤ Our Customers

- Vocational training schools, technical schools, colleges and universities...
- Industrial laboratories for vocational education and higher education

➤ Fields of Technology

- Fundamentals of electrical engineering
- Fundamentals of electronics
- Closed loop control technology
- Automation engineering
- Electrical machines / drive control
- Power electronics
- Building management systems
- Protection schemes to VDE 0100
- Radio- and TV technology
- Air conditioning and refrigeration
- Photovoltaic
- Communication technology
- Measuring systems, power supplies, accessories
- Experimental manuals, documentation

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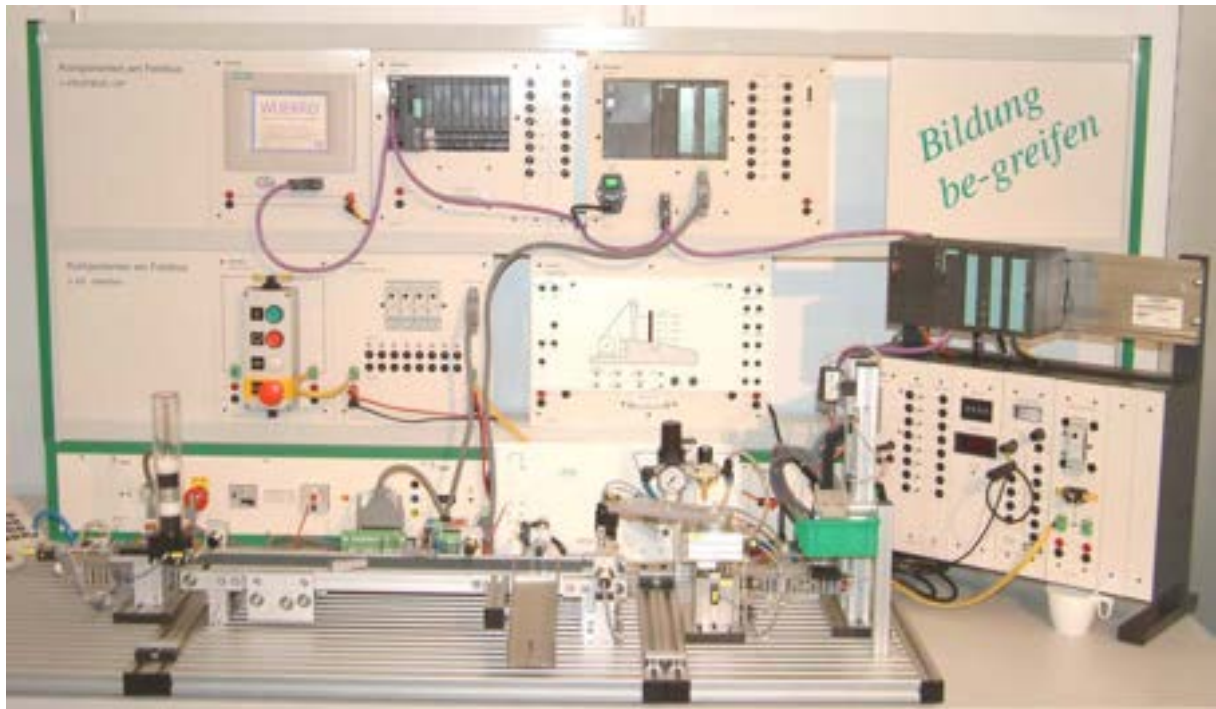
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S30020521P – 01/13

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➤ Training System Automation Technology



Educational Systems – Allocation – Target Groups

Study projects						
Dissertations						Automation systems
Specialized practical training						
College/University						
Basic practical training						
College/University						
Master craftsman/technician						
Further education (Chamber of Industry and Commerce)						
Skilled worker training						
Fundamentals						
Training/education						
	SIMATIC S7 - Experimenter					
		Programmable controllers, programming, industrial models				
			New technologies			
				Industrial bus systems		

➤ **Introduction**

Your learning needs will be fulfilled with our training systems

- Structure of numerical systems
- Declaration of variables
- Methods of PLC representation with FBL, LAD, STL, Graph 7, SCL according to standard IEC 1131-3
- Getting to know program execution procedures
- Getting to know the function groups of a PLC and their principles of operation according to standard IEC 1131-1,2
- Basic logic operations with a PLC
- Logic controls with dynamic response
Counters and comparators with/without storage function
Sequential controls with mode section
Sequencers
Operating status messages
Process-oriented or time-oriented
- Analog value processing
- Word processing
- Digital closed-loop control
- Autonomous modules
- Drive/position control
- Startup, maintenance
- Industrial networking
- Fundamentals of open communications
- Process visualization/control
- Fault diagnostics without/with visualization systems

The concept

The aim of the new IEC 1131 standard is to attain a worldwide unified system in the field of PLC technology. The programming languages are standardized in part 3. The standard encompasses the ladder diagram (LAD), function block language (FBL), sequence language (SL), statement list (STL), and structured text (ST).

PLC systems are an integral component of automation today. SIMATIC S7 has taken the lead by offering a basic system for the entire field of automation.

SIMATIC S7 is the platform for

- PLC
- Man-machine interface
- Industrial networking
- Process control engineering
- Automation computers
- Measurement and control
- DP applications

A great advantage for the user is the fact that this knowledge, once attained, can also be put to use in the other fields of technology.

The goal of our training concept for the different fields of automation is to provide

- Vocational schools
- Colleges
- Universities
- Places of training and further education

with the theoretical and practical prerequisites leading to trainees' and students' complete understanding of modern automation technology.

In general, there are two ways in which you can fulfill your training needs:

1. By working with the low-cost experimenter consoles and the technology simulators.
2. By working with the modular rack system, the technology simulators and models.

Here you can choose from the modules which are tailored to your curriculum.

Our program is rounded off with the model industrial bus system, the modular automation system aimed at engineering schools and colleges/universities.

Practical experiment instructions

Experiment instruction manuals on the individual modules, which have been compiled by specially trained and qualified employees, are available for use.

In general, the experiment instructions consist of three parts:

- Part 1 Introduces the training needs and provides the basic theory.
- Part 2 Contains the programming and test tasks.
- Part 3 Contains solutions to part 2. This keeps the time for test preparations to a minimum and offers a way of checking the results.

➤ Technology Simulators

General

Technology diagrams in 3-D simplify the understanding of the illustrated process and optimize the periods of training.

High-intensity LEDs symbolize sensors, actuators and operating states.

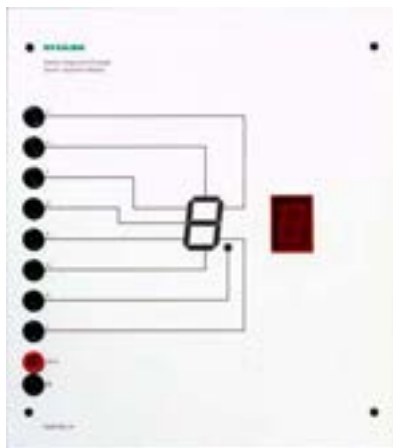
The material of the frontplate is of rigid, non-transparent PVC. The printing is scratch and solvent-resistant due to a double layer of protective lacquer. High-quality momentary-contact/maintained-contact switches with over 100,000 switching operations guarantee durability.

Thus, technology simulators with 3-D are a low-cost training alternative to models.

Logic controls without storage function

Logic controls without storage function are based on the application and combination of the basic logic functions:

- NOT • AND • OR



Seven-segment display technology simulator

The seven-segment display indicates the digits 0 to 9. The respective decimal value in BCD code (8-4-2-1) has to be set by the momentary-contact/maintained-contact switches on the PLC training unit.

The single segments are discretely controlled for each number.

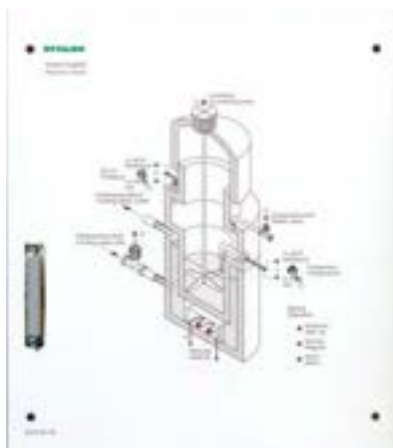
Training content

- Cyclic program processing
- Introduction of flags
- Structures of numerical systems

Number of inputs: 4

Number of outputs: 8

Order-No. W4760-1A



Reaction vessel technology simulator

A chemical process takes place at a certain temperature and under a certain pressure.

Limiting values for temperature and pressure are simulated by switches.

The actuators for heating, cooling-water and safety valve are used to control the three plant states.

Training content

- Control analysis
- Logic operations
- Status messages

Number of inputs: 4

Number of outputs: 7

Order-No. W4760-1B

➤ **Technology Simulators**

Logic controls with storage function

Many control tasks require a storage function.

This is available where a fleeting signal state is retained, i.e. stored.



Tank-filling device technology simulator

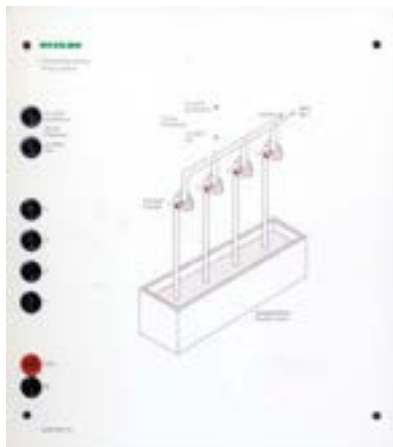
Three storage tanks with sensors for “full” and “empty” indication are to be discharged in a random order. One tank with “empty” indication is to be filled until “full” is indicated. But only one tank is to be permanently filled. The tanks are to be filled in the same order in which they were emptied.

Training content

- Interlock circuit
- Sequence control
- Storage types

Number of inputs: 6
Number of outputs: 3

Order-No. W4760-1C



Pump control technology simulator

Four motor-driven pumps deliver water from a suction tank into a pipeline. By switching the four pumps on and off in stages, the pressure in the mains is kept constant. The requirement is for the operating time of the pumps and the switching frequency to be as uniform as possible. Before switching the next stage on and off, an appropriate delay time is required.

Training content

- Truth table
- Pulse generator
- ON/OFF delay
- Process register

Number of inputs: 2
Number of outputs: 4

Order-No. W4760-1D

➤ Technology Simulators

Logic controls with dynamic response

The time generation is a basic binary function in control technology. Programmable „timers“ create a requested time-logic relationship between a start

signal at the input and a response signal at the output.



Automatic star-delta start-up technology simulator

The start-up of a three-phase asynchronous motor is to be controlled via a star-delta controller. When pressing a pushbutton switch the motor first runs in star connection and is then automatically switched to delta connection. When pressing another switch or operating the overcurrent relay the motor is disconnected at all poles.

Training content

- Time functions
- Interlock circuit

Number of inputs: 3

Number of outputs: 3

Order-No. W4760-1E



Belt control technology simulator

The three conveyor belts are to be switched on and off via a pushbutton switch. Belt 1 and 2 are not to run simultaneously. Belt 3 is to automatically run at the time when belt 1 or 2 are conveying. Belt monitors signal the conveyor movement. The belts are to slow down with different times after the OFF button has been pressed. Faults are signaled by a flashing light.

Training content

- Clock generator
- Pulse monitor of ON delays
- OFF delays
- Status messages

Number of inputs: 7

Number of outputs: 7

Order-No. W4760-1F

➤ **Technology Simulators**

Controls with counters and comparators

A certain set of values is often acquired by summing pulse. The corresponding pulses are passed to a counter which summates the received pulses.

Based on the compare functions, two digital values are compared with one another. The result of the comparison is binary and can be further processed.



Traffic light control technology simulator

A pedestrian crossing is regulated by traffic lights. During the day, the system operates automatically by permanently repeating a switch cycle.

During the night, only the amber signal is required to flash in order to warn drivers.

Training content

- Counters and comparators
- BCD coding/pulse count memory
- Clock generator

Number of inputs: 1
Number of outputs: 5

Order-No. W4760-1G



Automatic pill filling device technology simulator

An automatic pill filling device is to continuously fill a variable number of pills into tubes. The required number of pills is to be preselected by pressing a pushbutton. A conveyor belt moves the empty tube into the filling position. The number of pills to be filled is counted by a light barrier.

When the desired amount of pills is reached, the next empty tube is to be positioned.

When preselecting the amount of pills or stopping the machine, the last filling operation must first be completed.

Training content

- Up/down counter
- Signal preprocessing
- Initializing pulse generator/pulse contact
- Pulse count memory
- Status diagram

Number of inputs: 6
Number of outputs: 5

Order-No. W4760-1H

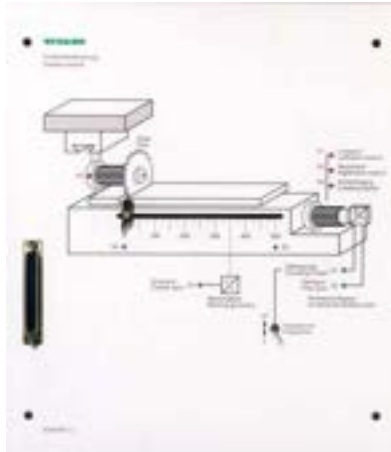
➤ Technology Simulators

Sequential controls

Sequential control is the control of a sequence of operations in individual steps. Switching from one step to the

following step is controlled by the control program in accordance with the “step enabling conditions”. The main property of the sequential control is that it can clearly assign individual steps to technological

procedures with respect to time and function. Consequently, distinction is made between “time-oriented” and “process-oriented” sequence control.



Positioning control technology simulator

Pieces of wood are cut true to dimensions on a saw table. For this purpose a stop is to be positioned from a control console with the help of an electric motor.

The movement of the stop is measured with a shaft-angle encoder. Limit switches are located at the end position of the spindle, which are to prevent the stop from entering the restricted area. Prior to restart and cold restart of the installation, the reference point is to be approached. The spindle drive can be controlled in clockwise or

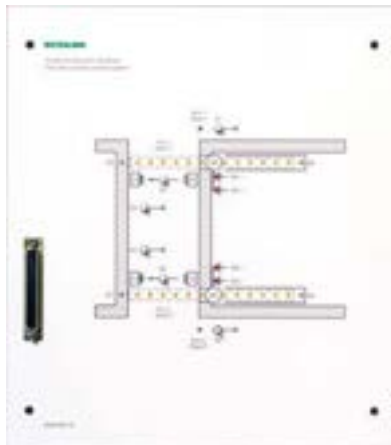
counter-clockwise rotation and also with creep speed.

Training content

- Word processing
- Positioning control
- Pulse contact
- Counters and comparators
- Prestructured status diagram
- Message display

Number of inputs: 5
Number of outputs: 4

Order-No. W4760-1J



Two-door access control system technology simulator

A dust-free room can be entered or left only through an air-lock with two automatically opening and closing doors. Light barriers monitor the entrances. In the case of an emergency the air-lock room can be opened or closed from within using additional door openers.

Limit switches indicate the corresponding positions of the doors.

All operating states are to be indicated via LEDs.

Training content

- Process and time-oriented sequential control
- Signal preprocessing
- Prestructured status diagram
- Structured sequencers
- Non-retentive flags
- Status messages

Number of inputs: 10
Number of outputs: 6

Order-No. W4760-1K

➤ **Technology Simulators**



**Embossing machine
automatic simulator**

A workpiece that has been released from the hopper is pushed into a machining station where it is to be embossed for 3 s. A nozzle blows the blank out and an ejector pushes the workpiece into a collecting container. An operator panel as used in industry controls the operating modes “automatic” and “manual with inching mode”. The final positions of the electropneumatically operated valves are automatically indicated by the limit switches. Internal electronics automatically simulate the valve feed.

Training content

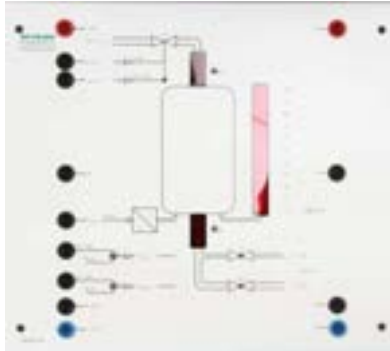
- Process-oriented sequential control
- Mode sections
- Step enabling conditions
- Protection against restart
- Controlled shutdown of a system

Number of inputs: 15

Number of outputs: 5

Order-No. W4760-1L

➤ Technology Simulators for Closed-Loop Control



Filling range control technology simulator

This simulator is an electronic model of a level control system in which the volume discharged in a specific time depends on the filling level (PT1 controlled system). Since the discharge is detected in analog mode, a system of n-order can be constructed with a second simulator, if this system is switched onto the inlet of the second simulator. Valves with different flow rates per unit time can be switched onto the system as a disturbance variable.

The filling level is indicated by a bar graph and is measured by an analog position sensor. In combination with the experimental panel PT1 Element you can switch variable, adjustable delay constants and gains onto the control circuit (PTn system).

According to the time spent on theory and practical experiments, the following learning targets can be reached:

- Analog value processing with SIMATIC S5/S7
- Getting to know the fundamentals of closed-loop control
- Know the characteristics of the controlled system, be able to differentiate between them and assess them according to their controllability
 - controlled system
 - steady-state behavior
 - dynamic response
 - flow chart

- Getting to know the tasks and elements of the controlling system
- Getting to know the structure and method of operation of discontinuous controllers
- Getting to know the structure and method of operation of continuous controllers
- Getting to know the combinations of controller and controlled system
- follow-up control
- set value control
- Being able to assess the control quality

Outputs

2 x binary: valves V2/V3
 1 x analog: 0...10 V, proportional valve V1

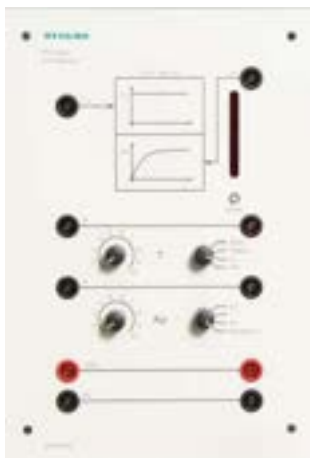
Inputs

0...10 V, actual value of filling level
 0...10 V, actual value of discharge rate

All I/O are connected to 4 mm safety sockets.

Required power supply: +/- 15 V
 e.g. W4610-4N

Order-No. W4760-1M



PT1 element technology simulator

Electronic simulation of a delay element of the 1st order. A stepless time-delay constant from 10 ms to 100 s and a stepless gain from 0.1 to 100 can be programmed. The PT1 element can be switched onto the control circuit of the simulator.

Training content

- Assessing control circuits of higher order according to
 - controllability
 - control quality
 - stability of control systems

Control 0...10 V

All I/O are connected to 4 mm safety sockets.

Order-No. W4760-1N

➤ **Technology Simulators for Closed-Loop Control**



DC power supply

Suitable for the supply of two filling level control technology simulators. designed as experimental panel height 297 mm for insertion into a compact unit or experimental frame. All connections are brought out to 4-mm-safety-sockets.

Technical specifications

Input voltage 1AC 230 V , 50 / 60 Hz
 Output voltage + 15 V / 1,5 A
 - 15 V / 1,5 A
 24 V / 0,5 A
 Dimensions (WxHxD) 130x297x100 mm
 Weight approx. 3 kg

Order-No. W4610-4N



Experiment instructions V 175 "Digital Control I" with SIMATIC S7

Part 1: Fundamentals of digital control
 Part 2: Experiments from two-position control to continuous-action control
 Part 3: Solutions

Order-No. W3017-5B

Experiment instructions V 174 "Digital Control II" with SIMATIC S7

Part 1: Design study PID controller
 Part 2: Experiments, setting procedures
 Part 3: Solutions

Order-No. W3017-4B

➤ Universal Simulators



Universal simulator electrical engineering

This simulator is especially suited for fundamental PLC training in the vocational field electrical engineering.

The experiments have been aligned with the curriculum.

The universal simulator is equipped with operator panel and simulator including overlays, and operates in a voltage range from 5 V...24 V DC. It is thus also suitable for applications from the fields of digital and microprocessor technology.

Design

Power +5V...24V is supplied via 4 mm safety sockets or 2 mm sockets, respectively.

There are 8 freely assignable momentary-contact/maintained-contact switches mounted on the operator panel. The connectors of the switches are brought out to 4 mm safety sockets and to 2 mm sockets.

The 5 digital inputs for the simulator are also wired to 4 mm safety sockets and to 2 mm sockets.

The scope of supply includes 11 different overlays with examples, ranging from simple logic control to sequential control.

- Fan control
- Tank filling device
- Star-delta start-up
- Gate control
- Roadwork traffic light
- Pump control
- Starter control
- Oven door control
- Traffic light control
- Buffer control
- Sheet bending device

By replacing the overlays, the LEDs assigned to the respective exercise become visible.

Teaching content (in conjunction with SIMATIC training units)

- Cyclic program processing
- Logic operations
- Interlock circuit
- Sequential circuit
- Storage types
- Pulse generator
- Edge evaluation
- Clock generator
- ON/OFF delay
- Counters and comparators
- Up/down counter
- BCD coding/pulse count memory
- Signal processing
- Initializing pulse generator/pulse contact
- Status diagram
- Process-oriented/time-oriented sequential control
- Mode sections
- Sequencers
- Step enabling conditions
- Word messages

Experiment instructions V 179 Universal simulator Electrical Engineering

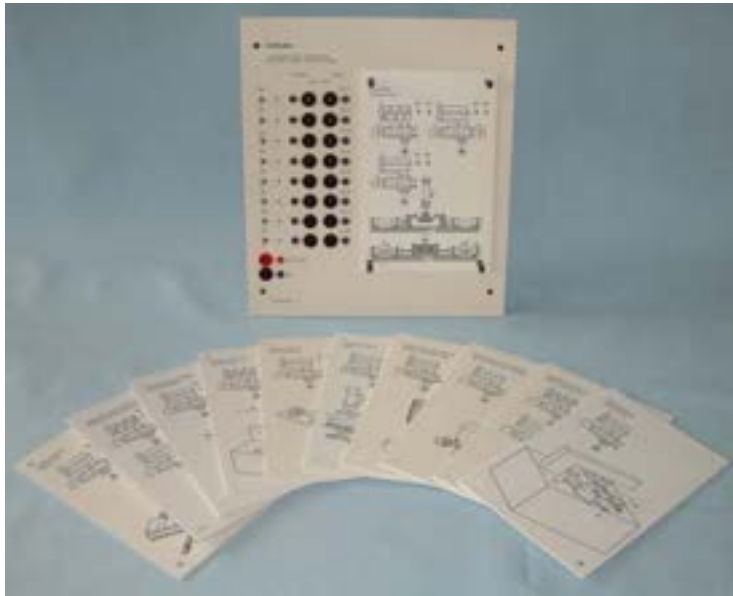
- Programming to standard IEC 1131-3
- Configuration of control tasks
- Instructions for setup and programming
- Example of a consistent configuration

Order-No. W4760-2A

- Programming tasks for universal simulator W4760-2A with solutions for instructor and teacher, English

Order-No. W3017-9B

➤ Universal Simulators



Universal simulator Metal Engineering

This simulator is especially suited for fundamental PLC training in the vocational field metal engineering. The experiments have been aligned with the curriculum. The universal simulator is equipped with operator panel and simulator including overlays, and operates in a voltage range from 5 V...24 V DC. It is thus also suitable for applications from the fields of digital and microprocessor technology.

Design

Power (+ 5 V ... 24 V) is supplied via 4 mm safety sockets or 2 mm sockets, respectively. There are 8 freely assignable momentary-contact/maintained-contact switches mounted on the operator panel. The connectors of the switches are brought out to 4 mm safety sockets and to 2 mm sockets.

The 8 digital inputs for the simulator are also wired to 4 mm safety sockets and to 2 mm sockets. The scope of supply includes 11 different overlays with examples, ranging from simple logic control to sequential control.

- Punching device
- Lifting unit for packages
- Stamping device
- Lifting unit with sorting unit
- Positioning unit
- Forming station
- Press with safety installation
- Silo control for 2 bulk goods
- Quality testing installation
- Distribution unit
- Sorting unit

By replacing the overlays, the LEDs assigned to the respective exercise become visible.

Teaching content (in conjunction with SIMATIC training units)

- Electropneumatics
- Electropneumatic signal flow diagram
- Safety conditions in installations with electropneumatics
- Logic operations
- Interlock circuit
- Process-oriented/time-oriented sequential control
- Storage types
- Counters and comparators
- Structured programming
- Status diagram
- Step enabling conditions

Experiment instructions V 189 Universal simulator Metal Engineering

- Programming to standard IEC 1131-3
- Configuration of control tasks
- Instructions for setup and programming
- Example of a consistent configuration

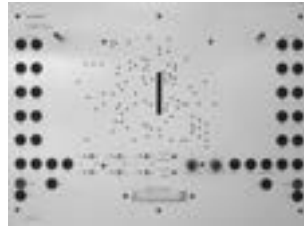
Order-No. W4760-2B

- Programming tasks for universal simulator W4760-2B with solutions for instructor and teacher, English

Order-No. W3018-9B

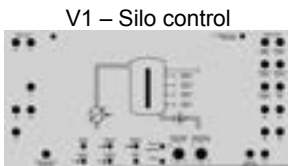
➤ Universal Simulators

Plant Simulator Analog/Digital technology

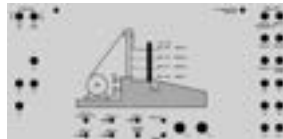


Basic Unit

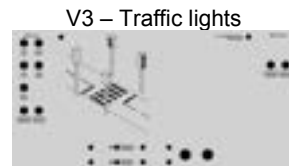
Set of Overlays
V2 – Goods lift



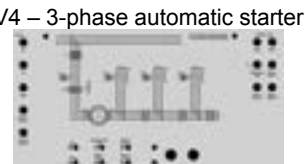
V1 – Silo control



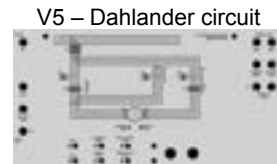
Set of Overlays
V2 – Goods lift



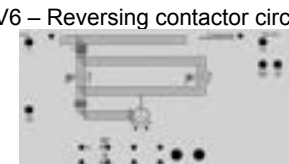
V3 – Traffic lights



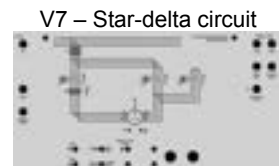
V4 – 3-phase automatic starter



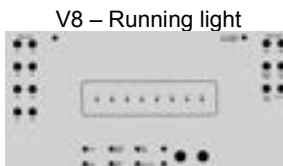
V5 – Dahlander circuit



V6 – Reversing contactor circuit



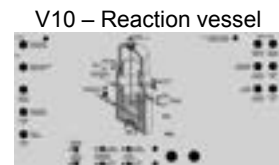
V7 – Star-delta circuit



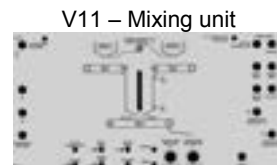
V8 – Running light



V9 – Drink vending machine



V10 – Reaction vessel



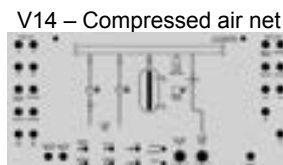
V11 – Mixing unit



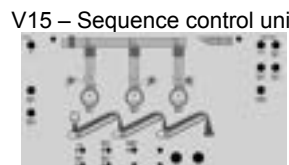
V12 – Latching circuit



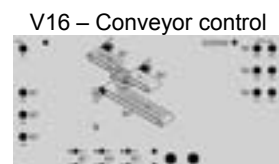
V13 – Multi storey car park



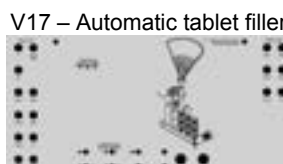
V14 – Compressed air net



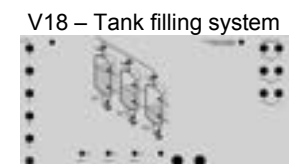
V15 – Sequence control unit



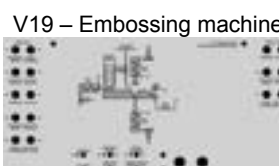
V16 – Conveyor control



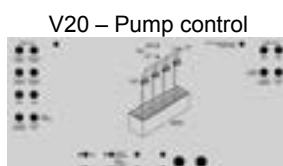
V17 – Automatic tablet filler



V18 – Tank filling system



V19 – Embossing machine



V20 – Pump control

➤ **Universal Simulators**

**Plant Simulator
Analog/Digital Technology**

The universal simulator is especially suitable for the basic PLC training in the professional field of electrical engineering and metal-working technology.

The experiments are tailored for the curriculum of vocational education.

The inputs and outputs are internally wired to the simulation field matrix of the simulator and additionally connected to 4-mm safety lab sockets.

The digital Inputs and Outputs are connected to a 37-pin D-SUB connector for an easy interconnection to SIMATIC Training-equipment.

By exchanging the different text overlays, the sockets, switches, potentiometer and LED's, which are assigned to a specific exercise, are uncovered. This makes sure a clear setup of the exercises and avoids mistakes.

Analog setpoint values can be adjusted by two potentiometers. The necessary power supply 24V can be supplied via 4-mm-safety sockets.

The Universal Simulator can be used as an experimental panel in combination with an experimental frame or as an table-top unit.

**Experiment instructions
V 187 " Plant Simulator"**

Delivery includes 20 different text overlays with exercises dealing with the simple logic control, as well as analog value processing.

- Silo control
- Goods lift
- Traffic lights
- Three phase automatic starter
- Dahlander circuit
- Reversing contactor circuit
- Star-delta circuit
- Running light
- Drink vending machine
- Reaction vessel
- Mixing unit
- Latching circuit
- Multi-storey car park
- Compressed air net
- Sequence control circuit
- Conveyor control
- Automatic tablet filler
- Tank filling system
- Embossing machine simulator
- Pump control

Training content

- Cyclic program processing
- Logic circuits
- Interlocking circuit
- Sequential circuit
- Different memories
- Pulse generator, edge evaluation
- Clock generator
- ON/OFF delay
- Counters and comparators
- Up/down counter
- BCD coding pulse count store
- Signal preprocessing
- Initializing pulse generator/pulse contact
- Structured programming
- Status diagram

- Programming acc. to standard IEC 1131-3
- Projecting of controls
- One task for each overlay

- Process and timed sequence control system
- Mode sections
- Sequencers
- Step enabling conditions
- Word output
- Analog value processing
- Getting to know the fundamentals of closed-loop control
- Getting to know the tasks and elements of the controlling system
- Getting to know the structure and method of operation of discontinuous controllers
- Getting to know combination of controller and controlled system

Technical data:

- 12 digital inputs on 4-mm safety lab sockets
- 12 digital outputs on 4-mm safety lab sockets
- 2 analog inputs on 4-mm safety lab sockets
- 2 analog outputs variable via potentiometers (0 - 10V) wires on 4- mm safety lab sockets
- 6 momentary-contact/ maintained-contact switch with LED status indicator
- 2 momentary-contact/ maintained-contact switch
- 1 Bargraph - display with 6 limit switches
- 1 system connector for 16 digital inputs and 16 digital outputs

Power supply: 24 V DC
 Dimensions: (W x H x D)
 390 x 297 x 100mm
 Weight: approx. 5 kg

Order-No. W4760-2C

- Programming tasks for plant simulator W4760-2C with solutions for teacher, english language

Order-No. W3018-7B

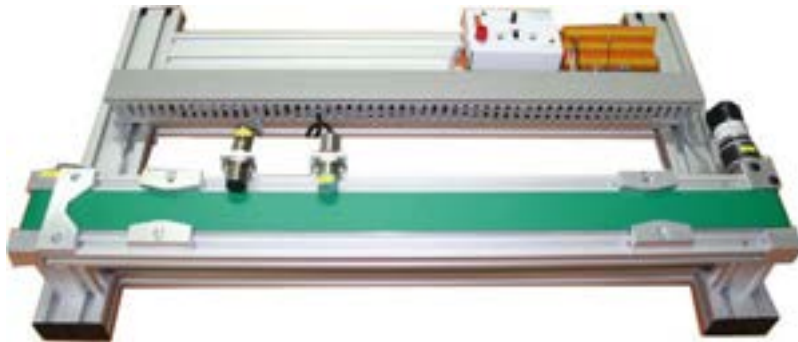
➤ Models for Training Units with SIMATIC S7

Industrial application

Models of complex industrial installations ensure that training is close to practice and are suitable for imparting specific fundamental

knowledge in the fields of electrotechnical engineering, pneumatics, material flow, design and sensor technology.

The purpose is to learn to deal with technical devices in a technical way using the proper instruments.



Conveyor belt model

For training in programmable logic control and material flow technology.

Consists of aluminum profile rails and a built-on 24 V DC industrial motor, spherically seated concave belt rollers, non-slip, rubber-coated fabric belt. Connection to SIMATIC training unit via 37-pin D-SUB plug.

Training content

Material flow technology
Startup
Troubleshooting
Maintenance
Process-oriented sequential control
Sequencer programming

Order-No. W4761-1B

Supplementary kit Sensor Technology

Supplementary kit Sensor Technology for conveyor belt model W4761-1B.

All cable ends are fitted with 2 mm connectors.

Consists of:

- 2 sensors: inductive
S=15 mm
optical
- 3 transport containers out of aluminum, black plastic and white plastic
- 2 fastening angles

Order-No. W3545-6J



Connecting lead

With 37-pin subminiature D-SUB plug (model side) and 1 x 37-pin D-SUB plug for connection to the SIMATIC S7 training units.

Order-No. W4760-8A

➤ **Models for Training Units with SIMATIC S7**



**Pneumatic model
Sheet Bending Device**

Sheet is to be bent by means of three 5/2-way valves, which are electropneumatically actuated on both sides.

The device is to be wired up using the pneumatic circuit diagram, and the control program is to be created.

The device can be isolated by a pneumatic Emergency-Stop switch. All terminals are wired to 4 mm safety sockets. For operation, a compressed-air supply of 6 bar is required.

The maximum sheet thickness which can be processed is 0.5 mm.

Training content

- Reading and applying pneumatic circuit diagram
- Creating sequencer
- Process-oriented sequential control system
- Getting to know safety-related precautions in electro-pneumatic installations

Number of inputs: 8

Number of outputs: 6

Experiment instructions are part of the scope of delivery.

Order-No. W4761-1C



Compressor

Fits the pneumatic model W4761-1C.

Technical specifications:

Supply voltage 1 AC 230 V
50/60 Hz

Power 340 W

Volume 4 l/340 W

Output 56 l/min

Admissible

operating pressure 8 bar

Weight approx. 20 kg

Order-No. W3545-8A

➤ Models for Training Units with SIMATIC S7



Elevator Model 3 storages

Features

with elevator cage over 3 floors.
Made of transparent acrylic glas.
The cabin is routet by a guide rail
and is moved with a pull rope from
a electric driven spindle.
The desired floor can be selected
in the control panel.
When the elevator cage reaches
the appropriate floor, limit switches
issue a signal and the elevator
cage should stop for 5 s.
The inputs and outputs are wired to
4 mm sockets and additionally
parallel connected 37pin D-SUB-
jack.



Learning contents:

- Process-controlled sequence control
- Commissioning
- Symbolic addressing
- Mode sections
- Installation, commissioning, operating and maintenace of automized controls

Number of inputs: 7

Number of outputs: 5

Dimensions (W x H x D):

680 x 200 x 260 mm

Weight: approx. 7 kg

Including experiment instructions
with tasks and solutions.

Order-No. W3545-6A

➤ **Models for Training Units with SIMATIC S7**

Conveyor belt case

with various equipment, safely packed attached in a compact formcase. The conveyor belt (length approx. 310mm, width approx. 40mm) runs smoothly on the inbuilt case-baseplate. The drive motor with integrated incremental encoder is invisibly mounted under the baseplate; so with appropriate programming a direct drive to a certain position is possible.

Cylindrical test pieces (diameter approx. 30mm, height approx. 20mm) with different filling materials (Aluminium, white and black plastic and wood) are fed from the magazine with an electrical pusher to the conveyor belt which transports the test item passing different sensors (inductive, capacitive and optical) and also an ultrasonic-sensor as an analogue one. Two additional electrical pushers allow a sorting of the test items.

2 light barriers avoid the "stock-overflow" (ex 2 test items in the storage area). A substantial operator control panel enables a direct "on-site-attendance" of the device. This panel includes 3 illuminated pushbuttons ("START", "STOP", "FC"), mode-switch (e.g. semi-automatic-system or machine-setup-control), 2x2 signal lamps ("LA1", "LA2", quality "Yes", "No").



Training content

- programmable logic control
- Material flow technology
- Startup
- Troubleshooting
- Maintenance
- Process-oriented sequential control
- Sequencer programming
- analog value processing
- sensor technology
- control panel device

Order-No. W4764-4A



**Supplementary kit
RFID Technology**

Extension set for the conveyor belt model compact case W4764-4A to dive into the wide field of radio identification with RFID (Radio Frequency Identification)

Scope of delivery:

Experimenter panel W4764-4AZ-RFID communication-module SIMATIC RF180C with Ethernet hub as interface to the CPU.

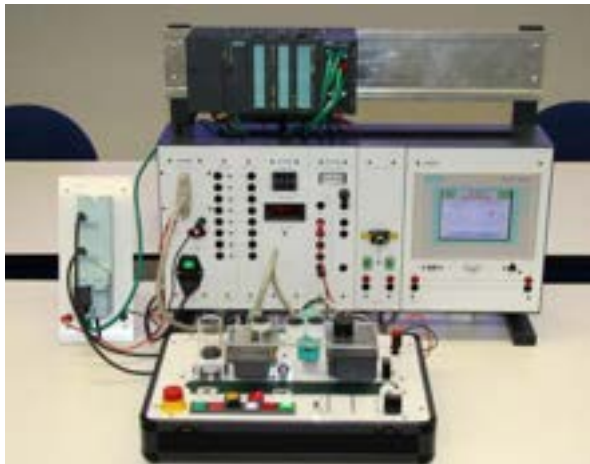
Scope of delivery (cont.):

2 RFID Read and Write modules fixed on a plexiglass plate with all necessary accessories like cables, wires and screws. Easily to be fixed at the holder of the ultrasonic sensor of W4764-4A with 4 screws. 6 Sample pieces of different height made out of black or white plastic or metal, equipped with a RFID transponder chip

Order-No. W4764-4A-Z

(only supplementary kit without case)

Complete RFID case: W4764-4A-RFID



Station in action

RFID Technology Station Set

Illustration:

- W4734-1V-PN/DP**
SIMATIC S7 Rack
- W4751-1U-Kit**
optional Touchpanel built in Rack
- W4764-4A-RFID**
(=W4764-4A + W4764-4A-Z)
Technology station RFID with testing and sorting station
- W4760-8A**
Connecting lead

➤ Technology Stations



Technology Station Loading

Didactic indications :

The technology station negotiates awareness of function and application of industrial components of the branch feeding of stock and handling.

By means of the didactic prepared industry components, the physical function principles, connecting technique and variants to the material provision are practically presented.

The station with the typical interfaces to the mechanics, pneumatics, electrical engineering/electronics and PLC-technique, is especially suitable to the approach in the multiple fields of the MECHATRONICS.

As individual station in the teaching or during the exercises in the lab, the station can be used quick and uncomplicated and it can be set into operation independently.

Task

- The work pieces are loaded from the loading magazine to the process
- Convey the work piece to the process

Structure

- Magazine with pneumatic double-acting thruster and control of level by means of the capacitive sensor
- Deposit table with sensor checking

Dimensions of the base plate (W x D) 350 x 500 mm

Technical data:

- 2 digital inputs ,
- 3 digital outputs
- necessary working pressure : min. 6 bars , max. 8 bars

Teachware:

Training material for the technology station Loading and handling

Scope of delivery

- 1 Loading magazine
- 1 Profile plate complete
- 1 Hardware
- 1 Technical documentation

Order-No. W4764-3A

Necessary Accessories

Connecting lead to SIMATIC Training unit (Order-No. W4760-8A)

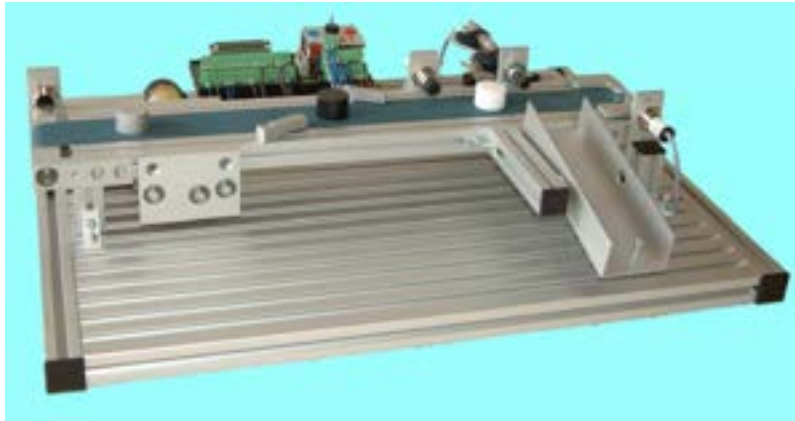
Air compressor (Order-No. W3545-8A)

Optional addition

Mobile underframe (Order-No.: W4764-5A)

Control panel (Order-No.: W4764-6A)

➤ Technology Stations



Technology Station Conveyor Belt

Construction

Programmable logic controls and material flow technology. Made of aluminum profiles and equipped with a built-on 24V industrial D.C. motor, incremental encoder, spherically seated concave ball-bearing, conveyor drums, a slip-resistant rubberized proofed textile belt, the speed of the belt can be controlled by means of a potentiometer or additional 0 to 10 V DC analog input, 2 switches for changing the direction left/right in setting-up mode. 37-pin D-SUB connector to connect conveyor belt to SIMATIC Training Equipment.

Learning contents

- material flow technology
- commissioning
- fault location
- maintenance
- process controlled sequence control
- sequencer programming
- analog value processing

Scope of delivery

- 2 sensors
- 1 reactive proximity switch, switching distance 15 mm
- 1 optical proximity switch, 18 mm diameter switching distance 60–400 mm
- 2 fixing brackets for sensors
- 1 brief description
- 1 technical documentation
- 1 STEP-7 program

Mounted on mounting panel
(W x D) 650 x 500 mm

Order-No. W4764-3B

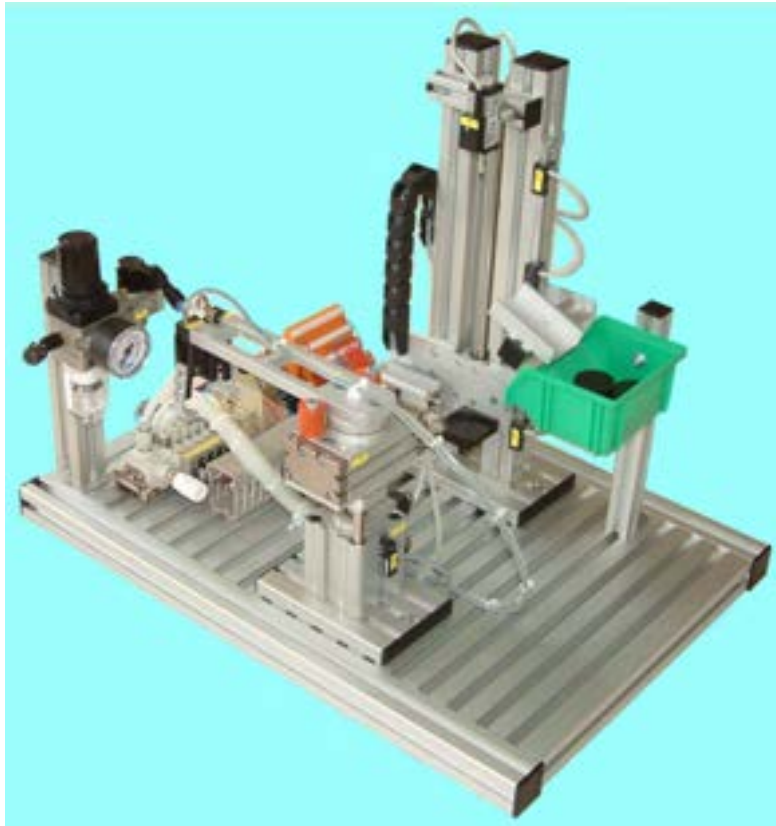
Necessary Accessories

Connecting lead to SIMATIC Training unit (Order-No. W4760-8A)
Air compressor (Order-No. W3545-8A)

Optional addition

Mobile underframe (Order-No.: W4764-5A)
Control panel (Order-No.: W4764-6A)
Pusher, pneumatic (Order-No. W3545-6H)
Pusher, electric (Order-No. W3545-6E)

➤ Technology Stations



Technology Station Measuring and Handling

The technology station measuring and handling negotiates awareness of function and application of industrial components of the branch handling and material selection.

Learning contents

The station with its coupling interfaces to other stations is suitable for learning the terms e.g. recognition of signals, signal processing and evaluation in training.

For example of optimization of conveying distance and a collision free movement, it will be shown, that the contradictory requirements in a mechanical system can also be controlled.

The technology station can be combined and be used quick and uncomplicated and it can be set into operation independently

Task:

- Thickness measuring with digital sensor
- Convey the work piece to the next process

Structure:

- Underframe with pneumatic lifting platform
- Analog thickness measuring
- Pneumatic pick and place with a pair of gripper jaws

Technical data

- 8 digital inputs,
- 6 digital outputs
- 1 analog output 0-10V

Necessary working pressure :
min. 6 bars , max. 8 bars

Teachware

Training material for the technology station measuring and handling

Scope of delivery

- 1 Analog thickness measuring
- 1 Pneumatic lifting platform
- 1 Pneumatic arm
- 1 Profile plate complete
- 1 Hardware
- 1 Technical documentation

Order-No. W4764-1C

Necessary Accessories

Connecting lead to SIMATIC Training unit (Order-No. W4760-8A)

Air compressor
(Order-No. W3545-8A)

Optional addition

Mobile underframe
(Order-No.: W4764-5A)

Control panel
(Order-No.: W4764-6A)

➤ Technology Stations



Technology Station High-Bay Warehouse

General

With the high shelf storing, you can store 20 work pieces of a diameter \varnothing 30 mm and of 20 mm height with a 3-axis handling system in 4 floors with 5 storing places each.

The work pieces are picked up (placed) from a position being in a distance of 85 mm next to the assembly plate by a pneumatic gripper. The 3-axis handling system consists of 2 electrically driven axis and one pneumatically driven axis.

Construction

- AL-T-slot plate 350x500x30 mm with one T-slot 8 mm, in a 25 mm grid
- 25-channel data interface
- 2 relay functional modules as reversing contactor circuit
- Maintenance unit with manual valve
- Valve island with 2 5/2 directional control valves, monostable
- High shelf store made out of aluminum elements with 20 storing places and 3-axis handling system

Function

X-axis:

The X-axis is driven with a d. c. motor 24V DC via a relay functional module. The final positions are protected with a micro switch as final position switch. At the same time, this switch is available as DU at the control and can be used as reference point. The positioning is done with a fork light barrier in defined positions for the deposit positions and the take-over (transfer). The correction of the transfer position is done by positioning of the whole high-shelf storing in X-direction. For the collection of the position the usual DU of a PLC (SPS) are sufficient.

Y-axis: The Y-axis has got the same drive as the X-axis. The positioning is done with a linear sensor with direct path measuring. The sensor reacts to a magnetic signal transmitter (metal strip at the axis). The impulse distance is approx. 0,4 mm. With the evaluation of the channels A and B you can reach a positioning accuracy of 0,2 mm.

For the collection of the impulses a counter input of the control is necessary.

Z-axis

The Z-axis is pneumatically controlled by a torsion-free cylinder and has only got 2 states. "Gone-in" is the transport position of the work pieces and "gone-out", the work pieces are put down or picked up. The position of the Z-axis is collected with a reed switch at the cylinder. An angular gripper at the cylinder piston picks up the work pieces for the transport. The position "gripper closed" is collected with an inductive sensor.

Technical Data

Signal transmitters:

- 3 cylinder switches
- 1 fork light barriers
- 1 path-measuring sensor
- 4 micro switches

Actuators:

- 2 5/2-directional control valves, monostable
 - 4 relays as reversing contactor circuit.
- Compressed air not oiled from 4 up to 6 bar
Power supply 24V DC Installation 37-pin. D-Sub-plug
Valve island
Maintenance unit with manual valve
Work pieces: 1 Cylinder \varnothing 30 x 20 mm

Dimensions: 350+150 x 500 x 450

Scope of delivery:

Technical documentation + PLC S7 programm "getting started"

Order-No. W4764-3R

High-Bay Warehouse, only electrically driven
Order-No. W4764-3R-Z-EL

Necessary Accessories

Connecting lead to SIMATIC Training unit (Order-No. W4760-8A)

Air compressor (Order-No. W3545-8A)


Optional addition

Mobile underframe (Order-No.: W4764-5A)

Control panel (Order-No.: W4764-6A)

Work pieces (Order-No.: W4764-5B)

Accessories - Leads/Plugs

Connecting lead	32 A/250 V, black, 100 cm long, with 4 mm safety plug	Order-No. W3907-3E
Connecting lead	32 A/250 V, red, 100 cm long, with 4 mm safety plug	Order-No. W3907-3F
Adapter	4 mm plug/2 mm socket for connection of 2 mm connecting leads	Order-No. W3942-2A
Connecting lead	37-pin D-SUB plug on both sides, 1.5 m long, for connection of technology simulators to SIMATIC S7 training units	Order-No. W4760-8A
		
Connector for PROFIBUS	SIMATIC DP, Bus Connector for PROFIBUS up to 12 MBIT/S 90 degree angle outgoing cable	(W X H X D): 15,8 X 54 X 34 mm Terminat. resistor with isolat. function without PG socket
		Order-No. W3947-1A
Connector for PROFIBUS	SIMATIC DP, Bus Connector for PROFIBUS up to 12 MBIT/S 90 degree angle outgoing cable	(W X H X D): 15,8 X 54 X 34 mm Terminat. resistor with isolat. function with PG socket
		Order-No. W3947-1B
PROFIBUS – Cable	SIMATIC NET, PB FC Standard Bus Cable, 2-Wire,	shielded special design for rapid installation, 20 m
		Order-No. W3947-2A
PROFIBUS – Cable	SIMATIC NET, PB FC Standard Bus Cable, 2-Wire,	shielded special design for rapid installation, 50 m
		Order-No. W3947-2B
PROFIBUS – Cable	SIMATIC NET, PB FC Standard Bus Cable, 2-Wire,	shielded special design for rapid installation, 100 m
		Order-No. W3947-2C

➤ **Experiment Instructions**

Practical experiment instructions



Experiment instruction manuals on all SIMATIC training systems, which have been compiled by specially trained and qualified employees, are available for use.

In general, the experiment instructions consist of three parts:

Part 1: Fundamentals

Introduces the training needs and provides the basic theory

Part 2: Experiments

Contains the experiments like programming and test tasks

Part 3: Solutions

Contains solutions to Part 2, offers ways of checking the results and thus reduces the time for test preparation

A = German

B = English

Experiment instructions

V172 SIMATIC S7-200

Order-No. W3017-2_

V173 SIMATIC S7-300

Order-No. W3017-3_

V175 Digital Control I with SIMATIC S7

Order-No. W3017-5_

V174 Digital Control II with SIMATIC S7

Order-No. W3017-4_

V176 PROSIM 95 (Process simulation)

Order-No. W3017-6_

V177 FUZZY-Logic

Order-No. W3017-7_

V178 PROFIBUS DP

Order-No. W3017-8_

V179 Universal Simulator Electrical Engineering

Order-No. W3017-9_

V189 Universal Simulator Metal Engineering

Order-No. W3018-9_

V187 Plant Simulator

Order-No. W3018-7_

V188 Contactor Control with SIMATIC S5/S7

Order-No. W3018-8_

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 - Electrical Machines 1000W
 - Electrical Machines 5kW
 - Electrical drive control systems 300W/ 1kW
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 - ISDN trainer (HICOM)
 - ISDN
- Measuring systems
- Power supply units
- Experiment instructions, manuals
- Training courses

Remarks:



Training & Didactic Systems

Process Control Technology with SIMATIC S7

Catalog

WA2E/04.03



➤ Our Services

- Development and production of didactic training systems
- Teachware and documentation
- Project engineering of complete lab's incl. furniture and lab equipment
- Quotations on customer's demand
- Installation, commissioning and training at site

➤ Our Customers

- Vocational training schools, technical schools, colleges and universities...
- Industrial laboratories for vocational education and higher education

➤ Fields of Technology

- Fundamentals of electrical engineering
- Fundamentals of electronics
- Closed loop control technology
- Automation engineering
- Electrical machines / drive control
- Power electronics
- Building management systems
- Protection schemes to VDE 0100
- Radio- and TV technology
- Air conditioning and refrigeration
- Photovoltaic
- Communication technology
- Measuring systems, power supplies, accessories
- Experimental manuals, documentation

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S30020708P – 01/13

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➤ Model for Process Control Engineering - General



The model for process control engineering, a laboratory distillation plant, promotes the understanding of the functioning of sequential control systems by developing and programming simple sequential control systems.

So, when creating a sequential control for example – regardless whether in the laboratory (automation of experimental or test processes) or in production (automation of production processes) – reaction processes are split up into very small successive steps. This way the student learns to think in those single steps the control unit is using.

Order-No. W5211-1A

1. Plant Description

This model in lab size is meant to represent the batch distillation principle, which is one of the most frequently used dissociation methods of distillation in process engineering. The control and switching processes using temperature, clock cycle and level monitoring, which are important in large and small plants, are combined with a programmable logic control on an operation and automation level and are controlled and activated in logical order.

The subsequent control board level with PC visualization, open-loop and closed-loop control including documentation is supposed to explain the application of instrument boards as practiced in industry. The laboratory distillation plant is made from a chemically resistant special glass (borosilicate glass 3.3) in order to offer a full view and to make it possible to observe the experimental process in detail.

The 2-l distillation flask with external heating represents the often used distillation vessel out of steel, steel/enamel or special alloys. Sensors for temperature and level monitoring are brought in via the various nozzles.

➤ **Model for Process Control Engineering – Plant Description**

Continued from 1. Plant Description

A stirrer with drive motor in a stirring duct that is tight enough for normal operation is provided for mixing and for preventing delays in boiling. The still-head can easily be emptied via the drain cock. The subsequently attached distillation column can be used to show the principle of multiple distillation by forming several steam-liquid equilibria which each correspond to a theoretical dissociation stage. By taking samples from the reaction flask and taking out a distillate sample the efficiency of the distillative dissociation can be determined analytically. As in industry, the electronically controlled column head is used for regulating the liquid load of the column for optimizing the distillative dissociation. The secondary, graduated distillate receiver permits a volume/time measurement for determining the distillate quantity per time unit. By on-off valves the distillate can be returned for another distillation or used for taking samples.

The very frequently used control of the sump heating by a Pt 100 resistance thermometer in the distillation mixture is demonstrated. Level monitoring is necessary in all plants for safety reasons. The reflux ratio in the column is controlled by a magnetically actuated liquid funnel, which sets the completely condensed liquid to reflux or removal according to the clock cycle. The head temperature is important in order to remove different fractions one after the other as separate fractions using temperature control. For safety reasons, the flow meter in the cooling water shows an alarm indication when the reflux of the cooling water has been interrupted behind the cooler. Atmospheric distillation is applied wherever no decomposition can occur caused by temperature. Vacuum distillation requires a considerably higher effort but has the effect that distillation takes place under gentler conditions.

Possibilities of application

Possibilities of application
Simple distillations of mixtures from 2 or 3 components with a boiling point difference of greater 10 °C.

Determination of the efficiency of columns packed by geometry and material using a known standard distillation mixture.

Influencing dissociation by means of the reflux ratio using different clock cycles for reflux and removal.

Simple reactions with 2 components and subsequent distillative dissociation of a highly volatile reactant.

Representation of the distillation results in trend diagrams or tables.

➤ Model for Process Control Engineering – Technical Data

1.1. Processes, Process Parameters, Media

The distillation equipment has been conceived as a demonstration model for the automation of switching and controlling processes with the SIMATIC PCS 7.

The design with the materials DURAN® and PTFE ensures a high degree of resistance to all kinds of media.

