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.

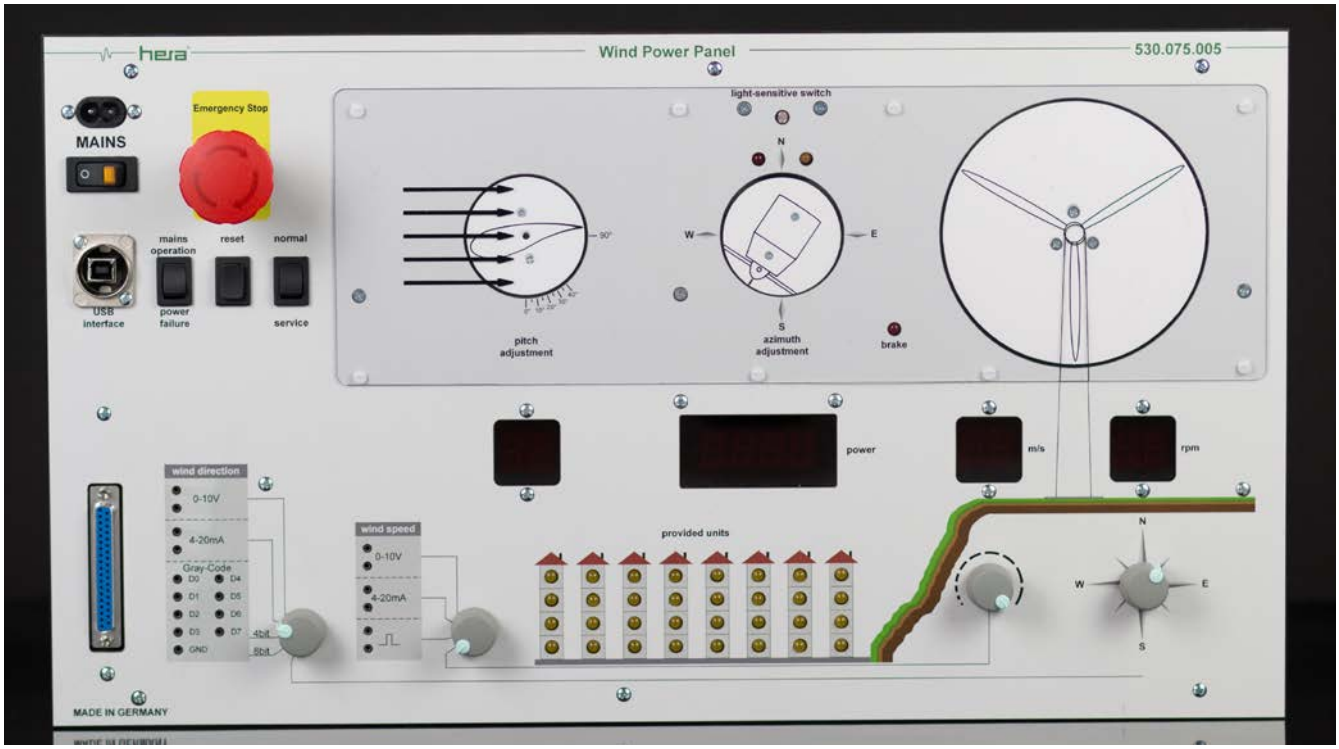
Manual Mode:

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.

