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hera Laborsysteme GmbH

THE CHOICE OF ENGINEERS

CATALOGUE 2021/22: **TECHNICAL TRAINING SYSTEMS**

hera Laborsysteme GmbH
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THAT‘S WHAT WE ARE STANDING FOR

COMPANY **TRADITION**

hera is a part of the family-owned ZECH-Unternehmensgruppe. Mr. Manfred Zech, owner and CEO of hera has a special interest in manufacturing all important key components within our company group to make sure, that only products of highest quality reach our customers. The success of this policy is reflected in the constant growth of the ZECH-Unternehmensgruppe within the 60 years of its existance. hera is equipped with machinery of latest technology which gives us a great manufacturing depth and thus the flexibility to even realize customized solutions. We are proud that so many educational institutions and industries around the world trust in our quality.

DURABILITY AND **SUSTAINABILITY**

In 1959 our LS2000 laboratory system was revolutionary, it was the first bench rack system on the market with integrated devices for electric professions. In 2006 we started the production of technical training systems, which enabled us to provide high-quality turnkey laboratories for colleges, universities and technical training centers.

MODULARITY OF PRODUCTS

Our laboratories are made to last a lifetime, so we are dedicated to develop and manufacture products of finest quality and durability. Due to the considerable product range and the high-degree of modularity, we are able to realize configurations that fully meet our customers concepts. We do not want you to adapt to our system but our system should be adapted to your needs.

FUNCTIONALITY COMPLYING WITH DESIGN

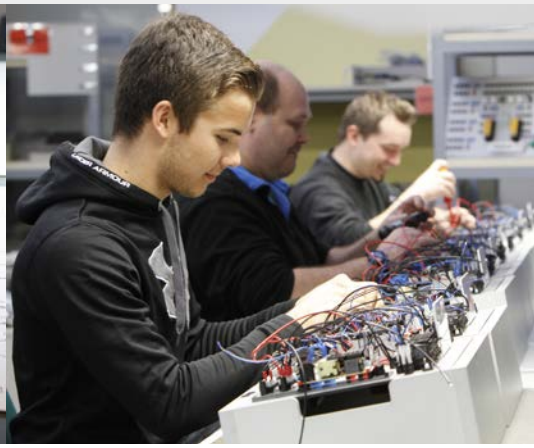
Attractive product design is a very important topic for hera, but never if it compromizes functionality. Quite contrary, our policy is to make products even more user-friendly. This means, functionality is the main priority when developing new products or doing product redesigns, because we know how important it is to get your processes even more efficient.

COMPATIBILITY OF PRODUCT SOLUTIONS

A complete laboratory system consists of a great variety of individual components. In order to avoid confusion, whenever you need additional products, we consequently make sure that all our new developments are compatible to the existing system. Thus an uncomplicated upgrade of your present system is always possible.

- OUR PRIMARY GOAL IS CUSTOMER‘S SATISFACTION!





TURNKEY LABORATORIES - **MANUFACTURED BY HERA**

In this catalogue you will find training systems for colleges, universities and vocational training centers for all basic topics in **electric engineering**, **installation technology**, **automation & mechatronics** as well as **renewable energies**.

If you are interested in laboratory furniture or turnkey solutions, then please ask for our

EXTRA CATALOGUE FOR LABORATORY FURNITURE

We are manufacturers of training systems, modular laboratory furniture and a broad selection of electrical laboratory devices.

All our products are 100% made in Germany.

Electrical Engineering Lab

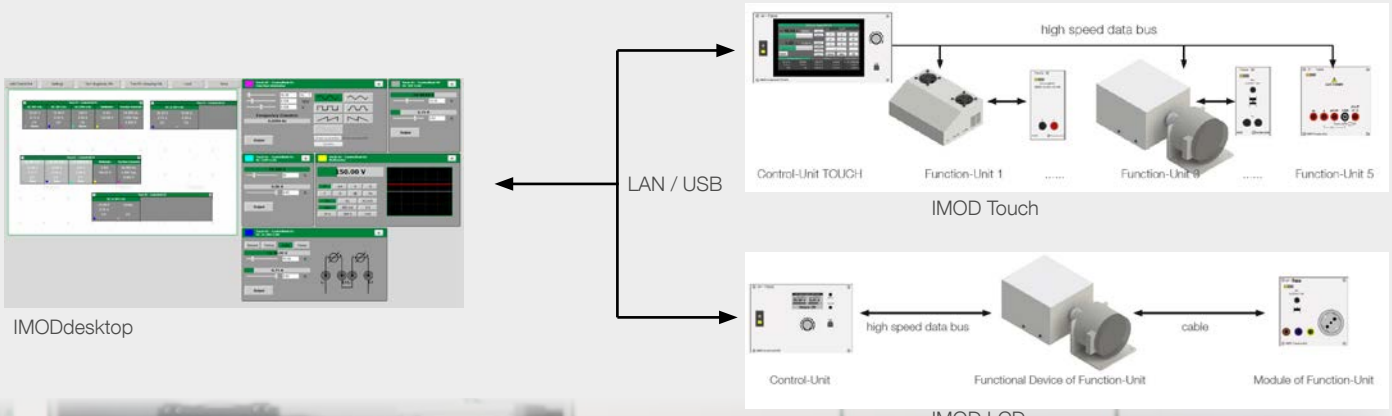
Automation Lab

Centrally Controlled Team Workstation

HVAC Workshop

IMOD LABORATORY - NETWORK-OPERATED

Digitalization is a worldwide topic and many of todays‘ students will face IoT technology tomorrow. The IMOD system is a highly advanced system which is used for educational labs and in industry. Students will use this intuitively due to an easy understandable HMI with touchscreen. The webbasing software enables the instructor to fully control the lab, either an individual workstation or the full room.



IMODdesktop

IMOD Touch

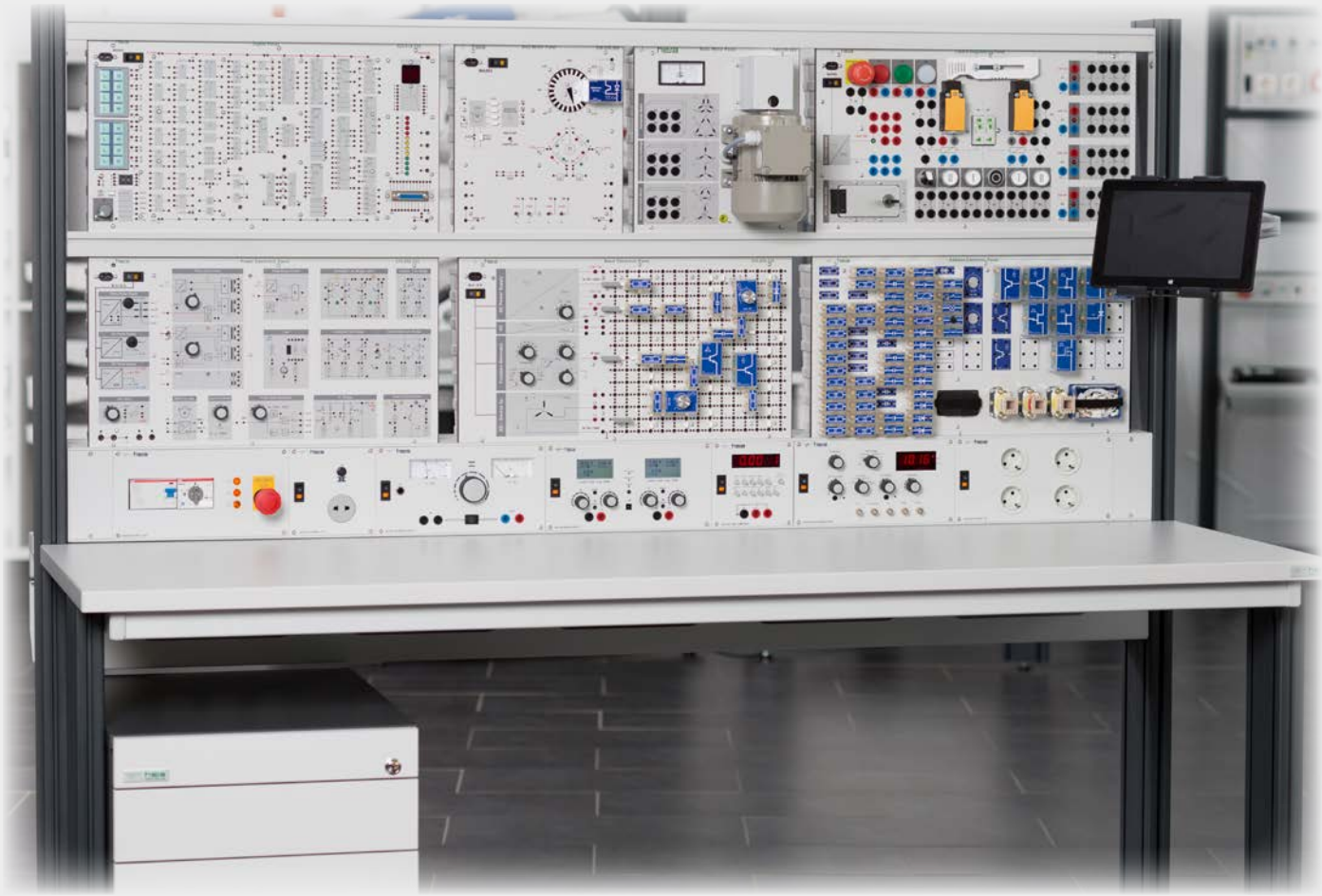
IMOD LCD

Universal Lab with Building Automation Trainer

LABORATORY WORKSTATIONS
FOR STANDARD TRAINING SYSTEMS

All our laboratory workstations can be individually equipped with regard to your requirement. The standard training systems come with ergonomic tilted hood and cable outlet to the front, so they can be used directly laying on the bench or suspended in a training system frame.

Basic Classroom Bench with circuit breakers and power outlets



Advanced Laboratory Bench with integrated sources and instruments, training system frame for the flexible use with all trainers in standard size (exchangable).

MOBILE **CLASSROOM SOLUTIONS**

In case you prefer theoretical classroom benches and your students only need the training systems for some lessons or if the topics should be taught in bigger groups, then it might be more comfortable to have the trainers on mobile stands.
The mobile stands are modular equipped with circuit breakers, sockets, etc and are prepared to hold training panels or training boxes on two or three levels.
For an utmost convenience they are equipped with cord holder, a shelf to hold the teaching manuals and a PC or notebook support if required.

Mobile Training Stands with circuit breaker and voltage supply, training system frame for standard sraining systems and shelf for manuals and cord holder

DIRECTORY

Basics of Electronics

Domestic & Industrial Installations

DIRECTORY

Automation & Mechatronics

Renewable Energies

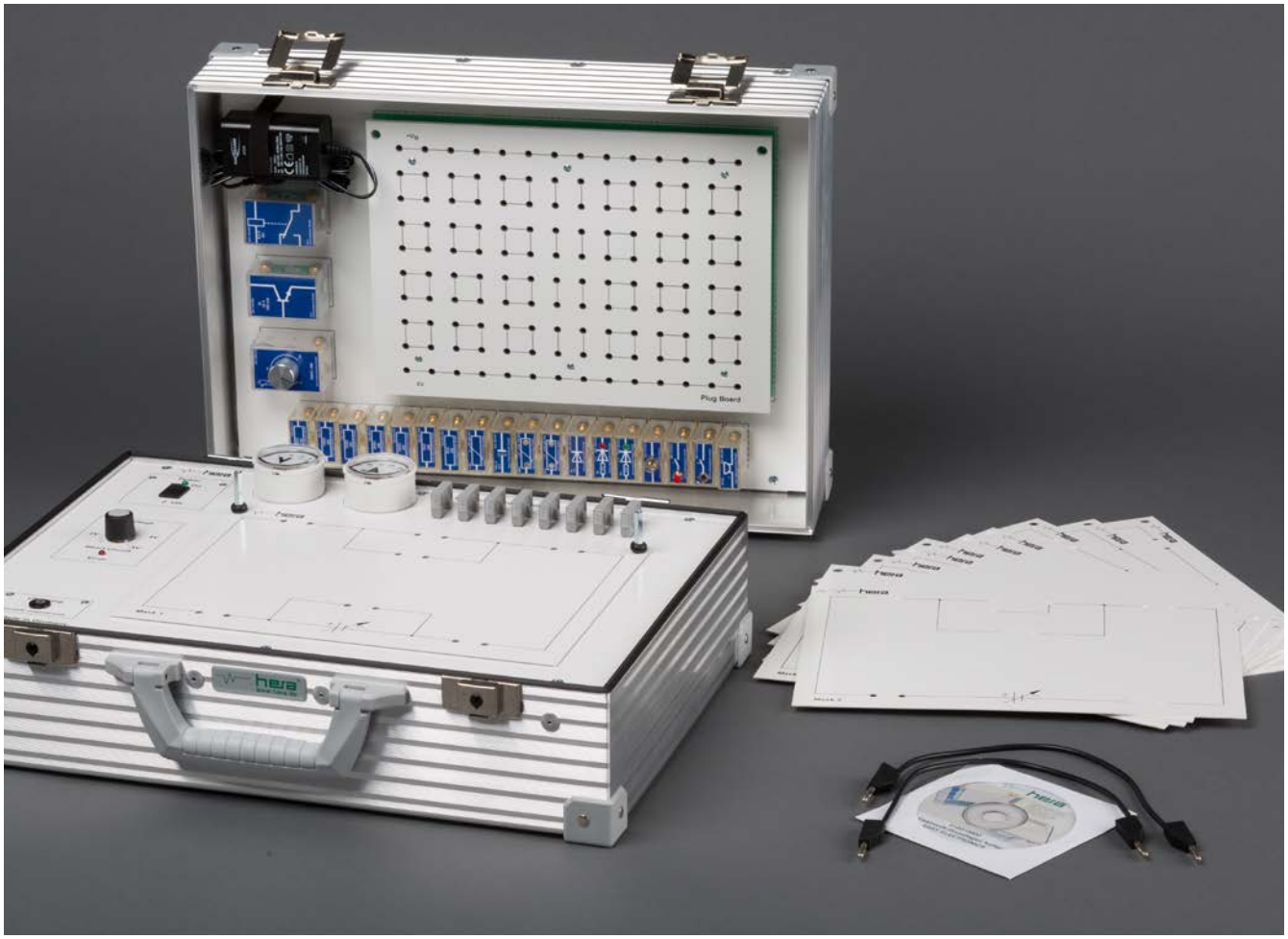
Laboratory Furniture

EASY ENTRY INTO ELECTRONICS
MASK-GUIDED BASICS

This system is suitable for a first contact to some basic electronic circuits and is recommended e.g. for higher grates in secondary schools or similar.
The Easy Electronics Case is a battery-operated training kit which holds everything that is needed for an interesting training. It can be used in regular classrooms with no extra laboratory instruments and it requires no special preparation.

Learning Content:

- Measurements with Analogue Instruments
- Ohms Law
- Resistors in Series and Parallel
- Bridge Circuits
- Extended Series / Parallel Connection
- Unloaded / Loaded Voltage Divider
- Diode
- Transistor as Switch
- Capacitor in DC Circuits
- Temperature Dependant Resistors
- NTC / PTC / LDR
- Circuit with Relay (Addition Kit)
- Continuity Test (Addition Kit)



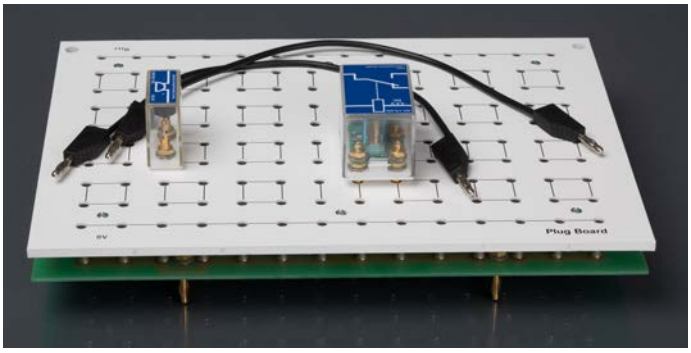
EASY ELECTRONICS CASE

Content of Supply:

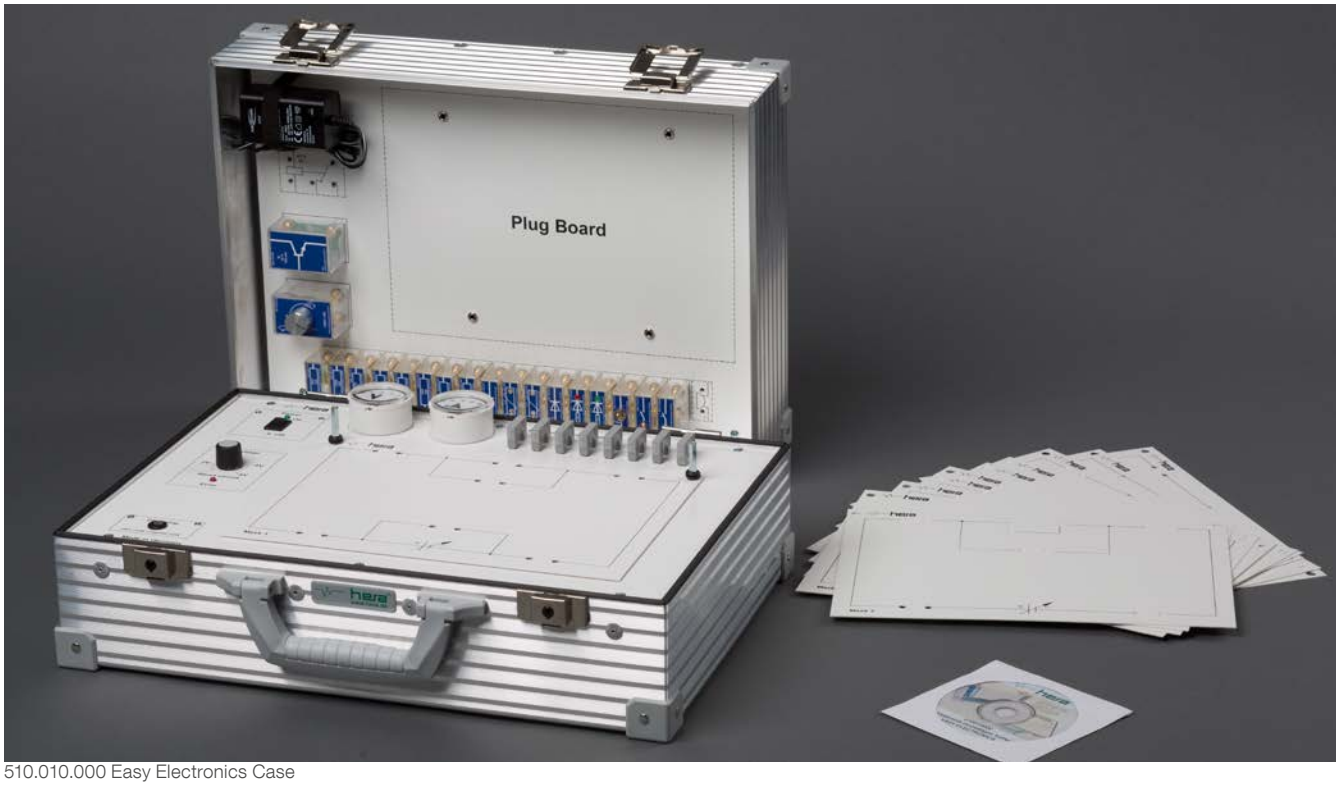
- Aluminium case with key and detachable cover 460 x 340 x 210mm (WxDxH).
- Integrated storage panel equipped with:
  - 8x 19mm Connecting Plugs
  - 1x Analogue Ammeter
  - 1x Analogue Voltmeter
  - 1x Potentiometer
  - 7x Resistor
  - 1x Switch
  - 1x Pushbutton
  - 1x Lamp
  - 2x Light Emitting Diode
  - 1x Diode
  - 1x PTC Resistor
  - 1x NTC Resistor
  - 1x Capacitor
  - 1x LDR
  - 1x Transistor
- Experimental plug-field with 11 circuit masks.
- Adjustable DC supply with accumulator for mains independant use.
- Incl. charge controller and mains connector.
- CD manual (DE + EN) as pdf file with tests and solutions.

Addition Kit consisting of:

- Plug-field for variable experiments with 4mm jacks in 19mm raster
- Buzzer
- Relay
- 4mm Laboratory Cables



510.010.100 Addition Kit for variable use



510.010.000 Easy Electronics Case

Easy Electronics Case			
510.010.000	Easy Electronics Case	510.010.100	Addition Kit

ELECTRIC / ELECTRONIC ENGINEERING

The following plug-board solutions for basic - and advanced electronics offer a wide range of fundamental knowledge in AC/DC - and semiconductor technology which is essential for all electric / electronic professions. With respect to the curriculum the plug-boards are available with a different assortment of components and suitable student - and instructor manuals. The plug-boards and components are made in 19mm standard raster and allow the configuration of flexible circuits.
For deepening the courses the basic plug-boards can be followed by topic-specific trainers, e.g. for digital electronics, power electronics, control engineering, etc.
The boards are in standard size with scratch-proofed hardlaminated front and due to the ergonomically tilted cover and front-side cable connection they can be used directly on the table or hanging in training system frames.

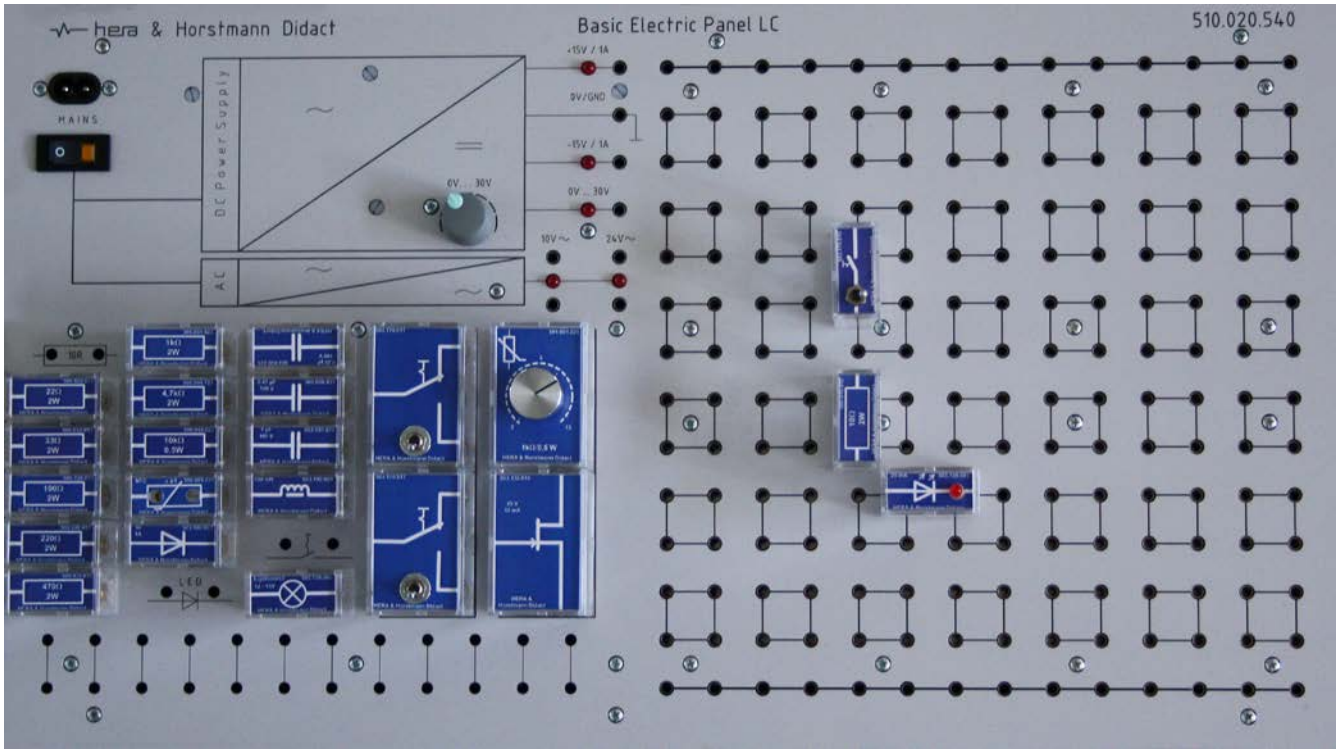
BASIC ELECTRIC CIRCUITS

The Basic Electric Panel LC is a compact training system with a small set of components for a choice of 1phase AC and DC circuits.
The training system is equipped with all necessary short-circuit proofed power supplies and a plug-board for variable circuits. All required components are directly positioned on a storage field. The plug-board is equipped with 4mm jacks in 19mm raster.

The training system can be directly plugged into a standard outlet and holds everything required for a sufficient training.

For your tests you will need an oscilloscope and a multimeter.

Operating voltage: 110...230V, 50/60Hz



Basic Electric Panel LC 510.020.540

Learning Content:

- Ohm's Law
- Voltage and Current Error Circuits
- Electric Resistors
- Voltage Sources
- Efficiency
- Parameter in AC Circuits
- Capacitors in AC Circuits
- Diodes
- Transistors

Technical Data:

- DC Voltage: +/- 15V, 1A (+/- 5%) and 0...30V, 1A
- AC Voltage 1phase: 10V, 100mA; 24V, 100mA

Included Components:

9x Resistors
1x NTC
3x Capacitors
1x Coil
1x Diode
1x Light Emitting Diode
1x Potentiometer
1x Transistor
1x Toggle Switch
1x Selector Switch
1x Lamp

Basic Electric Circuits and Accessory			
510.020.540	Basic Electric Panel LC incl. Set of Components	510.029.001	Manual with CD, Basic Tests in Electric / Electronic Engineering
510.022.040	Set of Cables and Connectors to Basic Electric LC		

BASIC ELECTRIC /ELECTRONIC CIRCUITS

The Basic Electric Panel and Addition Electric Panel is a compact training system with a comprehensive set of components for the major circuits in AC / DC technology. In addition to the tests of the Basic Electric Panel LC it covers a wide range of 3phase AC experiments.
The component set of the Addition Electric Panel is adapted to the manual 510.028.001 Basic Tests in Electric / Electronic Engineering.

For your tests you will need an oscilloscope and two multimeters (e.g. 1x digital, 1x analogue).

Operating voltage: 110...230V, 50/60Hz
Dimensions: 532 x 297mm (WxH)

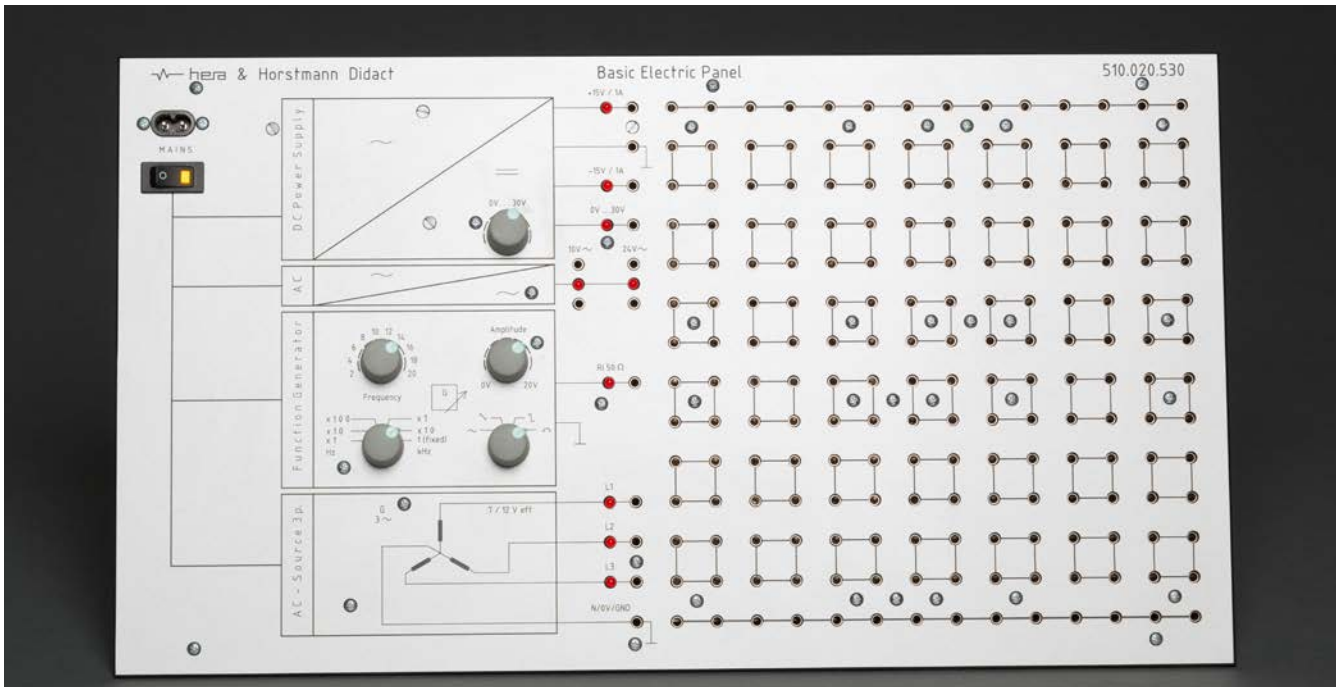
Learing Content:

- Electric Circuits
- Ohm's Law
- Voltage and Current Error Circuits
- Electric Resistors NTC, PTC, LDR
- Resistors in Series, in Parallel and Combined
- Voltage Sources
- Parameters in AC Technology
- Current -, Voltage - and Power Matching
- Parameters and Presentation of AC Signals
- Threephase Systems (Star & Delta)
- Resistors, Capacitors and Coils in AC Circuits
- Transformer / Transmitter
- Wheatstone's Bridge
- Diodes
- Sine Generator
- Transistors
- Thyristors
- Operational Amplifiers

Technical Data:

• DC Voltage:	+ 15V, 1A (+/- 5%) - 15V, 1A (+/- 5%) 0...30V, 1A
• AC Voltage:	10V, 100mA 24V, 100mA
• 3phase Generator:	7 / 12V (eff.) max. 50mA
• Function Generator:	
Wave Forms:	sinus, triangle, square and positive pulse
Frequency:	2Hz...200kHz
Volltage:	0...20V

Basic Electric Panel 510.020.530



ADDITION ELECTRIC PANEL

equipped with:

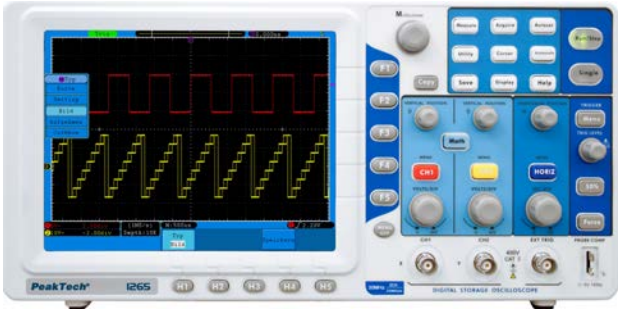
- 16 Resistors
- 1 NTC
- 1 LDR
- 1 Potentiometer
- 1 Laminated Iron Core
- 3 Coils (2x 300N, 1x 900N)
- 1 Coil 100mH
- 1 Transistor
- 1 Thyristor
- 1 Switch
- 2 Lamps
- 1 OP-AMP

Dimensions: 266 x 297mm (WxH)

Addition Electric Panel 510.021.020 (19mm connectors included in cable set 510.022.000)

Analogue Multimeter
590.100.005

Digital Multimeter
590.100.003



Oscilloscope 30MHz
590.126.500

Basic Electric / Electronic Circuits and Accessory			
510.020.530	Basic Electric Panel	590.100.003	Digital Multimeter
510.021.020	Addition Electric Panel	590.100.005	Analogue Multimeter
510.022.000	Set of Cables and Connectors to Basic Electric	590.126.500	Oscilloscope 30MHz
510.028.001	Manual with CD, Basic Tests in Electric / Electronic Engineering	590.130.500	Oscilloscope 70MHz

ADVANCED ELECTRONIC CIRCUITS

The Basic Electronic Panel and Addition Electronic Panel is a compact training system with a comprehensive set of components for advanced electronic circuits for AC and DC Technology and Semiconductor Technology.

For your tests you will need an oscilloscope and two multimeters (e.g. 1x digital, 1x analogue).

Operating voltage: 110...230V, 50/60Hz
Dimensions: 532 x 297mm (WxH)

Technical Data:

- DC Voltage: + 15V, 1A (+/- 5%)
  - 15V, 1A (+/- 5%)
  0...30V, 1A
- AC Voltage: 10V, 100mA
  24V, 100mA
- 3phase Generator: 7 / 12V (eff.) max. 50mA
- Function Generator:
  - Wave Forms: sinus, triangle, square and positive pulse
  - Frequency: 2Hz...200kHz
  - Volltage: 0...20V

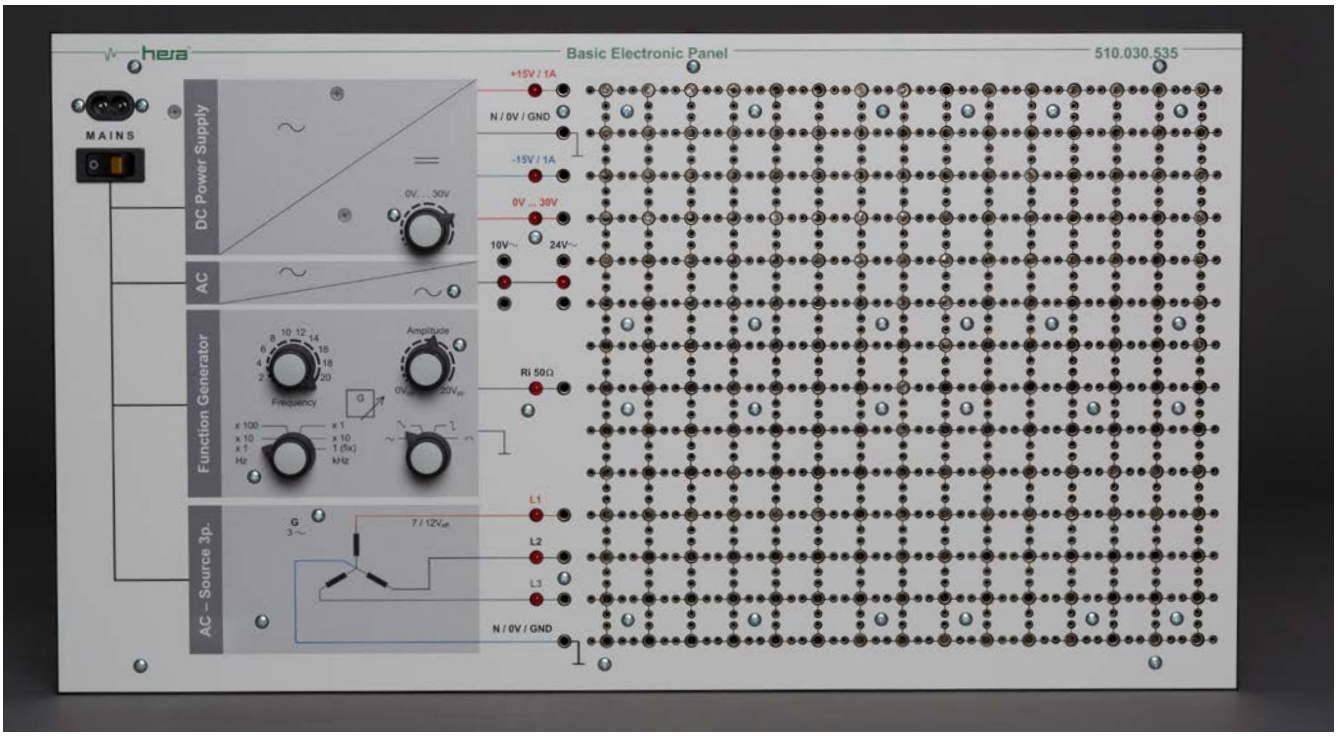
Learing Content to AC/ DC Technology:

- Electric Circuits
- Ohm's Law
- Voltage and Current Error Circuits
- Electric Resistors NTC, PTC, LDR, VDR
- Resistors in Series, in Parallel and Combined
- Voltage Sources
- Parameters in AC Technology
- Current -, Voltage - and Power Matching
- Parameters and Presentation of AC Signals
- Threephase Systems (Star & Delta)
- Resistors, Capacitors and Coils in AC Circuits
- Transformer / Transmitter
- Wheatstone's Bridge

Learning Content to Semiconductor Technology:

- Diodes (Rectifier, Z-Diodes, LEDs)
- Bipolar Transistors
- Unipolar Transistors
- MOSFET
- Unijunction Transistor (UJT)
- Thyristors (DIAC, TRIAC, Thyristor)
- Trigger Circuits (squarewave generator, multivibrator, monoflop, flip-flop, saw-tooth generator, sine generator
- Modulator - Demodulator (Amplitude, Frequency)
- Power Supplies (Rectifier Circuits)
- Binary Operations (AND, OR, NOT, NAND, NOR for DTL, TTL, CMOS)
- Operational Amplifiers

Basic Electronic Panel 510.030.535



ADDITION ELECTRONIC PANEL

The Addition Electronics Set is adapted to our manuals Basics of AC / DC Technology and Semiconductor Technology.

Tests for the optional components are included in the manuals.

Dimensions: 532 x 297mm (WxH)

equipped with:

- 28 Resistors
- 1 NTC
- 1 LDR
- 1 VDR
- 15 Capacitors
- 2 Potentiometers
- 4 Coils
- 1 Laminated Iron Core
- 10 Diodes
- 9 Transistors
- 1 DIAC
- 1 Thyristor
- 1 TRIAC
- 1 Switch
- 2 Lamps
- 1 OP-AMP

Addition Electronic Panel 510.031.030

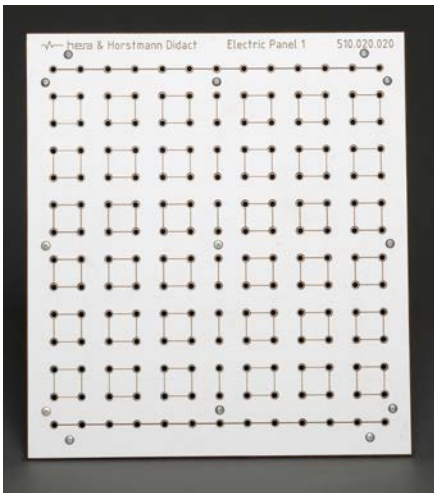
Advanced Electronic Circuits and Accessory		Options incl. Tests	
510.030.530	Basic Electronic Panel	510.031.100	Opto-Electronics (Fototransistor / Optical Coupler)
510.031.030	Addition Electronic Panel	950.050.700	PV Modules (Pair)
510.032.000	Set of Cables and Connectors to Basic Electronic Panel	950.044.100	IC-Socket with Timer 555
510.038.011	Manual with CD, Basic Tests to AC/DC Technology		
510.038.021	Manual with CD, Basic Tests to Semiconductors		

EXPERIMENTAL PLUG BOARDS FOR BASIC ELECTRIC

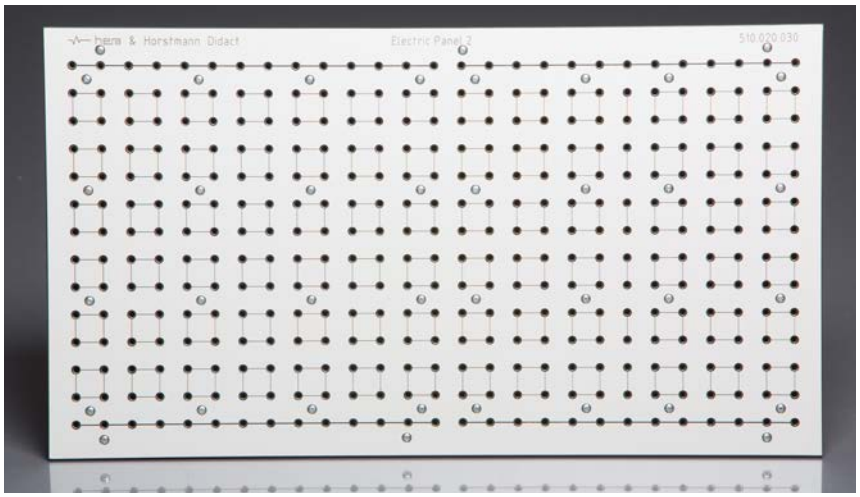
The experimental plug boards are for all standard plug components in 19mm raster with 4mm lamella plugs.

External power supply is required!
See suitable power supplies on the next pages.

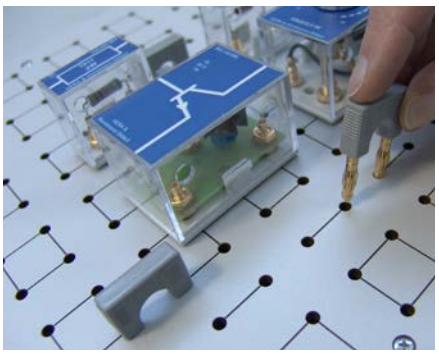
The plug boards are also available for safety lab cords.

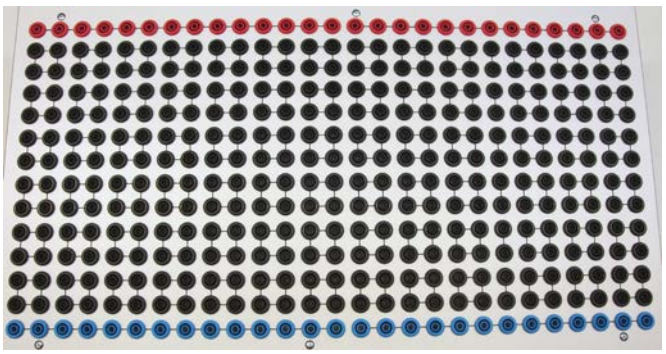


Electric Panel 1 510.020.020



Electric Panel 2 510.020.030





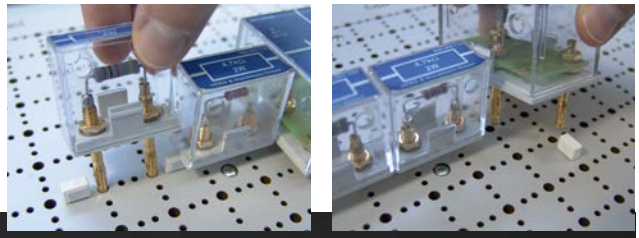
Electric Panel Safety Jacks 2, 510.025.030

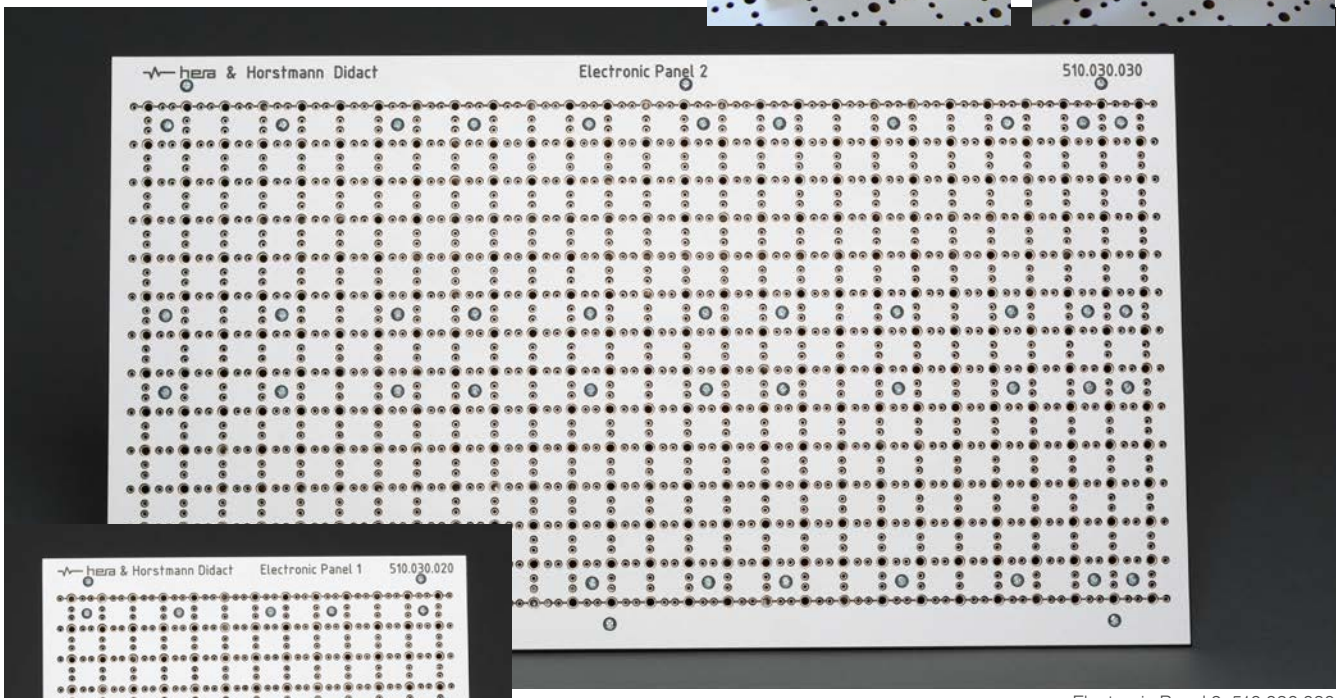
Experimental Plug Board Electric			
510.020.020	Electric Panel 1 small (266 x 297mm)	510.025.020	Electric Panel Safety Jacks 1 small (266 x 297mm)
510.020.030	Electric Panel 2 large (532 x 297mm)	510.025.030	Electric Panel Safety Jacks 2 large (532 x 297mm)

EXPERIMENTAL PLUG BOARDS FOR BASIC ELECTRONIC

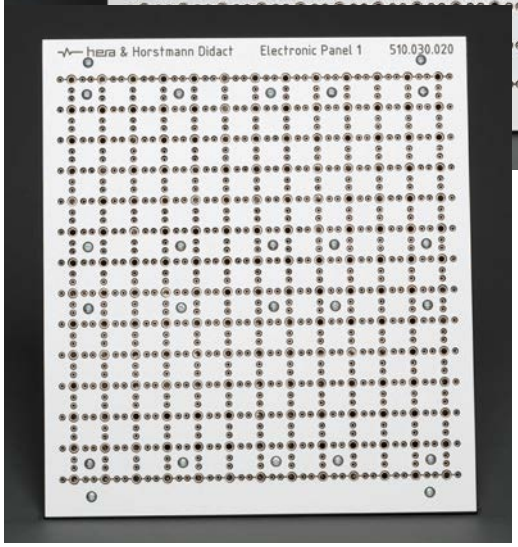
The experimental plug boards are for all standard plug components in 19mm raster with 4mm lamella plugs, connections between the components need to be done with 2mm standard plugs.

