



PHOTOVOLTAICS

in Training



HARDWARE

From the Cell to the Module



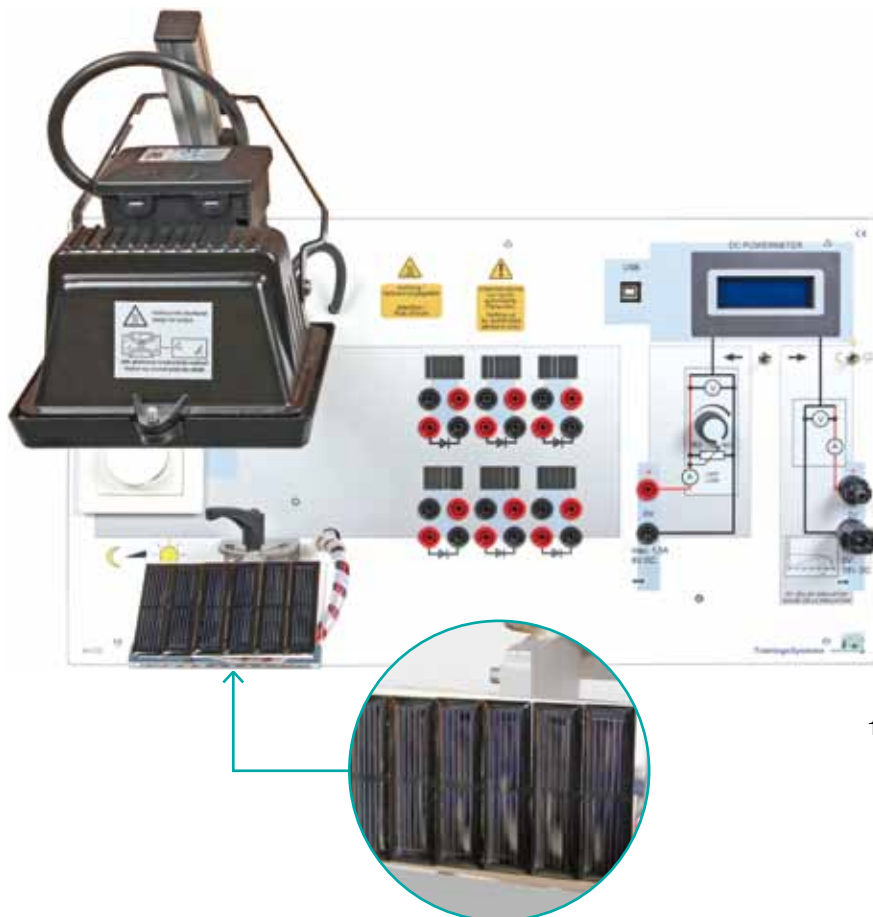
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Learning Objectives

- › Key solar cell data
- › Linking solar cells and modules
- › Bypass diodes
- › String diodes
- › Partial switch-off of cells and modules
- › Partial failure of modules
- › Solar cell output under different radiation conditions

No.	Description / Title	Order no.
1	PV Board	44100

Manual or computer-supported Recording of characteristic Curves



Technical Data PV Board (1)

- › 6 solar cells, wired separately, mounted able to rotate and swivel
- › 6 diodes, can be used as string or bypass diodes
- › 1 dimmable light source, can be swivelled to simulate the sun's path
- › Simulation PV-generator U_0 18 V, I_{SC} 2.5 A for connection to real charge controllers
- › Voltage, current and power meters with USB interface
- › Electronic load, to be set manually and using software

HARDWARE

Off-Grid Charge Controller Board and Series Charge Controller Board



Built-in meters
for current,
voltage and power



1

2

Learning Objectives

- › Types of charge controllers
- › Discharge protection
- › Deep discharge protection
- › Energy storage
- › Operation of consumers at a rechargeable lead gel battery
- › Power adaptation

Technical Data Off-Grid Charge Controller Board (1)

Off-Grid charge controller with display

- › With additional integrated meter for current, voltage, power
- › PWM-controlled
- › System voltage: 12 V DC
- › Maximum load current: 10 A

Technical Data Series Charge Controller Board (2)

Off-Grid charge controller

- › With additional integrated meter for current, voltage, power
- › Serial control
- › System voltage: 12 V DC
- › Maximum load current: 6 A