Materials	Borosilicate glass [®] PTFE
Operating temp.	max. 180 °C
Oper. pressure	-1/0.1 bar
Resistance to temperature change:	100 K

1.2. Equipment Configuration

The plant consists of the following components:

- | | |
|--|--|
| <ul style="list-style-type: none"> • Packed column - K1 • Still-head - B1 <ul style="list-style-type: none"> - Heating hood - H1/H2 - Column head as liquid separator with condenser - W1 - Distillate receiver - B2 Stirrer - R1 | <ul style="list-style-type: none"> • Mounting frame • Field measuring and control technology • Connector module |
|--|--|

Accessories

- Piping elements
- Spindle valve
- Flanged joints and seals
- Filling bodies
- Automatic valves
- Connecting pieces and adapters
- Ducts for sensors

1.3. Technical data

Operating pressure	-1/0.1 bar	Column K:		Dimensions	
Operating temp.	max. 180°C	Packed column	DN 25 x 300 mm	(BxHxT)	650x1500x400 mm
Nominal volumes:		Filling bodies -		Weight approx.	65 kg
still-head	(B1) - 1000 ml	Raschig rings	4 x 4 mm		
distillate receiver	(B2) - 250 ml	Stirrer:	type RW 16 basic		
Exchanger surface:	condenser	Driving power:	75/35 W		
	(W1) - 0.10 m ²	Power at the stirrer shaft:			
Heating capacity:	heating hood		53 W		
	(H1/H2) - 400 W	Output torque:	30 Ncm		
	2 heating zones	Output speed:	40 ... 1200 rpm		
Max. coolant pressure:			max. 800 rpm		
	condenser		admissible		
	(W2) - 2 bar	Electric connection:			
	(overpressure)		230 V/50 Hz		
		Stirrer type:	blade stirrer		

1.4. Specifications of the Materials Used

Glass components:

- | | | |
|---|---|--|
| <ul style="list-style-type: none"> • Borosilicate glass 3.3 (DURAN) • Resistance to temperature change: 120 K • Chemically resistant • Transparent, non-porous surface • Catalytically indifferent | <ul style="list-style-type: none"> • Stirrer closure • Stirrer • Seals • Spindle valves • Frame elements | <ul style="list-style-type: none"> glass/PTFE glass/PTFE PTFE glass/PTFE high-grade steel tubes |
|---|---|--|

➤ **Model for Process Control Engineering – Technical Data**

1.5. Field Measuring and Control Technology

<p>TI 1 Pt 100 in still-head, 4-wire type, class A</p> <p>TI 2 Pt 100 in column head, 4-wire type, class A</p> <p>TI 3 Pt 100 in heating hood, overtemperature protection, 4-wire type, class A</p> <p>LIS 4 Optical level switch in distillate receiver, Level monitoring "Maximum", Change of sensitivity by turning the setting screw at the sensor side, (clockwise = raising sensitivity, counter-clockwise = lowering sensitivity)</p>	<p>LIS 5 Optical level switch in still-head, Level monitoring "Minimum", Change of sensitivity by turning the setting screw at the sensor side, (clockwise = raising sensitivity, counter-clockwise = lowering sensitivity)</p> <p>FIS 6 Flow rate watchdog for cooling water Change of sensitivity by adjusting the setting screw at the front side of the sensor (behind the cover screw)</p>	<p>(clockwise = raising sensitivity, counter-clockwise = lowering sensitivity)</p> <p>KS 7 Reflux separating control by electromagnet (dead = reflux)</p> <p>HS 8 Stirrer control</p> <p>MV1 Electromagnetic valve for returning the distillate to the still-head (dead = closed)</p> <p>MV2 Electromagnetic valve for emptying the distillate receiver (dead = closed)</p> <p>H1 Lower heating zone</p> <p>H2 Upper Heating zone</p>
--	---	---

1.6. Features of Connector Module

The main function of the module consists in the conditioning of signals and it serves as plug-in board for the communication with the PLC.

- a) Pt100**
3 x Pt100 in four-wire design (high-grade steel sheath)
Connection of sensors via Lemos plugs (4-pin)
4 x laboratory sockets each per Pt100
- b) Filling levels**
2 x optical level sensors in three-wire design ("+", "-", switching output)
Connection of sensors via Lemos plugs (3-pin)
Supply with 24 V DC (from PLC)
Switching output and "-" each brought out to lab sockets
When filling level reached = output signal activated
- c) Cooling water monitoring**
1 x calorimetric sensor in three-wire design ("+", "-", switching output),
Connection of sensor via Lemos plug (3-pin)
Supply with 24 V DC (from PLC)

- Switching output and "-" brought out to lab sockets
when throughflow sufficient = output signal activated
- d) Connection reflux separator coil (two-wire)**
1 x reflux separator control magnet, connection of the magnet via Lemos plug (two-pin), 24 V DC switching voltage at the lab sockets for *KFS7* (control of coupling relay),
dead = reflux position,
live = distillate position
- e) Connection of magnetic valves**
2 x electromagnetic valves DN5, Connection of valves via Lemos plug (two-pin),
24 V DC switching voltage at the lab sockets for *MV1* and *MV2* (control of coupling relays),
dead = closed
- f) Connection of heating hood**
The heating hood consists of two heating zones of 200 W each
Connection of heating hood via multipole power connector in field

- 24 V DC switching voltage for each heating zone (control of coupling relay, common ground), lab sockets for "-", "H1", "H2"
H1= 24 V DC → lower heating zone ON
H2 = 24 V DC → upper heating zone ON
- g) Connection of stirrer motor**
Socket outlet (with ground contact) for connecting a lab stirrer in the field
- 24 V DC switching voltage for stirrer motor ON/OFF (control of coupling relay)
Lab sockets for "-" and "HS8"
- HS10 = 24 V DC → stirrer motor ON

Further lab sockets:
Voltage supply 24 V DC from PLC ⇒ connector module: a LAB SOCKET each in red and blue

General connector design:
Side part: Lemos sockets and outlet
Front part: safety lab sockets (divided by color)

➤ Programmable Logic Control



SIMATIC PCS7 AS414-3 Rack S7-414-3, 2x DI/DO, ANALOG-I/O-Module

Equipment

Industrial components:

- 1 SIMATIC CPU S7 414-3
Central Processing Unit,
2,8 MByte RAM
- 1 Digital-Input SM 421,
32 DI; DC 24V
- 1 Digital-Output SM 422,
32 DO; DC 24V;0,5A
- 1 Analog-Input SM 431,
8 AI; 14 Bit;
U/I/Resistor/PT 100
- 1 Analog-Output SM 432,
8 AO, 13 Bit, U/I
- 1 Power Supply module
PS 407, 10A, AC 120/230V,
DC 5V/10A
- 1 SITOP, Power 5, Basic Line,
DC 24 V / 5 A
- 1 Backup batterie 3,6 V/1,9 Ah
for PS 405, 4 A/10 A/20 A
and PS 407 4 A/10 A/20 A
- 1 UR2 RACK, centralized and
distributed with 9 slots

Simulation modules:

DI-module:

32 digital inputs, of which 16 DI are connected on momentary-contact/ maintained-contact switch and to 4 mm MC-safety sockets, signal statuses by LED

DO-module:

32 digital outputs, of which 16 DO are connected to 4 mm MC-safety sockets, signal statuses by LED

AI - module:

8 analog inputs, are connected to 4mm safety-sockets,
1 potentiometer steplessly adjustable, voltage +/-10V or current 4 -20mA

AO - module:

8 analog outputs, are connected to 4mm safety-sockets , 1 digital measuring device, voltage +/-10V or current 0 -20mA,

PS-module:

Inlet connector for non-heating apparatus 230 V AC , short circuit protection, fuse and illuminated on-of switch 24 V / 5A on 4 mm safety-sockets

32 DI on 37-pin D-SUB connector
32 DO on 37-pin D-SUB connector

Supply connection cable 2m,

Operator's guide english

Order-No. W4745-1D-PCS7

➤ **Software**

**PCS 7 Trainer Package V5
3 licences**

consisting of:
 PCS 7 (Trainer Paket)
 1 x D-J-C: PCS 7 V7.1 SP3
 1 x DVD: PDM Device Library 1/2009
 1 x DVD: Microsoft Service Packs & Tools 2009.01
 1 x Paper: Certificate of License (A5E00276662)
 1 x Paper: Produktinformation PCS 7 V7.1 SP3
 1 x Stick: License Key Memory Stick

Order-No. W4700-8A

PC adapter USB

for connection of PC with S7-300/-400, C7, M7 for PC with free USB slot
 incl . USB-cable (5m)
 suitable with WIN2000 or XP

Order-No. W4700-4M

Cooling water reservoir with electrical water-pump

Container for cooling water tank for operation of the process control model. The container contains a 20 liter tank with submersible-pump (12 V DC).
 The mains voltage is supplied by an integrated power supply.

The control of the PLC is realized by a control relay (24 V DC).
 The length of the connecting tubes to the model for the forward and backward movement is 3m each

The mains supply is connected via inlet connector for non-heating apparatus 230 V AC

Dimensions
 (W x H x D): 340x340x450mm

Order-No. W5211-1P

Set of connecting leads

For connecting the process control model (W5211-1A),

consisting of:
 10 leads black; length 300cm, with 4-mm safety laboratory plug connectors
 10 leads red; length 300cm, with 4-mm safety laboratory plug connectors

Order-No. W3901-0P

Getting Started Project "Lab and Destillation unit"

"Getting Started – PCS 7"
 Application program with one example for introduction and commission of the destillation unit

Consisting of:
 1 CD ROM
 1 Brief manual

Recommendation:
 Commissioning, System introduction and short training through our experts, duration: 1 day

Order-No. W3050-3A

➤ Personal Computer



Please contact us for actual models.

We also can give you the needed hardware- and software specifications for local purchase.

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Remarks:

Training & Didactic Systems

Electrical Machines 300 W

Catalog

WA2E/05.01



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- Development and production of didactic training systems
- Teachware and documentation
- Project engineering of complete lab's incl. furnitures and lab equipment
- Quotations on customers demand
- Installation, commissioning and training at site

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- Industrial laboratories for vocational education and higher education

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- Protection schemes to VDE 0100
- Radio- and TV technology
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Training System Electrical Machines 300 W



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Diploma Theses					
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Master craftsman / Technician					
Further Training at Chamber of commerce					
Skilled Worker Training					
Fundamentals					
Vocational education school / Education in Industry					

300 W Range

1000 W Range

5 kW Range

Foreword

If you can analyze problems systematically and understand interrelationships, you'll have no difficulty in coping with future developments - in any field of technology. As your partner for training systems, we can provide you with the technical equipment you require for this purpose including the necessary know-how in the form of comprehensive instruction manuals, training documentation and extensive configuring and design aids. Systematic analysis in the field of electrical machines means learning about the behavior of electrical machines through exact measuring exercises and evaluation of the characteristics recorded. This includes comprehension of basic electric circuits such as star-delta connections, stator-resistance starting circuits etc. and the ability to connect these with the specific problems of the individual machine types.

Understanding interrelationships means to view the electrical machines in their relation to drive engineering and automatic control engineering:

- Which electrical machine is best suited for a specific application problem?
- Which control method should be used with an individual machine in order to ensure that the drive meets the highest requirements e.g. relative to dynamic response or control accuracy?

We see it as our task to help you answer these and similar questions on a practical basis and to provide suitable experimental equipment for scientific studies.

Our training system gives you almost unlimited freedom, i.e. you can pick and choose elements to create your own "personal" training strategy.

If you have an entire room at your disposal for use as a machine laboratory and if you attach importance to characteristics of "large" machines, the system of your choice would be our machines in the range up to 5 kW¹⁾. This system is especially suited for use at technical colleges and universities. Experimental sockets ensure operational safety even with equipment from this output range²⁾.

1) Larger machines available on request.

2) For technical reasons, no experimental sockets are used with machines > 5 kW.

If the transport capability of the machines is a criterion besides the characteristics, the machines from the 1 kW range are right for you. They offer an ideal compromise between electrical operating behavior and low weight, which is also reflected in their extremely high cost effectiveness. This system can be used from basic training to practicals at technical colleges or universities and beyond. If due to the training situation you have to pay special attention to aspects such as mobility, training outside of technical rooms and space requirements, you will decide in favor of our 300 W machine range.

Regardless which of the three systems you eventually choose, you will have devices at your disposal that are tailor-made for your individual requirements.

➤ The Training Concept

The Aim

The aim of our training concept for the field of electrical machines is to provide

- vocational schools
- technical colleges
- universities and
- in-firm training centers

with systems for teaching the theoretical and practical knowledge which trainees and students require to learn and understand modern know-how about electrical machines and their control methods.

The machines we use are purely industrial equipment whose characteristics have been idealized only in exceptional cases, e.g. induction machine with slipping rotor. This applies for the 300 W range, the 1000 W range as well as the 5 kW range. You can choose between different DC machines, AC machines, three-phase machines as well as special machines such as the DC and three-phase compound machine.

Brakes and Measuring Systems

The available brake assemblies include magnetic powder brakes, eddy-current brakes and dynamometers. The setpoint for the brakes can be input either via front panel or PC, and characteristics can be traced either via recorder or also via PC, where a soft-ware specifically designed for the machine range facilitates the process.

While modules M1 to M5 focus on the electrical machine and its elementary control possibilities, modules M6 to M8 deal with technically expanded control methods up to the three-phase AC power controller SIKOSTART in combination with the squirrel-cage induction machine. Module M9 is devoted to the subject area of reactive-power compensation. The following matrix provides an overview of possible combinations of machine type and control method:

Practical instruction manuals

Instruction manuals designed by didactically trained specialists are available for our 300 W and 1000 W training systems. These instruction manuals generally consist of 3 sections:

Section 1: General section for introducing the trainees to the objectives of the training program and providing basic theoretical knowledge.

Section 2: Trainee's section containing measuring exercises. Value tables, diagrams and oscillograms must be filled out by the student or created on the PC.

Section 3: Instructor's section containing the answers to questions in section 2. The purpose of this section is to reduce valuable preparation time and provide a check for instructors.

Whether you choose machines from the 300 W or the 1000 W range, we can provide you with reliable instruction manuals for the appropriate system.

➤ The Training Concept

The Training Aim

- DC machines
- Single-phase motors
 - with running capacitor,
 - with starting and running capacitor
 - resistance start
- Asynchronous and synchronous polyphase machines
- Special machines

The concept

The "Electrical Machines" training system allows you to teach the aims listed with 300-W machines, 1-kW machines and also with machines up to 5-kW (higher-power machines on request). Depending on customer requirements, we can supply either single machines or complete systems with machines, loading facilities, drivers and measuring equipment. Specially prepared technical literature forms the basis of theory teaching.

The System

Our "Electrical Machines" training system consists of the following individual components:

- 300-W machines
- 1000-W machines
- Machines up to 5 kW
- Loading facilities
- Drivers
- Measuring equipment

300 W machines

Our 300-W machines are used primarily for training purposes in industry, trade and technical colleges. They are a handy size and can be easily assembled and dismantled. These "small" machines are "big" on electrical operating characteristics. They are industrial machines whose characteristics have only been modified for teaching purposes in exceptional cases. This is why they are also well suited to basic practical teaching in technical colleges and universities.

1000 W machines

This is the ideal "middle ground" between the "small" 300-W machine and the "large" machines in the performance range up to 5 kW. Thanks to its low weight, compact dimensions and excellent electrical characteristics, this machine offers more universality of use than any other machine type.

Machines up to 5 kW

If a machine laboratory is to be equipped and if practice-orientation is the main priority, this performance range is to be recommended. Demanding practical tests, engineering exams and certificate exams can all be set up easily in conjunction with these industrial drives.

➤ Load facilities, Drivers, Measuring Equipment

Load facilities

Brakes are available in the form of magnetic powder brakes and rotating eddy-current retarders (300-W and 1000-W range). They have been adapted exactly to the electrical machines. If the machine is to be subjected to both motive power loading and rheostatic loading, a DC dynamo-meter is recommended as loading facility (300-W, 1000-W and 5-kW ranges). All load facilities are equipped with optical indicating instruments, standardized analog outputs and interfaces for computer links.

Drivers

The constantly increasing requirements of drive technology mean that modern converter equipment is required in addition to contactor equipment. Digital converters for polyphase machines, analog and microprocessor-controlled converters for DC drives, special equipment for servo and stepper motors finish off the machines as compact and intelligent drive units.

Measuring Equipment

Measuring equipment as the interface between man and machine is of central significance in study and training. There is a correspondingly comprehensive and high-quality range of measured value processing systems and output devices available.

Whether you are making measurements with a multimeter or a multifunction meter, recording characteristic curves via value tables or PC, or carrying out torque acquisition via current, foil strain gauge or torque metering shaft, there is measuring equipment available for all your requirements.

Features and Design

General

The experimental machines feature the IM B 3 design with one shaft end and correspond to the VDE regulations 0530.

The 300 W and 1000 W machines are equipped with:

- an experimental terminal board. The ends of the windings brought out to the terminal board are connected to 4-mm-safety-socket outlets. The socket outlets are arranged on a plastic board in the same way as the connections of a normal terminal board of an industrial machine. The plastic board features the conventional industrial machine terminal designations.

- A PTC thermistor in order to protect the machines against thermal overload. This obviates overheating resulting from overload, high switching frequency, single phasing, large deviations in voltage, excessively high coolant temperatures or obstructed coolant flow. The leads of the thermistors are connected to 2-mm-socket-outlets in order to avoid faulty connections.
- A baseplate to compensate for differences in shaft height and to facilitate replacement of the machines. The baseplate features a guide mechanism on the underside for setting it onto the slide of the baseframe.

- A toothed gear coupling half which is identical for all machines and brake assemblies within each range. The coupling halves are connected to each other over an elastic adapter piece. This type of coupling and baseplate design allows you to combine any two machines to form one motor generator set as well as to couple each machine to the brake assemblies without having to change the coupling or the baseplate.

In order to keep the noise level low, preference has been given to machines with rated speeds of 1500 rev/min.

➤ **Electrical Machines 300 W**

The electrical machines are equipped as follows::

- with premounted coupling
- with base plate, to compensate the height of axes and for easy replacement of machines
- with thermistor protection
- Degree of protection IP21

Types of electrical machines



DC-Machines

DC Series-wound motor

For motor operation

Technical data

Output	0,3 kW
Voltage	DC 220 V
Current	1,9 A
Speed	2000 min ⁻¹

Dimensions (WxHxD)	approx
	310x180x210 mm
Weight	approx 8 kg
2 Axes end	

Bestell.-Nr. W3365-5A

DC compound-wound machine

with series and shunt winding; for motor and generator operation

Technical data:

Output	0,3 kW
Voltage	DC 220 V
Current	1,8 A
Speed	2000 min ⁻¹

Excitation Voltage	DC 220 V
Excitation Current	0,25 A
Dimensions (WxHxD)	approx
	310x180x210 mm
Weight	approx 9 kg
2 Axes end	

Order-No. W3365-5B

➤ DC-Machines**DC shunt-wound machine**

for motor and generator operation

Technical data::

Output 0,3 kW
 Voltage DC 220 V
 Current 1,8 A
 Speed 2000 min⁻¹

Excitation voltage DC 220 V
 Excitation current 0,3 A
 Dimensions (WxHxD) approx
 310x180x210 mm
 Weight approx 8 kg
 2 Axes end

Order-No. W3365-5C**DC shunt-wound machine, same as W3365-5C**with built-on tachogenerator (Voltage 30 V / 1000 min⁻¹)**Order-No. W3365-5G****Special DC compound machine with series, shunt and compound features**

for motor and generator operation

Technical data::

Output 0,3 kW
 Voltage DC 220 V
 Current 1,8 A
 Speed 2000 min⁻¹

Excitation Voltage DC 220 V
 Excitation Current 0,25 A
 Dimensions (WxHxD) approx
 310x180x210 mm
 Weight approx 11 kg
 2 Axes end

Order-No. W3365-5V**DC shunt-wound machine, cradle-mounted**

for motor- und generator operation,
 incl. baseframe;
 torque recorded via strain gauge,
 speed recorded optoelectronically

Technical data::

Generator operation

Output 0,4 kW
 Voltage 150 V
 Current 2,5 A
 Speed 1500 min⁻¹

Motor operation

Output 0,4 kW
 Voltage 150 V
 Current 3,4 A
 Speed 1440 min⁻¹

Excitation Voltage 200 V
 Excitation Current 0,3 A
 Resolution pulse
 generator 120 pulses./rev.

Weight approx. 18 kg

Order-No. W3365-1H

➤ **AC Machines, single and 3-phase 300 W**

Single-phase squirrel-cage AC motor with starting and running capacitor

Adapted industrial standard machine	Voltage	1AC 230 V / 50 Hz	Capacity C _B	14 μF
Technical data::	Current	2,65 A	Weight approx	7 kg
Output	0,37 kW	Speed	1395 min ⁻¹	1 Axes end
Cos φ	0,95	Capacity C _A	25 μF	

Order-No. W3365-3B

Single-phase squirrel-cage motor with auxiliary starting winding

Technical data::	Voltage	1AC 230 V / 50 Hz	Weight	approx 7 kg
Output	0,20 kW	Current	2,6 A	1 Axes end
Cos φ	0,7	Speed	1380 min ⁻¹	

Order-No. W3365-3C

Single-phase repulsion motor

with single brush rocker and special brush-shifting gear at the bearing plate	Voltage	1AC 230 V / 50 Hz 1AC 115V / 50Hz	Weight	approx 8 kg
Technical data::	Current	2,9 A	2 Axes end	
Output	0,25 kW	Speed	5,8 A	
Cos φ	0,69	Speed	2100..0..2100 min ⁻¹	

Order-No. W3365-3D

Single-phase split-pole motor

Technical data::	Voltage	1AC 230 V / 50 Hz	Weight	approx 7kg
Output	0,12 kW	Current	3,2 A	2 Axes end
Cos φ	0,6	Speed	2700 min ⁻¹	

Order-No. W3365-3E

Universal motor

for optional operation at AC or DC	Voltage	230V/50Hz,DC 140V	Weight	approx 8 kg
Technical data::	Current	3,0 A, 2,5A	2 Axes end	
Output	0,2 kW	Speed	3000 min ⁻¹	

Order-No. W3365-3F

Three-phase squirrel-cage induction motor

Adapted industrial standard machine for star-delta-operation	Voltage	3AC 400 V / 50 Hz 3AC 692 V / 50 Hz	Weight	approx 7 kg
Technical data::	Current	0,77 A / 0,45 A	1 Axes end	
Output	0,25 kW	Speed	1350 min ⁻¹	
Cos φ	0,78			

Order-No. W3365-2A

Three-phase squirrel-cage induction motor

Adapted industrial standard machine for star-delta-operation	Voltage	3AC 230 V / 50 Hz 3AC 400 V / 50 Hz	Weight	approx 7 kg
Technical data::	Current	1,32 A / 0,76 A	1 Axes end	
Output	0,27 kW	Speed	1380 min ⁻¹	
Cos φ	0,70			

Order-No. W3365-2M

➤ **AC Machines, 3-phase 300 W**

Three-phase two-speed pole-changing induction motor

with squirrel-cage rotor (Dahlander circuit)	Cos φ	0,73 / 0,8	Weight	approx 8 kg
Technical data::	Voltage	3AC 400 V / 50 Hz	1 Axes end	
Output	Current	1,0 A / 1,1 A	Order-No. W3365-2B	
0,3 kW / 0,43 kW	Speed	1400 min ⁻¹ , 2800 min ⁻¹		

Three-phase two-speed pole-changing induction motor

with squirrel-cage rotor and two separate windings	Cos φ	0,71 / 0,72	Weight	approx 8 kg
Technical data::	Voltage	3AC 400 V / 50 Hz	1 Axes end	
Output	Current	0,6 A / 0,7 A	Order-No. W3365-2G	
0,11 kW / 0,2 kW	Speed	880 min ⁻¹ , 1390 min ⁻¹		

Three-phase induction motor with slipping rotor

Slipping area covered with plexi- glass	Cos φ	0,72	Locked rotor voltage	95 V
Technical data::	Voltage	3AC 230 V / 50 Hz	Rotor current	2,3 A
Output	Current	3AC 400 V / 50 Hz	Weight	approx 9 kg
0,27 kW	Speed	2,0 A / 1,16 A	2 Axes end	
		1340 min ⁻¹	Order-No. W3365-2C	

Special three-phase compound machine

with slipping rotor, area covered with plexi-glass, synchronizable speed-torque-function with pronounced pull-up torque	Cos φ	1 / 0,70	Rotor voltage	AC 107 V
Technical data::	Voltage	3AC 230 V / 50 Hz		DC 20 V
Output	Current	3AC 400 V / 50 Hz	Rotor current	AC 1,7 A / DC 4,0A
0,27 kW	Speed	1,44 A / 0,83 A	Weight	approx 8 kg
		1500 min ⁻¹	2 Axes end	
		1340 min ⁻¹	Order-No. W3365-2V	

Three-phase synchronous machine with salient pole rotor

and damper winding; for motor and generator operation	Voltage	3AC 400 V / 50 Hz	Weight	approx 8 kg
Technical data::	Current	0,43 A	2 Axes end	
Output	Speed	1500 min ⁻¹	Order-No. W3365-4A	
0,3 kW	Excitation voltage	DC 140 V		
Cos φ	Excitation current	0,55 A		
1 / 0,80				

Three-phase synchronous machine with non-salient pole rotor

and damper winding; for motor and generator operation	Voltage	3AC 230 V / 50Hz	Excitation current	0,95 A
Technical data::		3AC 400 V / 50 Hz	Weight	approx 8 kg
Output	Current	1,14 A / 0,66 A	2 Axes end	
0,3 kW	Speed	1500 min ⁻¹	Order-No. W3365-4B	
Cos φ	Excitation voltage	DC 150 V		
0,97				

Reluctancemotor

Three-phase synchronous machine without excitation, with squirrel cage rotor and salient poles	Cos φ	0,45	Weight	approx 7 kg
Technical data::	Voltage	3AC 400 V / 50 Hz	2 Axes end	
Output	Current	1,5 A	Order-No. W3365-4C	
0,25 kW	Speed	1500 min ⁻¹		

➤ **Braking Equipment 300 W**

Compact braking unit 300 W



Technical data:

Maximum braking torque	5 Nm
Speed	1500 min ⁻¹ , max. 3000 min ⁻¹
Anschluß	
Voltage via main plug	1AC 230 V/50 Hz
Dimensions (WxHxD)	310x180x250 mm
Weight etwa	7 kg

Designed as magnetic powder brake with open-loop and closed-loop controls and measuring device, with analog display of speed and switch-selectable torque or calculated output.

Torque and speed can be recorded in three different operating modes:

- a) Open-loop control mode (manual control)
- b) Closed-loop speed control

Recording of brake torque as a function of speed.

The speed can be preselected on the setpoint potentiometer and is maintained at a constant value by the built-in control loop.

- c) Automatic mode

The brake is applied to the test object automatically until it stops.

The speed/torque characteristic can be traced on an x-y recorder.

In addition, analog outputs for speed, torque and calculated output are available

The terminals for temperature monitoring of the test object are connected to 2 mm sockets.

The magnetic powder brake is suitable for multiple tracings of the motor characteristic.

With analog inputs for control of the braking unit via PC.

Order-No. W3365-1E

Eddy current brake 300 W



Technical data:

Braking power at 1500 min ⁻¹	300W
Braking power at 3000 min ⁻¹	400W
Excitation voltage	0 – 180 V DC
Excitation current	1,8 A
Weight etwa	23 kg

Installed on a baseframe with cradle-mounted housing.

Suitable for loading a motor of the same rating up to starting torque (including measurement of the breakdown and mean starting torque); for operation in both directions of rotation with electronic torque load cell (strain gauge).

Speed recorded optoelectronically via forked light barrier. A ventilator ensures that the brake can be operated continuously at the rated data indicated

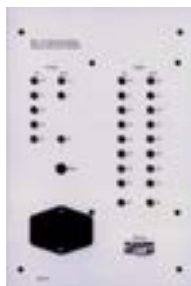
With built-in temperature monitor, with fitted half-coupling and transparent coupling cover; with torsionally rigid baseframe, mounted on vibration dampers; with draw spindles and slide guide for rapid fitting and removal of experimental machines.

Control and measurement are carried out by means of the associated control unit:

In addition to the eddy-current brake, an experimental machine in the 300 W range can be mounted on the baseframe.

Order-No. W3365-1F

Measuring and control interface for compact braking unit



The measuring and control interface consists of 8 digital inputs and outputs, 4 analog inputs and 2 analog outputs as well as an RS-232 interface. The analog and digital inputs and outputs are brought out to 2mm sockets.

The measuring and control interface provides the connection between PC and the magnetic powder brakes.

Analog inputs	max. ±10V
Analog outputs	max. ±10V
Digital inputs	5 - 24V DC
Supply voltage	1 AC 230V

Order-No. W3644-4L

➤ Software Modul "DRIVECOACH"

Software module „DRIVECOACH“ for tracing characteristics on electrical machines.

DRIVECOACH is a software program for operating the magnetic powder brakes, eddy current brakes and dynamometers. A measuring and control interface connects the unit to a PC and is necessary for picking the operating data with the software program. Operation of the software without connecting the measuring and control interface is not possible.

Note:

The software module "DRIVECOACH" is included in the scope of delivery of W3375-6F.

Performance features:

Setting possibilities:

The operating modes such as closed-loop speed, torque or current control for the terminal device (dynamometer, eddy-current brake) can be set via the measuring and control interface. The ramps to pass can be preselected relative to lower range value, limit value and rate of rise according to the current operating mode. The serial interface is adjustable.

Dimensioning of measured quantities:

The measured quantities are dimensioned automatically or by querying the hardware.

The following values are possible:

Speed 4000 min⁻¹

Torque 0 - 4 Nm

Current 0- 2 A

Tracing characteristics:

After setting or transferring the operating data or the ramps, the tracing of a characteristic can be triggered via the start button in a window.

The following measured values can be recorded:

With operating mode closed-loop speed control:

Torque, current, output

With operating mode closed-loop torque control:

Speed, current, output

With operating mode closed-loop current control:

Speed, torque, output

The diagrams can be saved in appropriate files and then printed.

The software module "DRIVECOACH" runs under WINDOWS.® 95/98/NT.

Operating mode load diagrammes:

with the operation mode diagrammes five different kind of diagrammes can be selected and recorded:

- constant Speed-torque-diagram
- constant Speed-torque-diagram with mit polarity reversal
- Linear Speed-torque-diagram
- squared Speed-torque-diagram
- Inverse Speed-torque-diagram

The characteristic parameters are variable with the mouse or can be entered into a text field. A modification of the constant factors is also possible in the current operation. A red signal point announces the operating point of the drive on the characteristic.

Hard- und Software coordination

For operation with the powder brake W3365-1E / W3375-1E the external measuring and control unit W3644-4L is necessary as well as the software modul "DRIVECOACH".

For operation with the eddy current brake or the dynamometer, the measuring and control unit W3375-6F is necessary.

Order-No. W3644-6A

➤ **Modular control units 300 W**

Modular control unit



General

The modular control unit provides the control for eddy-current brakes and dynamometers from the 300 W ranges. The basic unit consists of a fixed-wired 19" housing as well as the plug-in module "Display and Measuring Unit". The other plug-in modules can be selected as required for the individual application. The "Measuring and Control Interface" module serves for connecting the control unit system to the PC. Thus, you can start measurement processes from the PC, display the characteristics passed on the screen and print them on a printer.

Control unit for eddy-current brake and dynamometer



The basic unit of the modular control unit consists of a completely wired 19" housing and the plug-in module „Display and Measuring Unit“. Speed and either torque or calculated output as selected are digitally displayed via LCD's. The maximum speed is adjustable and can be displayed by pressing a button. Zero adjustment as well as calibration are performed via potentiometers.

Technical data:

- Analog output
- 1. Speed 400 U/min = 1 V
 - 2. Torque 0,4 Nm = 1 V
 - 3. Output 300 W = 1 V
- Supply voltage 1 AC 230 V/50 Hz
via main plug

Weight etwa 6 kg

Order-No. W3375-6A

Control unit for eddy-current brake and dynamometer, controlling module



Plug-in module for modular control unit W3375-6A. You can select between closed-loop speed, torque and current control. Lower range value and limit value of the measurements to be run are preselected via potentiometers. The selected values can be displayed using a button.

The rate of rise of the ramp can also be set. LEDs provide signals for „Enabled“, „Disabled“, „Brake fault“, „Motor fault“, „Mains fault“, and „Start ramp“. The measuring process is started with a button. With 2-mm-sockets for „Motor temperature“ and „Penlift“.

Weight approx.: 0.6 kg

Order-No. 3375-6C

➤ Control Units 300 W

Control unit for eddy-current brake, two-quadrant static converter

Plug-in module for modular control unit W3375-6A. Provides the control for eddy-current brakes W3360-1F and W3375-1F. The converter consists of a half-controlled B2 connection.

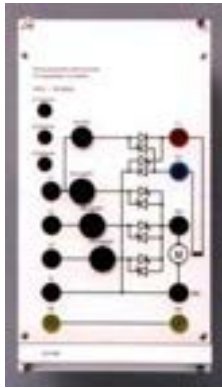
The trigger pulses are applied internally. All terminals are brought out to 4-mm safety lab sockets.

Technical data:
 Input voltage: 1 AC 230 V/50 Hz
 Output current: max. 2,5 A
 1,8 A

Weight approx. 2 kg

Order-No. W3375-6D

Control unit for dynamometer, four-quadrant static converter



Plug-in module for modular control unit W3375-6A. Provides the control for the dynamometers W3360-1H. The converter for the armature circuit consists of two anti-parallel M3 connections, the converter for the field circuit consists of a half-controlled B2 connection. The trigger pulses are applied internally. All terminals are brought out to 4-mm safety lab sockets.

Technical data
 Input voltage 3 AC 400 V/50 Hz with loaded PEN conductor
 Output current
 Armature circuit max. 4 A
 Output voltage
 Field circuit 200 V DC
 Output current
 Field circuit max. 0,5 A with speeds above 2000 rev/min field-weakening operation

Weight approx. 2,6 kg

Order-No. W3375-6E

Control unit for eddy-current brake and dynamometer, measuring and control interface



Plug-in module for modular control unit W3375-6A. The measuring and control interface contains an RS-232 interface for PC connection, an analog output +/-10 V as well as a reset button.

The scope of delivery includes the software module „DRIVECOACH“ which permits recording of measured values and control of measuring processes via PC.

Weight approx. 0,6 kg

Order-No. W3375-6F

Note:

We recommend the following setup for control of the eddy-current brake W3365-1F as well as the dynamometer W3365-1H:

- Basic unit with display and measuring unit W3375-6A
- Control unit W3375-6C

For control of eddy-current brakes additionally: Two quadrant static converter plug-in module W3375-6D

For control of dynamometers additionally: Four-quadrant static converter plug-in module W3375-6E

➤ Accessories for Electrical Machines 300 W

Baseframe for motor-generator set

for mounting two experimental machines with baseplates, torsionally rigid design, mounted on vibration dampers, with draw spindles; slide and slide guide for rapid fitting and removal of experimental machines, with transparent coupling cover.

Dimensions
(LxWxH) 750x230x40 mm
Weight approx. 8,5 kg

Order-No. W3360-8A

Rotor controller

For the rotor-locking of machines from the 300 W range, such as for example for use of the three-phase induction motor with slipping rotor as three-phase transformer. Designed as gearbox with handwheel.

With half-coupling and coupling cover, with baseplate for setup and centering on the baseframe.

Weight etwa 2 kg

Order-No. W3360-2D

Controller

for starting the three-phase induction motor with slipping rotor and reducing the speed by 50 % at constant torque, designed as rotary rheostat with limit switch for 300 W, installed in housing with circuit diagram on front.

All terminals are brought out to 4-mm safety lab sockets.



Degree of protection IP 10
Resistance 3 x 8,2 Ω
Current 3,5 A
Weight approx 6 kg

Order-No. W3360-8B

Single-coil slide resistor



for adjustable single-phase loading. With cover, rubber feet and earthing screw.

Terminals brought out to 4-mm safety lab sockets.

Degree of protection IP 10
Resistance 1400 Ω
Current 0,12 ... 1,2 A
Weight approx. 3 kg

Order-No. W3360-8E

Single-coil slide resistor

for adjustable single-phase loading. With cover, rubber feet and earthing screw.

Terminals brought out to 4-mm safety lab sockets.

Degree of protection IP 10
Resistance 2300 Ω
Current 0,1 ... 0,9 A
Weight approx 3 kg

Order-No. W3360-8F

Single-coil slide resistor

for adjustable single-phase loading. With cover, rubber feet and earthing screw.

Terminals brought out to 4-mm safety lab sockets.

Degree of protection IP 10
Resistance 430 Ω
Current 0,5 A
Weight approx 3 kg

Order-No. W3360-8G

➤ Accessories for Electrical Machines 300 W

Single-coil fixed resistor

for single-phase loading.
With cover, rubber feet and earthing screw.
Terminals brought out to 4-mm safety lab sockets.

Degree of protection IP 10
Resistance 98 Ω
Current 1,6 A
Weight approx 3 kg

Order-No. W3360-8K

Single-coil slide resistor

for adjusting the excitation of the three-phase synchronous machine or the DC shunt-wound machine and DC compound-wound machine;

With cover, rubber feet and earthing screw.
Terminals brought out to 4-mm safety lab sockets.

Degree of protection IP 10
Resistance 320 Ω
Current 1,1 A
Weight approx 3 kg

Order-No. W3360-8D

Controller

For starting DC motors and reducing the speed by 50% at constant torque,

Designed as rotary rheostat with limit switch (300 W), installed in housing with circuit diagram on front.

Degree of protection IP 10
Resistance 68 Ω
Current 2,35 A
Weight approx 5 kg

Order-No. W3360-8C

Excitation unit

with adjustable direct voltage output; for excitation of experimental machines from the 200 W and 1000 W ranges.



The direct voltage output is supplied over a variable transformer and a load-side rectifier.
Protective resistors for the field windings are fitted in parallel to the output terminals.

Technical data
Degree of protection IP 10
Supply voltage 1 AC 230 V/
50/60 Hz
via feeder cable, 2m in length, with earthing-pin plug
Output-voltage/current 0 – 230 V DC / 2 A

Weight approx. 5 kg

Order-No. W3360-1N

➤ **Accessories for Electrical Machines 300 W**
All accessories are equipped with 4-mm-safety-lab-sockets



1 NEOZED fuse element

with cartridge fuses
 for 4 A, 6 A, 10 A
 Voltage 3 AC 400 V
 250 V DC
 Current 16 A

Dimensions (HxW) 297x130 mm
 Weight approx. 1,4 kg

Order-No. W3221-4B

3 Incandescent lamp holders

E27

Dimensions (HxW) 297x260 mm
 Weight approx. 1,0 kg

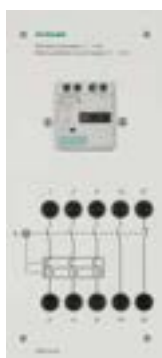
Order-No. W3228-4B

3 NEOZED fuse elements

NEOZED, with cartridge
 fuses for 4 A, 6 A, 10 A
 Voltage 3 AC 400 V /
 250 V DC
 Current 16 A

Dimensions (HxW) 297x130 mm
 Weight approx. 1,4 kg

Order-No. W3311-4B



W3312-4A

**Motor-protection
 circuit-breaker**

3 pin,
 Current max. 16 A
 Voltage 3 AC 500V

Dimensions (HxW) 297x130 mm
 Weight approx. 0,5 kg

Setting range	0,45 - 0,63 A	Order-No. W3312-4H
Setting range	0,7 – 1 A	Order-No. W3312-4A
Setting range	2,2 – 3,2 A	Order-No. W3312-4C

On/Off-switch

3-pin
 Voltage 3 AC 500 V
 Current 16 A

Dimensions (HxW) 297x130 mm
 Weight approx. 0,9 kg

Order-No. W3313-4A



Reversing switch

3-pin,
 Voltage 3 AC 500 V
 Current 16 A

Dimensions (HxW) 297x130 mm
 Weight approx. 0,9 kg

Order-No. W3314-4A

➤ Accessories for Electrical Machines 300 W



Star-delta switch

3-pin
 Voltage 3 AC 500 V
 Current 16 A

Dimensions (HxW) 297x130 mm
 Weight approx. 1,0 kg

Order-No. W3315-4A

Pole-changing switch

3-pin, for 2 speeds,
 Dahlander circuit,
 Voltage 3 AC 500 V
 Current 16 A

Dimensions (HxW) 297x130 mm
 Weight approx. 0,8 kg

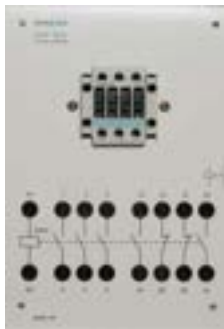
Order-No. W3317-4A

Pole-changing switch

3-pin, for 2 speeds
 2 separate windings
 Voltage 3 AC 500 V
 Current 16 A

Dimensions (HxW) 297x130 mm
 Weight approx. 0,8 kg

Order-No. W3318-4A



Contactor

3-pin, with auxiliary switch 2 make
 + 2 break contacts
 Operating voltage
 1 AC 230 V /
 50/60 Hz
 Voltage AC 500 V
 Current 16 A

Dimensions (HxW) 297x195 mm
 Weight approx. 1,0 kg

Order-No. W3321-4A

Auxiliary contactor

with 4 break + 4 make contacts
 Operating-
 voltage 1 AC 230 V / 50 Hz
 AC 400 V
 Current 6 A

Dimensions (HxW) 297x195 mm
 Weight approx. 0,5 kg

Order-No. W3328-4A

Overcurrent relay

thermally delayed,
 with auxiliary switch,
 with 1 make + 1 break contact

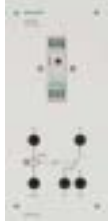
Dimensions
 (HxW) 297x130 mm
 Weight approx. 0,8 kg

Setting range	0,35 bis 0,5A	Order-No. W3330-4A
Setting range	0,45 bis 0,63 A	Order-No. W3330-4F
Setting range	0,55 bis 0,8 A	Order-No. W3330-4B
Setting range	0,9 bis 1,25 A	Order-No. W3330-4H
Setting range	1,4 bis 2,0 A	Order-No. W3330-4J
Setting range	2,2 bis 3,2 A	Order-No. W3330-4K

➤ **Accessories for Electrical Machines 300 W**

Time relay, delayed pickup

1 changeover contact



Operating-voltage 1 AC 230 V / 50/60 Hz
 Voltage 1AC 230 V
 Current 3 A
 Setting range 1,5 to 30 s

Dimensions (HxW) 297x130 mm
 Weight etwa 0,9 kg

Order-No. W3331-4A

Time relay

delayed drop-out

Operating-Voltage 1 AC 230 V/ 50/60 Hz
 Voltage AC 230 V
 Current 3 A
 Setting range 0,05 bis 100 s

Dimensions (HxW) 297x130 mm
 Weight etwa 0,9 kg

Order-No. W3331-4C

Starting capacitor

including discharge resistor

Voltage 1 AC 450 V/50 Hz
 Capacity 94 µF

Order-No. W3333-4A

Starting capacitor

including discharge resistor

Voltage 1 AC 450 V/50 Hz
 Capacity 22 µF

Order-No. W3333-4B

3 capacitors

including discharge resistor

Voltage 1 AC 450 V/50 Hz

Capacity	3 x 1 µF	Order-No. W3333-4C
Capacity	3 x 3,3 µF	Order-No. W3333-4D
Capacity	3 x 4,7 µF	Order-No. W3333-4E

Pushbutton switch

with 1 make + 1 break contact
 Technical data
 Voltage 1 AC 500 V
 Current 10 A

Dimensions (HxW) 297x130 mm
 Weight approx. 0,9 kg

Order-No. W3334-4A



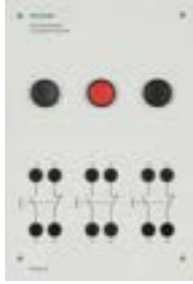
2 pushbutton switches

„ON“ black with 1 make + 1 break contact
 „OFF“ red with 1 make + 1 break contact
 Technical data:
 Voltage 500 V AC
 Current 10 A

Dimensions (HxW) 297x130 mm
 Weight approx. 0,9 kg

Order-No. W3334-4B

➤ Accessories for Electrical Machines 300 W



3 pushbutton switches

2x black, 1x red,
with 1 make + 1 break contact
Technical data
Voltage 500 V AC
Current 10A

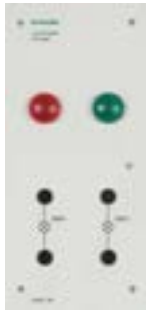
Dimensions (HxW) 297x195mm
Weight approx. 1,0kg

Order-No. W3334-4C

Pilot light

with incandescent lamp 230 V

color red	Order-No. W3335-4A
color green	Order-No. W3336-4A
color white	Order-No. W3337-4A



2 pilot lights

with 2 incandescent lamps 230 V
with 1 red and 1 green cover

Dimensions (HxW) 297x130 mm
Weight approx. 0,7 kg

Order-No. W3337-4B

3 pilot lights

with 3 incandescent lamps 230 V,
white

Dimensions (HxW) 297x130 mm
Weight approx 0,3 kg

Order-No. W3338-4A

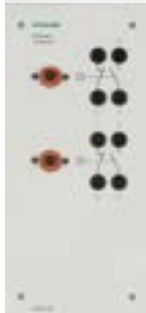


6 pilot lights

with 6 incandescent lamps 230 V, white

Dimensions (HxW) 297x260 mm
Weight approx 0,3 kg

Order-No. W3357-4A



W3340-4B

2 limit switches

1 break contact each
Voltage 400 V AC
Current 16 A

Dimensions (HxW) 297x130 mm
Weight approx. 0,8 kg

Order-No. W3340-4B

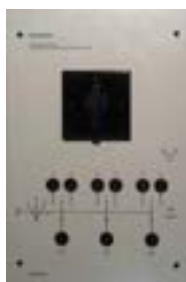
➤ **Accessories for Electrical Machines 300 W**



On/off switch

2-pin
 Switch positions 0 - I - 0 - I
 Voltage AC 400/220 V DC
 Current 16 A

Order-No. W3341-4B



On/off switch

2-pin
 Switch positions 0 - I - 0 - I
 Voltage AC 400/220 V DC
 Current 16 A

Dimensions (HxW) 297x130 mm
 Weight approx. 0,65 kg
 Order-No. W3341-4B

Two-circuit double-interruption switch

2-pin;
 Switch positions 0 - I - 0 - II
 Voltage AC 400/230 V DC
 Current 16 A

Dimensions (HxW) 297x130 mm
 Weight approx 0,9 kg

Order-No. W3342-4B

Two-circuit double-interruption switch

3-pin; datas same as W3342-4B

Order-No. W3342-4E

4-way switch

2-pin
 Switch positions I - II - III - IV
 Voltage AC 400 V/230 V DC
 Current 16 A

Dimensions (HxW) 297x130 mm
 Weight approx 0,8 kg

Order-No. W3343-4B

3 Resistors

1 x 10 Ω / 0,5 A
 1 x 20 Ω / 0,5 A
 1 x 50 Ω / 0,5 A

Dimensions (HxW) 297x130 mm
 Weight approx 0,3 kg

Order-No. W3344-4A

3 Resistors

1 x 100 Ω / 1 A
 1 x 330 Ω / 0,6 A
 1 x 1000 Ω / 0,3 A

Weight approx 2,5 kg

Order-No. W3344-4B

6 Resistors

Resistance 6 x 3,9 Ω
 Output 6 x 10 W

Dimensions (HxW) 297x130 mm
 Weight approx 1,5 kg

Order-No. W3345-4B

➤ Accessories for Electrical Machines 300 W



Double frequency meter

Frequency 2 x 45 - 55 Hz

Dimensions (HxW) 297x130 mm

Weight approx. 1,6 kg

Voltage 230V	Order-No. W3437-4A
Voltage 400V	Order-No. W3452-4A

Double voltmeter

Voltage 2 x AC 500 V/
15 - 65 Hz

Dimensions (HxW) 297x130 mm

Weight approx 1,5 kg

Order-No. W3438-4A



Synchroscope

Voltage AC 400 V

Dimensions (HxW) 297x260 mm

Weight approx 4,7 kg

Order-No. W3440-4A

➤ **Standard Training System Electrical Machines 300 W**

With the "Standard Training System ", the following experiments can be carried out:

1. DC Machines

DC series-wound motor:

- Motor operation
- Measuring current, voltage, speed, torque
- Tracing characteristics

DC shunt-wound machine:

- Motor operation, self-excited
- Motor operation, separately excited
- Generator operation, self-excited
- Generator operation, separately excited
- Measuring current, voltage, resistance, speed, torque
- Tracing characteristics

DC compound-wound machine:

- Motor operation
- Generator operation
- Measuring current, voltage, speed, torque
- Tracing characteristics

2. Single-Phase AC Machines

Measuring current, voltage, speed, torque and output as well as tracing characteristics on:

- Single-phase squirrel-cage motor with starting and running capacitor
- Single-phase squirrel-cage motor with auxiliary starting winding
- Repulsion motor
- Universal motor

3. Induction motors

Measuring current, voltage, speed, torque and output as well as tracing characteristics on:

- Three-phase squirrel-cage induction motor suitable for star-delta starting
- Three-phase two-speed pole-changing induction motor with squirrel-cage rotor (Dahlander circuit)
- Three-phase pole-changing induction motor with squirrel-cage rotor with two separate windings
- Three-phase induction motor with slipring rotor

With three-phase squirrel-cage induction motors additionally:

- Switch-on with motor protection
- Reversal
- Star-delta starting
- Stator-resistance starting circuit
- Operation at single-phase mains
- Reactive-power compensation
- Pole-changing Dahlander
- Pole-changing two separate windings
- Efficiency measurement

With three-phase induction machines with slipring rotors additionally:

- Starting circuits

4. Synchronous machines

Measuring current, voltage, speed, torque and output as well as tracing characteristics on:

- Measuring current, voltage, speed, torque and output as well as tracing characteristics on:
- Three-phase synchronous machine with salient pole rotor and damper winding
- Mains synchronization
- Isolated operation

➤ Standard Training System Electrical Machines 300 W

The following components are required to carry out these experiments:

1	W3228-4B 3 Incandescent lamps E27	2	W3331-4A Time relay 1 changeover contact	1	W3365-4A Synchronous machine with salient pole rotor
1	W3221-4B 1 NEOZED-fuse element	2	W3334-4B 2 Pushbutton switches	1	W3365-5A DC series wound machine
4	W3311-4B 3 NEOZED fuse elements	1	W3334-4C 3 Pushbutton switches	1	W3365-5B DC compound wound machine
1	W3312-4A Motor-protection circuit-breaker	1	W3337-4B 2 Pilot lights	1	W3365-5C DC shunt wound machine
1	W3312-4C Motor-protection circuit-breaker	1	W3340-4B 2 Limit switches	1	W3365-2D Rotor controller
1	W3312-4H Motor-protection circuit-breaker	1	W3333-4D 3 Capacitors	1	W3360-8B Controllerr
3	W3313-4A On/off switch 3-pin	1	W3357-4A 6 Pilot lights	1	W3360-8C Controllerr
4	W3341-4B On/off switch 2-pin	1	W3345-4B 6 Resistors	1	W3360-8D Single-coil slide resistor
1	W3342-4E Two-circuit double-interruption switch, 3-pin	1	W3365-1E Compact braking unit	1	W3360-8E Single-coil slide resistor
1	W3314-4A Reversing switch 3-pin	1	W3360-8A Baseframe	1	W3360-8F Single-coil slide resistor
1	W3315-4A Star-delta switch 3-pin	1	W3365-2A Three-phase squirrel-cage induction motor	1	W3360-8K Single-coil fixed resistor
1	W3317-4A Pole-changing switch	1	W3365-2B Three-phase two-speed pole-changing induction motor	3	W3901-0A Set Connecting leads
5	W3321-4A Contactor 3-phase	1	W3365-2C Three-phase induction motor with slipping rotor	1	W3010-7B V107 Experimental manual, "Connecting and Measuring el. Machines 300 W"
1	W3328-4A Auxiliary contactor	1	W3365-3B Single-phase squirrel-cage AC motor with starting and running capacitor		
2	W3330-4B ÜberCurrentrelais				
2	W3330-4F Overcurrent relay	1	W3365-3C Single-phase squirrel-cage motor with auxiliary starting winding		
2	W3330-4H Overcurrent relay				
1	W3330-4J Overcurrent relay	1	W3365-3F Universalmotor		

➤ **Standard Training System Electrical Machines 300 W**

To be continued ..necessary equipment

Recommended Lab equipment

Proposal:

Measuring instruments

- 1 W3428-4C
Experimental panel
Wattmeter
- 1 W3428-4D
Experimental panel
Wattmeter
- 1 W3434-4B
Experimental panel
Power factor meter
- 1 W3435-4A
Experimental panel
Power factor meter
- 2 W3422-4A
Experimental panel
Moving iron voltmeter
- 1 W3436-4A
Experimental panel
Frequency meter
- 4 Multimeter
- 1 Phase sequence indicator

Further experimental panels and machines

- 1 W3365-3D
Repulsion motor
- 1 W3365-3F
Universal motor
- 1 W3365-4B
Three-phase synchronous
machine with cylindrical rotor
- 1 W3365-4C
Three-phase synchronous
machine with reluctance rotor
- 1 W3365-2G
Three-phase two-speed pole-
changing induction motor
2 separate windings
- 1 W3318-4A
Pole changing switch
3 pins, for 2 speeds
2 separate windings

- 1 W2700-1A
Standard experimental set-up
Power Engineering with power
supplies, SCHUKO sockets and
experimental frame

Synchronizing Instruments

- 1 W3438-4A
Double voltmeter
- 1 W3452-4A
Double frequency meter
- 1 W3440-4A
Synchroscope

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 - Analog closed loop control
 - Digital closed loop control
- Automation engineering
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 - Transformers, Rectifiers and Reactive Power Compensation
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 - extra low voltage (24V)
 - low voltage (230/400V)
- Building management systems
 - KNX / EIB
- VDE 0100 safety measures
- Radio- and Television engineering
 - AM/FM – Technology
 - TV Engineering
 -
 - Satellite – Technology
- Cooling and air conditioning
- Photovoltaic cell technology
- Communication technology
 - Modulation -/demodulation
 - Fiber optic
 - ISDN trainer (HICOM)
 - ISDN
- Measuring systems
- Power supply units
- Experiment instructions, manuals
- Training courses

Remarks:

Training & Didactic Systems

Electrical Machines 300 W

Catalog

WA2E/05.01 / 2



➤ Our Services

- Development and production of didactic training systems
- Teachware and documentation
- Project engineering of complete lab's incl. furnitures and lab equipment
- Quotations on customers demand
- Installation, commissioning and training at site

➤ Our Customers

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- Automation engineering
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- Radio- and TV technology
- Air conditioning and refrigeration
- Photovoltaic
- Communication technology
- Measuring systems, power supplies, accessories
- Experimental manuals, documentation

For further information please contact:

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Internet: www.wuekro.de

➤ Electrical Machines 300 W

The electrical machines are equipped as follows:

- with premounted coupling
- with base plate, to compensate the height of axes and for easy replacement of machines
- with thermistor protection on 2-mm sockets
- with circuit diagram on front
- with all connections brought out to 4-mm safety laboratory sockets
- type of construction B3, unless otherwise specified
- all machines in degree of protection IP 21

Types of electrical machines



The electrical machines of the 300 W class of this catalog WA1E/05.01 / 2 are fully compatible to the 200 W program of catalog WA1E/05.01 in reference to:

- the baseplate and the placement on the baseframe
- the height of the axes and the coupling device
- the use of braking equipment and control units
- the use of accessories

➤ Single phase machines class 300 W

Single-phase squirrel-cage AC motor with starting and running capacitor



Technical data:		adapted industrial standard machine
Output	0,37 kW	Dim. (BxHxT) ca. 310x180x210 mm
Cos φ	0,93	Weight ca. 8 kg
Voltage	1AC 230 V / 50 Hz	1 Axes end
Current	2,6 A	
Speed	1400 min ⁻¹	
Capacity C _A	50 - 63 μF	
Capacity C _B	20 μF	

Order-No. W3365-3B

Single-phase squirrel-cage motor with auxiliary starting winding



Technical data:		
Output	0,20 kW	Dim. (BxHxT) ca. 310x180x210 mm
Cos φ	0,7	Weight ca. 8 kg
Voltage	1AC 230 V / 50 Hz	1 Axes end
Current	2,6 A	
Speed	1380 min ⁻¹	

Order-No. W3365-3C

Single-phase repulsion motor



Technical data:		with single brush rocker and special brush-shifting gear at the bearing plate
Output	0,25 kW	Dim. (BxHxT) ca. 310x180x210 mm
Cos φ	0,69	Weight ca. 8 kg
Voltage	1AC 230 V / 50 Hz	2 Axes ends
	1AC 115V / 50Hz	
Current	2,9 A	
	5,8 A	
Speed	2100..0..2100 min ⁻¹	

Order-No. W3365-3D

Single-phase split-pole motor



Technical data:		
Output	0,12 kW	Dim. (BxHxT) ca. 310x180x210 mm
Cos φ	0,6	Weight ca. 8 kg
Voltage	1AC 230 V / 50 Hz	1 Axes end
Current	3,2 A	
Speed	2700 min ⁻¹	

Order-No. W3365-3E

Universal motor

for optional operation at AC or DC voltage



Technical data:		
Output	0,2 kW	Dim. (BxHxT) ca. 310x180x210 mm
Voltage	1AC 230 V / 50 Hz	Weight ca. 8 kg
	DC 140 V	2 Axes ends
Current	3,0 A	
	2,5 A	
Speed	3000 min ⁻¹	

Order-No. W3365-3F

➤ **Three phase machines class 300 W**

Three-phase induction motor with squirrel cage rotor



Technical data:	
Output	0,25 kW
Cos φ	0,78
Voltage	3AC 400 V / 50 Hz 3AC 692 V / 50 Hz
Current	0,77 A / 0,45 A
Speed	1350 min ⁻¹

adapted industrial standard machine
for star-delta-operation
Dim. (BxHxT) ca. 310x180x210 mm
Weight ca. 8 kg
1 Axes end

Order-No. W3365-2A

Three-phase induction motor with squirrel cage rotor

for star-delta-operation
with pronounced stalling torque

Technical data:	
Output	0,27 kW
Cos φ	0,70
Voltage	3AC 400 V / 50 Hz 3AC 692 V / 50 Hz
Current	1,0 A / 0,58 A
Speed	1350 min ⁻¹

Dim. (BxHxT) ca. 310x180x210 mm
Weight ca. 8 kg
1 Axes end

Order-No. W3365-2K

Three-phase induction motor with squirrel cage rotor



Technical data:	
Output	0,27 kW
Cos φ	0,70
Voltage	3AC 230 V / 50 Hz 3AC 400 V / 50 Hz
Current	1,34 A / 0,77 A
Speed	1380 min ⁻¹

adapted industrial standard machine
for star-delta-operation
Dim. (BxHxT) ca. 310x180x210 mm
Weight ca. 8 kg
1 Axes end