External power supply is required!
See suitable power supplies on the next pages.





Electronic Panel 2 510.030.030



Electronic Panel 1 510.030.020

Experimental Plug Board Electronic	
510.030.020	Electronic Panel 1 small (266 x 297mm)
510.030.030	Electronic Panel 2 large (532 x 297mm)

UNIVERSAL SUPPLY FOR ELECTRIC / ELECTRONIC

The Universal Supply Panel is suitable for the external supply of the Experimental Plug Boards without integrated power supply or for the supply of different low voltage signals in eductational laboratories.

All outputs are short-circuit protected and equipped with 4mm safety jacks.

Dimensions: 266 x 297mm (WxH)
Operating voltage: 110...240V, 50/60Hz

Electric Supply Panel 510.030.520

Voltages:

- DC Voltages: + 15V, 1A (+/- 5%)
  - 15V, 1A (+/- 5%)
  0...30V, 1A
- AC Voltages: 10V, 100mA
  24V, 100mA

3 Phase Generator:

- Voltage L-N: 7V (eff.)
- Voltage L-L: 12V (eff.)
- Current: max. 50mA
- Frequency: approx. 50Hz (60Hz)

Function Generator:

- Wave Forms: sinus, triangle, square, positive pulse
- Internal Resistance: Ri= 50Ω
- Duty Cycle: V = 2
- Frequency: 2Hz...200kHz
- Voltage: 0...20V
  0...8V at positive pulse

Universal Supply for Electric / Electronic			
510.030.520	Electric Supply Panel (DC Supply, AC Supply 1phase, AC Supply 3phase, Function Generator)	510.060.520	DC Supply Panel (Lab Power Supply 0-30V 0-2A, analogue reading with selector for current or voltage)

ICOM DIDACTIC SUPPLY WITH USB INTERFACE

The ICOM Didactic Supply is suitable for the external supply of the Experimental Plug Boards without integrated power supply or for the supply of different low voltage signals in eductational laboratories.
With background illuminated graphical LC-Display.

The ICOM Didactic Supply is available in a carrying case for bench top use or integrated in a bench rack as KP, EP or MP module.
Front side with USB - and rear side with LAN interface.

Operating voltage: $110V_{AC}$...$125V_{AC}$ resp. 220...240V, 50/60Hz

Output Voltages:

- DC Voltages: +-5V, +-12V, +-15V / 1A
  0 ..30V, 0...2A
- AC Voltages: 10V, max. 0,2A
  24V, max. 0,2A

3Phase Generator:

- Voltage L-N: 0 ...10V $_{L-L}$ RMS
- Voltage L-L: 0...17,4V $_{L-N}$ RMS
- Current: max. 400mA
- Frequency: 1...120Hz, res. 1Hz

Function Generator:

- Wave Forms: sinus, triangle, square, saw tooth (rising / falling), trapezium signal, positive pulse
- Internal Resistance: Ri= 50Ω
- Frequency: 0,5Hz...200kHz
- Voltage: 0...15Vss

ICOM Didactic Supply	
630.800.301	ICOM Didactic Supply (Operating Voltage 220...240VAC)
630.800.308	ICOM Didactic Supply (Operating Voltage 110...125VAC)
394.205.301	Desktop Housing 2EP 535 x 195 x 142mm (LxDxH)

RESISTORS

Plug component in a transparent plastic housing with detachable cover and 2 nickel plated 4mm lamella plugs in 19mm raster.
The power resistors are in a metal housing.

Load capacity of resistors < 10kΩ: 2 Watt, higher resistance values: 0,5 Watt and the power resistors: 10 Watt.

Tolerance +/- 5%.

Dimensions of housing: 38 x 19 x 35mm (WxDxH).

Plug Components: Resistor 2W

Value	x 1Ω	x 10Ω	x 100Ω	x 1kΩ
1,0	500.001.012	500.010.012	500.100.012	500.001.022
1,2	500.001.212	500.012.012	500.120.012	500.001.222
1,5	500.001.512	500.015.012	500.150.012	500.001.522
1,8	500.001.812	500.018.012	500.180.012	500.001.822
2,2	500.002.212	500.022.012	500.220.012	500.002.222
2,7	500.002.712	500.027.012	500.270.012	500.002.722
3,3	500.003.312	500.033.012	500.330.012	500.003.322
3,9	500.003.912	500.039.012	500.390.012	500.003.922
4,7	500.004.712	500.047.012	500.470.012	500.004.722
5,6	500.005.612	500.056.012	500.560.012	500.005.622
6,8	500.006.812	500.068.012	500.680.012	500.006.822
8,2	500.008.212	500.082.012	500.820.012	500.008.222

Plug Components: Resistors 0,5W

Value	x 10kΩ	x 100kΩ	x 1MΩ
1,0	500.010.022	500.100.022	500.001.030
1,2	500.012.022	500.120.022	500.001.230
1,5	500.015.022	500.150.022	500.001.530
1,8	500.018.022	500.180.022	500.001.830
2,2	500.022.022	500.220.022	500.002.230
2,7	500.027.022	500.270.022	500.002.730
3,3	500.033.022	500.330.022	500.003.330
3,9	500.039.022	500.390.022	500.003.930
4,7	500.047.022	500.470.022	500.004.730
5,6	500.056.022	500.560.022	500.005.630
6,8	500.068.022	500.680.022	500.006.830
8,2	500.082.022	500.820.022	500.008.230

Plug Components: Resistor 10W

Value	x 1Ω	Wert	x 1Ω
1,0	500.001.014	15,0	500.015.014
2,2	500.002.214	22,0	500.022.014
5,1	500.005.114	33,0	500.033.014
10,0	500.010.014	43,0	500.043.014

POTENTIOMETERS & DEKADES

Plug component in transparent plastic housing with detachable cover and three nickel plated 4mm lamella plugs in 19mm raster.

Load capacity 0,5 Watt and 4 Watt.

Dimensions of housing: 38 x 57 x 35mm (WxDxH).

Plug Components: Potentiometer

501.022.020	22kΩ / 0,5W	501.100.014	100Ω / 4W
501.047.020	47kΩ / 0,5W	501.250.014	250Ω / 4W
501.100.020	100kΩ / 0,5W	501.470.014	470Ω / 4W
501.500.020	500kΩ / 0,5W	501.001.024	1,0kΩ / 4W
501.001.030	1,0MΩ / 0,5W	501.004.724	4,7kΩ / 4W
950.058.500	Decade 0...9kΩ		

SPECIAL **RESISTORS**

Plug component in transparent plastic housing with detachable cover and 2 nickel plated 4mm lamella plugs in 19mm raster.

Dimensions of housing 38 x 19 x 35mm (WxDxH).

Plug Components: Special Resistors			
500.011.099	VDR	500.080.019	PTC Resistor P330
500.470.029	NTC Resistor 470Ω with series resistor	500.085.029	LDR FW200
500.004.729	NTC Resistor 4,7kΩ		

Z DIODES

Plug component in transparent plastic housing with detachable cover and 2 nickel plated 4mm lamella plugs.

Plug Components: Z Diodes	
503.110.001	Zener Diode 3,3V, 130mA
503.110.002	Zener Diode 4,7V, 90mA
503.110.003	Zener Diode 6,2V, 64mA
503.110.004	Zener Diode 6,2V, 160mA
503.110.005	Zener Diode 10V, 40mA
503.110.006	Zener Diode 10V, 105mA
503.110.007	Zener Diode 12V, 86mA

DIODES AND LIGHT-EMITTING DIODES

Plug component in transparent plastic housing with detachable cover and 2 nickel plated 4mm lamella plugs.

Plug Components: Diodes and Light-Emitting Diodes			
503.100.004	Si-Diode 6A / 600V	503.120.030	Ga-As-LED, red, 5V, with series resistor
503.100.003	Si-Diode 1A	503.120.020	Ga-As-LED, yellow, 5V, with series resistor
503.100.002	Ge-Diode 30mA	503.120.010	Ga-As-LED, green, 5V, with series resistor
503.100.001	Si-Diode 200mA	503.120.006	Ga-As-LED, red, 15V, with series resistor
503.120.003	Ga-As-LED, red	503.120.005	Ga-As-LED, yellow, 15V, with series resistor
503.120.002	Ga-As-LED, yellow	503.120.004	Ga-As-LED, green, 15V, with series resistor
503.120.001	Ga-As-LED, green	950.007.700	Ga-As-LED, white
503.120.000	Ga-As-LED, blue		

CAPACITORS

Plug component in transparent plastic housing with detachable cover and 2 nickel plated 4mm lamella plugs in 19mm raster.

Dimensions of housing 38 x 19 x 35mm (WxDxH).

Max. rated current: 100V.

Plug Components: Tantalum Capacitors

Value	x 1pF	x 10pF	x 0,1nF	x 1nF	x 0,01µF	x 0,1µF
10	502.010.015	502.100.015	502.001.025	502.010.025	502.000.135	502.001.035
15	502.015.015	502.150.015	502.001.525	502.015.025	---	502.001.535
22	502.022.015	502.220.015	502.002.225	502.022.025	502.000.235	502.002.235
33	502.033.015	502.330.015	502.003.325	502.033.025	502.000.325	502.003.335
47	502.047.015	502.470.015	502.004.725	502.047.025	502.000.425	502.004.735
56	502.056.015	502.560.015	502.005.625	502.056.025	502.000.525	502.005.635
68	502.068.015	502.680.015	502.006.825	502.068.025	502.000.625	502.006.835

Plug Components: Electrolytic Capacitors (poled)

2,2µF / 63V	502.002.234	100µF / 35V	502.100.033
4,7µF / 63V	502.004.734	470µF / 35V	502.470.033
10µF / 63V	502.010.034	1000µF / 63V	502.001.044
22µF / 63V	502.022.034	2200µF / 63V	502.002.244
47µF / 63V	502.047.034	4700µF / 63V	502.004.744

TRANSISTORS

Plug component in transparent plastic housing with detachable cover and nickel plated 4mm lamella plugs.

Plug Components: Transistors

503.130.001	Transistor PNP 24V, 200mA, base left	503.130.009	Transistor NPN 40V, 1A, base right
503.130.002	Transistor PNP 20V, 100mA, base left	503.130.010	Transistor NPN 60V, 15A, base left
503.130.003	Transistor PNP 20V, 100mA, base right	503.130.011	Transistor PNP 60V, 15A, base right
503.130.004	Transistor PNP 40V, 1A, base left	503.130.012	Transistor PNP 40V, 1A, base left
503.130.005	Transistor PNP 40V, 1A, base right	503.130.013	Unijunction Transistor 35V, 50mA
503.130.006	Transistor NPN 20V, 100mA, base left	503.130.014	MOS-FET Transistor, 40V, 50mA, P-Channel, base left
503.130.007	Transistor NPN 20V, 100mA, base right	503.130.015	Barrier Layer Field Effect Transistor 25V, 10mA
503.130.008	Transistor NPN 40V, 1A, base left	503.130.016	Barrier Layer Field Effect Transistor 20V, 10mA
503.130.900	Photo Transistor BP103, 50V	503.130.017	MOS-FET Transistor, 40V, 50mA, N-Channel, base left

DIACS, **TRIACS** AND THYRISTORS

Plug component in transparent plastic housing with detachable cover and 3 nickel plated 4mm lamella plugs.

Plug Components: DIACs, TRIACs and Transistors	
503.140.001	DIAC 33V, 1mA
503.160.002	TRIAC 4A
503.150.001	Thyristor 3A
503.130.000	Transistor Socket

OPERATIONAL **AMPLIFIERS**

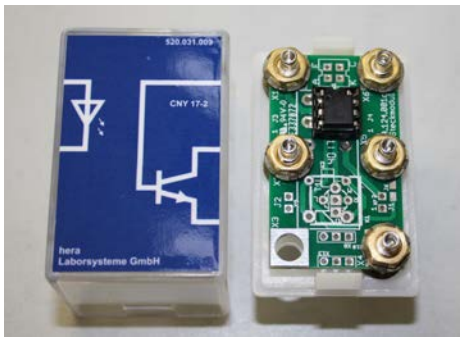
Plug component in transparent plastic housing with detachable cover and 3 nickel plated 4mm lamella plugs.

Plug Components: OP AMPs	
503.180.001	OP AMP
503.180.002	OP AMP, voltage supply from above

OPTICAL COUPLERS

- Plug component in transparent plastic housing with detachable cover and 5 nickel plated 4mm lamella plugs.
- Optical coupler OPTO-EL.CNY17-2.

Plug Component: Optical Coupler	520.031.009



COILS

Plug component in transparent plastic housing with detachable cover.

Plug Components: Coils	
503.190.005	10mH
503.190.006	20mH
503.190.010	30mH
503.190.007	40mH
503.190.008	80mH
503.190.009	100mH
503.190.011	200mH, big housing

TRANSFORMER SET

Different coils with 4mm lamella plugs and iron core for step up / step down transformer.

Plug Components: Transformers	
503.190.001	Coil N = 100
503.190.002	Coil N = 300
503.190.003	Coil N = 900
503.190.004	Laminated Iron Core, 1 Pair

OTHER PLUG COMPONENTS

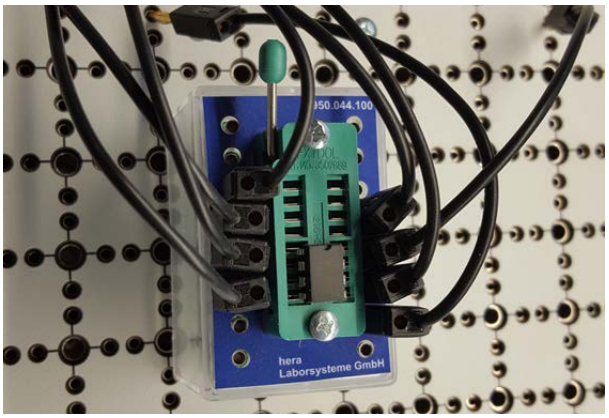
Plug component in transparent plastic housing with detachable cover and 3 nickel plated 4mm lamella plugs.

Plug Components: Switches, Relays and Lamps	
503.170.021	Relay 12V, 1 change over
503.170.020	Relay 24V, DC, 1 NOC
503.170.012	Button, NOC
503.170.014	Button, change over
503.170.013	Button, NCC
503.170.011	Change Over, 1pole
503.170.010	Toggle Switch, 1pole
503.170.005	Light Source
503.170.004	Lamp yellow, 15V, 82mA
503.170.003	Lamp red, 15V, 82mA
503.170.002	Lamp green, 15V, 82mA
503.170.001	Lamp Socket E10
950.050.700	Solar Cell 0,5V DC / 0,08A

IC SOCKET WITH **TIMER 555**

- Transparent plastic housing with detachable cover and nickel plated 4mm lamella plugs.
- IC socket 16poles with quick fastener for ICs.
- IC contacts with 2mm sockets.
- Timer NE555.
- 8x lab cables 2mm (75mm).

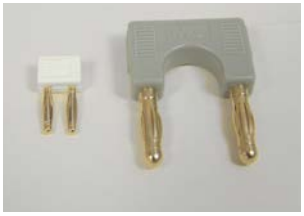
IC Socket with Timer NE555	950.044.100



CONNECTORS AND **EMPTY HOUSINGS**

Transparent plastic housing for plug systems are available in following dimensions:

- small: 38 x 19 x 35mm (WxDxH).
- large: 38 x 57 x 35mm (WxDxH).

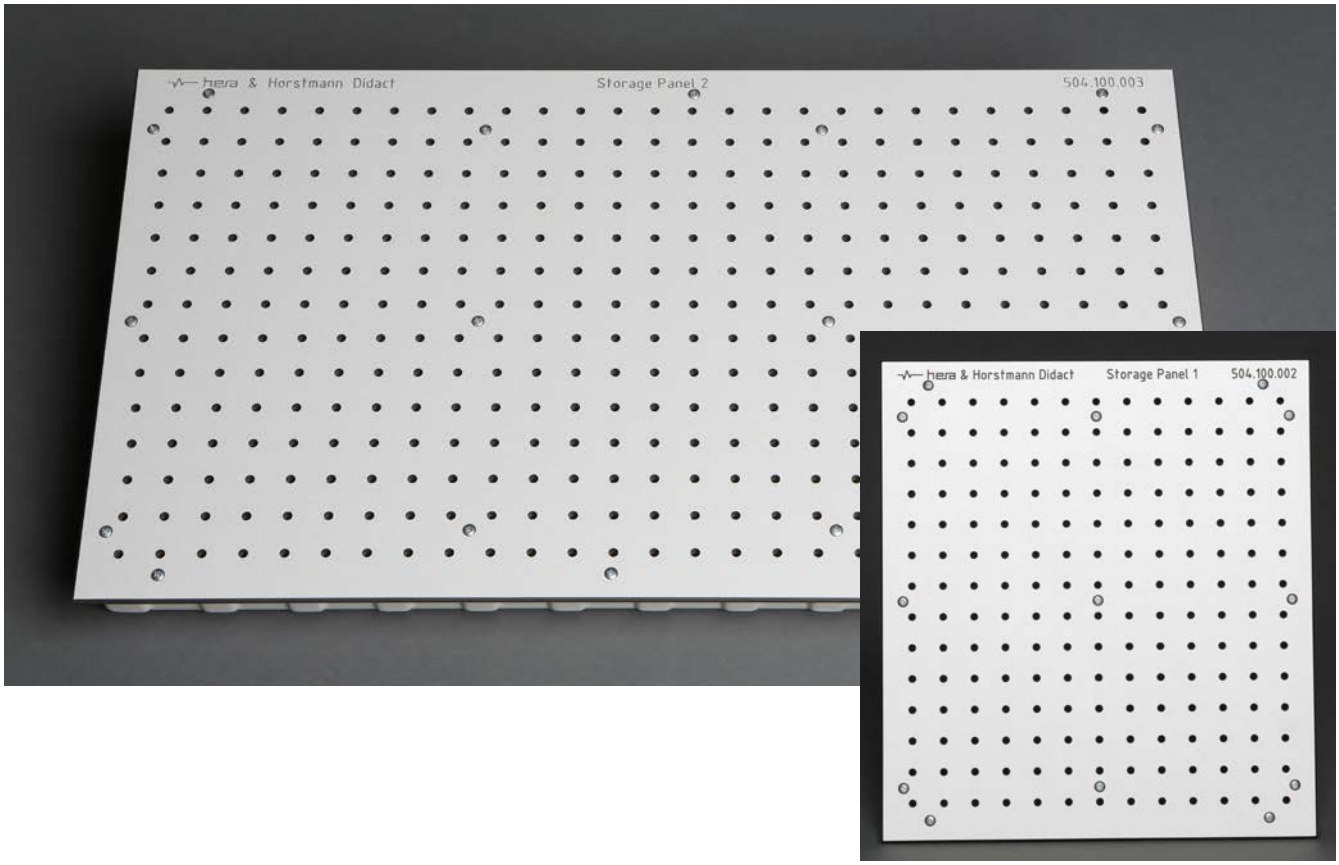


Connectors and Empty Housings	
505.000.010	Connector 2mm (plug spacing 5mm)
505.000.020	Connector 4mm (plug spacing 19mm)
505.000.022	Adapter 4mm plug to 2mm socket, black
505.000.023	Adapter 4mm plug to 2mm socket, red
505.000.030	Safety Connector 4mm (plug spacing 19mm)
504.001.001	Empty Housing, small with 2 lamella plugs
504.001.002	Empty Housing, small
504.001.003	Empty Housing, large with 3 lamella plugs
504.001.004	Empty Housing, large

STORAGE BOARDS FOR PLUG COMPONENTS

If you decide for an individual selection of plug components or you prefer to hand out only a selection instead of the whole set, then the storage boards in different sizes will be perfect to store or hand out.

Storage boards are not electrically connected.

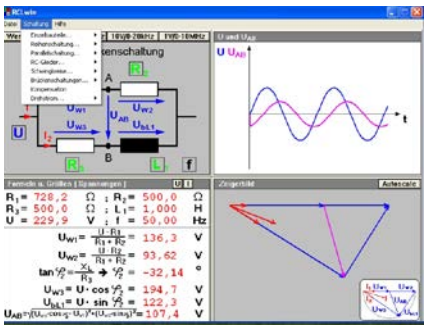


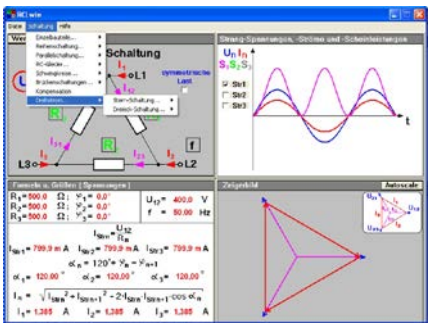
SOFTWARE COURSE ALTERNATING CURRENT

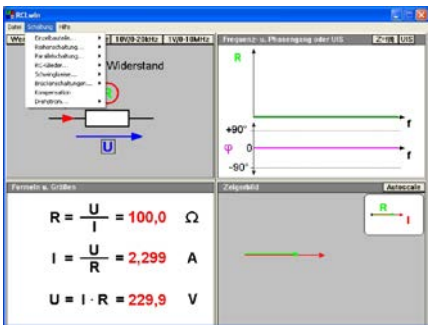
RCLwin is a selfsufficient teachware for the comprehension of alternating current circuits.

The trainee can choose AC circuits from a big library and examine its behavior when changing different parameters. The program continuously runs the values when increasing or decreasing the parameters.

RCLwin presents the calculated values in frequency - and phase response or UIS - and pointer diagram. The parameter can also be entered directly.
RCLwin is an ideal learning aid for students of technical colleges, universities or technical vocational schools.







Storage Panel for Plug Components		Software Course Alternating Current	
504.100.001	Storage Panel 133 x 297mm	510.900.003	RCLwin, Classroom License, EN
504.100.002	Storage Panel 266 x 297mm		
504.100.003	Storage Panel 532 x 297mm		

BASICS TO **OPERATIONAL AMPLIFIER**

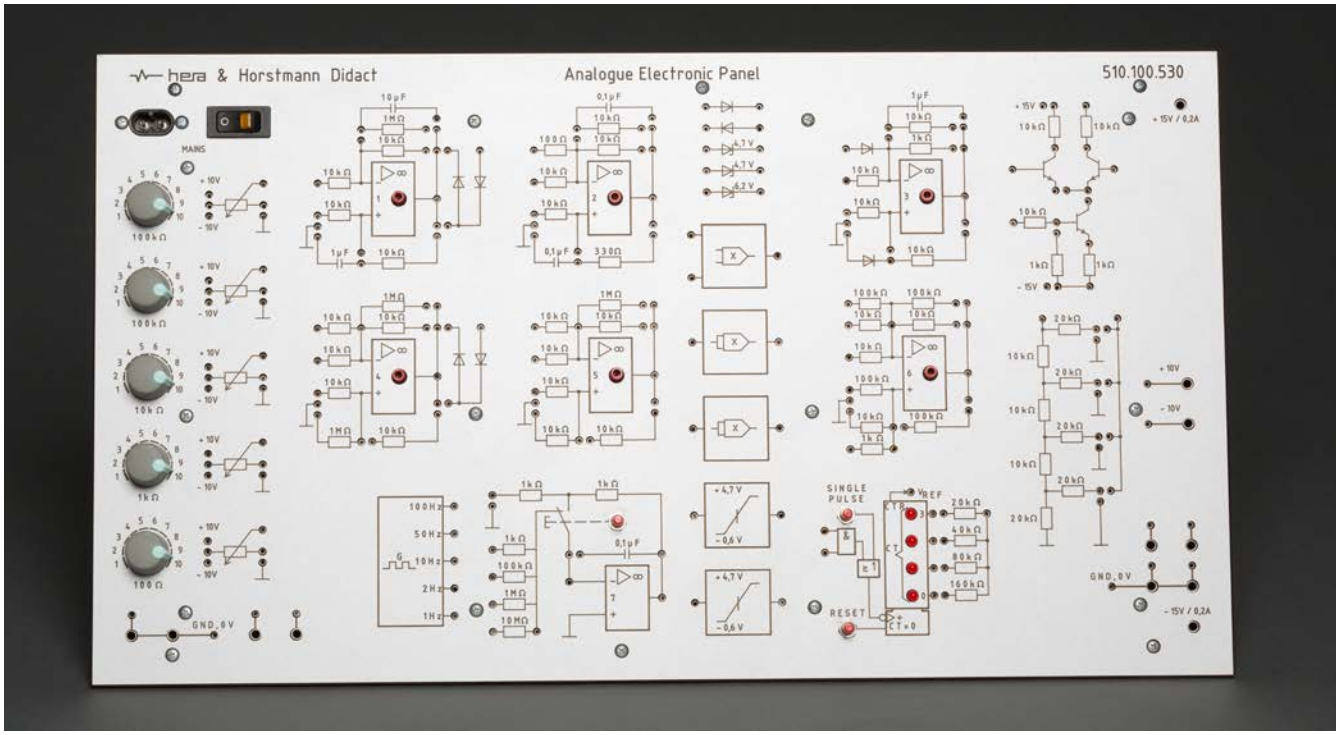
The Operational Amplifier Panel is a compact training system that imparts comprehensive knowledge to all kind of operational amplifier circuits such as used for designing or repairing laboratory devices.
The panel holds 11x operational amplifiers µA 741 and 5x potentiometers for voltage adjustment.

All connections are done with 2mm lab cords.
There are two 2mm resp. 4mm jacks for the connection of external instruments (+/- 15V, 0,2A).
For your tests you will need a multimeter.

Operating voltage: 110...230V, 50/60Hz
Dimensions: 532 x 297mm (WxH)

Learning Content:

- Differential Amplifier
- Inverter Circuits (inverted - / non-inverted amplifiers)
- Impedance Converter
- Calculation Circuits (summing, subtraction, multiply)
- Comparator (threshold switch, Schmitt trigger)
- Constant Current / Constant Voltage Source
- Precision Voltage Source, Precision Rectifier Circuits
- Astable / Monostable Multivibrator
- Integrator
- Function Generator (triangle, saw tooth)
- Differentiator
- RC-Oscillator with OP Amp
- AC Voltage Amplifier
- Squaring / Root-Extraction with Diodes Network
- A/D_D/A Converter and R2R Networks
- Divider / Root-Extraction



Operational Amplifier Panel 510.100.530

Basics to Operational Amplifiers			
510.100.530	Operational Amplifier Panel	590.100.003	Digital Multimeter
510.102.000	Set of Cables and Connectors		
510.108.001	Manual with CD, Basics to Operational Amplifiers		

BASICS OF **POWER ELECTRONICS**

The Power Electronic Panel is a compact training system that enables to do tests in the field of power electronics in DC, AC and 3phase AC circuits on safety low voltage base.

The panel holds resistive -, inductive - and capacitive loads. Optionally the PID-C Motor Panel can be used for load and generator.
Operating Voltage: 220...240V 50Hz (resp. 60Hz)
Dimensions: 532 x 297mm (WxH)

AC Tests 1phase:

- Uncontrolled Halfwave Rectifier
- Uncontrolled Bridge Rectifier
- Half-Controlled Rectifier Bridge
- Controlled Rectifier Bridge
- Line-Commutated Rectifier
- Pulse Group Control

AC Tests 3phases:

- Uncontrolled Rectifier M3
- Uncontrolled Rectifier B6
- Controlled Rectifier M3
- Controlled Rectifier B6

DC Tests:

- Basic Circuits for Pulse Width Modulation (PWM)
- PWM with H-Bridge (MOSFET)

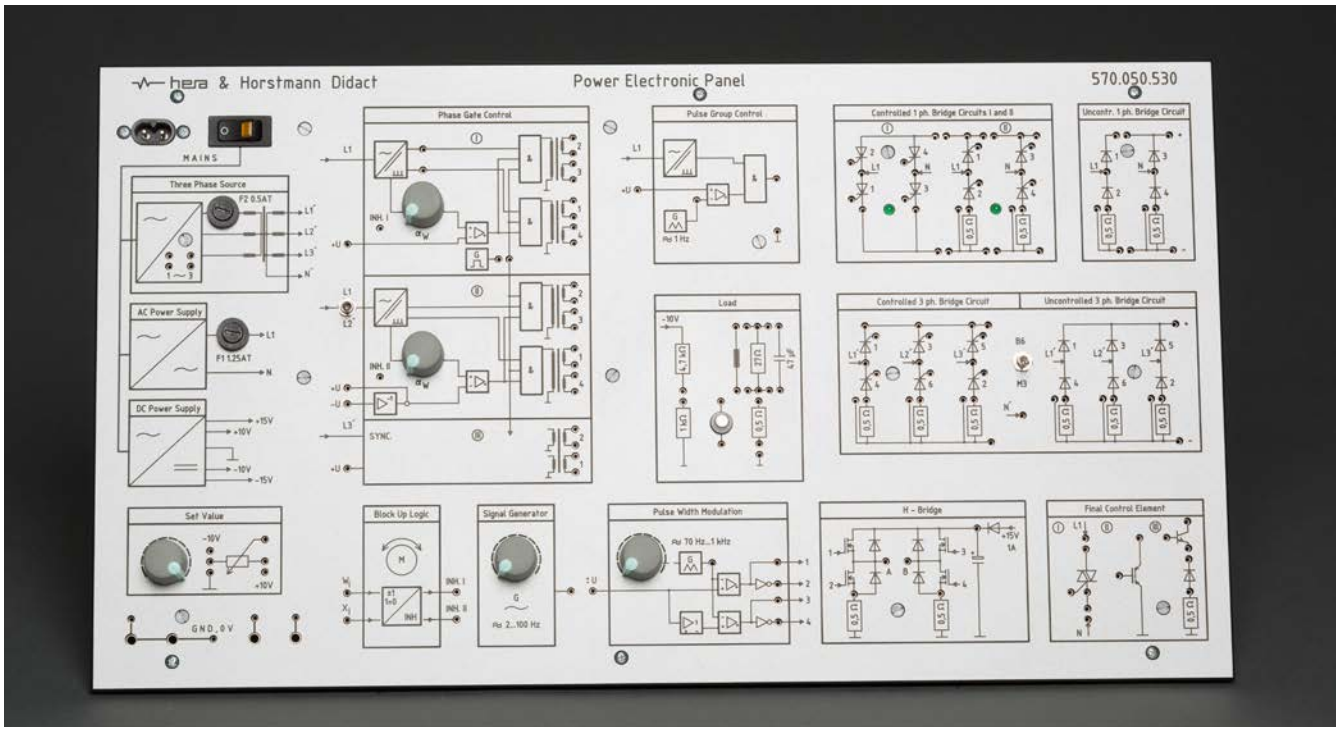
Tests to GTO:

- Triggering Pulse Manipulation
- GTO as Chopper

Technical Data:

- 3phase AC source: 12V / 20,5V
- 1phase AC source: 13V
- DC Souce : +15, +10V, -10V and -15V
- Adjustable Voltage, Signal Generator, Block Up Logic

>> SEE COMBINATION WITH PID-C MOTOR PANEL



Power Electronic Panel 570.050.530

Basics of Power Electronics			
570.050.530	Power Electronics Panel	570.052.000	Set of Cables and Connectors
570.050.536	Power Electronic Panel (60Hz)	590.126.500	Oscilloscope, 30MHz
570.058.001	Manual with CD, Principles of Power Electronics		

BASICS TO **PID CONTROL**

The PID Control Panel is a compact training system for studying the characteristics of controllers with P -, PI -, PD - and PID characteristics.

The panel consists of a set point generator -10V ... +10V and set point integrator, a sequence control 10ms ... 20s for measurements with standard oscilloscopes. It holds different types of P -, I -, D - elements that can be added to various control behaviors. An output limiter allows the adaption of the output voltage to external systems.

The PID Control Panel can be used in combination with following controlled systems: Light - and Temperature Control, PID-C Motor Panel, Fill Level Plant.

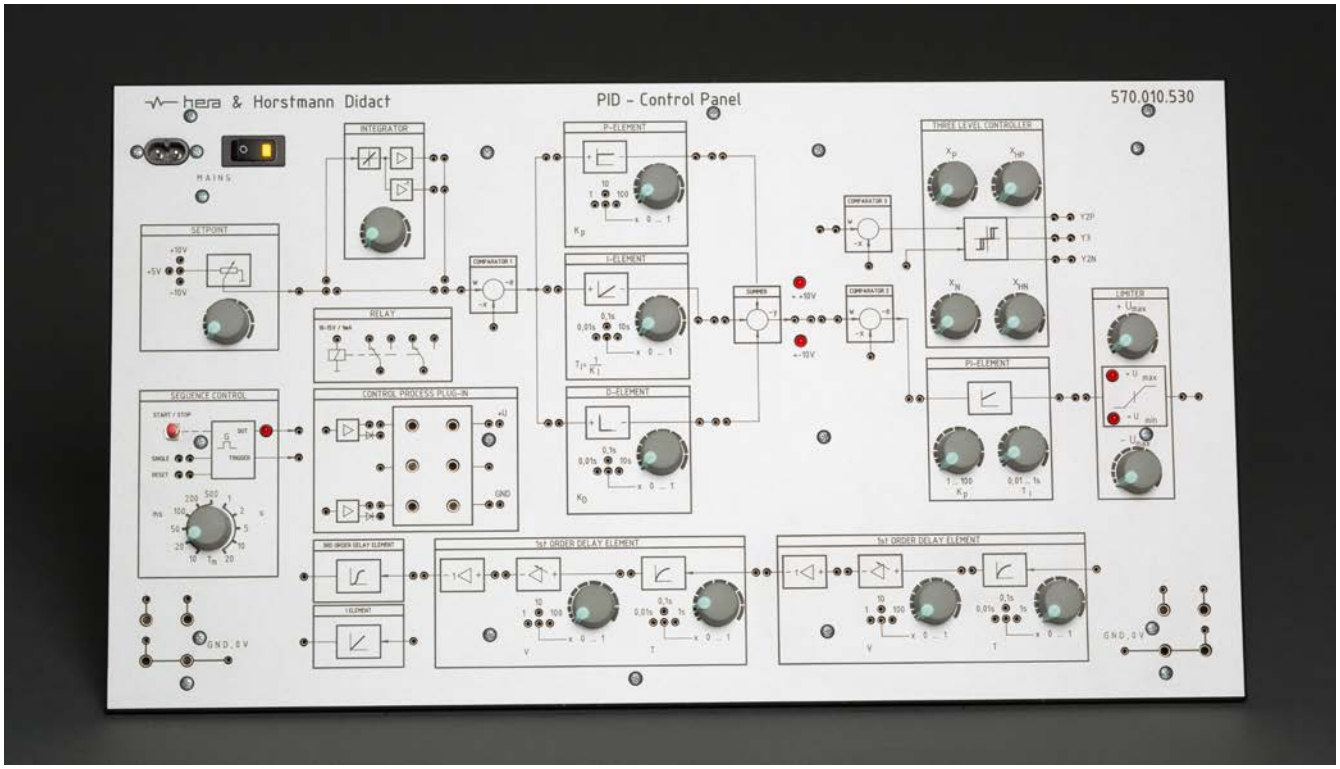
For doing you tests you will need an oscilloscope.

Operating voltage: 110...230V, 50/60Hz
Dimensions: 532 x 297mm (WxH)

Learning Content (with Power Electronic Panel):

- Functionality and Measurements of P -, I - and D-Controllers
- 2-Level Control and 3-Level Control
- P-Controlled Systems with 1st / 3rd Order Delay
- I-Controlled Systems, with and without delay
- I-Controlled Systems with dif. proportional coefficents
- PID-Controller
- Position Control
- Controller Optimization

>> SEE COMBINATION WITH PID-C MOTOR PANEL AND FILL LEVEL PLANT



PID-Control Panel 570.010.535

Basics to PID Control			
570.010.530	PID-Control Panel	570.031.200	Light - and Temperature Control
570.012.000	Set of Cables and Connectors	570.038.001	Manual with CD, Controlled Systems
570.018.001	Manual with CD, Closed Loop Technology	590.126.500	Oscillocope 30MHz

CONTROLLED SYSTEM - **MOTOR AND GENERATOR UNIT**

The PID-C Motor Panel can be used in combination with the PID Control Panel or with the Power Electronic Panel.

The integrated machine unit holds a DC motor (12V / 0,58mA) with actual current indication and plugable load, the shaft-connected DC generator is with tachogenerator, plugable gyrating mass and an encoder for rotation speed and - direction.

The DC power amplifier is for the direct control of the motor with controller or PLL circuit. A plug-field allows cirucit enhancement with light- and temperature control.

For your tests you will need an oscilloscope.

Operating voltage: 110...230V, 50/60Hz
Dimensions: 266 x 297mm (WxH)

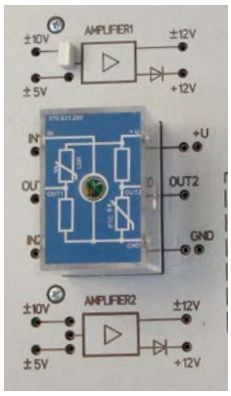
Learning Content (with PID Panel):

- Static/dynamic measurements for loaded/unloaded DC motor with (-out) gyrating mass (min-1, mA, mNm), current or torque controlled with a fexible combinaton of P-I-D controllers
- Voltage control by generator
- Speed control with underlaid current control (e.g. Servo)
- Behavior of the different controllers in the light - and temperature system
- One - and four quadrant operation

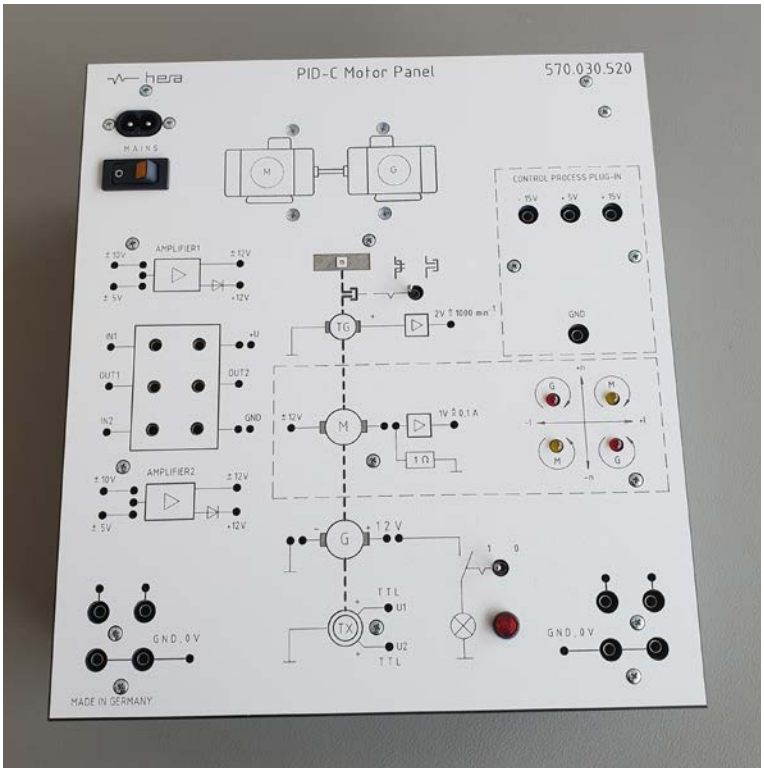
Learning Content (with Power Electronic Panel):

- DC Motor with controlled / uncontrolled half-wave converter (with big or small load)
- With / without smoothing choke
- Rotation speed with dependance to control angle
- Multipulse triggering
- DC motor with 3 quadrant H-bridge
- Counter-torque
- Unloaded motor output voltage/short-circuit current
- Electric load / load characteristics

>> APPLICABLE ALSO FOR THE PLC PANEL



Light - and Temperature Control 570.031.200



PID-C Motor Panel 570.030.520

Controlled Systems	
570.030.520	PID-C Motor Panel
570.038.001	Manual with CD, Controlled Systems
570.031.200	Light - and Temperature Control

CONTROLLED SYSTEM **- FILL LEVEL PLANT**

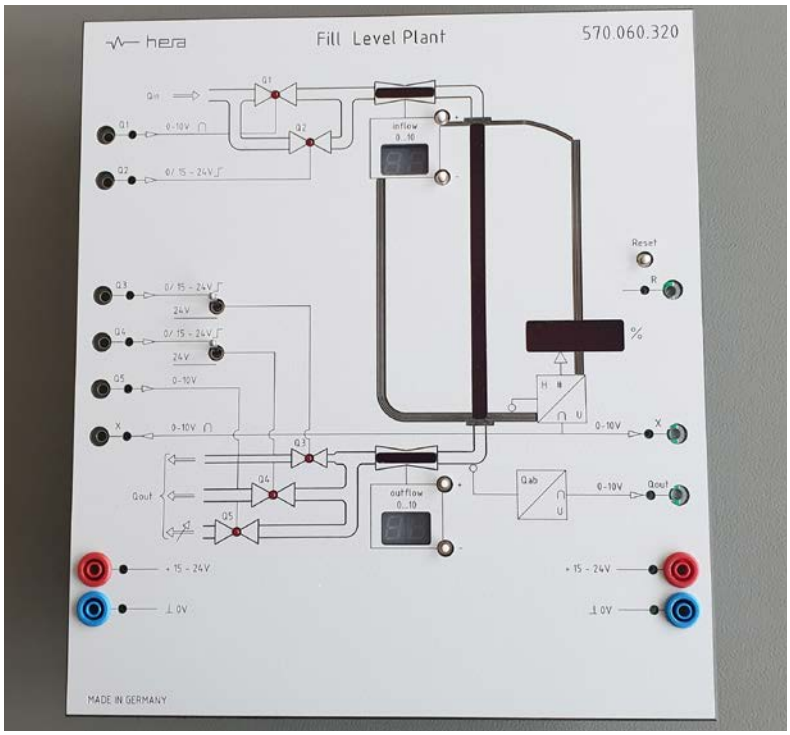
The Fill Level Plant Panel is a controlled system for the PID Control Panel and the PLC Panel. The manual offers an easy understanding of the expressions from control engineering. It simulates the effects of the different industrial controllers by value and LED bars.