No.	Description / Title	Order no.
1	Off-Grid Charge Controller Board	44101
2	Series Charge Controller Board	44106

Low-Voltage Consumer Board and Battery

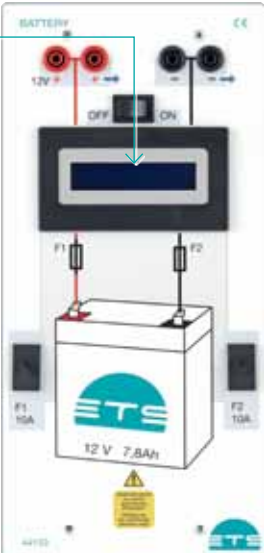


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Technical Data Low-Voltage Consumer Board (3)

- Low-voltage consumers
- LED lamp 1 W
- Fluorescent lamp 7 W
- Halogen lamp 20 W

Built-in meters for current, voltage and power



4

Technical Data Battery (4)

- Battery 12 V DC
- Lead gel battery with 7.8 Ah
- Built-in fuses
- Integrated, switchable meter for current, voltage, power

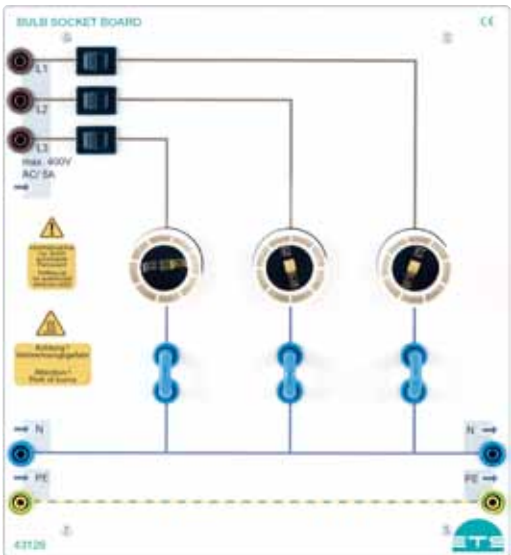
No.	Description / Title	Order no.
3	Low-Voltage Consumer Board	44103
4	Battery	44102

HARDWARE

Off-Grid Inverter Board and Bulb Socket Board



1



2

Learning Objectives

- › Stand-by losses
- › Efficiency of inverters
- › Start-up behaviour of inverters
- › Voltage shape and harmonics
- › Load behaviour

Technical Data Off-Grid Inverter Board (1)

- › Off-Grid inverter
- › Input voltage: 12 V DC
- › Output voltage: 230 V AC / 50 Hz, 275 VA, sinus-shape
- › Integrated metering device for current, voltage, effective, apparent and blind power, power factor, energy

Technical Data Bulb Socket Board (2)

- › Lighting technology board with sockets for 3 bulbs (E27)

Set of Bulbs (3)

- › Comprising 6 lamps 230 V



3

No.	Description / Title	Order no.
1	Off-Grid Inverter Board	44104
2	Bulb Socket Board	43126
3	Set of Bulbs	43122

Extensions



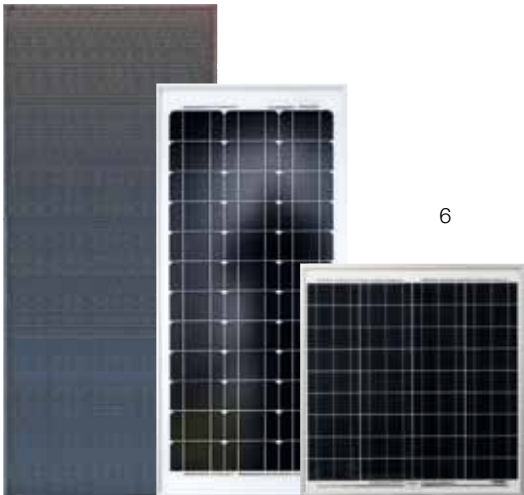
4

- PV sun position simulation (4)**
Mobile frame for carrying out technical measurements on solar modules
- Light source with dimmer, can be rotated and swivelled, for simulating the position of the sun during the day and during the year
 - Operating voltage 230 V
 - Module holder for the 10 W and 50 W solar modules from module sets 44121 and 44122, adjustable, for simulating different roof angles, adjustment using a degree scale
 - The frame is also suitable for the use of 50 W modules outdoors
 - The modules are attached using genuine roof attachment material, making the frame suitable for installation practice