Order-No. W3365-2M

Three-phase induction motor with squirrel cage rotor



Technical data:	
Output	0,25 kW / 0,37 kW
Cos φ	0,62 / 0,75
Voltage	3AC 400 V / 50 Hz
Current	1,0 A / 1,1 A
Speed	1400 min ⁻¹ 2800 min ⁻¹

Dahlander circuit
Dim. (BxHxT) ca. 310x180x210 mm
Weight ca. 8 kg
1 Axes end

Order-No. W3365-2B

Three-phase induction motor with squirrel cage rotor



Technical data:	
Output	0,12 kW / 0,18 kW
Cos φ	0,56 / 0,61
Voltage	3AC 400 V / 50 Hz
Current	0,72 A / 0,77 A
Speed	930 min ⁻¹ 1420 min ⁻¹

with two separate windings
Dim. (BxHxT) ca. 310x180x210 mm
Weight ca. 8 kg
1 Axes end

Order-No. W3365-2G

➤ Three phase machines class 300 W

Three-phase induction motor with slipping rotor



Technical data:	
Output	0,27 kW
Cos φ	0,72
Voltage	3AC 230 V / 50 Hz 3AC 400 V / 50 Hz
Current	2,0 A / 1,16 A
Speed	1340 min ⁻¹
Locked rotor voltage	95 V
Rotor current	2,3 A

slipping area covered with plexi-glass

Dim. (BxHxT) ca. 310x180x210 mm
Weight ca. 8 kg
2 Axes ends

Order-No. W3365-2C

Special three-phase compound machine

with slipping rotor, area covered with plexi-glass, synchronizable speed-torque-function with pronounced pull-up torque

Technical data:	
Output	0,27 kW
Cos φ	1 / 0,70
Voltage	3AC 230 V / 50 Hz 3AC 400 V / 50 Hz
Current	1,44 A / 0,83 A
Speed	1500 min ⁻¹ 1340 min ⁻¹
Rotor voltage	AC 107 V DC 20 V
Rotor current	AC 1,7 A / DC 4,0A

Dim. (BxHxT) ca. 310x180x210 mm
Weight ca. 8 kg
2 Axes ends

Order-No. W3365-2V

Three-phase synchronous machine with salient pole rotor



Technical data:	
Output	0,3 kW
Cos φ	1 / 0,70
Voltage	3AC 400 V / 50 Hz
Current	0,43 A
Speed	1500 min ⁻¹
Excitation voltage	DC 140 V
Excitation current	0,55 A

with damper winding; for motor and generator operation

Dim. (BxHxT) ca. 310x180x210 mm
Weight ca. 8 kg
2 Axes ends

Order-No. W3365-4A

Three-phase synchronous machine with non-salient pole rotor



Technical data:	
Output	0,3 kW
Cos φ	0,97
Voltage	3AC 230 V / 50Hz 3AC 400 V / 50 Hz
Current	1,14 A / 0,66 A
Speed	1500 min ⁻¹
Excitation voltage	DC 150 V
Excitation current	0,95 A

with damper winding; for motor and generator operation

Dim. (BxHxT) ca. 310x180x210 mm
Weight ca. 8 kg
2 Axes ends

Order-No. W3365-4B

Reluctancemotor



Technical data:	
Output	0,25 kW
Cos φ	0,45
Voltage	3AC 400 V / 50 Hz
Current	1,5 A
Speed	1500 min ⁻¹

three-phase synchronous machine without excitation, with squirrel cage rotor and salient poles

Dim. (BxHxT) ca. 310x180x210 mm
Weight ca. 8 kg
2 Axes ends

Order-No. W3365-4C

➤ **DC machines class 300 W**

DC series-wound machine



Technical data:
 Output 0,3 kW
 Voltage DC 220 V
 Current 1,9 A
 Speed 2000 min⁻¹

for motor operation
 Dim. (BxHxT) ca. 310x180x210 mm
 Weight ca. 8 kg
 2 Axes ends

Order-No. W3365-5A

DC compound-wound machine



Technical data:
 Output 0,3 kW
 Voltage DC 220 V
 Current 1,8 A
 Speed 2000 min⁻¹

with series and shunt winding for
 motor and generator operation
 Dim. (BxHxT) ca. 310x180x210 mm
 Weight ca. 8 kg
 2 Axes ends

Excitation voltage DC 220 V
 Excitation current 0,25 A

Order-No. W3365-5B

DC shunt-wound machine



Technical data:
 Output 0,3 kW
 Voltage DC 220 V
 Current 1,8 A
 Speed 2000 min⁻¹

for motor and generator operation
 Dim. (BxHxT) ca. 310x180x210 mm
 Weight ca. 8 kg
 2 Axes ends

Excitation voltage DC 220 V
 Excitation current 0,3 A

Order-No. W3365-5C

DC shunt-wound machine, same as W3365-5C

with built-on tachogenerator (Voltage 30 V / 1000 min⁻¹)

Order-No. W3365-5G

Special DC compound machine with series, shunt and compound features



Technical data:
 Output 0,3 kW
 Voltage DC 220 V
 Current 1,8 A
 Speed 2000 min⁻¹

for motor and generator operation

Excitation voltage DC 220 V
 Excitation current 0,25 A

Order-No. W3365-5V

➤ **Servo machine class 300 W**

AC-Servomotor three phase



Technical data:
 Static torque 1 Nm
 Nominal current 1,2 A
 Nominal power 0,47 kW
 Speed 6000 min⁻¹

Weight approx. 6 kg

Order-No. W3365-4S

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| <input type="checkbox"/> Closed loop control technology <ul style="list-style-type: none"><input type="checkbox"/> Analog closed loop control<input type="checkbox"/> Digital closed loop control | <input type="checkbox"/> VDE 0100 safety measures |
| <input type="checkbox"/> Automation engineering <ul style="list-style-type: none"><input type="checkbox"/> SIMATIC S7-200/300/400, Software<input type="checkbox"/> Technology simulators / Models<input type="checkbox"/> Process control engineering PCS7<input type="checkbox"/> AS-Interface<input type="checkbox"/> Profibus DP<input type="checkbox"/> LOGO!<input type="checkbox"/> Mechatronical technology stations<input type="checkbox"/> Courses on Automation | <input type="checkbox"/> Radio- and Television engineering <ul style="list-style-type: none"><input type="checkbox"/> AM/FM – Technology<input type="checkbox"/> TV Engineering<input type="checkbox"/><input type="checkbox"/> Satellite – Technology |
| <input type="checkbox"/> Electrical machines / Drive controls <ul style="list-style-type: none"><input type="checkbox"/> Electrical Machines 300W<input type="checkbox"/> Electrical Machines 1000W<input type="checkbox"/> Electrical Machines 5kW<input type="checkbox"/> Electrical drive control systems 300W / 1kW<input type="checkbox"/> Electrical drive control systems 5kW<input type="checkbox"/> Networked drive systems<input type="checkbox"/> Cutaway Models<input type="checkbox"/> Transformers, Rectifiers and Reactive Power Compensation<input type="checkbox"/> Courses on drive systems | <input type="checkbox"/> Cooling and air conditioning |
| | <input type="checkbox"/> Photovoltaic cell technology |
| | <input type="checkbox"/> Communication technology <ul style="list-style-type: none"><input type="checkbox"/> Modulation -/demodulation<input type="checkbox"/> Fiber optic<input type="checkbox"/> ISDN trainer (HICOM)<input type="checkbox"/> ISDN |
| | <input type="checkbox"/> Measuring systems |
| | <input type="checkbox"/> Power supply units |
| | <input type="checkbox"/> Experiment instructions, manuals |
| | <input type="checkbox"/> Training courses |

Remarks:

Training & Didactic Systems

Electrical Machines 1000 W

Catalog

WA2E/05.02



➤ Our Services

- Development and production of didactic training systems
- Teachware and documentation
- Project engineering of complete lab's incl. furnitures and lab equipment
- Quotations on customers demand
- Installation, commissioning and training at site

➤ Our Customers

- Vocational training schools, technical schools, colleges and universities...
- Industrial laboratories for vocational education and higher education

➤ Fields of Technology

- Fundamentals of electrical engineering
- Fundamentals of electronics
- Closed loop control technology
- Automation engineering
- Electrical machines / drive control
- Power electronics
- Building management systems
- Protection schemes to VDE 0100
- Radio- and TV technology
- Air conditioning and refrigeration
- Photovoltaic
- Communication technology
- Measuring systems, power supplies, accessories
- Experimental manuals, documentation

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➤ Training System Electrical Machines 1000 W



Training Systems - Assignment – Target audience

Project Theses Diploma Theses				
Practicals College / University				
Continuing Education Practical Training College/University				
Master craftsman / Technician Further Training at Chamber of commerce				
Skilled Worker Training				
Fundamentals Vocational education school / Education in Industry				

1000 W Range

5 kW Range

300 W Range

➤ Foreword

If you can analyze problems systematically and understand interrelationships, you'll have no difficulty in coping with future developments - in any field of technology. As your partner for training systems, we can provide you with the technical equipment you require for this purpose including the necessary know-how in the form of comprehensive instruction manuals, training documentation and extensive configuring and design aids. Systematic analysis in the field of electrical machines means learning about the behavior of electrical machines through exact measuring exercises and evaluation of the characteristics recorded. This includes comprehension of basic electric circuits such as star-delta connections, stator-resistance starting circuits etc. and the ability to connect these with the specific problems of the individual machine types.

Understanding interrelationships means to view the electrical machines in their relation to drive engineering and automatic control engineering:

- Which electrical machine is best suited for a specific application problem?
- Which control method should be used with an individual machine in order to ensure that the drive meets the highest requirements e.g. relative to dynamic response or control accuracy?

We see it as our task to help you answer these and similar questions on a practical basis and to provide suitable experimental equipment for scientific studies.

Our training system gives you almost unlimited freedom, i.e. you can pick and choose elements to create your own "personal" training strategy.

If you have an entire room at your disposal for use as a machine laboratory and if you attach importance to characteristics of "large" machines, the system of your choice would be our machines in the range up to 5 kW¹⁾. This system is especially suited for use at technical colleges and universities. Experimental sockets ensure operational safety even with equipment from this output range²⁾.

1) Larger machines available on request.

2) For technical reasons, no experimental sockets are used with machines > 5 kW.

If the transport capability of the machines is a criterion besides the characteristics, the machines from the 1 kW range are right for you. They offer an ideal compromise between electrical operating behavior and low weight, which is also reflected in their extremely high cost effectiveness. This system can be used from basic training to practicals at technical colleges or universities and beyond.

If due to the training situation you have to pay special attention to aspects such as mobility, training outside of technical rooms and space requirements, you will decide in favor of our 300 W machine range.

Regardless which of the three systems you eventually choose, you will have devices at your disposal that are tailor-made for your individual requirements.

➤ The Training Concept

The Aim

The aim of our training concept for the field of electrical machines is to provide

- vocational schools
- technical colleges
- universities and
- in-firm training centers

with systems for teaching the theoretical and practical knowledge which trainees and students require to learn and understand modern know-how about electrical machines and their control methods.

The machines we use are purely industrial equipment whose characteristics have been idealized only in exceptional cases, e.g. induction machine with slipping rotor. This applies for the 300 W range, the 1000 W range as well as the 5 kW range. You can choose between different DC machines, AC machines, three-phase machines as well as special machines such as the DC and three-phase compound machine.

Brakes and Measuring Systems

The available brake assemblies include magnetic powder brakes, eddy-current brakes and dynamometers. The setpoint for the brakes can be input either via front panel or PC, and characteristics can be traced either via recorder or also via PC, where a soft-ware specifically designed for the machine range facilitates the process.

While modules M1 to M5 focus on the electrical machine and its elementary control possibilities, modules M6 to M8 deal with technically expanded control methods up to the three-phase AC power controller SIKOSTART in combination with the squirrel-cage induction machine. Module M9 is devoted to the subject area of reactive-power compensation. The following matrix provides an overview of possible combinations of machine type and control method:

Practical instruction manuals

Instruction manuals designed by didactically trained specialists are available for our 300 W and 1000 W training systems. These instruction manuals generally consist of 3 sections:

Section 1: General section for introducing the trainees to the objectives of the training program and providing basic theoretical knowledge.

Section 2: Trainee's section containing measuring exercises. Value tables, diagrams and oscillograms must be filled out by the student or created on the PC.

Section 3: Instructor's section containing the answers to questions in section 2. The purpose of this section is to reduce valuable preparation time and provide a check for instructors.

Whether you choose machines from the 300 W or the 1000 W range, we can provide you with reliable instruction manuals for the appropriate system.

➤ The Training Concept

The Training Aim

- DC machines
- Single-phase motors
 - with running capacitor,
 - with starting and running capacitor
 - resistance start
- Asynchronous and synchronous polyphase machines
- Special machines

The concept

The "Electrical Machines" training system allows you to teach the aims listed with 300-W machines, 1-kW machines and also with machines up to 5-kW (higher-power machines on request). Depending on customer requirements, we can supply either single machines or complete systems with machines, loading facilities, drivers and measuring equipment. Specially prepared technical literature forms the basis of theory teaching.

The System

Our "Electrical Machines" training system consists of the following individual components:

- 300-W machines
- 1000-W machines
- Machines up to 5 kW
- Loading facilities
- Drivers
- Measuring equipment

300 W machines

Our 300-W machines are used primarily for training purposes in industry, trade and technical colleges. They are a handy size and can be easily assembled and dismantled. These "small" machines are "big" on electrical operating characteristics. They are industrial machines whose characteristics have only been modified for teaching purposes in exceptional cases. This is why they are also well suited to basic practical teaching in technical colleges and universities.

1000 W machines

This is the ideal "middle ground" between the "small" 300-W machine and the "large" machines in the performance range up to 5 kW. Thanks to its low weight, compact dimensions and excellent electrical characteristics, this machine offers more universality of use than any other machine type.

Machines up to 5 kW

If a machine laboratory is to be equipped and if practice-orientation is the main priority, this performance range is to be recommended. Demanding practical tests, engineering exams and certificate exams can all be set up easily in conjunction with these industrial drives.

➤ Load facilities, Drivers, Measuring Equipment

Load facilities

Brakes are available in the form of magnetic powder brakes and rotating eddy-current retarders (300-W and 1000-W range). They have been adapted exactly to the electrical machines. If the machine is to be subjected to both motive power loading and rheostatic loading, a DC dynamo-meter is recommended as loading facility (300-W, 1000-W and 5-kW ranges). All load facilities are equipped with optical indicating instruments, standardized analog outputs and interfaces for computer links.

Drivers

The constantly increasing requirements of drive technology mean that modern converter equipment is required in addition to contactor equipment. Digital converters for polyphase machines, analog and microprocessor-controlled converters for DC drives, special equipment for servo and stepper motors finish off the machines as compact and intelligent drive units.

Measuring Equipment

Measuring equipment as the interface between man and machine is of central significance in study and training. There is a correspondingly comprehensive and high-quality range of measured value processing systems and output devices available.

Whether you are making measurements with a multimeter or a multifunction meter, recording characteristic curves via value tables or PC, or carrying out torque acquisition via current, foil strain gauge or torque metering shaft, there is measuring equipment available for all your requirements.

➤ Features and Design

General

The experimental machines feature the IM B 3 design with one shaft end and correspond to the VDE regulations 0530.

The 300 W and 1000 W machines are equipped with:

- an experimental terminal board. The ends of the windings brought out to the terminal board are connected to 4-mm-safety-socket outlets. The socket outlets are arranged on a plastic board in the same way as the connections of a normal terminal board of an industrial machine. The plastic board features the conventional industrial machine terminal designations.

- A PTC thermistor in order to protect the machines against thermal overload. This obviates overheating resulting from overload, high switching frequency, single phasing, large deviations in voltage, excessively high coolant temperatures or obstructed coolant flow. The leads of the thermistors are connected to 2-mm-socket-outlets in order to avoid faulty connections.
- A baseplate to compensate for differences in shaft height and to facilitate replacement of the machines. The baseplate features a guide mechanism on the underside for setting it onto the slide of the baseframe.

- A toothed gear coupling half which is identical for all machines and brake assemblies within each range. The coupling halves are connected to each other over an elastic adapter piece. This type of coupling and baseplate design allows you to combine any two machines to form one motor generator set as well as to couple each machine to the brake assemblies without having to change the coupling or the baseplate.

In order to keep the noise level low, preference has been given to machines with rated speeds of 1500 rev/min.

➤ **Electrical Machines 1000 W**

The electrical machines are equipped as follows::

- with premounted coupling
- with base plate, to compensate the height of axes and for easy replacement of machines
- with thermistor protection

Types of electrical machines



➤ **DC-Machines**

DC Series-wound motor

Technical data

Degree of protection	IP 21
Output	1,3 kW
Voltage	220 V
Current	7,5 A
Speed	1500 min ⁻¹



Weight approx. 36 kg

Order-No. W3375-5A

DC Compound-wound machine

with series and shunt winding; for motor and generator operation

Technical data	
Degree of protection	IP 21
Motor operation	
Output	0,8 kW
Voltage	220 V
Current	4,4 A
Speed	1500 min ⁻¹

Generator operation	
Output	1 kW
Voltage	220 V
Current	4,6 A
Speed	1500 min ⁻¹
Shunt winding	
Field voltage	220 V
Field current	0,3 A
Weight approx.	ca. 36 kg



Order-No. W3375-5B

➤ DC-Machines 1000 W

DC shunt-wound machine

for motor and generator operation

Technical data

Degree of protection IP 21

Motor operation

Output 1 kW

Voltage 220 V

Current 5,3 A / 5,5 A

Speed 1500 min⁻¹

Generator operation

Output 1 kW

Voltage 220 V

Current 4,4 A

Speed 1500 min⁻¹

Shunt winding

Field voltage 220 V

Field current 0,3 A

Weight approx. ca. 36 kg



Order-No. W3375-5C

(picture W3375-5G)

DC shunt-wound machine

Same as W3375-5C but with built-on tachogenerator

Voltage 30 V / 1000 min⁻¹

Order-No. W3375-5G

DC shunt-wound machine

for motor and generator operation

Technical data

Degree of protection IP 21

Motor operation

Output 1,1 / 1,0 / 0,8 kW

Voltage 330 / 275 / 220 V

Current 4,0 / 4,8 / 6,0 A

Speed 1500 min⁻¹

Generator operation

Output 0,8 kW

Voltage 220 V

Current 0,8 A

Speed 1500 min⁻¹

Field voltage 110 V

Field current 1,2 A

With built-on tachogenerator

Voltage 20 V/1000 min⁻¹

Weight approx. 36 kg

Order-No. W3375-5D

Special DC compound machine with series, shunt and compound features

for motor and generator operation

Technical data

Degree of protection IP 21

Shunt winding-

Output 1 kW

Voltage 220 V

Current 6 A

Speed 1650 min⁻¹

Field voltage 220 V

Field current 1,5 A

Compound-output 1 kW

Voltage 220 V

Current 6 A

Speed 1450 min⁻¹

Field voltage 220 V

Field current 1,26 A

Series-output 1 kW

Voltage 220 V

Current 9 A

Speed 1000 min⁻¹

Weight approx. 40 kg



Order-No. W3375-5V

DC shunt-wound machine, cradle-mounted

for motor- und generator operation, incl. baseframe;

torque recorded via strain gauge, speed recorded optoelectronically

Technical data

Degree of protection IP 21

Generator operation

Output 1 - 2 kW

Voltage 150 - 300 V

Current 8,5 A

Speed 1500 - 3000 min⁻¹

Motor operation

Output 1 - 2 kW

Voltage 150 - 300 V

Current 8,5 A

Speed 1440 - 2800 min⁻¹

Field voltage 200 V DC

Field current 0,65 A

Resolution pulse generator 120 pulses./rev

Weight approx. 31 kg



Order-No. W3375-1H

➤ **AC Machines, single and 3-phase 1000 W**

Single-phase squirrel-cage AC motor with starting and running capacitor

Technical data

Degree of protection	IP 21
Output	0,8 kW
Voltage	1 AC 230 V / 50 Hz
Current	4,8 A
Speed	1420 min ⁻¹



Order-No. W3375-3B

Weight approx. 11 kg

Single-phase squirrel-cage motor with auxiliary starting winding

- Single-phase squirrel-cage motor with auxiliary starting winding
- with premounted coupling
- with base plate, to compensate the height of axes and for easy replacement of machines
- with thermistor protection

Technical data

Degree of protection	IP 21
Output	0,7 kW
Voltage	1 AC 230 V / 50 Hz
Current	6,4 A
Speed	1430 min ⁻¹
Weight approx.	12 kg



Order-No. W3375-3C

Single-phase repulsion motor

- with single brush rocker and special brush-shifting gear at the bearing plate

Technical data

Degree of protection	IP 21
Output	0,8 kW

Voltage	1 AC 230 V / 50 Hz
Current	9,4 A
Speed	2800..0..2800 min ⁻¹

Weight approx. 25 kg



Order-No. W3375-3D

Three-phase squirrel-cage induction motor

for star-delta-operation

Technical data

W3375-2A

Degree of protection	IP 21
Output	1,1 kW
Voltage	3 AC 400 V / 50 Hz 3 AC 690 V / 50 Hz
Current	2,6 A / 1,5 A
Speed	1400 min ⁻¹

for star-delta-operation

Technical data

W3375-2A

Voltage	230/400 V / 50 Hz
Current	3,3 A / 2,4 A
Speed	1400 min ⁻¹

Weight approx. 14 kg



Order-No. W3375-2A / -2M

Three-phase two-speed pole-changing induction motor

- with squirrel-cage rotor (Dahlander circuit)

Technical data

Degree of protection IP 21

Output	0,7 kW / 0,9 kW
Voltage	3 AC 400 V / 50 Hz
Current	1,8 A / 2,1 A
Speed	1390 min ⁻¹ / 2810 min ⁻¹

Weight approx. 11 kg



Order-No. W3375-2B

➤ AC Machines, single and 3-phase 300 W

Three-phase two-speed pole-changing induction motor

with squirrel-cage rotor and two separate windings

Technical data

Degree

of protection IP 21

Output 0,6 kW / 0,9 kW

Voltage 3 AC 400 V / 50 Hz

Current 1,8 A / 2,5 A

Speed 930 / 1430 min⁻¹



Weight approx. ca. 11 kg

Order-No. W3375-2G

Three-phase induction motor with slipping rotor

with slipping rotor, area covered with plexi-glass

Technical data

Degree of protection IP 21

Output 1 kW

Voltage 3 AC 230 V / 50 Hz

3 AC 400 V / 50 Hz

Current 4,8 A / 2,8 A

Speed 1400 min⁻¹

Locked rotor-voltage 100 V

Rated rotor-current 5,5 A

Weight approx. 26 kg



Order-No. W3375-2C

Special three-phase compound machine

with slipping rotor, area covered with plexi-glass, synchronizable

speed-torque-function with pronounced pull-up torque

Technical data

Degree

of protection IP 21

Output 0,8 kW

Voltage 230 V / 400 V, 50 Hz

Current 3,6 A / 2,1 A

Speed 1500 / 1400 min⁻¹

Weight approx. 27 kg

Order-No. W3375-2V

Three-phase synchronous machine with salient pole rotor

and damper winding;

for motor and generator operation

Technical data

Degree of protection

IP 21

Speed 1500 min⁻¹

Generator operation

Output- 1 kVA

voltage 3 AC 230/400 V / 50 Hz

Current 2,7 A / 1,6 A

Motor operation

Speed 1500 min⁻¹

Output 1,2 kW

Voltage 3 AC 230/400 V /

50 Hz

Current 2,9 A / 1,7 A

Field voltage 110 V

Field current 0,8 A

Weight approx. 25 kg



Order-No. W3375-4A

Three-phase synchronous machine with non-salient pole rotor

and damper winding;

for motor and generator operation

Technical data

Degree of protection IP 21

Speed 1500 min⁻¹

Generator operation

Output 1 kVA

Voltage 3 AC 230/400 V / 50 Hz

Current 2,75 A / 1,6 A

Motor operation

Speed 1500 min⁻¹

Output 1 kW

Voltage 3 AC 230/400 V /

50 Hz

Current 2,9 A / 1,7 A

Field-voltage 110 V

Field-current 0,8 A

Weight approx. 25 kg



Order-No. W3375-4B

➤ **Braking Equipment 1000 W**

Compact braking unit 1000 W



Technical data

Maximum braking torque	25 Nm
Speed	1500 min ⁻¹ , max. 3000 min ⁻¹
Supply-voltage	1AC 230 V/50 Hz
Dimensions (WxHxD)	310x250x340 mm
Weight approx.	14 kg

Designed as magnetic powder brake with open-loop and closed-loop controls and measuring device, with analog display of speed and switch-selectable torque or calculated output.

Torque and speed can be recorded in three different operating modes:

- a) Open-loop control mode (manual control)
- b) Closed-loop speed control

Recording of brake torque as a function of speed.

The speed can be preselected on the setpoint potentiometer and is maintained at a constant value by the built-in control loop.

- c) Automatic mode

The brake is applied to the test object automatically until it stops.

The speed/torque characteristic can be traced on an x-y recorder.

In addition, analog outputs for speed, torque and calculated output are available

The terminals for temperature monitoring of the test object are connected to 2 mm sockets.

The magnetic powder brake is suitable for multiple tracings of the motor characteristic.

With analog inputs for control of the braking unit via PC.

Order-No. W3375-1E

Eddy current brake 1000 W



Technical data

Degree of protection	IP 21
Braking power at 1500 min ⁻¹	1,3 kW
Braking power at 3000 min ⁻¹	1,5 kW
Field voltage	0 - 180 V DC
Field current	2,5 A
Weight approx.	45 kg

Installed on a baseframe with cradle-mounted housing.

Suitable for loading a motor of the same rating up to starting torque (including measurement of the breakdown and mean starting torque); for operation in both directions of rotation with electronic torque load cell (strain gauge).

Speed recorded optoelectronically via forked light barrier. A ventilator ensures that the brake can be operated continuously at the rated data indicated

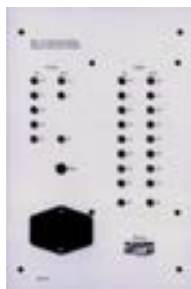
With built-in temperature monitor, with fitted half-coupling and transparent coupling cover; with torsionally rigid baseframe, mounted on vibration dampers; with draw spindles and slide guide for rapid fitting and removal of experimental machines.

Control and measurement are carried out by means of the associated control unit:

In addition to the eddy-current brake, an experimental machine in the 1000 W range can be mounted on the baseframe.

Order-No. W3375-1F

Measuring and control interface



The measuring and control interface consists of 8 digital inputs and outputs, 4 analog inputs and 2 analog outputs as well as an RS-232 interface. The analog and digital inputs and outputs are brought out to 2mm sockets.

The measuring and control interface provides the connection between PC and the magnetic powder brakes.

Analog inputs	max. ±10V
Analog outputs	max. ±10V
Digital inputs	5 - 24V DC
Supply voltage	1 AC 230V

Order-No. W3644-4L

➤ Software Modul "DRIVECOACH"

Software module „DRIVECOACH“ for tracing characteristics on electrical machines.

DRIVECOACH is a software program for operating the magnetic powder brakes, eddy current brakes and dynamometers. A measuring and control interface connects the unit to a PC and is necessary for picking the operating data with the software program. Operation of the software without connecting the measuring and control interface is not possible.

Note:

The software module "DRIVECOACH" is included in the scope of delivery of W3375-6F.

Performance features:

Setting possibilities:

The operating modes such as closed-loop speed, torque or current control for the terminal device (dynamometer, eddy-current brake) can be set via the measuring and control interface. The ramps to pass can be preselected relative to lower range value, limit value and rate of rise according to the current operating mode. The serial interface is adjustable.

Dimensioning of measured quantities:

The measured quantities are dimensioned automatically or by querying the hardware.

The following values are possible:

Speed	4000 min ⁻¹
Torque	0 - 20 Nm
Current	0- 10 A

Tracing characteristics:

After setting or transferring the operating data or the ramps, the tracing of a characteristic can be triggered via the start button in a window.

The following measured values can be recorded:

With operating mode closed-loop speed control:

Torque, current, output

With operating mode closed-loop torque control:

Speed, current, output

With operating mode closed-loop current control:

Speed, torque, output

The diagrams can be saved in appropriate files and then printed.

The software module "DRIVECOACH" runs under WINDOWS.® 95/98/NT.

Operating mode load diagrammes:

with the operation mode diagrammes five different kind of diagrammes can be selected and recorded:

- constant Speed-torque-diagram
- constant Speed-torque-diagram with mit polarity reversal
- Linear Speed-torque-diagram
- squared Speed-torque-diagram
- Inverse Speed-torque-diagram

The characteristic parameters are variable with the mouse or can be entered into a text field. A modification of the constant factors is also possible in the current operation. A red signal point announces the operating point of the drive on the characteristic.

Hard- und Software coordination

For operation with the powder brake W3360-1E the external measuring and control unit W3644-4L is necessary as well as the software modul "DRIVECOACH".

For operation with the eddy current brake or the dynamometer, the measuring and control unit W3375-6F is necessary.

Order-No. W3644-6A

➤ **Modular control Units 1000 W**

Modular control unit



General

The modular control unit provides the control for eddy-current brakes and dynamometers from the 1000 W ranges. The basic unit consists of a fixed-wired 19" housing as well as the plug-in module "Display and Measuring Unit". The other plug-in modules can be selected as required for the individual application. The "Measuring and Control Interface" module serves for connecting the control unit system to the PC. Thus, you can start measurement processes from the PC, display the characteristics passed on the screen and print them on a printer.

Control unit for eddy-current brake and dynamometer



The basic unit of the modular control unit consists of a completely wired 19" housing and the plug-in module „Display and Measuring Unit“. Speed and either torque or calculated output as selected are digitally displayed via LCD's. The maximum speed is adjustable and can be displayed by pressing a button. Zero adjustment as well as calibration are performed via potentiometers.

Technical data

Analog outputs

- 1. Speed 400 U/min = 1 V
- 2. Torque 2 Nm = 1 V
- 3. Output 300 W = 1 V
- Supply-voltage 1 AC 230 V/50 Hz
via mains plug

Weight approx. 6 kg

Order-No. W3375-6A

Control unit for eddy-current brake and dynamometer, controlling module



Plug-in module for modular control unit W3375-6A. You can select between closed-loop speed, torque and current control. Lower range value and limit value of the measurements to be run are preselected via potentiometers. The selected values can be displayed using a button.

The rate of rise of the ramp can also be set.

LEDs provide signals for „Enabled“, „Disabled“, „Brake fault“, „Motor fault“, „Mains fault“, and „Start ramp“. The measuring process is started with a button. With 2-mm-sockets for „Motor temperature“ and „Penlift“.

Weight approx.: 0.6 kg

Order-No. 3375-6C

➤ Control Units 1000 W

Control unit for eddy-current brake, two-quadrant static converter

Plug-in module for modular control unit W3375-6A. Provides the control for eddy-current brakes W3360-1F and W3375-1F. The converter consists of a half-controlled B2 connection.

The trigger pulses are applied internally. All terminals are brought out to 4-mm safety lab sockets.

Technical data:

Input voltage 1 AC 230 V /50 Hz

Technical data

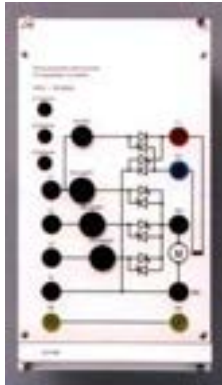
Input voltage 1 AC 230 V/50 Hz

Output current max.2,5 A

Weight approx. 2 kg

Order-No. W3375-6D

Control unit for dynamometer, four-quadrant static converter



Plug-in module for modular control unit W3375-6A.

Provides the control for the dynamometers W3360-1H. The converter for the armature circuit consists of two anti-parallel M3 connections, the converter for the field circuit consists of a half-controlled B2 connection.

The trigger pulses are applied internally.

All terminals are brought out to 4-mm safety lab sockets.

Technical data

Input voltage 3 AC 400 V/50 Hz with loaded PEN conductor

Output current

Armature circuit max. 4 A

Output voltage

Field circuit 200 V DC

Output current

Field circuit max. 0,5 A

with speeds above 2000 rev/min field-weakening operation

Weight approx. 2,6 kg

Order-No. W3375-6E

Control unit for eddy-current brake and dynamometer, measuring and control interface



Plug-in module for modular control unit W3375-6A.

The measuring and control interface contains an RS-232 interface for PC connection, an analog output +/-10 V as well as a reset button.

The scope of delivery includes the software module „DRIVECOACH“ which permits recording of measured values and control of measuring processes via PC.

Weight approx. 0,6 kg

Order-No. W3375-6F

Note:

We recommend the following setup for control of the eddy-current brake W3375-1F as well as the dynamometer W3375-1H:

- Basic unit with display and measuring unit W3375-6A
- Control unit W3375-6C

For control of eddy-current brakes additionally: Two quadrant static converter plug-in module W3375-6D

For control of dynamometers additionally: Four-quadrant static converter plug-in module W3375-6E

➤ Accessories for Electrical Machines 1000 W

Baseframe for motor-generator set

for mounting two experimental machines with baseplates, torsionally rigid design, mounted on vibration dampers, with draw spindles; slide and slide guide for rapid fitting and removal of experimental machines, with transparent coupling cover.

Dimensions
(LxWxH) 1200x280x50 mm
Weight approx. 14,7 kg

Order-No. W3375-8A

Rotor controller

For the rotor-locking of machines from the 300 W range, such as for example for use of the three-phase induction motor with slipping rotor as three-phase transformer. Designed as gearbox with handwheel.

With half-coupling and coupling cover, with baseplate for setup and centering on the baseframe.



Order-No. W3375-2D

Flywheel

For loading electrical machines from the 1000 W range.. With two half-couplings and coupling covers; mounted on baseplate; with protective cover. Moment of inertia adjustable in steps by removing of discs



Moment of inertia 1 $13 \times 10^{-3} \text{ kgm}^2$
Moment of inertia 2 $8,8 \times 10^{-3} \text{ kgm}^2$
Moment of inertia 3 $4,2 \times 10^{-3} \text{ kgm}^2$
Max. Speed 4000 min^{-1}
Weight approx. 30 kg

Order-No. W3375-2X

Controller

for starting the three-phase induction motor with slipping rotor and reducing the speed by 50 % at constant torque, designed as rotary rheostat with limit switch for 1000 W, installed in housing with circuit diagram on front. All terminals are brought out to 4-mm safety lab sockets.

Degree of protection IP 10
Resistance $3 \times 3,6 \Omega$
Current 11 A
Weight approx. 8,5 kg

Order-No. W3375-8B

Synchronizing unit

for closing three-phase synchronous generators or one generator and mains supply. Synchronization either by means of measuring instruments or with three synchronizing lamps.

The unit consists of :

- a double voltmeter,

- a double frequency meter, a zero voltage meter, a synchronoscope,
 - a closing contactor 20 A/500 V,
 - three synchronizing lamps,
 - control switches
- and laboratory terminals for connecting the two power systems.

The unit is built into a sheetsteel casing, degree of protection IP 10.

Dimensions
(WxHxD) 660x800x350 mm
Weight approx. 28 kg

Order-No. W3360-8L

Single-coil slide resistor



for adjustable single-phase loading. With cover, rubber feet and earthing screw. Terminals brought out to 4-mm safety lab sockets.

Technical data
Degree of protection IP 10
Resistance 250Ω
Current 0,9 ... 5,5 A
Weight approx. 6 kg

Order-No. W3375-8E

➤ Accessories for Electrical Machines 1000 W

Single-coil slide resistors

for adjustable single-phase loading. With cover, rubber feet and earthing screw. Terminals brought out to 4mm safety lab sockets.

Single-coil slide resistor

Degree of protection	IP 10
Resistor	1000 Ω
Current	0,25 ... 1,5 A

Weight approx. 3 kg

Order-No. W3375-8F

Single-coil slide resistor

Degree of protection	IP 10
Resistor	98 Ω
Current	1,6 A

Weight approx. 3 kg

Order-No. W3375-8G

Single-coil fixed resistor

Degree of protection	IP 10
Resistor	10 Ω
Current	4 A

Weight approx. 3 kg

Order-No. W3375-8K

Single-coil slide resistor

for adjusting the excitation of the three-phase synchronous machine or the DC shunt-wound machine and DC compound-wound machine;

Degree of protection	IP 10
Resistor	200 Ω
Current	2 A

Weight approx. 3 kg

Order-No. W3375-8D

Controller

for starting DC motors and reducing the speed by 50% at constant torque, designed as rotary rheostat with limit switch, installed in housing with circuit diagram on front.

Degree of protection	IP 10
Resistor	18 Ω
Current	10 A

Weight approx. 7 kg

Order-No. W3375-8C

Excitation unit

with adjustable direct voltage output; for excitation of experimental machines from the 300 W and 1000 W ranges.



The direct voltage output is supplied over a variable transformer and a load-side rectifier. Protective resistors for the field windings are fitted in parallel to the output terminals.

Technical data

Degree of protection IP 10
 Supply voltage 1 AC 230 V/
 50/60 Hz
 via feeder cable, 2m in length, with earthing-pin plug
 Output-voltage/current 0 – 230 V DC / 2 A

Weight approx. 5 kg

Order-No. W3360-1N

➤ **Accessories for Electrical Machines 1000 W**

All accessories are equipped with 4-mm-safety-lab-sockets



1 NEOZED fuse element

with cartridge fuses
for 4 A, 6 A, 10 A
Voltage 3 AC 400 V
250 V DC
Current 25 A

Dimensions (HxW) 297x130 mm
Weight approx. 0,5 kg

Order-No. W3221-4B

3 Incandescent lamp holders

E27

Weight approx. 0,5 kg

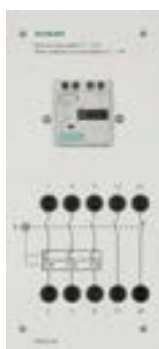
Order-No. W3228-4B

3 fuse elements

NEOZED, with cartridge
fuses for 4 A, 6 A, 10 A
Voltage 3 AC 400 V /
250 V DC
Current 16 A

Dimensions (HxW) 297x130 mm
Weight approx. 0,9 kg

Order-No. W3311-4A



**Motor-protection
circuit-breaker**

3-pin,
Current max. 16 A

Dimensions
(HxW) 297x130 mm
Weight approx. 0,5 kg

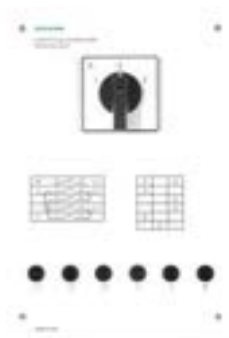
Setting range	1 – 1,6 A	Order-No. W3312-4B
Setting range	1,6 – 2,5 A	Order-No. W3312-4G
Setting range	2,5 – 4 A	Order-No. W3312-4C
Setting range	4 – 6,3 A	Order-No. W3312-4F
Setting range	6,3 – 10 A	Order-No. W3312-4D

On/Off-switch

3-pin
Voltage 3 AC 500 V
Current 16 A

Weight approx. 0,9 kg

Order-No. W3313-4A



Reversing switch

3-pin,
Voltage 3 AC 500 V
Current 16 A

Weight approx. 0,9 kg

Order-No. W3314-4A

➤ Accessories for Electrical Machines 1000 W



Star-delta switch

3-pin
Voltage 3 AC 500 V
Current 16 A

Weight approx. 1,0 kg

Order-No. W3315-4A

Pole-changing switch

3-pin, for 2 speeds,
Dahlander circuit,
Voltage 3 AC 500 V
Current 16 A

Weight approx. 0,8 kg

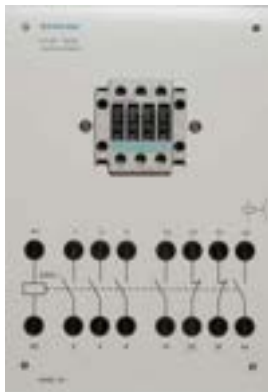
Order-No. W3317-4A

Pole-changing switch

3-pin, for 2 speeds
2 separate windings
Voltage 3 AC 500 V
Current 16 A

Weight approx. 0,8 kg

Order-No. W3318-4A



Contactor

3-pin, with auxiliary switch 2 make
+ 2 break contacts
Operating voltage

1 AC 230 V /
50/60 Hz

Voltage AC 500 V

Current 16 A

Dimensions (WxH) 195x297 mm

Weight approx. 1,0 kg

Order-No. W3321-4A

Auxiliary contactor

with 4 break + 4 make contacts
Operating-
voltage 1 AC 230 V / 50 Hz
AC 400 V
Current 6 A

Dimensions (WxH) 195x297 mm

Weight approx. 0,5 kg

Order-No. W3328-4A

Overcurrent relay

thermally delayed,
with auxiliary switch,
with 1 make + 1 break contact

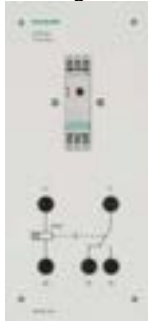
Dimensions
(HxW) 297x130 mm
Weight approx. 0,8 kg

Setting range	1,6 bis 2,5 A	Order-No. W3330-4J
Setting range	2,5 bis 4 A	Order-No. W3330-4K
Setting range	4 bis 6,3 A	Order-No. W3330-4L
Setting range	6,3 bis 10 A	Order-No. W3330-4M

➤ **Accessories for Electrical Machines 1000 W**

Time relay, delayed pickup

1 changeover contact



Operating-voltage 1 AC 230 V / 50/60 Hz
 Voltage 1AC 230 V
 Current 3 A
 Setting range 1,5 to 30 s

Dimensions (HxW) 297x130 mm
 Weight approx. 0,9 kg

Order-No. W3331-4A

Time relay

delayed drop-out

Operating-Voltage 1 AC 230 V/ 50/60 Hz
 Voltage AC 230 V
 Current 3 A
 Setting range 0,05 bis 100 s

Dimensions (HxW) 297x130 mm
 Weight approx. 0,9 kg

Order-No. W3331-4C

Starting capacitor

including discharge resistor

Voltage 1 AC 450 V/50 Hz
 Capacity 22 µF

Order-No. W3333-4A

Starting capacitor

including discharge resistor

Voltage 1 AC 450 V/50 Hz
 Kapazität 22 µF

Order-No. W3333-4B

3 capacitors

including discharge resistor

Voltage 1 AC 450 V/50 Hz



W3333-4D

Capacity	3 x 1 µF	Order-No. W3333-4C
Capacity	3 x 3,3 µF	Order-No. W3333-4D
Capacity	3 x 4,7 µF	Order-No. W3333-4E

➤ Accessories for Electrical Machines 1000 W



W3334-4B

Pushbutton switch

with 1 make + 1 break contact

Technical data

Voltage 1 AC 500 V

Current 10 A

Weight approx. 0,3 kg

Order-No. W3334-4A

2 pushbutton switches

„ON“ black with 1 make
+ 1 break contact

Voltage 1 AC 500 V

Current 10A

„OFF“ red with 1 make + 1 break
contact

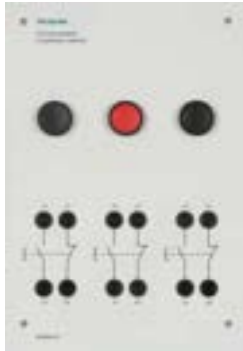
Voltage 500 V AC

Current 10 A

Dimensions (HxW) 297x130 mm

Weight approx. 0,9 kg

Order-No. W3334-4B



3 pushbutton switches

2x black, 1x red,
with 1 make + 1 break contact

Technical data

Voltage 500 V AC

Current 10A

Dimensions (WxH) 130x297mm

Weight approx. 1,0kg

Order-No. W3334-4C

Pilot light

with incandescent lamp 230 V

Weight approx. 0,2 kg

color red

Order-No. W3335-4A

color green

Order-No. W3336-4A

color white

Order-No. W3337-4A



2 pilot lights

with 2 incandescent lamps 230 V
with 1 red and 1 green cover

Dimensions (HxW) 297x130 mm

Weight approx. 0,7 kg

Order-No. W3337-4B

➤ **Accessories for Electrical Machines 1000 W**

3 pilot lights

with 3 incandescent lamps 230 V, white

Weight approx. 0,3 kg

Order-No. W3338-4A

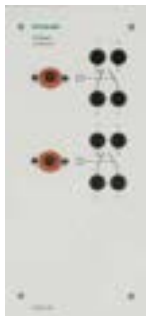


6 pilot lights

with 6 incandescent lamps 230 V, white

Weight approx. 0,3 kg

Order-No. W3357-4A



2 limit switches

1 break contact each
Voltage 400 V AC
Current 16 A

Dimensions (HxW) 297x130 mm
Weight approx. 0,8 kg

Order-No. W3340-4B

On/off switch

2-pin
Switch positions 0 - I - 0 - I
Voltage AC 400/220 V DC
Current 16 A

Dimensions (HxW) 297x130 mm
Weight approx. 0,65 kg

Order-No. W3341-4B

Two-circuit double-interruption switch

2-pin;
Switch positions 0 - I - 0 - II
Voltage AC 400/230 V DC
Current 16 A

Dimensions (HxW) 297x130 mm
Weight approx. 0,9 kg

Order-No. W3342-4B

Synchroscope

Voltage AC 400 V

Dimensions (WxH) 260x297 mm
Weight approx. 4,7 kg

Order-No. W3440-4A



Two-circuit double-interruption switch

3-pin;
Switch positions 0 - I - 0 - II
Voltage AC 400/220 V DC
Current 16 A

Weight approx. 0,5 kg

Order-No. W3342-4E

➤ Accessories for Electrical Machines 1000 W

4-way switch

2-pin
 Switch positions I - II - III - IV
 Voltage AC 400 V/230 V DC
 Current 16 A

Weight approx. 0,8 kg

Order-No. W3343-4B

3 Resistors

1 x 10 Ω / 0,5 A
 1 x 20 Ω / 0,5 A
 1 x 50 Ω / 0,5 A

Weight approx. 0,3 kg

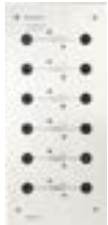
Order-No. W3344-4A

3 Resistors

1 x 100 Ω / 1 A
 1 x 330 Ω / 0,6 A
 1 x 1000 Ω / 0,3 A

Weight approx. 2,5 kg

Order-No. W3344-4B



6 Resistors

Resistance 6 x 3,9 Ω
 Output 6 x 10 W

Weight approx. 1,5 kg

Order-No. W3345-4B



W3452-4A

Double frequency meter

Frequency 2 x 45 - 55 Hz

Dimensions (WxH) 130x297 mm

Weight approx. 1,6 kg

Voltage 230V

Order-No. W3437-4A

Voltage 400V

Order-No. W3452-4A



Double voltmeter

Voltage 2 x AC 500 V/
 15 - 65 Hz

Dimensions (WxH) 130x297 mm

Weight approx. 1,5 kg

Order-No. W3438-4A



Phase-sequence indicator

Voltage 150 - 500 V AC
 Frequency 40 - 400 Hz

Dimensions (WxH) 130x297x60 mm

Weight approx. 0,7 kg

Order-No. W3443-4A

➤ **Standard Training System Electrical Machines 1000 W**

With the "Standard Training System Electrical Machines 1000W", the following experiments can be carried out:

1. DC Machines

DC series-wound motor:

- Motor operation
- Measuring current, voltage, speed, torque
- Tracing characteristics

DC shunt-wound machine:

- Motor operation, self-excited
- Motor operation, separately excited
- Generator operation, self-excited
- Generator operation, separately excited
- Measuring current, voltage, resistance, speed, torque
- Tracing characteristics

DC compound-wound machine:

- Motor operation
- Generator operation
- Measuring current, voltage, speed, torque
- Tracing characteristics

2. Single-Phase AC Machines

Measuring current, voltage, speed, torque and output as well as tracing characteristics on:

- Single-phase squirrel-cage motor with starting and running capacitor
- Single-phase squirrel-cage motor with auxiliary starting winding
- Repulsion motor

3. Induction motors

Measuring current, voltage, speed, torque and output as well as tracing characteristics on:

- Three-phase squirrel-cage induction motor suitable for star-delta starting
- Three-phase two-speed pole-changing induction motor with squirrel-cage rotor (Dahlander circuit)
- Three-phase pole-changing induction motor with squirrel-cage rotor with two separate windings
- Three-phase induction motor with slipring rotor

With three-phase squirrel-cage induction motors additionally:

- Switch-on with motor protection
- Reversal
- Star-delta starting
- Stator-resistance starting circuit
- Operation at single-phase mains
- Reactive-power compensation
- Pole-changing Dahlander
- Pole-changing two separate windings
- Efficiency measurement

With three-phase induction machines with slipring rotors additionally:

- Starting circuits

4. Synchronous machines

Measuring current, voltage, speed, torque and output as well as tracing characteristics on:

- Measuring current, voltage, speed, torque and output as well as tracing characteristics on:
- Three-phase synchronous machine with salient pole rotor and damper winding
- Mains synchronization
- Isolated operation

➤ Standard Training System Electrical Machines 1000 W

The following components are required to carry out these experiments:

4	W3311-4B 3 NEOZED-fuse elements	5	W3321-4A Contactor	1	W3221-4B 1 NEOZED fuse element
1	W3228-4B 3 Incandescent lamps E27	1	W3328-4A Auxiliary contactor	1	W3375-1F Eddy current brake
1	W3312-4B Motor-protection circuit-breaker	2	W3330-4J Overcurrent relay	1	W3375-6A Control unit for eddy-current brake and dynamometer
1	W3312-4G Motor-protection circuit-breaker	1	W3330-4K Overcurrent relay	1	W3375-6C Control unit for eddy-current brake and dynamometer
1	W3312-4C Motor-protection circuit-breaker	1	W3330-4L Overcurrent relay	1	W3375-6D Control unit for eddy-current brake, 2-quadrant converter
1	W3312-4F Motor-protection circuit-breaker	2	W3331-4A Time relay 1 changeover contact	1	W3375-6F Control unit for eddy-current brake and dynamometer, measuring and control interface
3	W3313-4A On/off switch 3-pin	2	W3334-4B 2 Pushbutton switches	1	W3375-2A Three-phase squirrel-cage induction motor
4	W3341-4B On/off switch 2-pin	1	W3334-4C 3 Pushbutton switches	1	W3375-2B Three-phase two-speed pole-changing induction motor
1	W3342-4E Two-circuit double-interruption switch, 3-pin	1	W3337-4B 2 Pilot lights	1	W3375-2C Three-phase induction motor with slipping rotor
1	W3314-4A Reversing switch 3-pin	1	W3340-4B 2 Limit switches	1	W3375-3B Single-phase squirrel-cage AC motor with starting and running capacitor
1	W3315-4A Star-delta switch 3-pin	1	W3333-4E 3 Capacitors	1	W3375-5A DC series wound machine
1	W3317-4A Pole-changing switch	1	W3333-4B Starting capacitor		
		1	W3357-4A 6 Pilot lights		

➤ **Standard - Training System Electrical Machines 1000 W**

to be continued ...necessary equipment

- 1 W3375-3C
Single-phase squirrel-cage motor with auxiliary starting winding
- 1 W3375-4A
Synchronous machine with salient pole rotor
- 1 W3375-4B
Synchronous machine with non salient pole rotor
- 1 W3375-5B
DC compound wound machine
- 1 W3375-5C
DC shunt-wound machine
- 1 W3375-8B
Controller
- 1 W3375-8C
Controller
- 1 W3375-8D
Single-coil slide resistor
- 1 W3375-8E
Single-coil slide resistor
- 1 W3375-8F
Single-coil slide resistor
- 1 W3375-8K
Single-coil fixed resistor
- 1 W3375-8H
3-phase coil slide resistor
- 1 W3644-3D
Inductive loading
- 1 W3644-3F
Capacitive loading
- 1 W3428-4F
Wattmeter

- 1 W3428-4D
Wattmeter
- 1 W3434-4A
Power factor meter
- 1 W3435-4A
Power factor meter
- 1 W3443-4A
Phase-sequence indicator
- 2 W3422-4A
Moving-iron voltmeter
- 1 W3438-4A
Double voltmeter
- 1 W3436-4A
Frequency meter
- 1 W3452-4A
Double frequency meter
- 1 W3440-4A
Synchroscope
- 3 W3901-0A
Set Connecting leads
- 1 W3010-8B
V108 Experimental manual, "Connecting and Measuring el. Machines 1000 W"

Recommended Lab equipment

- 1 W2700-1A
Standard experimental set-up
Power Engineering with power supplies, SCHUKO sockets and experimental frame

➤ FAX – reply to: +49 (0)9721-64691 - 20

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Remarks:

Training & Didactic Systems

Electrical Machines 5 kW

Catalog

WA2E/05.03



➤ Our Services

- Development and production of didactic training systems
- Teachware and documentation
- Project engineering of complete lab's incl. furniture and lab equipment
- Quotations on customer's demand
- Installation, commissioning and training at site

➤ Our Customers

- Vocational training schools, technical schools, colleges and universities...
- Industrial laboratories for vocational education and higher education

➤ Fields of Technology

- Fundamentals of electrical engineering
- Fundamentals of electronics
- Closed loop control technology
- Automation engineering
- Electrical machines / drive control
- Power electronics
- Building management systems
- Protection schemes to VDE 0100
- Radio- and TV technology
- Air conditioning and refrigeration
- Photovoltaic
- Communication technology
- Measuring systems, power supplies, accessories
- Experimental manuals, documentation

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➤ **Training System Electrical Machines 5 kW**



Training Systems – Assignment – Target audience

Project Theses Diploma Theses					
Practicals College / University					
Continuing Education Practical Training College/University					
Master craftsman / Technician Further Training at Chamber of commerce					
Skilled Worker Training					
Fundamentals Vocational education school / Education in Industry					

1000 W Range

5 kW Range

200 W Range

➤ Introduction

If you can analyze problems systematically and understand interrelationships, you'll have no difficulty in coping with future developments - in any field of technology. As your partner for training systems, we can provide you with the technical equipment you require for this purpose including the necessary know-how in the form of comprehensive instruction manuals, training documentation and extensive configuring and design aids. Systematic analysis in the field of electrical machines means learning about the behavior of electrical machines through exact measuring exercises and evaluation of the characteristics recorded. This includes comprehension of basic electric circuits such as star-delta connections, stator-resistance starting circuits etc. and the ability to connect these with the specific problems of the individual machine types.

Understanding interrelationships means to view the electrical machines in their relation to drive engineering and automatic control engineering:

- Which electrical machine is best suited for a specific application problem?
- Which control method should be used with an individual machine in order to ensure that the drive meets the highest requirements e.g. relative to dynamic response or control accuracy?

We see it as our task to help you answer these and similar questions on a practical basis and to provide suitable experimental equipment for scientific studies.

Our training system gives you almost unlimited freedom, i.e. you can pick and choose elements to create your own "personal" training strategy.

If you have an entire room at your disposal for use as a machine laboratory and if you attach importance to characteristics of "large" machines, the system of your choice would be our machines in the range up to 5 kW¹⁾. This system is especially suited for use at technical colleges and universities. Experimental sockets ensure operational safety even with equipment from this output range²⁾.

1) Larger machines available on request.

2) For technical reasons, no experimental sockets are used with machines > 5 kW.

If the transport capability of the machines is a criterion besides the characteristics, the machines from the 1 kW range are right for you.

They offer an ideal compromise between electrical operating behavior and low weight, which is also reflected in their extremely high cost effectiveness. This system can be used from basic training to practicals at technical colleges or universities and beyond.

If due to the training situation you have to pay special attention to aspects such as mobility, training outside of technical rooms and space requirements, you will decide in favor of our 200 W machine range.

Regardless which of the three systems you eventually choose, you will have devices at your disposal that are tailor-made for your individual requirements.

➤ Training Concept

The Aim

The aim of our training concept for the field of electrical machines is to provide

- vocational schools
- technical colleges
- universities and
- in-firm training centers

with systems for teaching the theoretical and practical knowledge which trainees and students require to learn and understand modern know-how about electrical machines and their control methods.

The machines we use are purely industrial equipment whose characteristics have been idealized only in exceptional cases, e.g. induction machine with slipping rotor. This applies for the 200 W range, the 1000 W range as well as the 5 kW range. You can choose between different DC machines, AC machines, three-phase machines as well as special machines such as the DC and three-phase compound machine.

Brakes and Measuring Systems

The available brake assemblies include magnetic powder brakes, eddy-current brakes and dynamometers. The setpoint for the brakes can be input either via front panel or PC, and characteristics can be traced either via recorder or also via PC, where a soft-ware specifically designed for the machine range facilitates the process.

While modules M1 to M5 focus on the electrical machine and its elementary control possibilities, modules M6 to M8 deal with technically expanded control methods up to the three-phase AC power controller SIKOSTART in combination with the squirrel-cage induction machine. Module M9 is devoted to the subject area of reactive-power compensation. The following matrix provides an overview of possible combinations of machine type and control method:

Practical instruction manuals

Instruction manuals designed by didactically trained specialists are available for our 200 W and 1000 W training systems. These instruction manuals generally consist of 3 sections:

Section 1: General section for introducing the trainees to the objectives of the training program and providing basic theoretical knowledge.

Section 2: Trainee's section containing measuring exercises. Value tables, diagrams and oscillograms must be filled out by the student or created on the PC.

Section 3: Instructor's section containing the answers to questions in section 2. The purpose of this section is to reduce valuable preparation time and provide a check for instructors.

Whether you choose machines from the 200 W or the 1000 W range, we can provide you with reliable instruction manuals for the appropriate system.