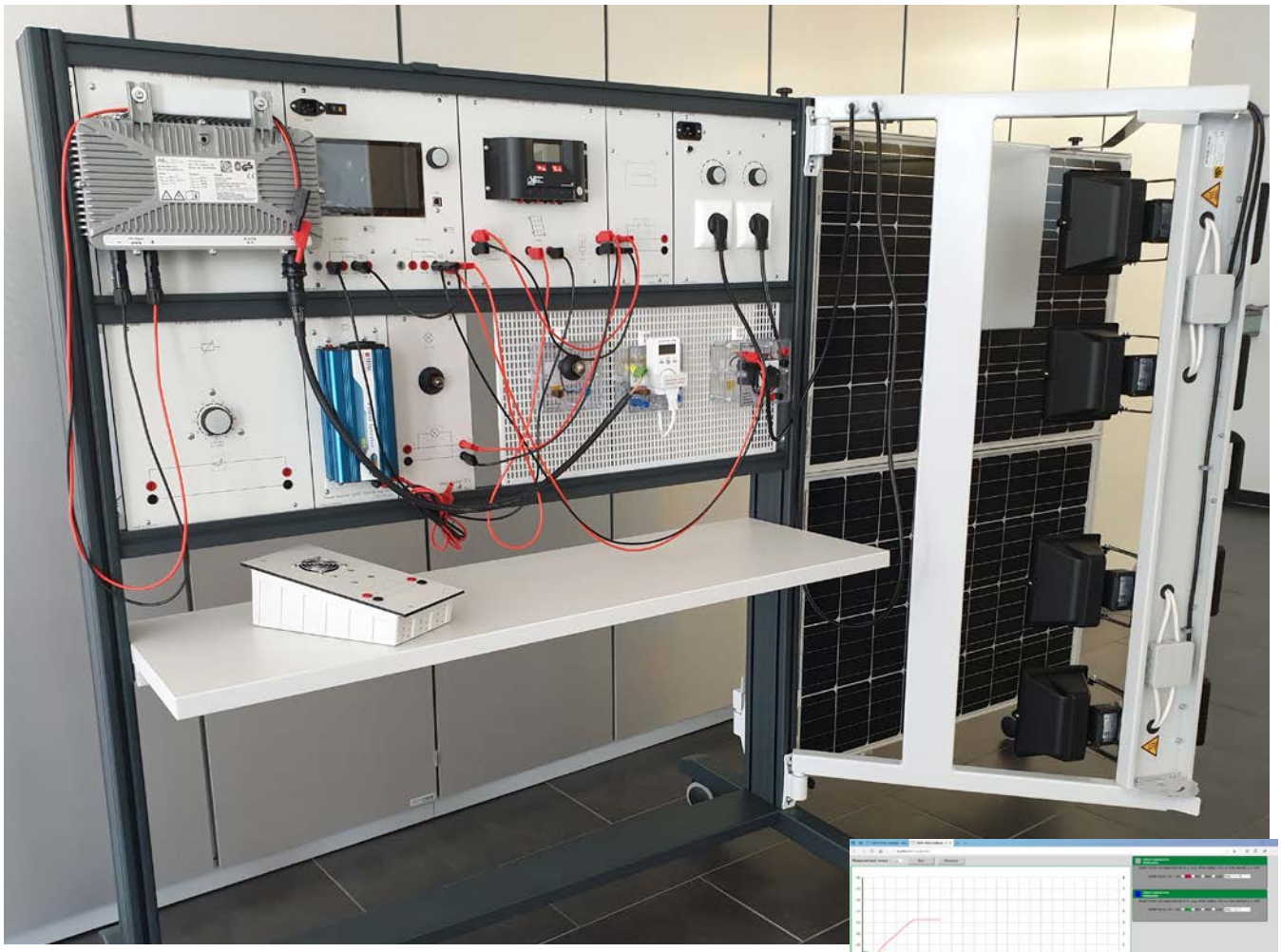
Power Consumption (full illumination): 3.200W.

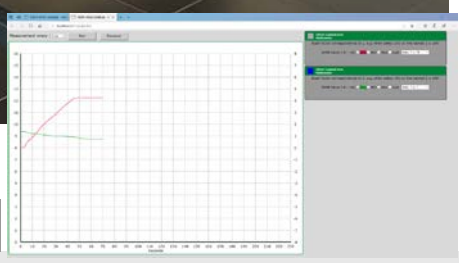
Consisting of:

- 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:

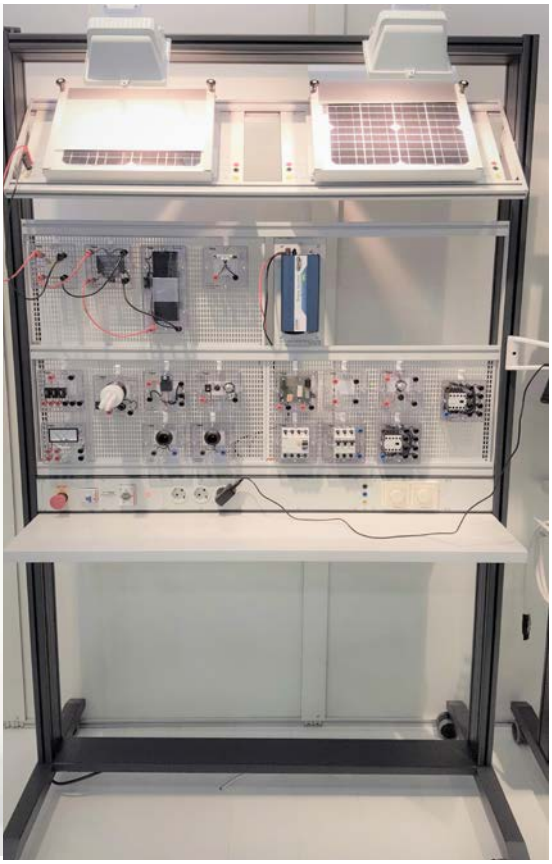
- PROFI Bench for 2 students with 2x dimmable 400W halogen lamps
- Tiltable frame for accptance of the solar modules
- 1 level training system frame for PV panels
- Energy channel with mains panel, 2x dimmer for halogen lamps, solar motor and variable load and 4x 230V sockets