Characteristics:

- Visualization of fill level, quantity of in- and outflow
- Outflow per time in dependance to fill level
- Cascadable for controlled system of higher order
- Applicable for industrial controllers, PLC and microprocessors
- Binary input controllable with 5V (microprocessor) and 24V (PLC)
- Analogue inputs 0 - 10V
- Analogue outputs 0 - 10V proportional to fill level and outflow per time
- Simulation fill level with LED bar and 7-segment display
- Indication of in- and outflow with 7-segment display
- In- and outflow simulation with running lights
- Valve simulation with LEDs

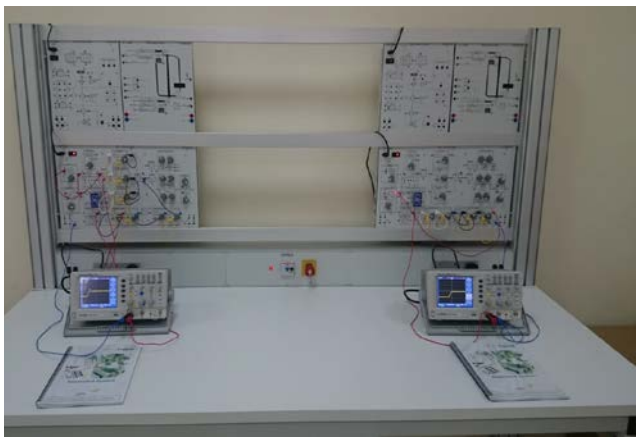
Operating voltage: 5...24V
Dimensions: 532 x 297mm (WxH)

>> APPLICABLE ALSO FOR THE PLC PANEL (MANUAL WITH EXAMPLE AVAILABLE)



Fill Level Plant 570.060.320

Control Engineering Lab with PID Panel, PID-C Motor Panel, Plug Component Light and Temperature System, Fill Level Plant (full training set up)



Controlled System	
570.060.320	Fill Level Plant

SOFTWARE **CONTROL ENGINEERING**

Control Engineering I:

Software for examination of different controllers (P, I, PI, PID and 2-position control) and different controlled systems for various industrial processes.
All results are stored and can be presented in graphical and statistical diagrams.

Simulated Processes:

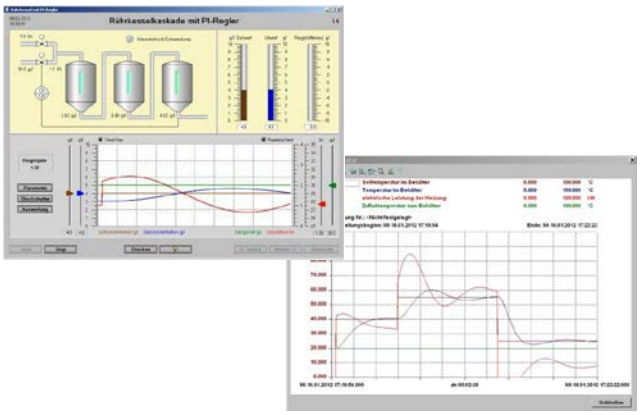
- Examination of Controller Behavior
- Liquid Level Control
- Temperature Control
- Temperature Control with Delay Time
- Control of a Mixing Container Cascade
- Analysis of Ptn-controlled systems with P, I, PI, PID
- Analyses of Controller Behavior

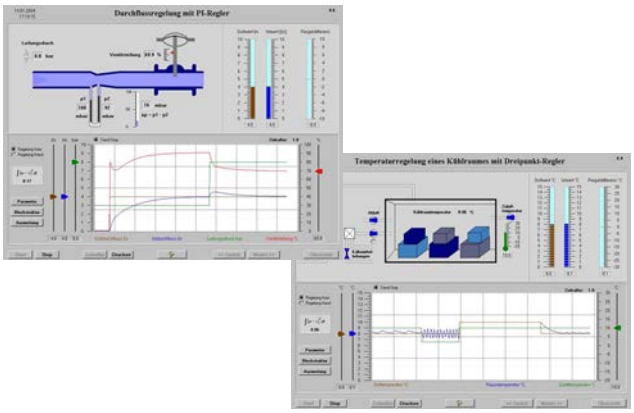
Control Engineering II:

Software for examination of different controllers (P, I, PI, PID and 3-position control) and different controlled systems for various industrial processes.
All results are stored and can be presented in graphical and statistical diagrams.

Simulated Processes:

- Flow Rate Control
- Engine Speed Control
- Room Temperature Control
- Cooling Chamber Control with 3-Position Controller
- Liquid Level Control with Standard Controller plus 3-Position Controller





Note: Both courses only differ in applications - no advanced course!

Software Control Engineering			
570.900.201	Control Engineering I (EN, DE), Single License	570.900.301	Control Engineering II (EN, DE, FR), Single License
570.900.210	Control Engineering I (EN, DE), 10x License	570.900.310	Control Engineering II (EN, DE, FR), 10x License

BASICS TO **1PHASE AND 3PHASE TRANSFORMERS**

The Transformer Panel is the ideal training system for doing all relevant tests and calculations for 1phase and 3phase transformers of different vector groups in unloaded or loaded circuits (different combinations of resistive -, inductive - and capacitive loads) and suitable safety installations.

For your tests we recommend 2 multimeters.

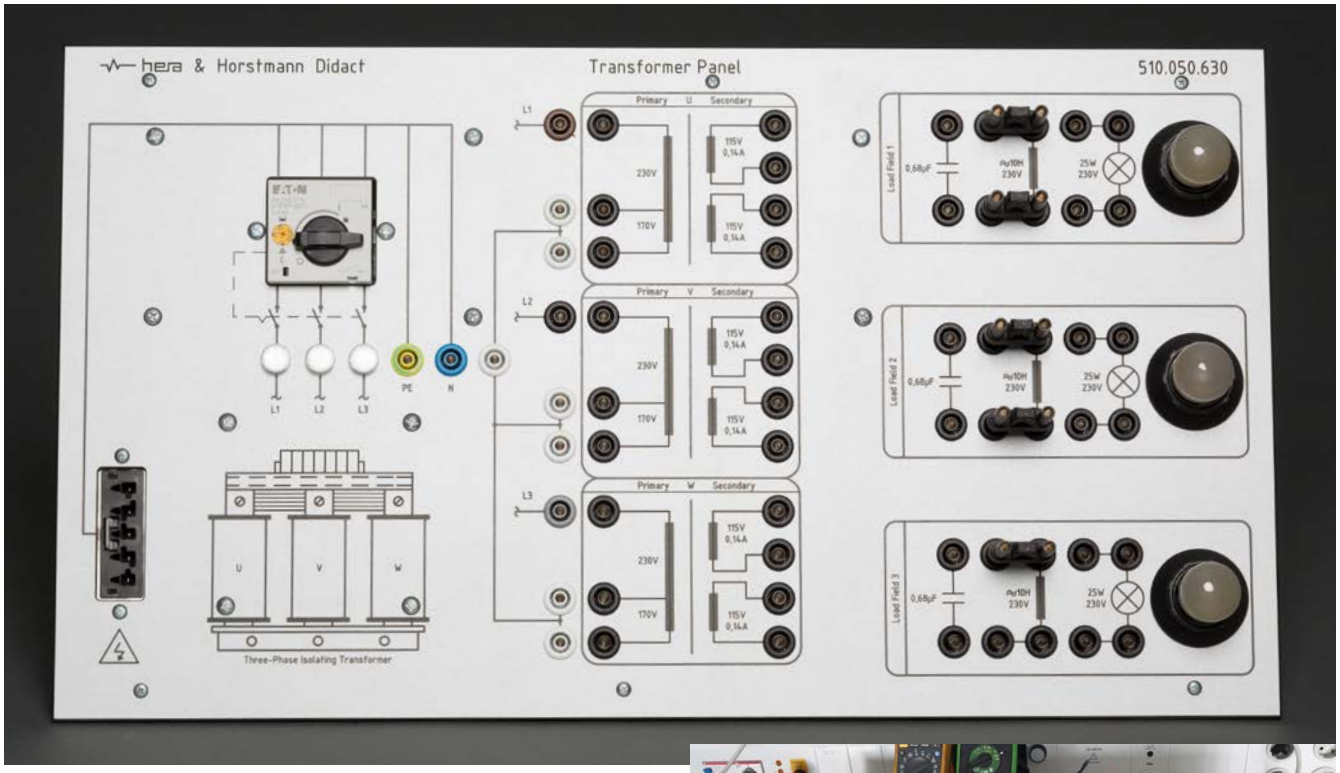
Technical Details:

- Power Connection: CEE plug 400VAC 50/60Hz
- 3phase tansformer, rated power: 100VA
- Primary: 3x 400V / secondary 6x 115V
- Pluggable resistive, inductive and capacitive load
- Applicable as autotransformer and isolating transformer
- Circuit breaker with adjustable tripping current

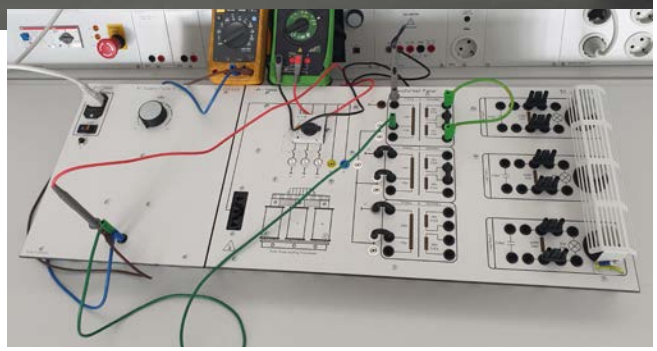
Learning Content:

- Types, functions and windings
- Operation without load and with different loads
- Up - and down transformation
- Autotransformer
- Short circuit operation
- 1phase transformers, ideal transformers, transformer loss
- 3phase transformers with different vector groups: Yd-, Yy-, Yz- Dy, Dd and Dz
- Phase multiplier circuit
- Symmetric and asymmetric loads
- Dimensioning of circuit breaker for transformer

>>Operating voltage: 400V, 3phase, 50/60Hz >>
Dimensions: 532 x 297mm (WxH)



Transformer Panel 510.050.630



Short Circuit Test with Transformer Panel and AC Supply Panel

Basics to Transformers			
510.050.630	Transformer Panel	510.052.000	Set of Cables and Connectors
510.050.640	AC Supply Panel 0...30V, 1A (for short curcuit test)	510.058.001	Manual with CD, Basics to Transformers

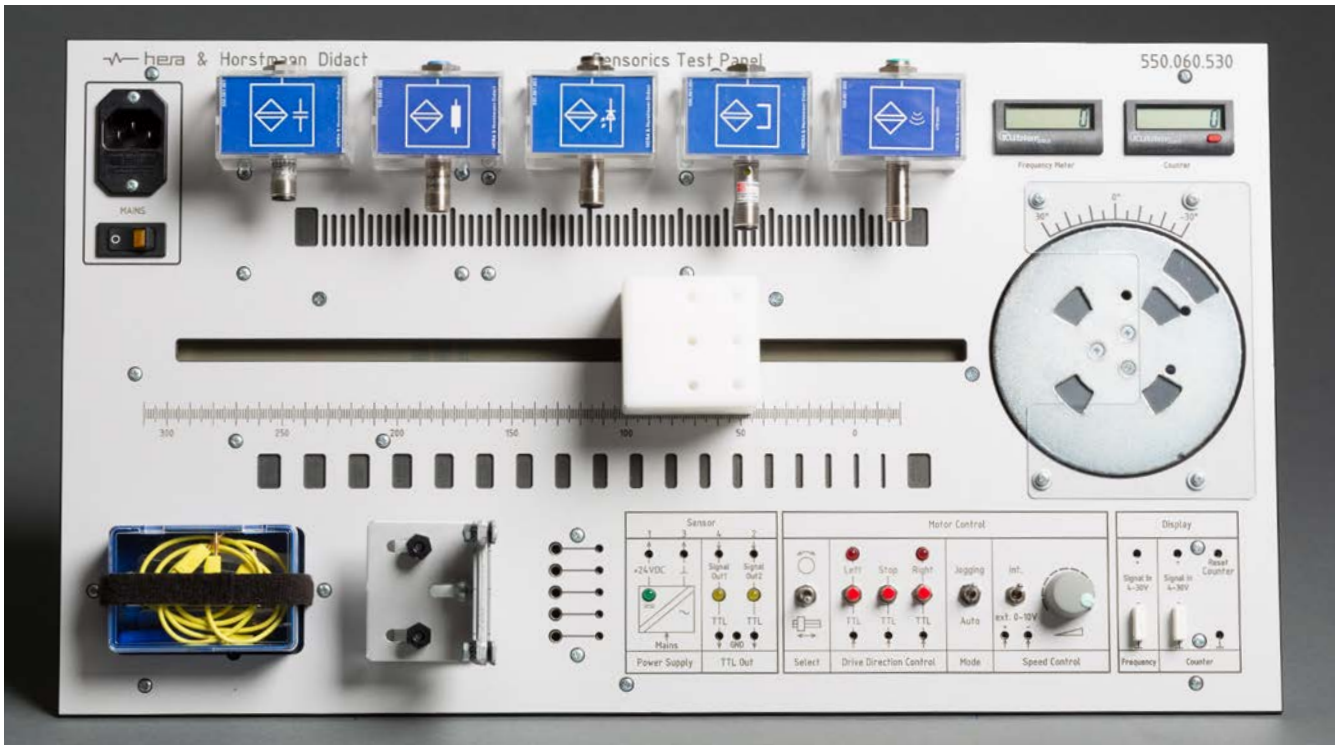
BASICS TO **INDUSTRIAL SENSORS**

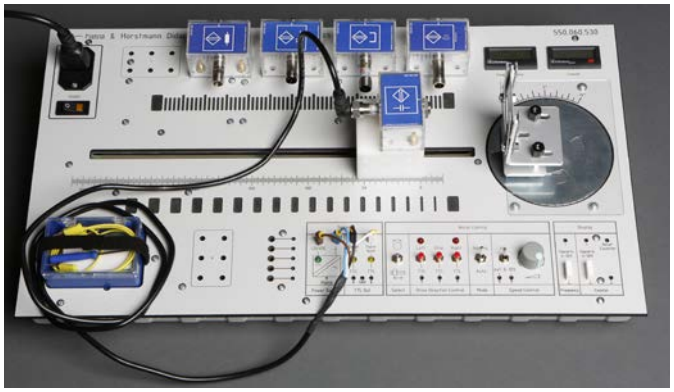
The Sensorics Test Panel is equipped with a motor-driven linear unit for tests to sensing distance as well as a coded disk for frequency counting and rotation speed as well as two digital counters.
The linear unit can be either directly controlled at the panel or externally with TTL signals or 24V for PLC control with feedback.
The basic system holds capacitive -, inductive -, resistive and optical sensors as well as material samples and cables. No additional equipment is required!

Operating power: 110 - 240V, 50/60Hz
Dimensions: 532 x 297mm (WxH)

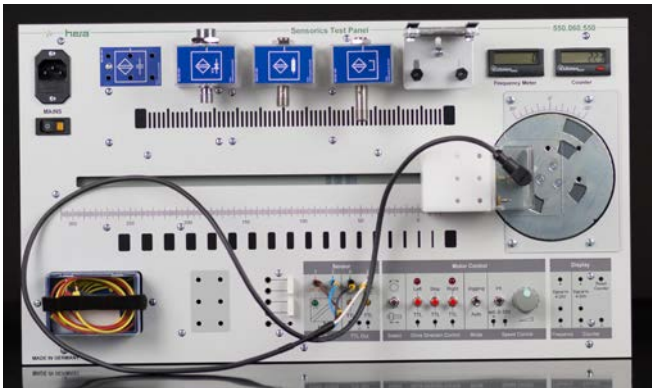
Learning Content:

- Active / passive sensors, switching hysteresis, reduction factor, response curve, sensing distance, responsive material
- Rotation counts and frequency measurement
- End position detection with sensitivity adjustment
- Hall sensors, magnetoresistive sensor, saturation core sensors
- Light barriers, adjustments and deflection on inclined surfaces
- Basics and tests to the optional sensors: inductive analogue sensors, ultrasonic sensors, optical fibers and expolsion-save NAMUR sensors.





Test to sensing distance for different sensors and materials



Rotation speed with inductive sensor

Basics to Industrial Sensors			
550.060.530	Sensorics Test Panel		**Extra Sensors (not in Panel included)**
	(magnetic, capacitive, inductive, optical sensor)	550.061.005	Ultrasonic Sensor
550.068.001	Manual with CD, Basics of Sensor Technology	550.061.006	Fibre Optics with Holder
038.111.100	2mm/4mm Adapter (10 Stck.)	550.061.007	Analogue Sensor
	(for application with PLC Panel)	550.061.008	NAMUR Set (inductive, capacitive, magnetic)

BASICS TO **DIGITAL TECHNOLOGY**

The Digital Panel is for a comprehensive understanding of common integrated circuits and their combination of NAND, NOR, XNOR and XOR gates.

The panel holds **input elements** (8x high/ 8x low membrane buttons, 1x debounced pushbutton, 1x hexadecimal dual coding switch, signal source 0...5V_{DC}, a square signal generator for TTL signals and plugable frequency divider), **processing elements** (7x AND/NAND, 7x AND/NAND with pull-up resistors, 5x OR/NOR, 5x OR/NOR with pull-up resistors, AND/OR combination, antivalence, equivalence and integrated ICs) and **output elements** (7segment reading with two 7segment decoders for hexadecimal codes, Sub-D 25poles for variable options).

For your tests you will need a multimeter!

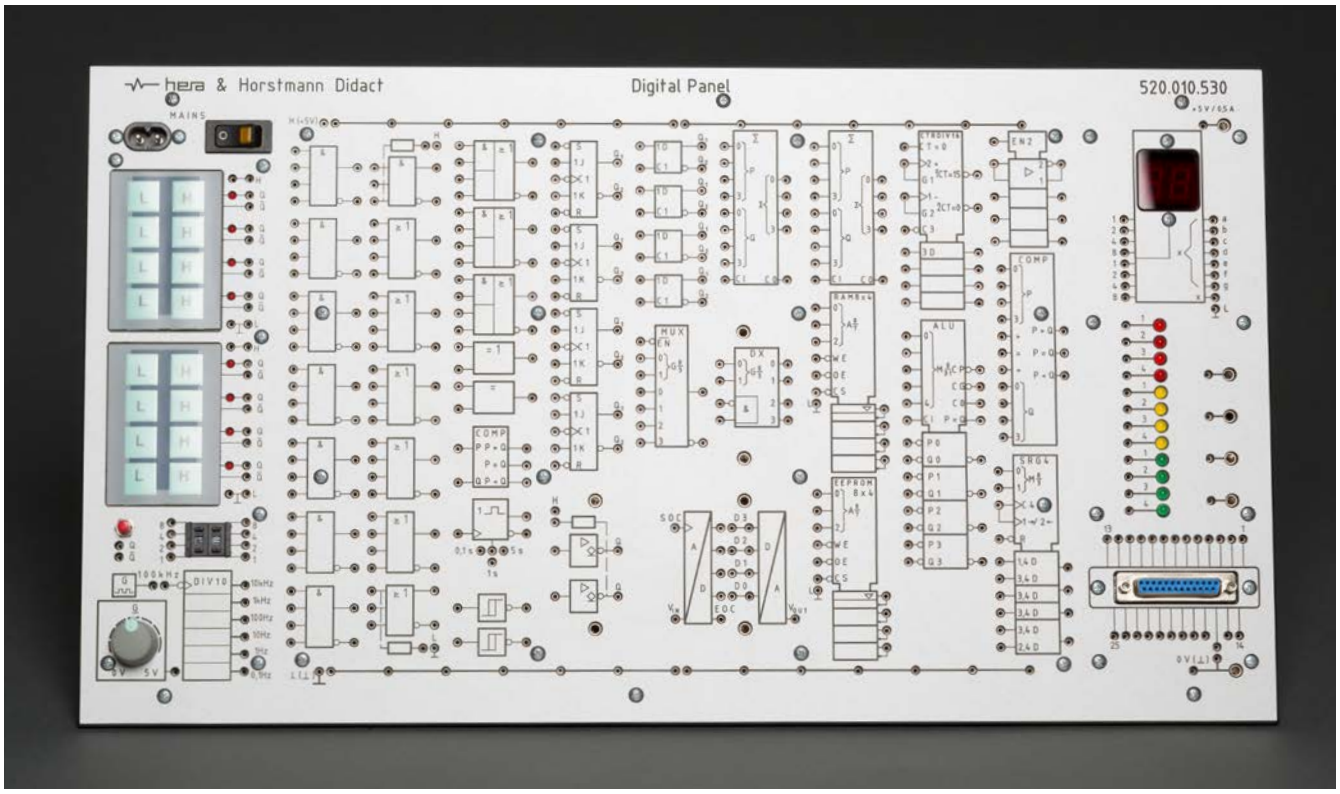
Operating voltage: 110...230V, 50/60Hz
Dimensions: 532 x 297mm (WxH)

Learning Content:

- Boolean Algebra and Karnaugh Diagrams
- NAND / NOR technology and pseudo tedrades
- Equivalence - and antivalence gates (XNOR/XOR)
- TTL 74 series (pull-up / pull-down resistors)
- Schmitt trigger (inverted / not-inverted)
- SR flip-flops presented with NAND/NOR gates
- different types of SR -, D -, JK flip-flops
- Mono-flop
- Code converters (8421-BCD to Excess-3-, Decimal, 7-Segment)
- Calculating circuit (correcting tedrads and carry overs)
- Arithmetic Logic Unit 74HC/HCT181(with/ without accu)
- Different types of counters (up, down, modulo-n, PLC,..)
- Register circuit, shift register
- Multiplexer / demultiplexer
- AD / DA converter

Plugging the elements is clearly indicated with MP4.

>> APPLICABLE FOR CONTROL OF THE STEP MOTOR PANEL



Digital Panel 520.010.530

Basics of Digital Technology			
520.010.530	Digital Panel	590.100.003	Digital Multimeter
520.012.000	Set of Cables and Connectors		
520.018.001	Manual with CD, Digital Technology		

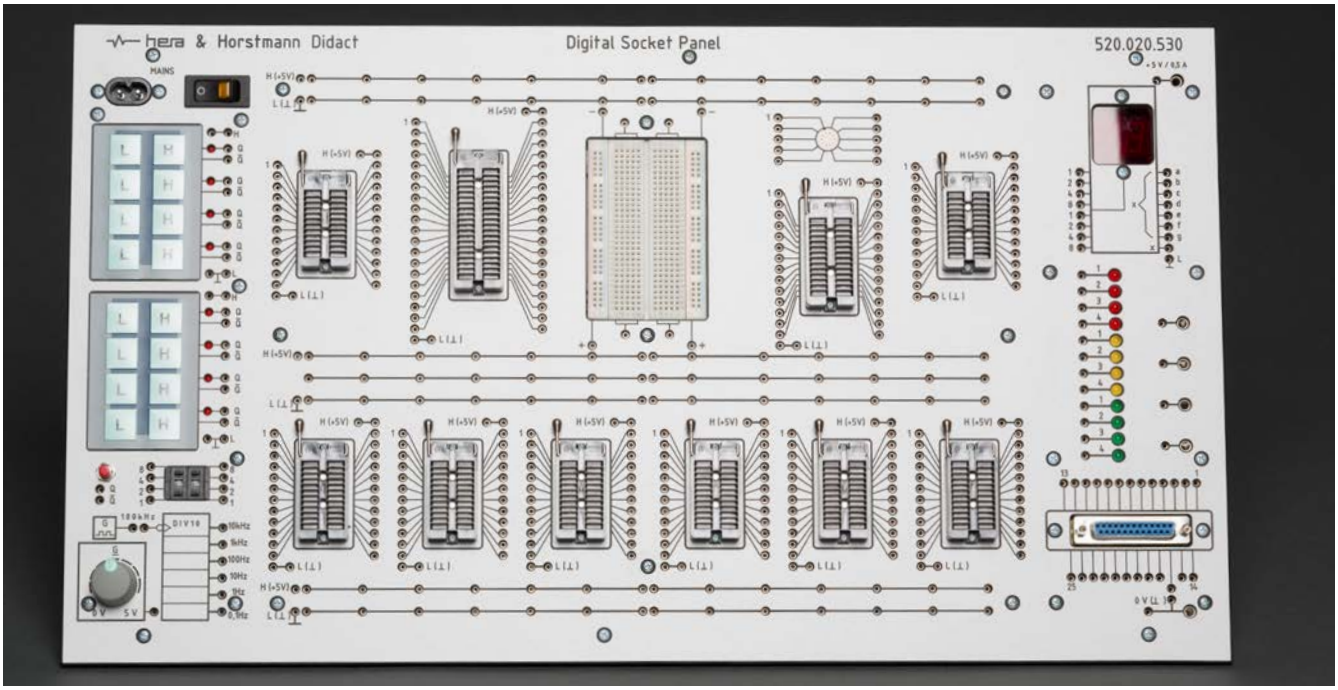
DIGITAL TECHNOLOGY WITH COMMON ICS

Instead of the integrated ICs the Digital Socket Panel is for direct use of ICs with fast connectors.

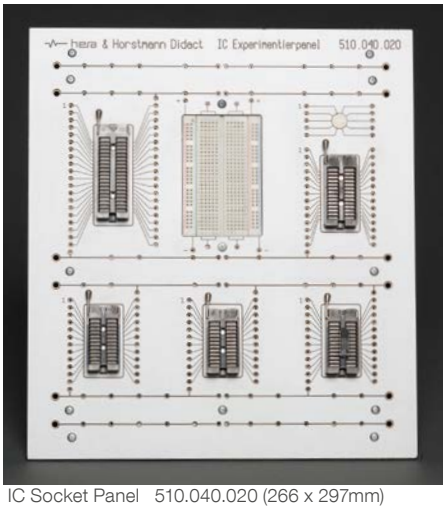
Like the Digital Panel, it holds **input elements** (8x high/ 8x low membrane buttons, 1x debounced pushbutton, 1x hexadecimal dual coding switch, signal source 0...5V_{DC}, a square signal generator for TTL signals and plugable frequency divider) and **output elements** (7segment reading with two 7segment decoder for hexadecimal codes, Sub-D 25poles for variable options). For integration of the **processing elements** there are IC fast connectors and a bread board.

In combination with the Set of Components 520.011.000, the system teaches the same topics than the Digital Panel 520.010.530 or it can be used with other ICs for flexible tests.
For your tests you will need a mutlimeter!
Operating voltage: 110...230V, 50/60Hz

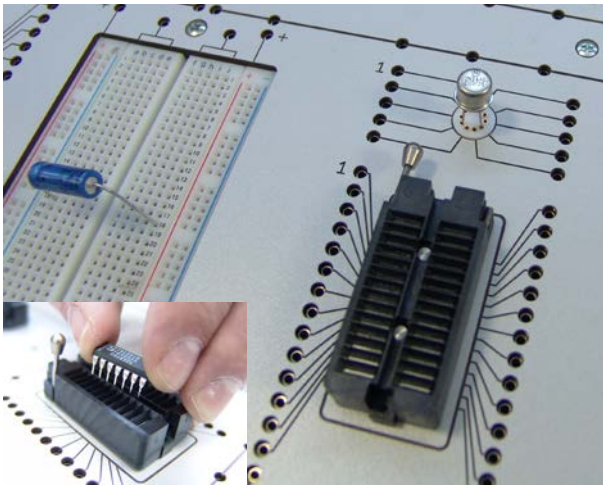
The IC Socket Panel does not hold any in- and output options, but it allows the integration of ICs or resistors into other training systems e.g. Basic Electronic Panel.



Digital Socket Panel 520.020.530 (532 x 297mm)



IC Socket Panel 510.040.020 (266 x 297mm)



Digital Technology with Common ICs			
520.020.530	Digital Socket Panel	520.028.001	Manual with CD, Digital Technology
520.022.000	Set of Cables and Connectors	510.040.020	IC Socket Panel
520.011.000	Set of Common ICs	510.042.000	Set of Cables to IC Socket Panel

BASICS TO **STEP MOTOR**

The Step Motor Panel is a self-sufficient training system with $12V_{DC,}$ 0,18A unipolar motor, which can be used as step motor or synchron motor. It can be operated with control logic, 4 manual switches or externally by phase shifting.
If the amplifier is connected, then the motor can be controlled with the squarewave generator of the Digital Panel, the Digital Socket Panel or with Software Digiwin plus the Multi Interface Panel.

For capturing rotation speed, rotation angle and rotation direction the reflective sensor can be plugged.

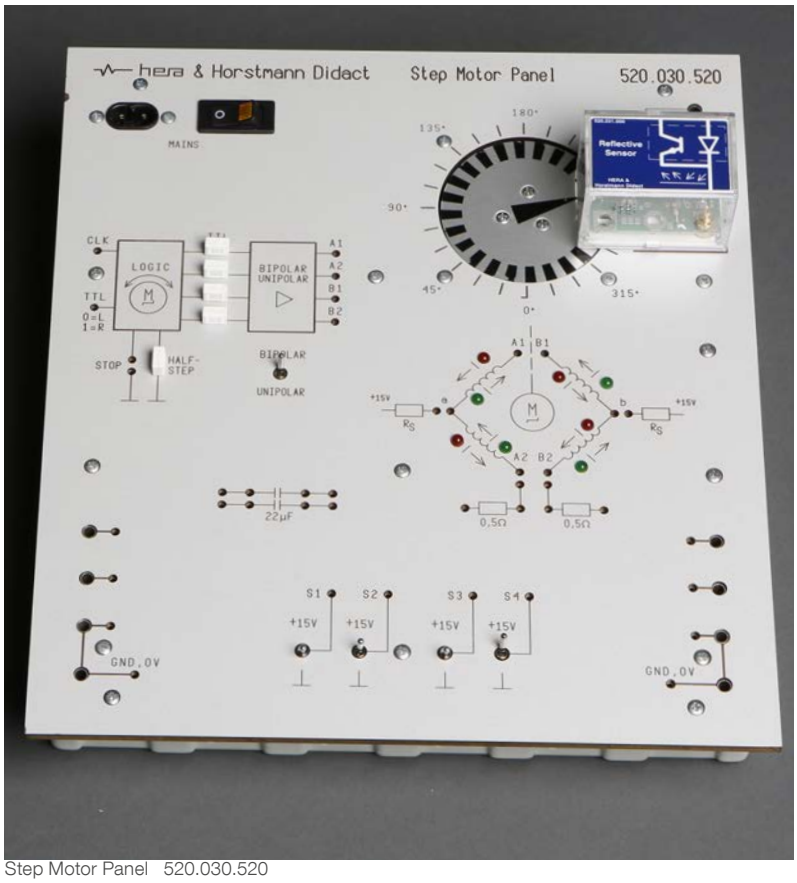
Operating voltage: 110...230V, 50/60Hz
Dimensions: 266 x 297mm (WxH)

Learning Content:

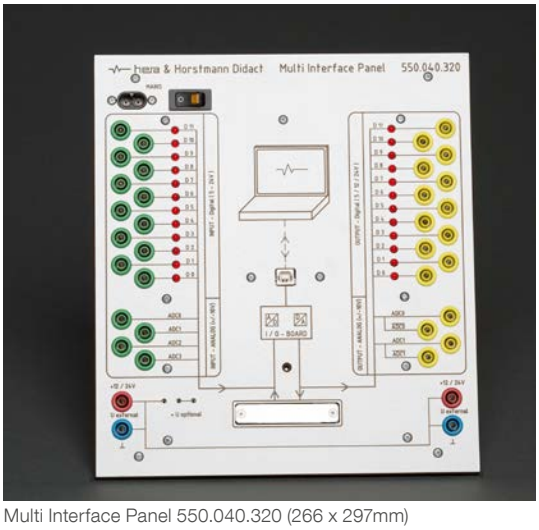
- Control Logic and Power Electronics of a Step Motor
- Microstep and sinus operation
- Bipolar and unipolar operation of a step motor
- Rest position, holding torque and induced voltage
- Determination of winding parameters

Following test are available for Digital Panel or Digiwin Software with Multi Interface Panel:

- Step mode with specified number of steps (single phase and double phase)
- Double phase full step operation with shift register
- Clockwise rotation for full step operation with synchron counter
- Clockwise and counter-clockwise rotation for full step operation with synchron counter



Step Motor Panel 520.030.520



Multi Interface Panel 550.040.320 (266 x 297mm)

Basics to Step Motor			
520.030.520	Step Motor Panel	550.040.320	Multi Interface Panel
520.031.000	Reflectic Sensor (Plug Component)	550.040.324	Set of Cables to Multi Interface Panel
520.038.001	Manual with CD, Step Motor Panel	550.042.000	I/O Interface 37poles for Multi Interface Panel
		550.040.322	Integrated Power Supply 12V or 24V

SOFTWARE DIGITAL - AND PID SIMULATION

Digiwin:

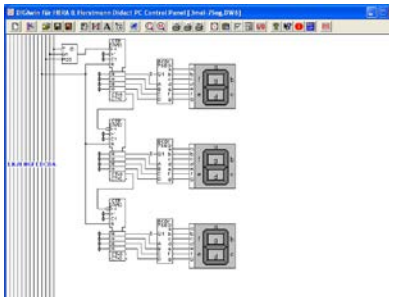
Digiwin is a simulation software for digital circuits, which can be either used as a self-sufficient learning software or in combination with the Multi Interface Panel for the control of external devices e.g. the step motor panel.

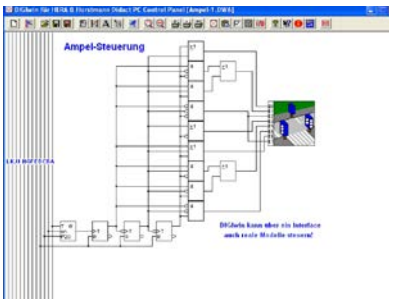
The circuits are generated in Windows with standard symbols, then the function can be tested. Digiwin holds a variety of combinatorial and sequential circuits, such as flip-flop JKMS, 4-bit counters and shift registers and also allows model simulations like traffic lights, step motors or press.

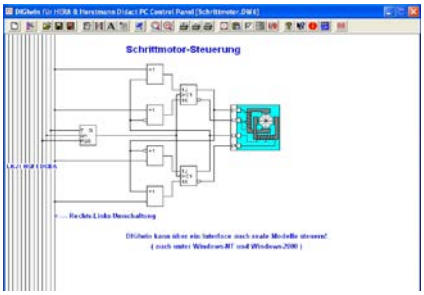
Modules for recording the KV diagram for 2, 3 and 4 variables as well as the simulation of PLF chips with 8 and 16 in- and outputs.

The program was developed with particular importance to easy handling, high opertion speed and minimum hardware requirements.

The help function provides detailed information to all functions and components.







Messwin:

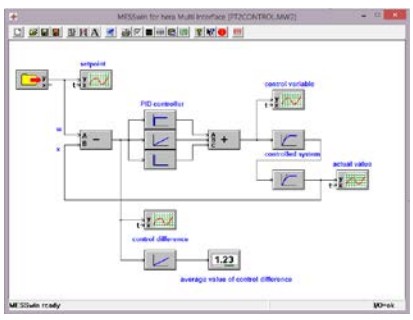
Messwin is a graphic program generator for all desired measure -, closed-loop - and control tasks in Windows.

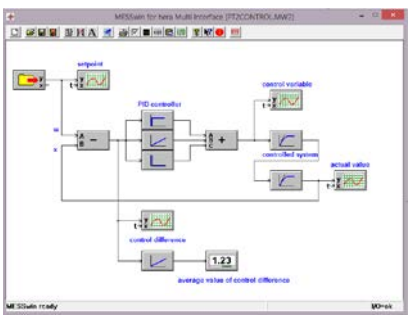
Programming is done by generating the circuit diagrams with the parametrizable function blocks from the library, like generator digital voltmeter, oscilloscope, A/D- or D/A-converter. Messwin generates the necessary program code and displays, prints or saves the measured results.

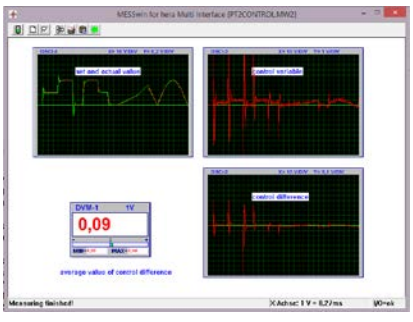
Due to its easy use, Messwin is particularly suitable for educational purpose in universities, colleges and technical training centers.

Messwin contains all basic elements of the closed-loop technology like 2-level - and PID controllers.

This enables either closed-loop simulation or if combined with the Multi Interface Panel external closed-loop systems can be connected e.g. PID-C Motor Panel with Light and Temperature Control and Fill Level Plant.







Software for Digital - and PID Simulation			
520.900.302	Digiwin Multiple License, DE	570.900.199	Messwin, Multiple License, DE
520.900.305	Digiwin Multiple License, EN	570.900.105	Messwin, Multiple License, EN

MICROCONTROLLER PROGRAMMING

The Microcontroller Panel is an ideal training system for the basic understanding of microcontrollers and to learn its programming. The training system bases on the ATmega168 as ATMEL is a leading manufacturer for microcontrollers.

Programming can be done in Assembler, C / C++ and Bascom although the manual supports Assambler and Bascom. The panel is clearly arranged in I-P-O principle. For **I**nput there are 6 switches and 3 potentiometers, the ATmega168 for **P**rocessing and an RGB LED, 12 LEDs and a Piezo buzzer as **O**utput elements.

Depending on the learning content, the panel can be used as basic version for programming the standard output elements or it can be enhanced with LC-Display, Real Time Clock, external EEPROM and Temperature Sensor.

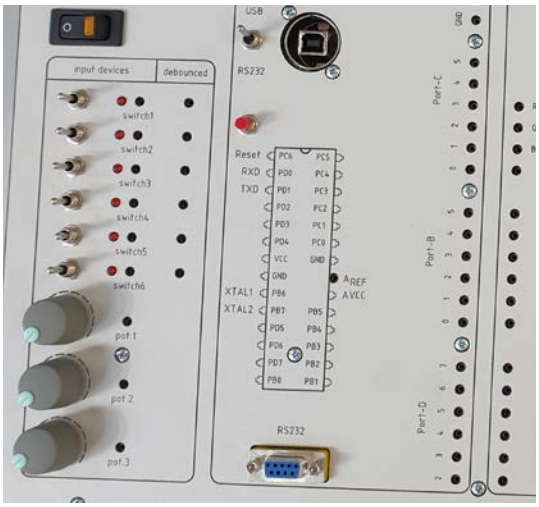
For even more flexibility an integrated plug-board allows to add flexible configurations with plug-components to the microcontroller circuit, e.g. transistor cirucits.
Integrated TTL ports allow to connect the Digital Panel, the Digital Socket Panel, the Step Motor Panel or the Sensor Test Panel for more advanced applications.

The panel is with USB interface for communication with the PC, a bootloader is pre-installed.

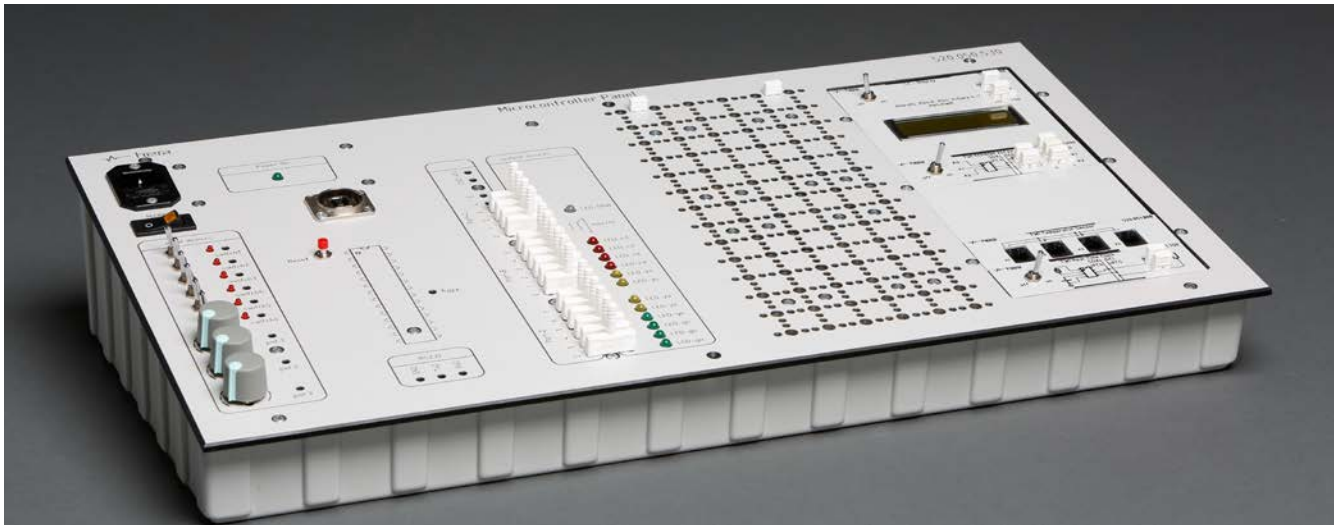
Operating voltage: 110...230V, 50/60Hz
Dimensions: 532 x 297mm (WxH)

Learning Content:

- Basics to Microcontrollers
- Programming in Assembler and C, Commands
- Bit Manipulation, Ports, Timer, Include Files
- Hardware PWM
- AD-Converter, Watchdog, Interrupt, I²C Bus
- Basic Structure of a Program
- Programming an In- and Output Test
- Programming a LED Flasher
- Programming a RGB-LED with PWM
- Programming an external interrupt



Input - Processing - Output Elements


Microcontroller Panel with ATmega168 with all options: LC-Display, Real Time Clock, EEPROM and Temperature Sensor

Microcontroller Programming			
520.050.530	Microcontroller Panel	520.051.000	Set of Cables and Connectors
520.058.001	Manual with CD, Basics to Microcontroller		

OPTIONS FOR **MICROCONTROLLER PANEL**

The right side of the Microcontroller Panel in basic version is covered with blank panels or it can be equipped with a variable selection of following options:

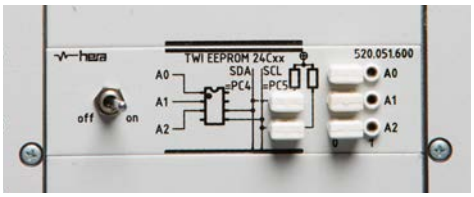
Option LC-Display

The LC-Display is an optional module, that can be integrated for the programming of a digital display, it is also the base for more experiments where a comfortable status display might be useful.

Option: LCD Display 520.051.100

Option EEPROM

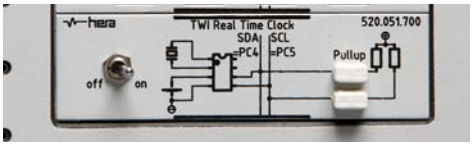
The EEPROM is an option, that allows the integration of extra memory by I²C bus into the microcontroller circuit. Data can be stored in an external memory and the full procedure is imparted in a comprehensive way.



Option: TWI EEPROM 520.051.600

Option Real Time Clock

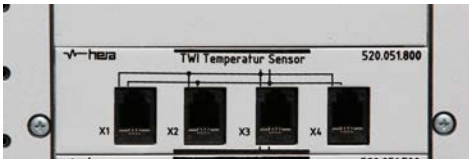
The Real Time Clock is an option, that allows the integration of real-time-clock ICs by I²C bus into the microcontroller circuit. The serial real time clock possess a decimal calendar with seconds, minutes, hours, days, month, year and leap year. 24h or 12h mode is available. Address and data transfer is done with a bi-directional serial bus.