5

- 10 W Solar Modules Set (5)**
- The set contains one polycrystalline (10 W) and one amorphous (6 W) solar module
 - The modules are equipped with an installation frame and Sunclix connectors ready for connection



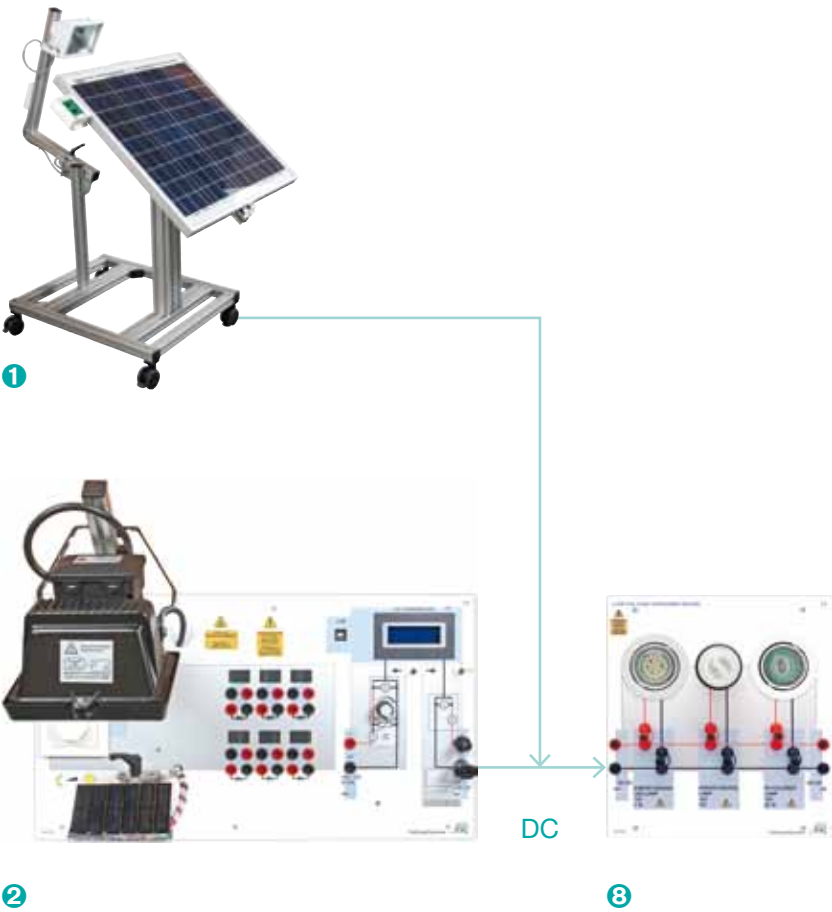
6

- 50 W Solar Modules Set (6)**
- The set contains one monocrystalline (50 W) and one polycrystalline (45 W) solar module
 - The modules are equipped with an installation frame and Sunclix connectors ready for connection

No.	Description / Title	Order no.
4	PV Sun Position Simulation	44120
5	10 W Solar Modules Set	44121
6	50 W Solar Modules Set	44122

