



# TRITEC

energy for a better world

## TRI-KA: SYSTEM MAINTENANCE AND ERROR DETECTION

Characteristics measurement in practice

- Simple controlling and logging of output
- Early detection of errors and problems
- Safeguarding long-term yields



**“With the TRI-KA, we have a handy device for monitoring and maintenance of large-scale systems“.**

*Enerparc, Dr. Heiko Lübke, Head of Operation and Maintenance*

Enerparc provides industrial services and consulting for large-scale solar power stations with outputs of more than 1 MWp.



## Why characteristics analysis?

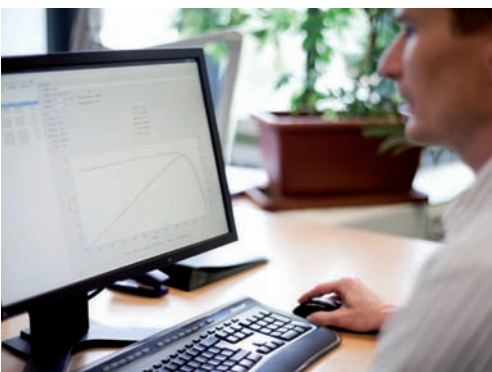
The market demand for output and quality control of installed PV modules and systems is increasing. On the one hand, customers have invested for a period of over 20 years and planned their systems' yields. On the other hand, customers have come of age: Frequently they know the target output of their PV systems precisely. In case of deviations, errors or defects, they expect these to be detected simply and remedied quickly.

This demanded quick error analysis on site is made possible by measuring devices analysing the STC characteristics. A characteristics analyser can measure the actual output of a PV system during installation, hand-over or maintenance of the system and compare it to the nominal output of the PV system under standard conditions, the STC ideal curve analysis.



## Maintenance of large-scale systems made easy: TRI-KA system configurator

Smooth operation is essential, especially for large-scale systems. If for example a megawatt system fails even partially for a longer period of time, the losses can quickly reach thousands. But even for smaller solar systems regular checks are worthwhile to ensure that they deliver the expected output.



## TRI-KA PC software: Evaluate measurements with just a few clicks

Thanks to the system configurator. The TRI-KA PC software makes it easy to map the system structure with all inverters and strings already in the office, so that only the individual measurements must be performed at the system. Additional functions allow to analyze the system and to create reports. Dr. Heiko Lübke, Head of Operation and Maintenance at Enerparc in Hamburg said the software was one of the main factors for buying a TRI-KA: “Here the TRI-KA is a step ahead of the other devices. Using the TRI-KA software, we can prepare the entire system architecture at the office, before we test the system in the field or on the roof. It makes our work noticeably easier“.





## Regularly output controls

The TRI-KA allows the proper logging of a system's output during its entire lifetime. Thanks to regular checks, the operator can rest assured that the output actually meets expectations. In addition, this way problems are identified early and can be remedied quickly without greater yield losses. According to Ralph Schultz, Product Manager Measurement Technology at TRITEC, the TRI-KA is mainly used to monitor and maintain systems: "Many of our customers use the TRI-KA to offer comprehensive services to system operators. This way they not only extend their value chain, but they also distinguish themselves as quality-conscious providers."



## Ability to identify and remedy errors quickly and easily

Photovoltaic systems are exposed to the harshest conditions for at least 20 years. Great heat and extreme cold, snow and ice put stress on modules and other system components. Even if manufacturers guarantee their products' performance, faults can occur. The system does not generate or only generates partially, thus reducing the yield.



## "The TRI-KA is the ideal tool for us".

*Dipl.-Ing. (FH) Christian Schroll, contact for renewable energies, HEWE Fenster GmbH from Ettenheim*

Besides windows and doors HEWE Fenster GmbH combines almost all pioneering energy technologies for buildings under one roof.

