

天祥太阳能源科技有限公司

DYESUN SOLAR TECHNOLOGY CO., LIMITED



- 天祥太阳能源科技有限公司是一家致力于为中国光伏企业提供整套太阳能检测方案的科技公司。具体提供以下服务：

- 1、提供户外I-V检测设备及户外电站测试检测方案设计。
- 2、提供太阳能光伏实验室的规划，及相关检测标准的解读。
- 3、提供光伏原材料、系统关键零部件等整条光伏产业链的检测方案和检测设备。提供一站式的服务。

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2017.11 (第8版)

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天祥科技亮相历届太阳能国际光伏展



Daystar, Inc. (美国公司)



- PV Systems Test Equipment
- Since 1988
- www.daystarpv.com
- 中国**独家-Daystar**公司代表处：天祥太阳能源科技有限公司
- www.dyesuntech.com

户外电站I-V及其它发电性能检测

测试精度业内最高!

★ 户外I-V测试系统

PV I-V Curve Tracer



★ 户外多通道I-V测试系统

Multi-Tracer



户外I-V测试系统 IV Curve Tracer

测试精度业内最高！达0.5%

28年来Daystar公司

只专注做户外IV测试系统
产品在硬件及软件方面不断
优化升级，产品测试数据的
精确性、稳定性获得了业内的
广泛认同，且软件的分析
处理功能强大，测试速度快，
软件

设备操作简单方便

Safe 安全

Reliable 稳定

Durable 耐久



DAYSTAR DS-100C

Photovoltaic Curve Tracer

Reliable, Safe, Accurate, Durable

Daystar IV Curve Tracers are used world-wide to test and evaluate photovoltaic systems. For over 20 years, major photovoltaic companies and national laboratories have used Daystar Tracers to set the standard for PV performance.

- IV curves of single PV modules or arrays
- Up to 100 Amperes, 600 Volts, 50 kilowatts
- Grounded or floating PV systems
- USB and RS-232 interfaces
- Portable, battery powered for up to 10 hours of testing
- Two voltage inputs, two Thermocouple inputs
- IVPC support software included



daystar, inc.

Since 1988

DAYSTAR'S 1000 VOLT, 100 AMP

Photovoltaic I-V Curve

Reliable, Safe, Accurate,

The DS-1000...

- Up to 100 Amperes, 1000 Volts, 100kW
- 1000 data pairs in an IV curve
- Slower IV curve for accuracy
- Portable, battery powered for > 10 hours of testing
- True short-circuit current measurement
- User accessible calibration routine

For over 25 years Daystar Tracers have set the standard for measuring performance of PV systems. Major photovoltaic companies and national laboratories use Daystar Tracers to evaluate their product.



DS-1000 Specifications			Daystar DS-1000 Characteristics	
PV Voltage	Resolution	Accuracy-Typical at 25°C	Maximum PV Power	100 kW, 1000 V, 100 A
1000V	30 mV	± 0.4 V ± 0.01% rdg	PV Grounding	Positive, Negative, Floating
100 V	3 mV	± 40 mV ± 0.01% rdg	True Isc Measurement	Yes
10 V	300 µV	± 4 mV ± 0.01% rdg	4-Wire Voltage	Yes
			Irradiance Inputs (X2)	Yes
PV Current			Temperature Inputs (X2)	Yes
100 A	3 mA	± 50 mA ± 0.05% rdg	Operation/Analysis Software	Yes
10 A	300 µA	± 5 mA ± 0.05% rdg	Data Connections	USB and RS-232
1 A	30 µA	± 0.5 mA ± 0.07% rdg	Tracer Electrically Isolated	Yes
			AC Power for Charging	85-264 VAC, 50/60 Hz
Temperature			DC Power for Charging	12-16 VDC
Type T (X2)	0.1 °C	-30 °C to 120 °C ±1°C	Internal Battery Operation	>10 Hours
Voltage Inputs (X2)			Size in Case	46 x 36 x 20 cm 18" x 14" x 8"
5 V	150 µV	± 500 µV ± 0.01% rdg	Weight in Case	12 kg 26 lbs
500 mV	15 µV	± 50 µV ± 0.01% rdg	Operating Temperature	0° - 50° C
50 mV	1.5 µV	± 5 µV ± 0.01% rdg	Shipping Case Included	Yes, Shipping weight 25 kg
5 mV	0.15 µV	± 0.5 µV ± 0.03% rdg		
	Daystar DS-1000 IVPC Software			
Control	Operates DS-1000 Tracer			
OS	Windows Software			
Help	Extensive Help Menu			
Auto Curve	Take Curves Automatically			
Analysis	Display and Compare Curves			
Normalization	Three methods included			
Multi-Plot	Display Multiple Curves			
Export	XML and IVA format			
Command	External Command Set			

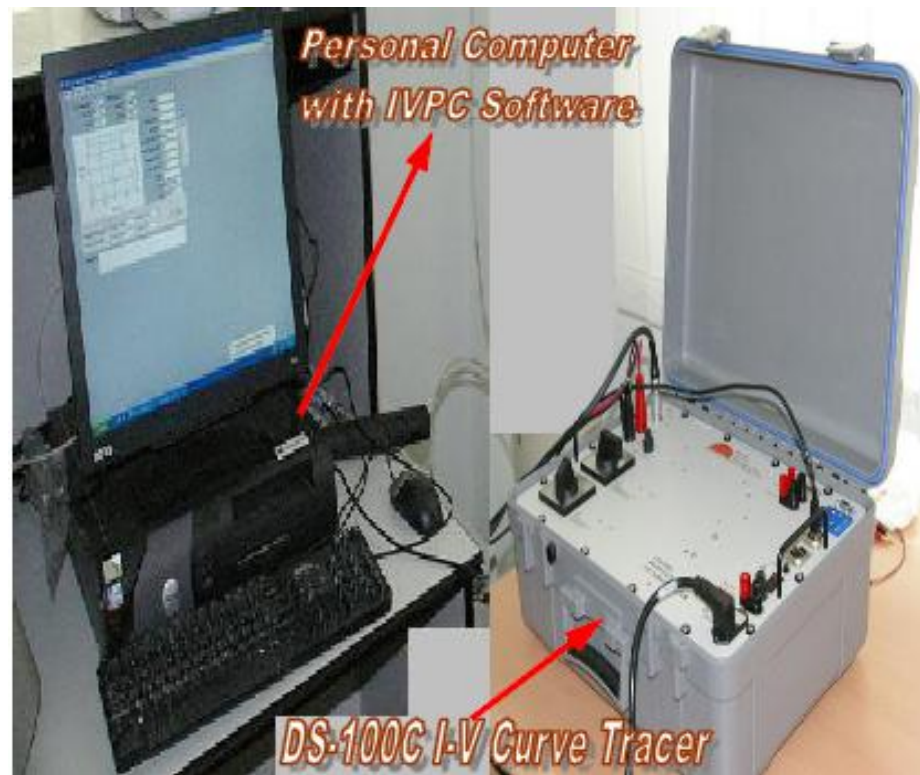
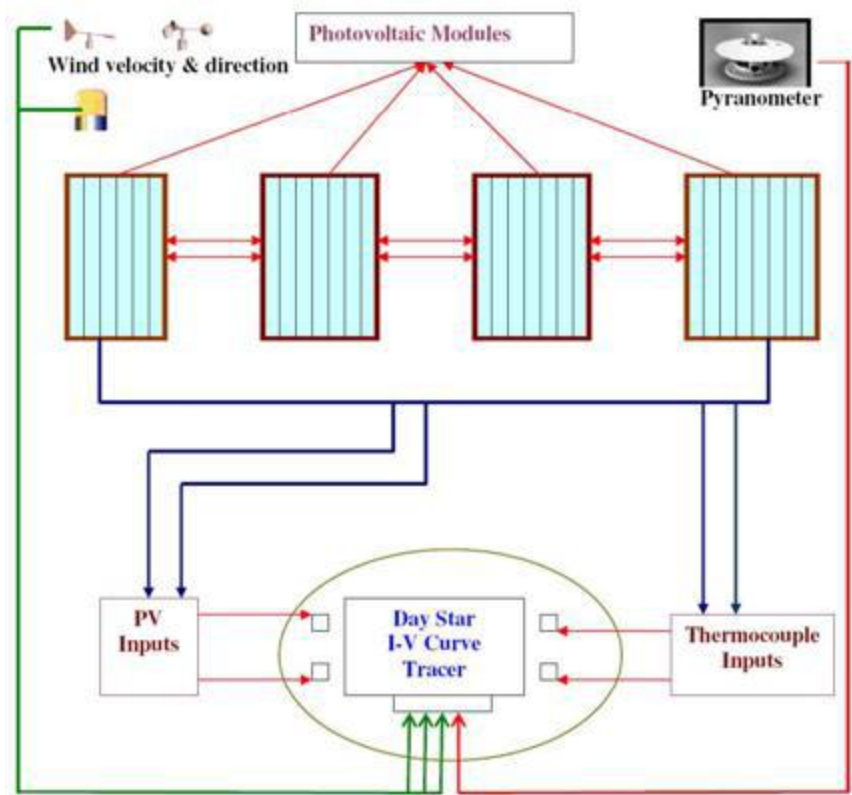


DS-1000 IV CURVE TRACER

- Accurate
 - Reliable
 - Durable



DS-100C和DS-1000现场测试原理图



DS-1000 IV CURVE TRACER



- Accurate Testing of any PV Technology
- Higher Quality IV Curves - 1000 Data Pairs
- Slower, More Accurate Curve Sweep
- Accurate for Modules and Large Arrays
- True Short-Circuit Measurement
- Accessible Calibration Routine

DS-1000 IV CURVE TRACER

- 1000, 100, 10 Volt Measurement Ranges
- 100, 10 Amp Measurement Ranges
- Two Voltage Inputs for Irradiance
- Two Thermocouple Inputs
- 4-wire Voltage Measurement
- Grounded or Floating Arrays

DS-100C IV Curve Tracer

户外I-V测试仪

- Portable (便携)
- 46 x 36 x 20 cm (体积小)
- 12 kg (重量轻)
- Battery powered - 10 hours (电池使用时间长)
- Shipping case included (配包装箱)



You may download of a copy of the DS-100C manual
at www.daystarpv.com/downloadT.html .