DC OFF-GRID SYSTEMS

Set-up Variant – DC Off-Grid Systems without Storage



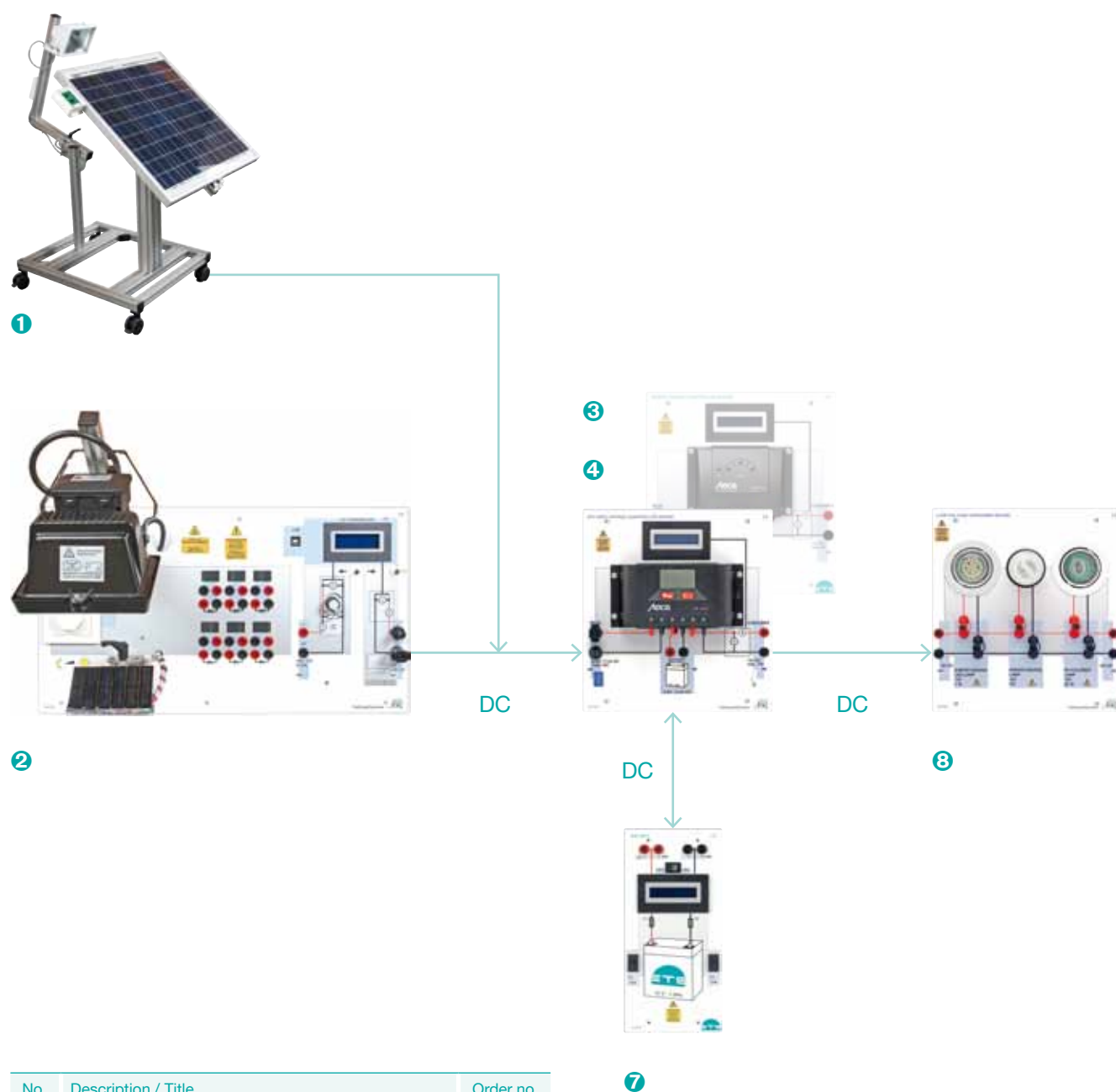
No.	Description / Title	Order no.
1	PV Cells simulation of the sun's position	44120
2	PV Board solar cells	44100
8	Low-Voltage Consumer Board – Low-voltage consumers	44103