Option: TWI Real Time Clock 520.051.700

Option Temperature Sensor

The Temperature Sensor allows the measurement of the ambient temperature and its measurement can be indicated in the LC display. Instead of the common PTC - or NTC resistor, the sensor is a LM75 sensor. The LM75 measures temperatures with 0,5 degree resolution and the results are transmitted by I²C bus, also included is a thermostat with adjustable threshold value and hysteresis.



Option: TWI Temperature Sensor 520.051.800

Options to Microcontroller Panel			
520.051.100	LC-Display	520.051.600	TWI EEPROM
520.051.700	TWI Real Time Clock	520.051.800	TWI Temperature Sensor

BASICS TO **IT TECHNOLOGY**

The Local Area Network (LAN) Panel is a compact training system, which holds all necessary components for setting up a networks and doing the necessary networks configurations. Besides the tests, the manual holds extensive fundamental informations about networks technology.

Technical Details:

- 8 Port Switch 1Gbit/s
- Power Line Adapter 500Mbit/s
- WLAN Access Point 300Mbit/s
  Repeater / Bridge, Client, Multi-SSID
- 5 Port Router
- Potentiometer for cable length simulation

Operating voltage: 110...230V, 50/60Hz
Dimensions: 532 x 297mm (WxH)

Learning Content:

- ISO / OSI reference modell
- TCP / IP reference modell
- Transmission cables and categories, wireless
- Network devices and functions
- Topologies
- Networks communications and protocolls
- Firewall / Virtual Private Networks (VPN)
- Network configurations e.g. IP addresses, DHCP server
- Power Line
- Configuring a network with one or more LAN Panels
- Influence of cable length to transmission speed

Local Area Network (LAN) Panel

Basics to IT Technology			
580.140.030	Local Area Network (LAN) Panel	580.141.000	Set of Cables and Connectors
580.148.001	Manual with CD, LAN Technology		

PANEL CASE FOR TRANSPORT OR STORAGE

The panel case is a convenient possibility to transport the standard panels from room to room or for storage.
One or two training panels (532 x 297mm) can be firmly installed in the case or the lid can be prepared for the acceptance of the manual and cables.

For a comfortable training the case and lid can be seperated. The case comes with lock and 2 keys.

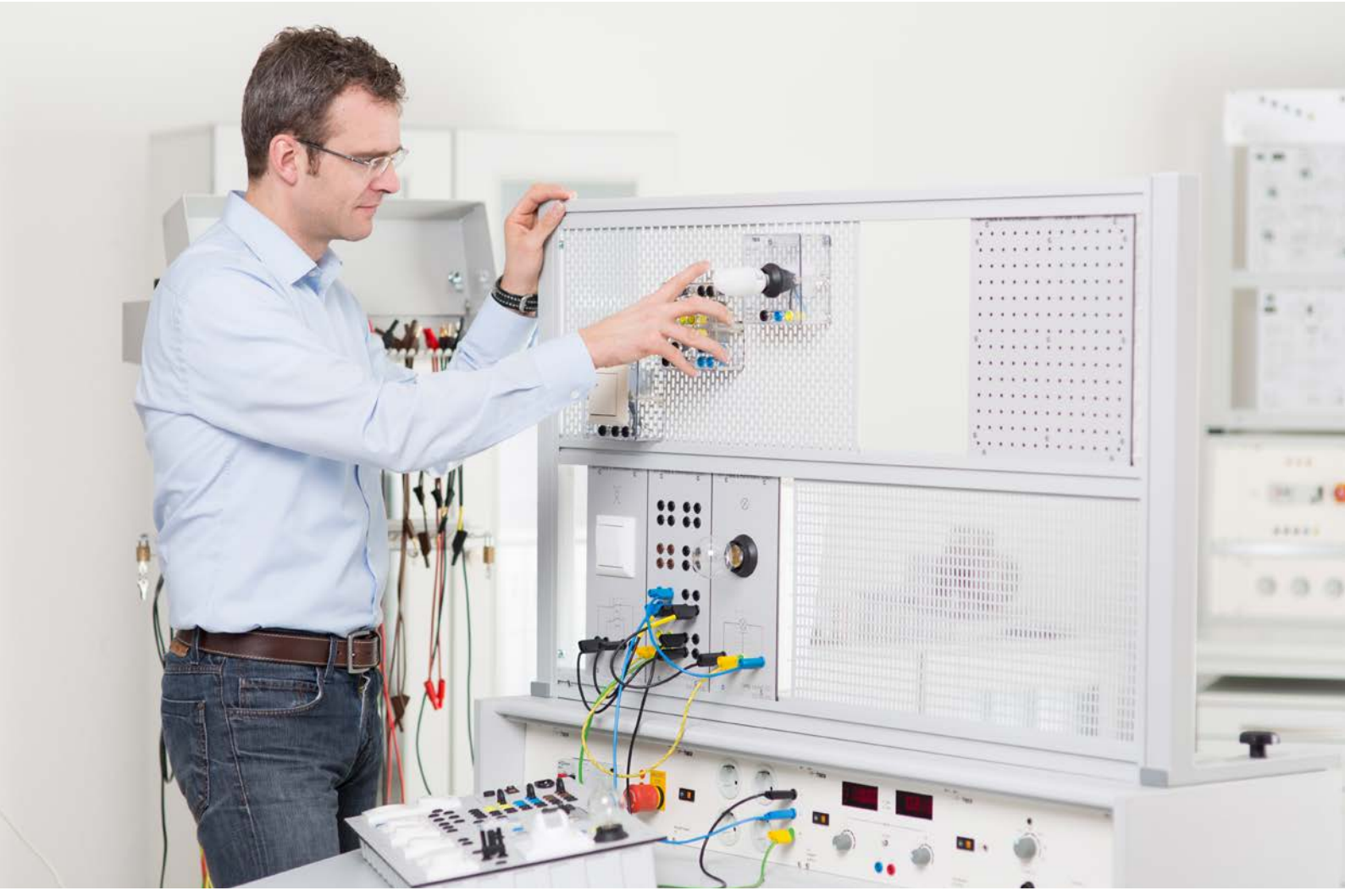
Dimensions:
555 x 390 x 250mm (WxDxH).

Panel Case			
509.002.000	Panel Case	509.010.001	Flap for Lid

SAFETY INSTALLATIONS, **DOMESTIC & INDUSTRIAL WIRINGS**

In this chapter you will get familiar with our training systems for domestic and industrial wirings. You can choose from compact panels with the complete topic in one board, or component panels where more panels can be combined to an individual solution, or alternatively transparent boxes, where you can arrange flexible circuits on perforated grid walls. No matter what system you choose, learning success is always granted. All cable connections are designed for use of the touch-protected 4mm safety leads, connections for extra-low voltage are done with 2mm laboratory leads, this ensures a maximum of safety for the trainees.

All courses for domestic or industrial wirings should start with the basics to electrical safety, e.g. the safeguard panel.



SAFETY INSTALLATON TECHNOLOGY

The Safeguard Panel is a mandatory training system for all electric professions. It teaches common dangers and protective measures for the errection of low-voltage installations according to German standard VDE0100.
For a save learning environment the output voltage is reduced by factor 10 (e.g. input: 230V = 23V operating voltage).

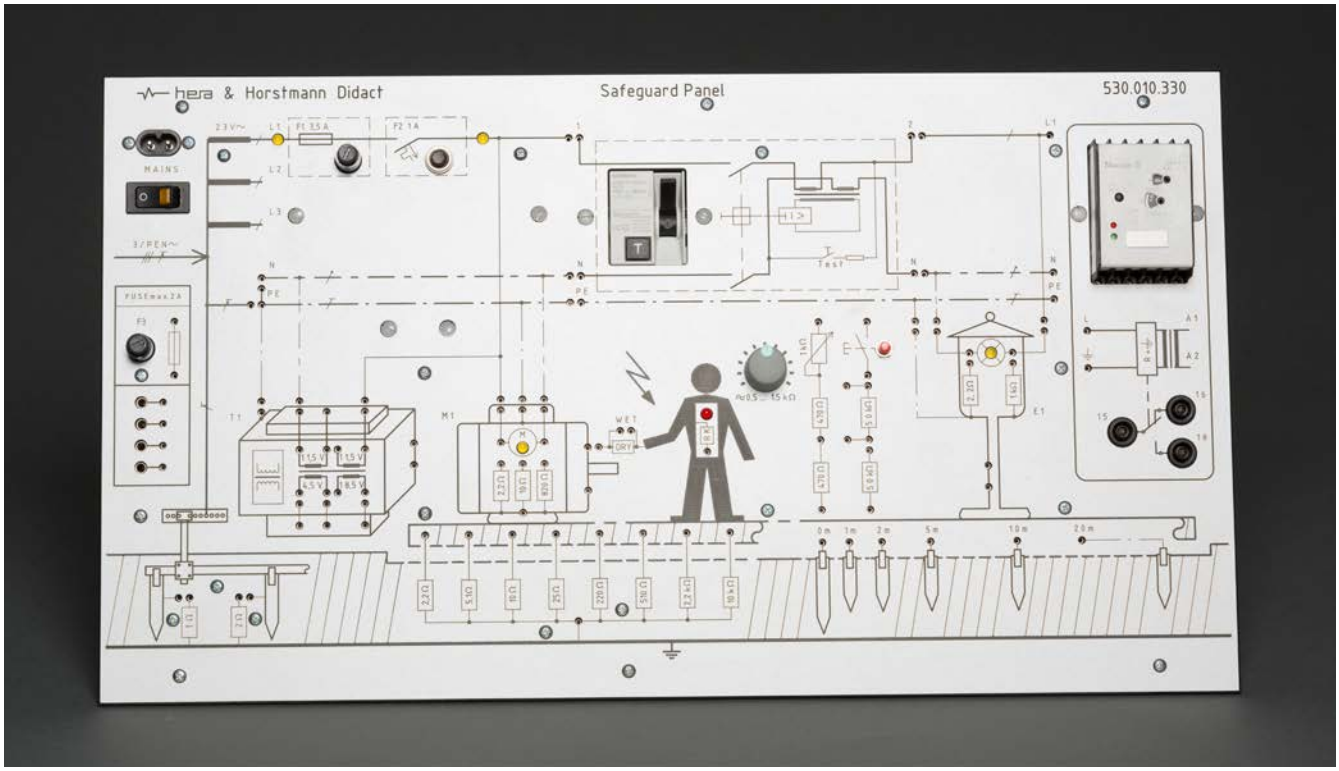
Learning Content:

- Protection against direct and indirect contact
- Active parts, fault types, SELV, PELV, FLEV, etc.
- Protective insulation
- Protective seperation
- Protection by safety extra-low voltage
- Residual current device (RCD)
- Automatic circuit breaker
- Summation current transformer
- Autotransformer
- Protective measures in TN -, TT - and IT networks
- Measurement of earth resistance
- Earth electrodes

The panel is for the simulation of different irregular electric situations, where equipment and person is protected by safety installations, or in case of danger to person a LED in red lights up.

For your measurements you will need a multimeter.

Operating voltage: 110...230V, 50/60Hz
Dimensions: 532 x 297mm (WxH)



Safeguard Panel 530.010.330

Safety Installation Technology			
530.010.330	Safeguard Panel	530.018.001	Manual and CD, Basic Tests VDE Protective Measures
530.012.000	Set of Cables and Connectors		

INSTALLATION TESTS ACCORDING TO VDE STANDARD

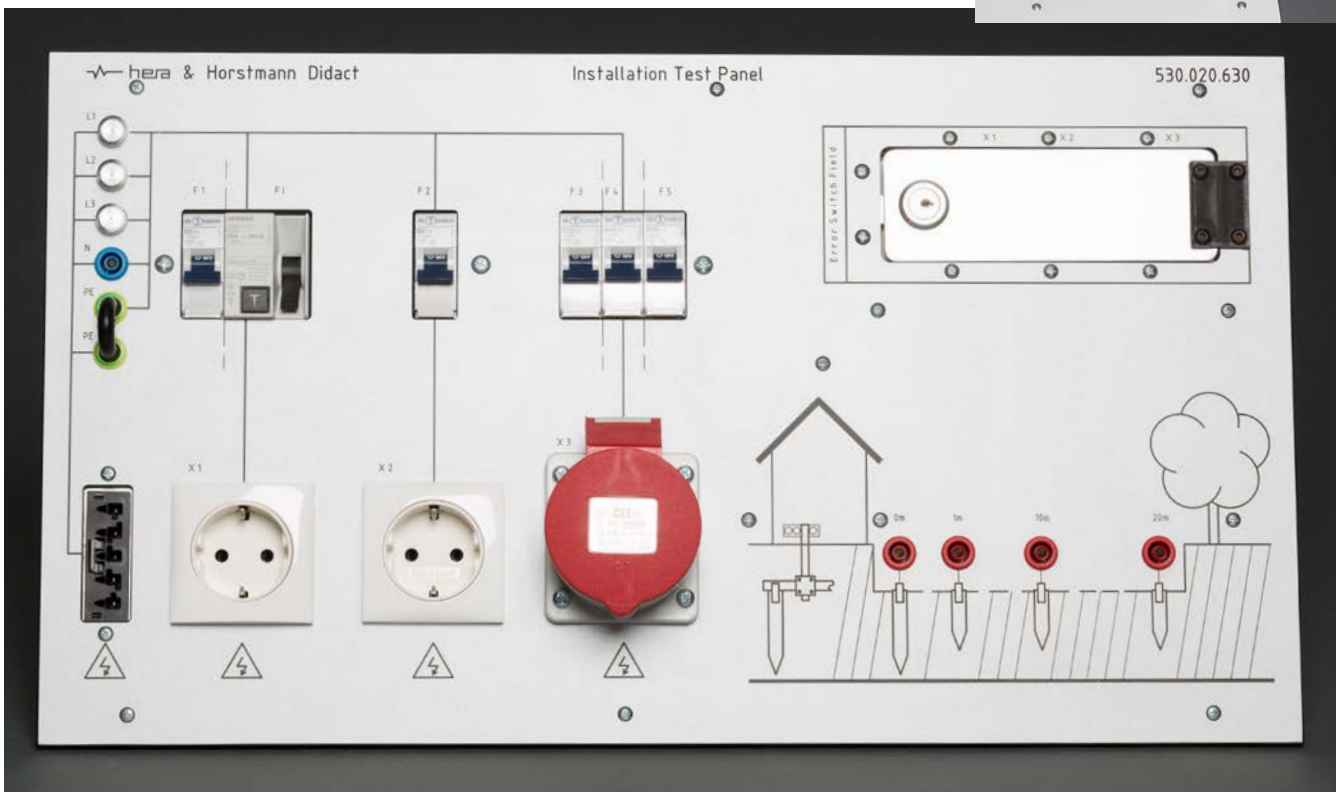
All electric appliances are subject to electrical tests in defined intervals and after repair. The Installation Test Panel teaches the standard procedure according to VDE0100 and how a professional hand-over report looks like.

Learning Content:

- Effects of human bodies exposed to electricity
- Electrical tests and hand-over test reports
- Conductor failure
- Measurement of loop impedance
- Measurement of line impedance
- Measurement of insulation resistance
- Tripping characteristic of a RCD
- Measurement of earth resistance
- Measurements in 1phase and 3phase sockets
- Measurements in faulty circuits

A lockable failure simulator allows to integrate 24 typical failures (e.g. phase interruption, phase mix-up, resistance), which need to be found by measurement. This provides a very effective training about possible wiring faults during installations and a targeted trouble shooting.

>>Operating voltage: 400V, 3phase, 50/60Hz >>
Dimensions: 532 x 297mm (WxH)



Installation Test Panel 530.020.630

CEE Adapter 540.099.007

Measurement - and Test Device 590.100.100

Installation Test to VDE Standard			
530.020.630	Installation Test Panel	530.028.631	Manual with CD, Safety Measures as per
590.100.100	Measurement - and Test Device for VDE Test		DIN VDE0100
540.099.007	CEE Adapter		

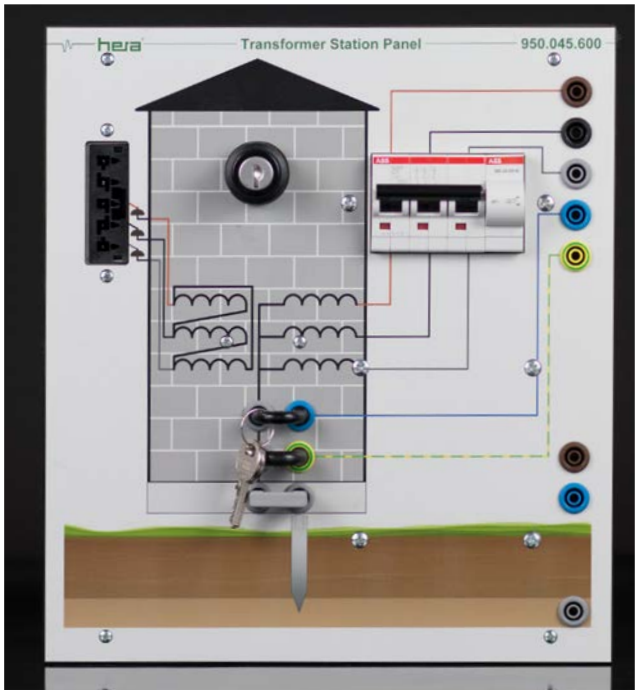
DOMESTIC **POWER DISTRIBUTION**

The Domestic Distribuition System consists of a Transformer Station 230V/400V (equipped with isolating transformer) with key release and automatic circuit breaker with undervoltage release, as well as the Mains Distribution Panel, which is supplied by the Transformer Station.

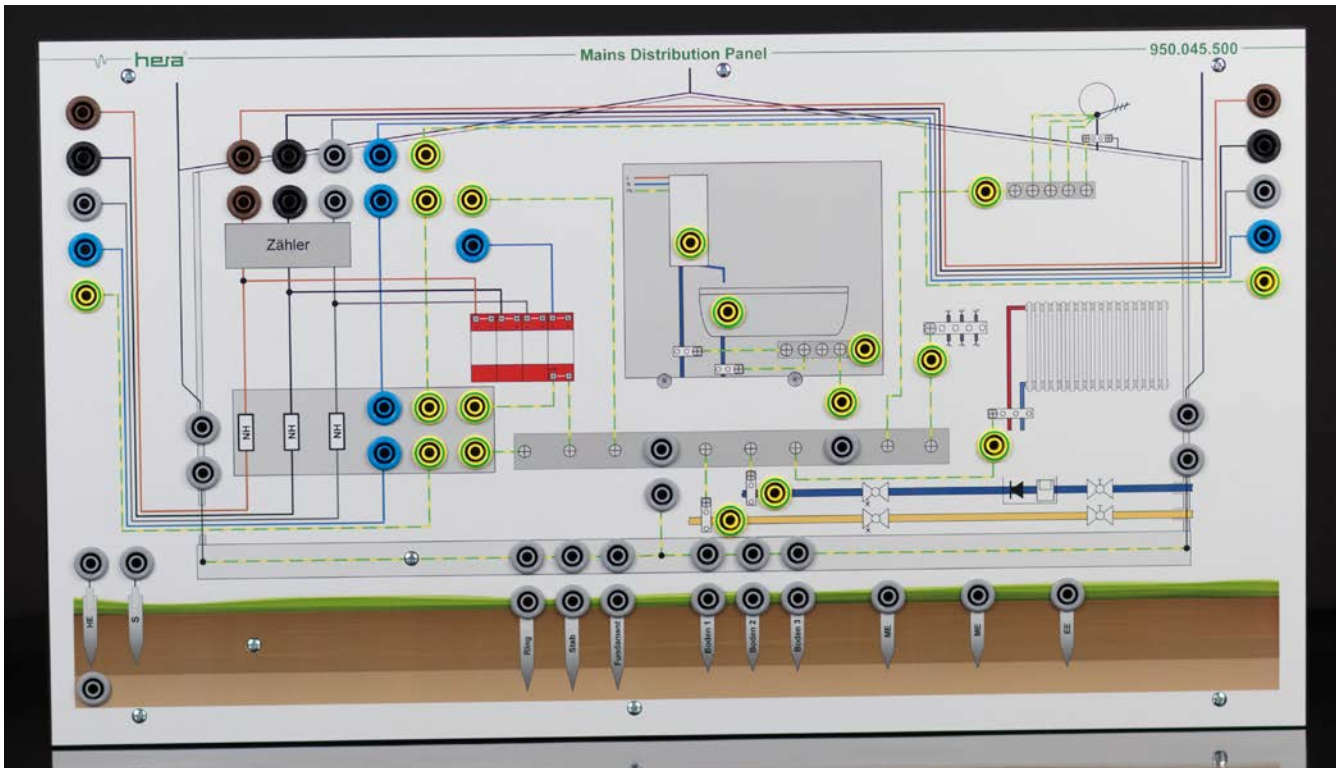
Learning Content:

- Basics to TN - , TT -, IT networks
- Domestic mains distribution box
- Equipotential bonding
- Fuse - or meter box
- Types of earth contact and specific earth contact
- Wenner and Schlumberger method
- System earth and operational earth
- Types of earth measurement for installations
- Testing the operational earth
- Lighting protection (inhouse and outdoors)

>> Operating voltage: 400V, 3phase, 50/60Hz >>
Dimensions: 532 x 297mm (WxH)



Transformer Station 230/400V 950.045.600 (266 x 297mm)



Mains Distribution Panel 950.045.500 (532 x 297mm)

Domestic Power Distribution			
950.045.600	Transformer Station 230/400V	950.045.561	Manual with CD, Domestic Power Distribution
950.045.500	Mains Distribution Panel	950.045.550	Set of Cables and Connectors

BASICS TO **RESIDUAL CURRENT DEVICES**

The RCD Test Panel allows the trainee to explore the switching characteristic of different RCDs in a 3phase networks without tripping the inhouse protective installations.

Technical Details:

- RCD Type A 300mA,
- RCD Type A 100mA S (selective)
- RCD Type A 30mA
- RCD Type B (sensitive to all currents) 30mA

- RCD outputs to 4mm safety jacks
- Residual current simulation
- Ammeter reading for tripping current

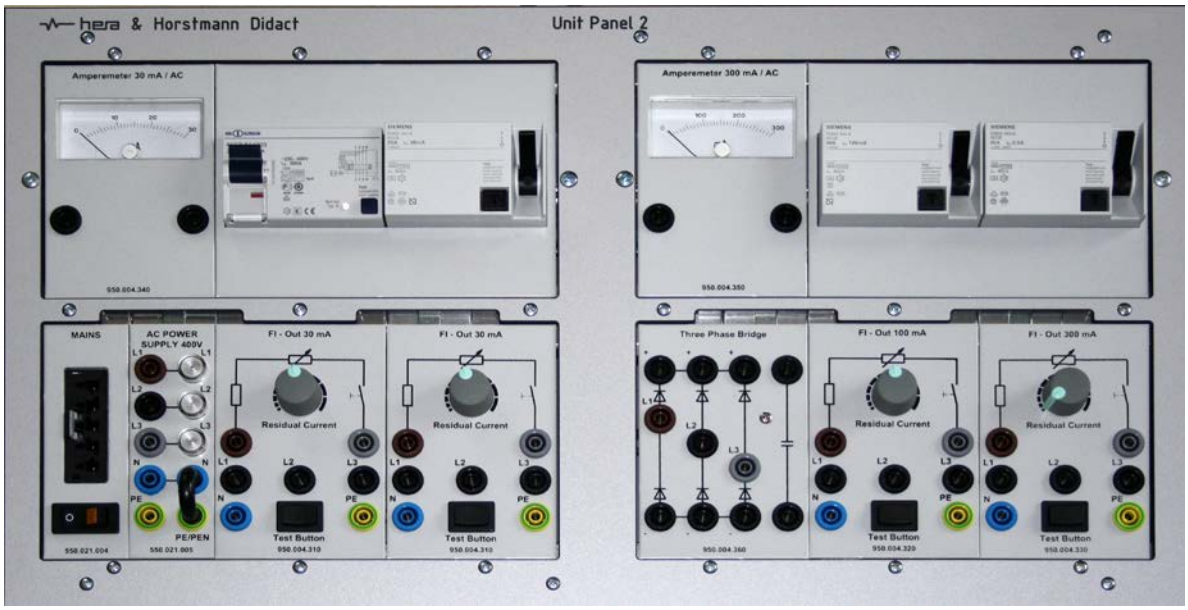
The modulare configuration of the panel allows to exchange the RCDs and tripping equipment.

Learning Content:

- Basics to electric safety and leakage currents
- Functionality and characteristics of RCDs
- RCDs for sinus-voltages
- Single pulse and more pulse rectification, with and without capacitor

>>Operating voltage: 400V, 3phase, 50/60Hz >>
Dimensions: 532 x 297mm (WxH)

>> TESTS TO RCD WITHOUT TRIPPING YOUR INHOUSE SAFETY INSTALLATIONS!



RCD Test Panel 530.030.630

Basics to Residual Current Devices			
530.030.630	RCD Test Panel	530.022.000	Set of Cables and Connectors
530.128.001	Manual with CD		

INSTALLATION **CABIN**

- The installation cabin replicates a room and thus offers the possibility for realistic installation arrangements.
- Installations can be done either with the transparent boxes and 4mm laboratory cords or with surface-mounted installation components fixed to the cabin with installation dowels and self-configured cables.
- The cabin can be flexibly equipped with MCB and RCD and different types of power supply (not included).
- The installation walls are available in the universal 10x5mm raster or the specific hera raster. hera installation boxes fit on both rasters.
- Optionally the cabin can be equipped with replacable wooden panels, which can be used from both sides (turnable sides).
- Dimensions: 1200 x 1000 x 2000mm (WxDxH).

Cabin with Wooden Walls

Application with Transparent Boxes

Application with Surface Mounted Installation Material

Installation Cabin			
461.600.000	Installation Cabin, Stationary, hera Raster	461.601.000	Installation Cabin with Casters, hera Raster
461.600.010	Installation Cabin, Stationary, universal Raster	461.601.010	Installation Cabin with Casters, universal Raster
461.600.050	Installation Cabin, Stationary, Wooden Walls	461.601.050	Installation Cabin with Casters, Wooden Walls
301.150.100	Set of Installation Dowels (100 pcs)	302.010.000	Set of Surface Mount Installation Material according to manual 530.038.001

BASICS TO **DOMESTIC INSTALLATIONS**

The Basic Installation Panel holds different components for domestic installations connected to 4mm safety jacks and a distribution field for various connection possibilities. A failure simulator with key-lock allows to switch in 6 typical installation failures which need to be found by measurement.

Operating voltage: 110...230V, 50/60Hz
Dimensions: 532 x 297mm (WxH)

Learning Content:

- Circuit symbols, number codes of installation cables
- Wiring diagrams
- Circuits with electrical sockets and lamps
- Dimmer circuits
- Circuits with motion detector
- Circuits with toggle switch
- Circuit with crossover switch
- Circuit with impulse switch
- Staircase time switch
- Measurements in faulty circuits

Basic Installation Panel 530.030.530

Failure Simulator with key-lock

Basics to Domestic Installations			
530.030.530	Basic Installation Panel	530.032.000	Set of Cables and Connectors
530.038.001	Manaul with CD, Basics to Installation Technology	590.100.003	Digital Multimeter

COMPONENT PANELS FOR DOMESTIC INSTALLATIONS

Instead or in addition to the Basic Installation Panel, the circuits can be done with component panels and flexibly connected with 4mm safety cords.
For configurations with many component panels we suggest to use a training system frames to keep your bench top clear for manuals and measuring instruments.

>> Operating voltage: 230/400V, 50/60Hz >>
Dimensions: 133 x 297mm (WxH)

531.000.100 Set of Panels: Installation Technology

(according to manual 530.038.001)

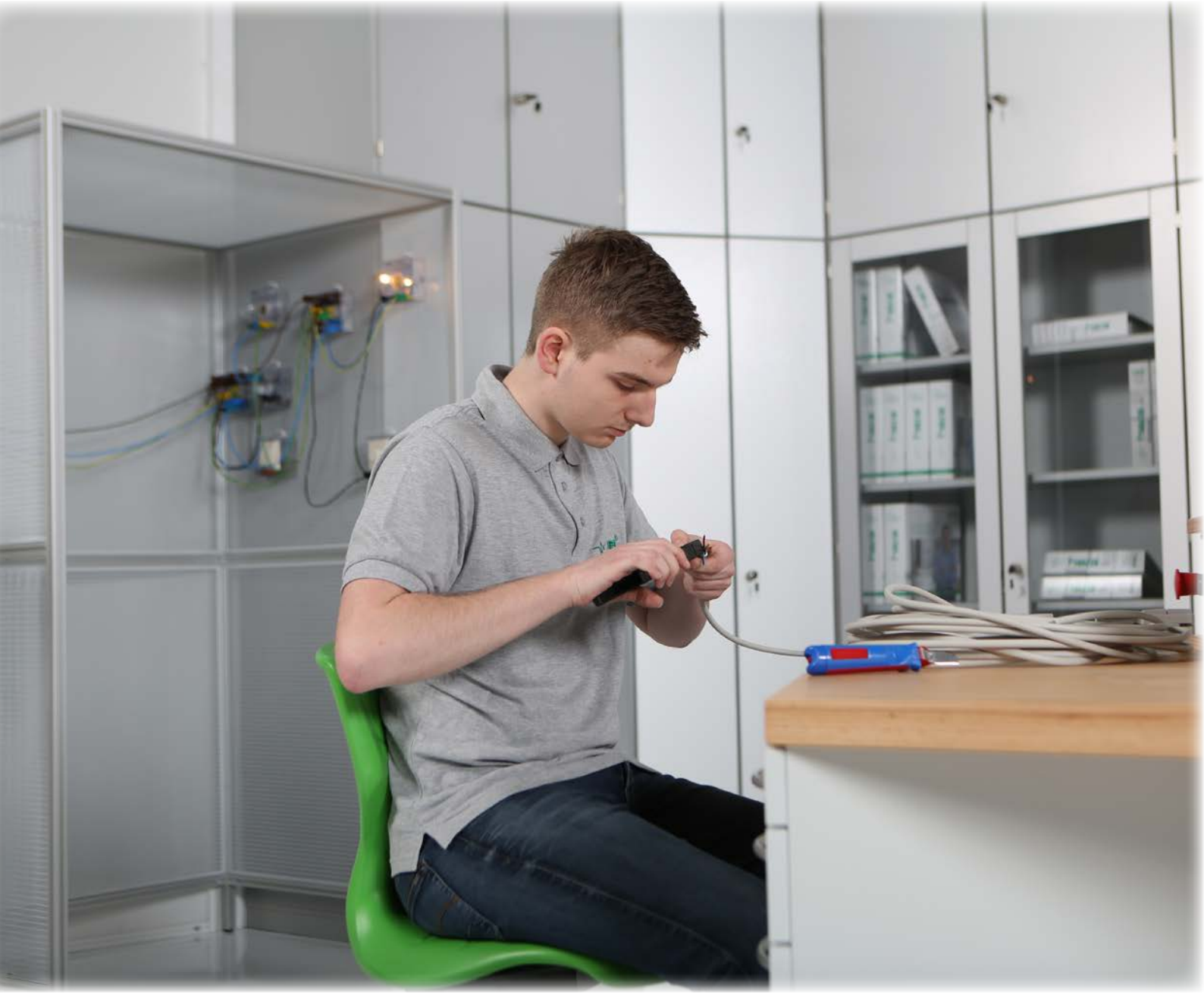
2x Distribution Panel
2x Toggle Switch 3-way
2x Pushbutton
2x Socket E27
1x PE Socket
1x Crossover Switch
1x Dimmer
1x Motion Detector
1x Impulse Switch
1x Staircase Time Switch

Component Panels for Domestic Installations

531.000.100	Set of Component Panels according to manual	531.510.510	Impulse Switch 230V
531.000.510	Mains Adapter (CEE Plug with 2,5m cable - 4mm jacks)	531.520.510	Staircase Time Switch
531.020.510	Distribution Panel with 8 Distribution Points	531.530.510	Multifunction Time Relay 8-230V; 1x Change-Over
531.130.510	Circuit Breaker 1pole, 6A	531.110.510	Pushbutton - Doorbell
531.140.510	Circuit Breaker 3polig, 6A	531.120.510	Pushbutton - Door Opener
531.180.510	Neozed Fuse 3 x 6A	531.150.510	Buzzer 5 - 8V
531.190.510	RCD 30mA, 4poles	531.160.510	Bell Transformer
531.210.510	RCD 30mA, 2poles		
531.010.510	PE Socket	**Blank Panels and Hoods**	
531.030.510	Change-Over Switch	500.000.001	Blank Panel S (W:133)
531.040.510	Cross-Over Switch	500.000.002	Blank Panel M (W:266)
531.050.510	Series Switch	500.000.003	Blank Panel L (W:532)
531.060.510	Pushbutton - Lamp	500.000.011	Blank Panel S with Ergonomic Hood
531.070.510	Dimmer for Incandescent Lamp	500.000.012	Blank Panel M with Ergonomic Hood
531.080.510	Motion Detector	500.000.013	Blank Panel L with Ergonomic Hood
531.200.510	Cellar Lamp 60W	500.000.021	Ergonomic Hood S
531.310.510	Lamp Socket E27 (incl. LED bulb)	500.000.022	Ergonomic Hood M
531.170.510	Lamp Socket 3x E14	500.000.023	Ergonomic Hood L

INSTALLATIONS
WITH TRAINING BOXES

In addition to the compact panels or component panels we offer the transparent boxes which can be used in combination with installation walls or installation cabins. The cabins can be quipped with circuit breakers and power connectors and offer most realistic roomlike conditions. All boxes are equipped with replacable hooks. If preferred, the set of installation material is available without housing but with installation dowels and cable ducts instead.



TRAINING BOXES FOR INSTALLATION TECHNOLOGY

Modular training system for the basic circuits of domestic installations. All components are in a transparent box with replacable hooks and detachable cover. All boxes are suitable for the specific hera grid (12x5mm) or the universal grid (10x5mm). All connections are done with touch protected 4mm safety cords.

Dimensions: 115 x 115 x 50mm.



completely housed, transparent training box with replacable hooks and safety lock for hera & universal installation walls

302.000.101 Set of Boxes: Installation Technology

(according to manual 530.038.001)

3x Distribution Box
1x Circuit Breaker 1pole C1A
1x RCD 2poles 16/ 0,01A
1x PE Socket
3x Lamp Socket E27 with LED bulb
2x Pushbutton
1x Pushbutton for Lamp
1x Change-Over Pushbutton
2x Change-Over Switch
1x Change-Over Switch with Light Indication
1x Cross-Over Switch
1x Series Switch
1x Dimmer for Incandescent Lamps
1x Impulse Switch 230V
1x Staircase Time Switch 230V
1x Relay 230V / AC, 1 NOC
1x Motion Detector

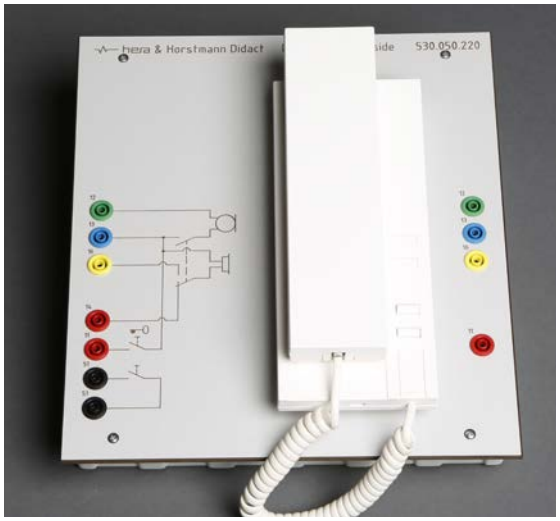
Training Boxes for Installation Technology			
302.000.101	Set Boxes according to manual 530.038.001	302.107.100	Lamp Socket E14 with Bulbs 40W + 25W
302.100.500	Feeding Panel with Power Cable	302.107.300	3fold Lamp Socket E14 with Bulbs 25W
302.100.100	Distribution Box	302.114.100	Impulse Switch 230V
302.101.100	Automatic Circuit Breaker 1pole C1A	302.114.300	Time Switch
302.101.300	Automatic Circuit Breaker 1pole C10A	302.114.200	Multifunction Time Relay 8 - 230V; 1x Change-Over,
302.101.500	Automatic Circuit Breaker 2poles B10A		time setting 0,1s ... 40h
302.101.600	Automatic Circuit Breaker 3poles C10A	302.115.100	Motion Detector
302.102.100	RCD 2poiles 2polig 16/ 0,01A	302.115.200	Twilight Sensor
302.102.500	RCD 4poles 25/ 0,03A	302.140.100	Impulse Switch 230V AC
302.105.100	Socket with PE	302.142.100	Relay 230V AC with 3x Change-Over
302.111.100	Change-Over Switch	302.177.100	Staircase Time Switch
302.111.200	Change-Over Switch with Light Indicator	302.104.100	AC Electricity Meter with S0-Interface
302.112.100	Cross-Over Switch	302.104.200	3Phase Electricity Meter with S0-Interface
302.112.200	Series Switch	302.108.100	Simulation Ground Fault
302.112.400	Off-Button 3poles		
302.110.100	Pushbutton	302.000.000	Empty Transparent Box (loose spare parts)
302.110.200	Pushbutton with Light Indicator	302.000.010	Pair of Replacement Hooks for Transparent Box
302.110.300	Change-Over Pushbutton	302.000.020	Safety Lock for Transparent Box
302.113.100	Dimmer for Incandescent Lamp	461.061.104	Installation Wall for Training System Frame 600mm
302.113.200	Dimmer for Electric Transformers	461.081.104	Installation Wall for Training System Frame 800mm
302.106.100	Lamp Socket E27 with LED Bulb		

DOOR BELL - AND **INTERCOM SYSTEMS**

The topic of door bell - and intercom system can be realized either with our panel solution or with the transparent training boxes. Wiring is conveniently done with 4mm safety leads.

The ideal training system holds one outdoor and two indoor units.
>> Operating voltage: 230V, 50/60Hz >>
Dimensions: 266 x 297mm (WxH)

Outdoor Unit 530.040.220



Indoor Unit 530.050.220

Panel for Door Bell - and Intercom System			
530.040.220	Component Panel Door Intercom Outside	530.048.001	Manual with CD
530.050.220	Component Panel Door Intercom Inside		
530.042.000	Set of Cables and Connectors		

Transparent Boxes for Door Bell - and Intercom System			
302.130.100	Bell Transformer 230V/8V	302.133.100	Buzzer 8V AC
302.132.300	Bell Button 2fold	302.135.300	Power Supply for Intercom
302.132.100	Door Opener Button	302.136.200	Door Intercom Outside
302.131.100	Door Bell 8V	302.136.100	Door Intercom Inside
302.131.500	Door Opener 8V	530.048.001	Manual with CD

BASICS TO **LIGHTING TECHNOLOGY**

The Lighting Panel compares characteristics like power consumption, illumination, light flux, light efficiency, light intensity, light quantity and phase angle for various light types under different conditions.

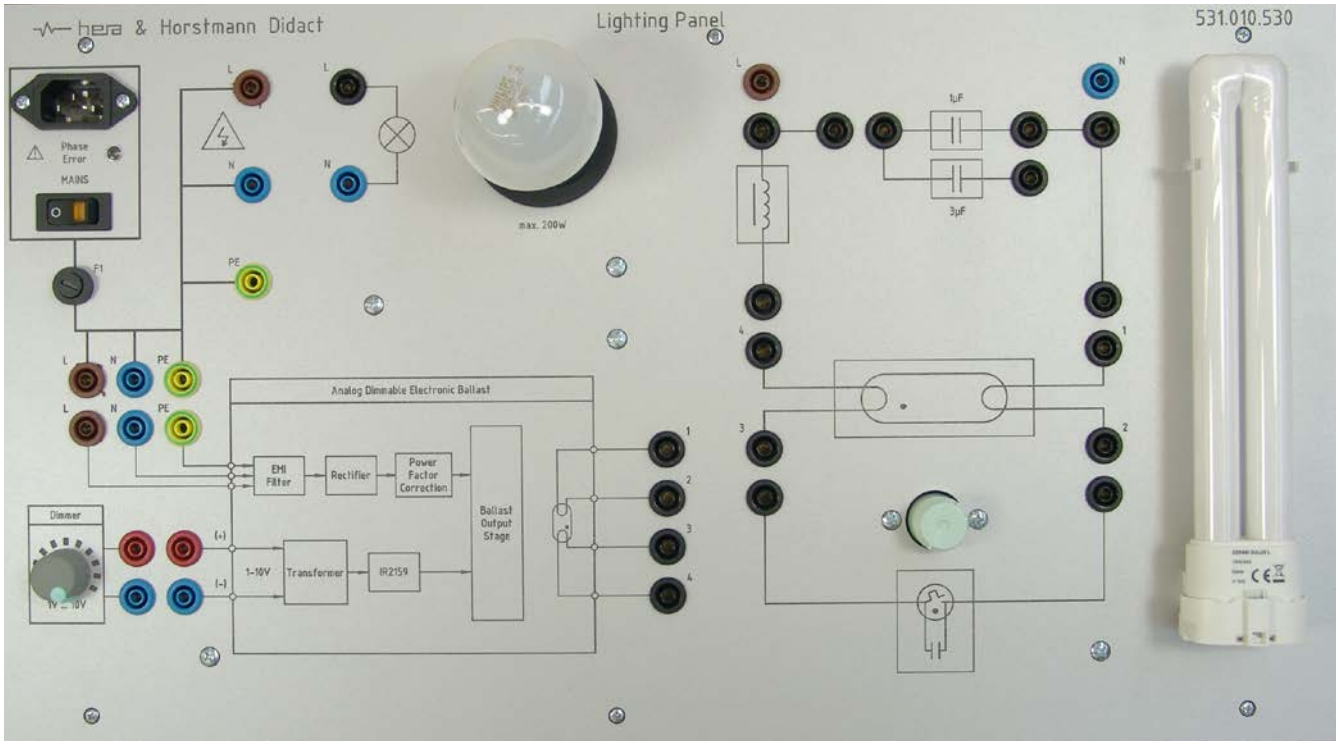
Technical Details:

- Filament Lamp
- Halogen Lamp
- Mixed Light Lamp
- Fluorescent Lamp
- Energy Saving Lamp
- Electric Starter and Choke
- Dimmer

Learning Content:

- Characteristics of filament lamps
- Characteristics of halogen bulbs
- Characteristics of a mixed light lamp
- Characteristics of a compact fluorescent lamp
- Characteristics of a fluorescent lamp
- Characteristics of a fluorescent lamp

>> Operating voltage: 220V... 240V, 50/60Hz >>
Dimensions: 532 x 297mm (WxH)



Lighting Panel 531.010.530

Basics to Lighting Technology			
531.010.530	Lighting Panel	531.018.001	Manual with CD
531.011.000	Set of Accessory; Starter and Lamps Set	590.010.001	Lux Meter, digital
531.012.000	Set of Cables and Connectors		

COMPONENT PANELS AND BOXES TO **LIGHTING TECHNOLOGY**

Lamp Socket E27 531.310.510

Special Lamp Panel 531.030.520

Component Panels

531.310.510	Lamp Socket E27	531.540.520	Low-Pressure Sodium Vapor Lamp
531.320.510	Fluorescent Lampe 18W		incl. Ballast and Starter
531.330.510	Starter and Low-Loss Ballast18W	531.030.520	High-Pressure Lamps (Halogen, Sodium, Mercurry)
531.345.510	Capacitor 4,5µF		incl. Ballast and Starter
		531.032.520	Set of Cables and Connectors

Training Boxes

302.106.100	Lamp Socket E27	302.113.300	Electronic Potentiometer for Electric Ballast
302.107.100	Lamp Socket E14	302.121.700	Electric Ballast, dimmable
302.121.400	Low-Loss Ballast 18W	302.120.600	Compact Fluorescent Lamp, dimmable
302.121.500	Low-Loss Ballast 36W	302.122.100	Capacitor 3,4µF for Double-Circuit
302.121.300	Electric Ballast 18W	302.122.200	Capacitor 4,5µF for Supression
302.121.600	Electric Ballast 36W	302.126.100	Socket for Na-High-Pressure Lamp E40
302.113.200	Dimmer for Electronic Transformers		and Bulb
302.120.100	Fluorescent Socket, no Starter (left side)	302.126.200	Ballast for Na-High-Pressure Lamp
302.120.200	Fluorescent Socket, with Starter (right side)	302.124.100	Conventional Transformer 230V/ 11,5V 60W
	and 18W Tube	302.124.200	Electronic Transformer 20 – 70W
302.120.300	Fluorescent Socket, with Starter (right side)	302.125.100	Halogen Lamp Socket with Bulb
	and 36W Tube	302.126.100	Socket for Na-High-Pressure Lamp with 150W
302.120.500	Socket for Compact Fluorescent Lamp		Bulb and Starter
	and 18W Bulb		

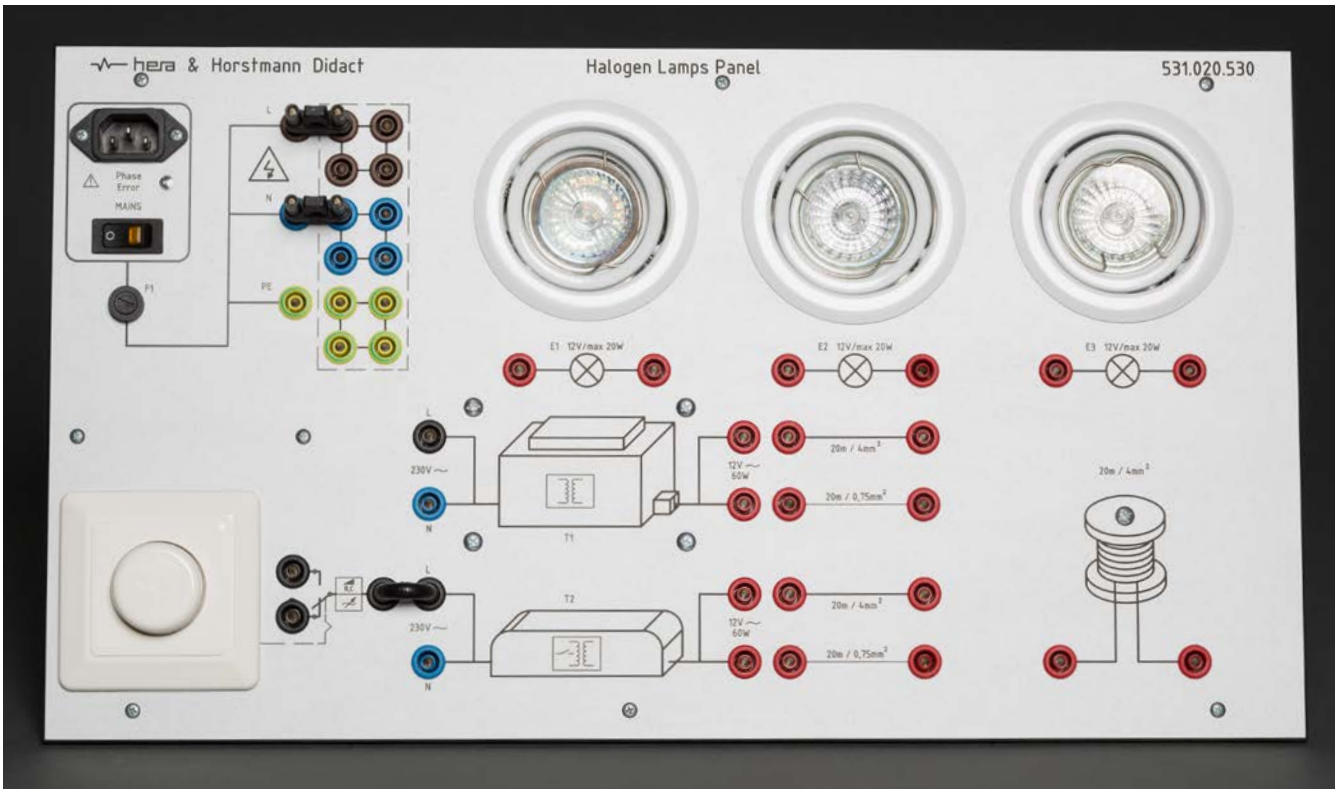
BASICS TO **HALOGEN LAMPS**

The Halogen Lamps Panel is a perfect addition to the Lighting Panel, it intensifies the knowledge to halogen low-voltage lamps. The panel is equipped with 1x halogen low-voltage lamp with increased efficiency and 2x standard halogen low-voltage lamps, one transformer and a dimmer with phase angle control.