1500V户外IV曲线测试仪-兼容1500V光伏系统测试需求

光伏系统从600V升级到1000V带来了成本下降和发电量提升，同样当1000V升级到1500V的时候，也会带来光伏系统效率的大幅提升。尤其在光伏补贴将逐年下调已成定局，而1000V直流系统整体降本空间有限的大背景下，向1500V升级将是一个变革。

新货上市
New goods appear on market

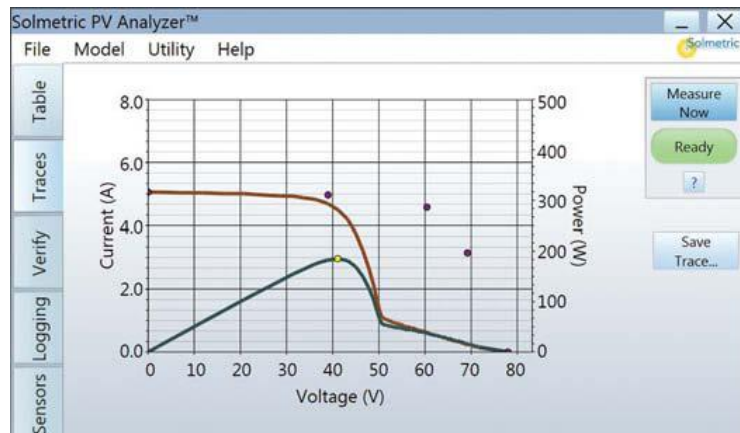
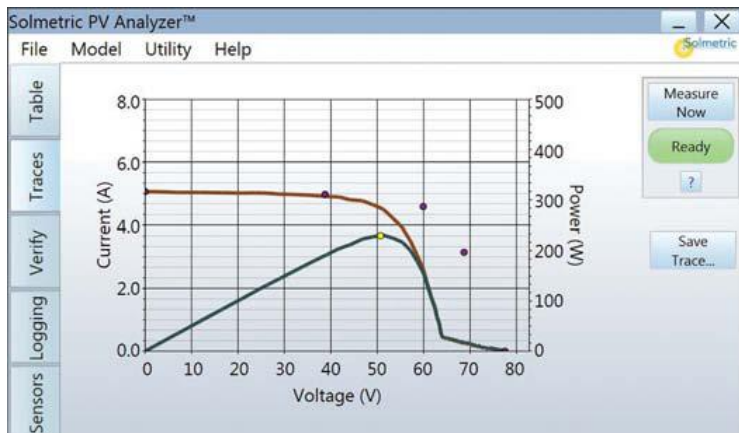


关键技术参数：Specifications

- PV voltage: 0-1500 V DC
- PV current: 0-30A DC
- Measurement sweep time: <250 ms
- Voltage accuracy (0 to 55 °C): +/-0.5% +/-0.25V
- Current accuracy (0 to 55 °C): +/-0.5% +/-40ma
- I-V trace points: 100, 500
- Wireless sensor range: >300 ft
- 1 year warranty

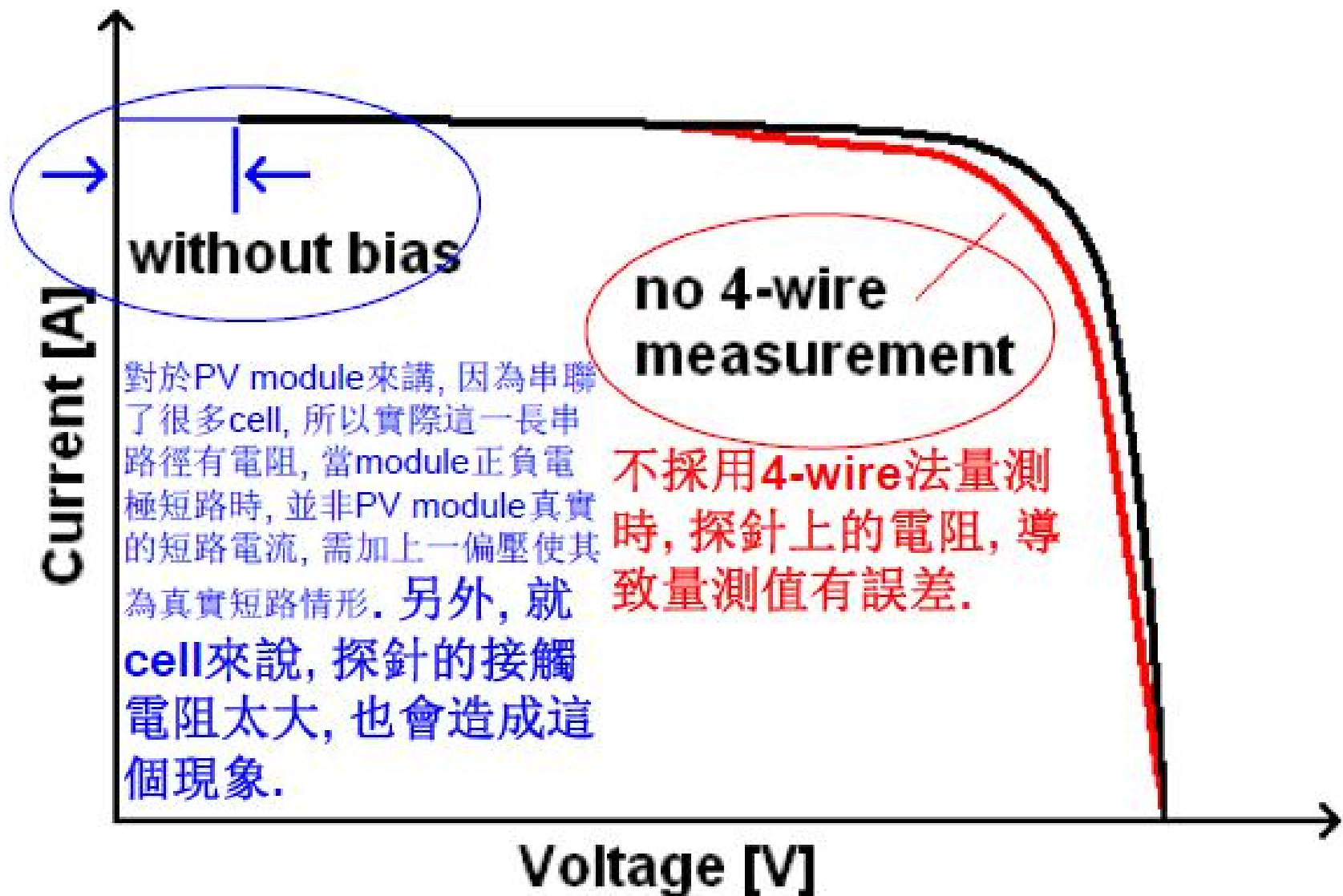
DS-1000 IV Curve Tracer

户外I-V测试仪



相同的遮挡面积，但不同的遮光方式，对发电所产生的不同影响能通过I-V测试方便的检测出来。因而户外I-V测试仪是电站的必备诊断工具。

4-wire measurement 四线制测量方法



美国Daystar多通道户外I-V测试系统

DAYSTAR

Multi-Tracers

A complete, self-contained, system for evaluating PV modules

Daystar MT5 Multi-Tracers, DS-3200 and DS-2400, control and monitor performance of multiple PV modules. I-V curves, average performance, weather data are collected and stored. Customized to user specifications.

- Two load sizes; 2400 Watts, 3200 Watts, expandable to 4 load units per control unit
- Up to 16 PV modules, expandable to 64
- 24 thermocouple inputs, expandable to 56
- 8 analog voltage inputs
- Independent PV module control, PPT or fixed voltage
- I-V curves at user-selected intervals
- Network device with on-board data storage
- Web browser access and setup