➤ Training Concept

The Training Aim

- DC machines
- Single-phase motors
 - with running capacitor,
 - with starting and running capacitor
 - resistance start
- Asynchronous and synchronous polyphase machines
- Special machines

The concept

The "Electrical Machines" training system allows you to teach the aims listed with 300-W machines, 1-kW machines and also with machines up to 5-kW (higher-power machines on request). Depending on customer requirements, we can supply either single machines or complete systems with machines, loading facilities, drivers and measuring equipment. Specially prepared technical literature forms the basis of theory teaching.

The System

Our "Electrical Machines" training system consists of the following individual components:

- 300-W machines
- 1000-W machines
- Machines up to 5 kW
- Loading facilities
- Drivers
- Measuring equipment

300 W machines

Our 300-W machines are used primarily for training purposes in industry, trade and technical colleges. They are a handy size and can be easily assembled and dismantled. These "small" machines are "big" on electrical operating characteristics. They are industrial machines whose characteristics have only been modified for teaching purposes in exceptional cases. This is why they are also well suited to basic practical teaching in technical colleges and universities.

1000 W machines

This is the ideal "middle ground" between the "small" 300-W machine and the "large" machines in the performance range up to 5 kW. Thanks to its low weight, compact dimensions and excellent electrical characteristics, this machine offers more universality of use than any other machine type.

Machines up to 5 kW

If a machine laboratory is to be equipped and if practice-orientation is the main priority, this performance range is to be recommended. Demanding practical tests, engineering exams and certificate exams can all be set up easily in conjunction with these industrial drives.

➤ Loads, Drivers, Measuring Equipment

Load facilities

Brakes are available in the form of magnetic powder brakes and rotating eddy-current retarders (300-W and 1000-W range). They have been adapted exactly to the electrical machines. If the machine is to be subjected to both motive power loading and rheostatic loading, a DC dynamo-meter is recommended as loading facility (300-W, 1000-W and 5-kW ranges). All load facilities are equipped with optical indicating instruments, standardized analog outputs and interfaces for computer links.

Drivers

The constantly increasing requirements of drive technology mean that modern converter equipment is required in addition to contactor equipment. Digital converters for polyphase machines, analog and microprocessor-controlled converters for DC drives, special equipment for servo and stepper motors finish off the machines as compact and intelligent drive units.

Measuring Equipment

Measuring equipment as the interface between man and machine is of central significance in study and training. There is a correspondingly comprehensive and high-quality range of measured value processing systems and output devices available.

Whether you are making measurements with a multimeter or a multifunction meter, recording characteristic curves via value tables or PC, or carrying out torque acquisition via current, foil strain gauge or torque metering shaft, there is measuring equipment available for all your requirements.

➤ Features and Design

General

The experimental machines feature the IM B 3 design with one shaft end and correspond to the VDE regulations 0530.

The 5 kW machines are equipped with:

- an experimental terminal board. The ends of the windings brought out to the terminal board are connected to 4-mm-safety-socket outlets. The socket outlets are arranged on a plastic board in the same way as the connections of a normal terminal board of an industrial machine. The plastic board features the conventional industrial machine terminal designations.

- A PTC thermistor in order to protect the machines against thermal overload. This obviates overheating resulting from overload, high switching frequency, single phasing, large deviations in voltage, excessively high coolant temperatures or obstructed coolant flow. The leads of the thermistors are connected to 2-mm-socket-outlets in order to avoid faulty connections.
- A baseplate to compensate for differences in shaft height and to facilitate replacement of the machines. The baseplate features a guide mechanism on the underside for setting it onto the slide of the baseframe.

- A toothed gear coupling half which is identical for all machines and brake assemblies within each range. The coupling halves are connected to each other over an elastic adapter piece. This type of coupling and baseplate design allows you to combine any two machines to form one motor generator set as well as to couple each machine to the brake assemblies without having to change the coupling or the baseplate.

In order to keep the noise level low, preference has been given to machines with rated speeds of 1500 rev/min.

➤ **Electrical Machines 5 kW**

The electrical machines are equipped as follows::

- with premounted coupling
- with base plate, to compensate the height of axes and for easy replacement of machines
- with thermistor protection

Types of electrical machines 5kW



➤ **DC - Machines**

DC Series-wound machine

Technical data		Voltage	420 V	Weight approx.	135 kg
Degree of		Current	15 A		
Protection	IP 21	Speed	1500 min ⁻¹		
Output	5 kW				

Bestell.-Nr. W3377-5A

DC Compound-wound machine

with series and shunt winding; for motor and generator operation

Technical data		Generator operation		Shunt winding:	
Degree of		Output	5 kW	Field voltage	310 V
Protection	IP 21	Voltage	400 V	Field current	1,0 A
Motor operation		Current	12,5 A	Weight approx.	135 kg
Output	5 kW	Speed	1500 min ⁻¹		
Voltage	420 V				
Current	14 A				
Speed	1500 min ⁻¹				

Order-No. W3377-5B

➤ DC - Machines 5 kW**DC Shunt-wound machine**

for motor and generator operation

Technical data

Degree of

Protection IP 21

Motor operation

Output 5 kW

Voltage 420 V

Current 14 A

Speed 1500 min⁻¹

Generator operation

Output 5 kW

Voltage 400 V

Current 12,5 A

Speed 1500 min⁻¹

Shunt winding

Field voltage 310 V

Field current 1,1 A

Weight approx. 135 kg

Order-No. W3377-5C**DC Shunt-wound machine**

with built-on tachogenerator

Voltage 30 V / 1000 min⁻¹**Order-No. W3377-5G****DC Shunt-wound machine, cradle-mounted**for motor- und generator operation,
torque recorded via strain gauge,
speed recorded via DC tachogenerator

Technical data

Degree of

Protection IP 21

Generator operation

Output 10 kW

Voltage 400 V

Current 25 A

Speed 1500 min⁻¹

Motor operation

Output 10 kW

Voltage 420 V

Current 28 A

Speed 1500 min⁻¹

Field voltage 310 V

Field current 1,3 A

Resolution of
tachogenerator 30 V / 1000 min⁻¹

Weight approx. 185 kg

Order-No. W3377-1H

➤ **3-phase – Asynchronous Machines 5 kW**

Three-phase squirrel-cage induction motor

for star-delta-operation	Voltage	3 AC 230 V / 400 V /	Weight approx.	60 kg
Technical data		50 Hz		
Degree of	Current	11 A		
Protection	Speed	1445 min ⁻¹		
Output	IP 21			
	5 kW			

Order-No. W3377-2A

Three-phase two-speed pole-changing induction motor

with squirrel-cage rotor	Voltage	3 AC 400 V / 50 Hz	Weight approx.	60 kg
(Dahlander circuit)	Current	10 A / 11,5 A		
Technical data	Speed	1450 min ⁻¹ /		
Degree of		2900 min ⁻¹		
Protection	IP 21			
Output	4,7 kW / 5,7 kW			

Order-No. W3377-2B

Three-phase two-speed pole-changing induction motor

with squirrel-cage rotor and two	Voltage	3 AC 400 V / 50 Hz	Weight approx.	60 kg
separate windings	Current	8,5 A / 9 A		
Technical data	Speed	965 / 1430 min ⁻¹		
Degree of				
Protection	IP 21			
Output	3 kW / 4 kW			

Order-No. W3377-2G

Three-phase induction motor with slipping rotor

with slipping rotor, area covered with	Voltage	3 AC 400 V / 50 Hz	Weight approx.	80 kg
plexi-glass	Current	11,5 A		
Technical data	Speed	1435 min ⁻¹		
Degree of	Locked rotor			
Protection	voltage	180 V		
Output	Rated rotor-			
	current	18,5 A		

Order-No. W3377-2C

➤ **3-phase – Synchronous Machines 5 kW**

Three-phase synchronous machine with salient pole rotor

and damper winding; for motor and generator operation	Motor operation	Weight approx.	120 kg
Technical data	Speed	1500 min ⁻¹	
Degree of	Output	5 kW	
Protection	Voltage	3 AC 400 V	
Speed		50 Hz	
Generator operation	Current	9,5 A	
Output	Field voltage	110 V	
Voltage	Field current	3,2 A	
Current			

Order-No. W3377-4A

Three-phase synchronous machine with non-salient pole rotor

and damper winding; for motor and generator operation	Motor operation	Weight approx.	120 kg
Technical data	Speed	1500 min ⁻¹	
Degree of	Output	4,5 kW	
Protection	Voltage	3 AC 400 V	
Speed		50 Hz	
Generator operation	Current	8,8 A	
Output	Field voltage	110 V	
Voltage	Field current	3,4 A	
Current			

Order-No. W3377-4B

➤ **Measuring Equipment / Loads**

The following subjects can be taught by using the standard training system with electrical machines 5kW

- Setup and commissioning of a testing station for electrical machines. Various DC, synchronous and induction machines as well as a DC dynamometer are available.
- Determining the suitability of specific machines for diverse drive requirements
- Determining the advantages/limitations of controlling machines with modern electronic power converters
- Incorporating and applying PC measuring technology
- Studying drives with the aid of conventional or PC measuring technology

Converter SIMOREG DC-Master



In circulating-current-free, inverse-parallel connection (B6) A (B6) C, with digital closed-loop control (16 bit microprocessor) for feeding a DC motor with a maximum output of 6kW. Suitable for four-quadrant drives with regulated field supply. The compact converter is operated via an integrated parameterization unit (display and keyboard). Operating statuses and faults are indicated. With RS 232 serial interface. Mounted in a rack-type sheet-steel housing. Plastic front panel with mimic diagram and designations.

Technical data:

Rated supply voltage	3AC 400V
Rated frequency	45 to 65Hz
Rated DC voltage	420 V
Rated direct current	30 A
Overload for 5 min.	1,5 - times
x rated current	
Rated output	12 kW
Rated DC voltage field	max. 325 V
Rated direct current field	5 A
Dimensions (HxWxD)	800x500x450 mm
Weight approx.	30 kg

Order-No. W3643-1M

➤ Measuring Equipment / Loads



DC shunt-wound machine cradle-mounted

Speed adjustable via armature control from 100 to 1500 rev/min at constant torque and via field weakening from 1500 to 3000 rev/min at constant output; with built-on electric torque load cell (strain gauge); with tachogenerator and pulse generator combination fitted on the non-drive end (30 V/1000 rev/min 1024 pulses/rev); with built-in temperature monitor (trigger temperature approx. 90 °C) and fitted half-coupling. Associated control unit W3643-1M.

Technical data

Generator operation:

Braking power	10 kW
Voltage	400 V
Current	ca. 25 A
Speed	1500 min ⁻¹

Motor operation:

Output	10 kW
Voltage	420 V
Current	ca. 28 A
Speed	1500 min ⁻¹
Field voltage	310 V
Field current	ca. 1,3 A
Degree of Protection	IP 21
Weight approx.	185 kg

Order-No. W3377-1H

Measuring and evaluating unit

Measuring and evaluating unit for speed, torque and calculated output for the dynamometer W3377-1H. With display on 3 digital measuring instruments with LCD.

Technical data

Supply voltage 1 AC 230 V/
50 Hz

Inputs:

Speed and torque actual values from terminal board of the DC dynamometer via prepared measuring leads. The prepared measuring leads are included in the scope of delivery.

Outputs:

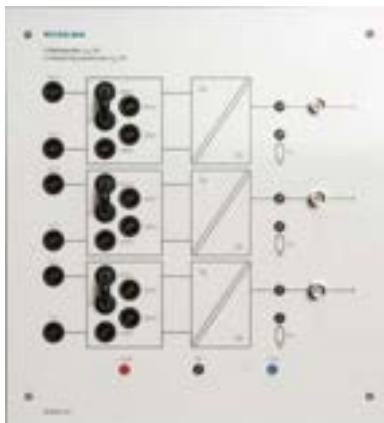
Analog outputs for speed, torque and calculated output; brought out to 4-mm-safety-lab-sockets

Speed	3000 min ⁻¹ = 10 V
Torque	60 Nm = 10 V
Output	10 kW = 10 V

The 9-pole Sub D-cable is in the scope of delivery.

Order-No. W3377-1V

Transducer (voltage)



Experimental panel for floating measurements of DC, AC and

pulse voltages; with electrical isolation between primary and secondary circuits. The panel features 3 built-in transducers with 4 different measuring ranges. The voltage inputs are brought out to 4mm safety lab sockets, the voltage outputs to 2mm sockets and BNC sockets. The power supply inputs are brought out to 2mm sockets.

Technical data

Input voltage max. 500/400/250/100 V switch-selectable

Output voltage	0 – 5 V
Accuracy	under 1 %
Error of linearity	± 0,2 %
Minimum time of reaction	under 1 µs
Power supply	± 15 V/150 mA

Dimensions (WxHxD) 260x297x100 mm
Weight approx.: 0.8 kg

Order-No. W3644-4J

➤ **Measuring Equipment / Loads**

Precision measuring transducer (current, 12,5 A)



Experimental panel for floating measurements of DC, AC and pulse voltages; with electrical isolation between primary and secondary circuits. The panel features 3 built-in transducers with 4 different measuring ranges. The voltage inputs are brought out to 4mm safety lab sockets, the voltage outputs to 2mm sockets and BNC sockets. The power supply inputs are brought out to 2mm sockets.

Technical data:
 Input current max. 12,5 A
 Output voltage 0 – 5 V
 Accuracy under 1 %
 Error of linearity under 0,1 %
 Minimum time of reaction under 1 μ s
 Power supply \pm 15 V/50 mA
 Dimensions (WxHxD) 297x130x60 mm
 Weight approx. 0,5 kg

Order-No. W3410-4C

Precision measuring transducer (current, 25 A)



Experimental panel for floating measurements of DC, AC and pulse voltages; with electrical isolation between primary and secondary circuits. The panel features 3 built-in transducers with 4 different measuring ranges. The voltage inputs are brought out to 4mm safety lab sockets, the voltage outputs to 2mm sockets and BNC sockets. The power supply inputs are brought out to 2mm sockets.

Technical data:
 Input current max. 25 A
 Output voltage 0 – 5 V
 Accuracy under 1 %
 Error of linearity under 0,1 %
 Minimum time of reaction under 1 μ s
 Power supply \pm 15 V/50 mA
 Dimensions (WxHxD) 297x130x60 mm
 Weight approx. 0,5 kg

Order-No. W3410-4D

Precision measuring transducer (current, 50 A)



Experimental panel for floating measurements of DC, AC and pulse voltages; with electrical isolation between primary and secondary circuits. The panel features 3 built-in transducers with 4 different measuring ranges. The voltage inputs are brought out to 4mm safety lab sockets, the voltage outputs to 2mm sockets and BNC sockets. The power supply inputs are brought out to 2mm sockets.

Technical data:
 Input current max. 50 A
 Output voltage 0 – 5 V
 Accuracy under 1 %
 Error of linearity under 0,1 %
 Minimum time of reaction under 1 μ s
 Power supply \pm 15 V/50 mA
 Dimensions (WxHxD) 297x130x60 mm
 Weight approx. 0,5 kg

Order-No. W3410-4E

➤ Accessories for Electrical Machines 5 kW

Baseframe

Baseframe for mounting the dynamometer, an experimental machine and a flywheel, or two experimental machines and a measuring shaft.

Torsionally rigid design, galvanized; mounted on vibration dampers; with draw spindles and baseplate guide for rapid fitting and removal of experimental machines; with coupling cover.

Dimensions
(WxHxD) 2200x460x200 mm
Weight approx.: 120 kg

Order-No. W3377-8A

Rotor controller

For the rotor-locking of machines from the 5 kW range, such as for example for use of the three-phase induction motor with slipping rotor as three-phase transformer. Designed as gearbox with handwheel.

With half-coupling and coupling cover, with baseplate for setup and centering on the baseframe.

Weight approx. 25 kg

Order-No. W3377-2D

Controller

for starting the three-phase induction motor with slipping rotor and reducing the speed by 50 % at constant torque, designed as step resistor with pulse contact, installed in housing with circuit diagram on front.

All terminals are brought out to 4-mm safety lab sockets.

Degree of Protection IP 20
Voltage 180 V
Current 18,5 A
Weight approx. 15 kg

Order-No. W3377-8B

Load resistor

for adjustable loading of the DC machines as well as for adjustable single-phase loading of the 3-phase synchronous machines

with integrated 6-step-cam-operated switch as coarse adjustment and integrated slide resistor as fine adjustment

Degree of Protection IP 20
Voltage 400 V
Current 0,12 ... 12,5 A
Weight approx. 40 kg

Order-No. W3377-8E

➤ **Accessories for Electrical Machines 5 kW**

Single-coil slide Resistor

for adjusting the excitation of the DC machines.
With cover, rubber feet and earthing screw. Terminals brought out to 4-mm safety lab sockets.

Degree of Protection	IP 20
Resistor	470 Ω
Voltage	310 V
Current	1,1 - 0,44 A

Weight approx. 5 kg

Order-No. W3377-8F

Double-coil fixed Resistor

As stator-resistor for 3-phase squirrel cage induction motor. With cover, rubber feet and earthing screw. Terminals brought out to 4-mm safety lab sockets.

Degree of Protection	IP 20
Resistor	12 Ω
Voltage	2 AC 400 V
Current	11 A
Operating time	10 s at 15 operations/h

Weight approx. 10 kg

Order-No. W3377-8K

Single-coil fixed Resistor

for adjusting the excitation of the synchronous machines.
Field regulation 1 : 2,5
With cover, rubber feet and earthing screw. Terminals brought out to 4-mm safety lab sockets.

Degree of Protection	IP 20
Voltage	110 V
Resistor	56 Ω
Current	3,2 - 1,3 A

Weight approx. 10 kg

Order-No. W3377-8D

Single-coil fixed Resistor

As starting resistor for W3377-8F, if the field voltage is 400 V. With cover, rubber feet and earthing screw. Terminals brought out to 4-mm safety lab sockets.

Degree of Protection	IP 20
Resistor	82 Ω
Current	1,1 A

Weight approx. 5 kg

Order-No. W3377-8V

Controller

for starting DC motors and reducing the speed by 50% at constant torque.
With cover, rubber feet and earthing screw. Terminals brought out to 4-mm safety lab sockets.

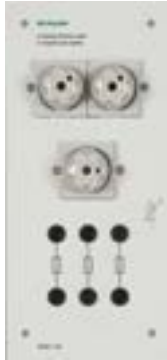
Degree of Protection	IP 20
Voltage	400 V
Current	15 A

Weight approx. 15 kg

Order-No. W3377-8C

➤ Accessories for Electrical Machines 5 kW

All accessories are equipped with 4-mm-safety-lab-sockets



1 NEOZED fuse element

NEOZED D1 with cartridge fuses for
 4 A, 6 A, 10 A
 Voltage 3 AC 400 V
 250 V DC
 Current 16 A max.

Dimensions (HxW) 297x130 mm
 Weight approx. 0,5 kg

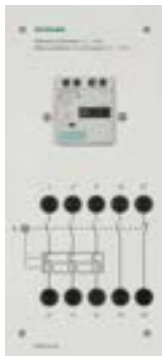
Order-No. W3221-4B

3 NEOZED fuse elements

NEOZED D1 with cartridge fuses for
 4 A, 6 A, 10 A
 Voltage 3 AC 400 V /
 250 V DC
 Current 16 A max.

Dimensions (HxW) 297x130 mm
 Weight approx. 0,9 kg

Order-No. W3311-4B



Motor-protection circuit-breaker

3-pin,
 Current max. 16 A
 Setting range 6,3 - 10 A
 Setting range 10 - 16 A

Dimensions (HxW) 297x130 mm
 Weight approx. 0,5 kg

Order-No. W3312-4D

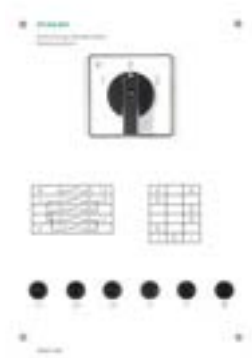
Order-No. W3312-4E

On/Off-switch

3-pin
 Voltage 3 AC 500 V
 Current 16 A

Weight approx. 0,9 kg

Order-No. W3313-4A



Reversing switch

3-pin,
 Voltage 3 AC 500 V
 Current 16 A

Weight approx. 0,9 kg

Order-No. W3314-4A

➤ **Accessories for Electrical Machines 5 kW**



Star-delta switch

3-pin
 Voltage 3 AC 500 V
 Current 16 A

Weight approx. 1,0 kg

Order-No. W3315-4A

Pole-changing switch

3-pin, for 2 speeds,
 Dahlander circuit,
 Voltage 3 AC 500 V
 Current 16 A

Weight approx. 0,8 kg

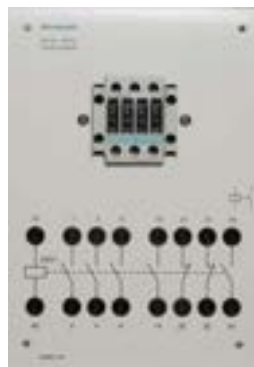
Order-No. W3317-4A

Pole-changing switch

3-pin, for 2 speeds
 2 separate windings
 Voltage 3 AC 500 V
 Current 16 A

Weight approx. 0,8 kg

Order-No. W3318-4A



Contactor

3-pin, with auxiliary switch 2 make
 + 2 break contacts
 Operating voltage

1 AC 230 V /
 50/60 Hz

Voltage AC 500 V

Current 16 A

Dimensions (WxH) 195x297 mm

Weight approx. 1,0 kg

Order-No. W3321-4A

Auxiliary contactor

with 4 break + 4 make contacts
 Operating-voltage

1 AC 230 V / 50 Hz
 AC 400 V

Current 6 A

Dimensions (WxH) 195x297 mm

Weight approx. 0,5 kg

Order-No. W3328-4A

Overcurrent relay

thermally delayed,
 with auxiliary switch,
 with 1 make + 1 break contact

Dimensions (HxW) 297x130 mm

Weight approx. 0,8 kg

Setting range 6,3 - 10 A

Order-No. W3330-4M

Setting range 10 - 16 A

Order-No. W3330-4N

➤ Accessories for Electrical Machines 5 kW

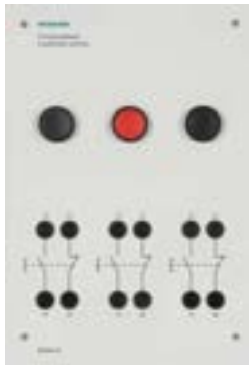


2 pushbutton switches

„ON“ black with 1 make
+ 1 break contact
Voltage 1 AC 500 V
Current 10A
„OFF“ red with 1 make + 1 break
contact
Voltage 500 V AC
Current 10 A

Dimensions (HxW) 297x130 mm
Weight approx. 0,9 kg

Order-No. W3334-4B



3 pushbutton switches

2x black, 1x red,
with 1 make + 1 break contact
Technical data
Voltage 500 V AC
Current 10A

Dimensions (WxH) 130x297mm
Weight approx. 1,0kg

Order-No. W3334-4C

2 pilot lights

with 2 incandescent lamps 230 V
with 1 red and 1 green cover

Dimensions (HxW) 297x130 mm
Weight approx. 0,7 kg

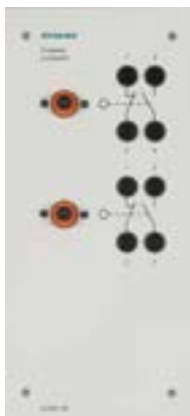
Order-No. W3337-4B

6 pilot lights

with 6 incandescent lamps 230 V,
white

Weight approx. 0,3 kg

Order-No. W3357-4A



2 limit switches

1 break contact each
Voltage 400 V AC
Current 16 A

Dimensions (HxW) 297x130 mm
Weight approx. 0,8 kg

Order-No. W3340-4B

On/off switch

2-pin
Switch positions 0 - I - 0 - I
Voltage AC 400/220 V DC
Current 16 A

Dimensions (HxW) 297x130 mm
Weight approx. 0,65 kg

Order-No. W3341-4B

➤ **Accessories for Electrical Machines 5 kW**



On/off switch

2-pin,
 Switch positions 0 - I - 0 - I
 Voltage AC 500 / 440 V DC
 Current 40 A

Dimensions (HxW) 297x130 mm
 Weight approx. 0,65 kg

Order-No. W3341-4C



Two-circuit double-interruption switch

2-pin,
 Switch positions 0 - I - 0 - II
 Voltage AC 500 /
 440 V DC
 Current 40 A

Dimensions (HxW) 297x130 mm
 Weight approx. 0,9 kg

Order-No. W3342-4C



Two-circuit double-interruption switch

3-pin,
 Switch positions 0 - I - 0 - II
 Voltage AC 400 /
 220 V DC
 Current 16 A

Dimensions (HxW) 297x130 mm
 Weight approx. 0,9 kg

Order-No. W3342-4E



Synchroscope

Voltage AC 400 V

Dimensions (WxH) 260x297 mm
 Weight approx. 4,7 kg

Order-No. W3440-4A



Double frequency meter

Frequenz 2 x 45 bis 55 Hz
 Voltage AC 400V

Dimensions (WxH) 130x297 mm
 Weight approx. 1,6 kg

Order-No. W3452-4A



Double voltmeter

Technical data
 Voltage 2 x AC 500 V/
 15-65 Hz

Dimensions (WxH) 130x297 mm
 Weight approx. 1,5 kg

Order-No. W3438-4A

Phase-sequence indicator

Technical data
 Voltage 150 bis 500 V AC
 Frequenz 40 bis 400 Hz

Dimensions (WxH) 130x297 mm
 Weight approx. 0,7 kg

Order-No. W3443-4A

➤ **Standard – Training System Electrical Machines 5 kW**

**With the standard-system electrical machines 5 kW
the following experiments can be carried out:**

1. DC Machines

DC series-wound motor:

- Motor operation
- Measuring current, voltage, speed, torque
- Tracing characteristics

DC shunt-wound machine:

- Motor operation, self-excited
- Motor operation, separately excited
- Generator operation, self-excited
- Generator operation, separately excited
- Measuring current, voltage, resistance, speed, torque
- Tracing characteristics

DC compound-wound machine:

- Motor operation
- Generator operation
- Measuring current, voltage, speed, torque
- Tracing characteristics

2. Asynchronous machines

Measuring current, voltage, speed, torque and output as well as tracing characteristics on:

- Three-phase squirrel-cage induction motor suitable for star-delta starting
- Three-phase two-speed pole-changing induction motor with squirrel-cage rotor (Dahlander circuit)
- Three-phase pole-changing induction motor with squirrel-cage rotor with two separate windings
- Three-phase induction motor with slipring rotor

With three-phase squirrel-cage induction motors additionally:

- starting circuits

3. Synchronous machines

Measuring current, voltage, speed, torque and output as well as tracing characteristics on:

- Measuring current, voltage, speed, torque and output as well as tracing characteristics on:
- Three-phase synchronous machine with salient pole rotor and damper winding
- Mains synchronization
- Isolated operation

➤ Standard – Training System Electrical Machines 5 kW

The following components are required:

1	W3377-1H DC shunt-wound machine	1	W3377-8V Single-coil fixed resistor	1	W3331-4B Time relay
1	W3377-8A Baseframe	1	W3377-8F Single-coil slide resistor	1	W3334-4C 3 pushbutton switches
1	W3643-1M SIMOREG K converter	1	W3377-8K Double-coil fixed resistor	1	W3340-4B 2 limit switches
1	W3377-1V Measuring unit	1	W3377-8B Controller	1	W3337-4B 2 pilot lamps
1	W3644-4J transducer (voltage)	1	W3377-8D Single-coil slide resistor	3	W3341-4B On/off switch
1	W3410-4D transducer (current)	2	W3311-4B 3 fuse elements	1	W3221-4A 1 fuse element
1	W3410-4E transducer (current)	3	W3341-4C On/off switch	1	W3312-4D Motor protection circuit breaker
1	W3377-2D Rotor controller	1	W3342-4C Two-circuit double-interruption switch	3	W3311-4A 3 fuse elements
1	W3377-5A DC series-wound machine	3	W3334-4B 2 pushbutton switches	1	W3342-4E Two-circuit double-interruption switch
1	W3377-5B DC compound-wound machine	1	W3312-4E Motor-protection circuit-breaker	1	W3357-4A 6 pilot lights
1	W3377-5C DC shunt-wound machine	2	W3313-4A On/off switch	1	W3436-4A Frequency meter
1	W3377-2A Three-phase squirrel-cage induction motor	1	W3314-4A Reversing switch	3	W5431-1A Moving Coil Demonstration Multimeter
1	W3377-2B Three-phase two-speed pole-changing induction motor	1	W3342-4E Two-circuit double-interruption switch	1	W5431-1C Electronic Power Meter
1	W3377-2G Three-phase pole-changing induction motor	1	W3315-4A Star-delta switch	1	W5431-1D Electronic Phase Angle/Power Factor Meter
1	W3377-2C Three-phase induction motor with slipring rotor	1	W3317-4A Pole-changing switch	1	W3440-4A Synchroscope
1	W3377-4A Three-phase synchronous machine	5	W3321-4B Contactor	1	W3438-4A Double voltmeter
1	W3377-4B Three-phase synchronous machine	1	W3328-4A Auxiliary contactor	1	W3452-4A Double frequency meter
1	W3377-8C Controller	2	W3330-4N Overcurrent relay	1	W3443-4A Phase-sequence indicator
3	W3377-8E Single-coil slide resistor	2	W3330-4M Overcurrent relay	1	W3010-8B V108 Experimental manual Connecting and Measuring Electrical Machines
				3	W3901-0A Set Connecting leads

➤ **FAX – Reply to: +49 (0)9721 - 64691 - 20****Sender:****Receiver:**

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Remarks:

Training & Didactic Systems

Electrical Drive Systems 300 W/1000 W

Catalog

WA2E/05.04



➤ Our Services

- Development and production of didactic training systems
- Teachware and documentation
- Project engineering of complete lab's incl. furniture and lab equipment
- Quotations on customer's demand
- Installation, commissioning and training at site

➤ Our Customers

- Vocational training schools, technical schools, colleges and universities...
- Industrial laboratories for vocational education and higher education

➤ Fields of Technology

- Fundamentals of electrical engineering
- Fundamentals of electronics
- Closed loop control technology
- Automation engineering
- Electrical machines / drive control
- Power electronics
- Building management systems
- Protection schemes to VDE 0100
- Radio- and TV technology
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- Communication technology
- Measuring systems, power supplies, accessories
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➤ **Training System Electrical Drive Systems 300 W / 1000 W**



Training Systems – Assignment – Target audience

Project Theses Diploma Theses				
Practicals College / University				
Continuing Education Practical Training College / University				
Master craftsman / Technician Further Training at Chamber of Commerce				
Skilled Worker Training				
Fundamentals Vocational education school / Education in Industry				

1000 W Range

5 kW Range

300 W Range

➤ **Introduction, Training Concept**

If you can analyze problems systematically and understand interrelationships, you'll have no difficulty in coping with future developments - in any field of technology. As your partner for training systems, we can provide you with the technical equipment you require for this purpose including the necessary know-how in the form of comprehensive instruction manuals, training documentation and extensive configuring and design aids.

Systematic analysis in the field of power electronics means learning about basic circuits, such as DC chopper controllers and AC power controllers, through specially designed measuring exercises and understanding the operating principle of devices and the real behavior of components. Understanding interrelationships means to see power electronics in terms of their relationship with drive and control systems.

- How can I apply open-loop and closed-loop controls in electric drives to achieve virtually no-loss operation?
- Which power electronics components can be combined to form drive units which meet special technical requirements such as, for example, good dynamic response, special speed/torque response, surge load, etc.

Our task should be to help you to answer these and similar questions on a practical basis and to provide suitable experimental equipment for scientific studies.

The aim

The aim of our training concept for power electronics and drive systems with closed-loop control is to provide

- vocational schools
- technical colleges
- universities and

in-firm training center with systems for teaching the theoretical and practical knowledge which trainees and students require to learn and understand modern industrial technology.

The subject area

Two options are also available for the subject area "Drive systems with closed-loop control", regardless of which system you wish to use for teaching power electronics, i.e.

1. Specially designed industrial training equipment on 230 / 400 V basis
2. A 230 / 400 V panel system

Both systems can either be operated with 300 W or with 1000 W machines.

A system with "open end" is available with our Test Station 1000 W. This Test Station is based on the standard system with 1000 W electrical machines, so that already available machines can be operated with the current actuators. With "open end" means, that all actuators can optionally be connected to PROFIBUS DP and therefore integrated in an automation system. With visualization systems like WIN CC all functions can be operated and monitored.

Practice oriented experimental manuals

You can order instruction manuals for the training systems. These manuals are written by experienced training staff and specialists with teaching knowledge.

The instruction manuals generally consist of 3 sections:

Section 1:

General section for introducing the trainees to the objectives of the training program and providing basic theoretical knowledge.

Section 2:

Trainee's section containing measuring exercises. Value tables, diagrams and oscilloscope displays must be filled out by the student.

Section 3:

Instructor's section containing the answers to questions in Section 2. The purpose of this section is to reduce valuable preparation time and provide a check for trainers, teachers and instructors.

AC Drive System - didactic industrial unit

MICRO MASTER frequency converter



The industrial device is built as an experimental panel, also suitable as bench unit, with a plastic front panel with mimic diagram and designations. All connectors for the power sections are brought out to 4mm safety lab sockets. Connectors for open and closed-loop control are brought out to 2mm sockets.

Also available is the Micro Master as a rack-version in 3-phase-input configuration.

Sinus modulated pulse converter with microprocessor controller for generation of frequency- and voltage-variable output voltage for standard-asynchronous machines. The 3-phase voltage system is converted into a DC voltage via a B6-rectifier circuit and smoothed by means of a intermediate capacitor. A pulse width modulated AC power controller generates a 3-phase voltage system with variable frequency and voltage amplitude. In connection to an asynchronous machine it leads to an sinusoidal motor current, which hold the stray losses at a small value and generates a good rotational accuracy.

The generated energy is picked up by pulse resistors (4-quadrant drive) The microprocessor calculates e.g. operates the sinusoidal-modulation pulses, operating orders, signals, setpoints and adjustable parameter. The parameters can be set in a simple way and are displayed by a LED-display. During operation the frequency-actual value of the AC power controller is displayed, in malfunction the fault. Open-loop and closed-loop control by means of actuatorless FCC (Flux Current Control) and V/Hz characteristic. A RS 485 interface allows the connection to 2-wire bus.

MicroMaster frequency converter 1000W, 3-phase

Technical data:
 Input voltage 3AC 400 V
 Frequency 50 / 60 Hz
 Output voltage 3AC 0 - 400 V
 Motor output max. 1500 W
 Output frequency 0 - 650 Hz
 Pulse frequency max. 16 kHz
 Overload for 60s 50 %
 Brake rating max. 1600 W for 12 s
 Dimensions (WxHxD) 390x297x175 mm
 Weight approx. 5.5 kg

MicroMaster frequency converter 1000W, 1-phase

Technical data:
 Input voltage 1AC 230 V
 Frequency 50 / 60 Hz
 Output voltage 3AC 0 – 230 V
 Motor output max. 1100 W
 Output frequency 0 - 650 Hz
 Pulse frequency max. 16 kHz
 Overload for 60s 50 %
 Brake rating max. 1600 W for 12 s
 Dimensions (WxHxD) 390x297x165 mm
 Weight approx. 4.5 kg

MicroMaster frequency converter 300W, 1-phase

Technical data:
 Input voltage 1AC 230 V
 Frequency 50 / 60 Hz
 Output voltage 3AC 0 - 230 V
 Motor output max. 350 W
 Output frequency 0 - 650 Hz
 Pulse frequency max. 16 kHz
 Overload for 60s 50 %
 Brake rating max. 800 W for 12 s
 Dimensions (WxHxD) 390x297x150 mm
 Weight approx. 3.5 kg

Order-No. W3643-4S

Order-No. W3643-4N

Order-No. W3643-4M

MicroMaster frequency converter like before, but with communication interface for Profibus-DP.

Order-No. W3643-4S-DP

Order-No. W3643-4N-DP

Order-No. W3643-4M-DP

➤ **AC Drive System - didactic industrial unit**

Three-phase induction motor with squirrel cage rotor



adapted industrial standard machine for star-delta-operation

- with premounted coupling
- with base plate, to compensate the height of axes and for easy replacement of machines
- with thermistor protection on 2mm sockets
- with connections brought out to 4mm safety lab sockets

Technical data:

Output	0,25 kW / 1,0 kW
Voltage	3AC 230 V / 50 Hz 3AC 400 V / 50 Hz
Current	1,34 A / 0,77 A (300W) 3,3 A / 2,4 A (1kW)
Speed	1350 min ⁻¹ (300 W) 1400 min ⁻¹ (1 kW)
degree of protection	IP 21
	1 Axes end

Order-No. W3365-2M (300W)

Order-No. W3375-2M (1000W)

Zubehör Frequenzumrichter MICRO MASTER Operatorbedienung

- For Configuration, Backup and parametrization of the frequency converter Micromaster via Operator Panel.
- For Configuration, Backup and parametrization of the frequency converter Micromaster via SIMOVIS Software and a PC.

- operator module OPM 2
- interface cable PC - OPM 2
- suitable power supply
- Software SIMOVIS
- extensive manual Getting Started

Order-No. W3643-4V

Assembly kit “Variable-Speed DC Drives”

The following experiments can be carried out:

- Motor speed characteristics at frequency converter
- Motor torque characteristics at frequency converter
- voltage boost with low IR compensation
- Setting of ramp-up and ramp-down times
- Specification of frequency setpoint
- Methods of switching on and switching off at the converter
- Selection of voltage/frequency characteristics
- DC braking
- comparison of the open-loop and closed-loop control by means of actuatorless FCC (Flux Current Control) and V/Hz characteristic.

The following components are required (incl. in the kit):

- 1 Frequency converter MICRO MASTER W3643-4M (300 W) W3643-4S (1000 W)
- 1 3-phase induction motor W3365-2M (300 W) W3375-2M (1000 W)
- 1 Baseframe W3360-8A (300 W) W3375-8A (1000 W)
- 1 Compact braking unit W3360-1E (300 W) W3375-1E (1000 W)
- 1 Voltage transducer W3644-4J
- 1 Current transducer W3410-4B (300 W) W3410-4C (1000 W)
- 1 Experimental manual W3007-7B
- 1 Set connecting leads W3901-0B

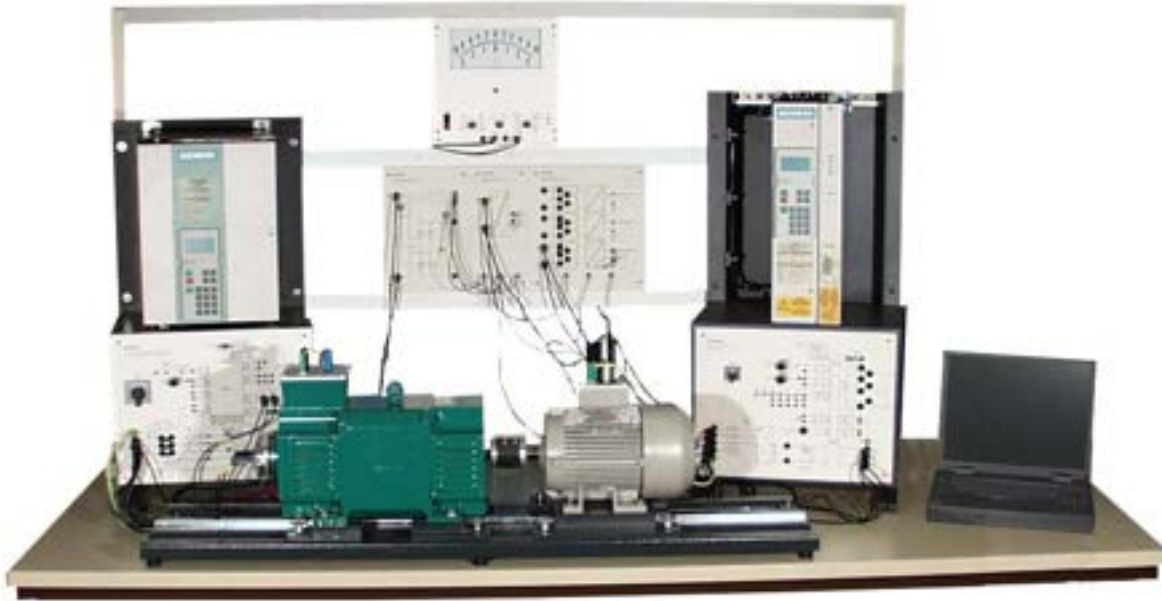
Further components are required (not incl. in the kit):

- 2 Multimeter *alternative*
- 2 *Multimeter as Demonstration instruments W5431-1B*
- 1 2-channel oscilloscope 20 MHz with 2 probes
- 1 Power supply ±15 V DC for transducer

Order-No. W3643-0C (300W)

Order-No. W3643-0D (1000W)

➤ **Electrical Drive System - 1000 W Test Station**



General description

The 1000 W drive control test station enables to investigate operational functions in the field of electrical drive controls. Different high dynamic drive control systems (servo drives) can be compared with conventional drive systems.

The following motor / converter combinations are available:

1. External excited DC shunt-wound machine with the converter SIMOREG DC-Master
2. 3-phase servo motor with shaft position encoder and voltage link AC converter SIMOVERT MASTERDRIVES MC
3. Standard-asynchronous machine with rotary pulse generator and voltage link AC converter SIMOVERT MASTERDRIVES VC.
4. Standard-asynchronous machine with controller SIKOSTART.
5. 3-phase stepping-motor with positioning control

A DC shunt wound machine, cradle mounted with integrated speed-torque detector is used as standard load. With the modular control unit the mode of operation and the setpoint can be set.

The actual value is available at the front panel and via RS 232-interface.

If only motor operation is required, so the magnetic powder brake or the eddy current brake can be used instead of using the DC shunt-wound machine, cradle mounted.

The machines are delivered complete with coupling and accessories for adjustment and mounted on a stable base frame construction with especially prepared surface. A guide rail enables to replace different machines without repetition of adjustment.

➤ **Measuring Equipment, Load Facilities**

Compact braking unit 1000 W



Designed as magnetic powder brake with open-loop and closed-loop controls and measuring device, with analog display of speed and switch-selectable torque or calculated output.

Torque and speed can be recorded in three different operating modes:

- a) Open-loop control mode (manual control)
- b) Closed-loop speed control
Recording of brake torque as a function of speed. The speed can be preselected on the setpoint potentiometer and is maintained at a constant value by the built-in control loop.
- c) Automatic mode

The brake is applied to the test object automatically until it stops.

Technical data:

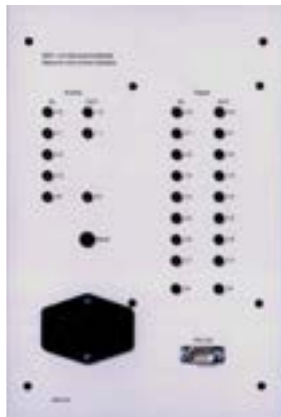
Maximum braking torque	25 Nm
Speed	1500 min ⁻¹ , max. 3000 min ⁻¹
Supply voltage	1AC 230 V/50 Hz
Dimensions (WxHxD)	310x250x340 mm
Weight approx.	14 kg

- with fitted half-coupling
- with base plate, to compensate the height of axes and for easy replacement of machines
- with built-in temperature monitor
- analog outputs for speed, torque and calculated output
- analog inputs for control of the braking unit via PC
- all terminals are connected to 2 mm sockets
- suitable for multiple tracings of the motor characteristics

For optional control of the magnetic powder brake via PC the measuring and control interface W3644-4L and the software module DriveCoach W3644-6A is required.

Order-No. W3375-1E

Measuring and control interface



The measuring and control interface consists of 8 digital inputs and outputs, 4 analog inputs and 2 analog outputs as well as an RS-232 interface.

The analog and digital inputs and outputs are brought out to 2mm sockets.

The measuring and control interface provides the connection between a PC and the magnetic powder brake. The measuring and control interface serves as well as the connection between a PC and measuring transducers to display results of experiments in power electronics and closed loop control technology on the PC in accordance with the software module „Anascoso“.

Technical data:

Analog inputs	max. ± 10 V
Analog outputs	max. ± 10 V
Digital inputs	5 - 24 V DC
Supply voltage	1AC 230 V
Dimensions (WxHxD)	195x297x100 mm
Weight approx.	1,3 kg

A RS232 cable for the serial connection to the PC is supplied.

Order-No. W3644-4L

➤ Measuring Equipment, Load Facilities

Eddy current brake, cradle mounted 1000 W



The eddy current brake is suitable for loading a motor of the same rating up to starting torque (including measurement of the breakdown and mean starting torque) and for operation in both directions of rotation.

Technical data:

Braking power at 1500 min⁻¹: 1,3 kW
 Braking power at 3000 min⁻¹: 1,5 kW
 Field voltage DC 0 – 180 V
 Field current 2,5 A
 Degree of protection IP 21
 Weight approx. 45 kg

- mounted on vibration dampers on a torsionally rigid baseframe baseframe with cradle-mounted housing
- with fitted half-coupling and transparent coupling cover
- with base plate, to compensate the height of axes and for easy replacement of machines
- with built-in temperature monitor
- with electronic torque load cell (strain gauge)
- speed recorded optoelectronically via forked light barrier
- a ventilator ensures that the brake can be operated continuously at the rated data indicated
- all connections brought out to 4mm safety laboratory sockets

To control the eddy current brake the control units W3375-6A, W3375-6C, W3375-6D, W3375-6F (incl. softwaremodule DriveCoach W3644-6A) is required.

Order-No. W3375-1F

Dynamometer DC shunt-wound machine, cradle mounted 1000 W



The DC shunt-wound machine is suitable for motor and generator loading of a motor of the same output and for operation in both directions of rotation.

Technical data:

Generator operation	Motor operation	Field voltage	DC 200 V
Output 1 - 2 kW	Output 1 - 2 kW	field current	0,65 A
Voltage 150 - 300 V	Voltage 150 - 300 V	Resolution pulse generator	120 Imp./min ⁻¹
Current 8,5 A	Current 8,5 A	Degree of protection	IP 21
Speed 1500 - 3000 min ⁻¹	Speed 1400 - 2800 min ⁻¹	Weight approx.	31 kg

- mounted on vibration dampers on a torsionally rigid baseframe baseframe with cradle-mounted housing
- with fitted half-coupling and transparent coupling cover
- with base plate, to compensate the height of axes and for easy replacement of machines
- with built-in temperature monitor
- with electronic torque load cell (strain gauge)
- speed recorded optoelectronically via forked light barrier
- a ventilator ensures that the brake can be operated continuously at the rated data indicated
- all connections brought out to 4mm safety laboratory sockets

To control the dynamometer the control units W3375-6A, W3375-6C, W3375-6E W3375-6F (incl. softwaremodule DriveCoach W3644-6A) is required.

Order-No. W3375-1H

➤ **Control Unit for Measuring Equipment, Load Facilities**

Modular control unit



General

The modular control unit provides the control for eddy-current brakes and dynamometers from the 300 W / 1000 W ranges. The basic unit consists of a fixed-wired 19" housing as well as the plug-in module "Display and Measuring Unit". The other plug-in modules can be selected as required for the individual application. The "Measuring and Control Interface" module serves for connecting the control unit system to the PC. Thus, you can start measurement processes from the PC, display the characteristics passed on the screen and print them on a printer.

Control unit for eddy-current brake and dynamometer, controlling module



The basic unit of the modular control unit consists of a completely wired 19" housing and the plug-in module „Display and Measuring Unit“. Speed and either torque or calculated output as selected are digitally displayed via LCD's. The maximum speed is adjustable and can be displayed by pressing a button. Zero adjustment as well as calibration are performed via potentiometers. All terminals are brought out to 4mm safety lab sockets.

Technical data:

Analog outputs

- 1. Speed 400 U/min = 1 V
 - 2. Torque 0,6 Nm = 1 V (300W)
 2,0 Nm = 1 V (1000W)
 - 3. Output 300 W = 1 V
- Supply-voltage 1AC 230 V / 50 Hz
via mains plug

Weight approx. 6 kg

Order-No. W3375-6A

Control unit for eddy-current brake and dynamometer, controlling module



Plug-in module for modular control unit W3375-6A. You can select between closed-loop speed, torque and current control. Lower range value and limit value of the measurements to be run are preselected via potentiometers. The selected values can be displayed using a button.

The rate of rise of the ramp can also be set.

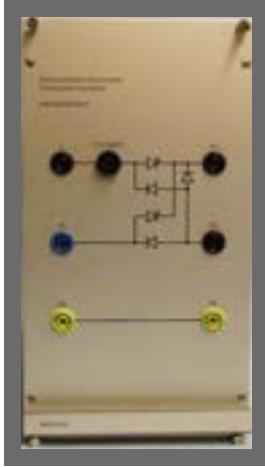
LEDs provide signals for „Enabled“, „Disabled“, „Brake fault“, „Motor fault“, „Mains fault“, and „Start ramp“. The measuring process is started with a button. With 2-mm-sockets for „Motor temperature“ and „Penlift“.

Weight approx. 0.6 kg

Order-No. W3375-6C

➤ Control Unit for Measuring Equipment, Load Facilities

Control unit for eddy-current brake – 2 quadrant static converter



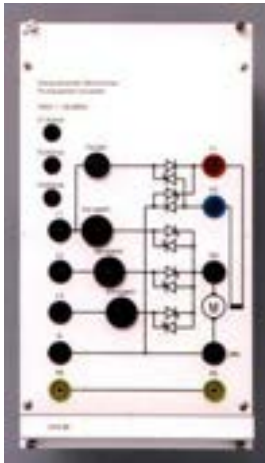
Plug-in module for modular control unit W3375-6A. Provides the control for eddy-current brakes W3360-1F (300 W) and W3375-1F (1000 W). The converter consists of a half-controlled B2 connection. The trigger pulses are applied internally. All terminals are brought out to 4mm safety lab sockets.

Technical data:
 Input voltage 1AC 230 V / 50 Hz
 Output current max.2,5 A

Weight approx. 2 kg

Order-No. W3375-6D

Control unit for dynamometer – 4 quadrant static converter



Plug-in module for modular control unit W3375-6A. Provides the control for the dynamometers W3360-1H (300 W) and W3375-1H (1000 W). The converter for the armature circuit consists of two anti-parallel M3 connections, the converter for the field circuit consists of a half-controlled B2 connection. The trigger pulses are applied internally. With speeds above 2000 rev / min field-weakening operation. All terminals are brought out to 4mm safety lab sockets.

Technical data:
 Input voltage 3 AC 400 V / 50 Hz
 loaded PEN conductor
 Output current armature circuit
 max. 6 A (300 W)
 max. 20 A (1000 W)
 Output voltage field circuit
 200 V DC
 Output current field circuit
 max. 0,5 A (300 W)
 max. 0,8 A (1000 W)
 Weight approx. 2,6 kg

Order-No. W3375-6E

Control unit for eddy-current brake and dynamometer, measuring and control interface



Plug-in module for modular control unit W3375-6A. The measuring and control interface contains an RS-232 interface for the PC connection and an analog output +/-10 V. With reset button.

The scope of delivery includes the software module „DRIVECOACH“ which permits recording of measured values and control of measuring processes via PC.

Weight approx. 0,6 kg

Order-No. W3375-6F

Necessary setup for control of the eddy-current brake W3375-1F:

- Basic unit with display and measuring unit W3375-6A
- Control unit W3375-6C
- Plug-in module 2 quadr. static converter W3375-6D

dynamometer W3375-1H:

- Basic unit with display and measuring unit W3375-6A
- Control unit W3375-6C
- Plug-in module 4 quadr. static converter W3375-6E

➤ **Softwaremodule DRIVECOACH**

Software module „DRIVECOACH“ for tracing characteristics on electrical machines.

DRIVECOACH is a software program for operating the magnetic powder brakes, eddy current brakes and dynamometers. A measuring and control interface connects the unit to a PC and is necessary for picking the operating data with the software program. Operation of the software without connecting the measuring and control interface is not possible.

Note:

The software module "DRIVECOACH" is included in the scope of delivery of W3375-6F.

Performance features:

Setting possibilities:

The operating modes such as closed-loop speed, torque or current control for the terminal device (dynamometer, eddy-current brake) can be set via the measuring and control interface. The ramps to pass can be preselected relative to lower range value, limit value and rate of rise according to the current operating mode.

The measured quantities are dimensioned automatically or by querying the hardware.

The following values are possible:

Speed	4000 min ⁻¹			
Torque	0 – 6 Nm	(300 W)	0 – 20 Nm	(1000 W)
Current	0 – 3 A	(300 W)	0 – 10 A	(1000 W)

Tracing characteristics:

After setting or transferring the operating data or the ramps, the tracing of a characteristic can be triggered via the start button in a window.

The following measured values can be recorded:

With operating mode closed-loop speed control:

Torque, current, output

With operating mode closed-loop torque control:

Speed, current, output

With operating mode closed-loop current control:

Speed, torque, output

The diagrams can be saved in appropriate files and then printed.

Operating mode load diagrams:

with the operation mode diagrams five different kind of diagrams can be selected and recorded:

- constant Speed-torque-diagram
- constant Speed-torque-diagram with mit polarity reversal
- Linear Speed-torque-diagram
- squared Speed-torque-diagram
- Inverse Speed-torque-diagram

The characteristic parameters are variable with the mouse or can be entered into a text field. A modification of the constant factors is also possible in the current operation. A red signal point announces the operating point of the drive on the characteristic.

Hard- und Software coordination

For operation with the compact braking unit the external measuring and control unit W3644-4L is necessary.

For operation with the eddy current brake or the dynamometer, the measuring and control unit W3375-6F as a plug-in module for the modular control unit is necessary.

The software module "DRIVECOACH" runs under WINDOWS.® 95/98/ME/NT/2000/XP. Supplied on disk.

Order-No. W3644-6A

- Brake assembly with servo-motor on a frequency converter with PC-connection and data recording of speed and torque
- SINAMICS S120 (with SIMOTION D) + servomotor

Converter SIMOREG DC Master



SINAMICS S120 1,5 kW, power feeding in network; frequency converter with SIMOTION D module

Siemens state of the art frequency inverter with digital control for 3-phase induction machines and servo motors (sine wave commutation). Four-quadrant operation is realized by using the integrated brake resistor and regulated infeed/regenerative feedback functions for preventing undesirable reactions on the supply allows recovery of braking energy and ensuring greater stability against line fluctuations.

The power stack PM340 of inverter uses IGBT modules. The inverter is operated via computer by ethernet connection with the software "DRIVE COACH SIM" that includes the integrated parameterization unit (display and keyboard) and control elements. Operating statuses and faults are indicated. Additionally the inbuilt control unit CU320 PN offers another ethernet interface for operation via PC.

. Operation modes:

1. Open-loop control by means of V/Hz characteristic
2. Sensorless vector control
3. Vector control with sensor (actual value by optical encoder)

Mounted in a rack-type sheet-steel housing.

Front panel with block diagram, manual control elements, signal and power sockets and test jacks."

All device connections with a voltage over 36V are led out on 4-mm-security sockets. All connections with a tension less than 36 V are led out on 2-mm sockets.

Technical data:

Rated supply voltage: 3AC 380 - 480V

Rated frequency: 47 to 63 Hz

DC link voltage: DC 510 to 650V

Output voltage: 3AC 0 to rated supply voltage

Output frequency: 0 to 650Hz

Rated output current: 4,1 A

Pulse frequency: 4 to 8 kHz

Rated motor power: 1,5 kW

Overload: 8,2 A

Dimensions (H x W x D): 530 x 350 x 320 mm

Weight approx.: 20 kg

The control software "DRIVE COACH SIM" for characteristic curve recording on electrical machines is part of delivery. This software offers clearly arranged display layout and measurement data export function for handling the recorded measured data.

The software has the following adjustment-possibilities:

The operating modes of speed or torque control can be selected.

The ramps can be pre-adjusted with reference to the final value according to the selected operating mode.

The motor characteristics like rated current, rated speed, maximum speed as well as rated torque of the servomotor and the rated current of the controller can be chosen with the installation of the testing stand.

On the drive control panel can be preset the ramp-time (1 ... 65535 ms), the main nominal value and the additional nominal value (-100% ... +100%) of the rated speed. Drive On/Off, preset possibilities for speed or torque-control, main nominal value On/Off and additional main nominal value On/Off as well as fault confirmation are pre selected via PC.

Measurement data can be preselected and indicated on the screen for nominal and real speed as well as nominal and real torque.

The sampling rate for the motor data screening can be preselected by 1, 10, 100 ms and 1 or 10 s.

For the sampling of motor data a start-stop button is on the screen. Export function of the data to other computer programs (e.g. MS Excel) is just another mouse click away..

The software modul "DRIVECOACH SIM" is running under WINDOWS XP.

Order-No.

W3643-4H + W3375-4S

Power Converter SIMOREG DC Master 15A



4Q-Power converter in circulating-current-free inverse-parallel connection (B6) with digital closed-loop control for feeding a DC motor. Additional to the main converter a regulated field supply is integrated. The converter is operated by an integrated parameterization unit (display and keyboard) and control elements. Operating statuses and faults are indicated. Additionally a serial interface RS 232 for operation via PC is available.

Mounted in a rack-type sheet-steel housing, Front panel with block diagram, manual control elements, signal and power sockets and test jacks."

All device connections with a voltage greater 36 V are led out on 4-mm-security sockets. All connections with a tension less than 36 V are led out on 2-mm sockets.