Picture: AE Photonics GmbH

Solar pump system in Morocco

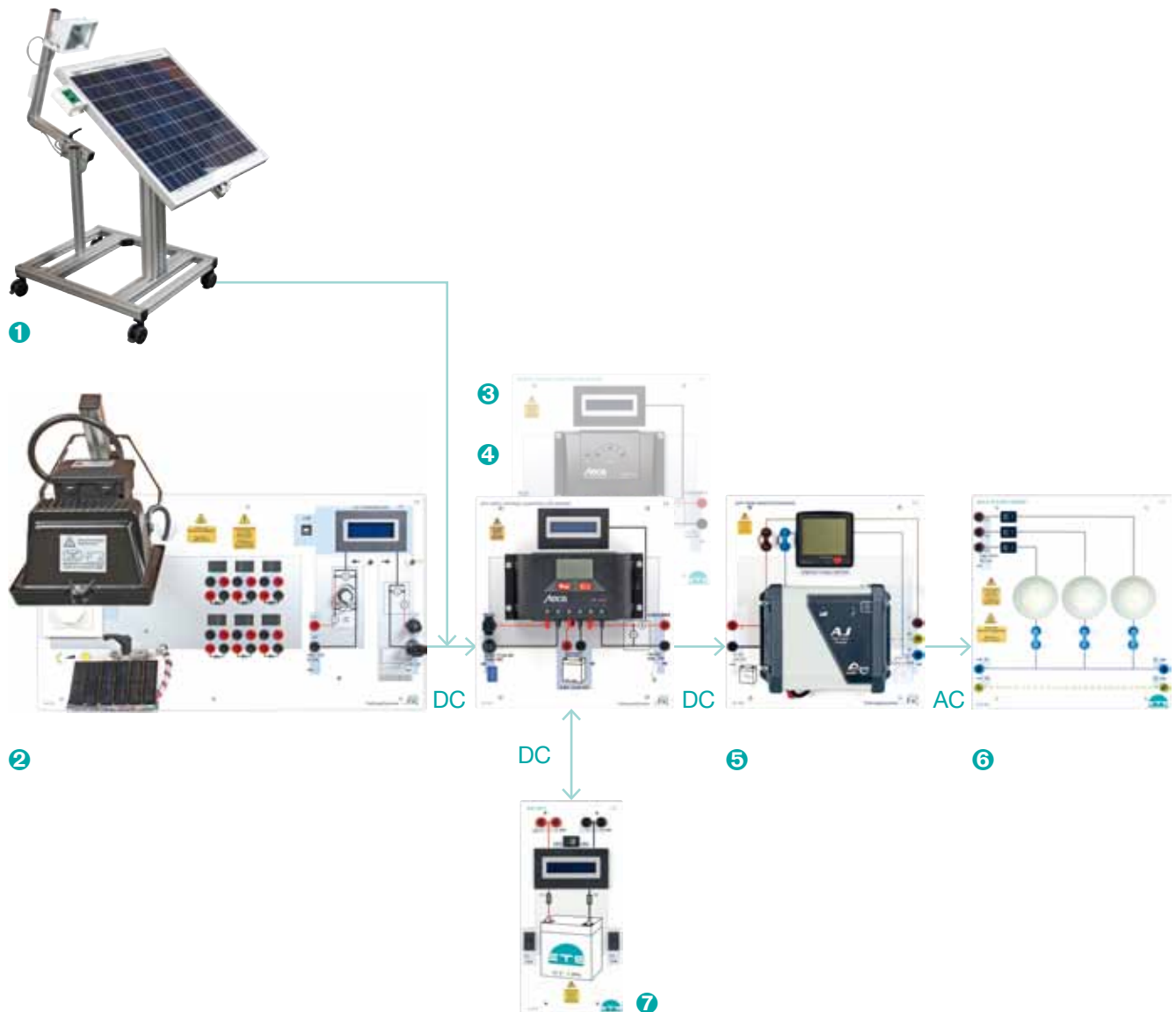
Set-up Variant – DC Off-Grid Systems with Storage



No.	Description / Title	Order no.
1	PV Cells simulation of the sun's position	44120
2	PV Board solar cells	44100
3	Series Charge Controller Board	44106
4	Off-Grid Charge Controller Board	44101
7	Battery 12 V DC	44102
8	Low-Voltage Consumer Board – Low-voltage consumers	44103

DC OFF-GRID SYSTEMS

Set-up Variant – DC Off-Grid Systems with Off-Grid Inverter and AC Load



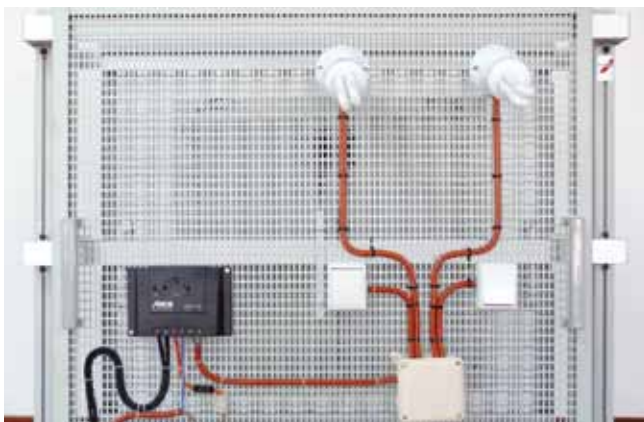
No.	Description / Title	Order no.
1	PV Cells simulation of the sun's position	44120
2	PV Board solar cells	44100
3	Series Charge Controller Board	44106
4	Off-Grid Charge Controller Board	44101
5	Off-Grid Inverter Board	44104
6	Bulb Socket Board	43126
7	Battery – 12 V DC	44102

OUR RESPONSIBILITY

1.3 Billion People around the World have no Electricity. In Africa, south of the Sahara, only one Third of the Population can use Electricity (source: GIZ).