户外多通道I-V测试仪 Daystar Multi-Tracers

测试精度业内最高！达0.1-0.2%



Control Unit
控制单元



Load Unit
负载单元

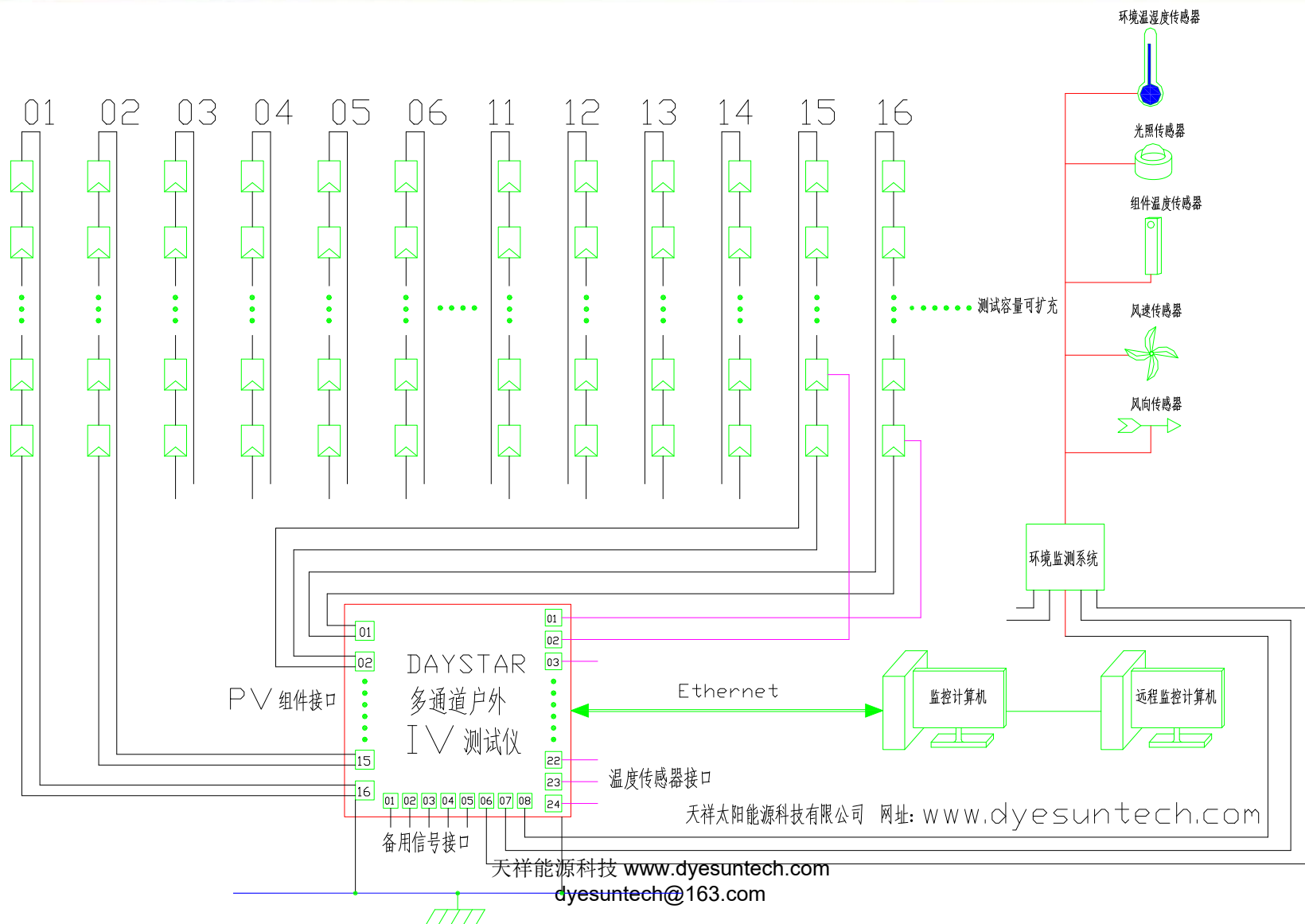
Daystar Multi-Tracers 多通道I-V测量仪

测试精度业内最高！达0.1-0.2%

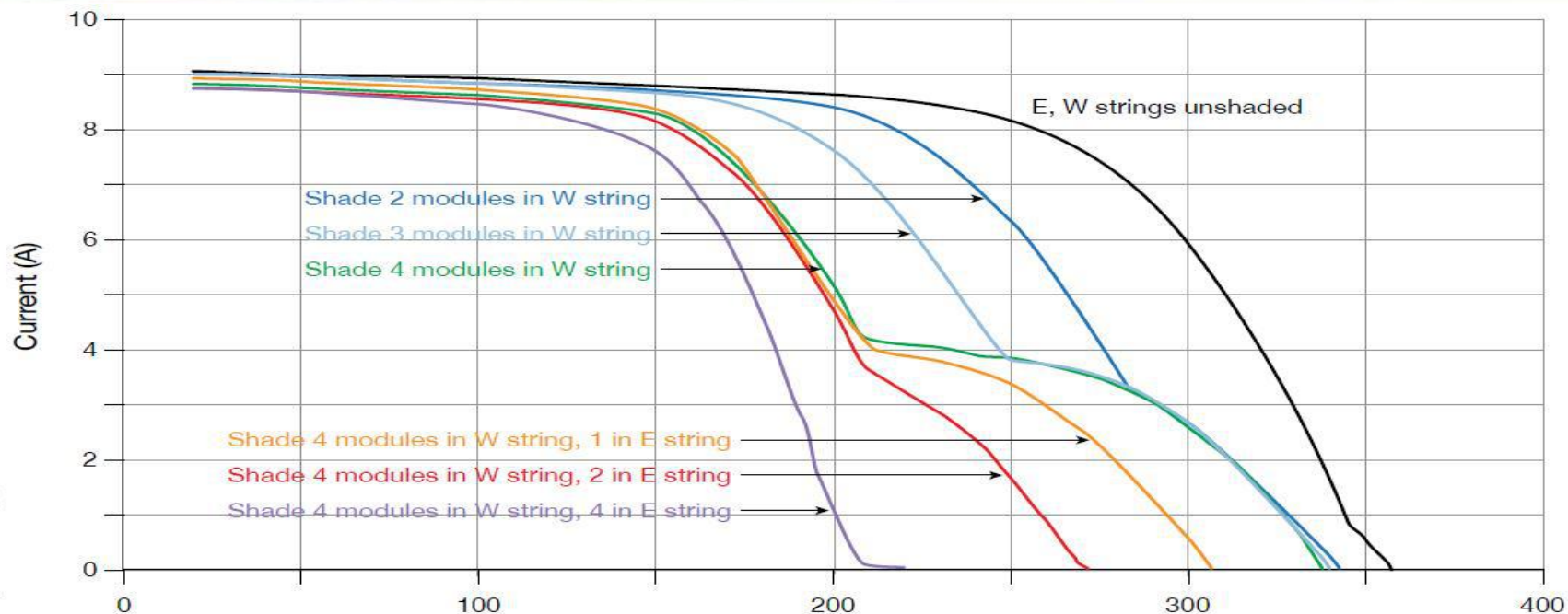
- Up to 16 PV Module Inputs per Load Unit Four-Wire Voltage Measurements
- 能同时监控16块PV组件，四线制电压测量方式
- Up to 56 Thermocouple Inputs - Control Unit
- 56个热电偶（组件温度监控）输入端口
- 8 Analog Voltage Inputs - Control Unit
- 8个电压输入端口
- Mating Connectors Provided
- Daystar的户外多通道IV测试仪能真实模拟组件实际工作状态，具有**MPPT**功能，能自动追踪**MPPT**，也可以通过设定组件在**某一特定电压值**情况下工作。Daystar的户外多通道IV测试仪的负载可以消耗组件或阵列的能量，并对**户外组件发电情况监控（如电流、电压、功率、发电量）**。

Daystar 户外多通道IV系统测试原理图

diagrammatic sketch for Multi-Tracer

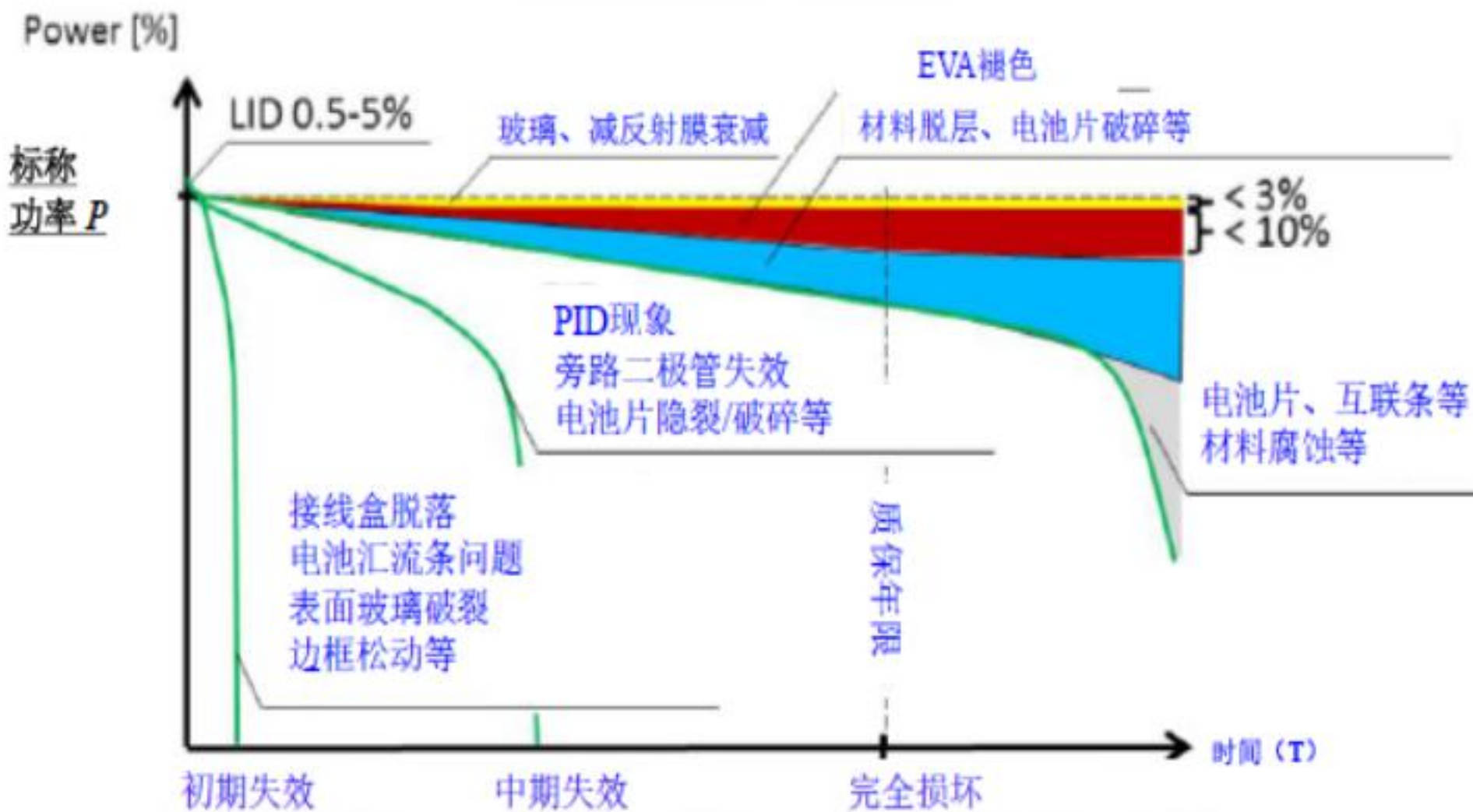


Multi-Tracers 多通道I-V测量仪



- Comprehensive PV Module Test System
- Long-term Comparison of Module Performance

光伏组件发电性能衰减....