>> Operating voltage: 220V... 240V, 50/60Hz >>
Dimensions: 532 x 297mm (WxH)

Learning Content:

- Power loss of transformers
- Dimming halogen low-voltage lamps
- Characteristics of halogen low-voltage lamps and the influence of cable diameter and cable length



Halogen Lamps Panel 531.020.530

Basics to Halogen Lamps			
531.020.530	Halogen Lamps Panel	590.010.001	Digital Lux Meter
531.022.000	Set of Cables and Connectors		
531.018.001	Manual with CD, Lighting Technology		

BASICS TO **LED TECHNOLOGY**

The LED Lamp Panel compares the characteristics of light emitting diodes and power diodes with energy-saving lamps and halogen lamps by means of energy consumption, brightness, light diffusion, costs and operating hours. A digital thermometer with selector switch indicates the the waste heat of each lamp. The panel is equipped with manual RGB controller for an individual adjustment of each color and the color changes can be observed.

For examination of the PWM signals the BNC outputs can be connected to an oscilloscope.

Learning Content:

- Diodes and breakdown voltage
- Basics and characteristics of RGB diodes and power diodes
- Basics and characteristics of energy-saving lamps and halogen lamps
- Dimming with pulse width modulation (PWM)

>> Operating voltage: 220V... 240V, 50/60Hz >>
Dimensions: 532 x 297mm (WxH)

LED Lamp Panel 531.030.530

Basics to LED Lamps			
531.030.530	LED Lamp Panel	531.028.001	Manual with CD, LED Lamp Panel
531.032.000	Set of Cables and Connectors	590.010.001	Digital Lux Meter

INSTALLATION TECHNOLOGY - **ALARM SYSTEMS**

The alarm systems are for the comprehension of intruder - and fire alarm systems, it teaches about the required components, the different types of sensors and its functionality.

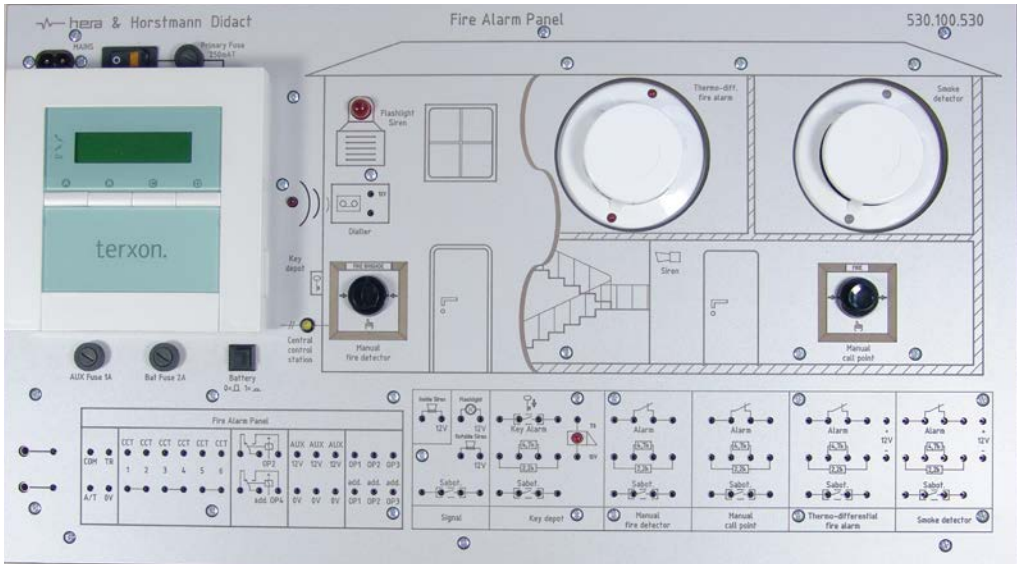
>> Operating voltage: 220V... 240V, 50/60Hz >>
Dimensions: 532 x 297mm (WxH)

Fire Alarm System consisting of:

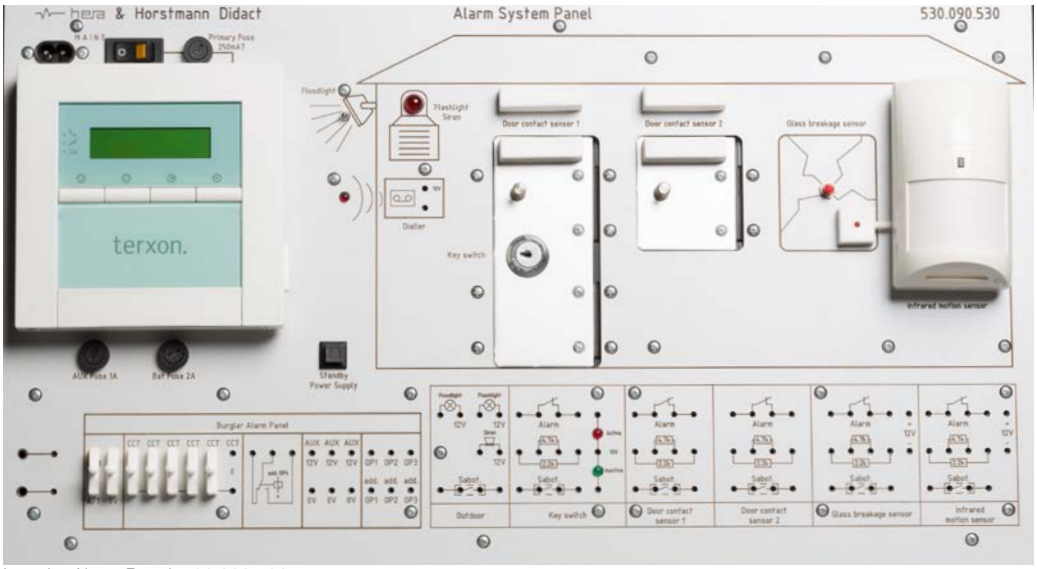
- Central Alarm Unit Terxon SX
- Infrared Sensor
- Smoke Detector
- Manual Call Point
- Alarm Center

Intruder Alarm System consisting of:

- Central Alarm Unit Terxon SX
- PIR Motion Sensor
- Reed Contact for Door and Window
- Glass Breakage Sensor
- Key Switch for Entrance Door
- External LED indication for activated / not activated
- Alarm Sirene with Flash Light
- Outer Light
- Dialing Simulator
- Alarm Center



Fire Alarm Panel 530.100.530

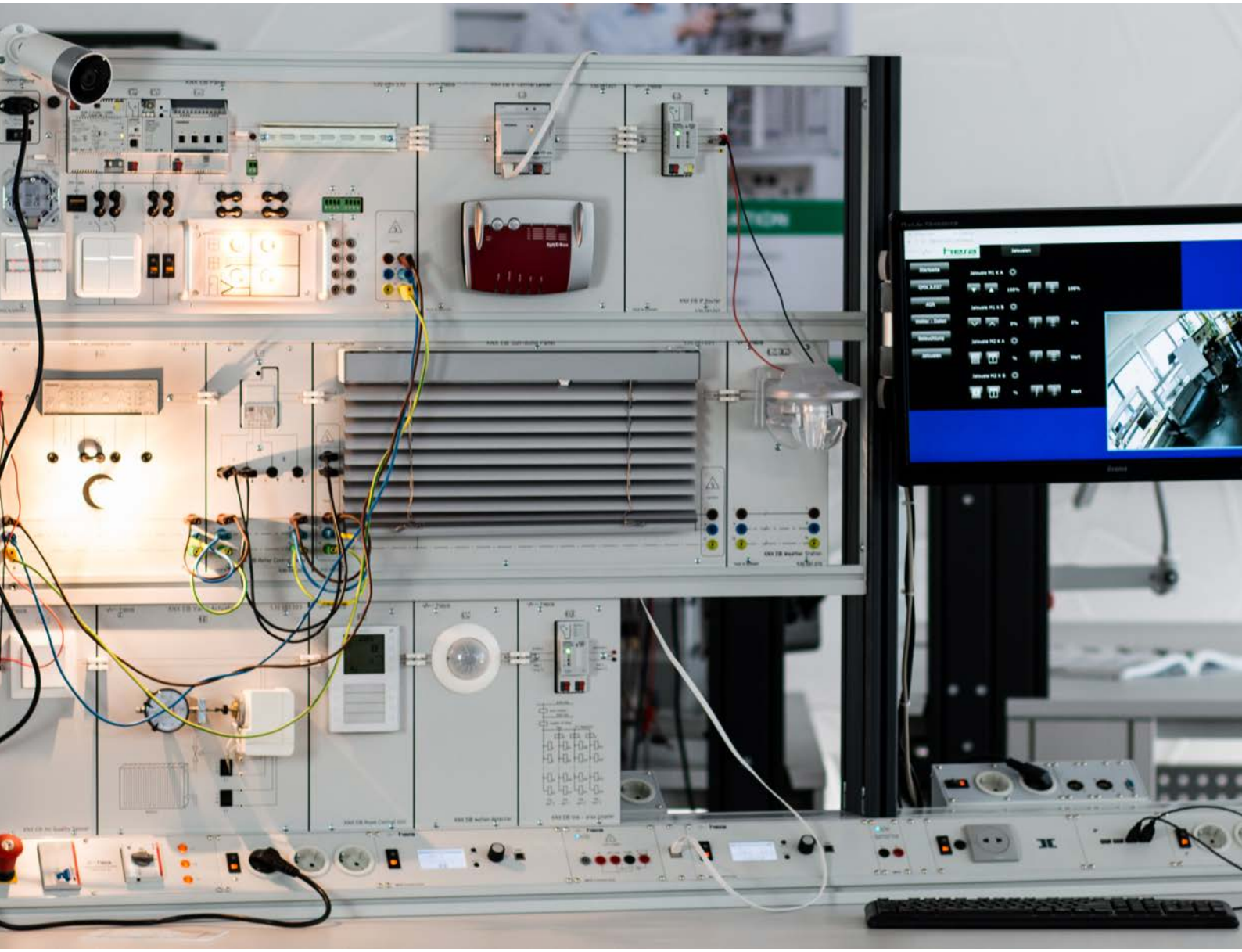


Intruder Alarm Panel 530.090.530

Installation Technology - Alarm Systems			
530.090.530	Intruder Alarm System	530.100.530	Fire Alarm System
530.092.000	Set of Cables and Connectors	530.102.000	Set of Cables and Connectors
530.098.001	Manual with CD, Intruder Alarm System	530.108.001	Manual with CD, Fire Alarm System

INSTALLATION TECHNOLOGY - **BUILDING AUTOMATION**

The KNX bus is the most common field-bus solution for public buildings but of cause it is also applicable for domestic homes. The importance of building automation is constantly rising as it provides smart solutions with comfort -, safety - and energy-saving features. Learn how to integrate and coordinate lighting, heating, shading, observing functions in your projects with different topologies.



BUILDING AUTOMATION - KNX BUS

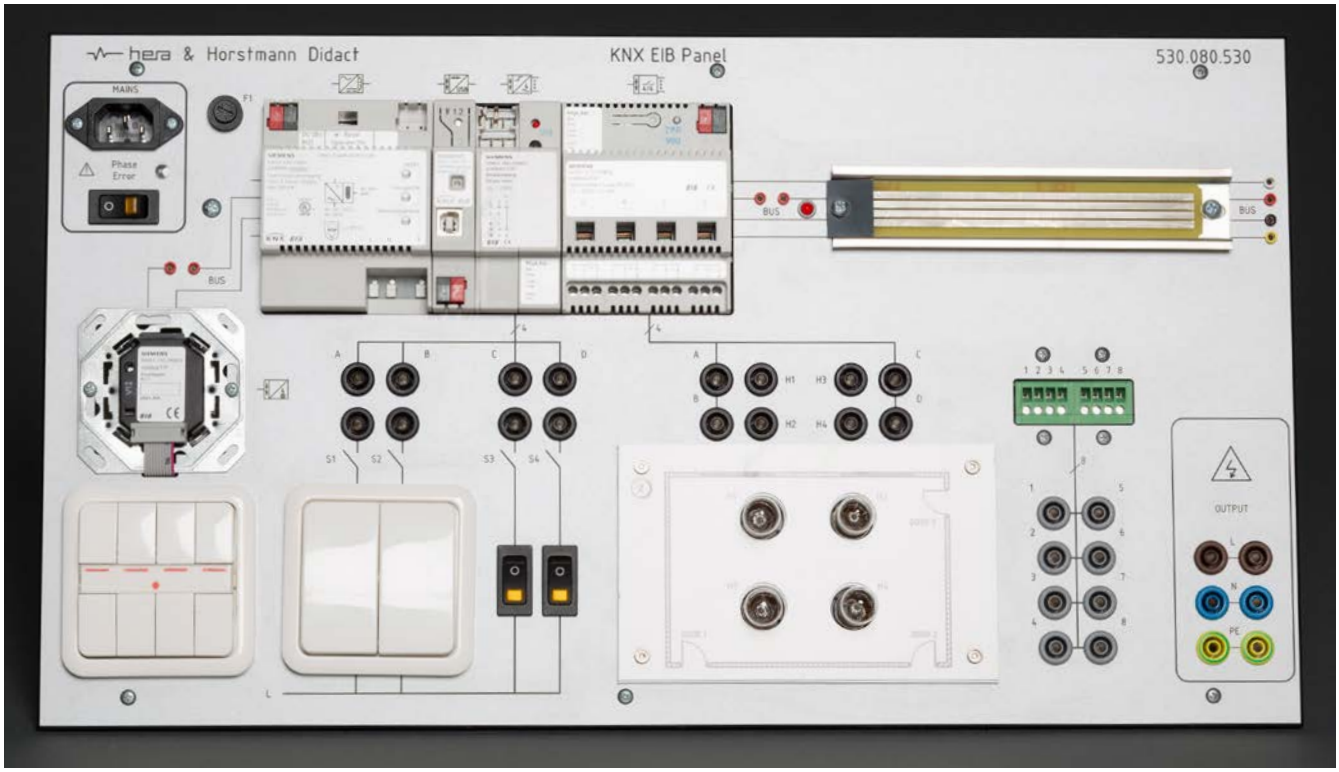
Building automation is an essential part of the installation technology due to comfort -, safety - and energy-saving features. The system teaches about the required components, how to set-up the bus-system and integrate the components, program the freaturs and organize in different topologies, e.g. in multi-storey buildings.
The basic training can be done with the compact KNX EIB Panel and EIB software or for a extensive training some or all component panels can be added.
The profile rail allows the integration of extra components.

>> Operating voltage: 120V... 240V, 50/60Hz >>
Dimensions: 532 x 297mm (WxH)

The panel hold following components:

- Power Supply with Choke
- USB Interface
- 4fold Binary Input
- 4fold Switching Actuator
- Bus Coupler UP
- 4fold Pushbutton with LED Indication
- LED Bus Detector
- Double Pushbutton
- 2x Control Switch
- 4 Lamps for Load Simulation
- 2 Masks for Room Simulations

If you decide for a system with several component panels, then we recommend to use a training system frame to keep your bench top clear.



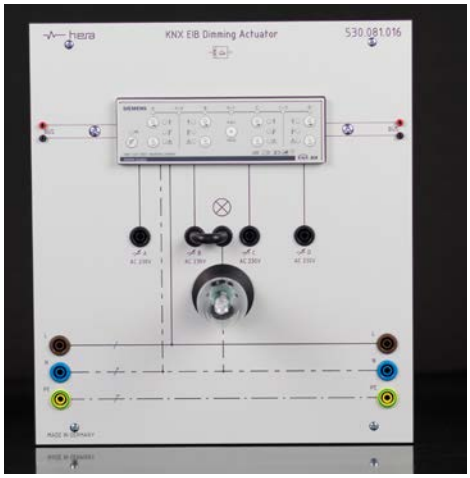
KNX EIB Panel 530.080.530

KNX EIB Installationsbus			
530.080.530	KNX EIB Panel	530.088.101	Manual with CD: Tests to KNX EIB Panel
530.082.000	Set of Cables and Connectors	530.088.001	Manual EIB: Planning, Installing and Visualizing (ETS5)
530.980.010	ETS 5 Lite Software Trainee Version		
530.980.011	ETS 5 Software Professional Version		

BUILDING AUTOMATION - COMPONENT PANELS

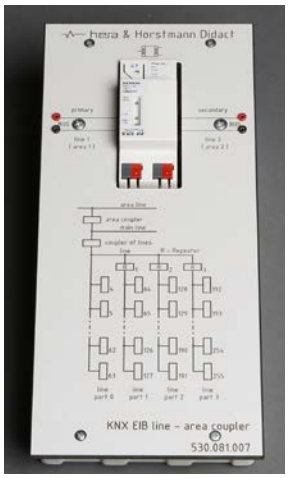
The compact panel can be added by following component panels in order to achieve a smart system with the most common applications.

530.081.021 IP Control Center (W: 266)
communication between KNX devices and computer (or e.g. smart phone) WLAN-Router
Web-Server for control and monitoring (e.g. control by computer, smart phone or notebook)
web-editor for creating a full graphic design with all control and monitoring elements



530.081.016 KNX EIB Dimming Actuator 4fold (W: 266)
4 outputs for switching and dimming of ohmic inductive and capacitive loads
3 outputs can alternatively used to switch RGB lights incl. E14 socket

530.081.017 KNX EIB IP Router (W: 133)
connects bus lines or bus areas by fast Ethernet 10base T and remote access in combination with the router



530.081.007 KNX EIB Line - Area Coupler (W: 133)
couples a KNX line to the main line or to an area line
used also as repeater

530.081.020 KNX EIB Weather Station (W: 133)
measurement and monitoring of wind / brightness / temperature
anemometer for measuring the wind speed

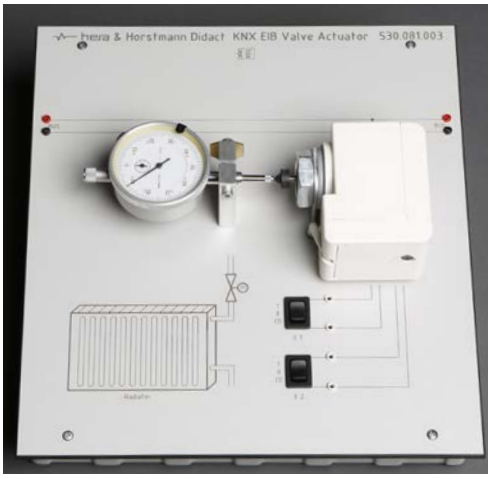
530.081.008 KNX EIB Motion Sensor (W: 133)

Component Panels KNX EIB Installation Bus	
530.081.021	KNX EIB IP Control Center with WLAN Router
530.081.016	KNX EIB 4fold Dimming Actuator
530.081.017	KNX EIB IP-Router
530.081.007	KNX EIB Line - Area Coupler
530.081.020	KNX EIB Weather Station
530.081.008	KNX EIB Motion Sensor

BUILDING AUTOMATION - COMPONENT PANELS

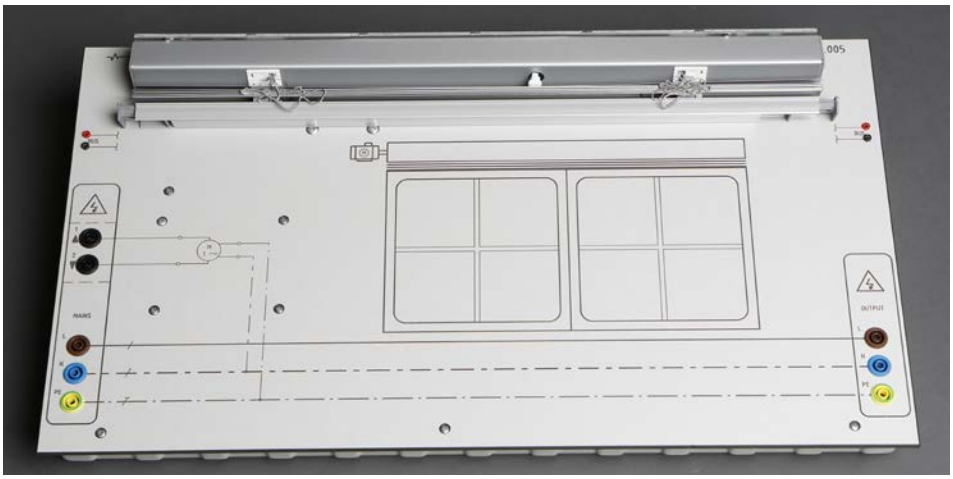
530.081.015 KNX EIB Room Control Unit (W: 133)
control of heating, ventilation and air conditioning
control of light, shutters and scenes
temperature indication
16 programmable buttons

530.081.018 KNX EIB Air Quality Sensor (W: 133)
room sensor for CO^2 and humidity measurement
LED indication for air quality



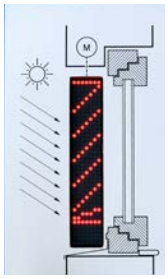
530.081.003 KNX EIB Heating Actuator (W: 266)
simulation of a heating actuator
status indication with analogue reading
input port simulation

530.081.004 KNX EIB Actuator for Sun Blinds (W: 532)
for max. 2 sun blinds



530.081.005 KNX EIB Sun Blinds (W: 532)
with integrated end switches
stop in each position and adjustable lamellas

530.081.018 WIFI IP Camera for In- and Outdoor Applications (W: 166)
Resolution 1920x1080
Lense 4mm, 16fold digital zoom
1x IR LED, night vision camera up to 15m
Access via Windows Client Software and iOS & Android App
independent from KNX system

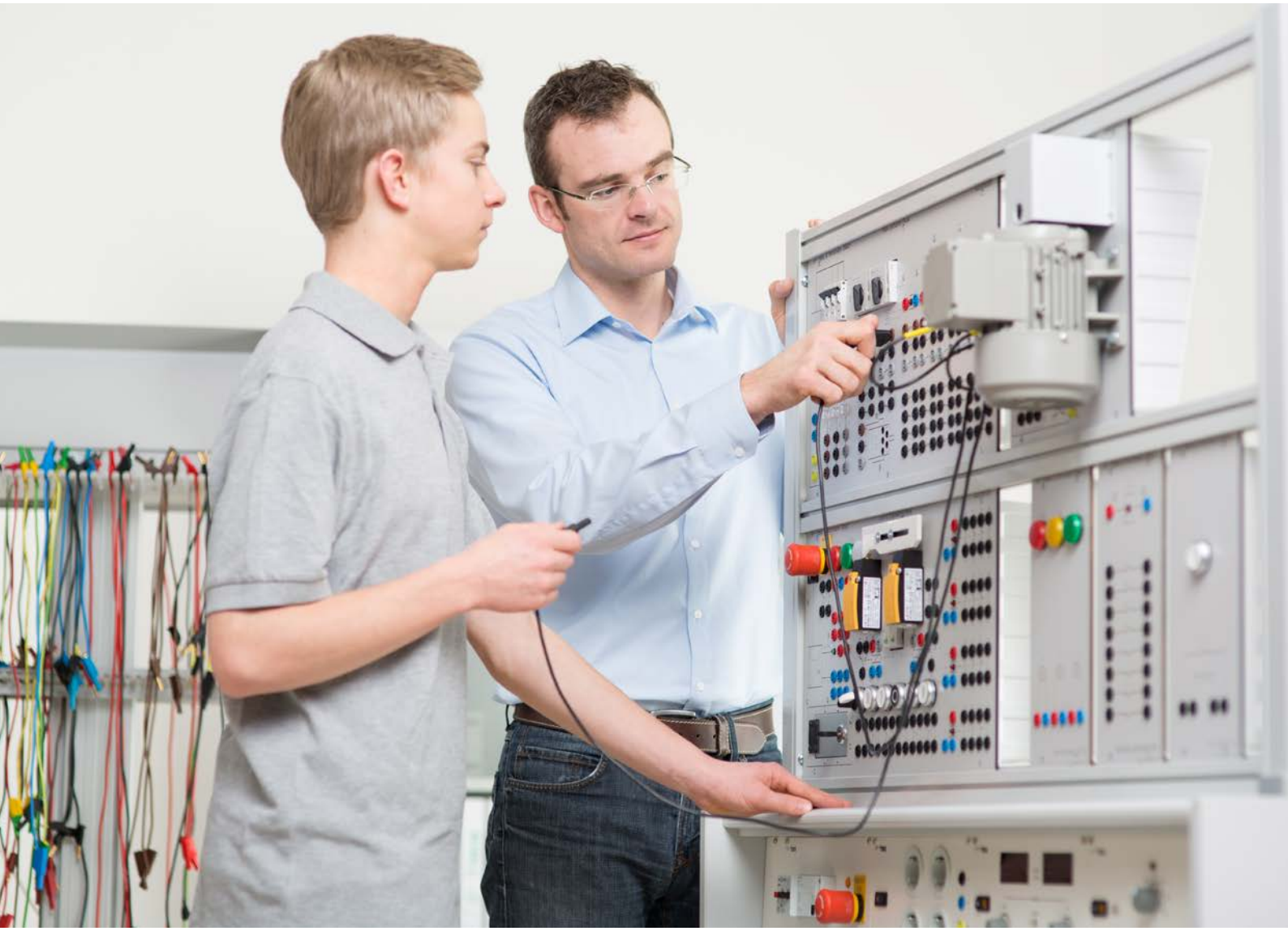


530.081.022 KNX EIB LED Sun Blinds Simulation (W: 166)

Component Panels: Building Automation	
530.081.015	KNX EIB Room Control Unit
530.081.019	KNX EIB Air Quality Sensor
530.081.003	KNX EIB Heating Actuator
530.081.004	KNX EIB Actuator for Sun Blinds
530.081.005	KNX EIB Sun Blinds (220V...240V only)
530.081.022	KNX EIB LED Sun Blinds Simulation
530.081.018	WIFI IP Camera for In- and Outdoor Applications

INDUSTRIAL WIRING - **CONTROL ENGINEERING**

Roughly spoken electric tools and processing machines consist of a control circuit for controlling the functions and a load circuit with the drive.
Our system for control engineering consists of the Control Engineering Panel (Control Circuit), the Main Contactor Panel and the Basic Motor Panel (Load Circuit). The trainees get to know different types of wiring with respect to functionality and safety (e.g. how to wire a mechanical press and ensure accident prevention for the operator). The Control Engineering Panel is a basic course for manufacturing, servicing and repairing electric tools and conventional machines and is a perfect foundation for professions related with automation technology.



BASICS TO **INDUSTRIAL CONTROL CIRCUITS**

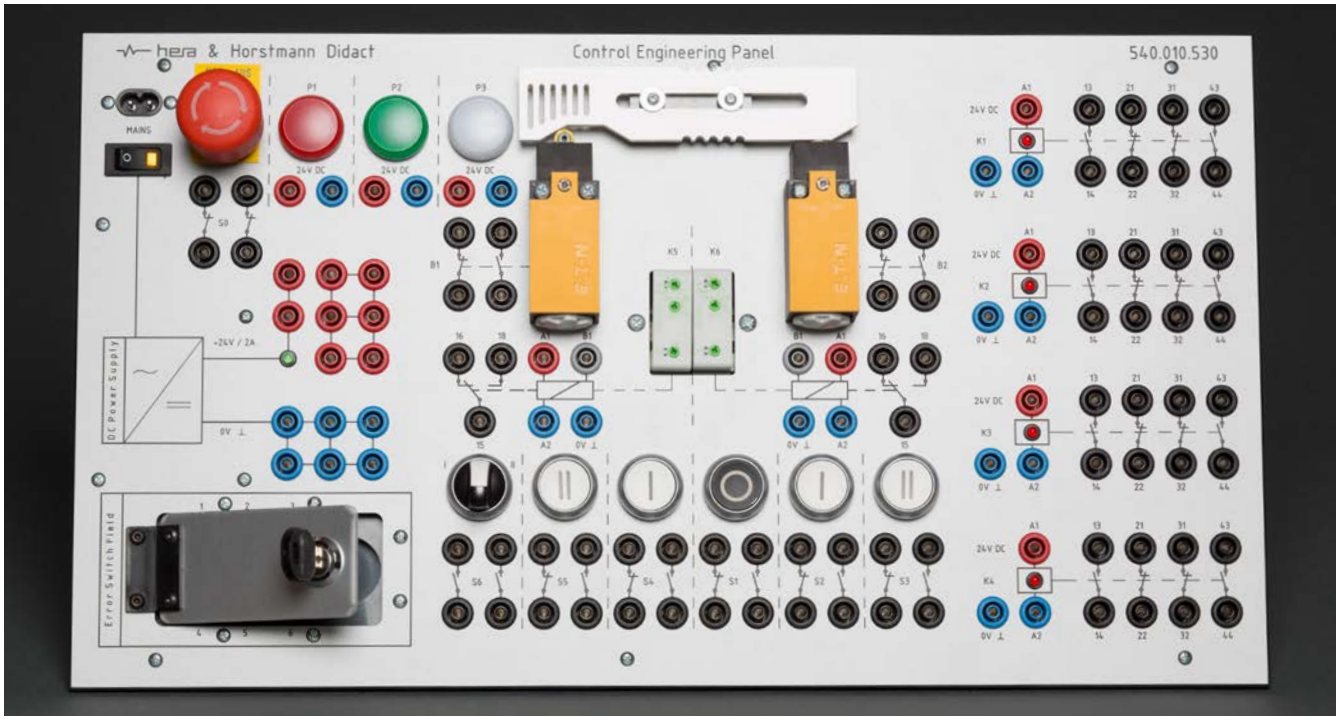
The Control Engineering Panel is a self-sufficient training system for doing tests with industrial control circuits. The panel holds a variety of signal lamps, pushbutton, auxiliary contactors, end switches, time relays which can be connected with 4mm safety cords. The trainer is with lockable failure box, so the trainees get to know the most common failures and learn how to trouble shoot.
The second part of the manual is with load circuit, so for a more exended training we recommend the Basic Motor Panel and Contactor Panel.

>> Operating voltage: 120V... 240V, 50/60Hz >>
Dimensions: 532 x 297mm (WxH)

>> RECOMMENDED IN COMBINATION WITH THE CONTACTOR PANEL AND THE BASIC MOTOR PANEL!

Learning Content:

- Wiring diagrams
- Categories for switches and contactors
- And - / or circuits with and without selfholding
- Auxilliary contactors
- Interlocking pushbutton - and contactor circuits
- Circuits with switch on - switch off delay
- Flashing cirucits
- Sequence control
- Directly switching on a motor
- Reverse contactor circuit
- Star-delta circuit
- Pole-changing of motors
- Trouble shooting in faulty circuits



Control Engineering Panel 540.010.530

Industrial Control Circuits			
540.010.530	Control Engineering Panel	540.018.001	Manual with CD „Control Engineering“
540.012.000	Set of Cables and Connectors		

CONTROL ENGINEERING - **LOAD CIRCUIT**

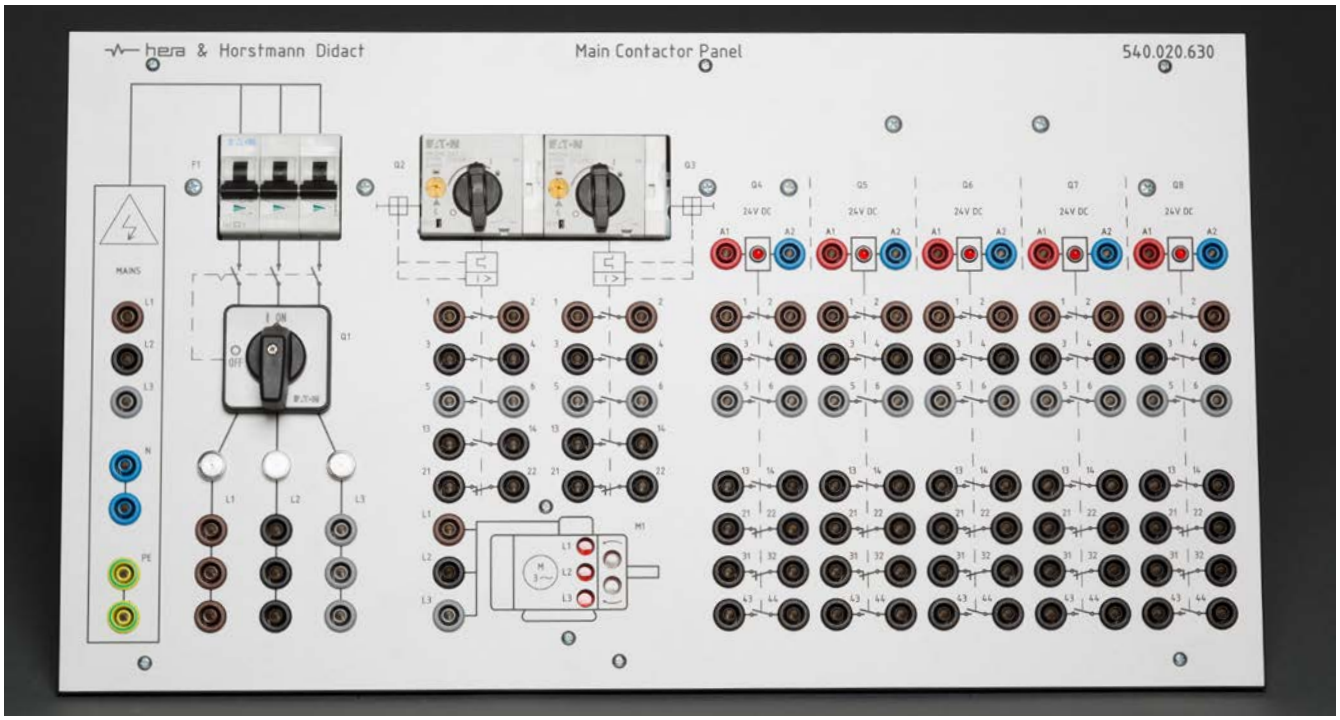
In combination with the Control Engineering Panel or the PLC Panel the Main Contactor Panel can be used to control a motor e.g. the Basic Motor Panel.
The Main Contactor Panel includes a 3phase CEE to 4mm jacks.

>> Operating voltage: 3x 220...240V 50/60Hz >>
Dimensions: 532 x 297mm (WxH)

>> RECOMMENDED ACCESSORY:
BASIC MOTOR PANEL

consisting of:

- Load Switch
- 2x Motor Circuit Breaker 0...0,63A
- Automatic Circuit Breaker 2A
- 5x Load Contactors 3kW
- 5x Auxiliary Contactors
- 3phase Motor Simulation
- 3phase CEE Adapter to 4mm Safety Jacks



Main Contactor Panel 540.020.630

3ph CEE adapter to 4mm safety jacks

Industrial Load Circuit			
540.020.630	Main Contactor Panel	540.099.007	3ph CEE Adapter to 4mm Jacks
540.022.000	Cables and Connectors		

UNIVERSAL **THREE-PHASE MOTOR**

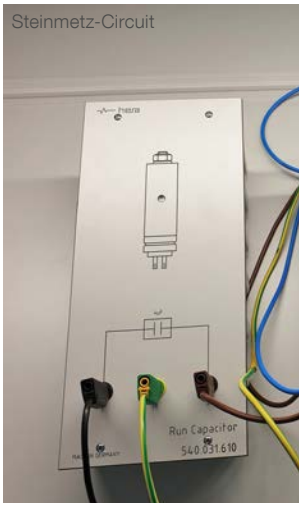
The Basic Motor Panel can be used as load panel either for the Control Engineering Panel in combination with the Main Contactor Panel or the PLC Panel with Frequency Converter.
The motor can be connected as asynchron motor, asynchron motor with seperate windings or in star-delta.

Technical data: 230V/400V 50Hz, 0,45 / 0,30kW, 2790/1380 $U_{min.}$

The analogue reading indicates the rotation direction and rotation speed. For a save operation the shaft is with protective hood.
The run capacitor panel is to study operation of a 3phase motor in case of phase failure or in case of 1phase supply.

Dimensions: 532 x 297mm (WxH)

Basic Motor Panel for Control Engineering and Frequency Converter



Steinmetz-Circuit

Universal Three-Phase Motor			
540.030.630	Basic Motor Panel	540.031.610	Run Capacitor (Panel 133 x 297mm)
540.032.000	Set of Cables and Connectors		

COMPONENT PANELS FOR CONTROL ENGINEERING

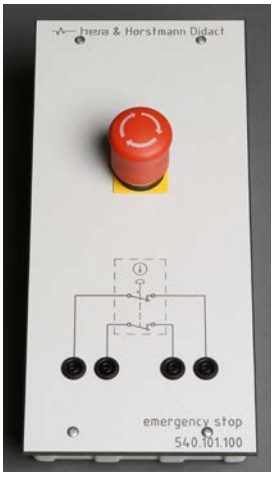
Instead of the Control Engineering Panel and the Main Contactor Panel you can select your own choice of component panels. The full set is available either as $230V_{AC}$ version or as $24V_{DC}$ version.

Dimensions: 133 x 297mm (WxH)

540.000.100 Set of Panels: Control Engineering

(according to manual 540.018.001)

2x Auxiliary Contactors 24V
1x Time Relay 24V on delay
1x Time Relay 24V off delay
1x Pushbutton 0-I-II
1x Control Lamps 24V 3-fold
1x Limiting Switch 1S/ 1O
1x Emergency Off
1x Power Supply $24V_{DC}$



Component Panels - Control Engineering			
540.000.100	Set of Panels according to Manual 540.018.001	540.100.207	Auxiliary Contactor 24V, 4 NOC, 4 NCC
540.100.103	Reversing Switch	540.100.208	Auxiliary Contactor 230V, 4 NOC, 4 NCC
540.100.104	Star-Delta Switch	540.100.334	Load Contactor 24V, 3 Load Contacts + 2 NOC + 2 NCC
540.100.105	Star-Delta Reversing Switch	540.100.234	Load Contactor 230V, 3 Load Contacts + 2 NOC + 2 NCC
540.100.106	Pole-Changing Switch, Dahlander Motors	540.100.706	Overcurrent Relay 0,4…0,6A
540.100.107	Pole-Changing Switch, Motor with Seperate Windings	540.100.710	Overcurrent Relay 0,6…1,0A
540.101.100	Emergency Off Button	540.100.716	Overcurrent Relay 1,0…1,6A
540.101.005	Pushbutton Off	540.100.911	Time Relay 24V drop-out delay
540.101.001	Pushbutton On	540.100.912	Time Relay 24V switch-on delay
540.101.002	Pushbutton, 2fold	540.100.913	Time Relay 230V drop-out delay
540.101.003	Pushbutton, 3fold, 0-I-II	540.100.914	Time Relay 230V switch-on delay
540.101.004	Pushbutton, 3fold, I-0-II	540.100.910	Multifunctional Relay 8-230V, Changeover, 0,1s-40h
540.101.023	Control Lamp 24V, 3fold		drop-out - / switch-on delay / clock generator / wiper
540.101.024	Control Lamp 230V, 3fold	540.100.806	Motor Circuit Breaker 0,4…0,6A
540.101.031	Limit Switch, 1 NOC, 1 NCC	540.100.810	Motor Circuit Breaker 0,6…1,0A
590.500.010	DC Power Supply Panel 24V / 4A	540.100.816	Motor Circuit Breaker 1,0…1,6A

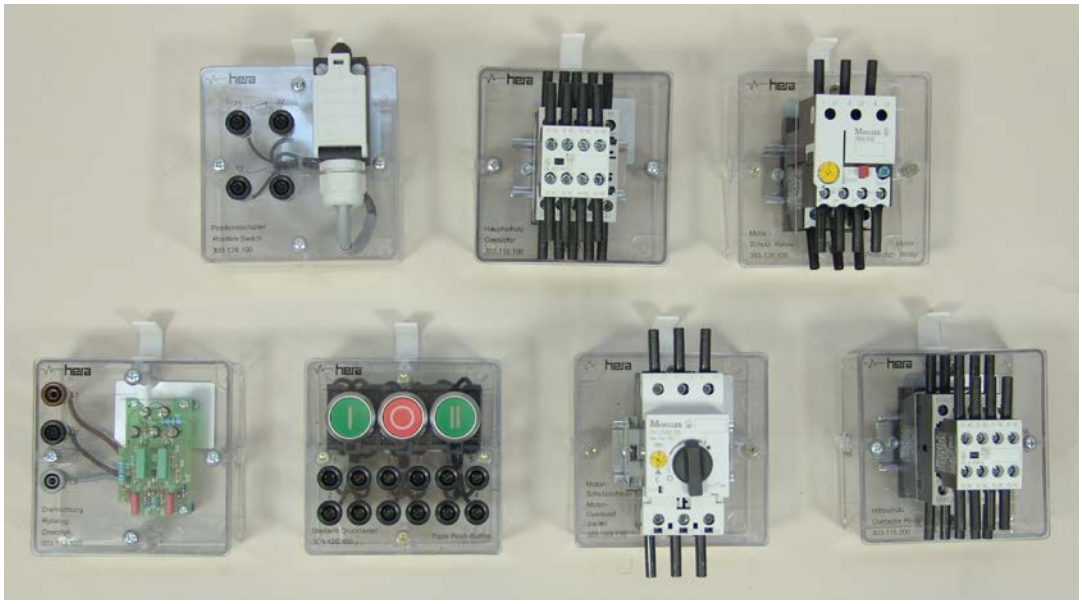
TRAINING BOXES - CONTROL ENGINEERING

The topic of Control Engineering can alternatively be tought with training boxes. For trainings with boxes you will need either a training system frame with installation wall or an installation cabin. The boxes are completely closeed with detachable cover and replacable hooks.
For a safe training environment the wirings are only possible with 4mm touch-protected safety laboratory cables.

