

# PV SYSTEMS TESTED WITH FORESIGHT

SAFELY INSTALLING AND TESTING  
PV SYSTEMS PER DIN EN 62446-1



**PROFITEST** | **PV SERIES**  
PHOTOVOLTAIC | TESTER

## ACCURATE

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- The acquired characteristic I-U curve is highly accurate thanks to consistent measurement at the capacitive load (max. 500 ms)
- Measurement of characteristic I-U curves at PV modules and strings with voltage up to 1000 (1500) V DC, current up to 20 A DC and power up to 20 (30) kW
- Measurement of short-circuit current  $I_{sc}$ , open circuit voltage  $U_{oc}$ , instantaneous peak power of a solar cell  $P_{max}$ , series resistance  $R_s$  and internal parallel resistance  $R_p$
- Power and temperature measurement via 4-wire cable for error-free results

## INTELLIGENT

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- Patented calculation process for evaluating PV generators without knowledge of the manufacturer's specifications
- Patented calculation process for determining the generator's internal series resistance based solely on a single characteristic IU curve
- Automatic conversion of momentary measured values to  $STC^*$  or  $NOCT^{*1}$

## FLEXIBLE

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- Reliable ascertainment of characteristic IU curves – for photovoltaic modules as well as for strings
- Testing of crystalline and thin-film modules
- Broad measuring spectrum included
- Calibrated irradiation sensor in accordance with IEC / EN 60904-2, VDE 0126-4-2 with integrated Pt1000 temperature sensor

## SAFE

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- High level of intrinsic safety thanks to included load disconnecter (1000 V/32 A / 1500 V/20 A DC)
- Continuous display of momentary irradiation and temperature provides information regarding measuring conditions
- Software for graphic representation, evaluation and documentation with integrated database

## FORWARD-LOOKING

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- Quick, simple and reliable troubleshooting and quality documentation
- Integrated module database, can also be expanded (PROFITEST PV / PV 1500)
- Highly luminous, high resolution color TFT display with energy-saving LED illumination (PV 1500)
- Supports E-CHECK PV “standards-compliant testing of grid-connected PV systems” (PROFITEST PV SUN and PROFITEST PV SUN MEMO)

\* In order to be able to compare different PV modules and cells with each other, standard test conditions have been established worldwide by means of which the characteristic curves of the solar cells are determined. The STCs make reference to the IEC 60904 and DIN EN 60904 standards. Essentially, the characteristic curve is defined by the MPP value, short-circuit current and open-circuit voltage.

\*1 NOCT is a set of conditions under which the performance of photovoltaic components is tested. The abbreviation stands for nominal operating cell temperature.



Peak Power Measuring Instrument and Characteristic Curve Tracer for Photovoltaic Systems with Auto-Ranging up to 1000 / 1500 V / 20 A.



## PROFITEST PV SERIES

The renewable energies exploit a very small portion of the flows of natural energy which take place on the Earth.

The inexhaustible power of the sun is available for regeneration. Solar energy can also be used directly in many ways. Solar cells in photovoltaic systems, solar thermal power plants and solar collectors utilize solar radiation without conversion and transform radiation energy into electricity or heat.

Solar cells convert sunlight directly into electrical power. At the heart of every solar cell is a semiconductor which usually consists of silicon and takes advantage of the "photovoltaic effect": the resultant direct current can be used to operate electrical devices, or can be stored in batteries. Absolute precision is required in order to exploit solar energy to the greatest possible extent, and with maximum yield.

This results in exacting demands for the utilized measuring technology during all project stages: already during the PV system planning phase, the general conditions must be precisely ascertained and incorporated into the system concept. During initial start-up and periodic testing, a report must be prepared which includes the measured electrical values and system data specified in the standards.

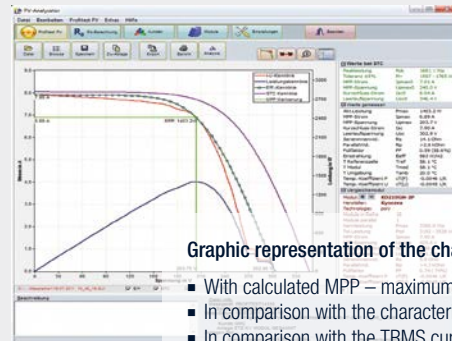
The PROFITEST PV SERIES was developed to meet these demanding criteria. The instrument makes it possible to perform measurements accurately, as well as efficiently. The design concept is based on maximized precision and minimized effort. Read your results while others are still entering data.

# PV ANALYZER Software Included

Included PV Analyzer software provides you with effective support for testing and documentation. It's been specially developed for use in the field of photovoltaics and permits graphic representation of measurement results, as well as an exact evaluation and reliable documentation with integrated database.