Source: Marc. Köntges, Haitao. Liu, etc, Review of Failures of Photovoltaic Modules, Report IEA-PVPS T13-01:2014

PV Array Performance Troubleshooting Flowchart

Brought to you by Solmetric
www.solmetric.com



START

Does measurement return a useful I-V curve?



NO

Are the test leads connected?
Are PV modules interconnected?

YES

No I-V curve?

Check for missing or blown fuses, and for open circuit or external string conductors. Check for burnt marks on module edges, conductors, overvoltage module junctions, or bad PV connections. Replace affected modules.

Drop-outs in I-V curve?

Notice vertical dropouts (downward spikes) in the I-V curve may be caused by intermittent electrical connections in the PV source circuit. Troubleshoot as applicable and repair.

YES

PF > 90% and normal shape?

PF = Performance Factor
Pmax measured / Pmax predicted

YES

Save Data & Test Next String

NO

Steps in the I-V curve?

NO

Low Isc?

NO

Low Voc?

NO

Rounded knee?

NO

Low Voltage Ratio? Vmp/Voc

NO

Low Current Ratio? Imp/Isc

YES

Is the irradiance sensor oriented in the plane of the array?
Does it have the same size of the obj on the string under test?
Is the sensor free of reflections?
Is the correct module selected for the PV model?

Uniform soiling? YES: Clean modules and re-test.

Dist damage? YES: A string of shade or soiling that is consistent across the string can reduce current without causing steps in the curve. Re-test after cleaning or removing shade.

Step-shade? YES: Possible performance degradation. Re-test in future to reveal trend.

Is the thermometer attached at a typical temperature location, and is it contacting the module backsheet?

Low by multiple of cell group Voc? YES: Possibly shaded bypass diodes, especially if Voc is reduced by a multiple of the Voc of a cell group. Locate the module using Selective Shading Method. Replace affected modules.

Combined with other deviations? YES: Possibly Potential Induced Degradation (PID), especially if combined with reduced PF Factor. Replace affected modules.

NO: Replace module or test in future to reveal trend.

Tapered shade or soiling across modules? YES: Re-test clean and un-shaded.

Slightly current-mismatched modules? YES: I-V curve may show increased slope in the horizontal leg, with or without slight steps. Document trend module types.

NO: Possible degradation of cell current response. Bottom shorts may be visible to IR imager or to the eye. May also be symptom of PID. Possible module replacement.

Mismatched modules? YES: A string of modules with significantly mismatched currents will show slight steps along the I-V curve.

Random soiling, debris or snow? YES: Clean modules and re-test.

Shading? YES: Obstructions or re-test in an un-shaded area.

Cracked cells? YES: Check cell, may not be visible to the eye. Find the cell module using the Selective Shading Method. May be caused by module degradation if cracked segments are visible. Replace module.

Burn marks? YES: Replace module.

Check again for shade. Diffuse shade is hard to detect by eye. Look for more distinct shadows alongside the array. Light reflected from nearby objects can also cause steps. When testing strings in parallel a step in the curve can also be caused by a shorted bypass diode.

STILL TROUBLESHOOTING

For best performance measurement accuracy, measure with irradiance > 700W/m² in the plane of the array.

A bad PV module can often be identified without disconnecting modules from one another, using the Selective Shading Method. For a string of N modules, measure the I-V curve N times, applying hard shade to a different module each time. Cover at least two cells in each cell group. Shading the bad module bypasses it and returns a normal curve shape. In the case of a shorted bypass diode, shading the bad module causes a smaller drop in Voc.

See the NREL module inspection checklist at www.nrel.gov/docs/fy12tech/56154.pdf. To contribute to NREL research, send failure observations to Concise.Packard@nrel.gov.

Possible cell degradation (ideality factor). Re-test in future to reveal trend.

Are the busbar run wire length & gauge correctly accounted for in the PV model?

Possible high series resistance. Check modules and string wiring for bad connections or overheating. Replace affected modules.



Measure Your Return On Irradiance

Solmetric PV Analyzer
1000 V I-V Curve Tester
Built-in 1000V PV Performance Monitor
(Power) (Data) (Data) (Data)

Thanks to NREL, Solmetric, and other partners for contributions to this project. Contact: Paul Hargis, paul@solmetric.com

For support or to learn more about Solmetric, visit www.FreeSolarPerformance.com

天祥科技 www.dyeSuntech.com 400-6892-163

Customers 客户群

- National Laboratories
- Testing Organizations - Certification
- Universities
- PV Companies

- Australia
- Canada
- China
- India
- Israel
- Italy
- Japan

- Korea
- Saudia Arabia
- South Africa
- Spain
- UAE
- And so on....

- BP
- First Solar
- DuPont
- Sharp
- 3M
- Boeing
- EMCORE
- PV
Powered
- Skywatch
- And so on....

IEA（国际能源署）组件户外实证检测实验室

15个实验室有一半以上选择的是美国**Daystar**户外多通道IV测试系统，设备认可度非常高，测试数据获得成员实验室广泛认可

15个实验室

AIT - Austria

TUV - Germany

GANTNER – Austria

SUPSI - Switzerland

KU LEUVEN - Belgium

ISE - Germany

UU - Netherlands

INES - France

UC - Cyprus

IEE.CAS - China

SANDIA - USA

NREL - USA

CSIRO – Australia

NIST - USA

LABORELEC - Belgium

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User's Manual for Data for Validating Models for PV Module Performance

W. Marion, A. Anderberg, C. Deline, S. Glick, M. Muller, G. Perrin, J. Rodriguez, S. Rummel, K. Terwilliger, and T.J. Silverman

客户用Daystar设备所完成的实验测试及在国际刊物发表的论文！

NREL is a national laboratory of the U.S. Department of Energy Office of Energy Efficiency & Renewable Energy Operated by the Alliance for Sustainable Energy, LLC

This report is available at no cost from the National Renewable Energy Laboratory (NREL) at www.nrel.gov/publications.

Technical Report
NREL/TP-5200-61610
April 2014

Contract No. DE-AC36-08G028308

- Daystar data acquisition system and thermocouple data logger to gather data
- Collect IV curves and temp data every 2 minutes over a mostly clear sky day
- Estimated measurement error is +/- 2.5%

Figure 1 shows Sandia's weather station and Figure 2 shows Sandia's primary dual-axis tracker.

Thermal testing was performed under clear, stable sky conditions, typically within two hours of solar noon. The front of the module under test was covered and the

the procedure. TÜV-PTL used a multiplex relay switch controlled by a data acquisition system (DAS) to switch connections from one module to the next with the DS-100 tracer. As shown in Figure 3, TÜV-PTL used four-probe connections from the multiplexer to the Daystar and two-

tem to be series and

respond with readings that are less than

temperature also gives

such as the character-

system or condenser, lose to meter and a total irradiance of the we been films, the el), and

- Meteorological parameters. Wind speed, wind direction, direct and diffuse irradiance, air temperature, and barometric pressure are monitored and recorded on-site continuously.
- User-controlled bias conditions. The user can set conditions, such as the range and polarity of the voltage, and then test the module I-V characteristics over an extended range, under reverse or forward bias, and more.
- Reference-cell calibration. This system is also used with the primary reference-cell calibration facility to evaluate concentrator modules.

Daystar DS-10/125 Portable I-V Curve Tracer

Like the SOMS, this system is used to make module I-V measurements under prevailing outdoor conditions. But it is typically used only when the sample is too cumbersome or impractical to disassemble and remount on the SOMS test bed. The total irradiance is measured using a pyranometer mounted in the same plane as the sample.

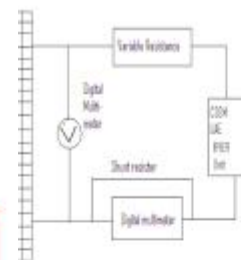
Features/Advantages

- Portable. This provides us with the capability of going to the sample and measuring in place.
- Line or battery powered. May be powered either with a 120 V_{AC} line or with a 12 V_{DC} battery.



The Daystar DS-10/125 Portable I-V Curve Tracer is being set up to measure I-V characteristics of large-area silicon modules mounted at the NREL outdoor test facility.

Resolution/Limit	Current Resolution/Limit
0.100 V	0.5 mA to 20 A
0.100 V	500 µA to 50 A
0.300 V	±1 µA to ±80 A
0.300 V	±1 µA to ±80 A
1.600 V	5 mA to 125 A



ic circuit diagram of PV module system

Characterization of PV module

It can be performed by placing module on set-up. CSEM-UAE is equipped with I-V curve tracer. Day star I-V curve IM-UAE AMCU flyer unit have been the I-V characteristics of PV modules.



I-V curve tracer

generates a complete current-voltage characteristics of photovoltaic system using conditions. It obtains an I-V curve electrical impedance connected across or array output terminals. Varying the m zero to infinity causes the array to change from I_{sc} to V_{oc} . The simplifies this impedance change by module or array to a capacitive load. As charges, the array moves through its

operating range and presents a set of current and voltage values that form the I-V curve. This system can provide I-V characterization up to 50 kW systems.

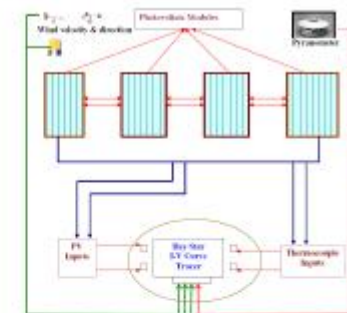


Fig. 3: Schematic diagram for I-V characterization of PV module or PV array

4. Experimental Results and discussion

PV module outdoor testing facility was installed on the roof of CSEM-UAE Innovation Center, at Ras Al Khaimah (Longitude: 25.6° N, Latitude: 55.9° E), United Arab Emirates.

For experiments multi-crystalline silicon (Model NIS-QSE2E, Sharp Electronics Corporation, USA) rating 165 peak power has been chosen. PV module was mounted as standalone at a fixed tilt angle of 30° facing true south. Table I shows electrical parameters of PV module.