303.000.100 Set of Panels: Control Engineering

(according to manual 540.018.001)

1x DC Power Supply 24 VDC / 4A
2x Auxiliary Contactor 4 NOC + 4 NCC, Coil 24VDC
1x Pushbutton, 3fold, 0 - I - II
1x Emergency Off Button
2x End Switch, 1 NOC, 1 NCC
1x Control Lamp, 3fold, 24V (red, yellow, green)
1x Time Relay, switch-on delay, 24VDC
1x Time Relay, drop-out delay, 230VAC



replacable 4mm for safety lab cables

completely housed, with detachable cover

replacable hooks and locks

suitable for hera installation walls and universal installation walls

Training Boxes for Control Engineering

303.000.100	Set of Boxes „Control Engineering“ according to manual	303.117.100	Multifunctional Relays 8 ... 230V UC
303.100.100	3x Resistors 50Ω, 100Ω, 220Ω, 0,5A each	303.120.100	Pushbutton, 3fold
303.101.100	Neozed Fuse Element 3x 6A	303.120.500	Emergency Off Button
303.103.100	Motor Circuit Breaker 1...1,6A	303.122.100	Control Lamps, 3fold 230V
303.105.100	Motor Protection Relay 1...1,6A	303.124.100	End Switch, 1 NOC + 1 NCC
303.105.200	Motor Protection Relay 0,6 ... 1A	303.125.100	Proximity Switch, inductive
303.105.300	Motor Protection Relay 0,4 ... 0,6A	303.125.200	Proximity Switch, capacitive
303.110.100	Main Switch, 3poles	303.156.100	Pushbutton Off, red
303.111.100	Reversing Switch	303.157.100	Pushbutton On, green
303.112.100	Star-Delta Switch	303.166.100	Control Lamps, 3fold, 24V
303.113.100	Motor Simulation, 3phase	303.177.800	Time Relay, switch-on delay 230V
303.115.100	Load Contactor 230V 3 Auxiliary + 2NOC - 2 NCC	303.177.810	Time Relay, drop-out delay 230V
303.115.110	Auxiliary Contactor 24V 3 Auxiliary + 2 NOC + 2 NCC	303.177.820	Time Relay, switch-on delay 24V
303.115.200	Auxiliary Contactor 230V 4 NOC+ 4NCC	303.177.830	Time Relay, drop-out delay 24V
303.115.210	Auxiliary Contactor 24V 4 NOC+ 4NCC		

AUTOMATION TECHNOLOGY - PLC AND MECHATRONICS

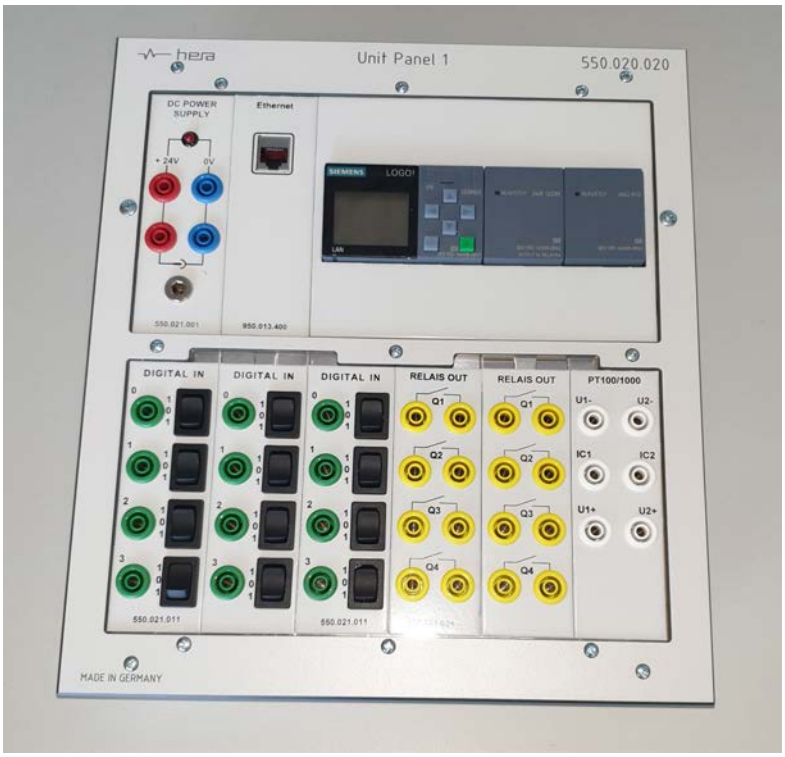
Any professionals related to industrial manufacturing will most likely get in touch with PLC technology. Either as an operator or for programming and wiring. So in following pages you will find a variety of trainers either for software simulations or with mechatronic conveyors and different drives.

LOGIC **CONTROLLER**

Logic controllers are an ideal control for small machines or comfort house installations. In standard we are offering controllers of Siemens and Eaton, but the Unit Panel can accept any other controllers.
Besides the programming of Logic Controllers the students are able to connect the controllers in- and outputs with individual cables. The inputs are on 4mm safety jacks with latching pushbuttons. The 4mm output jacks are either relay outputs (DRO) or transistor outputs (DTO).

Please see page 085 for Mechatronic System Compact with Siemens Logo! 8 (Art-No. 950.034.200).

Dimensions: 266 x 297mm (WxH)



Unit Panel with Siemens Logo! 8 including Temperature Measurement

Erweiterung
Temperaturmessung

Logic Controller Eaton EASY

Training Systems with Logic Controllers	
550.980025	Training System SIEMENS Logo! 8 12/24V, 12x DI / 8x DRO (4 x DI can be used as AI 0-10V) incl. Software Logo! Soft Comfort V8
550.980.026	Training System SIEMENS Logo! 8 230V, 12x DI / 8x DRO incl. Software Logo! Soft Comfort V8
550.980.027	Option: Temperature Measurement (2x AI für Pt100/Pt1000)
550.988.024	Logo! 8, Book EN
550.98A.030	Training System EATON Easy 24V (8x DI + 4x DRO)
550.98A.031	Training System EATON Easy 230V (8x DI + 4x DRO)
550.98A.032	Training System EATON Easy 24V (12x DI + 8x DRO)
550.98A.033	Training System EATON Easy 230V (12x DI + 6x DRO)

PLC TRAINING SYSTEM

The PLC Panel is the ideal base for various CPUs of the Siemens S7 family. Due to the flexible equipment with modules, the trainer can be individually configured with all required in- / outputs and interfaces.
This is very cost efficient and time saving as the trainees learn how to do the correct configuration and connections without spending much time on cable cutting and and connection.
So the lessons can be more efficiently filled with programming tasks.
The below stated numbers are blank boards ready for the acceptance of different PLCs, accessory and modules as listed in the next pages.

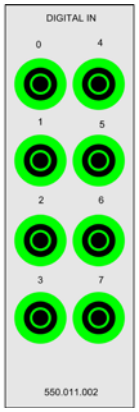
PLC Panel 950.061.600,0 with Siemens 7-1200 and KTP700 Operating Panel in Training System Frame

PLC Training System		
550.010.530	PLC Panel 1 (profile rail 320mm /15x units)	
550.010.531	PLC Panel 2 (profile rail 480mm /12x units)	
550.018.001	Manual with CD, Basics of Automation Technology	
950.061.600	PLC Panel with integrated KTP700	
	More Modules	
950.062.100	Analogue Simulation 0...20mA	
950.062.000	5x Analogue Inputs, 2x Analogue Outputs	
950.017.100	Word I/O (4 coding input switches, 4digit 7-segment display	
950.006.000	4x Analogue Output +-10V, each with analogue display (	

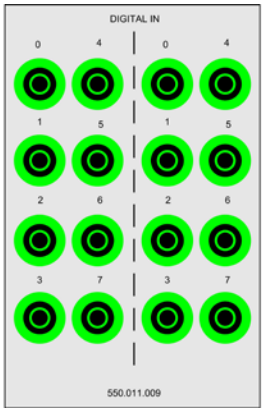
MODULES FOR PLC PANEL

The modules are equipped with touch protected 4mm safety jacks and fully wired to the PLC.

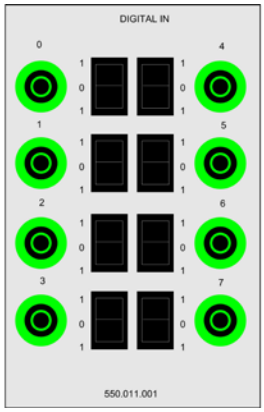
550.021.000
Blank Module



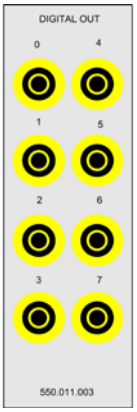
550.011.002
8x Digital Input



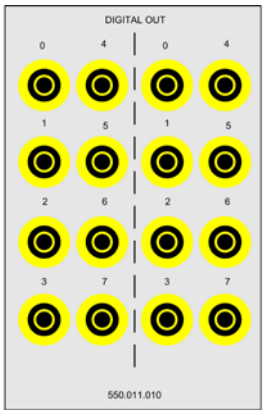
550.011.009
16x Digital Input



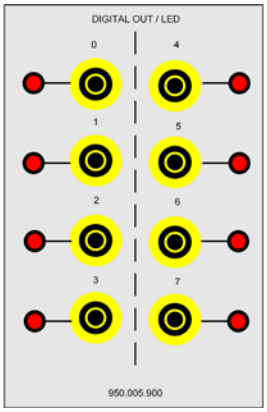
550.011.001
8x Digital Input with Latching Pushbuttons for Simulation



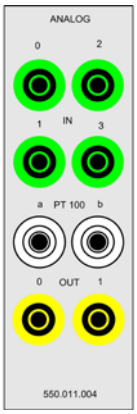
550.011.003
8x Digital Output



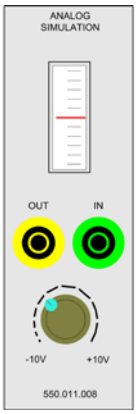
550.011.010
16x Digital Output



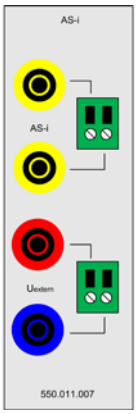
950.005.900
8x Digital Output with LED



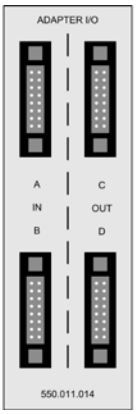
550.011.004
4x Analogue Input
2x Analogue Output
2x PT100 Input



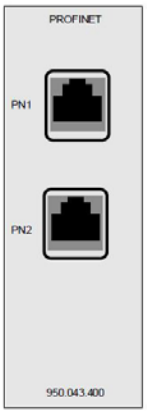
550.011.008
Analogue +/- 10 V In- and Output with Meter and Poti for Simulation



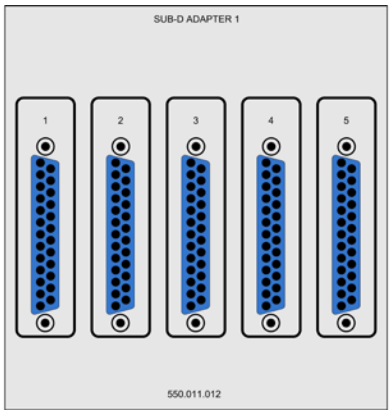
550.011.007
AS-Interface



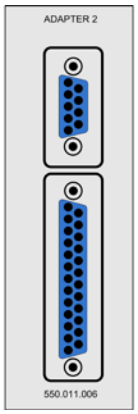
550.011.014
4x In- and Outputs with I/O Connector



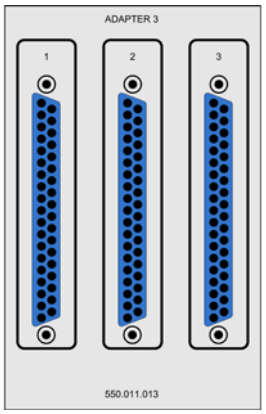
950.043.400
2x Profinet



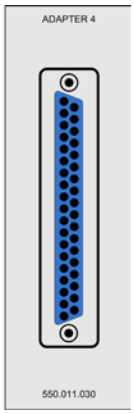
550.011.012
Mechatronic Interface
5x Sub-D 25poles



550.011.006
Mechatronic Int.
Sub-D 9poles
Sub-D 25poles



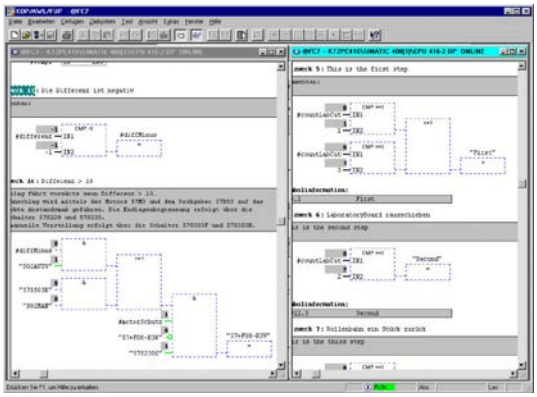
550.011.013
Mechatronic Interface
3x Sub-D 37poles



550.011.030
Mechatronic Int.
Sub-D 37poles

SIMATIC STEP 7 SOFTWARE

The Siemens SIMATIC STEP 7 is one of the most common softwares for automation in process technology. The software in combination with the PC Panel allows the students to design own projects. Below options are exclusively for educational purposes.
Supports following programming languages: AWL, FUP, KOP, SCL, S7-Graph



Learning Content:

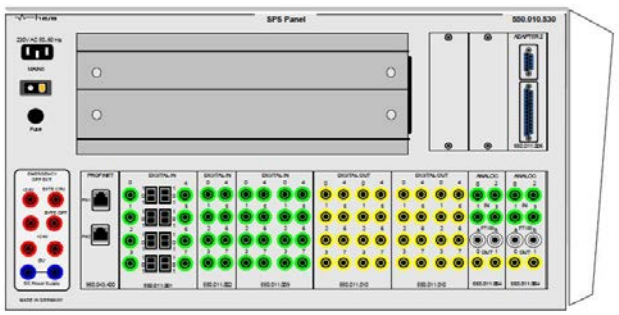
- Creating and managing projects
- Configuration and parametrizing of hardware and communication
- Symbol management
- Creating programs for SIMATIC S7 projects
- Uploading the programs to the automation projects
- Testing the automation project
- Diagnostics of system errors

Software	
550.990.090	SIMATIC STEP7 + TIA Portal Single License for educational purpose
550.990.091	SIMATIC STEP7 + TIA Portal classroom license (6x) incl. 20 student licenses (valid 1 year). Exclusively for schools, not for extra-curricular trainings.

PLC TRAINER WITH **SIEMENS S7-1500**

Fully configured PLC Trainer for S7-1500 equipped with:

- 2x ProfiNet Interfaces
- 8x DI with 4mm safety jacks and switches
- 24x DI with 4mm safety jacks
- 32x DO with 4mm safety jacks
- 8x AI with 4mm safety jacks
- 4x AO with 4mm safety jacks
- Interface Sub-D 9poles
- Interface Sub-D 25poles



- CPU1516PN/DP
- incl. Power Supply, I: AC 120/230V, O: DC 24V, 8A
- incl. Memory Card 24MB
- incl. Ethernet Cable 6m
- incl. Software License Step 7 Professional

System requirement Windows 7 or Windows 10
(for educational purpose only!)

>> Operating voltage: 220...240V 50/60Hz >>
Dimensions: 532 x 297mm (WxH)

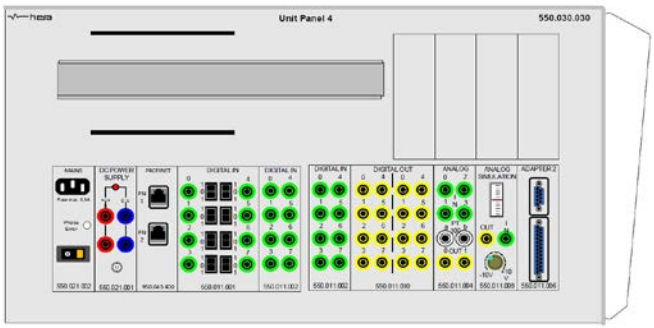
PLC Training System (fully configured)	
550.012.530	PLC Training System with S7-1500

Siemens CPU 1516 PN/DP

PLC TRAINER WITH **SIEMENS S7-1200**

Fully configured PLC Trainer for S7-1200 equipped with:

- 2x ProfiNet Interfaces
- 8x DI with 4mm safety jacks and switches
- 16x DI with 4mm safety jacks
- 10x DO with 4mm safety jacks
- 2x AI with 4mm safety jacks 0...10V DC
- 2x AO with 4mm safety jacks 0...20mA DC
- Simulation Input Module with Poti +/-10V
- Interface Sub-D 9poles
- Interface Sub-D 25poles



- CPU1215PN/DP
- incl. Power Supply, I: AC 120/230V, O: DC 24V, 2,5A
- incl. Ethernet Cable 6m
- incl. Single Software License Step 7 Basic

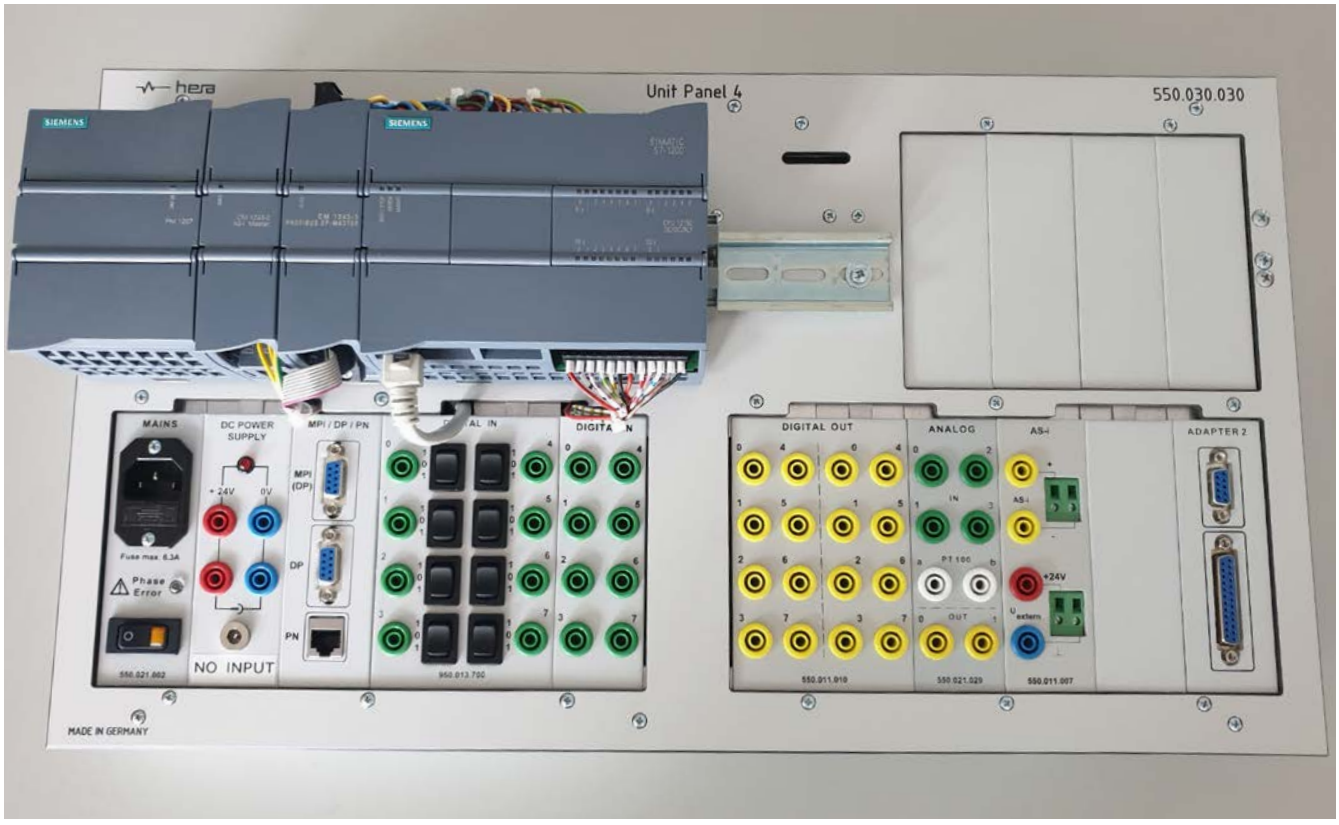
System requirement Windows 7 or Windows 10
(for educational purpose only!)

>> Operating voltage: 220...240V 50/60Hz >>
Dimensions: 532 x 297mm (WxH)

PLC Training System (fully configured)	
550.013.530	PLC Training System with S7-1200

Siemens CPU 1215C

Exemplary PLC Trainer with Siemens CPU 1215C configured for Ethernet, Profibus and AS-i applications



SURVEILLANCE AND **CONTROL**

Automized systems in industry are equipped with operator panels as human-machine-interface.

With this training system the trainees learn how to get this installed, programmed and finally used for controlling the processes.

Operator Panel **KTP700 Touch**:
7“ widescreen touch panel with color display and 8 function keys.
The KTP700 Basic is an operator panel for automized systems with S7-1200 for simple or medium requirements on visualization. The operator panel is available either for MPI/ Profibus or for Ethernet.

Note:
For projects with KTP700 software WIN CC Basic V 13 SP1 is required. The software is included in STEP 7 Basic V13 SP1 and STEP 7 Professional V15

Operator Panel **TP700 Comfort**:
7“ widescreen touch panel with color display and following interfaces:
2x RJ 45 Ethernet for ProfiNet (with integrated switch)
1x RS 485/422 for ProfiBus/MPI
2x USB-Host, 1x USB- Device
2x SD Card Slot

Note:
incl. WIN CC Advanced 15 software

Operator Panel KTP700 Touch 550.055.320

Operator Panel TP700 Comfort 550.060.320

Ethernet Switch

incl. WinCC and Ethernet Cable

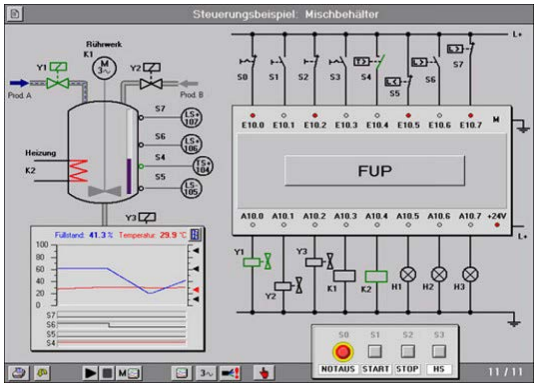
Surveillance and Control			
550.055.320	Touch Panel KTP700 Basic with Ethernet Switch / Cable	550.060.320	Comfort Panel TP700 with Profinet and MPI / Profibus DP interface incl. cable and software
550.056.320	Touch Panel KTP700 Basic DP		

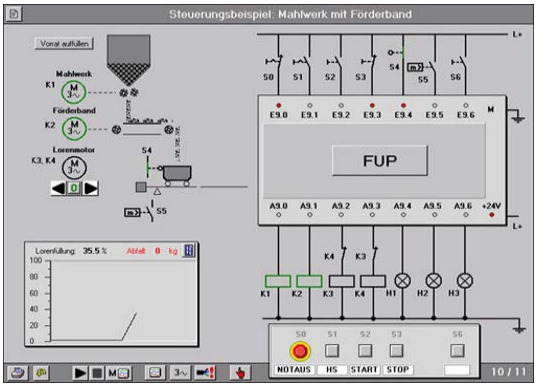
SOFTWARE FOR PLC PROCESS SIMULATION

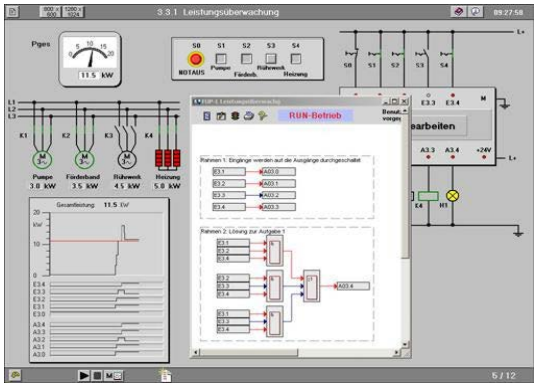
The software solution is a budgetary solution for the students to test their SIMATIC S7 programs in real time by simply connecting the PLC panel to the PC and run the software tasks.
The software with interface for MPI-Bus, Ethernet CP and Netlink Adapter.

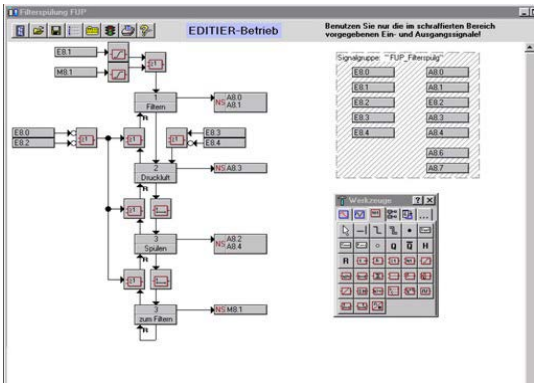
The software holds following tasks:

- Reversing Circuit for Motors
- Star-Delta-Circuit for Starting a Motor
- Star-Delta-Circuit for Motor Starting in either Direction
- Dahlander Circuit
- Control for Motors with 2 Seperate Windings
- Starting Circuit for Slip Ring Motor
- Traffic Light Control
- Power Monitoring
- Storrage Vessel
- Waste Water Tank
- Gate Control
- Filter Rinsing
- Mixing Vessel









Software Applications for S7 Program Testing	
550.041.001	Software for PLC Process Simulation

PROCESS SIMULATION FOR PLC

Instead of software simulation by PC, the processes can be simulated at the process simulation panel. Signal outputs are wired to LEDs, running lights, 7-segment-display and buzzer.

included Process Masks:

- Start-Delta-Connection
- Staircase Lighting
- Intruder Alarm System
- Traffic Lights (traffic dependant / - independant)
- Conveyor Belt with Buffer Store
- Segment Gate Control
- Machining Station
- Bottling Plant
- Mixing Vessel

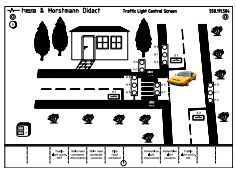
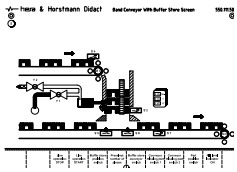
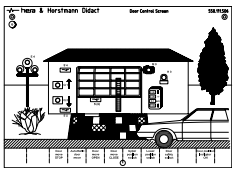
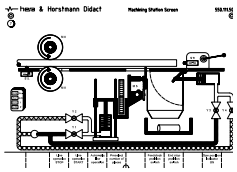
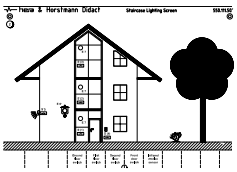
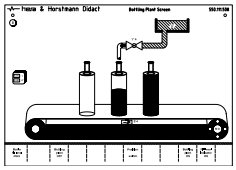
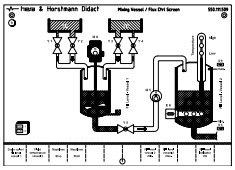
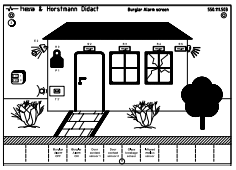
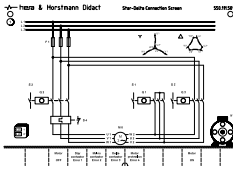
>> 24VDC supply required <<

The panel is equipped with a head rail for the acceptance of a Siemens S7 CPU, a compact controller e.g. Siemens Logo or ET200S for decentral control. Of cause you can control the process simulation panel with an extra PLC Panel and connect the 4mm in- / output jacks.

Technical Details:

- 16x digital input (8x 4mm jacks, 8x 4mm jacks with latching pushbuttons)
- 16x digital output (8x 4mm jacks, 8x LED-field)
- 2x analogue input (4mm safety jacks, with bridge connector for potentiometer use)
- 2x analogue output (4mm safety jacks and LED bar)
- 1x double-digit 7-segment display
- 2x acoustic signals

Article No. 950.032.800 is supplied with 115-240VAC and fully equipped with S7-1200, it is without 7-segment display.


Process Simulation Panel 950.062.200 with S7-1500

Prozess Simulation			
550.110.330	Process Simulation Panel	550.118.001	Manual with CD, Process Simulation
950.032.800	Process Simulation Panel with S7-1200	950.062.200	Process Simulation Panel with S7-1500

CONVEYOR BELT FOR MECHATRONICS

The mechatronic systems with conveyor belt are for an easy entry into the complex world of automation techology. It offers programming tasks like hardware parametrizing, back and forth, cummuting, driving in steps, rotation speed, drive and stop, softstart and -stop with DC small gear motor, 3phase AC motor or servo motor and can be used for training configurations with PLC and frequency conerter.
Dimensions 750 x 225 x 165mm (LxWxH).

Technical Details:

- 2x inductive sensors (NCC) with adjustable holder for end position.
- Coding disk with optical sensor for path measurement.
- 3x inputs with M12 connector for IO-Interface.
- 3x outputs with M12 connector for IO-Interface.
- IO-Interface with Sub-D 25poles connector for direct control to the PLC Panel and 8x M12 connector which can assigned either as in- or outputs.

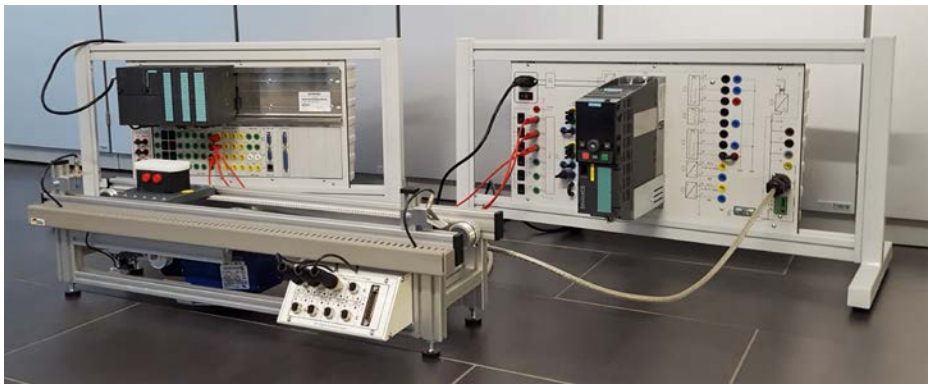
Drive Types:

- Small-gear motor 24V_{DC} with operator panel for rotation speed and drive direction.
- 24V_{DC} motor with operator panel for rotation speed and rotation direction and extra connector for sensors.
- 3phase motor 230/400V_{AC} (suitable for frequency gene rator, see page 091)
- Servo motor incl. power supply and software for parametrizing and control.

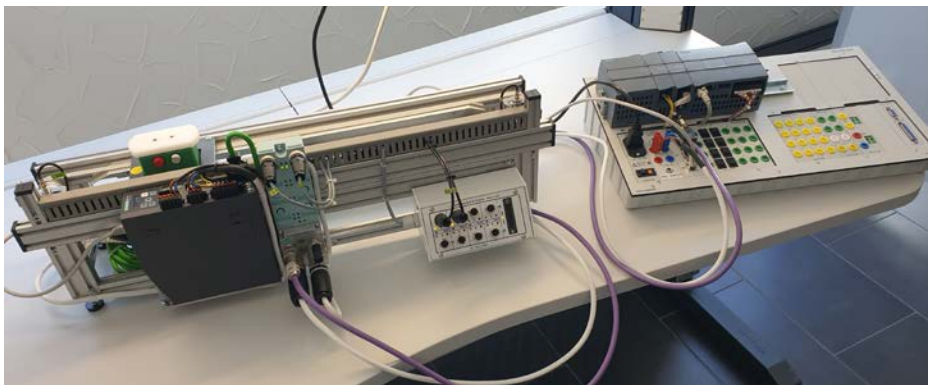
Optional Interfaces for the Conveyor Belts:

- AS-i (slave) with 4x digial inputs and 4x digital outputs (AS-i master and AS-i power supply is required).
- ProfiBus DP (slave) with 8x digital input and 8x digital output (ProfiBus master is required).
- ProfiNet (slave) with 8x digital input and 4x digital output (ProfiNet master is required).

DC Conveyor Belt with Operating Panel



3phase AC Conveyor Belt with Frequency Converter G120 and PLC Panel

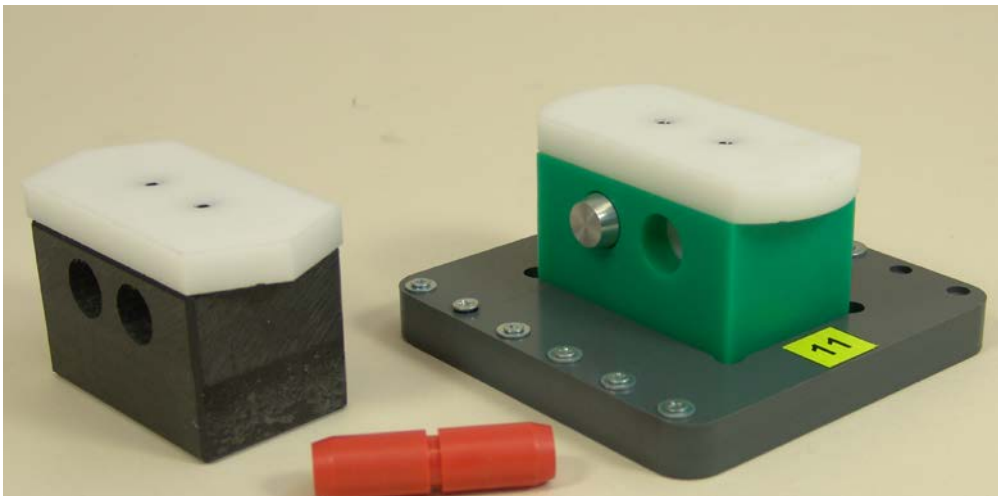


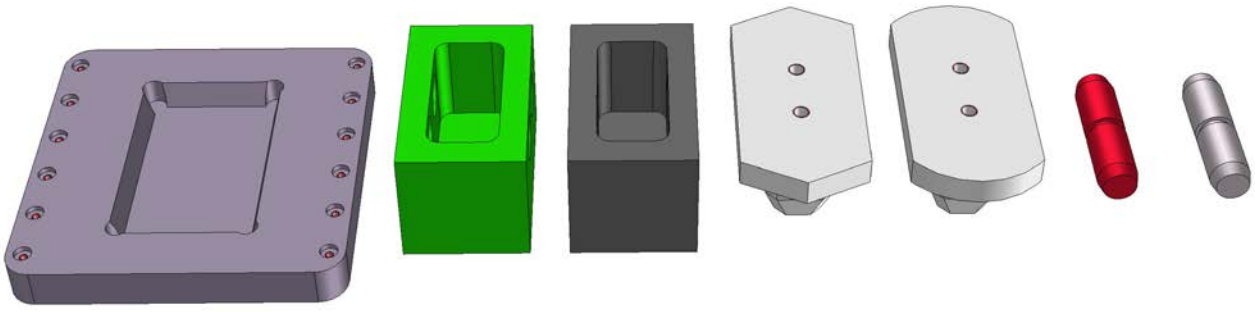
Conveyor Belt with Servo Motor and PLC Panel with S7-1200

Conveyor Belt for Mechatronics			
551.019.200	Conveyor Belt with Small-Gear Motor 24V_{DC} (2x DI + 2x DO)	551.011.040	Option AS-i Interface (4x DI + 4x DO)
551.019.300	Conveyor Belt with 24V_{DC} Motor (3x DI + 3x DO)	551.011.050	Option ProfiBus DP Interface (8x DI + 8x DO)
551.019.500	Conveyor Belt with 3phase Motor 230/400V (2x DI + 2x DO)	551.011.060	Option ProfiNet Interface (8x DI + 4x DO)
551.019.600	Conveyor Belt with Servo Motor	551.018.010	Sub-D Cable 25poles, 1,8m
551.018.001	Manual with CD: Transfer Systems	551.011.000	Workpiece Carrier 119x119mm
551.011.020	Option IO-Interface (8x DI + 8x DO)	551.011.001	Four-Part Workpiece: Lower/Upper, 2x Bolts

PALLET AND FOUR-PART WORKPIECE FOR MECHATRONICS

The pallet is suitable for all types of conveyor belts and for moving the four-part workpiece.
The four-part workpiece is especially necessary for the sensor test station of the Mechatronic Compact.





Pallet | Lower Workpart | Upper Workpart | Pin

Pallet and Four-Part Workpiece for Mechatronics			
551.011.000	Pallet 119 x 119mm	551.011.002	Aluminium Pin
551.011.001	Four-Part Workpiece I: Upper Workpart, round edges + Lower Workpart, black + 2 PVC Pins, red		
551.011.008	Four-Part Workpiece II: Upper Workpart, edged + Lower Workpart, green + 2 Aluminium Pins		
551.011.006	PVC Pin, red		

FREQUENCY **CONVERTER**

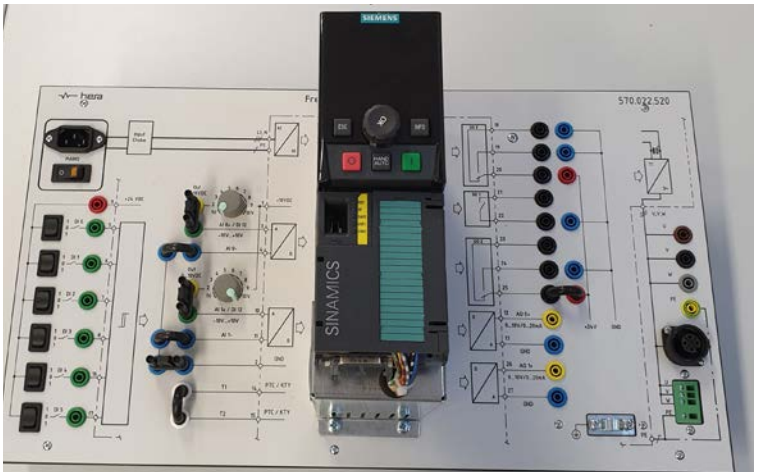
The training system teaches the students everything about the application, the correct connection and commissioning of a professional industrial frequency converter with EMC filter at the example of the Siemens G120. We offer a 1phase (200V) or 3phase solution (400V) for 50Hz and 60Hz.

Learning Content:

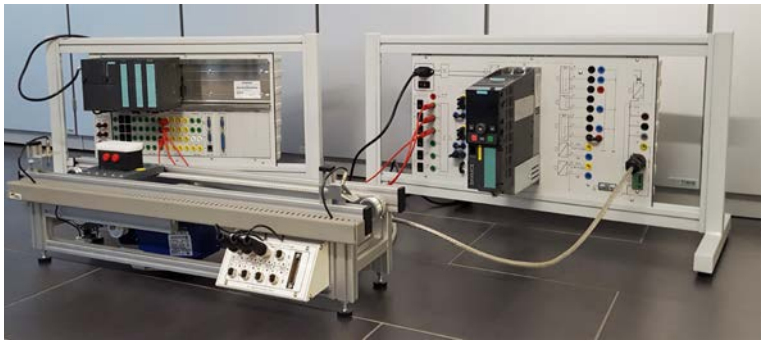
- Basics to Frequency Converters
- Connecting a Frequency Converter EMC-conform
- Commissioning a Frequency Converter
- Programming and Testing of Drive Functions
- Programming and Testing of Safety Functions
- Operation and Surveillance at the FU
- Operation and Surveillance at the PC
- Commissioning with Profibus

For a complete training system we recommend either the mechatronic AC conveyor belt or the FC Motor Panel with following technical data:

- 3phase AC Motor, rated power: 0,12kW.
- Nominal rotation speed: 1500U/min.
- Reading for rotation speed and - direction.



Frequency Converter Panel G120 1phase 570.022.520



Frequency Converter with PLC and 3phase AC conveyor belt 551.019.500 and Workpiece Set 551.011.001 (PLC Panel see e.g. page 076/077)

Frequency Converter with 300W Motor 540.030.630

Training System Frequency Converter			
570.022.520	Frequnecy Converter SIMATIC G120 1AC 200V incl.		**Optional 3phase Drive Solutions**
	IOP, Memory Card	540.030.630	3phase AC Motor, 300W
570.023.520	Frequency Converter SIMATIC G120 3AC 400V incl.	551.019.500	3phase AC Conveyor Belt, geared, 65W
	IOP, Memory Card and EMC Filter	551.011.001	Workpiece Set for Conveyor Belt
950.008.732	Set of Cables and Connectors	960.010.021	Mobile Training System Frame 860 x 300 x 360mm
570.028.010	Manual with CD, Frequency Converter G120		
550.990.092	Projecting Software for Electric Drives		
570.021.520	FC Motor Panel		

MECHATRONIC COMPACT WITH S7-1200

The Mechatronic Compact is a compact solution for PLC training in combination with sensors and pneumatics.

The ejecting unit requires pressured air!

Technical Details:

- PLC Panel with Siemens S7
- Conveyor Belt 24VDC small gear (2x inductive sensors, 1x optical sensor)
- Manual speed and direction control
- Test Station (3x inductive sensor, 1x reflective sensor, 1x capacitive sensor)
- Pneumatic Ejecting Unit for Pallet (2x reed switches, 2x magnetic valves)
- Power Supply 24VDC / 4A
- Pressured Air Control with Fine Filter

Learning Content:

- Programming with Simatic S7 (sample programs included!)
- Uploading the program to the PLC
- Tasks of different sensors in an industrial process
- Sensor adjustments
- End position -, position and speed detection
- Ejecting - and stop cylinder
- Pneumatic two-way cylinders

Mechatronic Compact with S7-1200	
950.050.800	Mechatronic Compact with S7 (incl. manual and example programs)
551.990.020	Silent Compressor

MECHATRONIC COMPACT WITH SIEMENS LOGO!

The Mechatronic Compact is a compact solution for small controller training in combination with real sensors and pneumatics.

The ejecting unit requires pressured air!