Technical data:
 Rated supply voltage: 3AC 400 V
 Rated frequency: 45 to 65 Hz
 Rated DC voltage: 420 V
 Rated direct current: 15 A
 Overload: max. 1,8 rated direct current
 Rated output: 6kW
 Rated DC voltage field: max. 325 V
 Rated direct current field: 3 A
 Dimensions (H x W x D): 530 x 600 x 320 mm
 Weight approx. 20kg

Order-No. W3643-1L

SIMOREG power converter as before, additionally with communication interface for Profibus-DP

Order-No. W3643-1L-DP

DC shunt-wound machine



for motor and generator operation

- with premounted coupling
- with base plate, to compensate the height of axes and for easy replacement of machines
- with thermistor protection on 2mm sockets
- with connections brought out to 4mm safety lab sockets

with built-on tachogenerator
 voltage 20V / 1000 rev / min

Technical data:
 Motor operation:
 Output 1.1 / 1.0 / 0.8 kW
 Voltage 330 / 275 / 220 V
 Current 4.0 / 4.8 / 6.0 A
 Speed 1500 rev / min
 Generator operation:
 Output 0.8 kW
 Voltage 220 V
 Current 3.6 A
 Speed 1500 rev/min
 Field voltage 110 V
 Field current 1.2 A

degree of protection IP 21
 2 Axes ends

Order-No. W3375-5D

➤ Test Unit DC Drive System

Assembly Kit “Test Unit DC drive system”

The following experiments can be carried out:

- Motor speed characteristics at converter
- Principle of operation of reversible converter in circulating-current-free, inverse-parallel connection
- Operating the DC motor in open-loop control mode
- Operating the DC motor in closed-loop control mode
- Speed controller as P controller
- Speed controller as PI controller
- Matching the Simoreg K and the driven machine according to setting instructions
- Matching the SIMOREG K at the driven machine according to analysis of controlled system and optimization methods used in control engineering
- Speed control, torque- and current control
- Dynamic behavior of the drive system at set point and disturbance change

The following components are required (incl. in the kit):

- | | |
|---|---|
| 1 | SIMOREG DC-Master
W3643-1L |
| 1 | DC machine
W3375-5D |
| 1 | DC shunt-wound machine,
W3375-1H |
| 1 | Control unit
W3375-6A, -6C, -6E, -6F |
| 1 | Voltage transducer
W3644-4J |
| 1 | Current transducer
W3410-4B |
| 1 | Current transducer
W3410-4C |
| 1 | Experimental manual
W3007-4A |
| 1 | Set connecting leads
W3901-0B |

Further components are required (not incl. in the kit):

- | | |
|---|--|
| 2 | Multimeter
<i>alternative</i> |
| 2 | <i>Multimeter as
Demonstration instrument
W5431-1B</i> |
| 1 | 2-channel oscilloscope 20 MHz
with 2 probes |
| 1 | Power supply ± 15 V DC
for measuring transducers |

Order-No. W3643-0L

➤ Test Unit Servo Drive System

Converter SINAMICS S120



Frequency inverter with digital control for 3-phase induction machines and servo motors (sine wave commutation). Four-quadrant operation is realized by using the integrated brake resistor. The power stack PM340 of inverter uses IGBT modules. The inverter is operated by an integrated parameterization unit (display and keyboard) and control elements.

Operating statuses and faults are indicated. Additionally on control unit CU310 PN an Ethernet interface for operation via PC is available. Operation modes:

1. Open-loop control by means of V/Hz characteristic
2. Sensorless vector control
3. Vector control with sensor (actual value by optical encoder)

"Mounted in a rack-type sheet-steel housing
Front panel with block diagram, manual control elements, signal and power sockets and test jacks."
All device connections with a voltage greater 36 V are led out on 4-mm-security sockets. All connections with a tension less than 36 V are led out on 2-mm sockets.

Technical data:
 Rated supply voltage: 3AC 380 - 480V
 Rated frequency: 47 to 63 Hz
 DC link voltage: DC 510 to 650V
 Output voltage: 3AC 0 to rated supply voltage
 Output frequency: 0 to 650Hz
 Rated output current: 4,1 A
 Pulse frequency: 4 to 8 kHz
 Rated motor power: 1,5 kW
 Overload: 8,2 A
 Dimensions (H x W x D): 530 x 350 x 320 mm
 Weight approx.: 20 kg

Order-No. W3643-4H

3-Phase Servo Motor



Permanent magnet excited synchronous machine working in connection with the frequency converter SIMOVERT MASTER-DRIVES MC as brushless DC motor.

- with premounted coupling
- with base plate, to compensate the height of axes and for easy replacement of machines
- with thermistor protection

Electronic commutation, arc free via rotor transmission sensor, resolution 2048 pulses per rotation, constant acceleration torque up to max. speed.

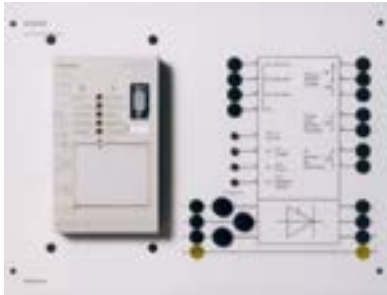
Technical data:
 Static torque 5,2 Nm
 Nominal current 2,6 A
 Nominal power 1,1 kW
 Speed 2000 min⁻¹
 degree of protection IP 21
 1 Axes end
 incl. Sensor cable

Order-No. W3375-4S



Test Unit Standard AC Drive Control System

SICOSTART three-phase AC power controller



Possible adjustments:

- Ramp time
- Starting voltage
- Limiting current
- Deceleration time

Functions are DC braking, break-away pulse, energy saving, emergency start and operation via RS-232 interface. The industrial device is built as an experimental panel, also suitable as bench unit, with a plastic front panel with mimic diagram and designations. All connectors for the power sections are brought out to 4mm safety lab sockets. Connectors for open and closed-loop control are brought out to 2mm sockets.

Technical data:

Supply voltage	1AC 230 V
Input voltage	3AC 400 V
Output voltage	0 - 400 V
Rated current	5,5 A
Rated output	2,2 kW
Ramp time	0 - 180 s
Starting voltage	20 - 100 %
Current limitation	0,5 - 6 x I _e
Dimensions (WxHxD)	390x297x150 mm
Weight approx.	3,5 kg

Order-No. W3643-4P

PC selection program

(included in the scope of delivery of the instruction manual W3007-8B)

The PC program automatically selects the proper SIKOSTART type for a given speed- torque characteristic of the working machine to be driven and a given motor type.

The PC program makes it possible to optimize the start-up and run-down process according to parameters to be set at the SIKOSTART.

The simulation of start-up provides insights in the speed- torque characteristics of load, motor at full-voltage start and motor with control by the SIKOSTART three-phase AC power controller.

The display of the voltage and current characteristics over time during start-up facilitate the evaluation of the parameters set.

The following load characteristics are stored:

- Constant torque characteristic
Linear speed-torque characteristic
- Square-law speed-torque characteristic
- Freely selectable speed-torque characteristic

The PC selection program runs under MS-DOS.

PC communication program

(included in the scope of delivery of the instruction manual W3007-8B)

The PC communication program is an aid for starting up the "SIKOSTART drive".

With this program it is also possible to control the motor and to monitor operating values such as motor current and heat sink temperature from the PC. The values for starting voltage, ramp time, limiting current etc. can be entered and saved in the SIKOSTART as numeric values.

Furthermore, up to three independent parameter sets can be entered, for example for the operation of Dahlander and pole-switching motors.

The individual functions are:

1. Program start
2. Parameter input
 - Selection of the number of parameter sets
 - Programming the switch functions
 - Entering the values for breakaway pulse, reduced-voltage start-up and stop, limiting current, DC brakes and pump stop

3. Saving the parameter sets in the EEPROM of SIKOSTART
4. Monitoring and control
 - Observing the LED indicators on the monitor
 - Display of current input, heat sink temperature, SIKOSTART heating and number of starts carried out since the last application of supply voltage
5. Overview of characteristic values
 - Reading the order number, the rated current and the ambient temperature set

➤ **Test Unit Standard AC Drive Control System**

Assembly Kit “Test unit standard AC drive system, controlled”

The subject area "Motor Control with SIKOSTART" includes configuring, commissioning & optimizing drives with standard induction machines. Functions such as reduced-voltage start, energy savings during partial-load operation, reduced-voltage stop, pump stop & DC braking available.

The behavior of the induction machine during start-up in stationary operation and during run-down can be adjusted to various load types (loads with constant speed-torque characteristic, linearly or squarely progressing speed-torque characteristic & with 1/n declining speed-torque characteristic).

Possible Proceedings:

- 1) Configuring the drive with the aid of the PC selection program, manual parametertransfer
- 2) Configuring the drive using the PC communication program, automatic parametertransfer

The following experiments can be carried out:

- Setup, connection and startup of an industrial three-phase AC power controller drive under consideration of various loading cases
- Understanding the possibilities and limitations of an induction machine drive with three-phase AC power controller
- Connection, Setup and startup of the industrial standard drive control system
- Parameterization of the drive via PC and at the unit
- Adapting the drive to different loading cases
- Guided configuring of a drive via PC selection program
- Observation and evaluation of starting and decelerating processes using measuring instruments and oscilloscope evaluations (also possible via PC)

The following components are required (incl. in the kit):

- 1 SIKOSTART power controller W3643-4P
- 1 Three-phase induction motor W3375-2A
- 1 Baseframe W3375-8A
- 1 DC shunt-wound machine, W3375-1H
- 1 Control unit W3375-6A, -6C, -6E, -6F
- 1 Flywheel W3375-2X
- 1 Voltage transducer W3644-4J
- 1 Current transducer W3410-4C
- 2 3 DIAZED fuses W3311-4A
- 1 Motor-protection circuit-breaker W3312-4C
- 2 Contactor W3321-4A
- 1 Overload relay W3330-4K
- 1 Auxiliary contactor W3328-4A
- 1 On/Off switch W3341-4B
- 2 2 pushbutton switches W3334-4B
- 1 Instruction manual W3007-8B
- 1 Set of connecting leads W3901-0B

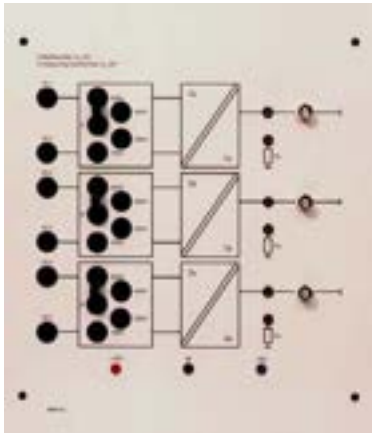
Further components are required (not incl. in the kit):

- 1 Voltmeter W3422-4A
- 1 Current indicator W3417-4D
- 1 Multimeter *alternative*
- 1 *Multimeter as demonstration instrument W5431-1B*
- 1 Dual-trace 20 MHz oscilloscope with 2 probes
- 1 Power supply ±15 V DC for measuring transducers

Order-No. W3643-0P

➤ **Accessories - Measuring Equipment**

Precision measuring transducer (voltage)



Experimental panel for floating measurements of DC, AC and pulse voltages; with electrical isolation between primary and secondary circuits.

The panel features 3 built-in transducers with 4 different measuring ranges.

The voltage inputs are brought out to 4mm safety lab sockets, the voltage outputs to 2mm sockets and BNC sockets.

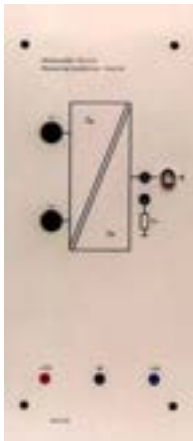
The power supply inputs are brought out to 2mm sockets.

Technical data

Input voltage	max. 500 / 400 / 250 / 100 V switch-selectable
Output voltage	0 – 5 V
Accuracy	under 1 %
Error of linearity	under 0,1 %
Minimum time of reaction	under 1 µs
Power supply	±15 V / 150 mA
Dimensions (WxHxD)	260x297x100 mm
Weight approx.	0.8 kg

Order-No. W3644-4J

Precision measuring transducer (current)



Experimental panel for floating measurements of DC, AC and pulse voltages; with electrical isolation between primary and secondary circuits.

The panel features 1 built-in transducer.

The current input is brought out to 4mm safety lab sockets, the output to 2mm sockets and BNC sockets.

The power supply inputs are brought out to 2mm sockets.

(current, max. 5 A)

Technical data:

Input current	max. 5 A
Output voltage	0 – 5 V
Accuracy	under 1 %
Error of linearity	under 0,1 %
Minimum time of reaction	under 1 µs
Power supply	± 15 V / 50 mA
Dimensions (WxHxD)	130x297x60 mm
Weight approx.	0,5 kg

Order-No. W3410-4B

(current, max. 12 A)

Technical data:

Input current	max. 12 A
Output voltage	0 – 5 V
Accuracy	under 1 %
Error of linearity	under 0,1 %
Minimum time of reaction	under 1 µs
Power supply	± 15 V / 50 mA
Dimensions (WxHxD)	130x297x60 mm
Weight approx.	0,5 kg

Order-No. W3410-4C

(current, max. 25 A)

Technical data:

Input current	max. 25 A
Output voltage	0 – 5 V
Accuracy	under 1 %
Error of linearity	under 0,1 %
Minimum time of reaction	under 1 µs
Power supply	± 15 V / 50 mA
Dimensions (WxHxD)	130x297x60 mm
Weight approx.	0,5 kg

Order-No. W3410-4D

FAX – Reply to: +49 (0)9721 / 64691 - 20

Sender:**Company****Dept.****Name****Street****City****Phone****Fax****E-Mail****Internet****Receiver:****WUEKRO GmbH**

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Remarks:



Training & Didactic Systems

Electrical Machines – Cutaway Models

Catalog

WA2E/05.07



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For further information please contact:

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Internet: www.wuekro.de

➤ Cutaway Models of Electrical Machines

Design

The cutaway models are manufactured from standard electrical machines.
 The frames are cut open along the entire length, the rotors are not cut.
 The terminal boxes feature a transparent plexiglass cover.
 The cutting planes are marked in color.

Three-phase induction motor with squirrel-cage rotor



Output 1,5 kW
 Total length 355 mm
 Weight approx. 16 kg

Order-No. W1370-1A

Three-phase induction motor with slipring rotor



Output 1,5 kW
 Total length 500 mm
 Weight approx. 40 kg

Order-No. W1370-1B

Three-phase synchronous machine



Output 1 kW
 Total length 445 mm
 Weight approx. 39 kg

Order-No. W1370-1C

DC shunt-wound machine



Output 1,35 kW
 Total length 530 mm
 Weight approx. 60 kg

Order-No. W1370-1D

Stepping motor



Output 0,3 kW
 Total length 281 mm
 Weight approx. ca. 9 kg

Order-No. W1370-1E

Three-phase transformer



Output 2,2 kVA
 Weight approx. 37 kg

Order-No. W1370-1F

➤ All pictures are exemplary

➤ **FAX – response to: +49 (0)9721 - 64691 - 20**

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WA1E/05.08



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- Communication technology
- Measuring systems, power supplies, accessories
- Experimental manuals, documentation

For further information please contact:

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➤ Static Electrical Machines, Transformers

General

The following subject areas can be taught using the "Static Electrical Machines" training system:

- Single-phase transformer, general, types of loads
- Three-phase transformer, general, types of loads
- Rectifier, general, method of operation
- Transformer- and rectifier circuits

Three-phase transformer



with separate windings
The secondary voltage can be tapped in steps. All terminals are connected to 4 mm safety lab sockets.

Technical data:
Degree of protection IP 00
Apparent power 250 VA

Primary voltage 3 AC 400 V with tapping at 230 V
Secondary voltage 2 part-windings each 110 V
Frequency 50/60 Hz

Weight approx. 9 kg

Order-No. W3360-6C

Single-phase isolating transformer

with separate windings
The secondary voltage can be tapped in steps. All terminals are connected to 4 mm safety lab sockets.

Technical data:
Degree of protection IP 00
Apparent power 100 VA
Primary voltage 1 AC 230 V
Secondary voltage 1 AC 12 V;
1 AC 24 V
Frequency 50 Hz

Weight approx. 4.5 kg

Order-No. W3348-4B

Single-phase variable transformer

with separate windings
Settings via rotary button with scale, with connecting lead, approx. 2 m in length, with earthing-pin plug. All terminals are connected to 4-mm-safety-lab-sockets.

Technical data:
Degree of protection IP 00
Output 300 VA
Primary voltage 220 V
Secondary voltage 250 V
Frequency 50 Hz

Weight approx. 7 kg

Order-No. W3360-6B

Three-phase isolating transformer



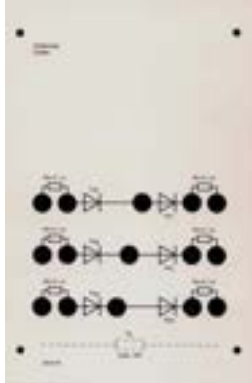
Installed in a sheet-steel housing with carrying handles
Technical data:
Output 2.8 kVA
Primary windings open
Voltages 3 x 230/400 V

Secondary windings
Voltages/ currents 3 x 24 V/6 A
3 x 127 V/6 A
3 x 230 V/6 A
3 x 400 V/4 A
star-connected, neutral brought out
Dimensions (WxHxD) 420x300x 220 mm
Weight approx. 35 kg

Order-No. W3644-2A

➤ Static Electrical Machines, Transformers

Diode set



consisting of 6 diodes, each diode protected by RC elements
 All connections are brought out to 4mm safety lab sockets.
 Measuring shunts (0.1Ω) are integrated in the current paths to allow indirect recording of currents on an oscillograph.

Technical data

U_{RRM} 1000 V
 Continuous load current 6 A
 Limit of RMS current 15 A
 max. input voltage 3 AC 400 V/50 Hz
 max. output voltage 540 V DC

Dimensions

(HxWxD) 297x195x100 mm
 Weight approx.: 1 kg

Order-No. W3644-4H

Assembly kit "Transformer- and Rectifier Circuits"

Order-No. W3348-0A

The following experiments can be carried out:

Single-phase transformer:

No-load experiment
 Short-circuit experiment
 Loadings

Three-phase transformer:

Star/star connection
 Star/delta connection
 Star/zigzag connection
 Delta/star connection
 Delta/delta connection
 Delta/zigzag connection

Rectifier circuits:

Measurements with uncontrolled rectifier circuits
 Half and fully controlled rectifier circuits: see "Power Electronics/Drive Systems" catalog WA1E/06

The following components are required:

- | | | | |
|---|--|---|--|
| 1 | Three phase isolating transformer W3644-2A | 2 | fuses W3221-4A |
| 1 | single-phase transformer W3348-4B | 1 | moving-iron voltmeter (60 V) W3422-4C |
| 1 | three-phase transformer W3360-6C | 1 | moving-iron voltmeter (400/100 V) W3422-4D |
| 1 | single-phase variable transformer W3360-6B | 1 | moving-iron current indicator W3417-4A |
| 1 | diode set W3644-4H | 1 | instruction manual W3011-2B |
| 1 | single-phase base load resistor W3360-8M | 1 | set of connecting leads W3901-0A |
| 1 | single-phase load resistor, alterable W3360-8N | | |
| 3 | load resistors, alterable W3360-8G | | |
| 3 | load resistors W3360-8F | | |
| 2 | on/off switches, 3-pin W3313-4A | | |
| 1 | on/off switch, 2-pin W3341-4B | | |
| 1 | 3 fuses W3311-4A | | |

➤ Reactive-Power Compensation

General

The subject area "Reactive-power Compensation" includes reactive-power compensation in the AC system, the three-phase system and VAR control.

The area deals with the compensation of fluorescent lamps, AC and three-phase motors.

The individual groups of experiments are organized such that they can be carried out independently of each other.

Extensive theoretical information as part of the instruction manual (V142) W3014-2A complete the subject area and provide the required basic knowledge.

In particular, the module features central p.f. correction with a VAR controller. The controller measures the present $\cos \varphi$ and switches capacitors via contactors as required. Thus the $\cos \varphi$ can be maintained at a constant value within certain limits independently of the load.

Technical data	Slide resistor	Capacitor	Capacitor	Capacitor	Capacitor	Capacitor	Reactor	Preheat ballast
Voltage	--	450V	450V	450V	450V	450V	230/400V	230V
Current	0,9 – 5,5A	-	-	-	-	-	6A	0,37A
Resistance	250Ω	-	-	-	-	-	-	-
Capacity	-	3x3,3μFY	3x4,7μFY	3x3,3μFΔ	3x2,2μFΔ	3x1μFΔ	-	-
Inductance	-	-	-	-	-	-	50/200mH	-
Weight	3kg	1kg	1kg	1kg	1kg	1kg	5kg	1,5kg
Order-No.	W3375-8E	W3333-4D	W3333-4F	W3333-4J	W3333-4H	W3333-4G	W3644-3C	W3231-4A

Controller

The controller features the following functions:

- Manual/automatic control
- 5 switching steps (250 V AC, 3 A each)
- Automatic step indicator
- Automatic display of control status
- Adjustable setpoint ($\cos \varphi$)

- Display of error messages
- Automatic adjustment of the C/K value
- With microprocessor and no-voltage tripping

Technical data:

Measuring voltage/mains voltage: 80 - 700V, 50/60Hz

Supply voltage:

1 AC 230V (+10%, -15%), 50/60Hz

Consumption

of power supply: 2 VA

Switching capacity

of the relay: max. 250V (AC), 3A;
30V (DC),
5A (150VA)

Weight approx. 2,5 kg

Order-No. W3351-4A

➤ Assembly Kit Reactive-Power Compensation

The following experiments can be carried out:

Power factor $\cos \varphi$ at loads with:
 ohmic resistance
 coil
 series connection of ohmic resistance and coil
 parallel connection of ohmic resistance and capacitor
 series connection of ohmic resistance and capacitor
 Carrying out reactive-power compensation at an AC motor
 Compensation in the three-phase system
 star connection
 delta connection
 Individual p.f. correction of a three-phase motor
 Group p.f. correction of two three-phase motors of fluorescent lamps
 Central p.f. correction with VAR controller

The following components are required to carry out these experiments:

1	slide resistor W3375-8E	1	3 fuse elements W3311-4A
1	smoothing reactor W3644-3C	1	VAR controller W3351-4A
1	capacitors 3 x 3.3 μ F W3333-4D	4	3-pole contactor W3321-4A
1	capacitors 3 x 4.7 μ F W3333-4F	1	wattmeter, single-phase W5431-1C
1	capacitors 3 x 3.3 μ F W3333-4J	1	power factor meter, single phase W5431-1D
1	capacitors 3 x 2.2 μ F W3333-4H	1	wattmeter, three-phase W3428-4C
1	capacitors 3 x 1.0 μ F W3333-4G	1	three-phase power factor meter W3434-4A
3	20 W reactor W3231-4A	1	three-phase varmeter W3433-4A
3	fluorescent lamp holder left W3230-4E	1	instruction manual W3014-2B
3	fluorescent lamp holder right W3230-4B	1	set of connecting leads W3901-0A
1	300 W single-phase AC motor W3365-3B		
1	compact braking unit W3360-1D		
1	baseframe W3360-8A		
4	on/off switch W3313-4A		
2	300 W three-phase motor W3365-2A		
1	5/5 A current transformer W3349-4A		

➤ FAX – Reply to: +49 (0)9721 - 64691 - 20

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Remarks:



Training & Didactic Systems

Power Electronics

Catalog

WA2E/06



➤ Our Services

- Development and production of didactic training systems
- Teachware and documentation
- Project engineering of complete lab's incl. furniture and lab equipment
- Quotations on customer's demand
- Installation, commissioning and training at site

➤ Our Customers

- Vocational training schools, technical schools, colleges and universities...
- Industrial laboratories for vocational education and higher education

➤ Fields of Technology

- Fundamentals of electrical engineering
- Fundamentals of electronics
- Closed loop control technology
- Automation engineering
- Electrical machines / drive control
- Power electronics
- Building management systems
- Protection schemes to VDE 0100
- Radio- and TV technology
- Air conditioning and refrigeration
- Photovoltaic
- Communication technology
- Measuring systems, power supplies, accessories
- Experimental manuals, documentation

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➤ Introduction

If you can analyze problems systematically and understand interrelationships, you'll have no difficulty in coping with future developments – in any field of technology. As your partner for training systems, we can provide you with the technical equipment you require for this purpose including comprehensive instruction manuals and training documentation.

Systematic analysis in the field of power electronics means learning about basic circuits, such as DC chopper controllers and AC power controllers, through specially designed measuring exercises and understanding the operating principle of devices and the real behavior of components.

Understanding interrelationships means to see power electronics in terms of their relationship with drive and control systems.

- How can I apply open-loop and closed-loop controls in electric drives to achieve virtually no-loss operation?
- Which power electronics components can be combined to form drive units which meet special technical requirements such as, for example, good dynamic response, special speed/torque response, surge load, etc.



Our task should be to help you to answer these and similar questions on a practical basis and to provide suitable experimental equipment for scientific studies.

Our training system gives you almost unlimited freedom, i.e. you can pick and choose elements to create your own “personal” training strategy.

If you attach particular importance to training with a supply voltage of 230/440 V, then you will want to use either our modular panel system or our specially designed “didactic” industrial equipment.

If you require an extra-low supply voltage for training purposes and if criteria such as mobility, tuition outside proper training laboratories and lack of space need to be taken into account, then you can choose between a compact panel and a modular “case” system.

The case system is identical in design to the 230/440V panels. Robust design, integrated laboratory power supply and excellent storage facilities are just some of its outstanding features.

The compact panel is an exceptionally low-price, space-saving training device which can be expanded by the industrial drive system equipment if required. So regardless which of the 3 systems you eventually choose (or you might even decide to combine 2 systems), you will have a range of training equipment which is tailor-made for your individual requirements.

➤ Training Concept

The aim

The aim of our training concept for power electronics and drive systems with closed-loop control is to provide

- vocational schools
- technical colleges
- universities and in-firm training center with systems for teaching the theoretical and practical knowledge which trainees and students require to learn and understand more on industrial technology.

There are basically two systems available for teaching power electronics:

1. A 230/400 V panel system for learning fundamental principles or
2. A 24 V system for learning fundamental principles

One of two different variants of the 24 V system can be selected:

- 2a) The compact panel which can be used to teach all syllabuses relating to power electronics
- 2b) A "case" system which is identical to the 230/400 V system in didactical terms

Practice oriented experimental manuals

You can order instruction manuals for modules 1/8. These manuals are written by experienced training staff and specialists with teaching knowledge.

The instruction manuals generally consist of 3 sections:

Section 1:

General section for introducing the trainees to the objectives of the training program and providing basic theoretical knowledge.

Section 2:

Trainee's section containing measuring exercises. Value tables, diagrams and oscilloscope displays must be filled out by the student.

Section 3:

Instructor's section containing the answers to questions in Section 2.

The purpose of this section is to reduce valuable preparation time and provide a check for trainers, teachers and instructors.

Whether you choose the experimenter, the compact panel or the 230/400 V panels or racks, we can provide you with reliable instruction manuals for the appropriate system.

➤ Training Systems – Attachment – Targets

Power electronics

Compact panel

Modules 1 - 4

Experimental panels

Modules 1 - 5

Modules

Module 1

Learning about power electronics components, measuring characteristics

Module 2

Assembling and learning about uncontrolled and controlled rectifier circuits

Module 3

Assembling and learning about different types of DC chopper controller circuit

Module 4

Assembling and learning about two different circuits for implementing an AC power controller

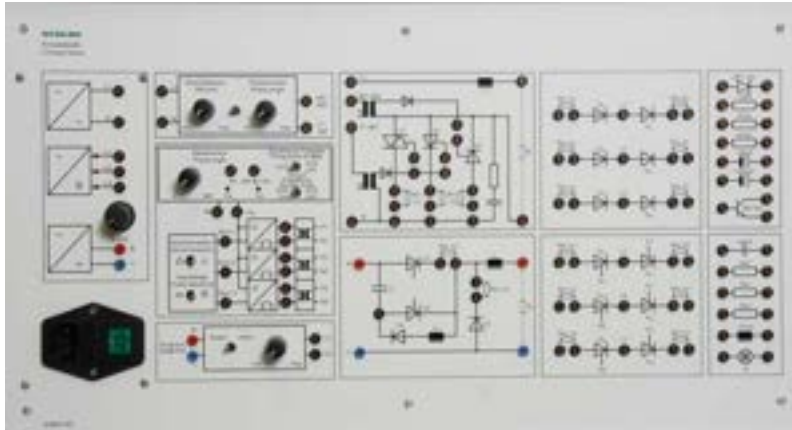
Module 5

Assembling and learning about circuits for implementing inverter operation

Projects				
Theses				
Practicals				
College/University				
Continuing Education				
Practical Training				
College/University		Compact Panel	Experimental Panels	Didactic Industrial Equipment Experimental Panels
Training as craftsman				
Basic principles				
School/Education				

Power Electronics Module 1 to Module 4

Compact Panel



The following subjects can be taught using the compact panel

- Learning about power electronics components, measuring characteristics
- Assembling and learning about uncontrolled and controlled rectifier circuits
- Assembling and learning about different types of DC chopper controller circuit
- Assembling and learning about two different circuits for implementing an AC power controller
- Assembling and learning about circuits for implementing inverter operation

The following functional units are integrated on the compact panel:

1. DC voltage source
DC voltage 0 – 15V, steplessly adjustable via 10-turn potentiometer, residual ripple 100mV
2. AC voltage source with: L1-N, 12V AC/1A
3. Three-phase source with: L1-L2-L3, 21V/1A
4. Drive circuit for DC chopper controller
5. DC chopper controller with thyristor. The output DC voltage setpoint can be adjusted via a setpoint potentiometer or an external analog signal between 0V and 10 V DC. Measuring shunts (1 Ω) are integrated in the current paths to allow indirect recording of current waveforms on an oscillograph. Special sockets are also provided to allow the recording of firing pulses. The input voltage is 15 V DC, the output voltage between 0 V and 15 V DC. A connection to a PLC or controller is provided.
6. Drive circuit for AC power controller

7. AC power controller.
The AC power controller can be operated as a phase control or a full-wave control. Measuring shunts (1 Ω) are integrated in the current paths to allow indirect recording of current waveforms on an oscillograph. Special sockets are also provided to allow the recording of firing pulses. The input voltage is 12 V AC, the output voltage can be varied between 0 V and virtually 12 V/AC by means of a potentiometer.
8. Drive circuit for fully controlled thyristor bridge
9. Thyristor bridge consisting of 6 thyristors. Measuring shunts (1 Ω) are integrated in the current paths to allow indirect recording of current waveforms on an oscillograph. Special sockets are also provided to allow the recording of firing pulses. The input voltage can be drawn from the AC or three-phase voltage source, the output voltage can be varied between 0 V and U_N depending on the circuit variant. If the thyristor bridge is connected as an AC power controller, the output voltage is 0 V to U_E in three phases.
10. Diode bridge consisting of 6 diodes.
Measuring shunts (1 Ω) are integrated in the current paths to allow indirect recording of current waveforms on an oscillograph. The input voltage can be drawn from the AC or three-phase voltage source, the output DC voltage is U_N (depending on circuit variant).

continued next page

➤ Power Electronics Module 1 to Module 4

... Compact panel

11. Ohmic resistors: To provide ohmic loading of the power electronics circuits and to permit construction of further circuits, the compact panel is equipped with the following resistors:
 3 x 50 Ω resistors
 2 x 470 Ω resistors
 1 x 100 Ω resistor
12. Inductors: To provide inductive loading of the power electronics circuits, the compact panel is equipped with a 10 mH inductor.

13. Capacitors: To provide capacitive loading of the power electronics circuits, the compact panel is equipped with a 100 nF capacitor and with two electrolytic capacitors (100 μ F and 1000 μ F).
14. Other components: A BD 139 transistor and a Z diode with 10 V reverse voltage. A light for indication of current direction and voltage identification.

The compact panel can be mounted in an experimental frame or used as a bench unit. The panel can be expanded by a motor-generator system if required.

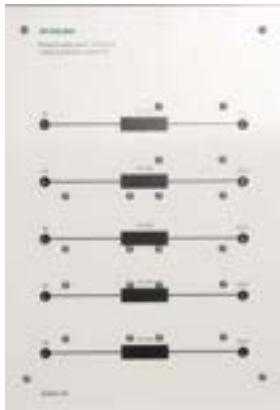
Technical data

Mains supply via 230 V AC/50 Hz connector for non-heating apparatus

Dimensions

(HxWxD) 297x520x150 mm
 Weight approx. 4.5 kg

Order-No. W3644-4G



Smoothing reactor

Supplementary panel to compact panel W3644-4G.

With 5 smoothing reactors, the connections are brought out to 2mm sockets. The experimental panel can be fitted into an experimental frame or used as a bench type unit.

Technical data

Inductance 5 x 50 mH
 Voltage 30 V
 Current 1 A
 Dimensions (WxHxD) 130x297x150 mm
 Weight approx. 1,5 kg

Order-No. W3644-4K

➤ **Power Electronics** **Module 1 to Module 4**

Assembly kit “Power Electronics with the Compact Panel”

Order-No. W3644-0A

The following experiments can be carried out

- Tracing of characteristics of Z diode and transistor, tracing of characteristics of diodes and thyristors. Principle of firing and turning off thyristors. Construction of simple voltage stabilization circuits with Z diode and Z diode with transistor as exercises to learn fundamental principles of power electronics.
- DC chopper controller with thyristor. Understanding the principle of capacitor turn-off, operating principle of ring-around circuit and free-wheeling diode, evaluation of switching performance
- AC power controller
AC power controller as phase control, AC power controller as full-wave control, triggering of thyristor and triac
- Investigation of rectifier circuits
 - Uncontrolled rectifier circuits, connection types M1, M3, B2, B6
 - Half-controlled rectifier circuits, connection types B2, B6
 - Fully controlled rectifier circuits, connection types M1, M3, B2, B6
 - Plotting of control characteristics and evaluation of switching performance
- Investigation of rectifier circuits in inverter operation

The following components are required to carry out these experiments (incl. in the kit):

- 1 Compact Panel for Power Electronics W3644-4G
- 1 V076 Experimental manual Power Electronics with the Compact Board, English W3007-6B
- 1 Set Connecting leads W3901-0C
- 1 Smoothing reactor W3644-4K

Required accessories (not included in the kit)

- 2 Multimeter
- 1 Dual-Oscilloscope 20MHz with two probes
- 1 Powermeter
- 1 Phase-angle meter

➤ Power Electronics Module 1

Modules of power electronics and their basic circuits

An assembly kit "Modules of power electronics and their basic circuits" can be configured individually, to meet the specific requirements of the training

The **Modules of power electronics and their basic circuits** for extra-low voltage comprises a DC and AC power supply, universal mounting panel and, depending on the degree of expansion of the assembly kit, various sets of components, trigger and loads.



AC/DC/3ph Power supply

All-in-one: All power supplies for principles of electrical engineering/electronics on one Board.

With additional function generator.

With integrated three-phase current source.

All outputs short-circuit-proof.

All outputs are brought to 4mm as well as 2mm plug sockets.

Depending on the degree of expansion of the kit, the following subjects can be taught:

- Investigation of passive components
- Tracing of characteristics of diodes, transistors, diacs, triacs, etc.
- Principle of thyristor firing and turn-off
- Simple stabilization circuits with Z diode and transistor
- Investigation of an integrated module for AC power controller application

Technical Data:

- Mains voltage: 230VAC/115VAC (110 V AC) 50 ... 60 Hz; approx. 70 VA

- DC voltages:

+15 V (+/- 5 %); 1 A

-15 V (+/- 5 %); 1 A

0 ... 30 V; 0.3 ... 1 A

(the current depends on the set voltage)

- AC voltages

10 V AC; 100 mA

24 V AC; 100 mA

- Three-phase current generator

Phase voltage: approx. 8,5V(rms)

Line voltage: approx. 15 V (rms)

Line current: max. 100 mA

Frequency: approx. 50 Hz

- Function generator

Sinewave: $U_{(pp)}$: 0 ... 20 V, f = 20 Hz ... 100 kHz.

Squarewave, positive: $U_{(p)}$: 0... 8 V, f = 20 Hz ... 20 kHz, V = 2 (duty cycle)

Squarewave, symmetrical: $U_{(PP)}$: 0 ... 16 V, f = 20 Hz ... 20 kHz, V = 2 (duty cycle)

The outputs (2 mm and 4 mm jacks) of the function generator, DC and three-phase current sources are short-circuit-proof and some LED-monitored.

Mechanical data

The front panel of the Generator Board is made of 5 mm thick white (RAL9002) plastic. The mimic diagrams, device symbols and labels are permanently attached to the panel fronts according to the prevailing standards. On the back the experimental panels have a solid metal case.

Dimensions / weights

260x297x100mm(wxhxd)

weight: approx. 3,2 kg

Order-No. W5430-1K



AC Power supply

The input voltage is supplied via a rear-mounted, fuse socket for non-heating apparatus with fuse and illuminated line switch. The output voltages are brought out to 4-mm-sockets.

Technical data

Input voltage 230 V, 50/60 Hz

Output voltages 2 x 0 – 24 V, 1 A

AC steplessly adjustable

Both outputs can be connected in series by means of 19-mm-connectors

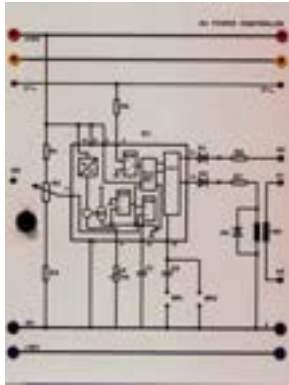
Dimensions

(HxWxD) 297x226x110 mm

Weight approx. 4kg

Order-No. W5430-1J

➤ **Power Electronics** **Module 1**

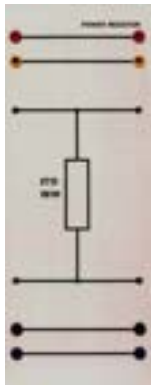


Pulse generator subassembly

The firing pulses required for the various converter circuits are generated by the IC TCA 785. Control pulses for thyristors, triacs and transistors can be obtained by varying the IC circuit arrangement. Line-commutated converter circuits and AC power controllers are typical applications for the IC. The synchronizing signal is connected to the synchronizing output of AC power supply unit W5430-1J.

Technical data	
Operating voltage	+ 15 V DC
Output current	250 mA
Dimensions	
(HxWxD)	297x226x50 mm
Weight approx.	1 kg

Order-No. W5430-2S



High-load resistor

Connections brought out to 4mm sockets

Technical data	
Resistance	27 Ω
Power	50 W

Dimensions	
(HxWxD)	297x113x90 mm
Weight approx.	1 kg

Order-No. W5430-2T



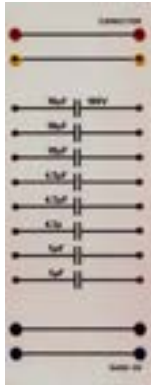
Inductive load

Connections brought out to 4-mm-sockets

Technical data	
Inductance	200 mH
Current	1 A
Dimensions	
(HxWxD)	297x113x90 mm
Weight approx.	1.2 kg

Order-No. W5430-2U

➤ Power Electronics Module 1

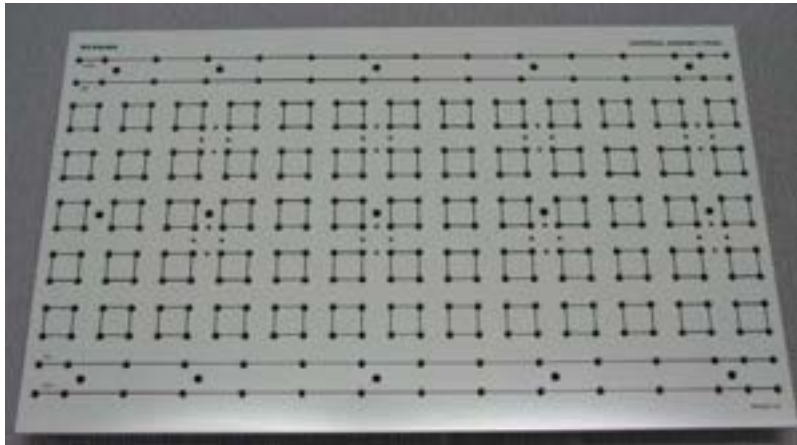


Capacitive load

Connections brought out to 4-mm-sockets.

Technical data	
Capacities	3 x 10 μ F 2 x 1 μ F 3 x 4,7 μ F
Voltage	100 V
Dimensions	
(HxWxD)	297x113x70 mm
Weight approx.	0.6 kg

Order-No. W5430-2V



Universal mounting panel

The universal mounting panel is equipped with gold-plated 4-mm-sockets arranged in a 19 mm grid (total of 320 sockets). Every four adjacent sockets are interconnected to form a ring. Provision is also made for gold-plated 2-mm-sockets which are used for the power supply of operational amplifiers (8 plug-in stations).

When a module is inserted, it is always connected to the supply voltage with the correct polarity. The two top and the two bottom rows of sockets are through-connected for power supply purposes.

From bottom to top:

- 15 V, ground/0 V, + 5 V, + 15 V.

The universal mounting panel has a cover for protecting the connections on the rear. For installation on a bench, mounting accessories permitting the panel to be mounted at an angle of 30° is provided on the rear.

Technical data:	
Dimensions (WxH)	493 x 297 mm
Weight approx.	4 kg

Order-No. W5430-1A

Storage panel

for storing 2-pin and 4-pin plug-in instruction modules.

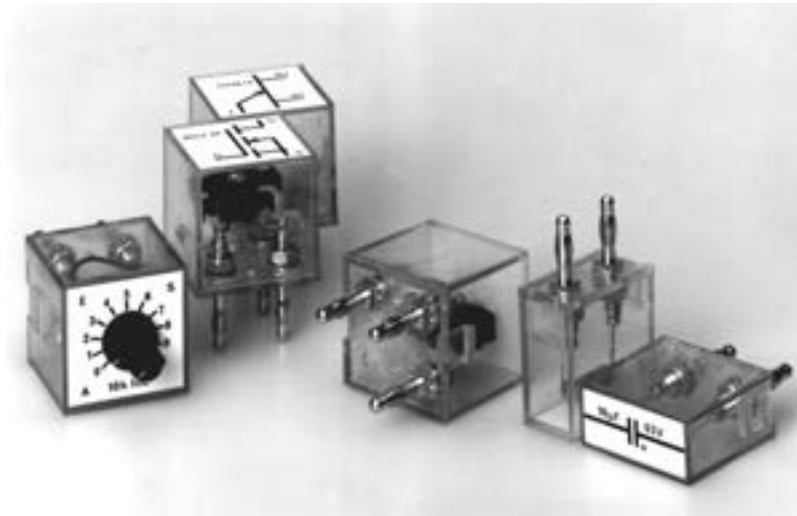
Dimensions	
(HxWxD)	297x226x10 mm
Weight approx.	0.6 kg

Order-No. W5430-2W

➤ **Power Electronics** **Module 1**

Assembly kit "Components of Power Electronics" (large set)

Order-No. W5101-8L



Mainly in the field of electronics Resistors, Capacitors etc. have to be changed quickly and without difficulties. Those components therefore are fixed in transparent, unbreakable housings and be connected to the circuit by means of 4-mm-hard-gold-plated plugs.

Plug-in components

consisting of the following plug-in components:

Resistors

- 2 1Ω/2W
- 1 10Ω/2W
- 2 22Ω/2W
- 1 47Ω/2W
- 4 100Ω/2W
- 1 150Ω/2W
- 1 220Ω/2W
- 2 330Ω/2W
- 2 470Ω/2W
- 1 1kΩ/2W
- 1 3,3kΩ/2W
- 1 4,7kΩ/2W
- 2 10kΩ/2W
- 1 22kΩ/2W
- 1 47kΩ/2W
- 2 100kΩ/2W
- 1 1MΩ/2W

Capacitors

- 2 10nF
- 1 0,1μF
- 1 0,15μF
- 1 0,47μF
- 1 1μF
- 1 Elco 470μF

Potentiometers

- 1 1kΩ linear/1W
- 1 10kΩ linear/1W
- 1 100kΩ linear/1W

Switches

- 1 NC contact
- 2 NO contact

Diodes

- 1 AA 118
- 1 1N4004
- 1 1N4148
- 1 BY 299
- 1 ZPD 6,2
- 1 ZPD 9,1
- 1 LED green
- 1 LED red

Signal elements

- 1 Incandescent lamp
30 V/85 mA

Transistores

- 1 BC 141
- 1 BC 161
- 1 BC 237
- 1 BUZ 10, MOS-FET N-channel
- 1 2N4870, Unijunction

Diac

- 1 Diac ER 900

Triac

- 1 Triac TIC 206

Thyristores

- 2 Thyristores TIC 106

Set of connecting leads and connectors

- 25 connectors 19mm
- 4 connectors 38mm
- 6 connecting leads 25cm
for 4mm sockets
2 x red, 2 x black, 2 x blue
- 4 connecting leads 50cm
for 4mm sockets
2 x red, 2 x black
- 2 connecting leads 100cm
for 4mm sockets
1 x red, 1 x black

➤ Power Electronics Module 1

Assembly kit "Components of power electronics" (small set)

Order-No. W5101-8N

With the assembly kit W5101-8N there can be investigated passive components of power electronics, furthermore semiconductor components as diodes, Z diodes, bipolar transistors, FET, unijunction transistors and diacs.

consisting of the following plug-in components

Resistors

- 1 1Ω/2W
- 1 10Ω/2W
- 1 47Ω/2W
- 1 100Ω/2W
- 1 220Ω/2W
- 1 330Ω/2W
- 1 470Ω/2W
- 1 1kΩ/2W
- 1 22kΩ/2W
- 1 47kΩ/2W
- 1 100kΩ/2W

Capacitors

- 1 1μF
- 1 electrolyt. 470μF

Potentiometers

- 1 1kΩ linear/1W
- 1 10kΩ linear/1W

Switches

- 2 NC contact

Diodes

- 1 AA 118
- 1 1N4004
- 1 1N4148
- 1 BY 299
- 1 ZPD 6,2
- 1 ZPD 9,1

Transistors

- 1 BC 141
- 1 BC 161
- 1 BC 237
- 1 BUZ 10, MOS-FET N-channel
- 1 2N4870, unijunction

Diac

- 1 diac ER 900

Set of connecting leads and connectors

- 13 connectors 19 mm
- 2 connectors 38 mm
- 3 connecting leads 25 cm for 4-mm-sockets
1 x red, 1 x black, 1 x blue
- 2 connecting leads 50 cm for 4-mm-sockets
1 x red, 1 x black
- 2 connecting leads 100 cm for 4-mm-sockets
1 x red, 1 x black

Assembly kit "Components of power electronics"

The assembly kit W5101-8P completes the assembly kit W5101-8N to assembly kit W5101-8L

Order-No. W5101-8P

consisting of the following plug-in components

Resistors

- 1 1Ω/2W
- 2 22Ω/2W
- 3 100Ω/2W
- 1 150Ω/2W
- 1 330Ω/2W
- 1 470Ω/2W
- 1 3,3kΩ/2W
- 1 4,7kΩ/2W
- 2 10kΩ/2W
- 1 100kΩ/2W
- 1 1MΩ/2W

Capacitors

- 2 10nF
- 1 0,1μF
- 1 0,15μF
- 1 0,47μF

Potentiometers

- 1 100kΩ linear/1W

Switches

- 1 NO contact

Diodes

- 1 LED green
- 1 LED red

Triac

- 1 triac TIC 206

Thyristors

- 2 thyristors TIC 106

Set of connecting leads and connectors

- 12 connectors 19 mm
- 2 connectors 38 mm
- 3 connecting leads 25 cm for 4-mm-sockets
1 x red, 1 x black, 1 x blue
- 2 connecting leads 50 cm for 4-mm-sockets
1 x red, 1 x black

➤ **Power Electronics Module 1**

Assembly kit " Power electronics Modules"

Order-No. W5101-8X

The following experiments can be carried out

- Investigation of passive components
- Investigation of semiconductor components such as diodes, Z diodes, bipolar transistors, field-effect transistors, diacs, unijunction transistors, thyristors, triacs
- Amplifier circuits such as low-signal amplifiers and push-pull power amplifiers
- DC power supply circuits such as voltage stabilization circuits and constant-current source
- Circuits for pulse generation such as pulse generation with diac and unijunction transistor

The following components are required to carry out these experiments

(included in the kit)

- 1 DC power supply W5430-1H
- 1 AC power supply W5430-1J
- 1 Universal mounting panel W5430-1S
- 1 Storage panel W5430-2W
- 1 Inductance W5430-2U
- 1 High load resistor W5430-2T
- 1 Assembly kit "Components" incl. connecting leads W5101-8L
alternative
- 1 Assembly kit "Components" (small set) W5101-8N
- 1 Supplementary kit (to assembly kit "Components" (small set)) W5101-8P
- 1 Experimental manual W3007-5A

Required accessories (not including in the assembly kit)

- 2 Multimeter
- 1 2-channel-Oscilloscope 20MHz with 2 probes
- 1 Powermeter
- 1 Phase-angle meter

➤ Power Electronics Module 1

Subassembly kit "Firing Pulse TCA 785"

Order-No. W5101-8Y

The following experiments can be carried out

- Investigation of IC TCA 785
- TCA 785 as drive subassembly for
 - thyristor
 - 2 thyristors (AC power controller)

The following components are required: (incl. in the kit)

- 1 Experimental panel DC power supply W5430-1H
- 1 Experimental panel AC power supply W5430-1J
- 1 Universal mounting panel W5430-1T
- 1 Subassembly kit „Firing Pulse TCA 785“ with plug-in components W5101-8M
- 1 Pulse generator subassembly + 2 thyristors TIC 106 W5430-2S
- 1 High load resistor W5430-2T
- 1 Inductive load W5430-2U
- 1 Experimental manual W3007-5A

Required accessories (not included in the kit)

- 2 Multimeter
- 1 2-channel oscilloscope 20MHz with 2 probes

Subassembly kit „Firing Pulse TCA 785“ consisting of the following plug-in modules and accessories

Order-No. W5101-8M



Resistors

- 3 100Ω/2W
- 2 220Ω/2W
- 1 2,7kΩ/2W
- 1 150kΩ/2W

Potentiometers

- 1 4,7kΩ/1W
- 1 100kΩ/1W

Capacitors

- 1 1nF
- 1 10nF
- 1 47nF
- 1 68nF

Diodes

- 3 1N4004

Transformer

- 1 ZKB418

IC

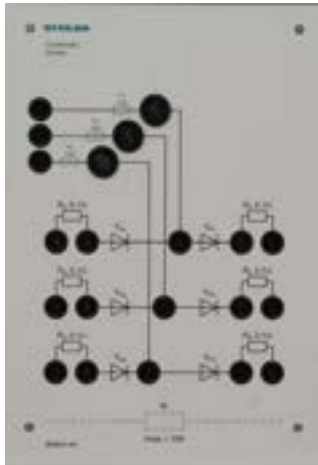
- 1 IC-socket 16-pin (Textool)
- 1 IC TCA785

Connecting leads and plugs

- 1 Connector 38 mm
- 15 Connector 19 mm
- 10 Adapter connectors black
- 3 2-mm leads 25 cm, black
- 2 2-mm leads 50 cm, black
- 14 2-mm leads 15 cm, 12 x black, 1 x red, 1 x blue

➤ **Power Electronics** **Module 2**

Rectifier Circuits



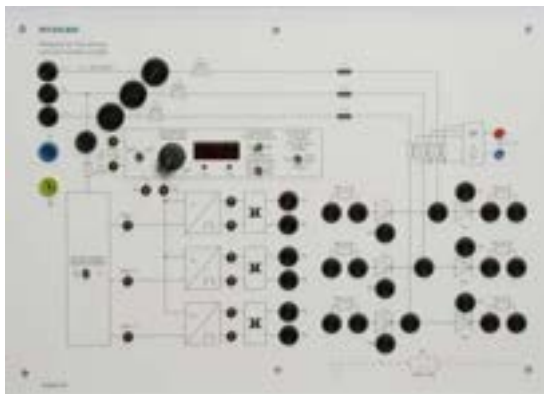
Diode set

consisting of 6 diodes, each diode protected by RC elements
All connections are brought out to 4-mm-safety lab sockets.
Measuring shunts (0.1 Ω) are integrated in the current paths to allow indirect recording of currents on an oscillograph.

Technical data
 U_{RRM} 1000 V
 Continuous load current 6 A
 Limit of RMS current 15 A
 max. input voltage 3 AC 400 V/
 50 Hz
 max. output voltage 540 V DC

Dimensions
 (HxWxD) 297x195x100 mm
 Weight approx.: 1 kg

Order-No. W3644-4H



Line-commutated thyristor set as compact unit, consisting of:

- 3 line-commutated single-phase bridges with trigger sets
- Power supply unit to provide the voltage for the different units as well as the synchronize AC voltage
- setpoint potentiometer for the controlled operation
- AC actual value sensor

Measuring shunts (0.1 Ω) are integrated in the current paths to allow indirect recording of currents on an oscillograph.

With additional analog input 0 – 10 V DC for connection of external controllers or PLC (brought out to 2-mm-sockets)

The angle is displayed digitally and can be set to a maximum or minimum limit, with connectors to oscillograph the firing pulses. The pulse sequence can be set to single or double pulse by means of a changeover switch. A second changeover switch is likewise used to enable the firing pulses. A third changeover switch is used for the Synchronization in Y or Δ. Potentiometer enables to limit the firing angle in the rectifier operation as well as in the AC controller operation. The thyristor set contains 3 commutating reactors.

The connectors of the power section are brought out to 4mm sockets. The maximum input voltage is 400V three-phase; the maximum output voltage is approximately 540V DC. The heat sinks are rated for a continuous load current of 6A.

Technical data
 input voltage 1 AC/3 AC
 230/400 V/50/60 Hz
 Current 6 A DC
 Output voltage max. 540 V DC

Dimensions
 (HxWxD) 297x390x100 mm
 Weight approx. 4 kg

Order-No. W3644-4F

Assembly Kit “Rectifier Circuits”**Order-No. W3644-0B****The following experiments can be carried out:**

- Investigation of uncontrolled rectifier circuits, connection types M1, M3, B2, B6
- Investigation of half-controlled rectifier circuits, connection types B2, B6
- Investigation of fully controlled rectifier circuits, connection types M1, M3, B2, B6
- Fully controlled rectifier circuit in inverter operation
- Investigation of AC power controller, three- phase AC power controller

The following components are required to carry out these experiments**(incl. in the kit):**

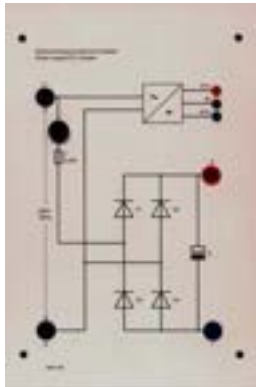
- 1 Line-commutated thyristor set W3644-4F
- 1 Diode panel W3644-4H
- 1 Load resistor single-phase W3375-8E
- 1 Load resistor 3-phase W3375-8H
- 1 Load inductor W3644-3C
- 1 Load inductor 3-phase W3644-3D
- 1 Load capacity 3-phase W3644-3F
- 1 Measuring transducer (voltage) W3644-4J
- 1 Measuring transducer (current) W3410-4B
- 1 Experimental manual W3007-3A
- 1 Set Connecting leads W3901-0B

The following components are required to carry out these experiments**(not included in the kit):**

- 2 Multimeter
- 1 2-channel oscilloscope 20MHz with 2 probes
- 1 Powermeter
- 1 Power supply $\pm 15V$ DC for measuring transducer (W4610-4N)
- 3 BNC – BNC leads
- 3 Adapter BNC – safety connecting leads

➤ **Power Electronics Module 3**

DC chopper controller circuits

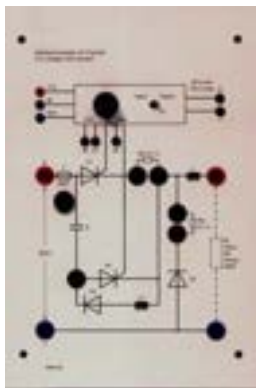


Power Supply

The power supply for the DC chopper controller panels consists of an uncontrolled B2 connection with loadside capacitor. The power supply module feeds the DC chopper control as well as the measuring transducers. The in- and outputs of the power section are brought out to 4mm safety sockets, for the control electronics to 2-mm-sockets.

Technical data	
Input voltage	1 AC 230 V/50 Hz
Output voltage	320 V DC
Current load	max. 5 A DC
	in bridge connection (B2)
Output power supply	
Voltage	±15VDC
Current	1 A
Dimensions	
(WxHxD)	297x195x100 mm
Weight approx.	4 kg

Order-No. W3644-4B

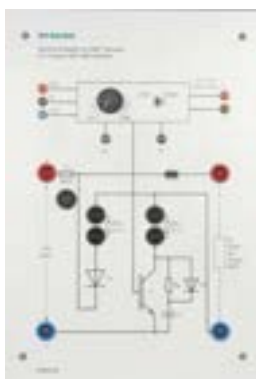


DC chopper controller with thyristor

The output voltage can be varied virtually by means of a potentiometer or an external analog signal. Measuring shunts (0.1 Ω) are integrated in the current paths to allow indirect recording of currents on an oscilloscope. The in- and outputs of the power section are brought out to 4-mm-safety-sockets, for the control electronics to 2-mm-sockets.

Technical data	
Input voltage	max. 320 V DC
Output voltage	to max. 300 V DC
Current load	5 A
Clock frequency	200 Hz
Control voltage	±15VDC
Dimensions	
(WxHxD)	297x195x100 mm
Weight approx.:	2.5 kg

Order-No. W3644-4C



DC Chopper controller with transistor

The input voltage can be varied virtually by means of a potentiometer or an analog signal (0V...10 V DC). Measuring shunts (0.1 Ω) are integrated in the current path to allow indirect recording of currents on an oscillograph. The in- and outputs of the power section are brought out to 4-mm-safety sockets, for the control electronics to 2-mm-sockets.