Table I: Electrical parameters for experimental PV module

Sharp No. QSE2E		
Parameters	Unit	Value
Open Circuit voltage (V_{oc})	V	43.3
Maximum Power voltage (V_{mp})	V	34.6
Short Circuit current (I_{sc})	A	5.46
Maximum power current (I_{mp})	A	4.77
Maximum power (P_{max})	W	165
Uncapacitated solar cell efficiency (η_c)	---	14.6
Module efficiency	---	12.7

OUR TRANSACTIONS OF THE ASME, THE JOURNAL OF Energy Engineering, Special Issue: Solar Thermal Processing, Vol. 123, No.2, pp. 194-199, 1.

his paper is a contribution of the National Standards and Technology and is not subject to

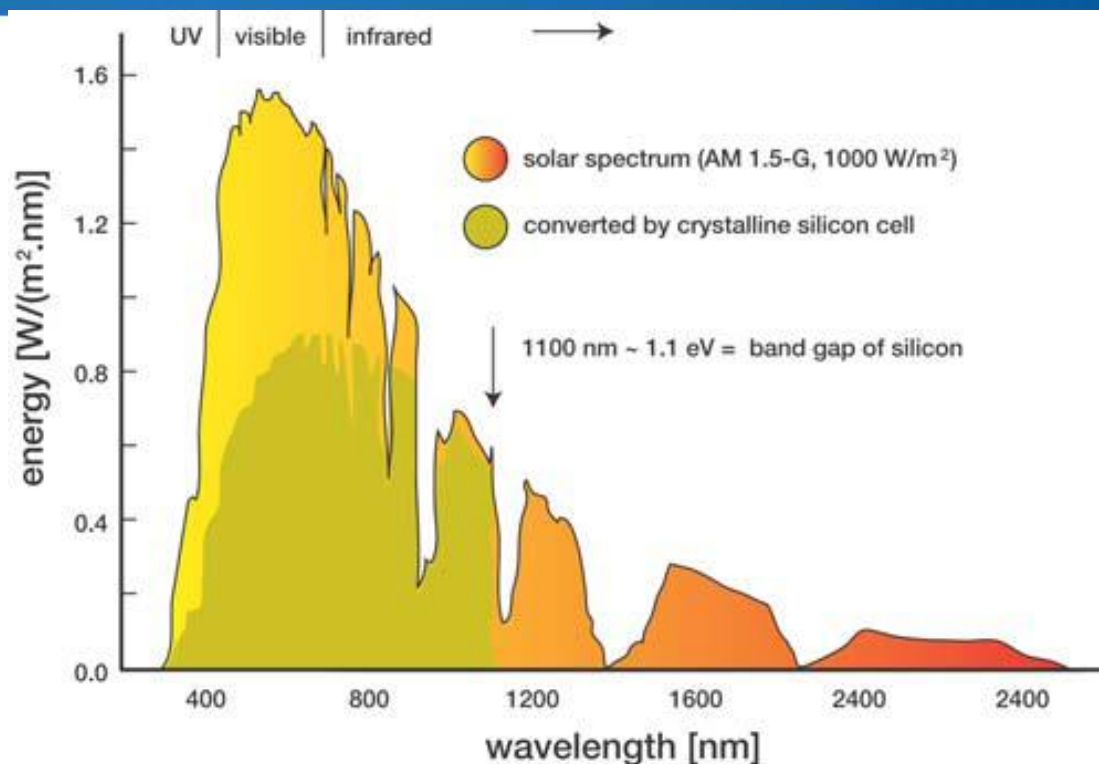


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太阳辐照度测试仪 (portable solar meter)



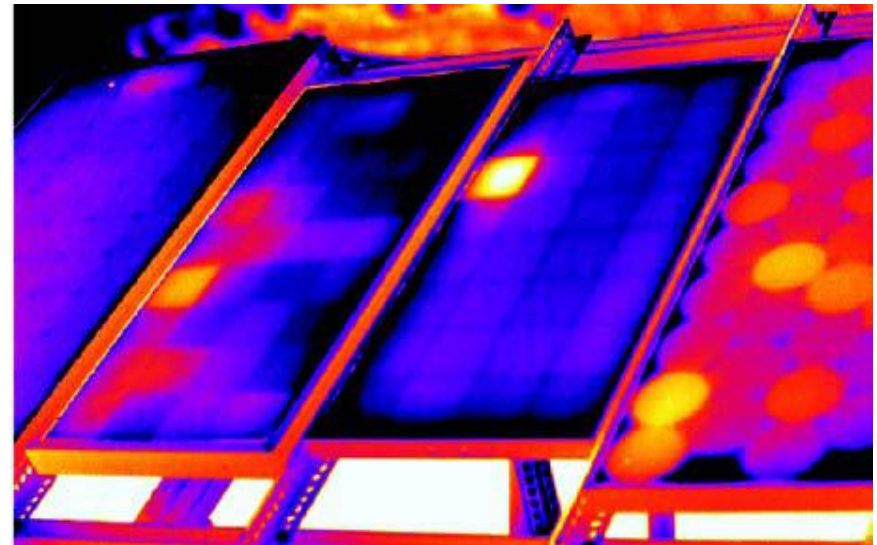
The solar meter provides an accurate reading (3%) from 0 - 1200 Watts/m² when they are pointed at the sun. Resolution is 1 W/m², maximum display reading is 1999. The irradiance value is presented on a 0.75" easy-to-read LCD display. The meter is (2.5" x 4.5" x 1.0" inches) (6.4 x 11.4 x 2.5 cm) and weighs (less than 5 ounces) (140 g) with the 9-V battery installed.

The meter PV cell sensor responds to light from approximately 500 to 1100 nanometers.

红外热成像仪（ thermographic measurement ）

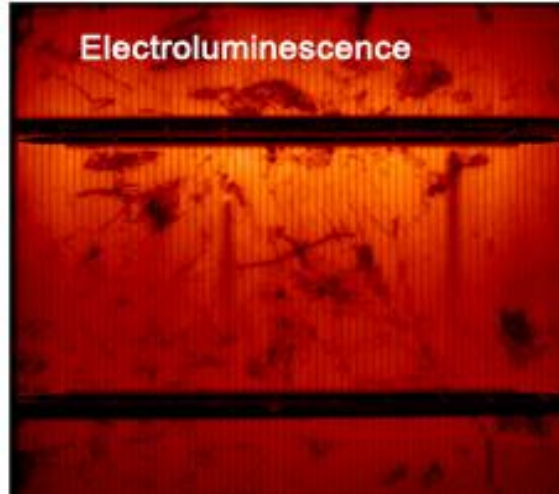
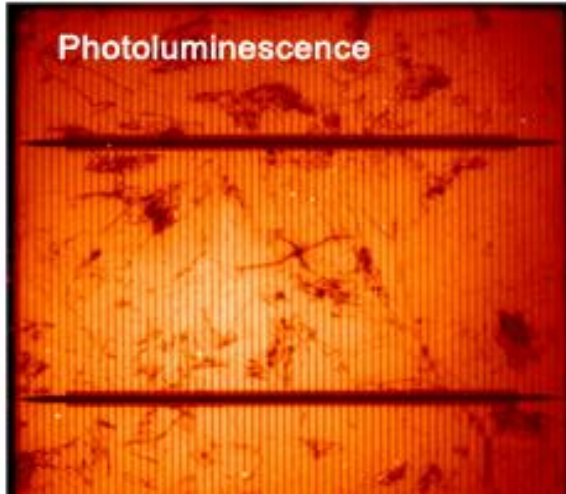


红外热成像技术可以方便的发现电池或组件出现的问题，同时具备速度快、准确率高的优点。即使对安装面积极大的光伏电池，组件，系统，设备进行检测，也可对可能存在的问题提供一个明确的判断，在业内使用非常广泛。



光伏电池及组件用电致发光和光致发光测试系统

EL(Electroluminescence) 和PL (Photoluminescence)



	Electroluminescence	Photoluminescence
Requirements	Electrical contacts are necessary.	No electrical contacts needed.
Substrates	Solar Cells, Strings, Modules	Wafers, Solar Cells
Materials	mono-Si, poly-Si, a-Si, micro-Si, CIGS, CIS, CdTe	mono-Si, poly-Si
Measurement time	0.5-1 sec for mono-Si or poly-Si	0.5-2 sec for mono-Si, poly-Si
Informative Value	Cracks, Shunts, Finger defects, Deposition problems, bad edge isolation, ...	similar to EL, problems of the electrical grid system typically not visible