Technical Details:

- Panel with Siemens Logo!
- Conveyor Belt with 24VDC small gear (2x inductive sensors, 1x optical sensor)
- Manual speed and direction control
- Test Station (3x inductive sensor, 1x reflective sensor, 1x capacitive sensor)
- Pneumatic Ejecting Unit for Pallet (2x reed switches, 2x magnetic valves)
- Power Supply 24VDC / 4A
- Pressured Air Control with Fine Filter

Learning Content:

- Programming with Siemens Logo! (sample programs included!)
- Uploading the program to the Controller
- Tasks of different sensors in an industrial process
- Sensor adjustments
- End position -, position and speed detection
- Ejecting - and stop cylinder
- Pneumatic two-way cylinders

Mechatronic Compact with Siemens Logo!	
950.034.200	Mechatronic Compact with Logo! (incl. manual and example programs)
551.990.020	Silent Compressor

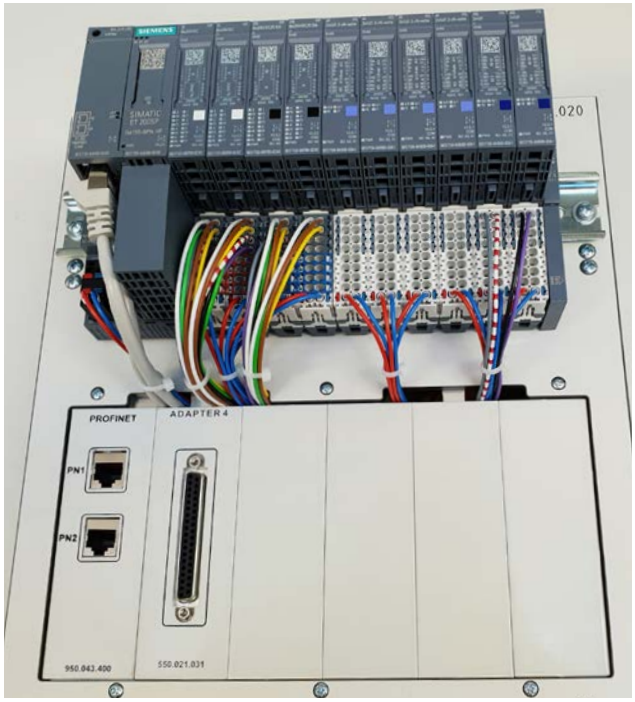
MODULAR **BUS SYSTEM**

The modular Unit Panel offers the possibility to integrate different industrial components into various bus systems, such as:

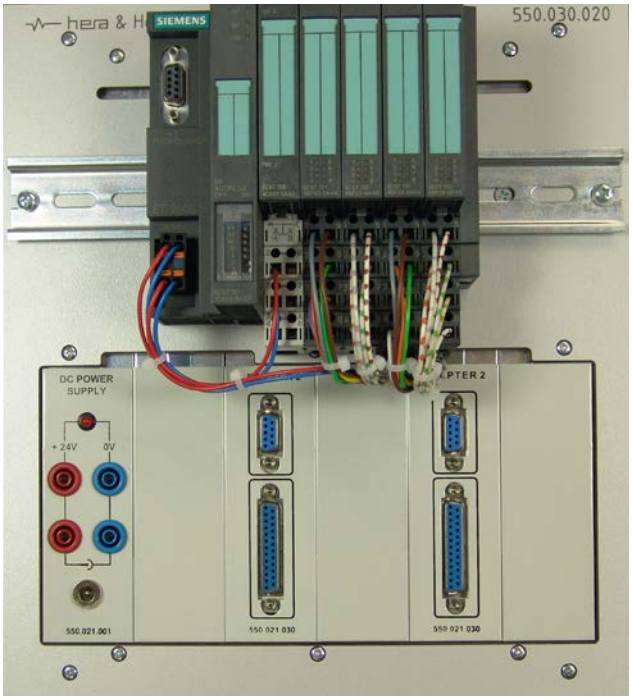
- ProfiBus
- InterBus
- Canopen
- DeviceNet
- Ethernet
- ProfiNet

Furthermore the Unit Panel is applicable for decentral peripheral systems.

Depending on the application the panel can be equipped with an individual choice of industrial automation components and a suitable choice of modules on the following page.



Example to Unit Panel 550.030.020 with ET200S



Example to Unit Panel 550.030.020

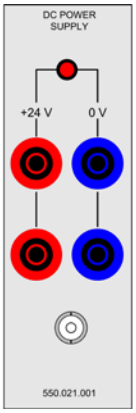
Modular Bus System			
550.020.020	Unit Panel I (inner head rail for 6x modules (W: 266mm)	550.030.020	Unit Panel III (outer head rail for 6x modules (W: 266mm)
550.020.030	Unit Panel II (inner head rail for 12x modules (W: 532mm)	550.030.030	Unit Panel IV (outer head rail for 12x modules (W: 532mm)

MODULES FOR **UNIT PANELS**

The modules are equipped with 4mm safety jacks and fully wired with the PLC components.

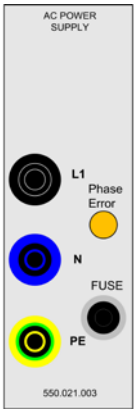
Not required spaces are covered with blank modules.

550.021.000
Blank Module

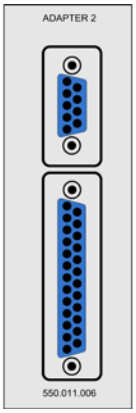


550.021.001
24VDC with
4mm Safety Jack
and Jack Socket

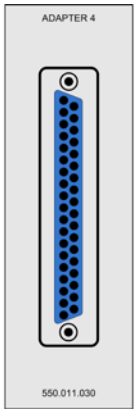
550.021.002
230V Mains
Connector



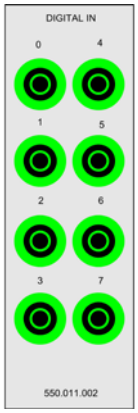
550.021.003
230V 4mm
Safety Jacks



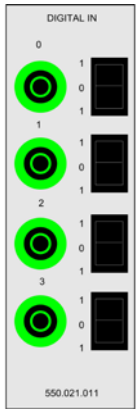
550.021.030
Interface
Sub-D 9poles
Sub-D 25poles



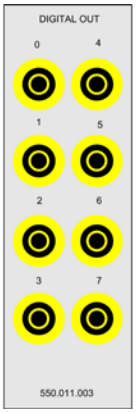
550.021.031
Interface
Sub-D 37poles



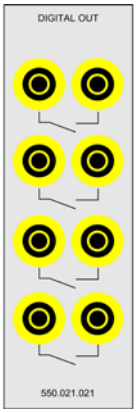
550.021.010
8x Digital Input



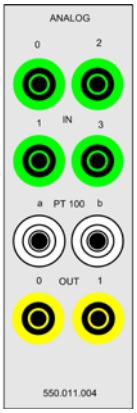
550.021.011
4x Digital Input
with Latching
Pushbuttons



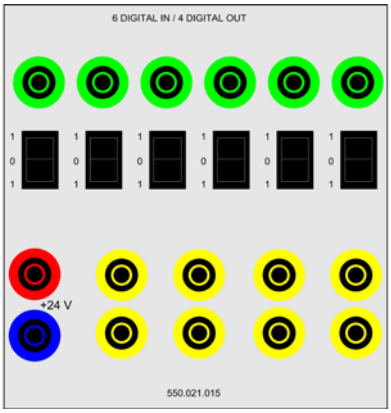
550.021.020
8x Digital
Output



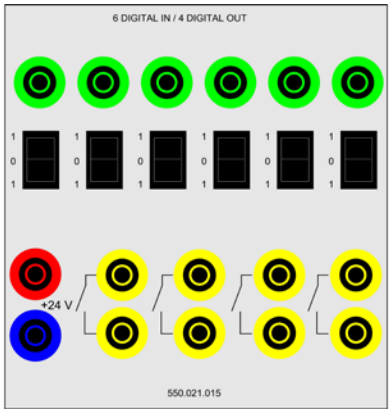
550.021.021
4x Relay Output



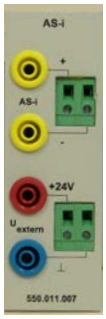
550.021.029
4x Analogue Input
2x Analogue Output
2x PT100 Input



550.021.015
6x Digital Input with
Latching Pushbuttons
4x Digital Outputs



550.021.016
6x Digital Input with Latching
Pushbuttons
4x Relay Output



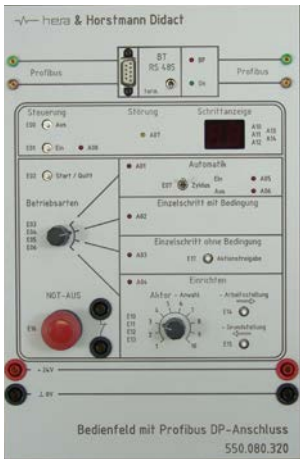
OPTIONS TO PLC PANEL

The Data Word I/O Panel is for manually entering 16 bit data words at the coding switches and receive the output on the 4digit 7-segment display.
The I/O word is available as a seperate panel or directly as module on the PLC Panel.
Connection between Data Word I/O Panel and the PLC Panel is done with 4x flat ribbon cables. The 4-digit coding switch is assigned to an input word and the 4-digit 7-segment display is assigned to an output word (depending on the hardware-sided wiring and the address assignment).
In - and output is coded hexadecimal.

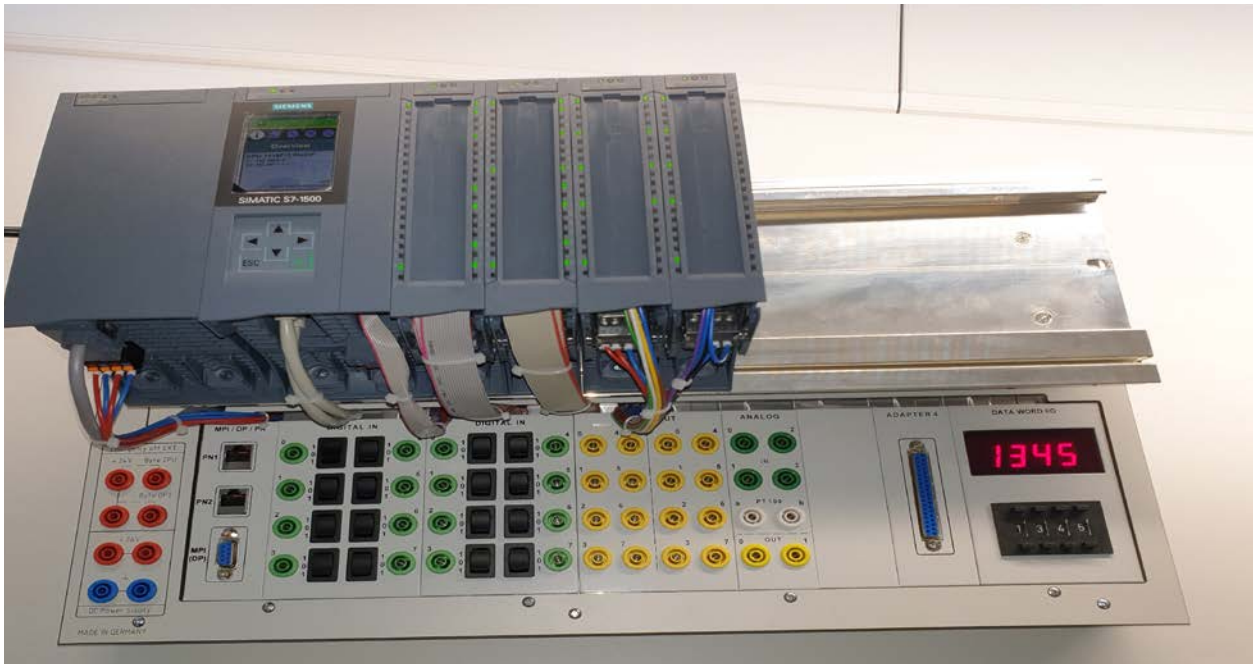
- 4-digit coding switch for input
- 4-digit 7-segment display for output
- Operating Voltage: external $24V_{DC}$

Data Word I/O Panel
550.100.310
(I/O interface on PLC Panel is required)

The Operator Panel with Profibus DP adapter is for the operation of the PLC via Profibus DP.
The panel holds selector switches and pushbuttons, which are required for an operator to interrupt the PLC programs. The signal and message elements for the operator's information are also included.
A 2digit display indicates each actual step of the sequence cascade. Four different operating modes can be selected: automatic, single step with condition, single step without condition and set-up mode.
In- and outputs of the operation panel are connected to the PLC by Profibus DP.
The panel is equipped with Profibus-slave (16x DI /16x DO).



Operating Panel with Profibus DP Adapter 550.080.320



PLC Panel with S7-1500 and Data Word I/O

Options to PLC Panel			
550.100.310	Data Word I/O Panel	550.102.000	Set of Flat Ribbon Cables to connect the Word I/O Panel to the PLC Panel
550.080.320	Operating Panel with Profibus DP Adapter		
550.011.014	Module I/O Adapter for PLC Panel to connect the Word I/O Panel with the PLC Panel	950.017.100	Data Word I/O for PLC Panel

AS-INTERFACE BUS

For trainings with AS-Interface Bus we have a selection of industrial components which can be used in combination with the PLC panel. In this case the panel must be equipped with AS-i communicator and AS-i power supply as well as a module in the panel for AS-interface.

Learing content is the connection and commissioning of AS-interface components.

AS-i Lamp Panel 550.090.310

AS-i Triple Pushbutton 550.090.330

Panels with Industrial Components for AS-Interface			
550.900.001	AS-i Compact Module (8x M12 Jacks with 4 DI + 4 DO)	550.990.074	AS-i 3-fold Indicator Lamp
		550.990.075	AS-i Contact Module with Sensor
059.945.401	SIMATIC S7-1200 Communication Processor for AS-i	590.600.001	AS-i, Addressing - & Diagnostic Device
550.990.072	AS-i Power Supply 3A (integrated in PLC Panel)	590.600.002	Cable to the Addressing Device zum Adres
550.011.007	AS-i Adapter Module for PLC Panel	590.600.003	Adapter AS-i Cable to M12 Sockets
505.900.501	AS-i Cable, yellow	550.908.001	Manual with CD
505.900.502	AS-i Cable, black		
550.090.310	AS-i Lamp Panel		
550.090.330	AS-i Tripple Pushbutton		

RENEWABLE ENERGIES - ECOLOGICAL AND SUSTAINABLE

Renewable energies can be generated in different ways and mainly depend on the environmental conditions. On following pages you will find different solutions for solar energies as well as a windpower trainer. Students will benefit from the practical tests and easily understand the principles of different renewable energy sources and how those can be utilized. Starting the training today will help our globe tomorrow!

WIND POWER

The Wind Power Panel is a simulator with realistic parameter of a real wind power plant. It imparts a great understanding on the components, its functionality and the effects of wind speed and wind direction on the power generation and system behavior.

Students will learn how the system acts in case of emergency stop, in service mode or in case of power failure. Those incidents can be simulated with switches.
The 7-segment display indicates wind speed, rotation speed per minute and the system's power consumption.

Automatic Mode

Set value simulation via potentiometer and connectors for external sensors.

Setting of Wind Direction:

- Potentiometer for Gray Code Generator
- Connector for External Gray Code (4bit or 8bit)
- 4-20mA and 0-10V

Setting of Wind Speed:

- 0-10V, 4-20mA, PWM Signal

Setting of Brightness:

- Internal LDR

After having done all settings, the wind power trainer is operating autarkic and simulates a real wind power plant.

- Pitch angle adjustment of rotor blades corresponding to the wind speed (between 0° and 90°).
- Azimuth adjustment with respect to the wind direction.
- Rotor speed corresponding to the wind speed.
- Automatic change between daytime - and nighttime navigation light.
- Drive train brake for emergency off mode.

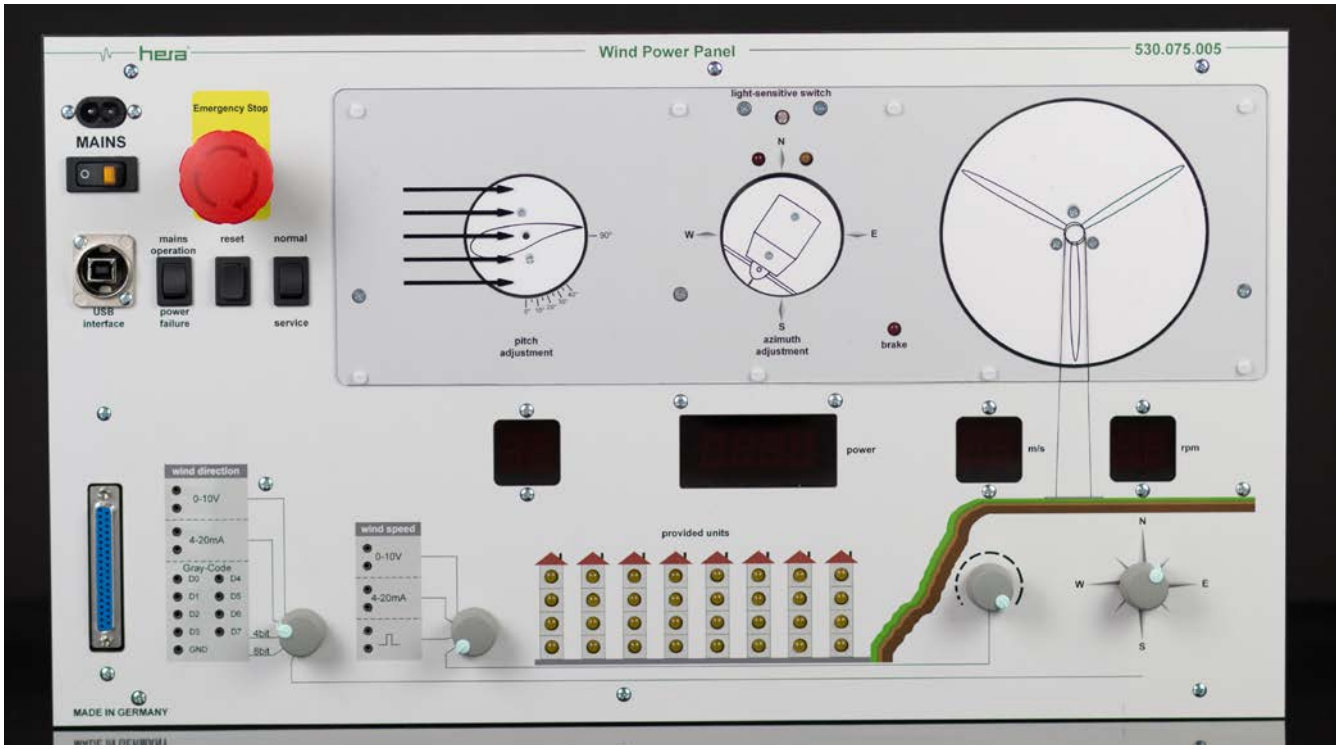
Manual Mode:

The manual mode stops all automatic controlled functions and the full system can be controlled and read out by connecting a PLC at the Sub-D connector.

- Rotor rotation speed by PWM signal.
- Pitch adjustment by PWM signal.
- Azimuth adjustment by +24V left or right signal.
- LED brake
- LED daytime navigation light
- LED nighttime navigation light

Sensors:

- Wind Direction (Gray Code)
- Azimuth Position (Gray Code)
- Service Switch (24V)
- Enabling Switch (24V)
- Emergency Off Button (24V)
- Power Failure Switch (24V)
- Actual Value Rotor Speed (Pulses per Minute)
- Brightness Sensor (0-10V)
- Wind Speed Sensor (0-10V)



Wind Power System	
530.075.000	Wind Power Panel
530.118.001	Manual with CD, Wind Power Panel

PV TRAINING SET 200W FOR ON- / OFF-GRID TECHNOLOGY

The system is designed for a comprehensive understanding of solar power generation, it teaches all about the characteristics of solar modules incl. maximum power point and how shading, sun angle, module angle, light intensity and module temperature influence the efficiency. The tests offer measurements in the DC and AC circuit under different ambient conditions.

Measuring results can be captured, evaluated and graphically presented by computer due to the 2-channel multimeter with interface and included software package.

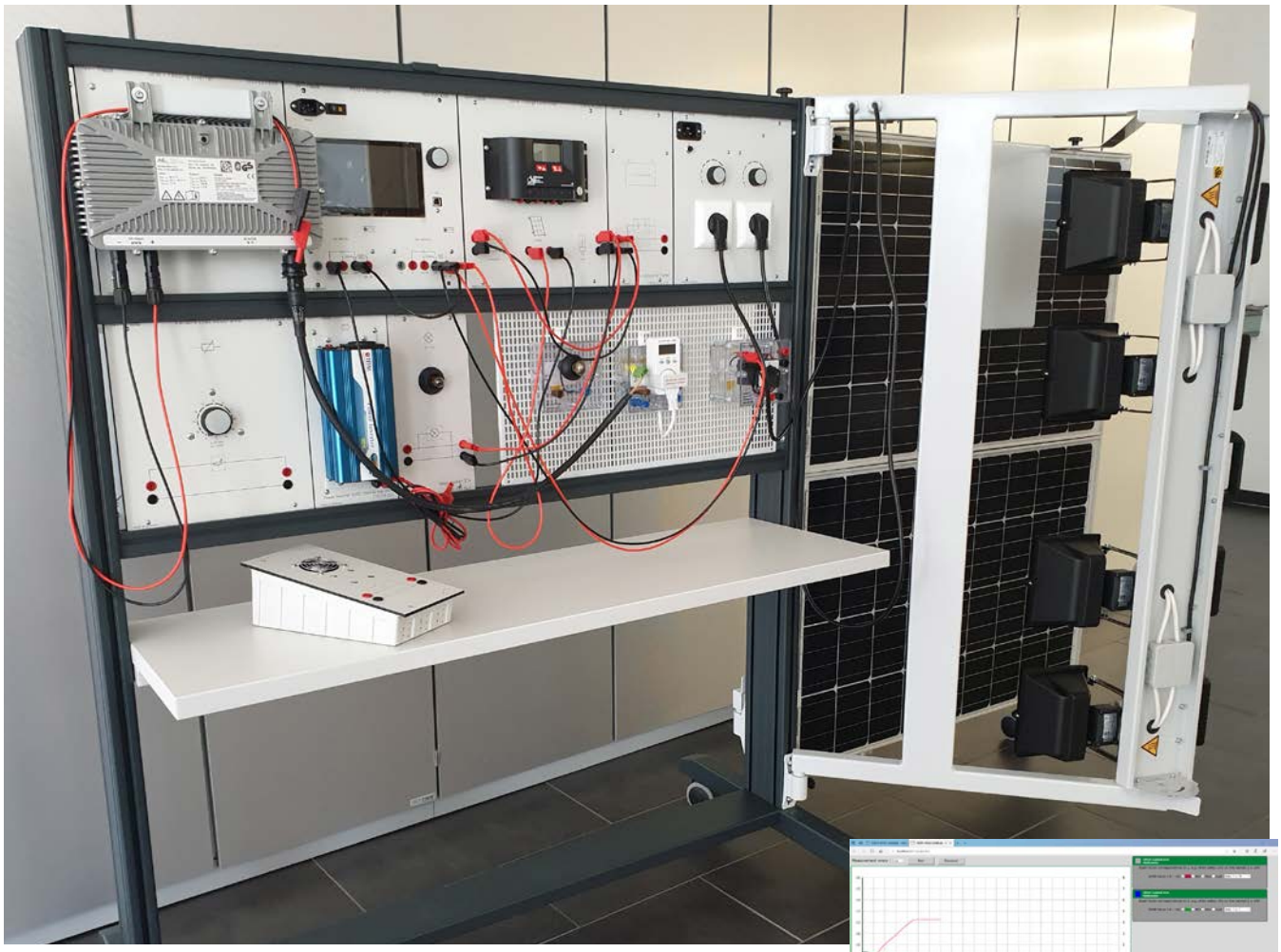
Power Consumption (full illumination): 3.200W.

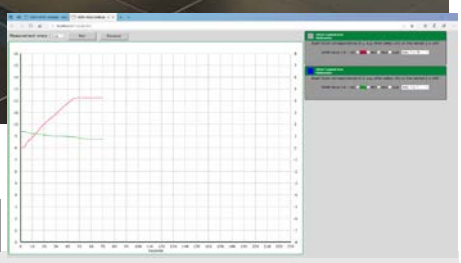
Consisting of:

- Mobile base with training system frame and shelf
- Adjustable lighting unit with 8x 400W dimmable halogen lamps
- 2x monocrystalline modules 100Wp (18,5Vmpp) with selector switch for series and parallel operation
- Grid-feeding inverter and 230V converter (300W)
- 2-CH multimeter with touch display and USB interface
- Lux meter and energy meter
- 230V lamp, 12VDC Lamp
- Variable Resistors
- Software for evaluation and graphical display
- Manual and set of cables

Learning Content:

- Maximum power point **(MPP)** , maximum power point tracking **(MPPT)** incl. data capturing and graphical presentation
- Fill level of solar cells
- String connection, parallel and series
- Effects of temperature change in solar cells
- Effects of shading, change of incidence angle and light intensity
- Configuration and measurements in grid-feeding circuits
- Configuration and measurements in grid-independent circuits
- Ratio of DC and AC circuit





Complete Training Set for Solar Module Characteristics and On- / Off-Grid Technnology

530.801.000	PV Training Set 200W incl. Software and Manual 770.318.021 (50Hz and 60Hz Version available - please state)

incl. Software IMODdesktop

BASIC FURNITURE FOR PV TRAININGS

PROFI Photovoltaics Bench consisting of:

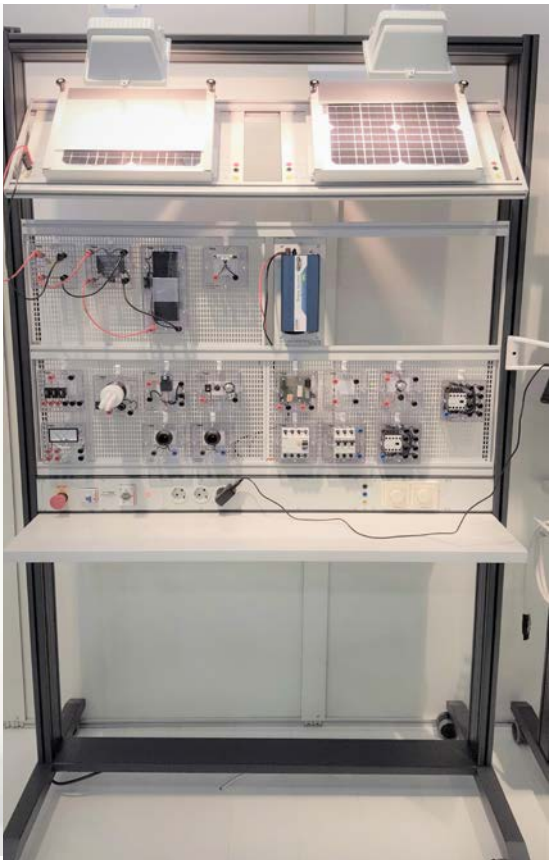
- PROFI Bench for 2 students with 2x dimmable 400W halogen lamps
- Tiltable frame for accptance of the solar modules
- 1 level training system frame for PV panels
- Energy channel with mains panel, 2x dimmer for halogen lamps, solar motor and variable load and 4x 230V sockets

PROFI Photovoltaics Mobile consisting of:

- PROFI Mobile with 4 casters, 2x with brakes
- 2x dimmable halogen lamps
- Tiltable frame for the acceptance of the solar modules
- 2 level training system frame with 3x perforated panels for acceptance of PV boxes
- Energy channel with mains panel, 2x dimmer for halogen lamps, 3x 4mm jacks 230V and 3x sockets

The training systems can be chosen on following pages!

PROFI Photovoltaics Bench (Training Systems not included)



Mobile Photovoltaics Stand (Training Systems not included)

Tiltable Frame for Solar Modules with Scale

Adjustable Halogen Lamps with Scale

Basic Furniture for PV Training (for 2x 10Wp Modules)	
458.100.000	PROFI Photovoltaics Bench 1800 x 800 x 1980mm
458.100.010	Mobile Photovoltaics Stand 1305 x 700 x 2130mm

PV COMPONENT PANELS

The component panels are ideal to enhance existing systems or to configure individual set-ups.
All components are mounted on the standard A4 panels and can be used in the training system frame of the PROFI Photovoltaics Bench or the Mobile Photovoltaics Stand.

530.070.230 Solar Module

950.003.900 Solar Module with Adjustable Shading

530.070.100 PV Modules with Bypass Diodes

530.070.220 Solar Charge Controller

530.070.210 Accumulator

530.070.240 Lamp (5W)

530.070.250 Variable Load

530.070.260 Solar Motor

530.070.400 Multimeter

Component Panels for Photovoltaics			
530.070.230	DP Solar Module 12V / 10Wp	530.070.240	DP Lamp (5W)
950.003.900	DP Solar Module 12V / 10Wp with Shading 0-100%	530.070.250	DP Adjustable Load (47Ω / 4W + 2,2kΩ / 4W)
530.070.100	DP Series - Parallel / Shading and Bypass Diodes	530.070.260	DP Solar Motor
530.070.220	DP Charge Controller	530.070.400	DP Digital Multimeter MetraHit 2+
530.070.210	DP Lead Gel Accumulator (7,2Ah)	770.318.011	Manual with CD, Photovoltaics II

PHOTOVOLTAICS - **OFF-GRID TECHNOLOGY**

The Photovoltaics Kit „Isolated Technology“ is a set of diactic boxes and the 230V converter panel for a comprehesive understanding of the photovoltaics off-grid circuits according to our manual 770.318.011.

For flexible configurations or system enhancements please see below the suitable articles.
For a ready-to-use training system please see below configuration example.

Configuration Example Off-Grid Technology

Learning Content:

- Basics to photovoltaics, getting familiar with the basic terms and basic components
- Open circuit voltage and short circuit current with varying illumination
- Alternating angle of illumination
- Influence of module temperature
- Maximum power point
- Shading / partial shading
- Charging an accumulator

Configuration Example:

1x 458.100.010	Mobile Photovoltaics Stand (see page 093)
2x 770.310.020	Solar Modules
1x 770.310.000	Photovoltaics Kit „Isolated Technology“
1x 770.310.005	Set of Cables to „Isolated Technology“
1x 770.318.011	Manual with CD, Photovoltaics II

Photovoltaic Kit „Isolated Technology“

770.310.000	Photovoltaics Kit „Isolated Technology“	770.310.005	Set of Cables to „Isolated Technology“
770.318.011	Manual with CD, Phototvoltaics II		

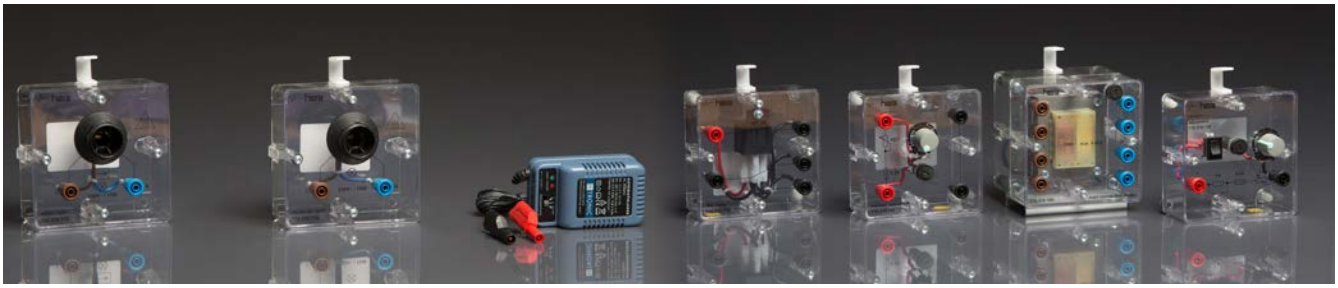
Didactic Panels (DP) and Didactic Boxes (DB) to Off-Grid Technology

770.310.010	DP Solar Module 12V, 10W tiltable	770.310.170	DB Load 12V with Standard Vehicle Socket (10A)
770.310.020	DP Dimmable Halogen Lamp, 230V, 400W		and Lamp Socket E27
770.310.030	DB Generator Connector & Voltmeter 15 / 150V	770.310.180	DB Circuit Breaker B6A, 3poles
770.310.040	DB Overvoltage Protection 12V	770.310.190	DB Relay 230V, 3x NOC 1x NCC, 10A
770.310.050	DB Discharge Protection (Schottky-Diode)	770.310.200	DB Mains Monitoring Relay 230 / 400V
770.310.060	DB Charge Controller 12V, 4A	770.310.210	DB Residual Current Device 4poles., 30mA
770.310.070	DB Deep Discharge Protection 12V, 15A	770.310.220	DB Fuse Box
770.310.080	DB Safety Light 12V, 5W Contin. Mode (Festoon)	770.310.230	Multimeter
770.310.090	DB Lead-Gel-Accumulator	770.310.240	Digital Lux Meter, 4½ -digits
770.310.100	Charging Unit for Lead-Gel-Accumulator	770.310.250	DP Power Inverter 300W 12VDC/230VAC
770.310.110	DB Safety Light, Stand-By Mode	770.310.270	Light Bulbs
770.310.120	DB Lamp 230V		1x Incandescent 12V, 5W E14 and 230V, 15W E14
770.310.130	DB Relay 12V, 30A		1x Energy Saving Lamp 12V, 11W E27
770.310.140	DB Resistor 10Ω, adjustable	770.310.290	Set of Spares
770.310.150	DB Resistor 2kΩ, adjustable		PV Box with Fuses, Tool for Blade-Type Fuses,
770.310.160	DB Mains Adapter with Cable		Festoon Light

PHOTOVOLTAICS KIT „ISOLATED TECHNOLOGY“ CONSISTING OF:

770.310.250

770.310.030 770.310.040 770.310.050 770.310.060 770.310.070 770.310.080 770.310.090



770.310.110 770.310.120 770.310.100 770.310.130 770.310.140 770.310.160 770.310.150

770.310.170 770.310.180 770.310.190 770.310.200 770.310.210 770.310.220 770.310.230 770.310.240


jack & jones®
TECH

COMPONENTS FOR **„GRID-CONNECTED TECHNOLOGY“**

Decentral power generation with renewables is worldwide gaining importance. The PV system can be connected to your public grid and either all generated energy or not required energy can be fed into your local networks.

Note: Grid-feeding is not allowed in all countries, so before using this technology, please check with you local electricity provider!

770.311.050

770.311.040

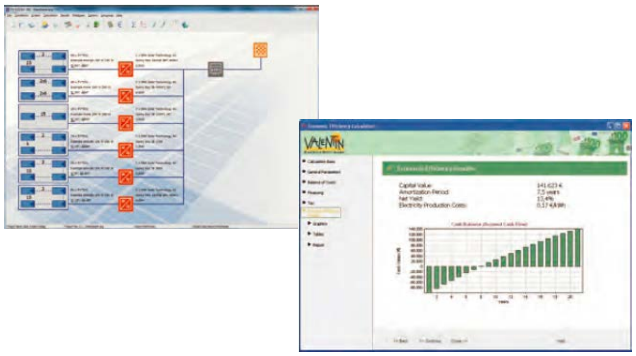
770.311.021

770.311.010

Components for „Grid-Connected Technology“			
770.311.050	DB DC Isolator	770.311.040	DB Energy Meter 230V
770.311.010	DP Solar Module 4x 10Wp, foldable with 4x 400W Halogen Lamps for Sun Simulation	770.311.021	DP Grid-Feeding Inverter 350W / 50Hz with Monitoring Unit
770.318.010	Manual with CD, Photovoltaics I On- and Off-Grid Technology	950.053.500	DP Grid-Feeding Inverter 350W / 60Hz with Monitoring Unit

PHOTOVOLTAICS **SOFTWARE**

PV*SOL® is a self-sufficient simulation software, which is also used from professionals for a realistic dimensioning and calculations of yield for grid-feeding and grid-autark photovoltaic systems.
The software includes a comprehensive range of solar modules and inverters for simulations and an automatic update function.
Realistic parameter offer a most suitable platform for system dimensioning and efficiency calculations.



Photovoltaics Software	
530.970.010	PV*SOL® Software / Single License
530.970.020	PV*SOL® Software / 10 Licenses

PHOTOVOLTAICS **MOBILE**

The Photovoltaics Mobile is an ideal base for photovoltaics training either grid-feeding, off-grid or a combination of both.

For a flexible acceptance of either PV panels or PV boxes, the Photovoltaics Mobile is equipped with 2x installation panels for boxes and one 1-level training system frame.

The PV Mobile consists of:

- Base Unit 970x700x1730mm (WxDxH) with Casters
- Lockable Container with 1x Door and 2x Drawer
- Training System Frame (1 level for Panels, 2 levels for boxes)
- Foldable Unit with 4 Solar Modules, 10Wp each, usable in parallel or series connection
- 4x 400W Halogen Lamps. dimmable

Configuration Example for Grid-Feeding and Off-Grid Technology

For a ready-to-use training system please see below configuration example.

Configuration Example:

950.040.000	PV Mobile
770.318.010	Manual Photovoltaics I
770.213.500	Set of Cables
770.310.230	Multimeter
770.310.240	Lux Meter
	Grid-Feeding Technology
770.311.021	Feeding Inverter 350W /50Hz
770.311.050	DC Isolator
770.311.040	Energy Meter
	Off-Grid Technology
770.310.250	Power Inverter 12VDC/230VAC
770.310.040	Overvoltage Protection
770.310.090	Lead-Gel Accumulator
770.310.100	Charger for Accumulator
770.310.140	Resistor, adjustable
770.310.170	Load 12VDC Vehicle Socket and Lamp
770.310.120	Lamp 230V

Photovoltaics Mobile

950.040.000	Photovoltaics Mobile	770.310.005	Set of Cables
770.318.010	Manual with CD, Photovoltaics I		
770.311.021	Grid-Feeding Inverter 50Hz		
950.053.500	Grid-Feeding Inverter 60Hz		

MODEL **THERMAL SOLAR RE BASIC** - FLAT COLLECTOR

The model enables the trainee to comprehend the functionality of a thermal solar system with pump cycle. The flat collector works either directly with sun light or with an artificial lighting unit. Due to its compact and clearly arranged configuration the model can be used either for theoretical or practical lessons.

Integrated, directly measuring instruments for temperature, flow rate and pressure allow the determination of specific characteristic values with high repeatability.

The compact dimensions and the mobile base allow to use this model fully flexible.

Learning Contents:

- General information to thermal solar systems.
- Getting familiar with the specific components.
- Name and describe the set-up and the function of the system and its components.
- Determination and evaluation of system specific parameters.
- Determination of optimized system variables.
- Functionality of safety and control equipments.
- Commissioning and hand-over to customers.

Technical Data:

- Dimensions: approx. 700x710x2100/1670mm (WxDxH)
- Weight: approx. 50kg
- Electrical data: Schuko 230V_{AC} (max. 100W)
- Cold water / waste water (fill / rinse)
- Collector Yield (ITW) : approx. 521kWh/m²a

Light Unit:

- Dimensions: approx. 540x710x1530/2000mm (WxDxH)
- Weight: approx. 20kg
- Electrical data: Schuko 230V_{AC} (max. 2000W)

incl. manual and CD

Model Thermal Solar - Flat Collector			
770.108.000	Thermal Solar RE Basic - Flat Collector	770.108.001	Set of Connectors
770.304.000	Light Unit RE-Indoor (4x 400W)	778.001.010	Dust Cover for Basic Models

MODEL **THERMAL SOLAR RE BASIC** - VACUUM TUBE COLLECTOR

The model enables the trainee to comprehend the functionality of a thermal solar system with pump cycle. The flat vacuum tube collector works either directly with sun light or with an artificial lighting unit. Due to its compact and clearly arranged configuration the model can be used either for theoretical or practical lessons.

Integrated, directly measuring instruments for temperature, flow rate and pressure allow the determination of specific characteristic values with high repeatability.

The compact dimensions and the mobile base allow to use this model fully flexible.

Learning Contents:

- General information to thermal solar systems.
- Getting familiar with the specific components.
- Name and describe the set-up and the function of the system and its components.
- Determination and evaluation of system specific parameters.
- Determination of optimized system variables.
- Functionality of safety and control equipments.
- Commissioning and hand-over to customers.

Technical Data:

- Dimensions: approx. 700x710x2100/1670mm (WxDxH)
- Weight: approx. 50kg
- Electrical data: Schuko 230V_{AC} (max. 100W)
- Cold water / waste water (fill / rinse)
- Collector Yield (ITW) : approx. 630kWh/m²a

Light Unit:

- Dimensions: approx. 540x710x1530/2000mm (WxDxH)
- Weight: approx. 20kg
- Electrical data: Schuko 230V_{AC} (max. 2000W)

incl. manual and CD

Model Thermal Solar - Vacuum Tube Collector			
770.108.200	Thermal Solar RE Basic - Vacuum Tube Collector	770.108.001	Set of Connectors
770.304.000	Light Unit RE-Indoor (4x 400W)	778.001.010	Dust Cover for Basic Model

MODEL **HEATPUMP RE BASIC** - WATER / WATER

The model enables the trainee to comprehend the function of a water / water heat pump.
After filling the thank with water the system is ready for operation.
Due to its compact and clearly arranged configuration the model can be used either for theoretical or practical lessons.
Integrated, directly measuring instruments for temperature and pressure allow the determination of specific characteristic values with high repeatability.

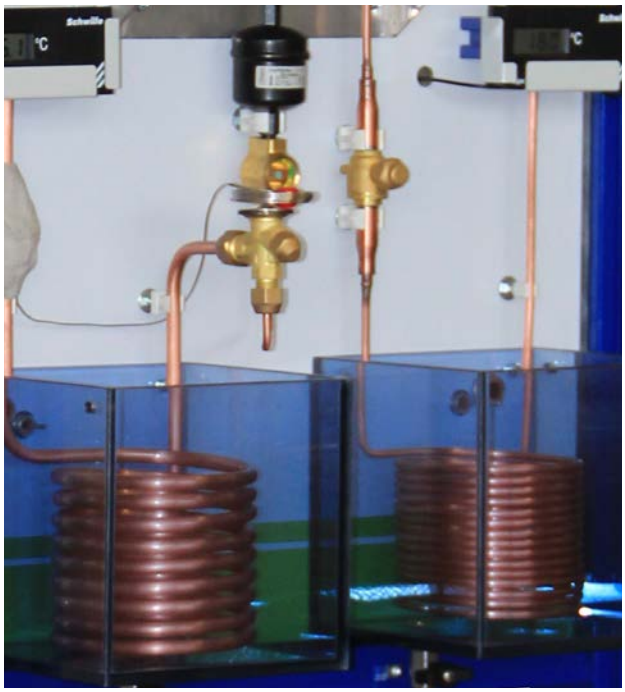
The compact dimensions and the mobile base allow to use this model fully flexible.

Learning Content:

- General information to heat pumps
- Getting familiar with the specific components.
- Name and describe the set-up and the function of the system and its components.
- Determination and evaluation of system specific parameters.
- Determination of optimized system variables.
- Functionality of safety and control equipments.
- Commissioning and hand-over to customers.

Technical Data:

- Dimensions: approx. 700x710x1750mm (WxDxH)
- Weight: approx. 50kg
- Electrical data: Schuko 230V_{AC} (approx. 100W)
- Water / waste water: approx. 2x 3l (measuring cup)
- Refrigerant : R134a



incl. manual and CD

Model Heat Pump Water / Water			
740.107.000	Model Heat Pump RE Basic Water / Water	740.107.001	Set of Connectors
		778.001.010	Dust Cover for Basic Models

MODEL **HEAT PUMP RE BASIC** - AIR / WATER

The model enables the trainee to comprehend the function of an air / water heat pump.
After filling the thank with water the system is ready for operation.
Due to its compact and clearly arranged configuration the model can be used either for theoretical or practical lessons.
Integrated, directly measuring instruments for temperature and pressure allow the determination of specific characteristic values with high repeatability.

The compact dimensions and the mobile base allow to use this model fully flexible.

Learning Content:

- General information to heat pumps
- Getting familiar with the specific components.
- Name and describe the set-up and the function of the system and its components.
- Determination and evaluation of system specific parameters.
- Determination of optimized system variables.
- Functionality of safety and control equipments.
- Commissioning and hand-over to customers.