Technical data	
Input voltage	max. 320 V DC
Output voltage	0 to max. 300 V DC
Current load	5 A
clock frequency	2 kHz
control voltage	±15 V DC
Dimensions	
(WxHxD)	297x195x100 mm
Weight approx.	2 kg

Order-No. W3644-4D

➤ Power Electronics Module 3

Assembly kit "DC chopper Controller Circuits"

Order-No. W3644-0C (300W)

Order-No. W3644-0D (1000W)

The following experiments can be carried out:

- DC chopper controller with thyristor:
 - Oscillograph-recording and measurement of input voltages and currents, and output voltages and currents.
 - Oscillograph-recording of valve voltages and currents. Understanding the principle of capacitor turn-off operating principle of the ring-around circuit and free-wheeling diode.
 - Evaluation of switching performance.
 - Recording and allocation of firing pulses.
- DC chopper controller with Bi-polar-transistor:
 - Oscillograph-recording and measurement of input voltages and currents, and output voltages and currents.
 - Oscillograph-recording of valve voltages and currents. Operating principle of the free-wheeling arm.
 - Evaluation of switching performance.
 - Understanding the various drive circuits for transistors and thyristors.
- DC chopper controller with IGBT-transistor:
 - Oscillograph-recording and measurement of input voltages and currents, and output voltages and currents.
 - Oscillograph-recording of valve voltages and currents. Operating principle of the free-wheeling arm.
 - Evaluation of switching performance.

The following components are required (incl. in the kit):

- | | |
|---|--|
| 1 | Power Supply
DC chopper
W3644-4B |
| 1 | DC chopper
with thyristor
W3644-4C |
| 1 | DC chopper
with IGBT
W3644-4D |
| 1 | DC machine
W3365-5C (300-W-Progr.)
W3375-5C (1000-W-Progr.) |
| 1 | Baseframe for motor-generator
set
W3360-8A (300-W-Progr.)
W3375-8A (1000-W-Progr.) |
| 1 | compact braking unit
W3365-1E (300-W-Progr.)
W3375-1E (1000-W-Progr.) |
| 1 | Excitation unit
W3360-1N |
| 1 | Precision measuring transducer
(voltage) W3644-4J |
| 1 | Precision measuring transducer
(current)
W3410-4B (300-W-Progr.)
W3410-4C (1000-W-Progr.) |
| 1 | On/Off switch, 2-pin
W3341-4B |
| 1 | Experimental manual
W3007-1B |
| 1 | Set Connecting leads
W3901-0B |

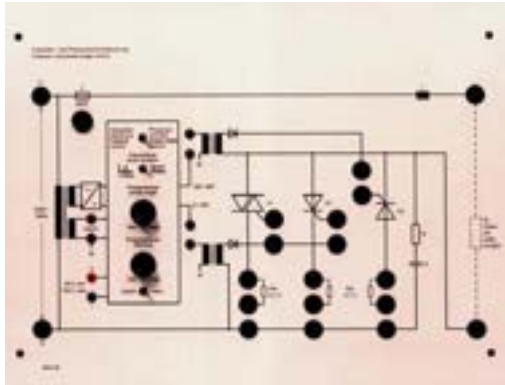
Further required components

(not included in the assembly kit):

- | | |
|---|--|
| 3 | Multimeter |
| 1 | 2-channel oscilloscope 20MHz
with 2 probes |
| 1 | Power supply $\pm 15V$ DC
for transducers (W4610-4N). |
| 3 | BNC – BNC leads |
| 3 | Adapter BNC – safety
connecting leads |

➤ **Power Electronics Module 4**

AC Power Controller Circuits



AC Power Controller

The power section of the AC power controller consists of 2 thyristors and a triac.

The phase angle and the ON time can be varied by means of a potentiometer or an external analog signal (0V...10V DC).

A changeover switch is used to select the "Full-wave control" and "Phase control" modes. The firing pulses can be sensed in an isolated circuit. The synchronizing voltage can be tapped in an isolated circuit.

The in- and outputs of the power section are brought out to 4-mm-safety sockets, for the control electronics to 2-mm-sockets. A smoothing inductor RC protective elements are provided. Measuring shunts (0.1 Ω) are integrated in the current paths to allow indirect recording of currents on an oscillograph.

Technical data

Input voltage	1 AC 230 V/50 Hz
Output voltage	1 AC
	0 – 230 V/50 Hz
current load	max. 5 A
Dimensions	
(WxHxD)	297x195x100 mm
Weight approx.	2 kg

Order-No. W3644-4E

Assembly kit "AC power controller"

The following experiments can be carried out:

- Phase control with 2 thyristors
- Phase control with triac
- Full-wave control with 2 thyristor
- Full-wave control with triac

The following components are required (incl. in the kit):

- 1 AC power controller W3644-4E
- 1 Universal machine W3365-3F
- 1 Baseframe for motor-generator set W3360-8A
- 2 Incandescent lamp with socket W3228-4A
- 1 Precision measuring transducer (voltage) W3644-4J
- 1 Precision measuring transducer (current) W3410-4B (300-W-Progr.)
- 1 Experimental manual W3007-2A
- 1 Set connecting leads W3901-0B

Further required components (not incl. in the kit):

- 2 Multimeter alternative
- 2 Multimeter as Demonstration instruments W5431-1B
- 1 2-channel oscilloscope 20MHz with 2 probes
- 1 Power supply ±15V DC for transducers
- 3 BNC – BNC leads
- 3 Adapter BNC – safety connecting leads

Order-No. W3644-0E

➤ Accessories – Resistive Loads

Load resistors

for loading components in the power electronics systems on 230 / 400 V basis.

With cover, rubber feet and earthing screw, terminals are brought out to 4-mm-safety-sockets.

Single-coil slide resistor

Technical data:	300W	1000W
Protection type	IP 20	IP 20
Resistance	1400 Ω	250 Ω
Current	0,12...1,2 A	0,9...5,5 A
Weight approx.	2,4 kg	6 kg



Order-No.	W3360-8E	W3375-8E
------------------	-----------------	-----------------

Technical data:	300W	1000W
Protection type	IP 20	IP 20
Resistance	2300 Ω	1000 Ω
Current	0,1...0,9 A	0,25...1,5 A
Weight approx.	3 kg	4 kg

Order-No.	W3360-8F	W3375-8F
------------------	-----------------	-----------------

3-times rotary rheostat

Technical data:	300W	1000W
Protection type	IP 20	IP 20
Resistance	2200 Ω	3 x 330 Ω
Current	0,3 A	3 x 1,5 A
Weight approx.	9 kg	10 kg



Order-No.	W3360-8H	W3375-8H
------------------	-----------------	-----------------

➤ **Accessories – Reactive / capacitive loads**



Inductive Load

Coil for placing inductive load on components in the power electronics system on 230/400 V basis.
All terminals are brought out to 4-mm-safety sockets.

Technical data
Inductance 200 mH
Current 5 A
Dimensions (WxHxD) 195x297x172 mm
Weight approx. 8.5 kg

Order-No. W3644-3C

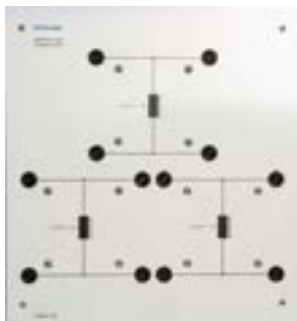


Inductive Load

Coil for placing inductive load on components in the power electronics system on 230/400 V basis.
All terminals are brought out to 4-mm-safety sockets.

Technical data
Inductance 100/400 mH
Current 14/7 A
Dimensions (WxHxD) 170x290x160 mm
Weight approx. 20 kg

Order-No. W3642-4U



Inductive Load

Coil for placing inductive load on components in the power electronics system on 230/400 V basis.
All terminals are brought out to 2 4-mm-safety-sockets.

Technical data
Inductance 3 x 100 mH
Current 1,5 A
Dimensions (WxHxD) 260x297x100 mm
Weight approx. 2.6 kg

Order-No. W3644-3D



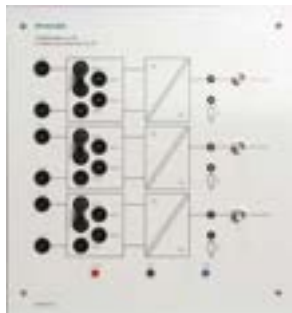
Capacitive Loading

for capacitive load of the components from the power electronics system and electrical machines.
Terminals brought out to 4-mm-safety-sockets.

Technical data
Capacity 3 x 2µF / 450V AC
3 x 4µF / 450V AC
3 x 8µF / 450V AC
Dimensions (W x H x D) 260x297x100mm
Weight approx. 2.0kg

Order-No. W3644-3F

➤ Accessories – Measuring Equipment



Precision measuring transducer (voltage)

Experimental panel for floating measurements of DC, AC and pulse voltages; with electrical isolation between primary and secondary circuits. The panel features 3 built-in transducers with 4 different measuring ranges. The voltage inputs are brought out to 4-mm-safety lab sockets, the voltage outputs to 2-mm-sockets and BNC sockets. The power supply inputs are brought out to 2-mm-safety-sockets.

Technical data	
Input voltage	max. 500/400/ 250/100 V switch-selectable
Output voltage	0 – 5 V
Accuracy	under 1 %
Error of linearity	under 0,1 %
Minimum	
time of reaction	under 1 μs
Power supply	±15 V/150 mA
Dimensions	
(WxHxD)	260x297x100 mm
Weight approx.	0.8 kg

Order-No. W3644-4J



Measuring transducer (current)

experimental panel for making oscillograph recordings of currents in power electronics devices and electrical drive equipment. The primary and secondary circuits are electrically isolated. The current inputs are connected to 4mm safety sockets, the output to 2-mm and BNC socket. The power supply inputs are brought out to 2-mm-safety-sockets.

Technical data	
Input current	max. 5 A
Output voltage	0 – 5 V
Accuracy	under 1 %
Error of linearity	under 0,1 %
Minimum	
time of reaction	under 1 μs
Power supply	±15 V / 50 mA
Dimensions	
(WxHxD)	130x297x60 mm
Weight approx.	0.5 kg

Order-No. W3410-4B

Order-No. W3410-4B

Measuring Transducer (current)

experimental panel for making oscillograph recordings of currents in power electronics devices and electrical drive equipment. The primary and secondary circuits are electrically isolated. The current inputs are connected to 4-mm-safety sockets, the output to 2-mm and BNC socket. The power supply inputs are brought out to 2-mm-safety-sockets

(current, max. 12A)

Technical data	
Input current	max. 12 A
Output voltage	0 – 5 V
Accuracy	under 1 %
Error of linearity	under 0,1%
Minimum	
time of reaction	under 1 μs
Power supply	±15 V/50 mA
Dimensions	
(WxHxD)	130x297x60 mm
Weight approx.	0,5 kg

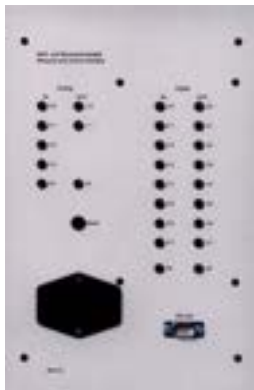
Order-No. W3410-4C

(current, max. 25A)

Technical data	
Input current	max. 25 A
Output voltage	0 – 5 V
Accuracy	under 1 %
Error of linearity	under 0,1%
Minimum	
time of reaction	under 1 μs
Power supply	±15 V/50 mA
Dimensions	
(WxHxD)	130x297x60 mm
Weight approx.	0,5 kg

Order-No. W3410-4D

➤ **Accessories – Measuring Equipment**



Measuring and control interface

The measuring and control interface consists of 8 digital inputs and outputs, 4 analog inputs and 2 analog outputs as well as an RS-232 interface. The analog and digital inputs and outputs are brought out to 2-mm-sockets.

The measuring and control interface provides the connection between PC and the magnetic powder brakes.

Technical data

Analog inputs	max. ± 10 V
Analog outputs	max. ± 10 V
Digital inputs	5 – 24 V DC
Mains supply	1 AC 230 V/50 Hz via connector for non-heating apparatus

Dimensions

(HxWxD)	195x297x100 mm
Weight approx.	1.3 kg

Order-No. W3644-4L

➤ **FAX – response to: +49 (0)9721 - 64691 - 20**

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 - Fiber optic
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 - ISDN
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Remarks:

Training & Didactic Systems

Building Service Management System KNX / EIB

Catalog

WA2E/07.01



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➤ Introduction

In general

The KNX / EIB is a distributed data bus system for flexible service management in functional and residential buildings. Every storey, every room is individually supplied according to its requirements and conditions with the optimum electrical power for the respective time of day. This new technology revolutionizes electrical installation, is easy to comprehend and easy to implement. It saves time because planning is PC-based and much fewer leads must be laid during installation. As all components are optimally matched to one another, buildings with an KNX / EIB installation consume considerably fewer resources and thus work more economically as traditional systems. What is more, the system can be quickly and easily adapted when the layout of the room changes by simply re-assigning devices and components.

How does the KNX / EIB work?

All switches, pushbuttons and controls (sensors) are connected to the bus line by bus couplers. The bus line is a two-wire MSR lead that runs through the whole building. If a pushbutton is actuated for example, a command telegram with a specific address goes on the bus line.

WUEKRO experimenters

After these words of introduction on building service management systems you will find experimenters and training units for the training and education on the KNX / EIB on the following pages.

Address assignment

Every bus station is provided with a teaching button with an LED at its coupler. When this button is pressed, the physical address sent by the PC is applied and acknowledged.

Functional interaction is reached by allocating the group address. This address is sent by the sensor together with the telegram and is received by all bus couplers with the same group address.

The time load on the bus line is very low here.

With event-controlled transmission a signal is only sent when a sensor is actuated, so the bus line is used only for a short time.

The addressed actuators (relays, contactors, binary outputs, etc.) that are also connected to the bus line via their bus couplers receive the commands, but only those actuators or that actuator group will be activated which have been specified in the telegram address.

Adaptation to changed rooms

It is especially relevant for functional buildings that a displacement of partition walls, which is often necessary there for organizational reasons, does not require the removal or a new laying of leads.

By means of a PC, the sensors and actuators can be assigned new group addresses that correspond to the new room layout, e.g. relations between light switches and lamps, from anywhere in the bus network.

So it is a prerequisite that all sensors and actuators obtain a physical address.

Thus they can receive all further inputs like group addresses and parameters and can also be queried specifically, e.g. in the line of diagnostics during maintenance.

➤ Configuration Proposals for [KNX / EIB](#)

Hands-on training I

**Starting package
(basic configuration)**

1 line power supply unit with USB interface (type with 640 mA)	W4010-1A
1 KNX / EIB pushbutton, 2-fold	W4010-2M
1 KNX / EIB binary output, 2-fold	W4010-3B
1 experimental panel with three lamp sockets	W3228-4C

The basic configuration can be expanded as desired by the following supplementary packages:

Supplementary package 1

for further lamp circuits and brightness control of incandescent lamps

1 experimental panel with three lamp sockets	W3228-4C
1 KNX / EIB binary output, 2-fold	W4010-3B
1 KNX / EIB pushbutton, 4-fold	W4010-2N
1 KNX / EIB switching/dimming actuator for lamps	W4010-3E

Supplementary package 2

for Venetian blind control, 230 V

1 KNX / EIB pushbutton, 2-fold	W4010-2M
1 KNX / EIB Venetian blind switch	W4020-2J
1 experimental panel Venetian Blind, 230 V	W4020-4C

Supplementary package 3

for integrating conventional pushbuttons and specifying environmental values

1 KNX / EIB pushbutton interface, 4-fold	W4010-3K
--	-----------------

Supplementary package 4

for infrared remote control

1 KNX / EIB IR receiver and decoder and a 2-fold wall-mounted transmitter	W4010-3D
1 KNX / EIB IR hand-held transmitter with 4 + 4 channels	W4010-5D

Supplementary package 5

for the brightness control of fluorescent lamps

1 KNX / EIB switching/dimming actuator with electronic ballast and fluorescent lamp	W4010-3J
1 KNX / EIB pushbutton, 4-fold	W4010-2N

➤ **Configuration Proposals for KNX / EIB**

Hands-on training I

Supplementary package 6

for the setup of additional bus lines

1 line power supply unit with line coupler
(type with 640 mA)

W4010-1C

The new bus line can now be equipped with further experimental panels from the KNX / EIB training system.

Further extensions

1 KNX / EIB motion detector
1 KNX / EIB twilight detector
1 KNX / EIB display unit
1 experimental panel Halogen Lamp
1 experimental panel Simulation of Door and Window Contact
1 brightness sensor, indoor
1 brightness sensor, outdoor
1 brightness control
1 scenic module
1 logic module
1 time module
1 event module
1 Esadrive (heating system simulation)
1 temperature controller
1 binary output for flow valve
1 KNX / EIB IR receiver and decoder
1 KNX / EIB wall-mounted IR transmitter, 2-fold
1 KNX / EIB wall-mounted IR transmitter, 4-fold
1 KNX / EIB IR hand-held transmitter with 4 + 4 channels
1 telecontrol device
1 wind sensor

W4010-3F
W4010-3G
W4010-3M
W4020-1J
W4010-3Y

W4010-3P
W4010-4P
W4010-3V
W4010-3S
W4010-3T
W4010-3U
W4010-3W
W4010-5H
W4010-3L
W4010-3H
W4010-4D
W4010-2G

W4010-2H

W4010-5D

W4010-3X
W4030-3U

The number of connecting leads required depends on the respective experimental setup. See under Accessories to choose.

➤ **Configuration Proposals for KNX / EIB**

Hands-on training II

Basic configuration

1 line power supply unit with USB interface
(type with 640 mA)
1 KNX / EIB pushbutton, 4-fold
1 KNX / EIB binary output, 4-fold
1 experimental panel Storey Lighting
With this basic configuration 4 groups of
lamps can be controlled.

W4010-1A
W4010-2N
W4010-3C
W4020-1H

Supplementary package 1

for 6 additional groups of lamps

1 KNX / EIB binary output, 4-fold
1 KNX / EIB binary output, 2-fold
1 KNX / EIB pushbutton, 4-fold
1 KNX / EIB pushbutton, 2-fold

W4010-3C
W4010-3B
W4010-2N
W4010-2M

Supplementary package 2

Dimming of incandescent lamps

1 KNX / EIB switching/dimming actuator
1 KNX / EIB pushbutton, 2-fold

W4010-3E
W4010-2M

Supplementary package 3

Twilight detector and motion detector

1 KNX / EIB twilight detector
1 KNX / EIB motion detector

W4010-3G
W4010-3F

The hands-on training II can also be
expanded by the supplementary packages 2
to 6 of hands-on training I.

The number of the connecting leads required
depends on the respective experimental
setup. See under Accessories to choose.

➤ **Configuration Proposals for KNX / EIB**

Hands-on training III

Basic configuration

1 line power supply unit with USB interface (type with 640 mA)	W4010-1A
1 storey lighting	W4020-1H
1 KNX / EIB pushbutton, 2-fold	W4010-2M
1 KNX / EIB pushbutton, 4-fold	W4010-2N
1 binary output, 4-fold	W4010-3C
1 binary output, 2-fold	W4010-3B

Supplementary package 1

Venetian blind control

1 Venetian blind simulation with light-emitting diodes	W4020-1C
1 KNX / EIB Venetian blind switch	W4020-2J
1 KNX / EIB pushbutton, 2-fold	W4010-2M
1 wind sensor	W4030-3U
1 binary input, 4-fold	W4010-3A

Supplementary package 2

Infrared remote control

1 KNX / EIB IR receiver and decoder incl. 2-fold wall-mounted transmitter	W4010-3D
1 KNX / EIB IR hand-held transmitter with 4 + 4 channels	W4010-5D

Supplementary package 3

Setup of additional bus lines

1 line power supply unit with line coupler (type with 640 mA)	W4010-1C
--	-----------------

The new bus line can now be equipped with further experimental panels from the KNX / EIB training system.

The number of the connecting leads required depends on the respective experimental setup. See under Accessories to choose.

➤ **KNX / EIB Experimenter with Simulator**



KNX / EIB Experimenter

The KNX / EIB experimenter is integrated in a sturdy case with a powdered look in anthracite. The main parts of the case are black ABS plates with two locks. The lid can be detached and is fitted with a carrying handle.

The following KNX / EIB components are integrated in the case bottom:

- 1 power supply unit (type with 640 mA)
- 1 USB interface
- 2 binary output, 2-fold
- 1 binary input, 4-fold
- 2 bus coupler
- 1 time switch, dual-channel
- 1 twilight detector
- 1 switching/dimming actuator
- 1 Venetian blind switch

By connectors the bus is wired to all bus stations. By using 2-mm sockets as an open bus interface further external bus stations may be connected easily.

Into the control panel the following elements have been incorporated:

- 1 pushbutton, 1-fold
- 1 pushbutton, 2-fold
- 1 pushbutton, 4-fold
- 1 temperature controller
- 1 display unit
- 5 bus coupler
- 1 motion detector

The detachable lid of the ready-to-use KNX / EIB experimenter houses two simulation modules for learning the basic possibilities of the building services management system by way of experiments.

Room lighting simulation

On the simulation panel a storey of a building with several rooms including corridor and staircase is represented. The partition walls are pluggable permitting the simulation of changes in the room in an easy manner. All 8 incandescent lamps (E14) can be connected to the respective actuator using safety lab sockets. To allow a better overview, N and PE are already wired internally.

Venetian blind simulation with LED

The Venetian blind simulation shows the position of the blind by an LED strip indicator and the blind strip position by single LEDs.

The contacts of the binary outputs are wired to 4-mm safety lab sockets.

By a sideways attached mains plug with fine wire fuse and switch, the mains voltage is led internally to safety lab sockets.

Included are:

- 1 mains connecting lead
- 8 glow lamps, 230 V
- 1 connecting lead PC - RS 232

Dimensions of the case (W x H x D): 520 x 375 x 175 mm
Weight approx.: 7 kg

Order-No. W4006-0C

➤ KNX / EIB compact-case



KNX / EIB Compact case

The KNX / EIB compact case is a space-saving and especially cost-effective variant for starting with building services management systems.

Especially the extremely short setting-up time has to be mentioned as an advantage.

Several experiments for Brightness control, Alarm messages on the bus sent by a motion controller etc. can be worked out.

It consists of the following components:

- 1 line power supply unit (type with 160 mA) including reactor
- 1 USB interface
- 1 binary input, 4-fold
- 1 binary output, 4-fold
- 1 scenic module

Room lighting simulation consisting of 4 incandescent lamps and pluggable partition walls for a fast change of the room layout.

- 1 4-fold pushbutton with separate bus coupler and integrated dimmer (1-channel)
- 1 top-hat rail with integrated data bus

In order to facilitate the connection of further modules it is possible to connect these via a Phoenix plug connection.

All 230 V-connections brought out to 4-mm safety lab sockets.

An open bus-interface for additional KNX-components is realized with 2mm sockets

Also included :
1 mains connecting lead
4 incandescent lamps

Dimensions of the case
(W x H x D): 420 x 340 x 135 mm
Weight approx.: 5 kg

Order-No. W4006-2S

➤ **KNX / EIB Experimental Panels**



Experimenter panels in general:

The experimental panels are made from plastic. The color is white similar to RAL 9002. They are 297 mm high (DIN A4) and about 5 mm thick. The width is 130 mm or has been expanded by integer multiples of 65 mm.

On the back the experimental panels have hoods out of transparent plastic.

The devices and components are built into the panels or mounted on the back.

The transfer of the bus signals is implemented by female 2-mm connectors.

All terminals for the mains voltage are wired to 4-mm safety lab sockets.

The simulation panels are supplied with voltage via the bus.

The mimic diagrams, device symbols and labels are permanently attached to the panel fronts according to the prevailing standards.

➤ KNX / EIB Experimental Panels



KNX / EIB Line Power Supply Unit with USB

Built-in components:
Power supply with integrated reactor and USB-connetor.
The power supply unit generates the system voltage required for the KNX / EIB and feeds it into the bus line by means of the reactor.
Primary nominal voltage:
AC 230 V +10% -15%, 50 Hz
Secondary nominal voltage:
DC 29 V +/- 1 V
Secondary nominal current: 640 mA
The reactor prevents a short circuit of the data telegrams on the bus line caused by the power supply.
The USB interface enables the connection of the PC for addressing,

parameterization and diagnosis of the bus stations (connecting lead included in scope of delivery). The data bus is glued into the top-hat rail and establishes the connection by means of the pressure contacts of the KNX / EIB devices.
The connector constitutes the transition from the data bus to the bus lines (2-mm sockets).
Mains connection via switch, fuse, mains plug and 2-m lead.
Width: 260 mm

Order-No. W4010-1A

not illustrated

KNX / EIB Line Power Supply

Built-in components:
Data bus, reactor, connector and power supply.
The power supply unit generates the system voltage required for the KNX / EIB and feeds it into the bus line by means of the reactor.
Primary nominal voltage:
AC 230 V +10% -15%, 50 Hz
Secondary nominal voltage:
DC 29 V +/- 1 V
Secondary nominal current: 640 mA
The reactor prevents a short circuit of the data telegrams on the bus line caused by the power supply.

The data bus is glued into the top-hat rail and establishes the connection by means of the pressure contacts of the KNX / EIB devices.
The connector constitutes the transition from the data bus to the bus lines (2-mm sockets).

Mains connection via switch, fuse, mains plug and 2-m lead.
Width: 260 mm

Order-No. W4010-1B

not illustrated

KNX / EIB USB Interface:

Enables the link-up of the PC or laptop for addressing, parameterization and diagnosis via a 9-pin Sub D socket.

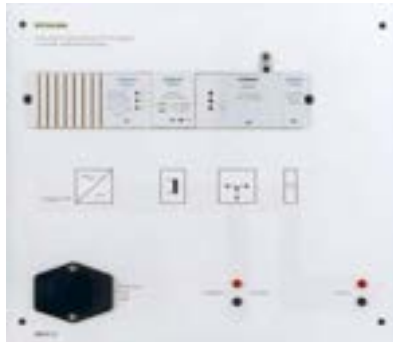
The connecting lead is part of the scope of delivery.

Width: 130 mm

The USB interface is connected to a bus coupler and can be switched into the bus at any place.

Order-No. W4010-1R

➤ **KNX / EIB Experimental Panels**



**KNX / EIB
Line Power Supply Unit with
Line Coupler**

Built-in components:
Data bus, reactor, line coupler,
connector and power supply.

The power supply unit generates the system voltage required for the KNX/EIB and feeds it into the bus line by means of the reactor.

Primary nominal voltage:
AC 230 V + 10% - 15%, 50 Hz
Secondary nominal voltage:
DC 29 V +/- 1 V
Secondary nominal current: 640 mA

The mains connection is implemented by a mains plug with switch and fuse. Includes 2-m lead.

The reactor prevents a short circuit of the data telegrams on the bus line caused by the power supply.

The line coupler acts as a data flow filter. It allows only command telegrams to pass that are also intended for bus stations in other bus lines and thus contributes to a reduction of the bus load.

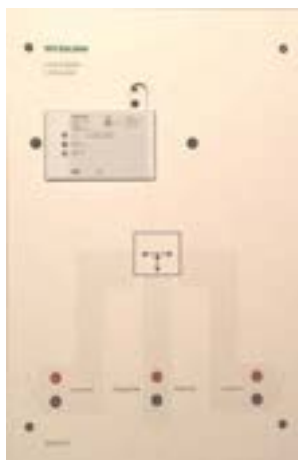
Furthermore, it isolates the bus lines electrically so that interference on a bus line is restricted.

The data bus is glued into the top-hat rail and establishes the connection by means of the pressure contacts of the KNX/EIB devices.

The connector constitutes the transition from the data bus to the bus lines (2-mm sockets).

Width: 325 mm

Order-No. W4010-1C



**KNX / EIB
Line Coupler**

The line coupler acts as data flow filter. It allows only command telegrams to pass that are also intended for bus stations in other bus lines and thus contributes to a reduction of the bus load. Furthermore, it isolates the bus lines electrically so that interference on a bus line is restricted.

The experimental panel can be used for setting up another bus line together with the line power supply W4010-1A or W4010-1B.

Width: 195 mm

Order-No. W4010-1D



**KNX / EIB
Bus Coupler**

The bus coupler enables the connection of bus stations to the bus line via the user interface (e.g. pushbuttons, display units, motion detectors, RS 232 interface).

The connection to the KNX/EIB is implemented via 2-mm sockets.

Width: 130 mm

Order-No. W4010-2K

➤ KNX / EIB Experimental Panels



KNX / EIB Pushbutton, 1-fold

Pushbutton and bus coupler are separate. That has the advantage that the pushbutton does not have to be removed from the bus coupler when the physical address is programmed.

Via the bus coupler the pushbutton outputs commands to actuators for defined ON/OFF switching, for the dimming of lamps, for moving Venetian blind strips up/down or adjusting them, etc. by using a corresponding application program.

The display field features an LED that can be used as a locating light, etc. In the labeling field the operating function can be described in plain text or by pictographs. The pushbutton is designed as a rocker with neutral middle position.

Width: 130 mm

Order-No. W4010-2L



KNX / EIB Pushbutton, 2-fold

Pushbutton and bus coupler are separate. That has the advantage that the pushbutton does not have to be removed from the bus coupler when the physical address is programmed.

Via the bus coupler the pushbutton outputs commands to actuators for defined ON/OFF switching, for the dimming of lamps, for moving Venetian blind strips up/down or adjusting them, etc. by using a corresponding application program.

The display field features two LEDs that can be used as locating lights, etc.

In the labeling field the operating functions can be described in plain text or by pictographs.

The control area is designed as a double rocker with neutral middle position.

Width: 130 mm

Order-No. W4010-2M



KNX / EIB Pushbutton, 4-fold

Functions are the same as for the 2-fold pushbutton.

Pushbutton and bus coupler are separate. That has the advantage that the pushbutton does not have to be removed from the bus coupler when the physical address is programmed.

The display field features four LEDs that can be used for preselection or status display, etc.

In the labeling field the operating functions can be described in plain text or by pictographs.

The control area is designed as a rocker with neutral middle position by which four channels can be controlled. The active channel is always selected by one of the preselection keys.

Width: 130 mm

Order-No. W4010-2N

not illustrated

Pushbutton

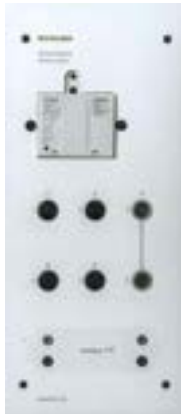
Pushbutton, 250 V~, 10 A, wired to 4-mm safety lab sockets.

The pushbutton can be used in conjunction with binary input W4010-3A.

Width: 130 mm

Order-No. W3217-4B

➤ **KNX / EIB Experimental Panels**



**KNX / EIB
Binary Input, 4-fold**

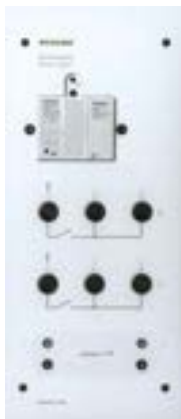
Binary input for four independent 230-V maintained-contact/momentary-contact switching signals that are converted into bus telegrams.

Thus, up to four conventional 230-V pushbuttons (e.g. W3217-4B) can be integrated into the bus system.

The 4-fold binary input is delivered including connector.

Width: 130 mm

Order-No. W4010-3A



**KNX / EIB
Binary Output, 2-fold**

Binary output for switching two independent groups of electrical loads. Can be used as time switch or time relay.

Nominal voltage: AC 230 V, 50 / 60 Hz
Current switched per output:
6 A for ohmic load
Switching capacity per output:
1000 Watts for incandescent lamps

The 2-fold binary output is delivered including connector.

Width: 130 mm

Order-No. W4010-3B



**KNX / EIB
Binary Output, 4-fold**

By its four outputs, the binary output panel can switch four independent groups of electrical loads.

Depending on the application program, the binary output can be used for direct ON/OFF switching, etc.

The switching behavior can be set as normally closed or normally open contact.

Nominal voltage: AC 230 V, 50/60 Hz
Current switched per output:
6 A for ohmic load
Switching capacity per output:
1000 Watts for incandescent lamps
The 4-fold binary output is delivered including connector.

Width: 260 mm

Order-No. W4010-3C

➤ KNX / EIB Experimental Panels

not illustrated

KNX / EIB Pushbutton Interface, 4-fold

The pushbutton interface is used for connecting up to four conventional pushbuttons with floating contacts.

The required scanning voltage is directly supplied by the pushbutton interface. The connection is implemented by eight strands of wire that are twisted in pairs and are permanently attached to the pushbutton interface.

Depending on the application program, the connected pushbuttons can be used to output commands to actuators for a defined turn-on/turn-off, for dimming lamps or for driving blinds or adjusting blind strips.

The experimental panel contains:

- 1 pushbutton interface
- 1 conventional installation pushbutton for illumination or Venetian blind control
- 3 pushbuttons for environmental variables (brightness, wind speed and temperature)

Width: 130 mm

Order-No. W4010-3K



KNX / EIB IR Receiver/Decoder and Wall-mounted IR Transmitter

For the remote control of actuators, the wall-mounted IR transmitter sends out infrared signals that are picked up by the IR receiver and transferred to the IR decoder, which converts them into the corresponding bus telegrams.

Thus the wall-mounted IR transmitter can be used to output commands to actuators for a defined turn-on/turn-off or dimming of lamps or for driving blinds up/down or adjusting blind strips.

Width: 130 mm

Order-No. W4010-3D

Order-No. for single orders:

KNX / EIB IR Receiver/Decoder

Order-No. W4010-4D

KNX / EIB Wall-mounted IR Transmitter, 2-fold

Order-No. W4010-4G

➤ **KNX / EIB Experimental Panels**



**KNX / EIB
Hand-held IR Transmitter
4 + 4 Channels**

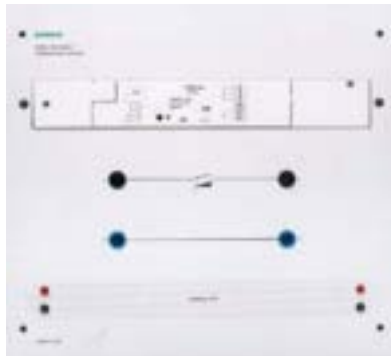
The hand-held IR transmitter can be used in conjunction with the experimental panels W4010-3D or W4010-4D.

Up to eight different groups of actuators can be controlled.

Transmitter range: approx. 20 m

Batteries 4 x LR03 (1.5 V)
(not included in scope of delivery)

Order-No. W4010-5D



**KNX / EIB
Switching/Dimming Actuator**

For switching and dimming incandescent lamps and low-voltage halogen lamps (via electronic transformers). With integrated bus coupler, short-circuit and overload protection.

The turn-on characteristics, the memory function and the dimming speed can be defined by the user.

Mains voltage: AC 230 V +10% / -15%

Nominal power: 215 Watts

Width: 325 mm

Order-No. W4010-3E



**KNX / EIB
Switching/Dimming Actuator
for Fluorescent Lamps**

With built-in electronic ballast and fluorescent lamp. The switching/dimming actuator controls the fluorescent lamp by means of the DC 10 V control connector of the electronic ballast (EVG Dynamic). The control voltage is supplied by the ballast EVG Dynamic.

Several functions can be parameterized like switch-on/switch-off or dimming of a fluorescent lamp, or setting a specific, programmed brightness value.

Width: 390 mm

Order-No. W4010-3J

➤ KNX / EIB Experimental Panels



KNX / EIB Motion Detector, PEHA

The motion detector is a proximity switch which responds to changes in temperature. It is used for detecting people in its area of supervision and applies bus couplers and a respective application program to output switching commands to actuators such as binary outputs for switching groups of lamps, or to signaling units.

Angle of detection:
max. 180 degrees, adjustable

Range: approx. 10 m

Reset time: 3 s ... 6 min, adjustable

Controls: 1 changeover switch (OFF, permanent ON, automatic)

2 shielding wings for reducing the detection angles (left and right) and two rotary switches for setting the reset time and the response threshold. The dusk response threshold is infinitely adjustable.

The experimental panel Motion Detector is delivered including the bus coupler.

The application software for the PEHA motion detector is available in the Siemens product database.

Width: 130 mm

Order-No. W4010-3F



Wind Sensor

The Busch-Jaeger wind sensor is driven by a fan. The rotating speed of the fan can be set by a potentiometer. The switching value of the wind sensor can also be adjusted. At the wind speed set, an output (normally open contact) is activated for 3 min.

By means of this signal, additional actuators (e.g. Venetian blind control) can be activated.

Switching capacity: 690 VA

Current switched: 3 A $\cos \varphi$ 0.6

The link-up to the Powernet® EIB or the KNX / EIB is implemented by a binary input.

Order-No. W4030-3U

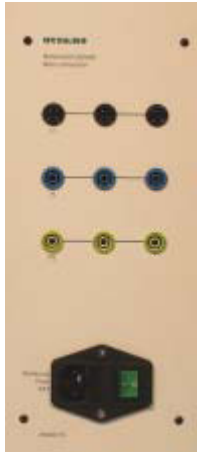
➤ **KNX / EIB Experimental Panels**

not illustrated

**Simulation
Door/Window Contact**

On the experimental panel a residential building is depicted. Three window models and one door model can be open/closed manually. Contacts implemented by MICRO switches.

Order-No. W4010-3Y



Power Supply Panel

Equipped with:

- 9 4-mm safety lab sockets
- 1 built-in mains connector with light and fuse
- 1 2-m mains connecting lead

This experimental panel enables the connection of the standard components to the 230-V mains voltage (e.g. conventional switches/pushbuttons for 230-V lamps).

L1, N, PE are brought out to 4-mm safety lab sockets.

Order-No. W4020-1K

➤ **KNX / EIB Experimental Panels**



**KNX / EIB
Twilight Detector, Grässlin**

Via the bus coupler and by means of a corresponding application program the 1-channel twilight detector outputs brightness-dependent commands to actuators for switching on/off lamps or for driving blinds up/down, etc. The brightness is measured by the photo-sensor which is connected to the twilight detector by a lead. The twilight detector has two ranges where the desired brightness value can be set by a potentiometer. If the brightness value set is not reached, the built-in LED lights up and the twilight detector sends an "ON" telegram via the bus coupler

When the brightness value set is exceeded, an "OFF" telegram is sent and the LED goes off.

Setting range	2...300 Lux
or	200...20000 Lux
Action	two-step
Hysteresis	Factor 1.3 of the ON value
Display elements	1 red LED
Controls	1 rotary switch for changing the setting range

The experimental panel Twilight Detector is delivered including the photo-sensor, the bus coupler and the connector.

Width: 130 mm

Order-No. W4010-3G



**KNX / EIB
Brightness Sensor, outdoor**

The brightness sensor is used for measuring the outdoor brightness and consists of a converter and photo-sensor. The brightness value measured by the photo-sensor is output to the KNX / EIB via the converter and can be

processed for daylight evaluation by the brightness module W4010-3V.

Setting range: 0 ... 16 000 Lux.

Width: 130 mm

Order-No. W4010-4P



**KNX / EIB
Brightness Sensor**

The brightness sensor is used for measuring the brightness and consists of a converter and photo-sensor. The converter receives the brightness value measured by the photo-sensor and controls the illumination using the KNX / EIB.

Various application programs such as calibration, continuous light or two-step control and read-out of the brightness value are available. Setting range: 150 ... 1 950 Lux

Width: 130 mm

Order-No. W4010-3P

➤ **KNX / EIB Experimental Panels**

not illustrated

**KNX / EIB
Brightness Control**

The brightness control features 10 independent light controls which operate the indoor lighting according to the outdoor brightness. For each light control a separate brightness characteristic can be input according to which dimming commands are calculated and sent to dimmers. The actual outdoor brightness value, which is identical for all ten light controls, is measured by the brightness sensor (W4010-3P or W4010-4P) and sent to the brightness control module.

When dimming is adjusted manually, e.g. by a switch, the corresponding brightness characteristic is adapted to the new indoor brightness required. After the lighting is switched ON/OFF the next time, the original characteristic is activated again. Each light control can also be operated as a two-step control with hysteresis, i.e. the indoor lighting is not dimmed but switched ON/OFF via binary output devices, etc. in relation to the outdoor brightness.

Width: 130 mm

Order-No. W4010-3V



**KNX / EIB
Scenic Module**

Up to four different scenes can be stored. A scene may consist of switching/dimming settings for lamps and of limit positions for blinds that can be queried by pressing a button when required. It can also be stored in a scene whether the heating or the ventilation is switched on or off, whether the room temperature is to be set to a new value or whether a new brightness command value is to be sent to the constant light stabilizer.

For each scenic module up to eight group addresses can be stored that can be assigned to the four scenes.

Width: 130 mm

Order-No. W4010-3S

➤ KNX / EIB Experimental Panels



KNX / EIB Logic Module

The logic module is used to combine binary signals that can be sent and received via telegrams. Currently, three application programs are available:

AND, OR operations
4 inverters
Telegram multiplication

Width: 130 mm

Order-No. W4010-3T



KNX / EIB Time Module

The time module is used for the time-related control of binary signals that can be sent and received via telegrams.

The module features 4 inputs and 4 outputs which can be inverted.
ON/OFF delays
Staircase lighting (time switch)
Disabling the inputs is possible.

Width: 130 mm

Order-No. W4010-3U



KNX / EIB Event Module

The application program manages up to 255 communication objects. Up to 60 event programs, which can receive up to 200 event jobs, can be programmed. For the daily programs and the calendar entries the event module needs the timing element *Time Master*.

The event module manages 100 calendar entries/daily programs.

These calendar entries/daily programs can contain up to 300 time jobs.

It is possible to send up to 60 texts with 14 characters each to the KNX / EIB.

Width: 130 mm

Order-No. W4010-3W

➤ **KNX / EIB Experimental Panels**



**KNX / EIB
Binary Output for Flow Valve**

The binary output is built into the experimental panel together with the bus coupler. Both parts are connected by a ribbon cable with plug connector. By the two 230 V AC/6 A outputs electrothermal servo-drives for heating valves can be operated, etc.

The terminals are wired to 4 mm safety sockets. The control at the bus coupler can be implemented by the experimental panel Temperature Controller W4010-3L.

Width: 195 mm

Order-No. W4010-3H



**KNX / EIB
Temperature Controller**

Bus coupler and temperature controller are separate.

The temperature controller can be used as a two-step controller (thermostat) or as a continuous controller (P or PI controller) for pure heating as well as for combined heating and cooling operation. Via the bus coupler and using a corresponding application program, the controller outputs switching commands to actuators such as binary output W4010-3H for activating electrothermal servo-drives (two-step control).

The clearly arranged and intuitive control panel features 5 LEDs for the operating states Normal, Standby, Night, Freeze/Heat Protection and Dew Point Alert. A presence switch is used for switching over between comfort and standby mode and a rotary button for shifting the basic setpoint.

Width: 130 mm

Order-No. W4010-3L



**KNX / EIB
Esadrive**

Esadrive designates the electromotive, proportional EIB servo-drive with integrated bus coupler for standard radiator valves.

The servo-drive has the following functions:
Automatic synchronization of the drive (calibration to 0%)
Setpoint after commissioning (set by parameter)
Automatic flushing of the valve (set by parameter)

Forced setting, e.g. freeze protection (set by parameter)

There is a running light on the experimental panel showing the inflow quantity as it runs forward. The speed of the running light is proportional to the inflow quantity. Two light-emitting diodes indicate the valve function (opening/closing).

Width: 195 mm

Order-No. W4010-5H

➤ KNX / EIB Experimental Panels



KNX / EIB Display Unit

The display unit is used for displaying user-programmable messages. A message usually consists of permanently stored text and several wildcards which are replaced by text segments or information according to the data from the bus. Depending on the parameter setting it is possible to assign alarm functions to the messages. The display unit consists of a two-line LCD display. Messages can be displayed in one or two lines.

The different messages can be selected at the display unit by pressing a key. Bus coupler and display unit are separate.

Number of messages: 8 (freely assignable)
Number of characters per message: one-line 10, two-line 20

Width: 130 mm

Order-No. W4010-3M

not illustrated

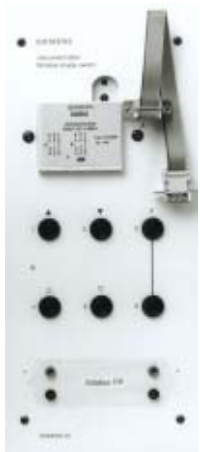
Venetian Blind Simulation with LEDs

The blind simulation with LEDs for blind and blind strip control is a cost-effective and space-saving alternative to the 230-V blind W4020-4C.

According to the height of the blind, yellow, rectangular LEDs light up. Red LEDs show the respective inclination of the strips.

Power is supplied via the bus voltage. Bus interfacing via 9-pin Sub D plug. The connecting lead to the bus coupler is part of the scope of delivery. Fits to: Venetian blind switch W4020-2J
Width: 130 mm

Order-No. W4020-1C



KNX / EIB Venetian Blind Switch

The blind switch controls 2 independent drives for UP/DOWN and switches the strips step-by-step to OPEN or CLOSE triggered by sensors. Channel A is wired to a 9-pin Sub D plug for controlling the experimental panel Venetian Blind Simulation W4020-1C.

Channel B is wired to 4-mm safety lab sockets for connecting the original blind (230 V) W4020-4C.

Width: 130 mm

Order-No. W4020-2J

➤ **KNX / EIB Experimental Panels**



Venetian Blind, 230 V

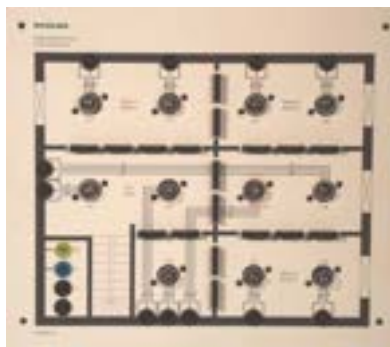
The blind is mounted on a transparent plastic panel which can be hung into the experimental rack. It is driven by an original blind motor.

It is controlled via experimental panel Venetian Blind Switch W4020-2J (channel B).

The functions Up, Down, Stop or Strip Adjustment are possible. Connection is implemented by 1 m long lab leads with 4-mm safety lab sockets.

Width: 605 mm

Order-No. W4020-4C



Storey Lighting

On the experimental panel a storey of a building with several rooms including corridor and staircase is represented. The partition walls are pluggable permitting the simulation of changes in the room in an easy manner. By addressing the sensors and actuators anew, they can be adapted to the current situation. All 11 incandescent lamps (E14) can be connected to the respective actuator using safety lab sockets. To allow a better overview, N and PE are already wired internally. The storey lighting model can be controlled by various actuators like the 2-fold binary output, the 4-fold binary output or the switching/dimming actuator.

These actuators can be arranged around the experimental panel in a experimental rack with 3 rows. Possible experiments: Commissioning of the individual rooms with various actuators. Adaptation of the installation to the changed room utilization (assignment of group addresses). Influencing the illumination using motion detectors or brightness sensors and load management.

Width: 325 mm

Order-No. W4020-1H

not illustrated

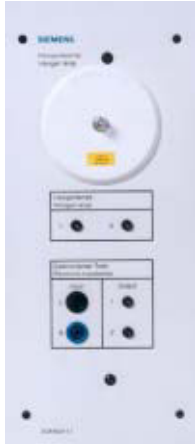
E 14 Lamp Sockets

Three lamp sockets are wired to 4-mm safety lab sockets.

The incandescent lamps are not included in the scope of delivery! Width: 130 mm

Order-No. W3228-4C

➤ KNX / EIB Experimental Panels



Halogen Lamp

The input of the electronic transformer is wired to 4-mm safety lab sockets. The output is further connected to the halogen lamp via 2-mm sockets.

Width: 130 mm

Order-No. W4020-1J

not illustrated

KNX / EIB Telecontrol Device

The telecontrol device connects the KNX / EIB to the telephone network. Via the telephone, electrical loads can be switched directly and using the bus. Messages from conventional signal inputs and messages from the bus can be transmitted to various destination numbers by phone.

A status query of the loads and the respective device functions is possible. This information is communicated by voice output. A code number protects from unauthorized switching. Alarm functions can also be set.

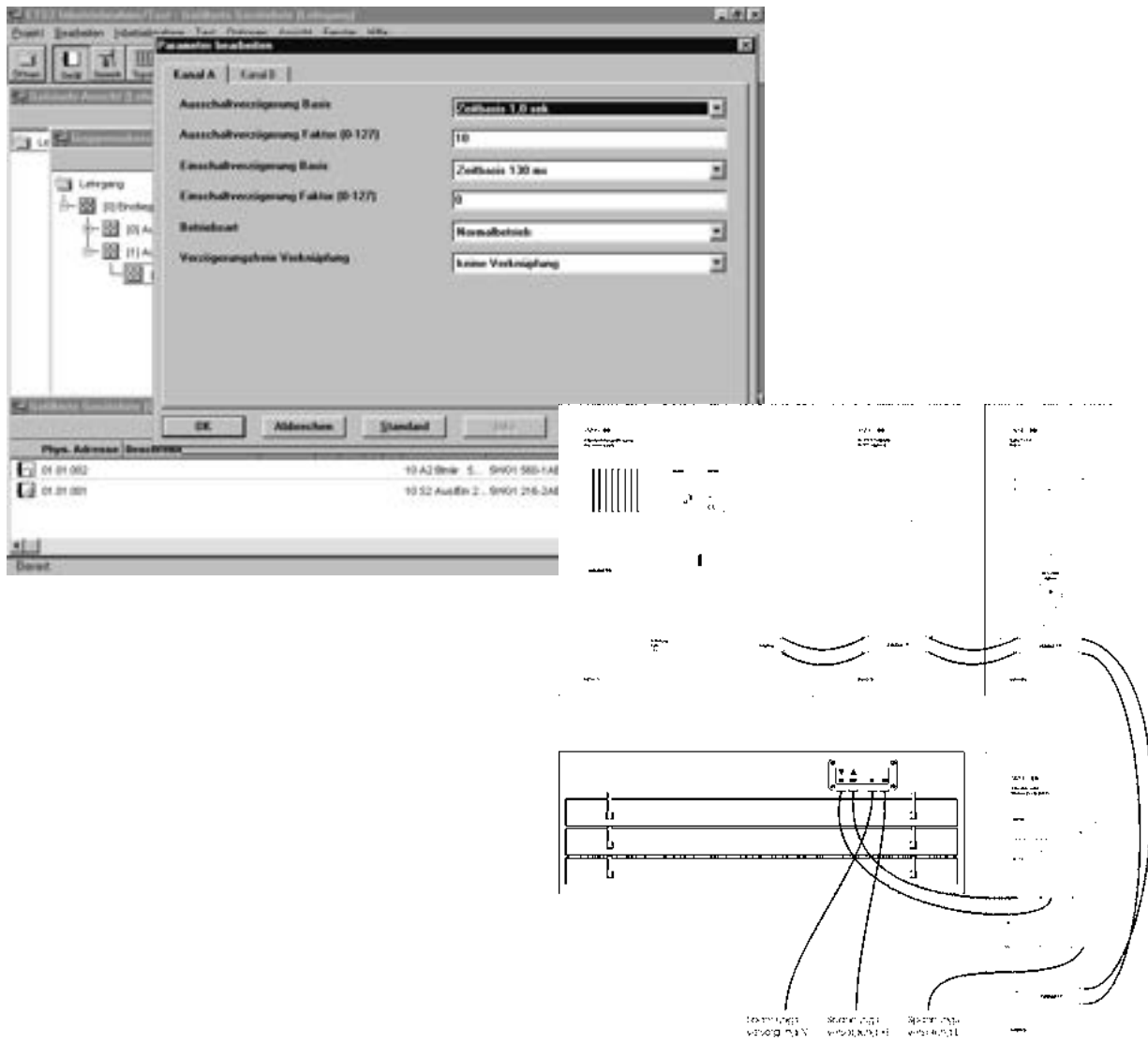
Order-No. W4010-3X

➤ Teachware

Order-No. W3005-1B

Experiment instructions KNX / EIB V051

Detailed experiment instructions with exercises, solutions, descriptions of the software parameter settings and wiring diagrams.

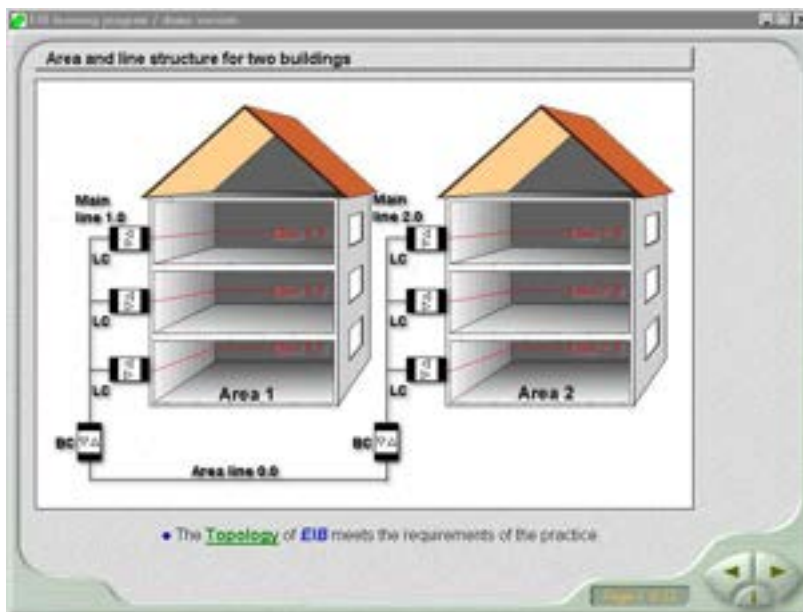


Excerpt from experiment instructions
KNX / EIB W3005-1B

➤ Software

Training Program on the KNX / EIB (European Installation Bus)

- Fundamentals of the EIB
- Technology
- Topology
- Telegrams
- Bus stations
- Installation



Training program on the KNX / EIB

The training program European Installation Bus is suited for learners as well as for advanced students who want to learn and repeat the theoretical basics of the EIB field.

The teaching subjects are imparted by spoken texts (audio files) in order to avoid having to read long texts on the screen.

Mnemonic sentences, important formulae, summaries and exercises are also displayed on the screen though.

A lot of animations, videos and interaction in the training program is supposed to increase the learning effect.

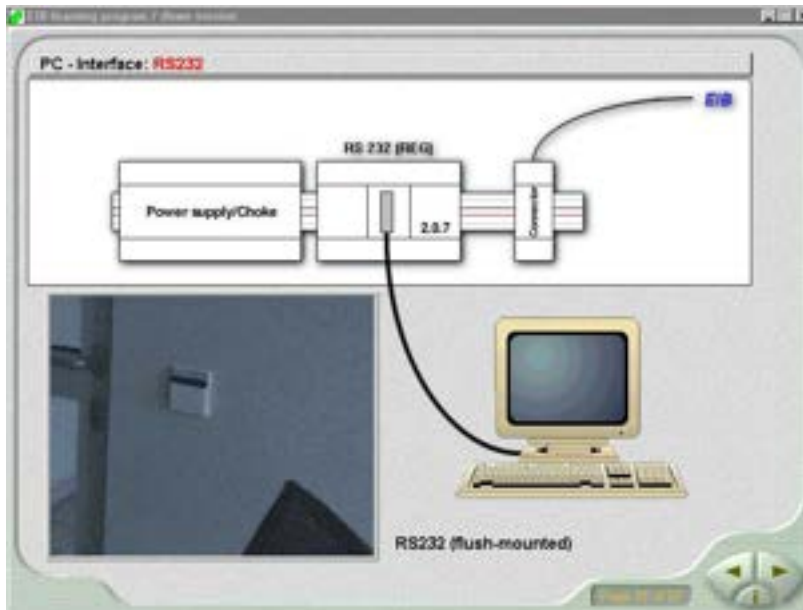
Review questions are posed during the teaching process as well as at the end of each learning step.

During the exercises the program reacts to each response of the student with a respective feedback.

The training program is available in German and English.

➤ Software

Training Program on the KNX / EIB (European Installation Bus)



Training program on the EIB



Training program on the EIB

Order-No. W4000-2B

➤ **Accessories**

Connecting leads of 0.5 mm² with 2-mm plugs (bus line)

Length/color	Order-No.
7.5 cm black	W3903-1E
7.5 cm red	W3903-1F
30 cm black	W3903-3E
30 cm red	W3903-3F
60 cm black	W3903-8E
60 cm red	W3903-8F
100 cm black	W3903-5E
100 cm red	W3903-5F

Connecting leads of 2.5 mm² with 4-mm safety lab plugs

Length/color	Order-No.
25 cm black	W3907-1E
25 cm blue	W3907-1G
50 cm black	W3907-2E
50 cm blue	W3907-2G
50 cm green/yellow	W3907-2H
100 cm black	W3907-3E
100 cm blue	W3907-3G
100 cm green/yellow	W3907-3H
150 cm black	W3907-4E
150 cm blue	W3907-4G

➤ **Notes:**

A series of horizontal dashed lines for taking notes, filling most of the page.

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 Remarks:



Training & Didactic Systems

Protection Schemes DIN VDE 0100

Catalog

WA2E/08



➤ Our Services

- Development and production of didactic training systems
- Teachware and documentation
- Project engineering of complete lab's incl. furnitures and lab equipment
- Quotations on customers demand
- Installation, commissioning and training at site

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- Electrical machines / drive control
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- Protection schemes to VDE 0100
- Radio- and TV technology
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- Measuring systems, power supplies, accessories
- Experimental manuals, documentation

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S30020616P – 01/13

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➤ Protection against electrical shock in accordance to DIN VDE 0100 Part 410

Foreword

Our Training Systems program "Protection Schemes to VDE 0100" is suitable to show the design, principle of operation and performance of the circuits protecting against indirect contact with the live parts specified in DIN VDE 0100 Part 410.

The limits of the effectiveness of the individual protective measures are to be determined by measurements to ensure that the trainers understand the regulations specified.

Protection schemes are continuous to be adapted to the newest technology, therefore we have enhanced our resp. training systems.