户外便携式EL测试仪

DISCOVER WHAT
THE EYE CAN'T SEE



On-site

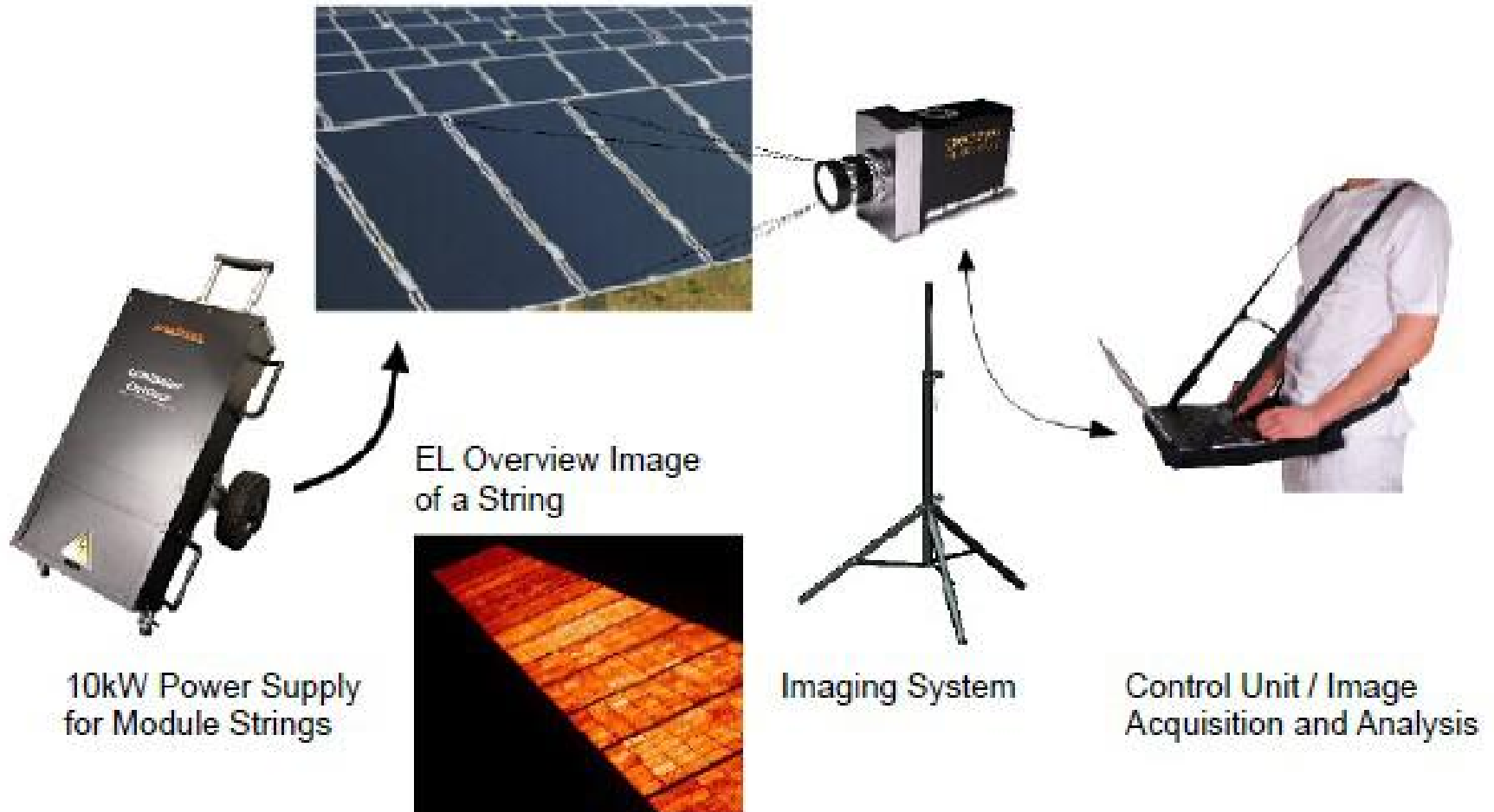
**Electroluminescence Inspection
of Photovoltaic Modules**

户外EL测试简单便携



户外EL测试简单便携

Schematic measurement set-up:



户外EL测试简单便携

SolarOutdoor Systems



- no demounting
- saves time and costs
- quick and reliable method
- mobile, lightweight equipment
- no damages due to assembly work
- single module / string version available
- measurements in the open air at twilight/night



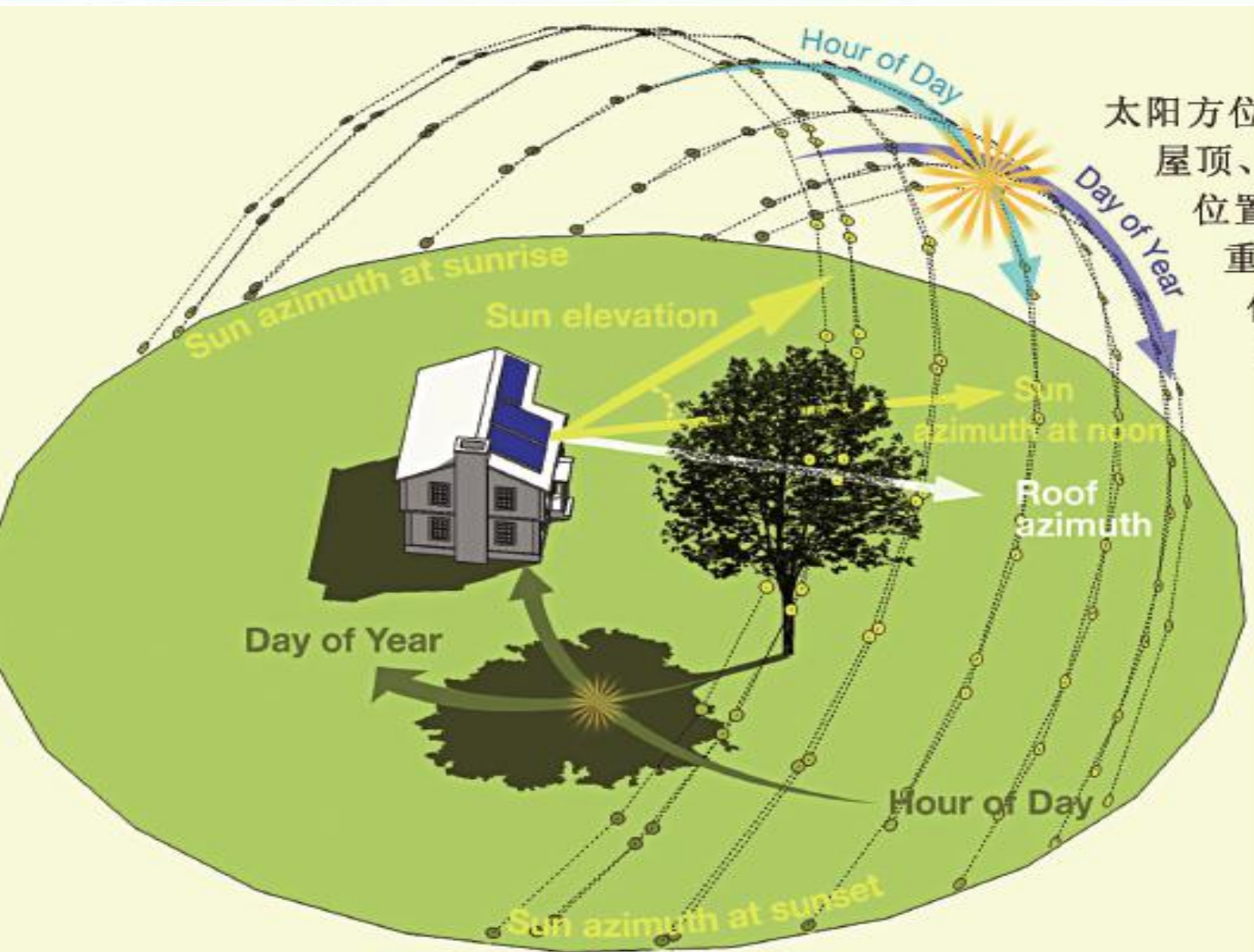
Insulation Resistance and Continuity Testers



- ✓n Insulation testing up to 1000 V and 200 GΩ
- ✓n Patented analog arc and dual digital display
- ✓n TRMS & DC Voltage measurement
- ✓n Continuity testing at 200 mA or 20 mA down to 0.01
- ✓n Pass/Fail limit alarms
- ✓n PI/DAR and Timer function
- ✓n Test result storage
- ✓n Bluetooth® wireless data transfer
- ✓n Measurement of capacitance and distance by capacitance
- ✓n User selectable test voltage in 1V increments from 10V to 100V
- ✓n Three year product warranty
- ✓n IP54 rated



光伏（光热）系统太阳阴影分析仪 shading analysis



太阳方位角和倾角对于太阳、屋顶、阵列、以及障碍物的位置和朝向的确定是非常重要的。太阳位置的变化会导致太阳相对太阳能阵列方位角和倾角的变化。这些弧线图显示了在每年不同的月份里太阳的运行轨迹，箭头表示太阳位置的变化。



太阳影子分析仪



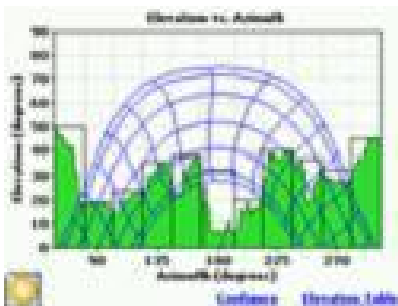
太阳能光伏系统或太阳能热水系统的太阳辐照量的利用率将直接影响在该太阳能系统上投资回报率的盈亏。精确的阴影分析，以及前期的太阳能系统的设计规划，对最大化地增加太阳能系统的太阳能能量的利用率，以及预测太阳能系统的太阳能能量的利用率有着重要的作用。

太阳能应用领域的专家都广泛应用太阳影子分析仪，完成对整年太阳运

行轨迹，以及各障碍物对太阳能阵列所造成的太阳影子影子的分析。该设备使用简单，只需按动该设备的按钮，分析结果就自动显示出来。采用经过校准认证的鱼眼摄像头

(fisheylens)对整个天空进行测量，测量对象包括水平面和障碍物，如树、烟囱、和建筑物等。测量角度是从太阳能光伏(热)阵列的角度进行测量的，测量结果结合太阳在经纬度的运行轨迹，从而确定各种障碍物产生阴影的效果图，并计算出太阳能阵列对太阳辐照度的可运用率。操作者通过设备可以观察到什么地方和什么时候阴影将会出现，以及太阳能光伏组件应安装在何处可以最大化的降低太阳阴影的影响，从而使太阳能光伏组件发电量最大化。该设备还提供添加和删除障碍物分析功能，及通过模拟添加或删除障碍物，分析光伏组件发电量的变化量。

太阳阴影分析仪shading analysis



产品主要特征

1. Digital camera with calibrated fisheye lens
2. Bubble level and Compass
3. Two-Handed Operation
4. Worldwide weather data
5. Data views: Annual sunpath, monthly solar access, obstruction elevation
6. Edit mode to add or remove obstructions
7. Bluetooth GPS add-on (Optional)
8. Desktop software for use on Windows PC
9. Export reports for printing and emailing results
10. Export files for other popular simulation programs