## PV Analyzer includes the following functions and more:

- Import of measured characteristic curve values from the PROFITEST-PV Series
- Export of measured values or results (e.g. as XLS file)
- Generation of a test report (e.g. as PDF file)
- Online measurement – graphic representation of the characteristic curve and measured values (also suitable for continuous measurement)
- Online access to the database / data management in the PROFITEST-PV Series
- Representation of measured and calculated values under STC/NOCT
- Overview of characteristic IU curves for a given test series in the browser window
- Compatible with MS Windows® NT, 2000, XP, Vista, 7 and 10
- Module database (42,000 modules)
- Analysis function: evaluation of measured values as against STCs (fault interpretation)



**Graphic representation of the characteristic I-U curve**

- With calculated MPP – maximum power point (Pmax)
- In comparison with the characteristic power curve
- In comparison with the TRMS curve
- In comparison with the STC/NOCT curve
- Characteristic I-U curve with display of measuring points
- Representation of measured and calculated values under STC

### Standard Measuring Ranges

	Voltage [V]	Current [A]	Temperature	Irradiation	Insulation Measurement		Earth Fault Measurement
					Measuring Range	Test Voltage	
<b>PV</b>	25, 100, 500, 1000	2, 5, 10, 20	0 -40 °C ... +100 °C for PT1000	0 ... 1300 W/m <sup>2</sup> (standard sensor)	–	–	–
<b>PV 1500</b>	25, 100, 500, 1500	2, 5, 10, 20	0 -40 °C ... +100 °C for PT1000	0 ... 1300 W/m <sup>2</sup> (standard sensor)	–	–	–
<b>PV SUN</b>	0 ... 1000V DC	0 ... 20 A DC	–	–	0 ... 20 MΩ	250, 500, 1000 V DC	0 ... 1000V DC

# E-CHECK PV

In the meantime, more than a million photovoltaic systems (PV) have been installed in Germany and are supplying electrical power for private use, and for feeding solar power to the grid. Some of them are getting on in their years. As with all electrical installations, the operators of these systems justifiably demand high levels of reliability, especially since they're also liable for system safety.

PV systems which have not been correctly installed or are poorly maintained may fail, besides which they represent a potential hazard. Specialized companies authorized by the Central Association of German Electrical and Information Technology Trades (ZVEH) offer an E-CHECK PV for the detection and elimination of possible weak points in photovoltaic systems to private system operators, as well as commercial customers, municipalities and official authorities.

## In concrete terms, the following measures are included within the framework of an E-CHECK PV:

- Visual inspection for defects and damage
- Assessment based on installation diagram or schematic circuit diagram
- Measurement of the system's insulation resistance
- Measurement of the operating equipment's leakage current
- Testing and measurement of the effectiveness of protective measures
- Function and yield performance testing

A test report and, if applicable, a defects report are generated after the examination.



# PROFITEST PV SUN

All required electrical safety tests for photovoltaic systems can be executed simply and safely in accordance with DIN EN 62446-1 with the PROFITEST PV SUN and the PROFITEST PV SUN MEMO. The test instruments are suitable for testing PV modules and strings with up to 1000 V / 20 A. In addition to insulation measurement, polarity testing and ground fault testing, the protective conductor can also be tested for continuity. The testers are distinguished by their ergonomic design and easy handling with a weight of just 500 g.

## PROFITEST | PV SUN — SAFE UNIVERSAL NIFTY PHOTOVOLTAIC | TESTER

- Voltage measurement: 0 ... 1000 V DC
- Current measurement (direct): 0 ... 20 A DC
- Insulation resistance measurement, measuring range: 0 ... 20 MΩ, test voltages: 250, 500, 1000 V DC
- Earth fault measurement 0 ... 1000 V DC
- Testing for protective conductor continuity: 0 ... 10 Ω / > 200 mA
- Polarity test
- Backlit LCD panel
- Compact and rugged – for service calls under harsh conditions
- Extensive accessories
- DAkkS calibration certificate (optional)



### PROFITEST | PV SUN MEMO also includes:

- Bidirectional interface
- Internal memory for storing 10,240 data records
- Free software tool

# PERFECTLY MATCHED ACCESSORIES

Perfectly matched accessories make it possible to conveniently take advantage of the measuring diversity offered by the PROFITEST PV for a great variety of testing tasks at photovoltaic systems. The instrument and its accessories can be comfortably transported in the rugged case system.



### Included with the PROFITEST PV / PV 1500:

- Case system for the PROFITEST PV and accessories
- External Pt100 temperature sensor for separate measurement of temperatures at the irradiation sensor and the back of the module
- 4-wire measurement cable for connecting the load disconnector and the PV generator, 10 meters
- External power pack (16 V DC, 2.5 A) for charging batteries and for power supply, with integrated charge controller
- Shielded mini USB cable
- PV Analyzer PC software (for download from website)
- External load disconnector (1000 V / 32 A) with outstanding intrinsic safety for all-pole disconnection from the PV generator
- Calibrated, monocrystalline irradiation sensor in accordance with IEC/EN 60904-2 with integrated Pt1000 temperature sensor, 10 m connector cable

### PROFITEST PV SERIES OPTIONS:



MC3 – MC4 PV Adapter Set (Z360K)



SUNCLIX – MC4 PV Adapter Set (Z360H)

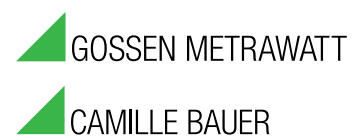


TYCO – MC4 PV Adapter Set (Z360J)



Magnetic Test Probes with MC4 Plug (Z502Y)

**GMC INSTRUMENTS**



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