For our experimental-panel system and the demonstration board we use commercially available test gear.

VDE 0100 Training System is usable for testing protection schemes in electrical systems. By alternating the earth-resistors faults can be simulated and located. The results are useful to ensure the practical work of the trainees.

Concept

Demonstration Board 230 V for teachers and instructors with practical oriented experiments for theoretical lessons

Experimental-Panel System 230 V for the students to carry out several experiments to get familiarized with the different systems of protection schemes.

The Complete Concept

Decisive for this specified training system is the didactical structure of the complete training system. All circuits are printed with the same layout. Therefore the panels can be continued for the relevant experiments.

Learning contents / Experiments

The following learning contents are adapted to the professions in the field of electrical engineering and can be performed by using the demonstration board as well as the experimental panels.

Introduction

accident prevention regulations
Guidelines for the performance of experiments

Direct/indirect contact

Protection against accidental contact with live parts
Protection against electrical shock when touching exposed conduction parts

Protection extra-low voltage / purpose extra-low voltage

protection by means of extra-low voltage
Exception of effectiveness
functions of extra-low voltage

Safety Separation

Safety separation at a metal conductive location
Safety separation with two loads

Protection by Disconnection

Tripping behaviour of circuit breakers
Tripping behaviour of residual-current devices

Protective measures in the TN-System

Protection by disconnection with overcurrent protection devices in a TN-C-System
Protection by disconnection with overcurrent protection devices and various PEN resistances
restrictions on effectiveness

➤ **Protection against electrical shock in accordance to DIN VDE 0100 Part 410**

TN system types

Main equipotential bonding

- Enhancing the protective function
- Equipotential bonding and foundation earthing
- Residual-current device in the TN system
- Residual current device in the TN system when PE has an open circuit

Protective measures in the TT System

- Residual-current device in the TT system
- Residual-current device in the TT system N/PE connection downstream of the residual-current-operated circuit breaker
- Residual-current device in the TT system – effects of inadequate (defective) equipotential bonding

Protective measures in the IT System

- Types – principles of operation
- Effect of cable capacitances on the protective function
- Double short circuit to frame in the IT system
- Fault signals from the earth-leakage monitor

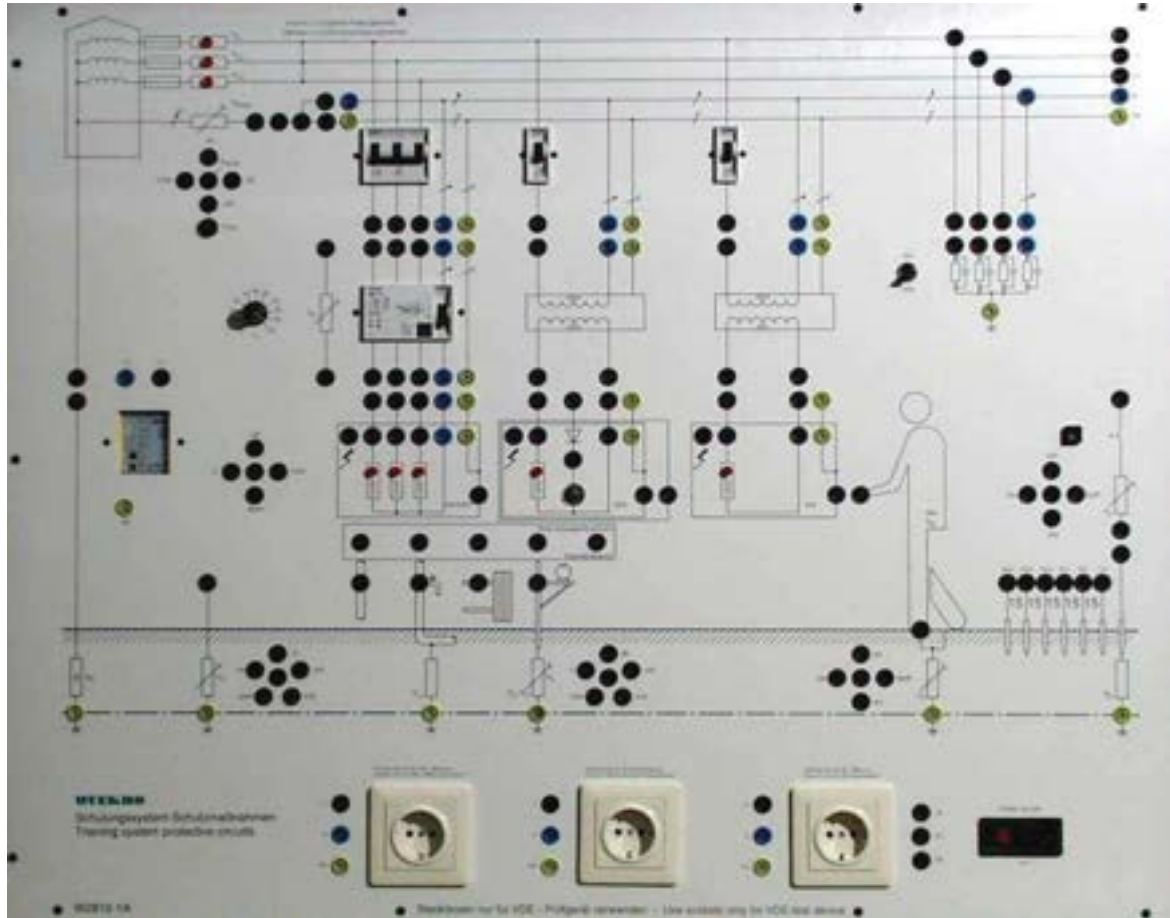
Tests for protective measures

- Test measures for installations
- Overview of measurements for testing protective measures

Measurement Methods for testing protective measures

- Measuring the voltage drop on an earth electrode
- Measuring the earth-electrode resistance
- Measuring the voltage shape of the resistance area, step-voltage
- Measuring the loop impedance Z_L and the breaking current I_b
- Measuring $U_{CL_{max}}$ and $RE_{E_{max}}$ of the r.c.d. protection in the TT system
- Measuring the insulation resistance

➤ Demonstration Board "Protection Schemes against electrical shock in accordance with DIN VDE 0100 Part 410



VDE-Demonstration Board 230V

The VDE-Demonstration board is built into a metal sheet cabinet with two lockable frontdoors, the front-panel is white.



The board can be set up on a bench.

Scope of delivery including

- 1 Demo-board 230 V
- 1 Experimental manual W3006-3B
- 20 plug-connectors 4 mm
- 15 safety-connecting-leads 4 mm

The concept of the VDE-demonstration board is according to the training regulations.

To minimize the preparation for the experiments the design is a compact housing and includes all relevant components.

To carry out all experiments we recommend two multimeters and one protection schemes measuring unit. These instruments are not included the scope of supply.

The components of the demonstration board are in accordance with the components used in the experimental panels system W2812-0A

Dimensions

(WxHxD) 650x900x250 mm

Weight approx. 50 kg

Order-No. W2812-1A

➤ **Assembly kit with experimental panels**

Assembly kit "Protection schemes against excessive touch voltage to DIN VDE 0100 Part 410

Order-No. W2812-0A

The assembly kit contains experimental panels and accessories, as well as the experimental manual.

The panels are designed for insertion in the experimental frames.

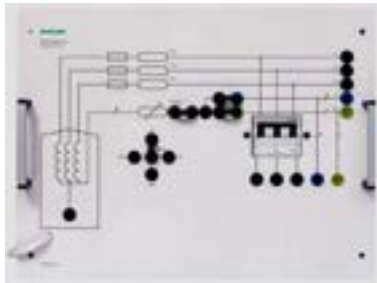
The layouts of the circuits are the same than on the demonstration board.

Dimensions of the panels (W x H) 297x130mm or wider by whole number multiples of 65mm

The instruction modules permit various experiments to be carried out.

We recommend that the assembly kit be used for carrying out the experiments in accordance with our instruction manual.

The following components are required (included in the kit)



System infeed

with built-in 3-phase transformer for supplying the current, 3 miniature automatic circuit-breakers, phase-lamps and in line resistors

Dimensions
(WxHxD) 390x297x190 mm
Weight approx. 10 kg

Order-No. W2812-2A



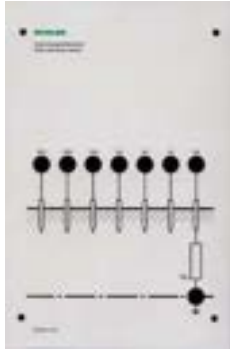
Current-operated earth-leakage circuit-breaker

4-pole 230/400V, 25A, ΔI_n 30mA, with test potentiometer for fault simulation

Dimensions
(WxHxD) 195x297x110 mm
Weight approx. 1,3 kg

Order-No. W2812-2B

➤ Assembly kit with experimental panels



Earth electrode resistor

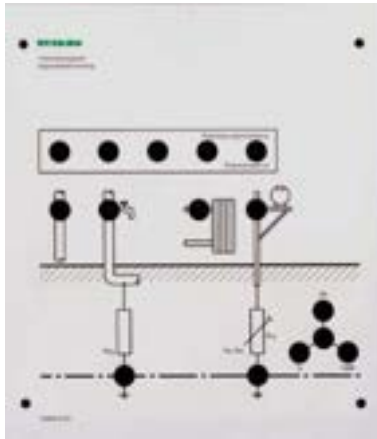
39 Ω , for simulation of earth rods

Dimensions

(WxHxD) 195x297x1100 mm

Weight approx. 0,8 kg

Order-No. W2812-2C



Equipotential bonding

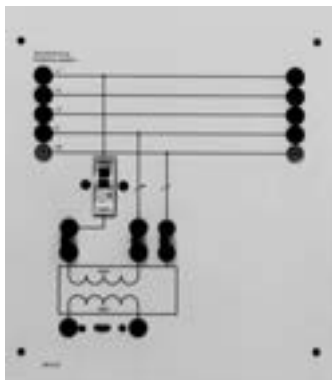
for adjustment of different contact resistances

Dimensions

(WxHxD) 260x297x110 mm

Weight approx. 1,2 kg

Order-No. W2812-2D



Safety Separation

Transformer 230/230 V
CB 1-pole 0.5 A, C

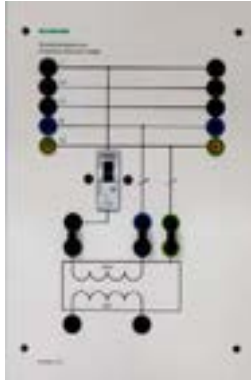
Dimensions

(WxHxD) 195x297x110 mm

Weight approx. 3,4 kg

Order-No. W2812-2E

➤ **Assembly kit with experimental panels**

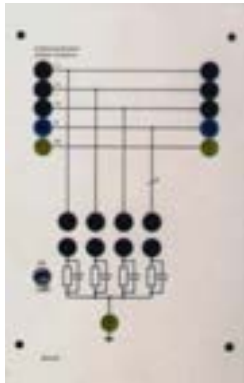


Protective extra-low voltage

Transformer 230/50 V
CB 1-pole 0.5 A, C

Dimensions
(WxHxD) 195x297x110 mm
Weight approx. 3,3 kg

Order-No. W2812-2F



Insulation resistance

with changeover switch for
adjustment of the cable capacity

Dimensions
(WxHxD) 195x297x110 mm
Weight approx. 1,1 kg

Order-No. W2812-2G



Earth-leakage monitor

Ranges 2,2 k Ω and 220 k Ω

Dimensions
(WxHxD) 130x297x180 mm
Weight approx. 0,8 kg

Order-No. W2812-2H

➤ Assembly kit with experimental panels

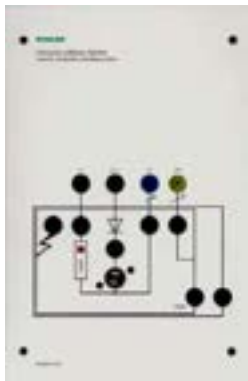


Three-phase load

Power resistor 1,2 k Ω ,
Body resistor of
0 – 100 – 620 – 1000 Ω

Dimensions
(WxHxD) 260x297x180 mm
Weight approx. 3,1 kg

Order-No. W2812-2J

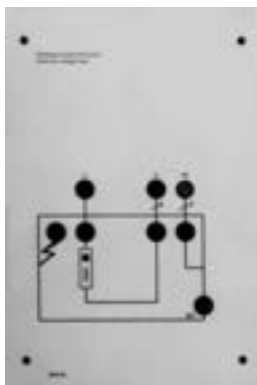


Load on conductive standing surface

Power resistor 1,2 k Ω
Z-diode for DC

Dimensions
(WxHxD) 195x297x110 mm
Weight approx. 1,1 kg

Order-No. W2812-2K



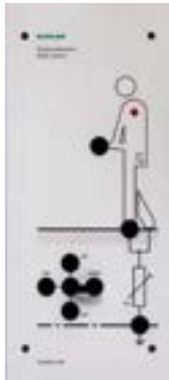
Extra-low voltage load

Power resistor 1,2 k Ω

Dimensions
(WxHxD) 195x297x110 mm
Weight approx. 0,9 kg

Order-No. W2812-2L

➤ **Assembly kit with experimental panels**



Body resistor

simulation of resistance of man, with adjustable contact resistance

Dimensions (WxHxD) 130x297x180 mm
Weight approx. 0,9 kg

Order-No. W2812-2M



Test resistor

Resistors 22 Ω to 22 kΩ

Dimensions (WxHxD) 130x297x110 mm
Weight approx. 0,7 kg

Order-No. W2812-2N



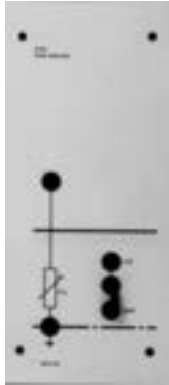
System earth

Loop resistance 2 Ω

Dimensions (WxHxD) 130x297x65 mm
Weight approx. 0,5 kg

Order-No. W2812-2P

➤ Assembly kit with experimental panels



Earth electrode

Contact resistor
1 Ω to 1,4 Ω

Dimensions
(WxHxD) 130x297x110 mm
Weight approx. 0,7 kg

Order-No. W2812-2Q



Loop impedance measures

Resistor 5 Ω and 7 Ω

Dimensions
(WxHxD) 130x297x70 mm
Weight approx. 0,6 kg

Order-No. W2812-2R



Test of residual current device

Measurement of the tripping behaviour of a current-operated earth-leakage circuit-breaker

Dimensions
(WxHxD) 130x297x70 mm
Weight approx. 0,6 kg

Order-No. W2812-2S

➤ **Assembly kit with experimental panels**



Insulation measures

Measurements between L1 – PE
and N – PE with different
resistances

Dimensions
(WxHxD) 130x297x70 mm
Weight approx. 0,6 kg

Order-No. W2812-2T

**Further components,
(included in the kit)**

- 15 plug connectors 4-mm
- 15 safety-connecting leads 0.3 m
- 20 safety-connecting leads 0.5 m
- 10 safety-connecting leads 1 m

**Further components
(not included in the kit)**

- 2 multimeters
- 1 test instrument for protection schemes

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➤ Introduction

Our Radio- and Television Training Systems are especially designed for basic and advanced training in the field of television and radio engineering.

They allow to show and work on fundamental principles and operating behavior to be demonstrated and explained.

Realistic exercises show how to various faults can be pinpointed and rectified.

The models take the form of fully operational television and radio sets as well as antenna systems with high picture and sound quality, allowing them to be used for audio-visual training purposes as well. for example

A variety of further training systems are available, please contact us for information.

➤ **Hi-Fi AM/FM Radio Trainer**



Demonstration model for Hi-fi AM/FM radio and amplifier engineering

The following functional groups are incorporated



Fault simulator

The radio trainer is a portable training unit in a case with convertible cover. All stages are shown on the front panel as detailed block diagrams. Circuit diagram, waveforms and voltages at the 2mm test points are printed on the front plate. All circuits are protected against short circuits to avoid damages of the circuits. Built in AM and FM tuner with stereo decoder and integrated loudspeakers. Also a sinewave generator and a plug in field for the included AM/FM Transmitter is built in. Under a lockable cover 15 typically faults for trouble shooting can be simulated by microswitches.

Technical Data:

Technical data:
 AM (540-1600 kHz)
 FM (88-108 MHz)
 PLL Demodulator
 Mono/Stereo switch
 Potentiometers for volume, treble, bass and balance
 2 x 5 watts output power

Power connection: 230 V, 50 to 60 Hz
 Dimensions (W x D x H): 400 x 290 x 100mm
 Total weight approx. 3,8 kg

Order-No. W5405-2A

➤ Satellite Aerial Trainer



General description

The satellite aerial receiver is a demonstration model which covers the following ranges of the analogue satellite technique by example of a so called "two eye" unit

- Reception of 2 satellites
- Individual aerial single and multiple reception
- Central aerial single and multiple reception
- SAT-TV channel processing (digital)
- SAT-IF distribution
- External signal infeed of monitoring camera or VCR
- Decoder terminal use
- additional infeed of terrestrial aerial frequencies

Technical Description

The demonstration board is built in a stabile steel case with a surface area of 1000x700 mm. The imprinted connection diagram facilitates the mapping.

The following components are integrated:

- 1 SAT-ZF Multiswitch with 5 inputs and 4 outputs
- 1 digital processing unit für 2 free configurable channels
- 1 Universal-LNC
- 1 SAT-ZF test pattern generator
- 1 Twin-Receiver

Order-No. W5401-2B

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Refrigeration and Air-Conditioning

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➤ Introduction



This new developed experimental station for refrigeration and air-conditioning training permits refrigeration and air-conditioning tests to be conducted in the normal cooling, air-conditioning and deep-freeze ranges, the electrical circuits to be set up, and measurements to be taken.

A test group should comprise not more than 2-3 trainees for each experimental station.

Experimental panels

The experimental panels consist of plastic sheets with etched symbols, on which the respective equipment is attached on the front side. The devices are equipped with quick-connectors for connection of the refrigerant lines.

The Electrical connection occurs over 4-mm safety terminals. In order to ensure secure fastening, e.g. when handling the connection lines.

Dimensions of the panels (H x W): 297x130mm or wider by a whole number multiple of 65mm.

➤ Experimental Station Refrigeration and Air-Conditioning



➤ Design

The „Refrigeration and Air-Conditioning“ experimental station consists basically of a lab bench with back upright section, power supply and evaporator frame, and a trolley for the condensing unit. The tests are conducted by using experimental panels. The experimental panels can quickly be clamped by setting the upper sectional rail and fixing this rail with thumb bolts.

They are interconnected by refrigerant-resistant flexible lines, the electrical connection being made by highly flexible leads with 4mm safety plugs. The experimental station is available with a basic set of experimental panels and devices, as well as an additional extension set.

The basic equipment allows technical refrigeration instruction which is oriented on the required level of training. By means of the additional equipment, more complex experiments can be performed for advanced training.

Experimental place with power supply and evaporator frame

Order No.W2700-3A

Possible measurements and analyses:

- Different refrigerant flow rates
- power consumption
- capacity measurements
- pressure drop rate in regulators and refrigerant conducting pipes
- variable heat fluxes on the evaporator and condenser
- net refrigeration capacity
- heat equivalent
- compressor capacity and liquefaction pressure
- operational overheating on thermostatic butterfly valves
- over or undercharging with refrigerant plant
- fault analysis during installation and commissioning
- setting of all switchgear and regulators
- pressure and temperature measurements
- start-up problems of compressor motors and their elimination
- damage to compressors due to superheated refrigerant.

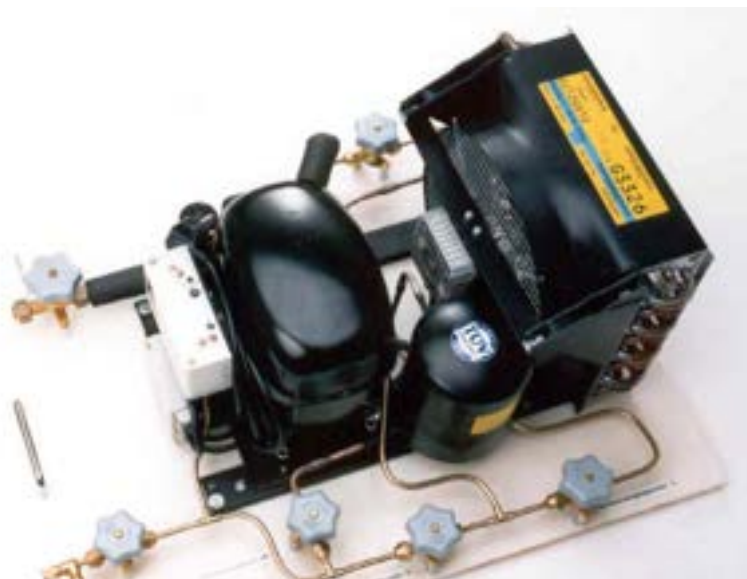
➤ Experimental Station Refrigeration and Air-Conditioning

Experimental place with power supply and evaporator frame

Order No. W2700-3A

Consisting of:

<p>1 Experimental bench W: 1800 D: 900 H: 780 mm</p> <p>1 Lower cabinet for mobile use 3 drawers and central lock W: 420 D: 555 H: 545 mm</p> <p>1 Trolley for the bench-type compressor and condensing unit. W:900 D: 600 H: 780 mm</p> <p>1 Lower cabinet with 2 drawers for fitting under the trolley.</p> <p>3 Organisation modules for drawers</p> <p>1 Back upright for accommodating 3 power supply panels W: 1800 D: 320 H: 155 mm</p>	<p>1 Power supply panel for 1-ph. connection, with key-operated switch, and 16 A circuit-breaker, indicator light, 2 SCHUKO socket, outlets and 3 laboratory terminals. With 25 A current- operated e.l.c.b, sensitivity= 30mA</p> <p>1 Power supply panel with 1 „emergency off“ pushbutton 1 „ON“ switch with illuminated rocker 4 SCHUKO socket outlets</p> <p>1 Power supply panel with 3 SCHUKO sockets without power connection 1 distribution board with 15 safety sockets 1 switch with illuminated rocker 3 safety sockets with line voltage</p>	<p>1 Flat evaporator with two fans, built in in a case for mounting on the top of the back upright design like the experimental place. with additional cold insulation, transparent frontpanel adjustable in height, and two injection facilities. W: 490 D: 320 H: 530 mm</p> <p>1 Experimental frame 2 tiers The experimental modules can quickly clamped by setting the upper section rail and fixing this rail with thumb bolts. W: 1220 D: 250 H: 720 mm</p>
--	---	---



Compressor and condensing unit

mounted on portable base, consisting of:

Compressor, condenser, refrigerant receiver and butterfly valves.

Electrical connection via SCHUKO sockets.

For refrigerant R 22

Order No. W7301-1A

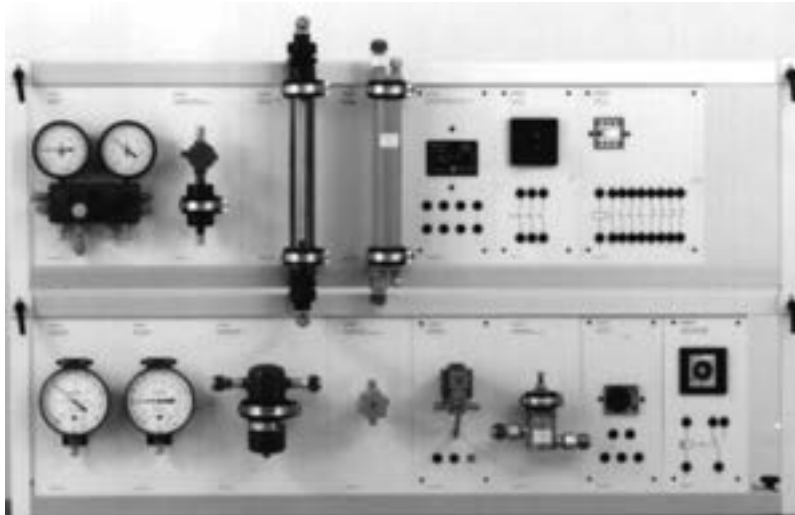
Like W7301-1B, but
for refrigerant R 134 a

Order No. W7301-1B

➤ Basic Set Refrigeration and Air-Conditioning

Basic Set Refrigeration and Air-Conditioning

Order No. W7301-0A



For conducting the following experiments in the normal cooling range, air-conditioning range and deep-freeze range:

- Simple refrigeration cycle with manually operated control valve (3 experiments)
- Simple refrigeration cycle with capillary tube feed (6 experiments)
- Simple refrigeration cycle with automatic control valve (6 experiments)
- Simple refrigeration cycle with thermostatic control valve (6 experiments)
- Simple refrigeration cycle controlled by evaporator and/or room thermostat (6 experiments)
- Simple refrigeration cycle with variable refrigerant compounds and pressure drops (1 experiment)
- Simple refrigeration cycle - start-up and fault-finding (1 experiment)

➤ Basic Set Refrigeration and Air-Conditioning

Basic Set Refrigeration and Air-Conditioning

Order No. W7301-0A

The basic set is consisting of the following equipment

Experimental Panels	Quantity	Order number
Inspection glass with filter drier	1	W7301-2A
Mass flowmeter	1	W7301-2B
Refrigeration manometer (pressure gauge)	1	W7301-2C
Refrigeration manometer (Suction gauge)	1	W7301-2D
Valve set 80 mm	1	W7301-2E
Superheater	1	W7301-2F
Flow restrictor	1	W7301-2G
Automatic flow restrictor	1	W7301-2H
ON/OFF switch, 3pole	1	W3313-4A
Electrical control unit, -5 to +25° C including sensor	1	W7301-2J
Electronic control unit, -25 to +5° C including sensor	1	W7301-2K
Extensive instruction manuel	1	W3011-1A

Accessories for basic set consisting of:	Order No.: W7301-8A	
Capillaries, matched to condensing unit	2	
Substitute filter drier	3	
Refrigeration-resistant flexible lines, length 915mm, 5/8" dia	4	
Refrigeration-resistant flexible lines, length 1800mm, 5/8" dia.	2	
Refrigeration-resistant flexible lines, length 915mm, 7/16" dia.	6	
Refrigeration-resistant flexible lines, length 1800mm, 7/16" dia	2	
Gaskets, 7/16"	20	
Gaskets, 5/8"	20	
Sundries jointing pieces etc.		
Safety connecting leads, highly flexible, with plug 4mm, length 0.5m, black.	20	
dito, length 1.0m, black	20	
dito, length 1.5m, black	5	
dito, length 1.0m, blue	5	
dito, length 1.0m, green-yellow	5	

➤ Extension Set Refrigeration and Air-Conditioning

Extension Set Refrigeration and Air-Conditioning

Order No. W7302-0A

For conducting the following experiments in conjunction with the basic set

- extended refrigeration cycles with constant evaporator-pressure regulators (3 experiments)
- extended refrigeration cycles with suction pressure regulator (2 experiments)
- extended refrigeration cycle with start-up relief (3 experiments)
- extended refrigeration cycle with hot-gas bypass regulator (3 experiments)
- extended refrigeration cycle with liquid trap (1 experiment)
- extended refrigeration cycle with temperature regulator (3 experiments)
- extended refrigeration cycle with electric evaporator defrosting (3 experiments)
- extended refrigeration cycle with periodic defrosting of evaporator (3 experiments)
- extended refrigeration cycle with four-way reversing valve (1 experiment)
- extended refrigeration cycle with hot-gas bypass regulation and injection valve (1 experiment)

Extension Set Refrigeration and Air-Conditioning

Order No. W7302-0A

The extension set is consisting of the following equipment

Experimental panels	Quantity	Order number
Manual-operated through valve 6mm	1	W7302-2A
Temperature regulator	1	W7302-2B
Evaporator pressure regulator	1	W7302-2C
Suction pressure regulator	1	W7302-2D
Hot-steam bypass (capacity regulator)	1	W7302-2E
4-way reversing valve	1	W7302-2F
Injection valve	1	W7302-2G
Moisture separator	1	W7302-2H
Defrosting time relay	1	W7302-2J
Electrical control unit -5 to + 25° C	1	W7302-2K
Solenoid valve 6 mm	2	W7302-2L
Time relay, 0,5 to 20s, delayed pickup	1	W3331-4A
3-pole contactor 16A, auxiliary switch with 2 make and 2 break contacts	1	W3321-4A
Auxiliary contactor 6A, 4 make and 4 break contacts	1	W3328-4A

➤ Set of Accessories

**Set of accessories for 1 to 5 work stations,
for refrigerant R 22****Order No. W7302-8A****Consisting of:**

Description	Quantity	
Mobile charging station	1	
Extaction valve	1	
Vacuum meter	1	
Electronic temperature meter	1	
Acid tester	1	
Liquid for testing proposes	1	
Recording manometer, -1 to 24 bar, complete with measuring disc	1	
Electronic leakage detector unit	1	
Refrigerant cylinder with 14kg refrigerant R 22	1	

**Set of accessories for 1 to 5 work stations,
for refrigerant R 134 a****Order No. W7302-8B****Consisting of:**

Description	Quantity	
Mobile charging station	1	
Extaction valve	1	
Vacuum meter	1	
Electronic temperature meter	1	
Acid tester	1	
Liquid for testing proposes	1	
Recording manometer, -1 to 24 bar, complete with measuring disc	1	
Electronic leakage detector unit	1	
Refrigerant cylinder with 14kg refrigerant R 134 a	1	

➤ Measuring Instruments

For conducting the tests the following measuring instruments are also necessary:



Profi-Digital-Multimeter with USB, 3 3/4-digit

This digital multimeter has autorange and manual range options and dual-display, with maximum reading 3999 displayed in 40 analogue bars inscale making the measured value to be seen clearly and indicating the trend of changing quickly. In addition to the conventional measuring functions, there is new breakthrough in frequency test with maximum range of 400 MHz. Optical standard serial port is equipped with this meter for easy connection with computer to realize macro recording and monitoring and capture of transient dynamic data, displaying change of waveform during the measurement, providing data and evidence to engineering technicians for scientific research. A highly applied digital multimeter of high performance with full input protection and display backlight. The basic functions can be selected by push button keys easily and automatic range selection for DCV-, ACV-, DCA-, ACA-, ohm-, diode-, continuity-, capacitance-, frequency- and temperature measuring-function.

- 40 segment analogue bargraph display
- Auto power off, low battery display
- Data hold and max/min mode
- Relative function
- Diode test
- Backlight
- Safety: EN 61010-1; CAT III 1000 V; CAT IV 600 V

Accessories: test leads, test clips, type K temperature probe, battery, USB-interface cable, software for Windows 95/98/2000/XP/NT/Vista/7 and manual.

- DCV: 400 mV/4/40/400/1000 V \pm 0,8 % + 1 dgt.; 100 μ V
- ACV: 4/40/400/700 V \pm 1,0 % + 5 dgt.; 1 mV
- DCA: 400 μ A/4/40/400mA/10 A \pm 1 % + 2 dgt.; 100 μ A
- ACA: 400 μ A/4/40/400mA/ 10 A; \pm 1,5 % + 5 dgt.; 100 μ A
- Ohm: 400 Ω /4/40/400 k Ω / 4/40 MO; \pm 1,0 % + 2 dgt.; 0,1 Ω
- Cap.: 4/40/400nF/4/40/ 400 μ F/4/40 mF; \pm 4 % + 3 dgt.; 1 pF
- Freq.: 4/40/400 kHz/4/40/ 400 MHz; \pm 0,1 % + 3 dgt ; 1 Hz
- Temp.: -40°C ... +1000°C \pm 1 % + 3 dgt.; 1°C

Battery: 9 V-Battery

Dimensions (W x H x D): 100 x 210 x 45 mm

Weight: 330 g

Order No. P3315 USB

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➤ Introduction

Photovoltaics - a Regenerative Energy source

Generally speaking, photovoltaics is the conversion of sunlight into electric power by means of photovoltaic cells.

By connecting photovoltaic cells in series, and parallel, various voltages or currents can be reached, as with batteries.

Photovoltaics – the elegant way to convert solar energy into power.

The enormous efforts of our economy in the field of photovoltaic cell development has resulted in remarkable progress in the past 30 years so that nowadays photovoltaic cells with an efficiency of 20% can be produced.

Characteristic features

- Simplicity of systems
- Almost maintenance-free, therefore low service costs
- Non-polluting
- Large range of application, from the milliwatt range up to the megawatt range

Fields of application

- Miniature generators for watches and pocket calculators
- Power supply for house and camping
- Traffic engineering (solarmobiles, ticket machines, emergency telephones)
- Power supply for isolated farms or for irrigation systems
- Interconnected power plants
- Protective equipment (overvoltage, charge and anti-discharge protectors)
- Battery (buffer store)
- Loads (pumps, fans, decentralized controlling and monitoring equipment, etc.)

All system components are to be coordinated so that the electric power generated can be converted, stored and consumed best.

The typical behavior (I/U characteristic) of the photovoltaic generator is to be taken into account here in order to take advantage of the optimum operating point, i.e. to work with the best efficiency possible.

As all other fields of modern technology in photovoltaics, too, practice-oriented training that corresponds to the state of the art shall be provided for future specialists.

The WUEKRO Photovoltaic training and didactic system on photovoltaics which is available as

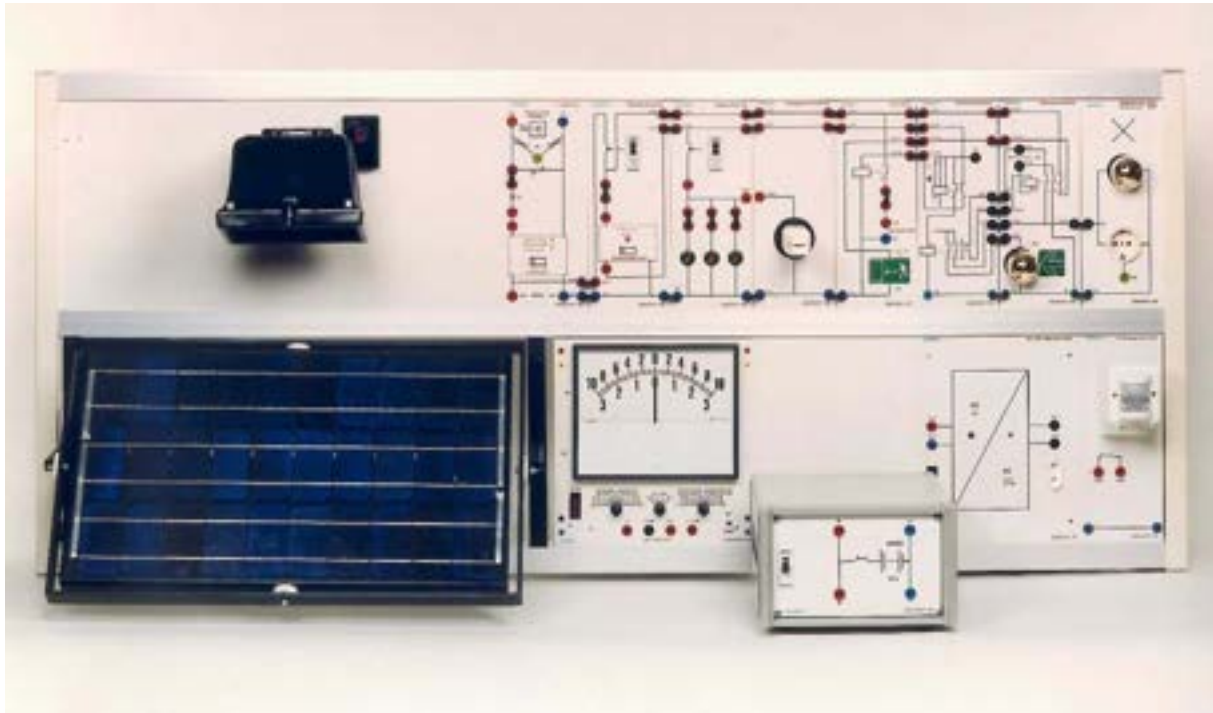
- Compact experimental panel
- Experimental box system and
- Experimental panel system meets these requirements.

Setup of photovoltaic systems

Solar modules can supply directly to the load. This direct coupling, however, is rarely used due to high losses of efficiency and because of strongly varying power output. The following basic setup provides independence of the varying solar irradiation for the load:

- Photovoltaic generator (consists of one or more modules)
- Charge regulator

➤ Training Equipment



Photovoltaic Lab bench and Standby Power Supply

Instruction and experimenting systems for setting up a photovoltaic power system in isolated operation.

The modular construction with equipment used in practice is especially suited for the practice-oriented training of the future.

As a training project this instruction system permits the setup of a complete power system for general and emergency lighting.

Not only the fundamentals in photovoltaic cell technology but also the project-oriented application of basic electrotechnical knowledge together with practice-oriented special knowledge of power engineering, measuring and lighting technology are trained.

➤ Experimental Panels

The experimental panels consists of white colored plastic, they are 297mm high and can be hung on DIN A4 rack. The experimental panels possess covers on the back for preventing that live parts are touched.

Mimic diagrams, device symbols and captions are attached to the panel fronts according to standards and in a durable form enabling easy transition from technical drawing to the setup of circuits.

The panels are fitted with 4-mm safety lab sockets and designed for 12 V DC and 230 V AC range.

The experimental panel system, like the box system, has the didactic advantage that only devices currently needed are applied.

The experimental panels are equally suited for demonstration in theoretical courses as for practical training experiments.

As ELCB-protected plugs are mainly used for the interconnection of the panels, the students have a "clear view" on the experiment panels

The following experiments can be performed with the experimental panel system

Measurements at the solar module

- With different illuminance values
- With different angles of incidence
- With cold and heated module
- With covered module
- Calculation of internal resistance of the solar panel as source of charge
- Characteristic curves of photovoltaic cells

Measuring technology

- Calculation of isolated systems
- Application of rms measuring instruments and oscilloscopes, measurement of voltage, current, frequency and periods
- Calculation of the loop resistance for battery systems with longer leads
- Intrinsic of consumption
- Current and voltage measurement during loading of the battery and when connecting a load

Safety devices

- Overvoltage protector; how 12V loads can be protected against overvoltage
- Reverse voltage protection
- Meaning of discharging device at the module
- Functioning of charge regulator; monitoring of charge, overcharge, charge status
- Protection again discharge of battery by the solar panel, and protection against excessive discharge by the load
- Short-circuit devices of the system
- Practical applications in domestic electrical installation to VDE directives, calculation of distribution fuses and load MCBs
- Function of flat-battery protector and determination of cut-off voltage

Stand-by power supply

- Installation and setup of system and standby power supply for emergency lighting
- Switch-over to inverter operation in case of system trouble by means of a phase-failure relay

Inverter

- Range of application, efficiency and functioning of inverters, and the corresponding safety technology
- Phase-commutated inverters

Batteries

- Solar, lead acid, nickel-cadmium batteries
- Charge and discharge, self discharge, efficiency of batteries
- Interconnection of batteries

➤ Experimental Panels



Order-No. W5501-3A

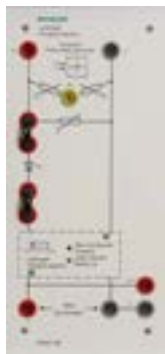
Photovoltaic Generator (Solar Module)

With mechanism for modifying the angle of incidence, azimuth and elevation angle, power 20 Wp, off-load voltage 18V, nominal voltage 14,5V, nominal current 1,4 A

Dimensions (H x W x D): 600 x 360 x 40 mm
Weight: approx. 5 kg

For demonstration and experiment purposes a 230V/500W tungsten-halogen reflector lamp is provided. The reflector lamp is mounted on a board and is fitted with power switch and power cable.

Dimensions (H x W x D): 297 x 226 x 300 mm
Weight: approx. 2 kg



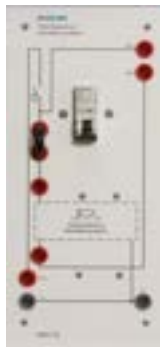
Charging Regulator

Integrated are: connector sockets for photovoltaic generator, overvoltage protector consisting of 3 VDR resistors, Schottky diode as anti-discharge protection, and charge regulator. Status display in the charge regulator by 3 LEDs.

By removing two jumpers current can be measured in front of and behind the anti-discharge diode.

Dimensions (H x W x D): 297 x 130x 60 mm
Weight: approx. 1 kg

Order-No. W5501-3B



Flat-Battery Protector

With B-type MCB as protection against overload and short circuit, jumper for current measurement, flat-battery protection for protecting the battery when the battery voltage drops below 10,8V.

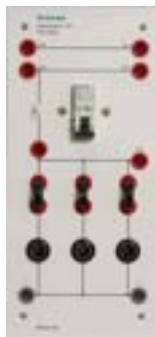
Dimensions (H x W x D): 297 x 130 x 100 mm
Weight: approx. 1 kg

Order-No. W5501-3C

12 V Loads

With B-type MCB (16 A) as protection for 12V loads, plus 3 standard automobile standard socket outlets, in front of which jumpers for current measurement are arranged.

Dimensions (H x W x D): 297 x 130 x 100 mm
Weight: approx. 1 kg



Order-No. W5501-3D

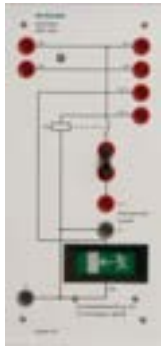
Energy-Saving Lamp

E 27 base, 12 VF, 10 W (Öko-Light®)
Dimensions (HxWxD): 297x130x60mm
Weight: approx. 0.8kg



Order-No. W5501-3E

➤ **Experimental Panel**



Start Relay

For inverter startup. With jumpers for current measurement as well as connector sockets for the inverter, 12V emergency lighting with escape route symbol.

Dimensions (H x W x D):
297 x 130 x 60 mm
Weight: approx. 1 kg

Order-No. W5501-3F

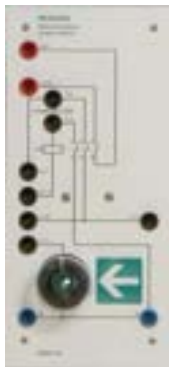


**230V General Lighting
230V Load**

with E 14 base including lamp (230V, 25W) for general lighting. With socket outlet for loads. The earthing contact must be separately provided by a safety socket, pickoff power 230V, 200 VA.

Dimensions (HxWxD):
297x130x60 mm
Weight: approx. 0,9kg

Order-No. W5501-3J



System Selector

With connector sockets for the inverter output voltage as well as contactor for system transfer of the inverter output voltage. With emergency lighting including escape route symbol, lamp with E 14 base, 230V, 15W.

Dimensions (H x W x D):
297 x 130 x 100mm
Weight: approx. 1,2 kg

Order-No. W5501-3H

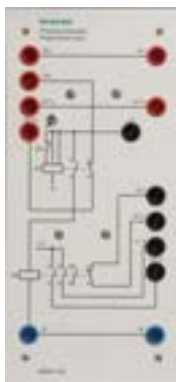


IR Motion Detector

Range 10 m, angular detection range 110°, current switched 10 A, time setting from 10 s to 10 min, NO contact, e.g. for energy saving lamp. Connection is implemented by 2 leads instead of the jumper between panel „12V Energy-Saving Lamp“, includes 3 connecting leads of 1m.

Dimensions (H x w x D):
297 x 130 x 60 mm
Weight: approx. 0,9 kg

Order-No. W5501-3L



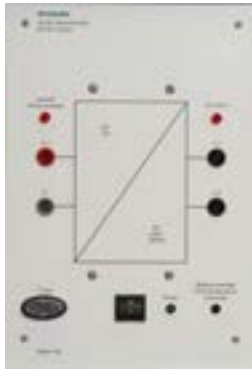
Phase-Failure Relay

Picks up on failure of phase 1. Phase failure can be simulated by a toggle switch. With contactor relay for controlling system transfer and further switching operations.

Dimensions (H x W x D):
297 x 130 x 100 mm
Weight: approx. 1,2 kg

Order-No. W5501-3G

➤ Experimental Panels



DC / AC Inverter

Input voltage 12 V, output voltage 230 V, frequency 50 Hz +/- 1 Hz, output power 200 VA. Overvoltage and undervoltage cut-off. Standby indication by green LED. The output voltage is indicated by a glow lamp.

Dimensions (H x w x D):
297 x 195 x 100 mm
Weight: approx. 3 kg

Order-No. W5501-3K

Wind-driven Generator with additional Charge Regulator

Upon request

Assembly Kit for Experimental Panels

Including solar module and one set of connecting leads as well as one set of experiment instructions with tasks and solutions.

Order-No. W5501-0C

The assembly kit consists of the following experimental panels:

- 1 W5501-3A
- 1 W5501-3B
- 1 W5501-3C
- 1 W5501-3D
- 1 W5501-3E
- 1 W5501-3F
- 1 W5501-3G
- 1 W5501-3H
- 1 W5501-3J
- 1 W5501-3K

Optionally, the IR motion detector, order-no. W5501-3L, is available

➤ **Accessories**



12 V / 24 Ah Solar Battery

In a sheet-steel enclosure, protected by 25 A B-type MCB, maintenance-free, no water, no acid.

The solar battery as most important component within the photovoltaic system should always be maintained at its full capacity.

If it is not possible to align the solar module on the sun to load the battery, the acquisition of a charging set is inevitable. When choosing a charging set make sure that the set is suited for loading this 12V/24 Ah lead-acid battery.

Dimensions (H x W x D):
160 x 260 x 300 mm
Weight: approx. 8 kg

Order-No. W5501-1B

Set of Connecting Leads for Experimental Box System

consisting of:
49 connecting leads with different colors and lengths and 4-mm ELCB-protected plugs;
1 safety adapter (from socket outlet with earthing contact to 4-mm safety sockets)

Order-No. W5501-1W

Set of Connecting Leads for Experimental Box System

consisting of:
10 connecting leads with different colors and lengths and 4-mm ELCB-protected plugs;
1 safety adapter (from socket outlet with earthing contact to 4-mm safety sockets)
35 4/mm ELCB/protected safety connector plugs

Order-No. W5501-3W

Perforated Mounting Panel for Experimental Box System

Mounting at the workplace is performed by simply hanging the boxes on the panel. 5 x 10 mm perforation, standing upright with a web of 3 mm, sheet thickness 1.5mm.

Dimensions
(HxW): 685x900mm

Order-No. W2760-3G

Set of Experimental Instructions Photovoltaic Cell Technology

consisting of task and solution section with the following contents:

- Measurements at solar module
- Measuring technology
- Safety devices
- Standby power supply
- Inverters
- Batteries

Order-No. W3028-7B

➤ **FAX – Reply to: +49 (0)9721 / 64691 - 20**

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Please send the following catalogues to the a.m. address!

- Fundamentals of electrical Engineering
 - Installation circuits
 - Bell ringing and entrance call stations
 - Contactor control / Control technology
 - Measurement and control of non-electrical variables
- Fundamentals of electronics
 - Analog technology
 - Digital technology
 - Microprocessing technology
- Closed loop control technology
 - Analog closed loop control
 - Digital closed loop control
- Automation engineering
 - SIMATIC S7-200/300/400, Software
 - Technology simulators / Models
 - Process control engineering PCS7
 - AS-Interface
 - Profibus DP
 - Process simulation-software SIMIT
 - LOGO!
 - Mechatronical technology stations
 - Courses on Automation
- Electrical machines / Drive controls
 - Electrical Machines 300W
 - Electrical Machines 1000W
 - Electrical Machines 5kW
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- VDE 0100 safety measures
- Radio- and Television engineering
 - AM/FM – Technology
 - TV Engineering
 -
 - Satellite – Technology
- Cooling and air conditioning
- Photovoltaic cell technology
- Communication technology
 - Modulation -/demodulation
 - Fiber optic
 - ISDN trainer (HICOM)
 - ISDN
- Measuring systems
- Power supply units
- Experiment instructions, manuals
- Training courses

Remarks:



Training & Didactic Systems

Communication Technology

Catalog

WA2E/16



➤ Our Services

- Development and production of didactic training systems
- Teachware and documentation
- Project engineering of complete lab's incl. furniture and lab equipment
- Quotations on customer's demand
- Installation, commissioning and training at site

➤ Our Customers

- Vocational training schools, technical schools, colleges and universities...
- Industrial laboratories for vocational education and higher education

➤ Fields of Technology

- Fundamentals of electrical engineering
- Fundamentals of electronics
- Closed loop control technology
- Automation engineering
- Electrical machines / drive control
- Power electronics
- Building management systems
- Protection schemes to VDE 0100
- Radio- and TV technology
- Air conditioning and refrigeration
- Photovoltaic
- Communication technology
- Measuring systems, power supplies, accessories
- Experimental manuals, documentation

For further information please contact:

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Phased-Locked-Loop (PLL)	16
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➤ Introduction

Discussions, letters, telephone calls and magazines, as well as radio- and television service – no day is without communications. The communications systems are more and more significant, beside the “normal” telephone conversation, the communications systems take care also for the fast growing services like BTX, Telefax, PC-networks, for application in the industry, administration and last but not least in the private sector.

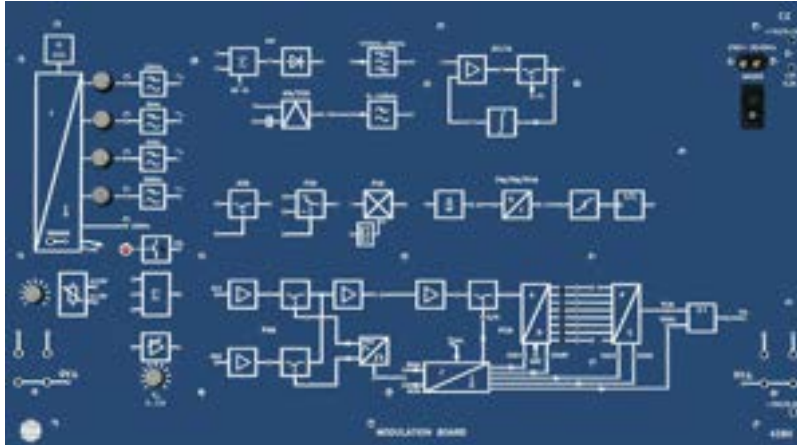
To teach and train this wide sector of technology efficiently, we offer a training system that meets the demands of the curricula as well as the demands of practice.

The training concept

The training concept is a determined concept in which the training sets, the teachware and the resp. training courses are offered. The training concept is of modular design, therefor the individual training aims can be integrated

➤ **Communications - Modulation**

Modulation Board



- All the important modulations on one Board
- Experiment setup time reduced to a minimum
- Built-in power supply (short-circuit-proof)
- Integrated clock generator with synchronised carrier and modulation frequencies to provide static oscilloscope images
- Expandable with the DEMODULATION BOARD

Modulation Board

The MODULATION BOARD offers a training and demonstration system for the major analog and digital modulation techniques.

The following modulation techniques can be studied

- Amplitude Modulation (AM)
- Single Sideband Modulation (SSB)
- Frequency Modulation (FM)
- Phase Modulation (PM)
- Pulse Amplitude Modulation (PAM)
- Pulse Code Modulation (PCM)
- Pulse Frequency Modulation (PFM)
- Pulse Phase Modulation (PPM)
- Delta Modulation (DM)
- Amplitude Shift Keying (ASK)
- Frequency Shift Keying (FSK)
- Phase Shift Keying (PSK)

Function groups (Section 1)

- Clock generator (quartzcontrolled) with frequency dividers for generating the carrier and modulation signals.
- The signals are therefore in synch and enable "frozen" images to be displayed with the oscilloscope. They can be tapped as squarewave and sinewave signals and can be altered in amplitude. The clock generator also supplies a trigger signal, switching signal for the delta modulator and a synchronised signal for the process control of the PCM modulator
- Signal button, for simple examination of the digital modulation techniques, with electronic debounce and optical indication by an LED
- DC voltage source, adjustable, for generating static, analog modulation signals
- Summer, for adding up to 3 signals
- Amplifier, variable gain, for matching external modulation signals such as from the microphone for example.

Function groups (Section 2)

- modulators with all the necessary measuring points

Application

The MODULATION BOARD can be converted into a portable training unit by simply screwing it into a Box (Type 4280.20)

All the experiments can be conducted directly in the Box. Dust-free storage and protection against transport damages are further advantages of the Box version.

➤ Communications - Modulation

Technical data

Mains connection	Signal button	Adapter field
Voltage 230V AC/115V AC (110V), 50/60 Hz,	With TTL output	Serves for adapting 4mm to 2mm connections and for plugging two adapters (BNC socket → two 4mm connectors)
50VA	Amplifier, variable gain Vu 0 ... 2.5	Board (4280)
DC voltage output (short-circuit-proof) +/-15V/0.15A ; +5V/0.2A, for conn- ecting external devices.	FM / PM / PFM fo = 20kHz fn = DC ... 3.4kHz	Dimensions (W x H x D) 532x297x90mm
Signal source	PAM/PCM	Weight approx. 3,6kg
Sinewave: Upp < 5V, f = 0.5/1/2/20kHz	Two channels AD converter; 8 bits with LED indicator.	Box (4280.20)
Squarewave: Up < 5V, f = 0.25/0.5/1/2/20kHz	Bits 2 ⁰ and 2 ⁷ can be switched off.	Dimensions (W x H x D) 580x450x155mm
Summer	Frame frequency: approx. 16kHz Sampling frequency: approx. 8kHz	Weight approx. 6,8kg
DC voltage	AM U _{in} pp ≥ 5V	
adjustable	Bandpass: 15 ... 25kHz	
0 ... approx. +/-2.5V	Low pass: 0 ... 20kHz	
0 ... approx. +/-1.5V		

Board [Order-No. W4280](#)

Box [Order-No. W4280.20](#)

Recommended Accessories

1 Set of connecting plugs and leads

Manual "Modulation Techniques / Modulators"

[Order-No. W4280.1](#)

[Order-No. WV0130](#)

Extensions

DEMODULATION BOARD

TRANSMITTERBOARD

RECEIVERBOARD

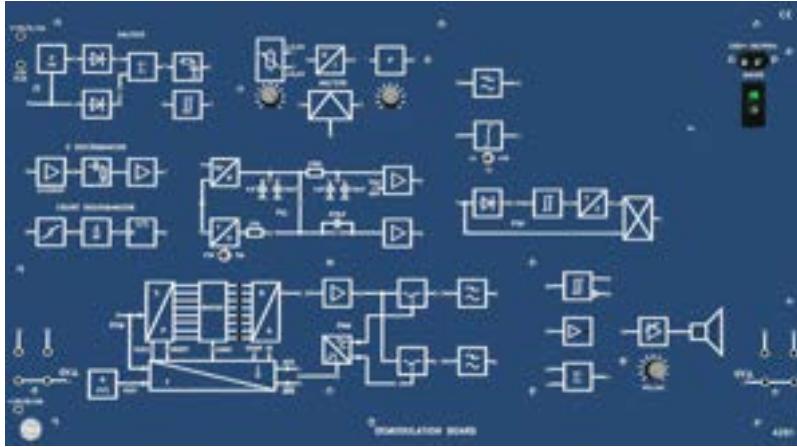
[Order-No. W4281](#)

[Order-No. W4282](#)

[Order-No. W4283](#)

➤ **Communications - Demodulation**

Demodulation Board



- All the important demodulators on one Board
- For extending the range of experiments in connection with the MODULATION BOARD (Type 4280)
- Reduces experiment setup times to a minimum
- Built-in power supply (short-circuit-proof)
- Additional output jacks for power supply to other units

Demodulation Board

The DEMODULATION BOARD offers a training and demonstration system for extending the range of experiments in connection with the MODULATION BOARD (WType 4280)
All output signals of the MODULATION BOARD can be demodulated with the DEMODULATION BOARD.

The following modulation modes can be demodulated

- AM / SSB Demodulation with envelope demodulator, coherent demodulation
- FM Demodulation with PLL, counting discriminator and C-discriminator
- PM Demodulation with FM demodulators and series circuited integrator
- PAM Demodulation with dual channel demultiplexer and series circuited low pass
- PCM PCM demodulator
- PFM Demodulation with low pass
- DM Demodulation with integrator
- PSK Demodulation with reference phase
- FSK Demodulation with PLL loop and Schmitt trigger
- ASK Demodulation with AM demodulators and low pass and series circuited Schmitt trigger

Furnishing

The DEMODULATION BOARD contains a built-in power supply unit for internal power supply and is therefore electrically isolated from the MODULATION BOARD.

+/-15 V and +5 V can be tapped off at 4 mm jacks for supplying power to additionally connectable transmission paths and sources of interference between the modulator and the demodulator.

An audio frequency amplifier with loudspeaker is integrated in the Board for acoustic checking of the demodulated signals.

To conduct the experiments, the DEMODULATION BOARD is placed on a table or suspended in experimental frame for demonstration purposes.

Additionally the DEMODULATION BOARD can be converted into a portable training unit by simply screwing it into a box (Type W4280.20)

All the experiments can be conducted directly in the box. Dust free storage and protection against transport damages are further advantages of the box version.

➤ Communications - Demodulation

Technical data

Mains connection

230/115V AC;
50/60Hz 50VA

DC voltage output (short-circuit-proof)
for connecting external devices

+/-15V/0,15A;
+5V/0,2A

AM/ASK

- Envelope demodulator
- Half-wave and full-wave rectifiers, switchable, with additional RC wiring.
- A low pass can also be used alternatively to the RC wiring.
- Recovery of the digital input signals by Schmitt-trigger

AM / SSB/PSK

- Coherent demodulation by multiplier
- Generator for carrier generation, adjustable frequency
- Phase shifter, adjustable

FM/PM/FSK

- Counting discriminator
- C-discriminator with constant voltage source

PAM/PCM

- Two channels
- DA converter, 8 bits with LED display
- Buffer memory
- Frame frequency: approx. 16 kHz
- Sampling frequency of the PAM: approx. 8 kHz, can be replugged to 4 kHz to prove the sampling theorem.