产 天祥能源科技 www.dyesuntech.com

更多信息 www.dyesuntech.com/_d274493277.htm

Site assessment and energy prediction 选址评估与发电量预估

Sunpath, Shading,
Orientation
太阳行程, 阴影, 朝向



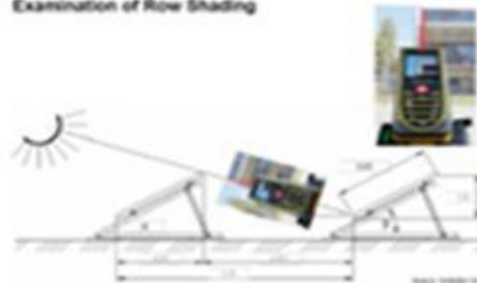
GPS



Inclination of row
阵列倾角



Examination of Row Shading



各国内外检测认证机构都采用本产品（太阳阴影分析仪）
进行光伏系统发电量的评估与光伏系统设计。

太阳阴影分析仪



新版太阳阴影分析仪，测试速度更快，能够存储的数据更多，阴影模拟分析功能得到了进一步的优化，分析功能更强、准确。

硬件方面：升级为数字罗盘，方位指向更准确。内置了**GPS**、其新版太阳阴影分析仪体积小轻便，如果配置支撑杆的话，还可以方便的对屋顶的阴影情况进行分析。

总的来说，新版太阳阴影分析仪是在旧版的基础上全面升级的一款产品。新版太阳阴影分析仪的质保期为**2**年。

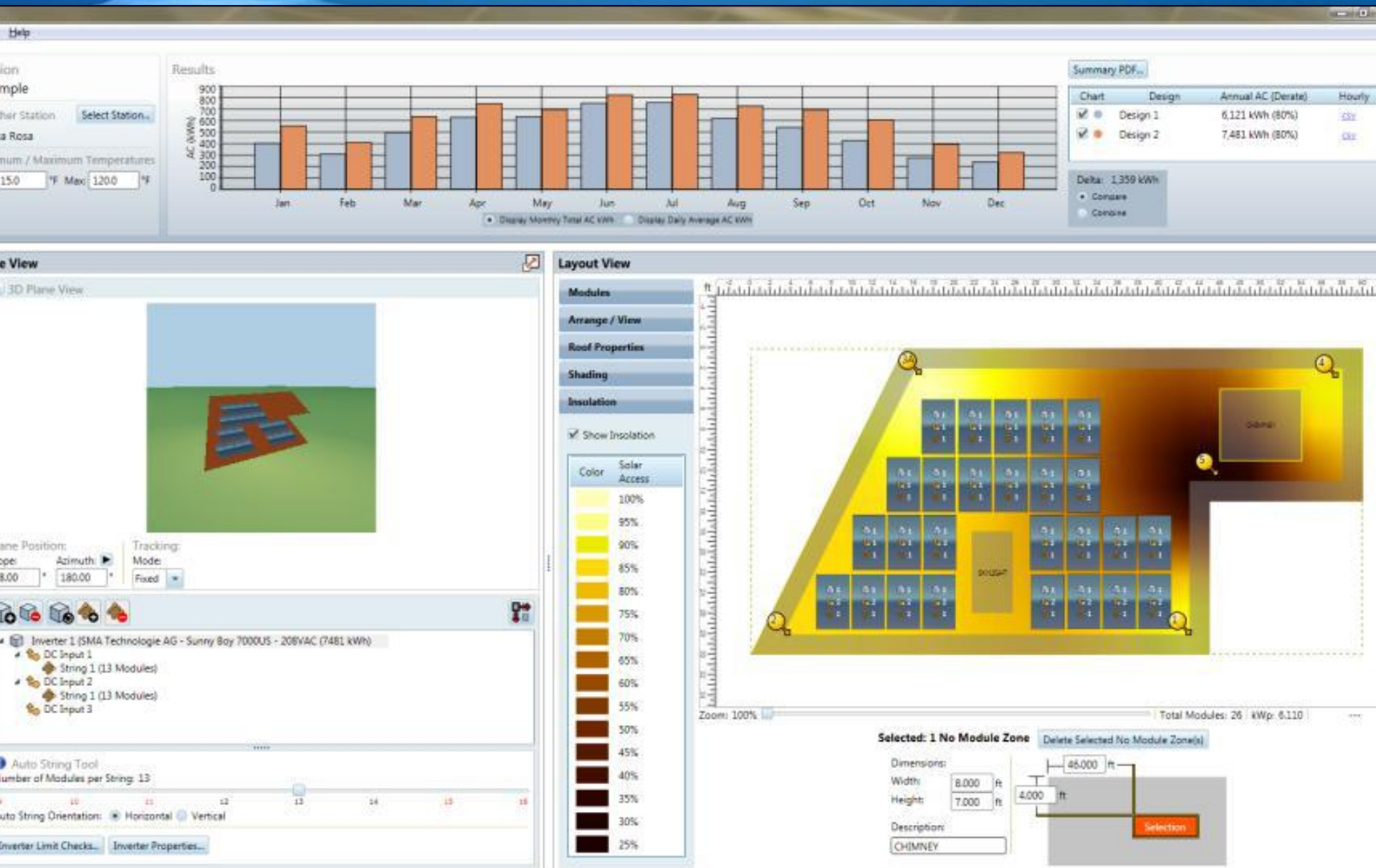


产品

科技 www.dyesuntech.com
技术支持 esuntech@163.com

www.dyesuntech.com/_d275398267.htm

光伏电站设备软件 (PV design software)



光伏电站及新能源电站实时监控系统（软件+硬件）

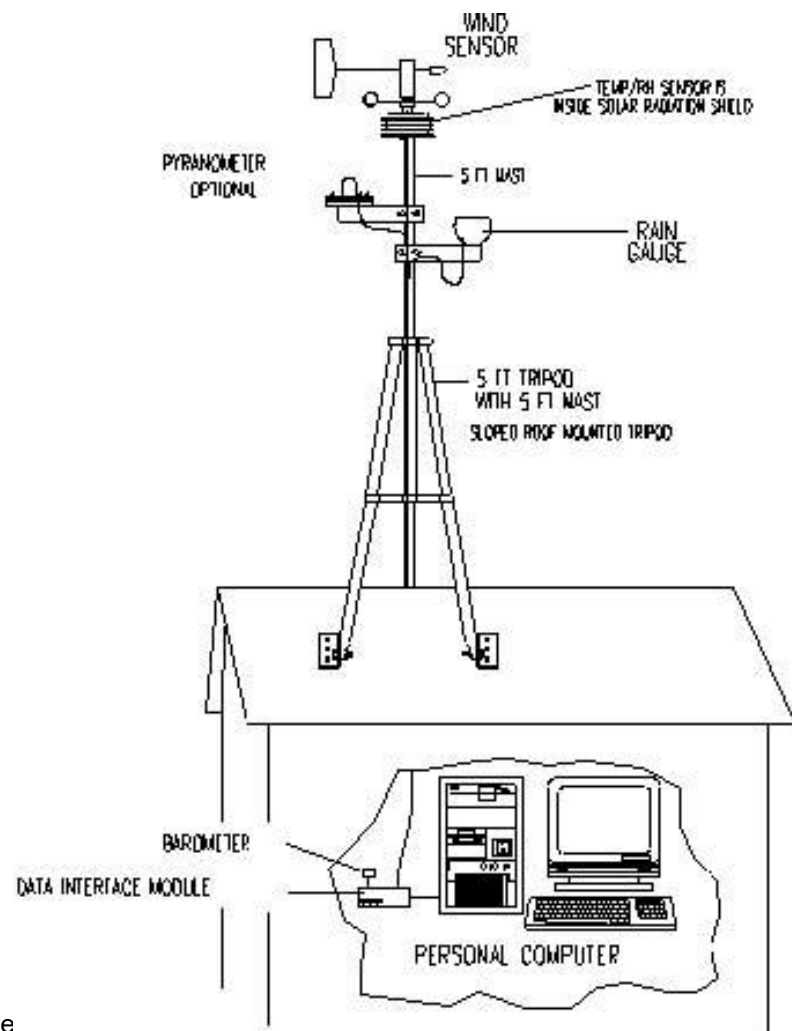
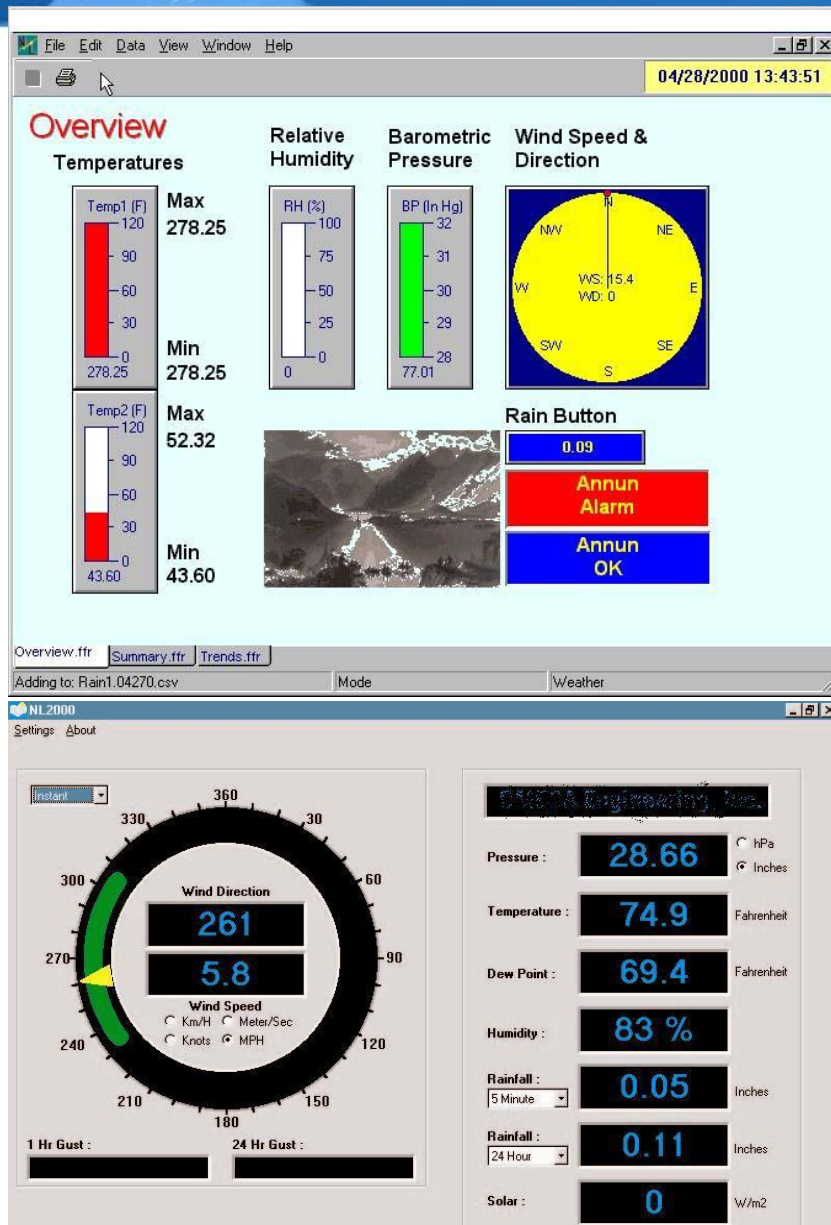