Technical Data:

- Dimensions: approx. 700x710x1750mm (WxDxH)
- Weight: approx. 50kg
- Electrical data: Schuko 230V_{AC} (approx. 100W)
- Water / waste water: approx. 3l (measuring cup)
- Refrigerant : R134a

incl. manual and CD

Model Heat Pump Air / Water			
740.108.000	Heat Pump RE Basic Air / Water	770.108.001	Set of Connectors
		778.001.010	Dust Cover for Basic Models

MODEL **HEAT PUMP VARIO**

The model Heat Pump Vario explains in a comprehensive way the 4 different heat pump systems.
A selector switch allows to change between air / air -, air / water - , water / air - and water / water heat pump.
Due to its compact and clearly arranged configuration the model can be used either for theoretical or practical lessons.

Integrated, directly measuring instruments for temperature, flow rate and pressure allow the determination of specific characteristic values with high repeatability.

For visualization of the refrigerant‘s aggregate state pressure resistant glass windows are integrated at the relevant positions.

Learning Content:

- General informations to heat pumps
- Getting familiar with the specific components.
- Name and describe the set-up and the function of the system and its components.
- Aggregate states of the refrigerant
- Determination and evaluation of system relevant variables.
- Comparing the data of air / air -, air / water -, water /air - and water / water systems
- Determination of the application limits and the resulting fields of application.
- Fuction and testing of safety - and control installations.
- Determination of possible sources of failure in heat pumps and the consequences on functionality.
- Preparing argumentation aids for meetings with customers.
- Preparing a check list for periodic services on heat pumps.

Technical Data:

- Dimensions: approx. 1200x600x1600mm (WxDxH)
- Weight: approx. 90kg
- Electrical connection: Schuko 230V_{AC}
- Kaltwasseranschluss SK - ¾“
- Waste water connection: SK- ¾“

Model Heat Pump VARIO	
740.106.000	Model Heat Pump VARIO
740.106.001	Set of Connectors

MODEL **DOMESTIC VENTILATION RE BASIC**

The model enables the trainee to comprehend the functionality of a domestic ventilation system basing on cross-flow ventilation. The system housing is partly cut open and glass-covered to allow the view inside for a better underestanding of the components. Due to its compact and clearly arranged configuration the model can be used either for theoretical or practical lessons.

Optional available digital thermometers allow to measure system specific characteristic values with high repeatability.

The compact dimensions and the mobile base allow to use this model fully flexible.

Learning Contents:

- General information to thermal solar systems.
- Getting familiar with the specific components.
- Name and describe the set-up and the function of the system and its components.
- Determination and evaluation of system specific parameters.
- Determination of optimized system variables.
- Functionality of safety and control equipments.
- Commissioning, hand-over to customers and system maintenance.

Technical Data:

- Dimensions: approx. 700x710x2100/1760mm (WxDxH)
- Weight: approx. 50kg
- Electrical data: Schuko $230V_{AC}$ (max. 60W)
- Air flow rate: approx. 15-105m³/h (4 levels)
- Heat transfer: cross-flow heat exchanger
- Air filter: G4
- Remote controlled.

incl. manual and CD

Model Domestic Ventilation			
742.080.000	Domestic Ventilation RE Basic	748.000.020	Digital Meter for Temperature with 2 Sensors
748.000.030	Digital Impeller Anemometer	778.001.010	Dust Cover for Basic Model

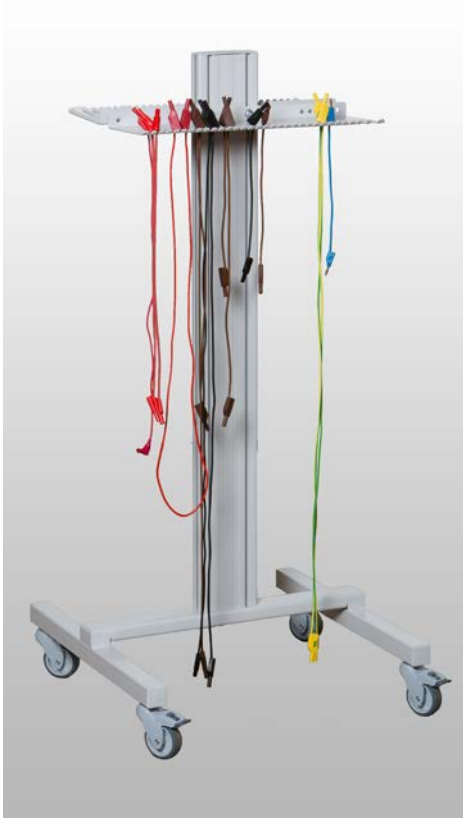
ACCESSORIES FOR **STORING**

For storing and convenient transportation of the standard-sized training systems we recommend the storage cart. Optionally with sheet steel trays in panel size for storing training boxes or other accessory in the cart.

- Body made of melamine resin covered chipboard with slotted mats for.
- 100mm heavy duty casters, 2x with brakes.
- Dimensions: 661 x 625 x 1490mm (WxDxH).

Cables can be conveniently kept on movable cord holders.

- Tubular steel base with aluminim extension and 2x cable combs, each with 29 slots for laboratory cords.
- Mobile base with 4 casters, 2x with brakes.
- Dimensions: 600 x 600 x 1290mm.



940.256.100 Storage Cart

Photovoltaics Mobile	
940.256.100	Storage Cart for Training Systems
940.256.200	Sheet Steel Tray
940.186.200	Cord Holder LC

BENCH SUPPORT FOR TRAINING SYSTEM FRAMES

- Two braces for screw-fixation on a bench.
- Training system frame not included.
- Durable light grey powder coating.
- Depth: 295mm.

Bench Support for Training System Frame	
170.001.901	1 Level H: 360mm
170.002.901	2 Level H: 680mm
170.003.901	3 Level H: 1000mm

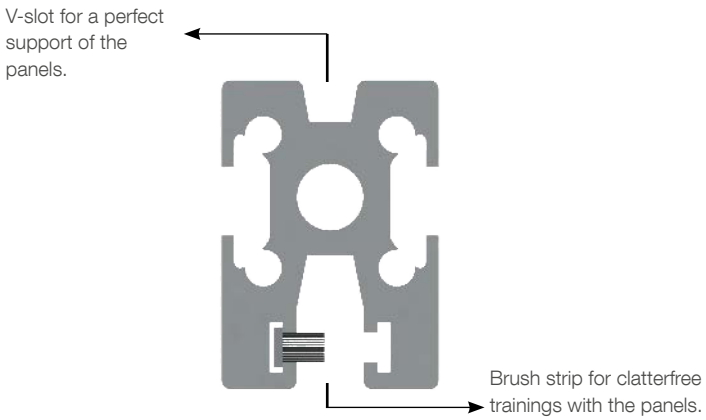
PORTABLE SUPPORT FOR TRAINING SYSTEM FRAME

- Two portable braces, lower side with rubber feet.
- Training system frame not included.
- Durable light grey powder coating.
- Depth: 300mm.

Portable Support for Training System Frame	
171.001.900	1 Level H: 360mm
171.002.900	2 Level H: 680mm
171.003.900	3 Level H: 1000mm

TRAINING SYSTEM FRAME

- H-Profile im DIN A4 distance for holding all universal training systems in standard size. Durable powder coated.
- Lower side is equipped with brush strip for clatterfree workings with the training systems.



Training System Frame	461. BB H .902

BB Width				H Levels / Height	
05	500mm	**13**	1295mm	**1**	360mm
06	603mm	**15**	1500mm	**2**	680mm
08	800mm	**16**	1600mm	**3**	1000mm
09	900mm	**18**	1800mm		
10	1000mm	**20**	2000mm		
12	1200mm	**23**	2303mm		

Didact H-Profile

- clatterfree due to brush strip
- Front - and rear sided with slot for optional acceptance of cable trays or other accessory

PROFI **BENCH**

- Aluminium Bench Legs 125 x 40mm.
- Tubular Steel Frame with extra middle brace.
- Durable powder coated.
- 30mm Bench Top with 0,8mm hardlaminate surface.
- Bench height: 780mm.
- Load capacity: 500kg.
- others in main catalogue!

PROFI Bench	
406.160.901	PROFI Bench 1600 x 800mm
406.180.901	PROFI Bench 1800 x 800mm
407.200.901	PROFI Bench 2000 x 900mm

PROFI PC SUPPORT

- Made of durable powder coated sheet steel.

Portable Support for Training System Frame	
940.616.000	LC Version W: 210mm
491.080.100	Adjustable Width: 160-210mm

PROFI **EXTENSIONS & SHELF**

- H-Profile im DIN A4 distance for holding all universal training systems in standard size. Durable powder coated.
- Lower side is equipped with brush strip for clatterfree workings with the training systems.

PROFI Extension & Shelf	
401.006.902	PROFI Extension 600mm
401.008.902	PROFI Extension 800mm
424.0xx.000	Sheet Steel Support (xx= Bench in cm)
328.xx4.000	Shelf 28mm thick (xx= Bench in cm)

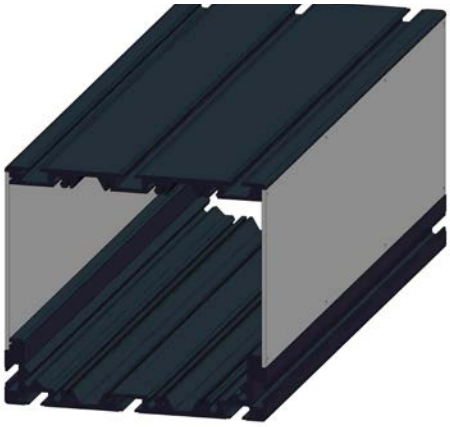
PROFI **TFT SUPPORT**

- Swivel arm, made of anodized aluminium.
- Vesa-adapter with quick release for monitor.
- Load capacity: 15kg.

PROFI TFT Support	
491.057.210	Single Element, 250mm
491.057.400	Double Element, 505mm

MODULAR **ALUBOARD COMPACT**

- Front - and rear side modular equippable.
- Powder coated aluminium profile.
- For bench top fixation or suspended between profiles.
- others types and dimensions in main catalogue!



PROFI Aluboard	
304.xxx.200	Aluboard D: 125 / H: 96mm (width in cm)
306.xxx.320	Aluboard D: 250 / H: 170mm (width in cm)
308.xxx.420	Aluboard D: 350 / H: 281mm (width in cm)

MAINS PANEL

- Automatic Circuit Breaker with undervoltage release.
- RCD 25A, 30mA, type A
- Emergency Stop.
- Voltage control lamps.
- others in main catalogue!

Mains Panel	
332.215.102	Mains Panel 1phase
332.235.102	Mains Panel 3phase

SOCKETS & OUTLETS, 1PHASE

- 1phase sockets of international standards with PE
- Schuko (0), Indian (3), Australian (4), Franco Belgian (5), Italian (6), British (7), NEMA 5-15 (8), NEMA 6-20 (9)
- others in main catalogue!

Sockets and Outlets, 1phase	
333.032.102	AC Sockets 3x 4mm jacks
333.032.202	AC Sockets 3x 4mm jacks, with Switch
333.231.1x2	3x Sockets
333.231.2x2	3x Sockets, with Switch
333.331.1x2	6x Sockets
333.331.1x2	6x Sockets, with Switch

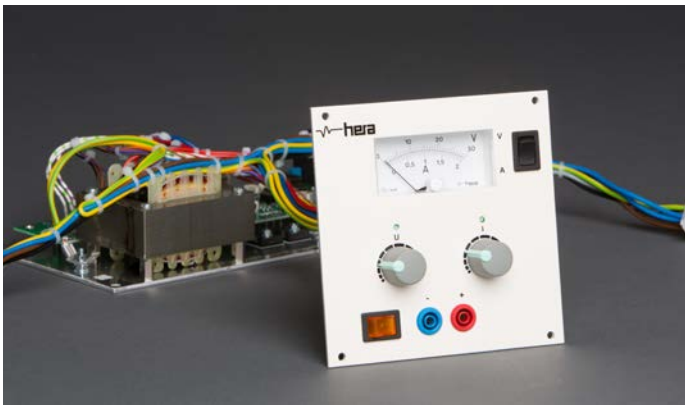
SOCKETS & OUTLETS, 3PHASE

- CEE Sockets, 5poles, 400V.
- Optionally with 5x 4mm jacks (L1, L2, L3, N, PE).
- others in main catalogue!

Sockets and Outlets, 3phase	
333.052.202	5x 4mm jacks, with Switch
333.052.302	5x 4mm jack, with Key-Switch
333.352.202	CEE Socket with Jacks and Switch
333.352.302	CEE Socket with Jacks and Key-Switch
333.302.502	CEE Socket, with Rotary Switch

DC POWER SUPPLY 0...30V, 0...2A

- Linear controlled,short-circuit proofed power supply.
- Ripple: < $1mV_{eff.}$
- Offset: <0,05%.
- Selector switch for voltage / current indication.
- others in main catalogue!



DC Power Supply 0...30V, 0...2A	
334.810.202	analogue
334.810.402	digital

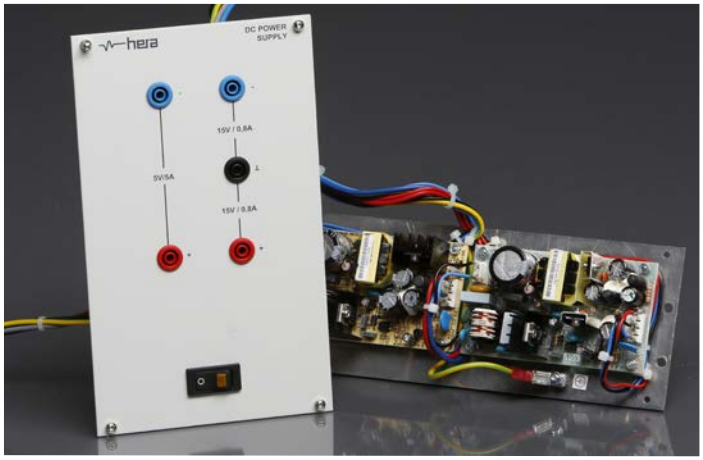
DC POWER SUPPLY 0...42V/ 0...6A

- 1 channel or 2 channels (series or parallel operation).
- Stability at 0...100% load <0,8%.
- Stability at 10% mains alternation: <0,02%.
- Ripple < 5mV rms.
- Overvoltage protection: 0...46,2V.
- Offset: < 0,2%.
- USB interface and software.
- others in main catalogue!

DC Power Supply Extended Range	
334.406.702	1 Channel, 100W, 0...42V/ 0...6A
334.406.802	2 Channel, 2x 100W, 0...42V/ 0...6A

DC VOLTAGE, FIXED

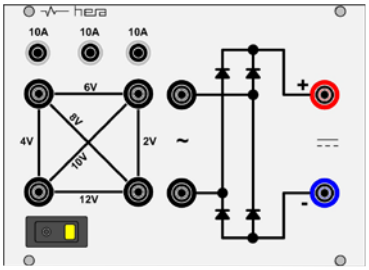
- Stabilized, short circuit proofed power supply with galvanically isolated outputs.
- Overload, overvoltage and overtemperature protected.
- Offset: < 2%.
- Ripple: < $100mV_{p-p.}$
- others in main catalogue!



DC Voltage, fixed	
333.112.062	12V/ 6A
333.124.032	24V/ 3,2A
333.312.012	+-12V/ 1A, +5V/ 5A

AC LOW VOLTAGE, 1PHASE

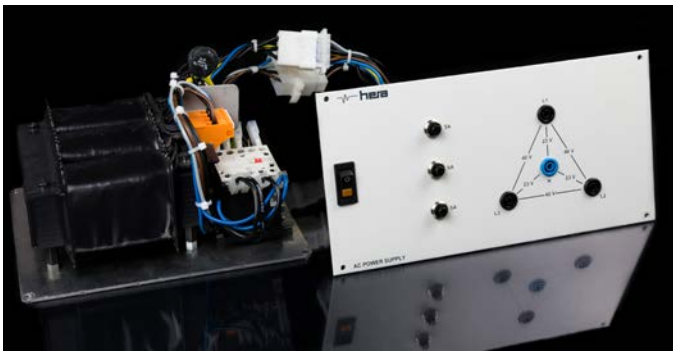
- Experimental transformer with 4 isolatd outputs for 6 output voltages.
- Front-side operated thermomagentic fuses.
- Output with 4mm jacks.
- Bridge rectifier for DC voltage.
- others in main catalogue!



AC Low Voltage, 1phase	
334.221.302	2, 4, 6, 8, 10, 12V/ 10A
334.221.102	6, 12, 18, 24, 36, 42V/ 3A

AC LOW VOLTAGE, 3PHASE

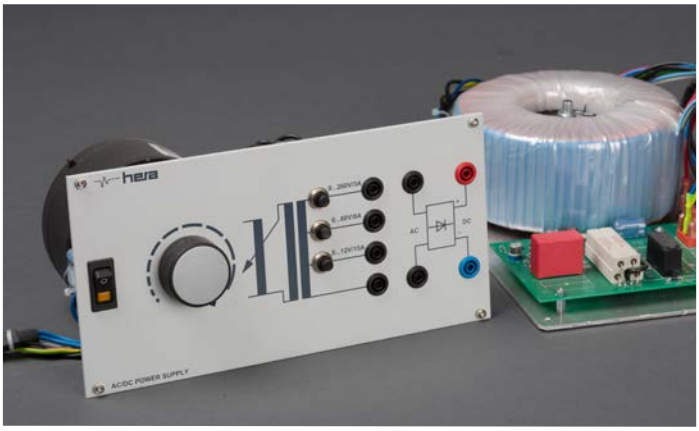
- Automatic Circuit Breaker with undervoltage release.
- RCD 25A, 30mA, type A
- Emergency Stop.
- Voltage control lamps.
- others in main catalogue!



Mains Panel	
332.215.102	Mains Panel 1phase
332.235.102	Mains Panel 3phase

AC SOURCE 0...260V WITH DIVIDER TRAFO AND RECTIFIER

- 0...260V / 3A variac with isolating transforer for 260V/ 3A, 60V/ 6A and 12V/ 15A.
- Front-side operated thermomagentic fuses.
- Output with 4mm jacks.
- Bridge rectifier for DC voltage with 48% ripple.
- others in main catalogue!



334.221.402	AC Source 0...260V

LOAD **RESISTANCE**

- Stepless adjustable potentiometer 50W.
- Thermal overload protection.

Load Resistance	
334.005.102	0...10Ω, 2,2A
334.005.202	0...100Ω 0,7A
334.005.302	0...1kΩ 0,2A
334.005.402	0...10kΩ 0,1A

R- L- C **DECADES**

- R Decade: 8x switches with precision resistors 1Ω...10MΩ. Accuracy: 0,1% +100mΩ. $V_{max.}$= 200V_{AC}, $A_{max.}$ =0,5A.
- C Decade: 5x switches with precision capacitors, 100pF, 1nF, 10nF, 100nF, 1µF. Accuracy: 5% +75pF. $V_{max.}$= 200V_{AC}, $A_{max.}$ =0,5A.
- L Decade: 4x switches with precision coils, 1µF, 10µF, 100µF, 1mH. $V_{max.}$= 100V_{AC}

Decades	
334.441.102	R Decade
334.441.202	C Decade
334.441.302	L Decade

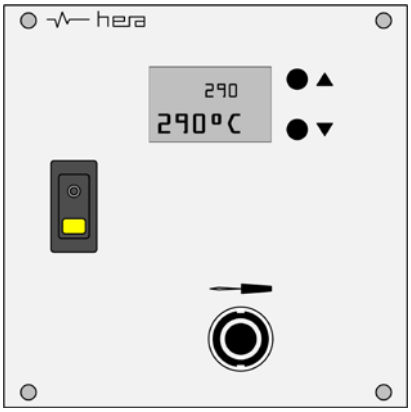
IT SOCKETS & JACKS

- For networks and IT connection.
- others in main catalogue!

IT Socket and Jacks	
333.802.303	RJ45 CAT6, single
333.802.403	RJ45 CAT6, double
333.805.502	USB Hub 3.0 incl. power supply
333.352.302	DVI Socket (Digital Visual)
333.804.502	HDMI (High Definition Multimedi)

SOLDERING STATION

- Microprocessor controlled soldering station. Switch-off and standby function. Selection between 3 temperatures or stepless adjustable between 150...450°C.
- Incl. soldering tool and stand with cleaning wool.
- others in main catalogue!



Soldering Station	**334.154.103**

AC DC SOURCE, 3PHASE

- 3phase variac, non-floating with inrush current limiter.
- Protected by front side operated fuses.
- AC Source with 6-level rectifier for pulsating DC voltage (4,3% ripple).
- AC: 0...400VAC / 7A
- DC: 0...250V / 7A and fixed output 220V / 3A
- others in main catalogue!

AC DC Source	**930.394.700**

STUDENT **CHAIR**

- Ergonomic shaped blow-moulding ploypropylene seat.
- Groved seat and backrest for comfortable air ventilation.
- Stepless adjustable height with gas lift.
- Aluminium 5-beam-base with casters.
- Sitting height: 45 - 53cm.
- Available colors: grey, black, blue, yellow, orange, red and green.
- others in main catalogue!

Student Chair	**182.260.901**

IMOD DEVICES IN **IOT STANDARD**

The intelligent and modular IMOD device series can be easily integrated in existing networks and it fully communicates with the bus-integrated devices, thus it is fully in accordance with latest IoT standards. The system consists of a modular choice of:

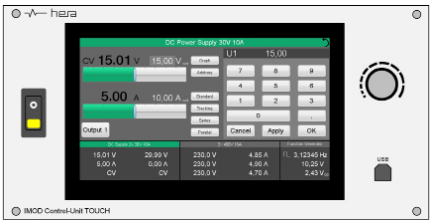
- the Control-Unit as HMI
- selection of Function-Units
- corresponding Connecting-Units with In- and Output Jacks and Sockets

The modular system offers following advantages:

- one Control-Unit TOUCH supports 5 Function-Units, which is very space saving
- the Control-Unit can be located in ergonomic reach and view of the operator, which allows to control and monitor all devices without permanently moving around
- bulky and heavy Function-Units (e.g. variacs) can be placed comfortably under the bench
- Connecting-Units are very small and can even be located in modular equipped ENERGY extensions, which keeps the laboratory cords clearly-arranged at the sides of the table

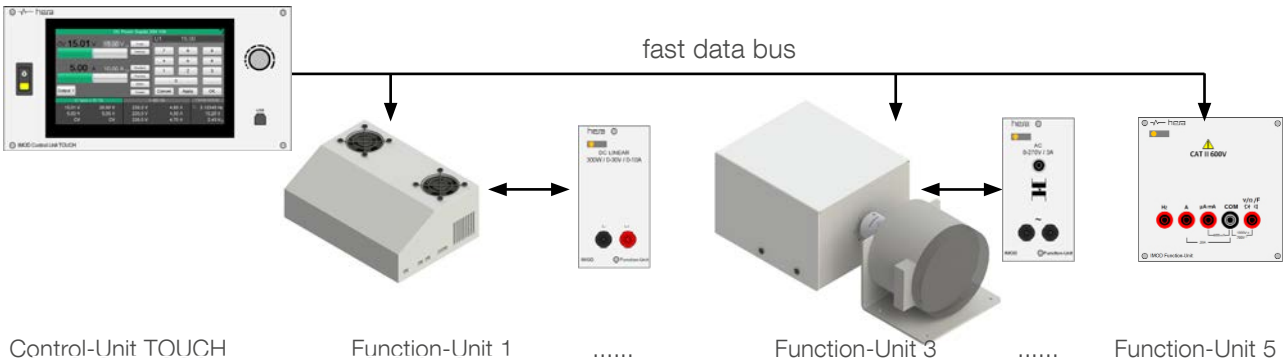
IMOD **CONTROL-UNIT TOUCH 7“**

Main priority when developing the IMOD system was an easy comprehension; for this reason students will use the system intuitively by touch navigation.



- Up to 5 Function-Units can be connected.
- All connected devices can be activated and used at the same time.
- The acutal and nominal values of all 5 devices are always indicated.
- Settings can be done at the touch screen or potentiometer with pushbutton-function.
- Front side with USB interface, rear side with LAN interface.
- Software-Option: All Control-Units can be controlled, monitored, limited, blocked, blinded-out by software-master (e.g. instructor desk).

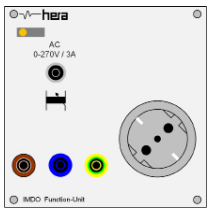
IMOD Control Unit	
630.000.100	IMOD Control Unit TOUCH
299.000.100	IMOD Test - and Measuring Leads



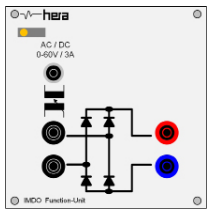
IMOD **AC SOURCE 1PHASE**

The IMOD AC Source corresponds with the Control-Unit by data bus and can be fully operated and monitored by software.

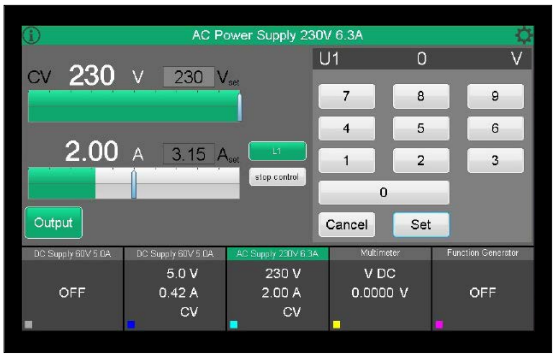
- Thermomagnetic output protection.
- Silent motor-driven variac for fast and precise voltage and current setting.
- 2x TrueRMS converter with 12 bit resolution.
- Set time: max. 8 sec.
- Hysteresis: ± U_{max} / 153.
- Types with bridge rectifier offer a pulsating DC voltage with 48% ripple.
- up to 0...300V / 0...16A in main catalogue!



Socket with Jacks



with Bridge Rectifier for AC / DC Voltage

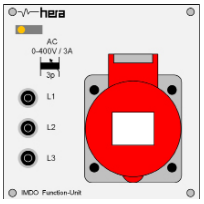


IMOD AC Source 1phase	
632.406.035	0...60V/ 3A jacks, with bridge rectifier
632.323.060	0...230V/ 6A, socket and jacks
632.327.105	0...270V/ 10A floating, with socket and jacks

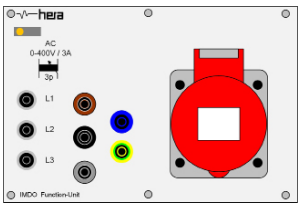
IMOD **AC SOURCE 3PHASE**

The IMOD AC Source corresponds with the Control-Unit by data bus and can be fully operated and monitored by software.

- Thermomagnetic output protections.
- Silent motor-driven variac for fast and precise voltage and current setting.
- 6x TrueRMS converter with 12 bit resolution.
- Set time: max. 8 sec.
- Hysteresis: ± U_{max} / 153.
- Types with bridge rectifier offer a pulsating DC voltage with 48% ripple.
- up to 0...520V / 0...10A or 0...400V/ 0...14A in main catalogue!



CEE Socket

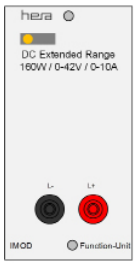


CEE Socket with Jacks

IMOD AC Source 3phase	
633.340.030	0...400V/ 3A with CEE and jacks
633.445.055	0...450V/ 5A jacks, with bridge rectifier
633.340.100	0...400V/10A with CEE and jacks

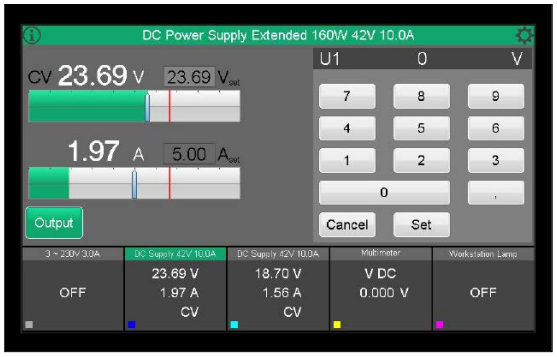
IMOD **LAB POWER SUPPLY** EXTENDED RANGE

The IMOD DC Source corresponds with the Control-Unit by data bus and can be fully operated and monitored by software. If two power supplies of same value are equipped, they can either be used seperately or in parallel or series for double current or double voltage.

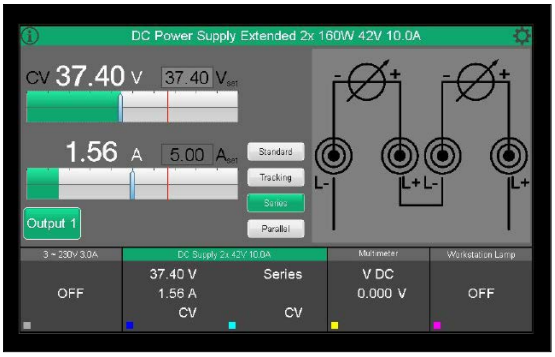


- Devices up to 160W are fanless.
- Stability with 0-100% load: <0,8%.
- Stability at 10% mains alternation: <0,02%.
- Ripple: <5mV$_{RMS}$.
- Set time 10-100% load: <1ms.
- Overvoltage protection: 0…46,2V.
- Accuracy: < 0,2%.
- Nominal values for current and voltage adjust one another so the max. power is not increased.
- other types in main catalogue!

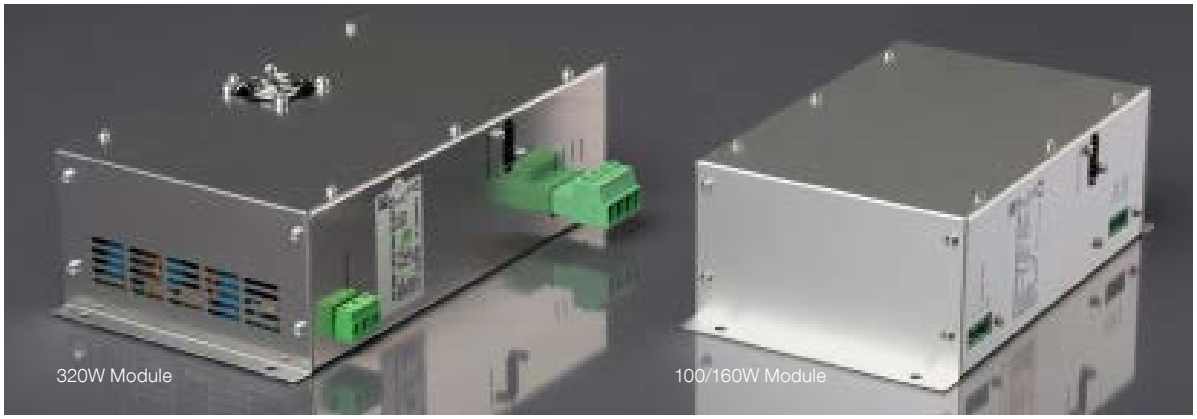
IMOD Lab Power Supply Extended Range	
635.104.060	100W, 0...42V/ 0...6A
635.104.100	160W, 0...42V/ 0...10A
635.108.050	160W, 0...84V/ 0...5A
635.104.200	320W, 0...40V, 0...20A



TOUCH Display Single Power Supply - Keypad or Slider Setting

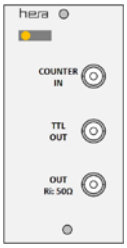


TOUCH Display Double Power Supply - Parallel Operation

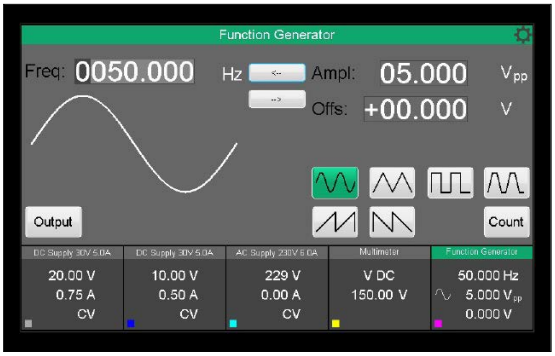


IMOD **FUNCTION GENERATOR**

The IMOD Function Generator corresponds with the Control-Unit by data bus and can be fully operated and monitored by software.



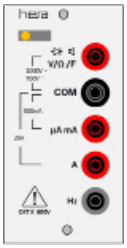
- 3x BNC jacks.
  (COUNTER IN, TTL OUT und OUT Ri: 50Ω)
- Basic functions: sine, triangle, square , saw tooth, pulse, trapezium.
- Frequency range: 50 mHz – 10 MHz (sine), 50 mHz – 1 MHz (other signals).
- Arbitrary with value table (conveniently done with IMODdesktop).
- Other functions: pulse width modulation, TTL output.
- Amplitude: 30V_{SS} (max. 1MHz), max. f 3V_{SS} at 10MHz.
- Resolution: 12 Bit.
- Duty cycle: 0,1 % … 99,9%.
- DC Offset: ± 7,5 V.
- Frequency measurement: max. 50 MHz.



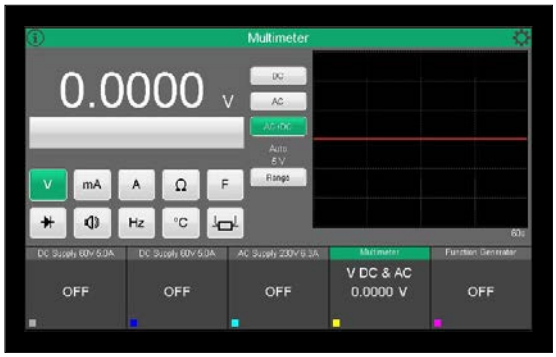
IMOD Function Generator	637.000.000

IMOD **MULTIMETER CAT II 600V**

The IMOD Multimeter corresponds with the Control-Unit by data bus and can be fully operated and monitored by software.



- 5x 4mm safety jacks (Hz, A, µA/ mA, COM, V/ Ω/ F/ diode/ continuity/ temperature.)
- Resolution: 4 3/4 digit (50.000 counts).
- Voltage DC: 10µV – 1000V.
- Voltage AC TrueRMS: 10µV – 700V.
- Curret DC: 10nA – 20A .
- Current AC TrueRMS: 10nA – 20A.
- Current inputs protected by fuse.
- Resistance: max. 50MΩ.
- Frequnecy: 100µHz – 50MHz.
- Capacity: max. 5mF.
- Other functions: diode test, continuity test, temperature measurement and shunt measurement for high currents.
- Manual or autoranging.



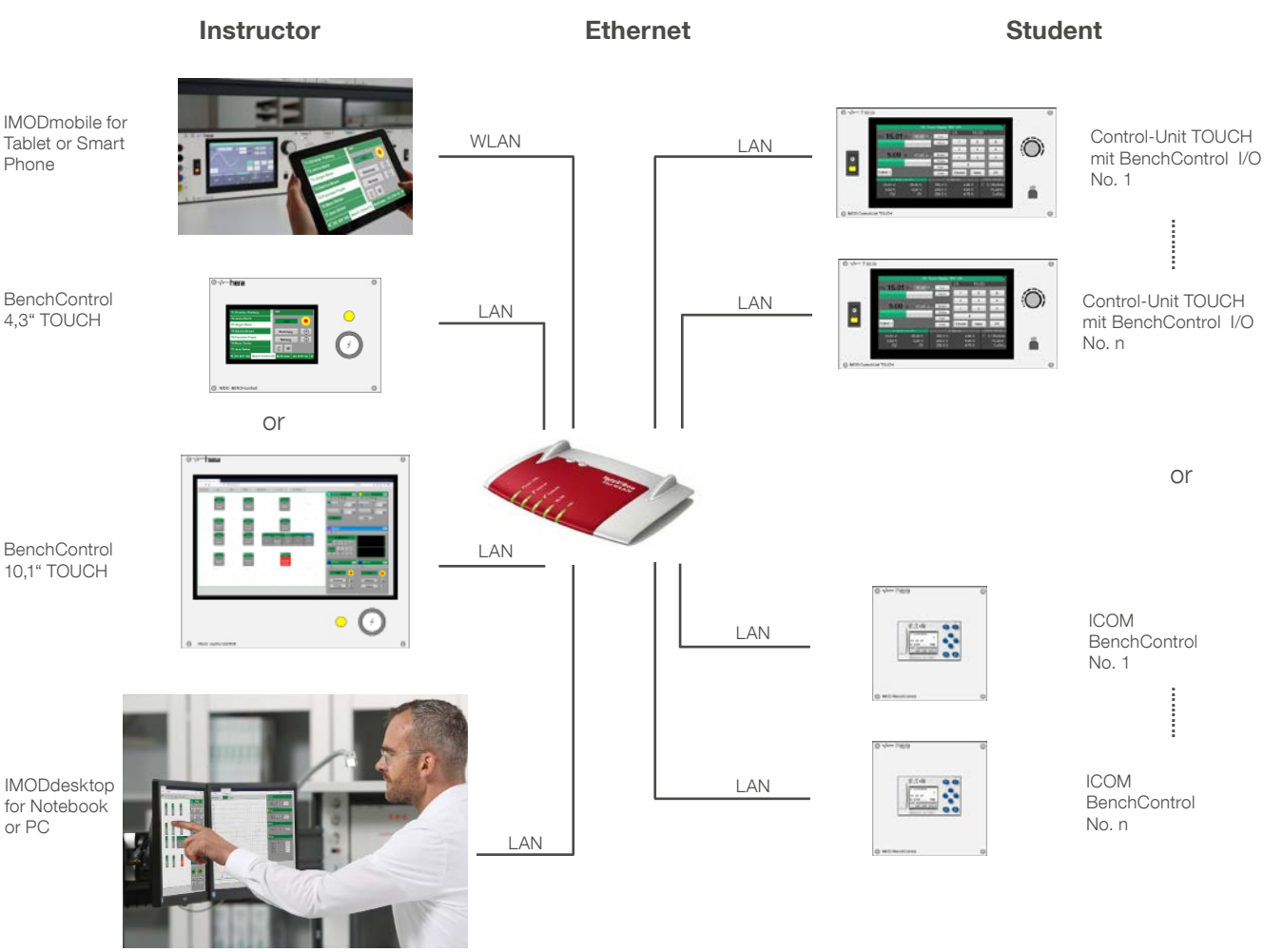
IMOD Multimeter	
634.000.000	IMOD Multimeter
604.000.100	Immersion Temperature Sensor -70°C...+250°C
604.000.200	Surface Temperature Probe -190°...+260°C
604.000.300	Kapton Tape Sensor -190...260°C

IMOD **BENCHCONTROL CENTRAL**

The BenchControl is for the central control of the full classroom. It provides access to all Function-Units and other connected BenchControl I/Os, either by ethernet connection or remotely by mobile devices. The full system is selfsufficient (no PC required).

- Fanless, high performance singleboard computer with high-resolution HDMI interface and fast LAN interface.
- Available TFT displays with wide-view-angle, sizes: 4,3“ (800x480) or 10,1“ (1024x600)
- Highly precise, capacitive multitouch operation.
- Web brouser basing control software with selectable view, either with compact indication of all switching modes (IMODmobil) or with individual classroom configuration (IMODdesktop).
- Key-switch enabling.

IMOD BenchControl Central	
630.100.100	4,3“ TFT Display TOUCH
650.100.100	10,1“ TFT Display TOUCH



IMODdesktop and IMODmobile

Software for IMOD Device Series

- applicable as web server solution for the full classroom or as single license for individual stations
- browser client software for OS-independancy, thus the software can be used for all devices (PC, notebook, tablet and smart phone)
- two optimized resolutions, either IMODdesktop for big monitors or IMODmobile for smaller mobile devices
- personalized user management (log in data collection)
- personalized password protection with various profiles
- comfortable software installation

Tablet with IMODdesktop

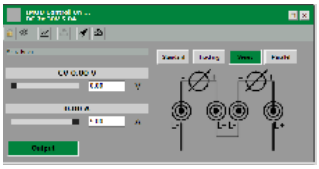
Tablet with IMODmobile

Smart Phone with IMODmobile

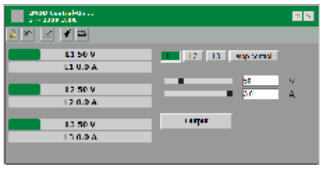
IMODdesktop control view, second monitor with multi-channel recorder

Available Functions

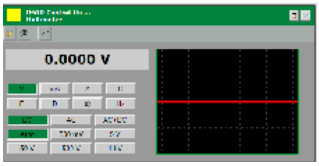
- ICOM CONTROL
- BenchCONTROL I/O
- Variable AC Sources 1- and 3-phases
- Single - and Double Lab Power Supplies
- LAN Integration of High Performance DC Supplies
- Multimeter
- Function Generator
- LED Workstation Lamp



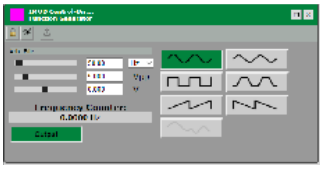
Double Lab Power Supply



AC Source 3phase



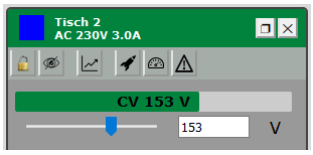
Multimeter



Function Generator

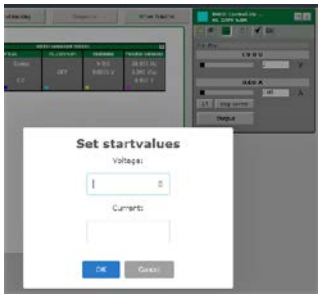
Software Menu

- Display of actual values as bargraph and digital value
- Value setting via slider or keypad
- Switchable modes and outputs
- Starting value and limit setting
- Four selectable enabling modes
- Recording function for all actual values
- Arbitrary generator by set value table (matrix).



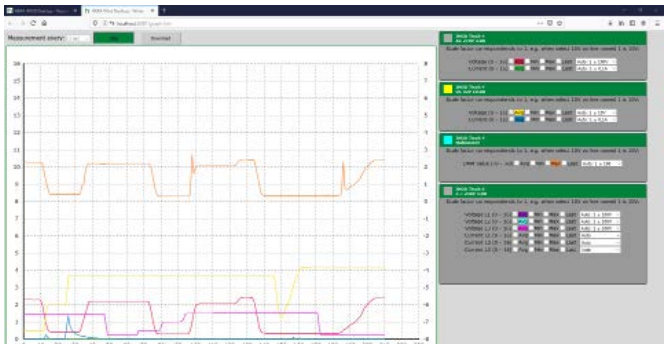
Function-Unit Buttons:

- block manual control
- display blank out
- recorder activation
- load arbitrary generator
- start value setting
- limit value setting
- warning value setting



Recorder

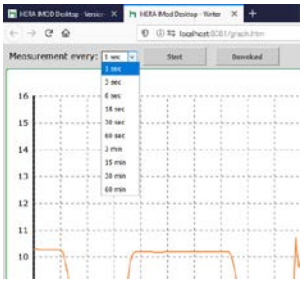
- Simultaneous measurement and presentation of more Function-Units, this allows to evaluate the results of more functions with same time stamp
- Settings for measurement evaluation (min, max, average or last measurement)
- Time base settings, even long term measurements
- Data logging and processing of captured data as CSV file



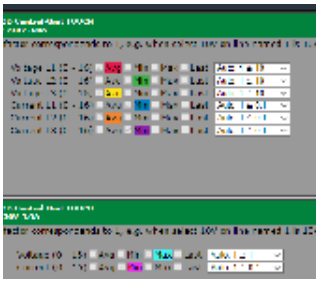
Multi-Channel Recorder

Enabling Modes

- Remote control of all IMOD Control-Units via IMOD-desktop or IMODmobile
- Limit setting with IMODdesktop: the Control-Unit can be only operated within the limiting values (voltage and current for AC and DC sources).
- The control elements can be blocked with IMODdesktop (voltage and current cannot be changed with the Control-Unit).
- The control elements can be blocked and display blanked out with IMODdesktop (the Control-Unit does not allow any control and the display is blanked).



Time base for recorder:
selectable time base and download as CSV file



measurement indication of recorder:
for each measured value a color, capturing mode and measuring range can be chosen

IMODdesktop and IMODmobile		
600.000.100	Single License	(max. 2 IMOD Control-Units can be controlled)
600.000.200	Classroom License	(unlimitted number of IMOD Control-Units can be controlled)

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