

# PV-KLA MULTIPLEXING SYSTEM

## for I-V Curve measurement of PV modules

Based on our successful I-V curve analyser PV-KLA we developed a system for automatic I-V curves measurement of several PV modules, called PV-KLA-MUX. Usually the PV-KLA MUX is used for collecting I-V curves under different natural conditions for determining the behaviour not only under STC but also at natural conditions and therefore to compare different PV module types. One other application is the analysis of the degradation of PV modules during light soaking.



### Description of Function

To measure the output performance of PV modules under natural sunlight conditions it is necessary to measure their I-V curves periodically under all possible weather conditions. Our multiplexing system, called PV-KLA MUX, is the ideal solution for nearly every climatic zone. It is built completely modular, so that different combinations of modules, electronic loads (passive or active) or meteorological sensors can be realised.

Because the PV-KLA consists of a passive load together with a high speed data acquisition it is possible to measure different types of modules within the same multiplexing system; crystalline modules together with thin-film modules and even single cells are possible with our Zero-Volt option,

that measures from  $-0.3V$  up to the open-circuit voltage of the test samples.

The cabinet is optimised for low and high temperature, while it normally gets a stainless steel hood for preventing direct sunlight. Additionally there are temperature controlled fans as well as cooling and heating aggregates implemented. Robustness in combination with accuracy leads to a leading equipment for all PV module test facilities.

Several options for a customised optimisation of the MUX are available, such as additional data logging, complete meteorological sensor station or additional temperature sensors for every module.



**INGENIEURBÜRO**  
Mencke & Tegtmeier GmbH

Meßgeräte für die Solartechnik

**INGENIEURBÜRO**  
Mencke & Tegtmeier GmbH

Schwarzer Weg 43A  
D-31789 Hameln  
Phone: +49 51 51 40 36 99 - 0  
Fax: +49 51 51 40 36 99 - 19  
email: [info@ib-mut.de](mailto:info@ib-mut.de)  
<http://www.ib-mut.de>

Banking Account:  
Stadtsparkasse Hameln  
(BLZ 254 500 01)  
Konto 5 22 33

UID-Nr. DE258133277  
Customs no: DE6018572  
County Court Hannover  
HRB 202636

# PV-KLA MUX

## Multiplexing System

### Technical Data

- Basic accuracy (16 bit resolution):  $\pm 0,2\%$  fsr  
Accuracy of meteorological sensors depend of sensor type used
- Voltage ranges: 50, 100 and 200 V
- Current ranges: 4, 8, 16 and 32 A  
All current and voltage ranges can be combined to each other
- Irradiance range: 1500 W/m<sup>2</sup>
- Temperature range: -10 to 100 °C
- Maximal sampling rate for one current-voltage data pair: 50 ksamples/s
- Measuring time for I-V curve: 2 to 500 ms
- User interface: controlled directly via PC und Software PVscan
- Analogue inputs for sensors: 0...10 V



## CONTENT OF DELIVERY

Main cabinet containing:

- Industrial PC with touchscreen, MS Windows XP pro, LAN, software PVscan
- Complete PV-KLA unit
- Internal fans and heating unit, stainless steel weather-protection hood
- Data acquisition for 6 meteorological sensors using 12 bit system integrated
- Pt100 temperature sensors (one for every PV module, more on request)
- External cabinet(s) for working point resistances

## OPTIONS

- Customised voltage and current ranges, Zero-Volt option
- Additional analogue inputs
- Meteorological sensors like pyranometers for global and diffus irradiance, wind speed and direction, ambient and module temperature
- Cooling unit
- Additional module temperature sensors
- 19 bit data logging system for meteorological sensors (several analogue input types)

## REFERENCES

Institut für Solarenergieforschung GmbH (ISFH), Hameln-Emmerthal

Intertek Semco, Lake Forest, USA

Dow Chemicals, USA

TÜV Rheinland, Arizona, USA

SolarWorld Innovations GmbH, Freiberg

Stiebel-Eltron GmbH, Holzminden

Siemens Information Systems Ltd., Bangalore, India