The control signal for the demultiplexer can be inverted; this makes it possible to switch over the two channels.

PLL

- For demodulation of the FM and FSK

Integrator

For phase modulation (PM) and delta modulation (DM)

Schmitt-Trigger

- For recovery of the digital signals in ASK, FSK and PSK

Low Pass Filter

- Band width: $f_g = 3,4\text{kHz}$
- Summer, for adding up 2 signals
- Loudspeaker, volume adjustable; connectable with 2-mm plugs

Dimensions

Board (4281)
(W x H x D) 532x297x90mm
Weight approx. 3,6kg

Box (4281 + 4281.20)
(W x H x D) 580x450x155mm
Weight approx. 6,8kg

Board [Order-No. W4281](#)

Box [Order-No. W4280.20](#)

Recommended Accessories

1 Set of connecting plugs and leads

Manual "Modulation Techniques / Modulators"

Extension

MODULATION BOARD

TRANSMITTER BOARD

RECEIVER BOARD

[Order-No. W4280.1](#)

[Order-No. WV0130](#)

[Order-No. W4280](#)

[Order-No. W4282](#)

[Order-No. W4283](#)

➤ **Communications – Transmission Technology**

General

Universal training system for the transmission of signals with optical fibres, infrared link or connection line.

Can be used with the MODULATION BOARD and the DEMODULATION BOARD

Also very suitable to perform experiments with usual commercial generators and measuring instruments. With analog and digital channel suitable for all fundamental experiments of the fibre optics technology.

With two built-in transmit diodes of different wavelengths.

Two amplifiers and different terminating resistors allow experiments with coaxial lines.

Can be extended with an Optical Bench and with the COAXIAL BOARD

The following experiments can be performed

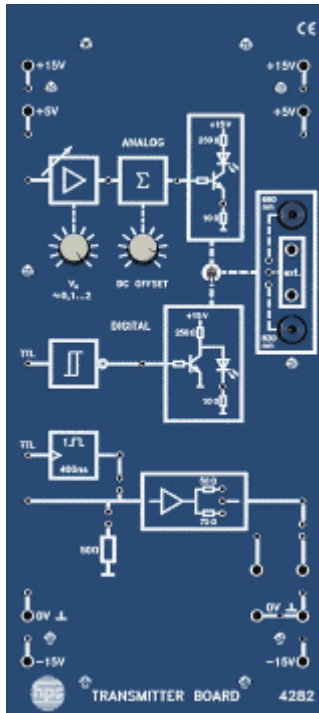
- Difference in transmission of signals between optical fibres, infrared link or connection line
- Setting of the operating point to transmit diodes
- Characteristics of transmit diodes
- Attenuation measuring of optical fibres of different length

- Sensibility to interference of different transmission links
- Transmission of TTL signals through optical fibres

Additional Experiments

- with the optical bench
- infrared transmission
- Transmission with lines, e.g. with the COAXIAL BOARD

Transmitter Board



- Analog amplifier for fibre optic transmission, with adjustable gain and setting of the operation point
- TTL-channel with Schmitt trigger and matching circuit for the transmit diode
- 1 transmit diode red (660nm)
- 1 Sendediode, infrared (820nm)
- Transmission field for additional transmit diode
- Line driver with different, additional connectable resistors

Technical data

Fibre optic transmission

- 1 LED: 660 nm, red
- 1 LED: 820 nm, infrared
- External LED: pluggable (e.g. infrared-plug-in module for wireless transmission)

Analog transmission

- amplifier vu 0,1...2
- DC-offset adjustable with potentiometer
- Frequency range approx. 0...80kHz

Digital transmission

- TTL-input; Schmitt trigger; matching circuit for transmit diode
- transmission rate: max. 200kHz

Amplifier

- input resistor: 75Ω, connectable with 2mm plug
- output resistor: 37,5/50/75/150Ω, connectable with 2-mm plug
- Frequency range: 5MHz
- Operating voltage: ± 15V, + 5V

Dimensions

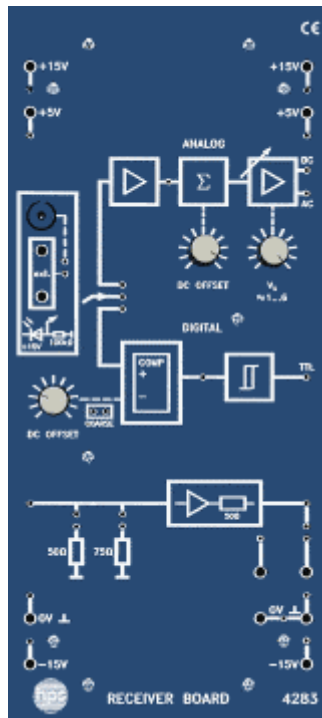
(W x H x D) 133x297x110mm

Weight approx. 0,7kg

Order-No..W4282

➤ Communications – Transmission Technology

Receiver Board



- Fibre optic receive diode, fixed
- Reception field for additional receive diode
- Analog amplifier, DC offset and gain adjustable
- TTL-channel, composed of a comparator with adjustable operating threshold and subsequent Schmitt trigger
- Amplifier with additionally connectable input resistors

Technical data

Fibre optic transmission

- receive diode: SFH 202, fixed
- external receive diode: pluggable (e.g. for wireless transmission)

Analog transmission

- DC-offset: adjustable with potentiometer
- amplifier $v_U = \text{approx. } 1 \dots 6$
- Frequency range: 0 ... 80kHz

Digital transmission

- Comparator and Schmitt trigger with TTL-output
- transmission rate max. 200kHz

Amplifier

- input resistor: 37,5/50/75/150 Ω , connectable with 2mm plug
- output resistor 75 Ω
- frequency range approx. 0... 5MHz
- Operating voltage: $\pm 15V, + 5V$

Dimensions

(W x H x D) 133x297x110mm

Weight approx. 0,7kg

Order-No. W4283

Necessary Accessories (not included in scope of supply)

IR-Transmitter Module



Order-No. W4282.4

IR-Receiving Module



Order-No. W4283.4

1 Set Connecting plugs and leads

Order-No. W4280.1

Manual "Modulation Technique / Demodulators"

Extensions

MODULATION BOARD

DEMODULATIONSBOARD

RECEIVERBOARD

Order-No. WV0131

Order-No. W4280

Order-No. W4281

Order-No. W4283

➤ **Communication – Fibre Optics Technology**

General

The Fibre Optics Training System offers a comprehensive program for conducting experiments in the field of opto-electronic communications. The training systems is suitable for both demonstrations and practical experiments.

- For plastic and glass fibres
- With built-in transmit diodes of different wavelengths
- Characteristic recording and attenuation measurement also possible with DC voltage
- Coupling attenuations can be simulated directly on the Optical Bench
- Additional experiments with laser diode

Essential components of the Fibre Optics Training system:

- Fibre Optic Transmitter board with integrated transmit diodes
- Fibre Optics Receiver Board with integrated receive diodes
- Optical Fibres plastic and glass fibres
- Laser with accessories
- Optical Bench
- Storage of transmission and receiving modules

A variety of types of Optic Fibres to be connected to the transmitter and receiver are available as transmission media.

The system therefore offers the possibility of various Optic Fibres and thus setting up a variety of fibre optic transmission lines to investigate the influence of the individual transmission parameters in experiments.

A laser diode makes it possible to compare the performance characteristics of such diodes with those of conventional luminescent diodes.

The system can be extended with an Optical Bench.

The Optical Bench makes it possible to show the particular connecting problems in the field of fibre optic technique in the experiments.

Moreover the Optical Bench is used for experiments with the laser diode.

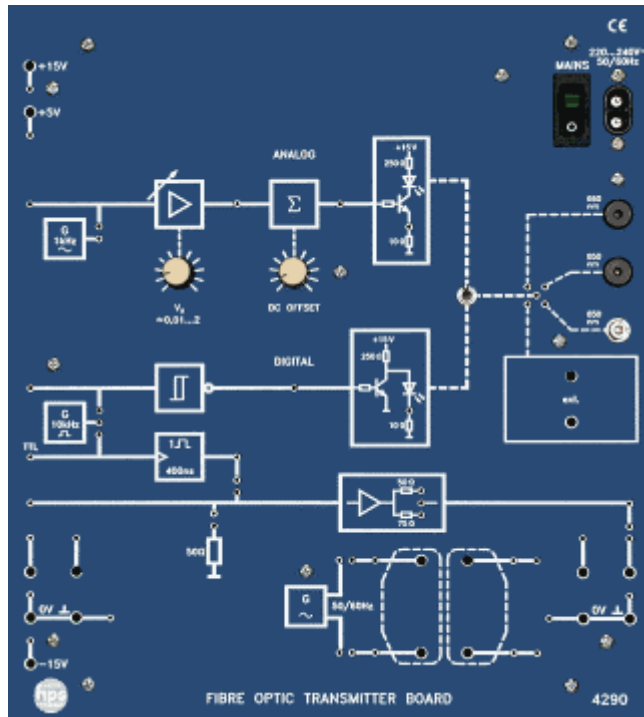
The training system and the accompanying experiment manual "Fibre optics" (WV 0134) have been designed to impressively demonstrate the advantage of this technique over conventional transmission media

Subjects dealt with the experiments section of the experimental manual

- Experiments on fibre optics with plastic fibre
- Characteristics of transmit diodes
- Attenuation of plastic fibres and connectors
- Transmission of TTL signals
- Immunity of interference of the optical fibre
- Measurement of propagation time
- Experiments in fibre optics with laser diode
- Fibre optic experiments with glass fibres

➤ Communication – Fibre Optics Technology

Fibre Optic Transmitter Board



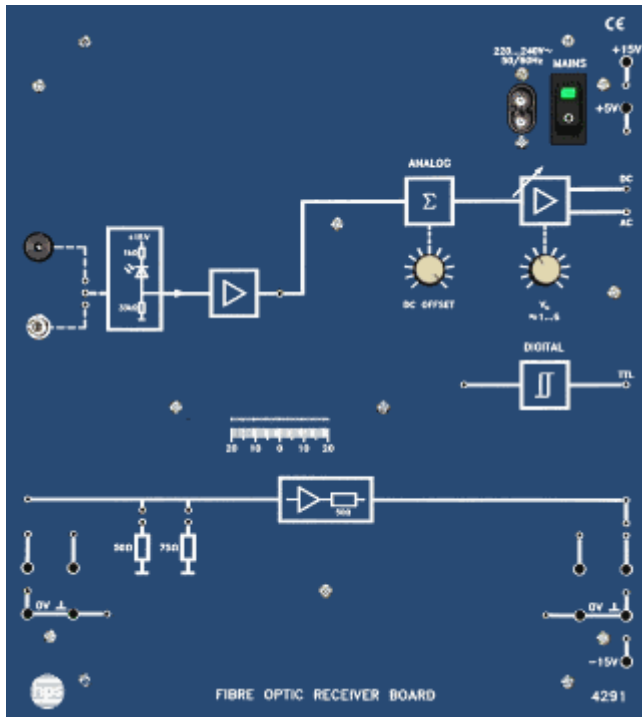
Technical data

Mains connection	230V AC; 50...60Hz;20VA
Inputs (via 2mm jacks)	1 analog/ 1 digital
Optical outputs	660nm / 850nm (plastic fibre) 850nm (glass fibre, ST-standard)
Electrical output (via 2mm jacks)	With preceding driver circuit for connecting a two-wire line or coaxial cable for comparative measurements on fibre optic transmission path. Output impedance: 50Ω / 75Ω
Function groups	Sinewave generator: $f = 1\text{kHz}$, $U_{pp} = 3\text{V}$ Squarewave generator: $f = 10\text{kHz}$ (TTL) Pulse generator: impulse duration 400ns Patch field and power supply for plug-in transformer to simulate interferences Patch field for Laser Modul
Accessories	1 mains lead
Dimensions (W x H x D)	266x297x110mm
Weight approx.:	1,9kg

Order-No. W4290

➤ **Communication – Fibre Optics Technology**

Fibre Optic Receiver Board



Technical data

Mains connection	230V AC; 50...60Hz;10VA
Optical input	Plastic fibre / Glass fibre
Electrical input (2mm jacks)	For connecting a two-wire line or coaxial cable for comparative measurements Input impedance: 50Ω / 75Ω
Output amplifier	Voltage gain:1...6 (adjustable) DC offset: +0,5V -5,5V (adjustable)
Outputs (2mm jacks)	DC: $V_{out} = 0...±8V$ AC: $V_{out pp} = 0...16V$ TTL: with Schmitt-Trigger; fan-out =10
Adjustable fibre coupler	For simulation of attenuation
Accessories	1 mains lead
Dimensions (W x H x D)	266x297x110mm
Weight approx.	2,0kg

Order-No. W4291

➤ Communication – Fibre Optics Technology

Lasermodul



The Laser Module can be plugged into the patch field of the Fibre Optic Transmitter Board. It is used in conjunction with the plastic fibre.

With the integrated monitor diode it is possible to measure the transmitted light. The wave length of the laser diode is 670nm

In combination with the plastic fibres reflector measurements are possible.

Housing dimensions: 57x38x35mm (WxDxH)

Weight 50g

Order-No. W4290.70

Optical Bench



The Optical Bench is used to simulate faults that can occur on fibre optic links or at fibre optic connections and which lead to increased attenuation: inter-face gap, lateral offset, angular offset.

It is suitable for accepting optical fibres with a diameter of approx. 1mm

The experiments with the laser likewise done in combination with the Optical Bench.

For this, the laser will be mounted on the rotation part of the Optical Bench.

Dimensions: 266 x 297 x 130 mm (WxHxD)

Weight approx: 1,8 kg

Order-No. W4185

Necessary Accessories (not included in scope of supply)

Set of Accessories consisting of:

- Plastic fibres: 20m, 5m und 0,5m
- Glass fibres: 20m und 1m
- Optical coupling for glass fibres
- Connecting plugs, 2mm (12 pieces)
- Coils: N = 900 and N = 100
- Tape-wound core (pair)
- Connecting lines, 2mm (8 pieces)

Order-No. W4290.1

Necessary Accesories

Manual "Fibre optic Technology"

Optical Powermeter

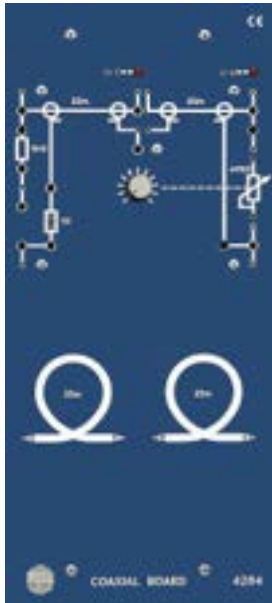
Multimeter

Oszilloscop 20MHz

Order-No. WV0134

Order-No. W4190

➤ **Communication – Coaxial - Board**



- Training Board for experiments with a screened line
- Line length 50m, divided in 2x25m
- With incorporated LEDs for demonstration of standing waves in a line
- Incorporated terminating resistor, adjustable
- Several COAXIAL BOARD's can be connected one after the other to simulate longer lines

General

The COAXIAL BOARD offers a screened line which allows to impressively prove all regularities of electric lines in experiments in the following fields:

- Communications technology
- Transmission technology
- Electric energy transmission
- Data transmission

The following experiments can be performed

- Evaluation of the electric data of a line
- Attenuation characteristic of a line
- Frequency dependence of a line
- Input resistance of a line (no-load, short-circuit, matched)
- Transit times and phase displacements on a line
- Standing waves on a line
- Transmission behaviour of a line
- Error detection
- Pulse behaviour (transit time, reflection)

Technical data

- Length of the coaxial line: 50 m, divided in 2 x 25 m
- Inductance: 0.4 µH/m
- Capacity: 100 pF/m
- Resistance: 300 Ω/km +/-60 Ω
- Characteristic impedance: 50 Ω +/- 2 Ω
- Terminating resistor: 0 ... 470 Ω, continuously adjustable
- Shunt: 1 Ω, for current measuring
- 2 LEDs to verify standing waves
- 1 kΩ dropping resistor for simulation of mismatches

Dimensions : 133 x 297 x 110 mm
(W x H x D)

Weight: 1.25 kg

Order-No. W4284

Necessary Accessories (not included in scope of supply)

Experiment manual: „Experiments with Screened Lines“

Connecting plugs and leads

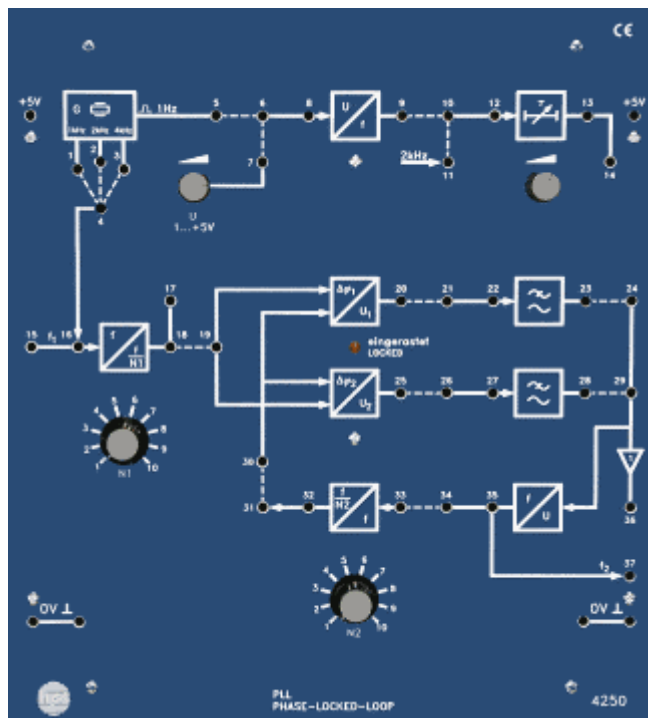
Oscilloscope 20 MHz

Function generator

Multimeter

Order-No. WV 0135

➤ Communication – Phase-Locked-Loop (PLL)



- Universal training system on the subject of PLL
- All function blocks of the PLL circuit are equipped with test jacks and can be decoupled
- Generators, frequency dividers and phase shifter integrated in Board
- Low demand on additional measuring equipment
- With detailed experiment descriptions

General

The Phase-Locked Loop (PLL) training system offers a concept for practical teaching of the function and application possibilities of this technology.

PLL systems are being used in electronics for a wide range of applications such as:

- Frequency synthesis (e. g. setting radio and TV channels including channel search and memory – fixed frequencies)
- Accurate motor speed control (e. g. CD players)
- Phase shifter
- Modulation and demodulation (AM, FM, PM, FSK)
- Stereo decoder and PAL decoder (TV)
- Pulse synchronous operation

The training system on PLL is designed didactically in such a way that the theoretical contexts can be presented clearly and comprehensibly.

It consists of the following components:

- 2 different phase detector types (comparators)
- 2 loop filters, low-pass characteristic
- Voltage-controlled oscillator (VCO)
- 2 digital frequency dividers, divider factor adjustable from 1 ... 10

The Phase-Locked Loop Board contains additional auxiliary equipment for conducting tests and experiments:

- Crystal-stable squarewave generator for reference frequencies

- Variable squarewave generator for the generation of input frequencies
- Phase shifter for examining the phase detectors

The frequencies in the Phase-Locked Loop are in the AF range so that a problem-free measuring technique can be applied and no great demands need to be made on additional measuring equipment (oscilloscope, multimeter, frequency meter).

The inputs and outputs of the individual function blocks are equipped with 4 mm jacks as test points. Individual blocks (components) can be decoupled with 4 mm connecting plugs from the overall complex if necessary, in order to conduct individual measurements.

➤ Communication – Phase-Locked-Loop (PLL)

Technical data

Squarewave generator (crystal-stable)	Frequency: 1 Hz; 1 kHz; 2 kHz; 4 kHz
DC voltage source	Voltage: 1 V ... 5 V (adjustable with potentiometer)
Voltage-controlled oscillator	Input voltage: 0 ... +5 V Output voltage: +5 V (symmetrical squarewave) Output frequency: approx. 20 Hz ... 6 kHz
Comparator (phase detector)	Type I: phase sensitive (XOR) Type II: phase and frequency sensitive (JK flip- flops with charging pump via tristate)
Low pass (loop filter)	Type I: RC low pass (approx. 300 Hz) Type II: R/RC low pass (approx. 3 Hz)
2 frequency dividers	Factor: N1 and N2 = 1 ... 10 (adjustable with rotary switch)
Phase shifter	$\varphi_p = -7^\circ \dots -230^\circ$ or $+7^\circ \dots +230^\circ$ (adjustable with potentiometer); referred to 2 kHz
Operating voltage and current:	+5 V DC/150 mA (through external power supply) LED for displaying lock-in state of the PLL circuit Measuring amplifier (impedance converter)
Dimensions	266 x 297 x 110 mm (W x H x D)
Weight	1.3 kg

Order-No. W4250

Necessary Accessories (not included in scope of supply)

Experimental manual: "Phase-Locked Loop"

5 V Power supply board

Plugs for Power supply

Connecting plugs and leads

Oscilloscope 20 MHz

Frequency meter

Multimeter

Order-No. WV0068

Order-No. W1002.3

Order-No. W9101

Order-No. W9102.2

➤ **Notes:**

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➤ **Notes:**

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No. of pages

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- Fundamentals of electrical Engineering
 - Installation circuits
 - Bell ringing and entrance call stations
 - Contactor control / Control technology
 - Measurement and control of non-electrical variables

- Fundamentals of electronics
 - Analog technology
 - Digital technology
 - Microprocessing technology

- Closed loop control technology
 - Analog closed loop control
 - Digital closed loop control

- Automation engineering
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 - Electrical drive control systems 5kW
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 - Cutaway Models
 - Transformers, Rectifiers and Reactive Power Compensation
 - Courses on drive systems

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 - low voltage (230/400V)
- Building management systems
 - KNX / EIB

- VDE 0100 safety measures
- Radio- and Television engineering
 - AM/FM – Technology
 - TV Engineering
 -
 - Satellite – Technology

- Cooling and air conditioning
- Photovoltaic cell technology
- Communication technology
 - Modulation -/demodulation
 - Fiber optic
 - ISDN trainer (HICOM)
 - ISDN

- Measuring systems
- Power supply units
- Experiment instructions, manuals
- Training courses

Remarks:



Training & Didactic Systems

Communication Training System with SIEMENS HIPATH 2030

Catalog

WA2E/16.02



➤ Training System Siemens HIPATH 2030

The communication training system SIEMENS HIPATH includes an actual communication platform (or PABX) for short and medium companies. It is an ISDN and Voice-over-IP "Communication Server" that handles telephone calls as well as fax and data calls and the access to the Internet; guaranteeing the ISDN lines towards the public network to be used best. The training unit can also be operated without ISDN connection to the public telephone systems (isolated operation).

One set is suitable for max. 2 students and adapted to the curriculum for vocational training schools and technical institutes in the field of communication. The SIEMENS HIPATH Trainer is much more than a trainer for a „small PABX“. The configuration software which is included in the trainingssystem is suitable for the whole range of HIPATH PABX. This means that the same software is used for communication platforms up to 500 extensions.

This may sound complicated for beginners, but an easy getting started manual with screenshots of the necessary settings or the possibility to program the PABX by telephone leads the student to successful experiments.



The PABX "SIEMENS HIPATH 2030" is mounted on in stable 19" metal training rack. All ports are wired to 2-mm plugs.

Different faults can be set to enlarge the understanding of the wiring.

A clearly arranged simulation board includes an intercom, a dooropen relay and telecommunication interfaces like TAE or Western or IAE (or local standard according to the customers requirements).

The wiring of the internal ISDN S0-Bus can be studied easily.



All Interfaces are additionally brought out to 2mm plugs. Measurements can be carried out during a phone call when the telephone is connected to the western port.

A set of telephones with different protocols is included.

By using the recommended measuring instruments, the d-channel of the S0 bus can be traced and a S0 bus test for installation can be done.



➤ **Technical Specification / Scope of Supply**

Features:

With the network- and ISDN trainer the following teaching and learning content can be adopted:

- Installation of telecommunication system (HiPath 2030 including basic development 4S_o / LAN / 2 a/b)
- Installation / commissioning of "voice over IP" end devices and system telephones
- Programming of the telecommunication system by computer
- Modifications in the programming structure and equipment configuration
- Fault diagnostics in programming and wiring
- Measurements of ISDN S_o-Bus
- Measurements and fault diagnostics of analogue (a/b) and digital ports (ISDN)
- Measurements and fault diagnostics of network in CAT6 and CAT7 (optional order no. W3820-1H-Z)
- optional remote maintenance for SIEMENS SIMATIC S7 components of automation technology

The training-system is highly suitable for practical operators like technician for communication electronics, service technicians, network admins and engineers.

Technical data (components included in the system):

The telecommunication system SIEMENS HiPath 2030 V1.0 is built in a stabile 19"-training rack. All analogue and ISDN-Ports as well as all the LAN Ports of the HiPath 2030 are patched back-sided on the front panel with RJ45 plugs. All analogue and ISDN ports of the telecommunication system are wired at established connector units like IAE, TAE etc., which are placed on the front panel. The data connectors for cat.6 computers and voice-over-IP-telephones are also mounted on the front panel and are patched directly to the telephone system .

In the basic configuration the following interfaces are available:

4 LAN networking connectors (2 outlet sockets with 2 different connectors each)

2 (a/b) (via 2 TAE2x6NFF telephone sockets)

4 (S_o) on the telephone system; 3 (S_o) at the front panel

Additionally lots of signals can be tapped on 2mm sockets for measurement exercises, also during dial-up or an existing connection.

A door intercommunication system with 2 doorbell-knobs and alarm bell as analogue extension is integrated.

With the door-opening function of the telecommunication system a real door-opener will be controlled.

The mains-supply is at the lower part of the rack with a fused rubber connector with illuminated switch.

27 fault switches are available For the line-network of analogue a/b and ISDN-S_o-connections as well as for door opener, door intercommunication system and bell transformer. These switches simulate in practical experience real common faults like wire interruption, short cuts and connection permutation (chaotical and pairwise) and permit measurements to locate and clear these faults.

Order-No. W3820-1H

Set of 2-mm-connecting leads

consisting of: (different colours)

8 x 2mm connecting leads; L=30cm

32 x 2mm connecting leads; L=60cm

Order-No. W3820-1V

Optional patch field



assembled in W3820-1H

- only available together with W3820-1H -

19" path panel with 16 RJ45 sockets integrated in the front of VOIP trainer W3820-1H. Patched to the HIPATH maodule and the simulation front.

For the 4 LAN outputs of the HIPATH 2030 are available 8 inputs associated with 8 outputs connected pairwise with different length of wires.

7 pairs of such sockets are prepared with common faults out of daily service practice. This allows exercises in measuring and maintenance service in the network of CAT6 and CAT7.

Also included for the test-exercises is a FLUKE MicroScanner² Cable Verifier and 7 patchcables of different length and colour and a crossover patchcable.

Order-No. W3820-1H-Z

ISDN Measuring Instrument

for HiPath trainingsystem



3UNT - An overview:

Ergonomic design with integrated telephone (test handset design)
Tests the S-interface in TE, and NT operation with monitoring of the U and analogue interfaces in TE mode
Optimized user interface with softkeys, cursor keys and direct-mode keys
Automatic test sequence at the press of a button (Autotest)
Integrate a PC as a user interface for performing traces as well as generating access commissioning reports (ARGUS®WINplus) and handling protocol decoding (ARGUS®WINanalyse), as an alternative you can also send the commissioning report directly to a printer
Internal storage of test results
Intelligent supply design with power-down mode and power management, supply from the S-bus, U-interface, battery, power pack or power supply
Future-proof thanks to the Flash-ROM technology - simple software updates from a PC
3UNT -
the U-interface and analogue line functions:
U-interface with 4B3T or 2B1Q
Measurements of the U-interface voltages incl. OK evaluation; U-interface operation functions like the S-bus
Analogue-interface with DTMF and pulse dialling with flash function (80, 120, 240 or 600 ms), loop resistance: 470 Ohm
Automatic detection of the analogue interface characteristics
Voltage measurement on the analogue line (with receiver on or off-hook)
Telephony functions on the analogue line such as S-bus display of the call number (CLIP)

3UNT- the S-bus functions
S-interface in accordance with the CCITT I.420 - various operating modes: TE-mode (terminal simulation), NT-mode (network simulation), monitor (passively monitor the S-bus with online recording of the data on a PC)
Automatic detection of the protocol and access configuration when switched on: Point-to-Point or Point-to-Multipoint, DSS1, 1TR6, BILINGUAL or NO Protocol, with display of Layers 1 and 2 and the B-channel status (free/busy)
Automatic service test: an automatic check of which ISDN services are available on the send and receive sides of the access
Automatic test of the supplementary services
1TR6: supplementary service test;
DSS1: automatic tests of CLIP, CLIR, COLP, COLR, HOLD, TP and CFU, test of CW, Charges displayed during and at the end of the call, CFB, CFNR, call back when busy (CCBS) and CW (Call Waiting), with an incoming call the subaddress (SUB) and user text (UUS) will be displayed, and keypad commands are also supported
Bus status interrogation with query, display and clearing of the active call diversions CFU, CFB, CFNR for all services
Automatic X.31(D) test: Is the supplementary service "Packet data in D-channel" available and which TEI-values are assigned to the access, simulation of a X.31(D)-terminal up to the X.25-network?
Telephony function with hotkey dialling, call number memory for 10 numbers or for keypad commands to program the PBX, the calling and called numbers are displayed for incoming calls, the B-channel is selectable, dialling with en-bloc or overlap signalling
Terminal or network simulation for the various ISDN services
Displays the most important cause for the disconnect in clear text

In network simulation it is possible to manually enter the date to perform year 2000 tests on PBXs or servers, and to send charges (AOC,D/E)
A bit error rate test BERT can be made in an extended to call to oneself or in an end-to-end BERT, the number of bit errors and the bit error rate will be displayed, BERT with selectable Good/Bad threshold and OK/Not OK evaluation, bit pattern in accordance with ITU-T O.150, adjustable measurement time, loop-box function for B-channels and all services
Testing ISDN permanent circuits: Telephone function, B-channel B1 or B2 selectable, BERT B-channel B1 or B2 selectable, loop-box function for B-channels
Layer 1 tests and bus feed:
Measurement and evaluation of the phantom voltage (OK, NORMal or Restricted Power) and the ISDN signal send and receive levels of the NTBA or the PBX
Wiring tests: Check the bus terminating resistor, determine whether there is a short circuit or the wires are swapped? If yes, which wires? Displayed in clear text.
Technical features:
Power Supply:
alternatively fed from ISDN S-bus, supplied by standard batteries (3 x 1.5V Mignon AA) or from the power supply
Keypad:
16-key keypad, 2 cursor keys, 3 softkeys
LC-Display:
4 lines with 16 characters, backlit
5 LEDs for displaying the status (ISDN-Layer 1, 2, 3, Activity, Trace Activity, Line Power)
Dimensions:
H 230 mm W 72 mm D 30mm
Standard package:
Device with batteries, mains adapter (9V), S-bus cable, U-interface cable, analogue cable, test-adaptor for wiring tests, ARGUS® WINplus PC software, English manual, carrying strap with practical clips to on the case, transport bag

Order-No. W3820-0T

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| | <input type="checkbox"/> Photovoltaic cell technology |
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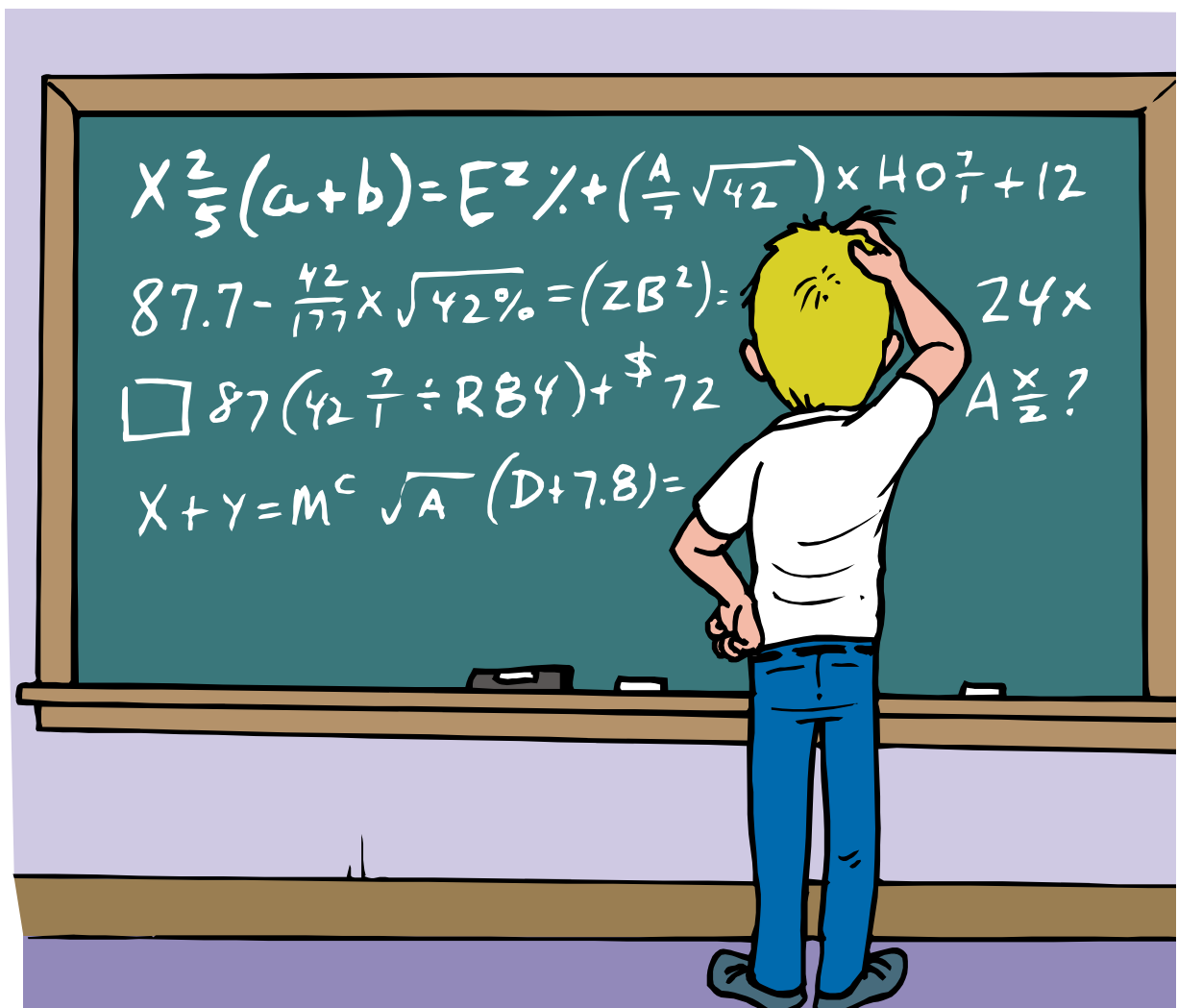


Training & Didactic Systems

Experiment Instructions

Catalog

WA2E/18



➤ Our Services

- Development and production of didactic training systems
- Teachware and documentation
- Project engineering of complete lab's incl. furnitures and lab equipment
- Quotations on customers demand
- Installation, commissioning and training at site

➤ Our Customers

- Vocational training schools, technical schools, colleges and universities...
- Industrial laboratories for vocational education and higher education

➤ Fields of Technology

- Fundamentals of electrical engineering
- Fundamentals of electronics
- Closed loop control technology
- Automation engineering
- Electrical machines / drive control
- Power electronics
- Building management systems
- Protection schemes to VDE 0100
- Radio- and TV technology
- Air conditioning and refrigeration
- Photovoltaic
- Communication technology
- Measuring systems, power supplies, accessories
- Experimental manuals

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S30020619P – 01/13

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➤ Introduction

Our experiment instructions are an essential part of our training concepts. We offer them for instructors and teachers dealing with

- electrical trades,
- metal-working trades and
- scientific trades.

In cooperation with the training workshops, vocational schools and colleges for higher technical training, our experiment instructions have been tailored to the learning objectives and the teaching tools developed by us. As the mediator between theory and practice they help the instructor, teacher and the student. Instructors and teachers are spared the preparation time in everyday teaching, and the student is assisted in his work by clearly formulated standards.

The modular design of our experiment instructions allows instructors and teachers to make a selection according to learning fields and objectives. Optimum matching to the particular level of knowledge of the trainees is thus ensured.

On the following pages you will find an overview of our experiment instructions with the teaching fields and objectives to be imparted.

➤ **Summary of experiment instructions**

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➤ **Experiment instructions for practice-oriented training**

V051

KNX / EIB

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**Basic configuration (Starting package)
Fundamentals of EIB-programming with
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Task 2

Changing of an existing configuration.

Learning the advantages of an installation wired with a
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Task 3

Fundamentals of time functions.

Task 4

Extensions of time functions.

Supplementary package 1

EIB-programming with ETS 2 software.

Task 5

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Task 6

Further lamp circuits and brightness control incl.
differentiation of Bit and Byte orders.

Supplementary package 2

EIB-programming with ETS 2 software.

Task 7

Venetion blind control

Supplementary package 3

EIB-programming with ETS 2 software.

Task 8

Integrating conventional components in **KNX / EIB**
projects.

Supplementary package 4

EIB-programming with ETS 2 software.

Task 9

Fundamentals of IR control.

Task 10

Extension of IR control

Supplementary package 5

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Task 11

Switching and dimming of flouescent lamp.

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EIB-programming with ETS 2 software.

Task 12

Setup of additional buslines with line coupler

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Task 13 Fundamentals motion dedector

Task 14 Extension motion dedector

Further extensions 2

Task 15 Twilight dedector

Further extensions 3

Task 16 Fundamentals display unit

Task 17 Extension display unit

V063

Protection Schemes to DIN VDE 0100

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E1.2 Protection against indirect contact

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E2.1 Protection by extra low voltage

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TOPIC 3:Safety separation

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E3.1 Safety separation at a metal conductive location

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TOPIC 5:Protective measures in the TN system

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Solutions

Order No. W3005-1A German
Order No. W3005-1B English

Order No. W3006-3A German
Order No. W3006-3B English

➤ Experiment instructions for practice-oriented training

V071

DC Chopper Regulators

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V072

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Order No. W3007-1A German
Order No. W3007-1B English

Order No. W3007-2A German
Order No. W3007-2B English

➤ **Experiment instructions for practice-oriented training**

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Order No. W3007-3A German
Order No. W3007-3B English

Order No. W3007-4A German
Order No. W3007-4B English

➤ Experiment instructions for practice-oriented training

V075**Fundamental Principles of Power Electronics****Contents**

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Solutions

Order No. W3007-5A German
Order No. W3007-5B English

Order No. W3007-6A German
Order No. W3007-6B English

➤ **Experiment instructions for practice-oriented training**

V077

Variable-Speed Three-Phase Drives using the MicroMaster® Frequency Converter

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Solutions

Order No. W3007-7A German
Order No. W3007-7B English

V078

"SIKOSTART 3RW22"

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 - 2.2 Conventional starting methods for three-phase asynchronous motors
 - 2.3 Soft start with SIKOSTART
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 - 3.2 Unit type(s)
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Order No. W3007-8A German
Order No. W3007-8B English

➤ Experiment instructions for practice-oriented training

V081

Power Electronics with Experimenter IV

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Solutions

Order No. W3008-1A German
Order No. W3008-1B English

V100

Installation circuits

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General remarks for performance of experiments and details of technical data
Equipment list and allocation for individual tests
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 - E2 On/Off circuit with single-pole switch and Schuko socket
 - E3 On/Off circuit with two-pole switch
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 - E16 Protective multiple earthing, classical (TN-C system)
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 - E18 Bell and door opener unit for single connection
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 - E20 Door intercom system with 2 house stations and door opener
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Solutions

Order No. W3010-0A German
Order No. W3010-0B English

➤ **Experiment instructions for practice-oriented training**

V101

Fundamentals of electrical engineering for the field of power engineering

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 List of components
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 E 25 Single-phase transformer, no-load current, short-circuit current and impedance voltage
 E 26 Single-phase transformer - efficiency
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V104

Control Schemes with Contactors

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 2. Trouble Shooting in Control Circuits
 3. Closing with contactor
 4. Trouble shooting
 5. Contactor control with current surge switch
 6. Setting-up of Control Circuits
 7. Detection and Elimination of Incorrect Connections
 8. Sequence control with contactors
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 10. Trouble shooting
 11. Setting-up of Control Circuits
 12. Delayed switch-on and switch –off
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 15. Traffic light control

Order No. W3010-1A German
Order No. W3010-1B English

Order No. W3010-4A German
Order No. W3010-4B English

➤ **Experiment instructions for practice-oriented training**

V107

**Connecting and Measuring electrical Machines
200W / 300W**

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Switching on using a contactor

Changing direction of rotation using a reversing switch

Changing direction of rotation using a contactor (measurements)

Star-delta starting circuits

Starting with a star-delta switch (measurements)

Star-delta starting using a contactor (measurements)

Stator-resistance starting circuit

Automatic starting using a contactor

Reversal using a control switch (measurements)

Reversal using a control switch (recording characteristics)

Operating characteristics

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Single-phase operation

Changing direction of rotation using a reversing switch

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PF correction (measurements)/(recording characteristics)

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Dahlander circuit

Switching on using a pole-changing switch (measurements)/ (recording characteristics)

Switching on using a contactor

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Switching on using a pole-changing switch and contactor (measurements)/ (recording characteristics)

Switching on using a contactor (various circuits)

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Three-phase slipring induction machine

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Starting using a controller (measurements)

Starting using a contactor

Operating characteristics

Starting using a controller

Single-phase machines

Basic circuit

Single-phase motor with running capacitor (measurements)

Single-phase motor with starting and running capacitor (measurements)

Single-phase motor with auxiliary starting winding (measurements)

Single-phase motor with auxiliary starting winding and pushbutton control

Single-phase repulsion motor

Universal motor (measurements)

Operating characteristics

Single-phase motor with running capacitor

Single-phase motor with starting and running capacitor

Synchronous machine

Basic circuit (motor operation)

Changing direction of rotation using a reversing switch (measurements)

Starting using a contactor

Switching on using a contactor

Operating characteristics (motor operation)

Synchronous motor with salient pole rotor

Synchronous motor without excitation (reluctance motor)

Generator operation

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DC series-wound machine

Basic circuit, operation characteristics

Motor operation with change of direction of rotation (measurements)/ (recording characteristics)

Motor operation with on/off switch

DC shunt-wound machine, self-excited

Basic circuit

Motor operation (measurements)

Generator operation (measurements)

Operating characteristics

Motor operation

Generator operation

DC shunt-wound machine with separate excitation

Basic circuit

Motor operation (measurements)

Generator operation (measurements)

Operating characteristics

Motor operation

Generator operation

DC compound-wound machine

Basic circuit

Motor operation (measurements)

Generator operation (measurements)

Operating characteristics

Motor operation

Generator operation

Solutions

Order No. W3010-7A German

Order No. W3010-7B English

➤ **Experiment instructions for practice-oriented training**

V108

**Connecting and Measuring electrical Machines
1000W**

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DC compound-wound machine
 Basic circuit
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 Motor operation
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Solutions

Order No. W3010-8A German
Order No. W3010-8B English

➤ **Experiment instructions for practice-oriented training**

V111

Experimental station for refrigeration and air conditioning

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For conducting the following experiments in the normal cooling range, air-conditioning range and deep-freeze range:

- Simple refrigeration cycle with manually operated control valve (3 experiments)
- Simple refrigeration cycle with capillary tube feed (6 experiments)
- Simple refrigeration cycle with automatic control valve (6 experiments)
- Simple refrigeration cycle with thermostatic control valve (6 experiments)
- Simple refrigeration cycle controlled by evaporator and/or room thermostat (6 experiments)
- Simple refrigeration cycle with variable refrigerant com-pounds and pressure drops (1 experiment)
- Simple refrigeration cycle - start-up and fault-finding (1 experiment)

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- Extended refrigeration cycles with constant evaporator-pressure regulators (3 experiments)
- Extended refrigeration cycles - with suction pressure regulator (2 experiments)
- Extended refrigeration cycle with start-up relief (3 experiments)
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- Extended refrigeration cycle with liquid trap (1 experiment)
- Extended refrigeration cycle with temperature regulator (3 experiments)
- Extended refrigeration cycle with electric evaporator defrosting (3 experiments)
- Extended refrigeration cycle with periodic defrosting of evaporator (3 experiments)
- Extended refrigeration cycle with four-way reversing valve (1 experiment)
- Extended refrigeration cycle with hot-gas bypass regulation and injection valve (1 experiment)

Order No. W3011-1A German
Order No. W3011-1B English

➤ **Experiment instructions for practice-oriented training**

V112

Transformer and rectifier circuits

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 E3 Single-phase transformer - loading
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 Transformation ratio
 Vector groups
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 E4 Star/star connection
 E5 Star/delta connection
 E6 Star/zigzag connection
 E7 Delta/star connection
 E8 Delta/delta connection
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Solutions

V118

Measurement and Control of NON-ELECTRICAL Quantities

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3. Temperature Controlled System
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Order No. W3011-2A German
Order No. W3011-2B English

Order No. W3011-8A German
Order No. W3011-8B English

➤ Experiment instructions for practice-oriented training

V142

Reactive-Power Compensation

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- 1. Introduction**
- 2. Emergence reactive current**
 - 2.1 Disadvantage of reactive current
 - 2.2 Regulation of the power factor $\cos \varphi$
- 3. Behavior of ac resistors**
 - 3.1 Ohmic resistance
 - 3.2 Ideal coil
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- 4. Experiments of reactive power compensation in ac circuit**
 - 4.1 Carrying out the power factor of ac resistors
 - 4.1.1 Ohmic resistor
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- 5. Experiments of reactive-power compensation in the three-phase system**
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 - 5.5.3 Control of learning objectives
 - 5.6 Central power-factor correction with VAR controller
 - 5.7 Control of learning objectives
- 6. Solutions**

Order No. W3014-2A German
Order No. W3014-2B English

➤ **Experiment instructions for practice-oriented training**

V172

**Programmable Logic Controllers
SIMATIC S7-200 with Simulators
W4760-1D/1E/1G**

Contents:

Traffic Light Control

Task

The control sequence for the traffic light system at a pedestrian crossing is to be implemented for day and night operation with a programmable logic control. From the functional description provided the assignment list, the macrostructure, the functional block diagram and the statement list are to be supplemented or drawn up, respectively. The function-tested control program is to be saved and documented.

Pump Control

Task

The control sequence for a pump system is to be implemented with a programmable logic control. From the functional description provided the assignment list, the macrostructure, the function block diagram and the statement list are to be supplemented or drawn up, respectively. The function-tested control program is to be saved and documented.

Star-delta Start-up

Task

The control sequence for an automatic star-delta start-up of a three-phase asynchronous motor is to be implemented with a programmable logic control. From the functional description provided the assignment list, the macrostructure, the function block diagram and the statement list are to be supplemented or drawn up, respectively. The function-tested control program is to be saved and documented.

V173

**Programmable Logic Controllers
SIMATIC S7-300**

Contents:

1. Preface

2. The standard IEC 1131 for PLC

3. Structure and Function of a PLC

4. Programming language STEP7

- 4.1. General comments on the programming language STEP7
- 4.2. Control instruction
- 4.3. Addressing
- 4.4. Program generation
- 4.5. Bit Memories
- 4.6. Data blocks
- 4.7. Converting STEP5⇒STEP7

5. Basic Instructions

- 5.1. Assign
- 5.2. AND - Instruction
- 5.3. OR - Instruction
- 5.4. AND- before OR- Instruction
- 5.5. OR- before AND- Instruction
- 5.6. Negate Binary Input
- 5.7. Exclusive- OR- Instruction
- 5.8. Interrogation of Outputs
- 5.9. Output with Memory
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- 5.12. RLO Instructions
- 5.13. Load and Transfer Instructions
- 5.14. Counter Instructions
- 5.15. Comparison Instructions
- 5.16. Timer Instructions
- 5.17. Program Control Instructions
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- 5.19. Null Instructions

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- 6.1. Scheme of a Sequence control
- 6.2. Components of a Sequence control system
- 6.3. Method of representation

7. Configuring

- 7.1. Sequence of Configuring in principle
- 7.2. Sequence of Configuring with an Example
- 7.3. Safety requirements

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- Task 1 Seven-segment display
- Task 2 Reaction vessel
- Task 3 Tank-filling device
- Task 4 Pump control
- Task 5 Automatic star-delta start-up
- Task 6 Belt control
- Task 7 Traffic light control
- Task 8 Automatic pill filling device
- Task 9 Fundamentals of position control
- Task 10 Two-door access control
- Task 11 Embossing machine

Solutions

Order No. W3017-2A German
Order No. W3017-2B English

Order No. W3017-3A German
Order No. W3017-3B English

➤ **Experiment instructions for practice-oriented training**

V174**Digital Control 2 with SIMATIC S7-300****Contents:**

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- 2. Controller Design PID controller**
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 - 2.2. The PI controller as a special case of a PID controller
 - 2.3. Adjustment of the PI controller with optimum of absolute value
 - 2.4. Adjustment of the PI controller with symmetrical optimum
 - 2.5. T_u - T_g - Approximation
 - 2.6. Adjustment of the PI controller with Ziegler- Nichols
 - 2.7. Adjustment of the PI controller with Chien, Hrones and Reswick
 - 2.8. Adjustment of the PI controller with root locus curve
 - 2.9. Adjustment of the PI controller with Bode diagramm
- 3. Description of the Test Set-up**
 - 3.1. Description of the Level control
 - 3.2. Description of the PT_1 -element
 - 3.3. Description of the Programmable Logic Controller
 - 3.4. Wiring of the Test Set-up
 - 3.5. Mathematical Description of the resulting Control line
- 4. Programming of the S7-300 with STEP7 V2.x/V3.x**
 - 4.1. Programming and Parameterization of the S7-300 with STEP7 V2.x/V3.x
 - 4.2. Standard-Control with S7-300 and STEP7 V2.x/V3.x
- 5. Standard PID Control**
 - 5.1. Adjustment of the PI controller with optimum of absolute value
 - 5.2. Adjustment of the PI controller with symmetrical optimum
 - 5.3. T_u - T_g - Approximation
 - 5.4. Adjustment of the PI controller with Ziegler- Nichols
 - 5.5. Adjustment of the PI controller with Chien, Hrones and Reswick
 - 5.6. Adjustment of the PI controller with root locus curve
 - 5.7. Adjustment of the PI controller with Bode diagramm
- 6. Solution Standard PID Control**
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 - 6.6. Adjustment of the PI controller with root locus curve
 - 6.7. Adjustment of the PI controller with Bode diagramm
 - 6.8. STEP7-Programs

V175**Digital Control 1 with SIMATIC S7-300****Contents:**

- 1. Task 1**
 - 1.1 On-off control of a tank filling level
 - 1.2 Solution
- 2. Task 2**
 - 2.1 Continuous control of a filling level
 - 2.1.1 Starting of continuous control and fault clearing with:
 - 2.1.1.1 STEP7 V1.x
 - 2.1.1.2 STEP7 V2.x/3.x
 - 2.1.1.3 STEP7 V5.x
 - 2.1.2 Time response of process variable x
 - 2.1.2.1 P-controller
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 - 2.1.2.3 PI-controller with optimum control parameters
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 - 2.2.1 Time response of process variable x
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 - 2.2.1.2 PI-controller
 - 2.2.1.3 PI-controller with optimum control parameters

Order No. W3017-4A German
Order No. W3017-4B English

Order No. W3017-5A German
Order No. W3017-5B English

➤ **Experiment instructions for practice-oriented training**

V176

Process Simulation PROSIM 95 with SIMATIC S7

Contents:

1. Introduction
2. Triggering Seven-segment Display
3. Control of a Tank Filling System
4. Control of a Set of Traffic Lights
5. Traffic Lights Control Traffic Pacer
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7. Racking Plant Control 1
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11. Press Control
12. Bending Equipment Control
13. Star-Delta Starting
14. Starter Control
15. Control of a Sorting Plant (High-bay Warehouse)
16. Control of a Production Facility
17. Positioning Control

Order No. W3017-6A German
Order No. W3017-6B English

V179

Universalsimulator Electrical Technology with SIMATIC S7-300

Contents:

- Task 1: Fan control
- Task 2: Tank level control
- Task 3: Gate control
- Task 4: Furnace door controller
- Task 5: Pump control
- Task 6: Star-delta startup
- Task 7: Starter control
- Task 8: Construction site traffic light
- Task 9: Embossing machine
- Task 10: Backup control
- Task 11: Traffic light control

Order No. W3017-9A German
Order No. W3017-9B English

V183

Belt conveyor control

Contents:

Task
 The control sequence for the conveyor belt is to be implemented with a programmable logic controller. From the assignment lists and the functional descriptions the statement lists are to be drawn up. The function-tested control program is to be saved and documented.

Order No. W3018-3A German
Order No. W3018-3B English

V184

Experimenter with SIMATIC S7-200, Electrical Technology

Contents:

- Task 1: Fan control
- Task 2: Tank level control
- Task 3: Gate control
- Task 4: Furnace door controller
- Task 5: Pump control
- Task 6: Star-delta startup
- Task 7: Starter control
- Task 8: Construction site traffic light
- Task 9: Embossing machine
- Task 10: Buffer store
- Task 11: Traffic light control

Order No. W3018-4A German
Order No. W3018-4B English

➤ Experiment instructions for practice-oriented training

V185

Experimenter with SIMATIC S7-200, Metal Technology

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- Task 1: Stamp device
- Task 2: Parcel lifting device
- Task 3: Stamp device
- Task 4: Parcel lifting device with sorter
- Task 5: Position unit
- Task 6: Shaping station
- Task 7: Press with protection cage
- Task 8: Silo control for 2 bulk materials
- Task 9: Quality testing device
- Task 10: Allotment device
- Task 11: Sorter

Order No. W3018-5A **German**
Order No. W3018-5B **English**

V187

Plant Simulator with SIMATIC S7-300

Contents:

- Task V1: Silo Control
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- Task V3: Traffic Lights
- Task V4: Three Phase Automatic Starter
- Task V5: Dahlander Circuit
- Task V6: Reversing Contactor Circuit
- Task V7: Star-Delta Circuit
- Task V8: Running Light
- Task V9: Drink Vending Machine
- Task V10: Reaction Vessel
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- Task V15: Sequence Contr. Circuit for Conveyor System
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Order No. W3018-7A **German**
Order No. W3018-7B **English**

V188

Contactor Control with SIMATIC S7/S5

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- Task V5: Dahlander Circuit
- Task V6: Reversing Contactor Circuit
- Task V7: Star-Delta Circuit
- Task V12: Latching Circuit

Order No. W3018-8A **German**
Order No. W3018-8B **English**

V189

Universalsimulator Metal Technology with SIMATIC S7-300,

Contents:

Important Notes

- Task 1: Stamp device
- Task 2: Parcel lifting device
- Task 3: Stamp device
- Task 4: Parcel lifting device with sorter
- Task 5: Position unit
- Task 6: Shaping station
- Task 7: Press with protection cage
- Task 8: Silo control for 2 bulk materials
- Task 9: Quality testing device
- Task 10: Allotment device
- Task 11: Sorter

Order No. W3018-9A **German**
Order No. W3018-9B **English**

➤ **Experiment instructions for practice-oriented training**

V211

Video Trainer

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- 2. Wiring Diagram**
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 - 3.2 Power Supply Architecture
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- 10. Tuner/IF**
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Order No. W3021-1A German
Order No. W3021-1B English

V215

Aerial Engineering

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 - 3.2 Experiments with the aerial amplifiers
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Order No. W3021-5A German
Order No. W3021-5B English

V216

The Fundamentals of Closed-Loop Control Box System

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- 2. Closed-Loop Control**
- 3. Investigating Control Loop Elements**
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 - 3.3.1. 2-step controller
 - 3.3.2. P controller
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 - 3.3.4. D controller
 - 3.3.5. PI controller
 - 3.3.6. PD controller
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 - 4.1. Control Loop Process Simulator First-Order Proces
 - 4.2. Temperature Control
 - 4.3. Speed Control of a DC Motor

Solutions

Order No. W3021-6A German
Order No. W3021-6B English

➤ Experiment instructions for practice-oriented training

V220

Colour Generator Training Unit

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- X/Y operation
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- Four-vector fields
- External gating (colour bar)
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- Opening the training unit
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- Technical data
- Circuit diagram

V224

Demonstration Model for HiFi FM/AM Radio and Amplifier Engineering

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 - 1.1 Health and Safety at Work
 - 1.2 Startup
 - 1.3 Test Equipment required
 - 1.4 Summary of features and brief description of the various stages in the radio demonstration model
 - 1.4.1 AM stage
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 - 2.1 AM-Amplitude Modulation
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- 3. Circuit Description/ Servicing/ Circuit diagram**
 - 3.1 AM-Stage
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 - 3.2.1 Digital Frequency Display for AM and FM
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 - 3.4 Stereo Decoder
 - 3.5 AF-Stage
 - 3.6 Output stage
 - 3.7 Power supply
- 4. Description of faults**
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 - 4.2 FM stage
 - 4.3 IF stage
 - 4.4 Stereo decoder
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 - 5.3 IF stage
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Order No. W3022-0A German
Order No. W3022-0B English

Order No. W3022-4A German
Order No. W3022-4B English

➤ **Experiment instructions for practice-oriented training**

V225

**Training Model Colour Television Engineering
"Multi Standard System w. IR Remote Control"**

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DEMONSTRATION OSZILLOSCOPE 20 MHz

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Order No. W3022-7A German
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➤ **Experiment instructions for practice-oriented training**

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Order No. W3025-2B English

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➤ **Experiment instructions for practice-oriented training**

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➤ Experiment instructions for practice-oriented training

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