It is a well-known fact that theory alone is not enough; that's why we give hands-on training to our customers all over the world.



Installation and maintenance of Pico and Solar Home systems.



SHARING KNOW-HOW

Planning, Installation and Commissioning of PV and Hybrid Systems



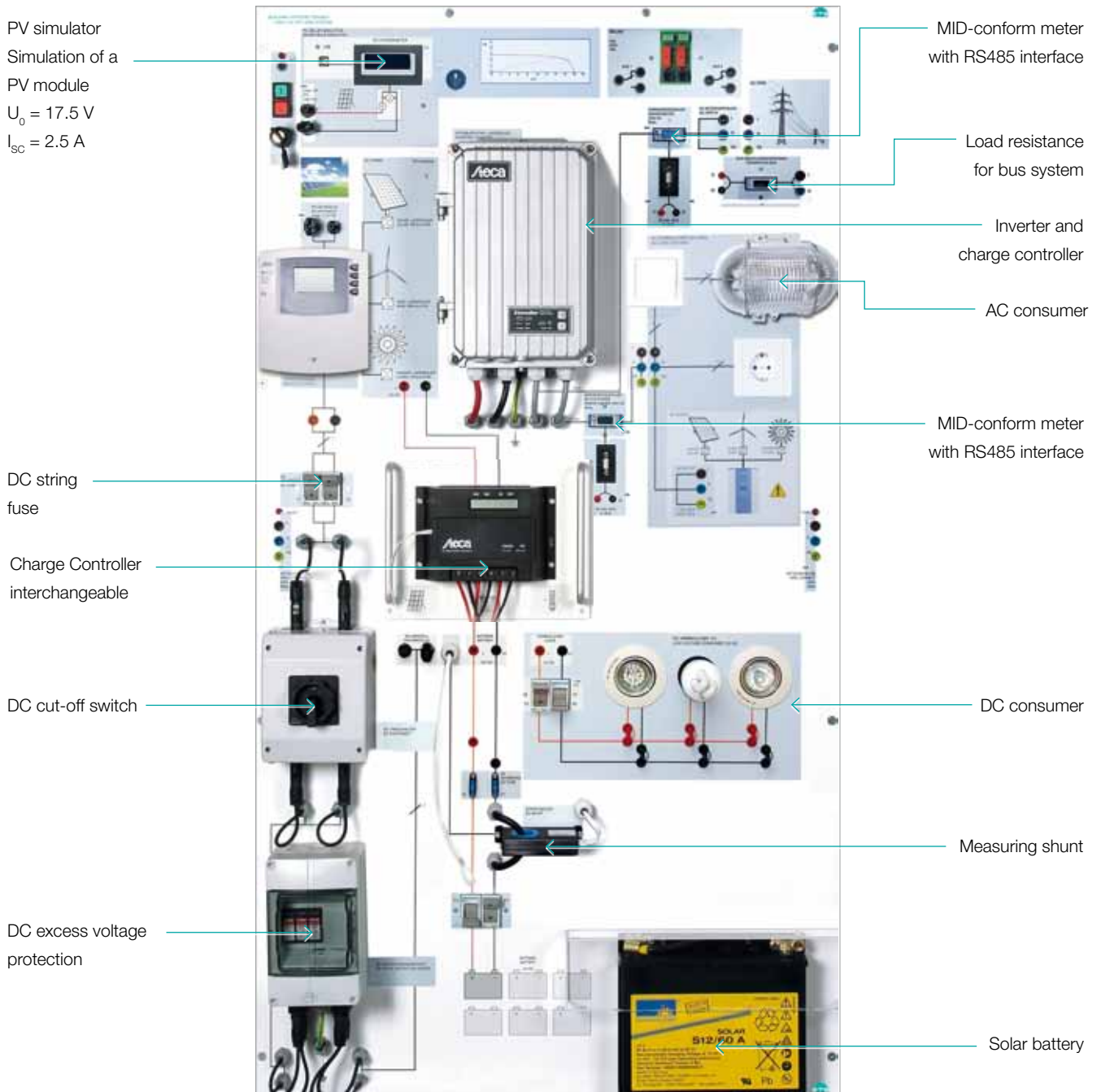
We share all our know-how with our customers in practical hands-on seminars.