Dipl.-Ing. (FH) Christian Schroll, contact for renewable energies is convinced that more and more customers want yield tests for their systems: "To this end we have the ideal tool with the TRI-KA. Previously we had to make do with multi-meters and clip-on ammeters for output tests. Now we have an intuitively operable tool in the full set of the TRI-KA".



## Ensure yields

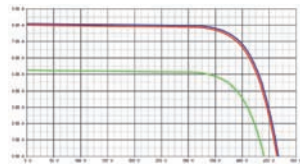
To ensure the highest possible yield for system operators, errors must be identified early and remedied quickly. With the TRI-KA, installers have the appropriate device. In case of conspicuous systems, the installer can work through from the complete strings to the faulty module, due to the large input range for current (0.1–15 Ampere) and voltage (1–1000 Volt). This way age-related defects or soiled modules can be identified as well as partial shading by grass or moss that has grown over the years.

## Identify typical curves and remedy errors

Green: measured characteristic curve

Red: measured characteristic TRI-KA extrapolated to STC with TRI-SEN data

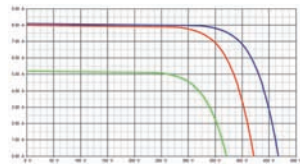
Blue: STC curve of the module manufacturer



### Good measurement

- Shape of the measured curve (green) and extrapolated to STC (red) and of the STC curve of the manufacturer (blue) is nearly congruent.

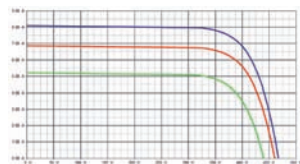
- No error



### Open-circuit voltage too low

- Incorrect temperature reading
- Short circuit of individual cells
- Wrong number of "Modules in row" in system configuration

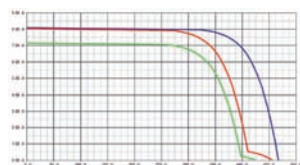
- Repeat temperature measurement at several different points
- Check partial strings
- Check system configuration



### Short circuit current too low

- Modules are soiled
- Obstacle at greater distance
- Aging
- Manufacturing error

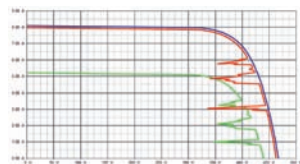
- Clean modules
- Remove obstacle
- Check laminate, cells and covering material for dullness, moisture etc.
- Contact the manufacturer



### Inaccurate shape of I/U characteristic

- One module with low irradiation (small shadow)
- Uneven soiling
- Individual manufacturing error
- Production spread in modules

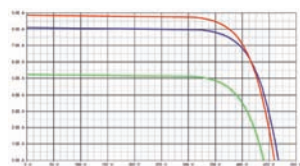
- Search for the visual obstacle (aerial, chimney, neighbouring building, power lines etc.)
- Clean the module
- Check partial strings
- Contact the manufacturer



### Inaccurate shape of I/U characteristic

- Part of the strings completely shaded for a short time

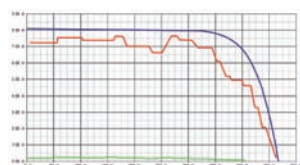
- Repeat the measurement, making sure that the string cannot be shaded temporarily.



### Short-circuit current too high

- Incorrect irradiation measurement
- Wrong module selected in system configuration

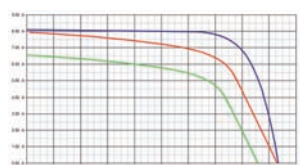
- Place irradiation sensor at module level
- Check irradiation sensor for shading
- Check setting for module type in system configuration.



### Irradiation too low during characteristics measurement

- Irradiation too variable during measurement

- Repeat measurement at irradiation  $\geq 700\text{W/m}^2$  (EN 61829)



### Inaccurate shape of I/U characteristic

- Additional series resistance within the system
- Voltage loss over feed and return line from module string.

- Check cabling, plug contacts, clamps etc.
- Enter and activate line length, cross-section and special resistance in the TRI-KA, repeat measurement