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		

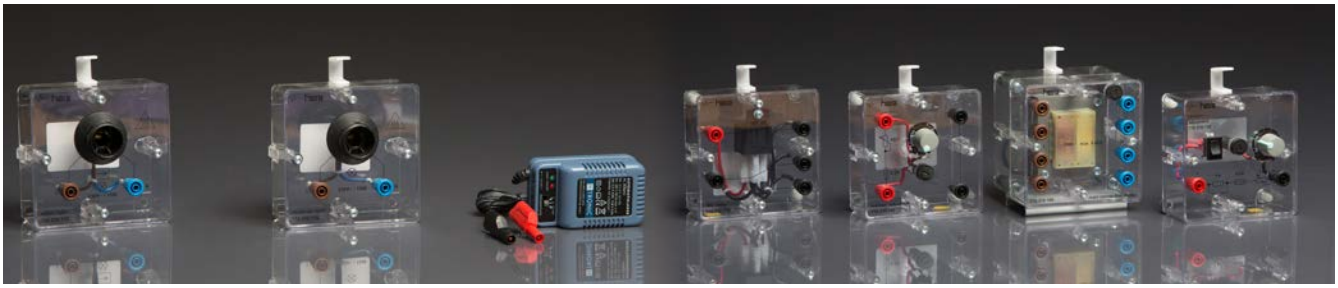
Didactic Panels (DP) and Didactic Boxes (DB) to Off-Grid Technology

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

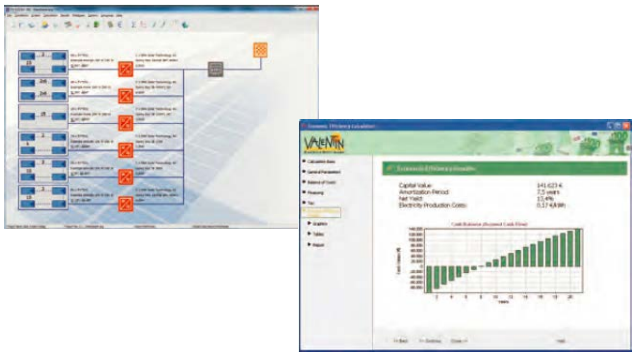
770.311.021

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.

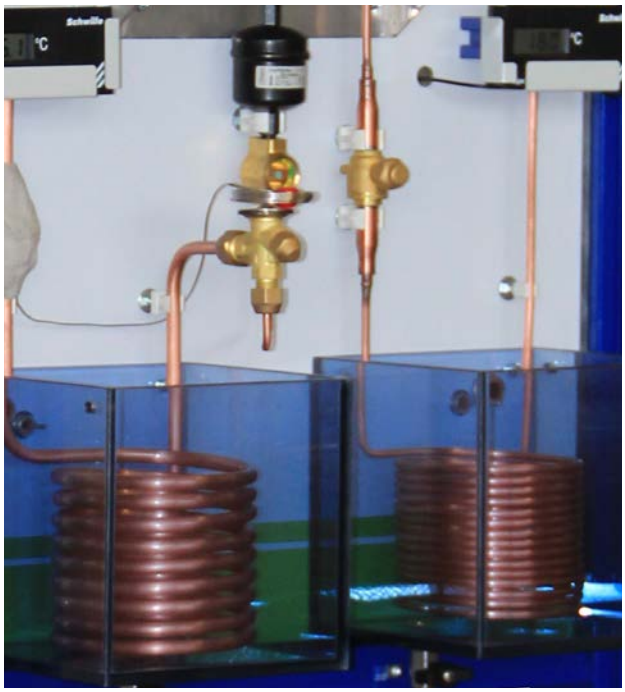
The compact dimensions and the mobile base allow to use this model fully flexible.

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