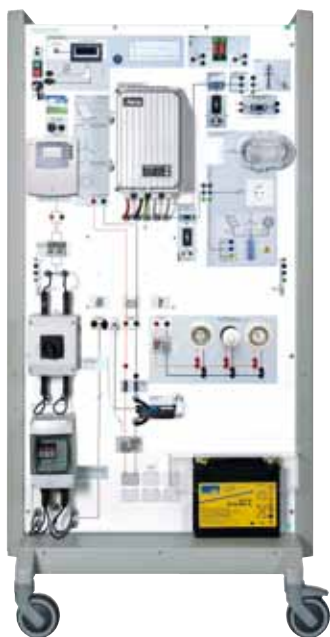




PHOTOVOLTAIK OFF-GRID

BST®–BuildingSystemsTrainer





1



2

Target Group

- › Electrical engineers specialising in energy and building technology
- › Electrical engineers for building and infrastructure systems
- › Institutes of higher education
- › Technical colleges
- › Schools for master trade qualifications

Technical Data

- › Different modes of operation possible (hybrid operation),
Off-Grid system, DC-hybrid, AC-hybrid
- › Simulation of a PV module
- › Switchover grid/solar operation
- › Integration of existing PV modules
- › Integration in a SMARThome
- › Smart Grid thanks to network-capable meters

Learning Objectives

- › Project planning for PV system components
- › Setting up and integrating decentralised energy supply and energy conversion systems
- › Setting up and connecting all the necessary energy supply and communication units
- › Establishment of the necessary lighting and excess voltage protection
- › Maintenance and service of PV systems

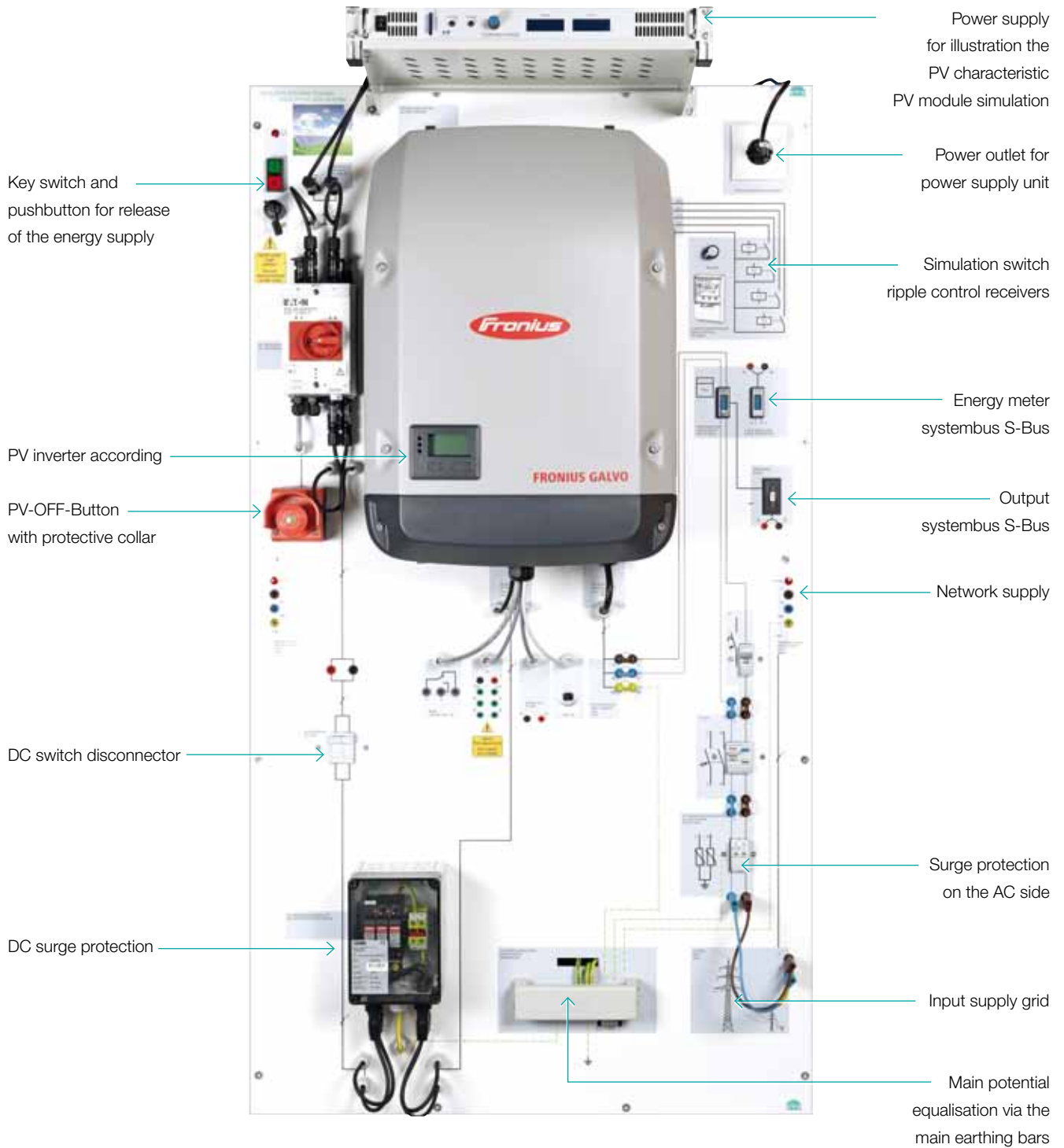
Advantages

- › Learning targets integrated in an overall concept
- › Better understanding of the contexts
- › Use of components standard on the market

No.	Description / Title	Order no.
1	BST® PV Off-Grid System	43521
2	BST® PV On-Grid System	43520

PHOTOVOLTAIK ON-GRID

BST®–BuildingSystemsTrainer





2

Target Group

- › Industrial engineers
- › Electrical engineers specialising in energy and building technology
- › Technical grammar schools, environmental technology
- › Schools for master trade qualifications, higher education institutions, technical colleges

Technical Data

- › To be operated on existing PV modules from a voltage of 150 V
- › To be operated as "stand alone" unit thanks to PV characteristic curve simulator
- › DC and AC protective devices
- › Data logger for data recording and power control
- › PV inverter according to the current standards (ENS, 50.2 Hz problem etc.)

Learning Objectives

- › Planning, implementing and commissioning photovoltaic (PV) systems
- › Repairing and modifying PV systems
- › Measuring the energy produced in a PV system
- › Planning data recording and remote systems for implementing mandatory requirements and putting systems into operation
- › Controlling the power of a PV system in accordance with the power to grid directive
- › Control of own consumption

Advantages

- › Integration of the PV system in Smart Grid/Smart Home systems
- › Practical use of abstract terms (Smart Grid, Smart Metering, Smart Home)
- › Practical set-up, with use of components standard on the market

No.	Description / Title	Order no.
1	BST® PV On-Grid System	43520
2	BST® PV Off-Grid System	43521

ACCESSORIES

Measuring Devices





1

Power and I-U characteristic curve analyser (1)

- › The instrument allows the on field measurement of I-V curve as well as of the main parameters of a single module and of a whole photo-voltaic system up to a maximum of 1000 V and 10 A.
- › The instrument allows to perform quick tests (IVCK) to measure the open voltage Voc, the short circuit current I_{sc} and the maximum power point on PV modules/strings. The acquired data are then worked out and transferred to the reference conditions (STC) in order to compare them with the rated data declared by the manufacturer of those modules.
- › The comparison between the detected and the rated data permits to immediately determine whether the string or the module respect the parameters declared by the manufacturer.
- › The I/V curve tester is delivered in a rigid carrying case



2

Solar power meter (2)

- › Portable digital meter for power solar radiation measurements up to 2000 W/m², extremely compact and easy to use with photo sensor connected to the meter to perform accuracy readings.
- › With carrying bag and battery.

No.	Description / Title	Order no.
1	Power and I-U characteristic curve analyser	90240
2	Solar power meter	90241

EXCELLENCE IN TRAINING



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 Made
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