户外气象检测台 *Solar Monitoring Station*



该户外气象检测台的标准配置可通过控制器对风速、风向、温度、湿度以及降雨量等气象信息进行收集和分析。并且该户外气象测试台对其它气象传感器具备很强的兼容性，客户可以根据需要，通过增加相应的传感器，对关心其它的气象信息进行监控和数据收集，比如太阳辐照度。产品的这种定制化的功能扩展可由客户自行配置完成，也可由厂家配置而成，该户外气象检测台是户外光伏实验电站必备的实验设施。

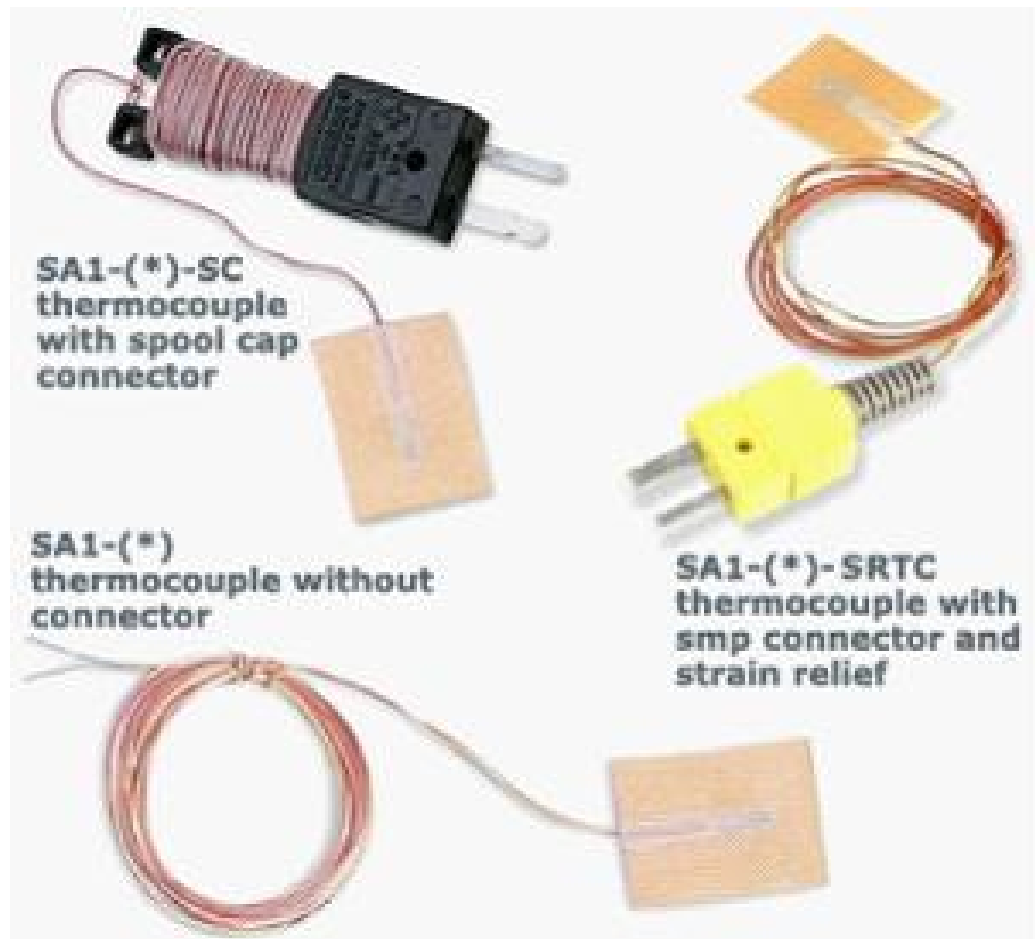
户外气象检测台 *Solar Monitoring Station*



v.dye
@163.com

高灵敏度可自粘式热电偶温度传感器

Thermocouples+高灵敏热电偶延长线



快速反应性自粘式热电偶，型号构成:(J,K,T,E)-(72,120,SRTC,SC),快速反应性自粘式热电偶,自粘式基材便于安装,优于**0.3秒**反应时间, **PFA**绝缘导线,可达到**175° C (350° F)** 并能维持较长时间,有J,K,T,E等规格热电偶。粘合剂:硅衬底接合剂 最高温度: 热电偶分度: J (铁康铜), K (**CHROMEGA®-ALOMEGA®**), T (铜 康铜), E (**CHROMEGA®-Constantan**) 最低温度: 持续 **-60° C (-75° F)** 尺寸: **25 L x 19 W x 0.3 mm (1 x 0.8 x 0.01")**层板: 高温聚合物和玻璃纤维加固聚合物面板 导线: **30 AWG** 外涂 **PFA**

多通道温度记录仪（8/16通道或更多）



HD32.8.8 and HD32.8.16 probes
All the thermocouple types K, J, T, N, R, S, B, and E can be connected using a standard miniature connector.
Other sizes are available on request.

HD32.8.8 and HD32.8.16 accessories
BCPR8232: Connection cable with sub D 9-pole female connectors for RS232C (full modem)
CP22: Connection cable USB 2.0 connector type A - connector type B
BAQ32.2: Carrying case for the HD32.8 instrument and accessories
HD32CS: Carrying strap
SWD10: 100-240VAC/12VDC-1A stabilized mains power supply
VTAP32: Tripod complete with 6-input head and 5 probe holders code HD3218K
HD3218K: Shaft for another probe

产品名称:

温度记录仪，热电偶输入（8/16 路）

产品型号:

RDHD32.8.8/HD32.8.16

简介说明:

热电偶输入（8/16 通道）

大屏幕显示

可存储 800, 000 万个数据

15 按键简易操作，可不用连接至 PC 机设置
密码保护



高精度日射强度计 Spectral Pyranometer



The Precision Spectral Pyranometer, is classified as a ISO Secondary Standard or WMO High Quality Pyranometer.

- 该精密辐射传感器是世界气象组织（WMO）一级辐射表，用于测量太阳和天空辐射，适应很宽的波长范围。
- 由一个组合热电堆电路组成，可以很好的抵抗机械震动和打击。传感器的接收器有一层Parson黑漆，底部为一个半球型玻璃顶罩。
- 玻璃半球使用的是WG295玻璃，对于0.285-2.8um的波长具有非常好的透光性，而且能量传输非常的均一。
- 传感器包括一个水平调节装置，一个水平泡和水平调节螺栓以及一个干燥器。
- 传感器外壳为铸造青铜体，外层为白色珐琅遮蔽盘，传感器的标定可溯源WRR，含温度补偿曲线。

高精度日射强度计关键参数

Precision Spectral Pyranometer



The Precision Spectral Pyranometer, is classified as a ISO Secondary Standard or WMO High Quality Pyranometer.

- **Classification:** ISO Secondary Standard Pyranometer / WMO High Class
- **Response Time (95%):** 10-15 seconds
- **Zero Offset to 200 Wm⁻² net radiant loss to sky:** 4-6 Wm⁻²
- **Zero Offset to 5° C/hr change in ambient temperature:** 1-2 Wm⁻²
- **Resolution:** < 1 Wm⁻²
- **Non-Stability:** <0.5% / yr (typical)
- **Non-Linearity:** ±0.5% from 0-2800 Wm⁻²
- **Directional Response:** < 10 Wm⁻²
- **Spectral Selectivity:** 1%
- **Temperature Response:** ±1%
- **Tilt Response:** < 0.5%
- **Achievable Uncertainty (Hourly):** 1-2 %
- **Achievable Uncertainty (Daily):** 1-2 %
- **Suitable Application:** Working Standard or Network Measurements

自动太阳追踪器

Automatic Solar Tracker



**Double Shade Disk Adaption kit
with Ventilators mounted on an
Solar Tracker equipped with a
Normal Incidence
Pyrheliometer, a Black and
White Pyranometer and, a
Precision Infrared Pyranometer**

直达日射仪由感应器、太阳追踪器及信息处理系统等部分组成。太阳追踪器上有纬度、经度与时间刻度，可以调整对准太阳。受光面吸收直射光后转换为热能，再输出至变换器或由信息处理系统处理。美国这款直达日射仪是目前世界上最适合光伏系统的一款仪器。

The Automatic Solar Tracker is a 2 axis, azimuth/elevation device programmed to align direct beam instruments with the normal incidence of the sun from any position on the earth's surface. Tracking is achieved using a computer program which calculates the solar position for the time and location and transmits pulses to the drives, which then operate the 2 stepping motors. The stepping motors move the elevation and azimuth axes to the correct position. After initial installation, the tracker will continue to track the sun and reset during darkness. Only periodic resetting of the system clock is required.

太阳直接辐射传感器 Incidence Pyrheliometer



该直接辐射传感器是世界气象组织一级辐射表，设计用于测量太阳直接辐射。该传感器底部为一个管，管内为热电堆电路。这个黄铜管的内部是黑色的，同时采用控光隔膜保护。在大气压力条件下，管内充满干燥空气，用一个1mm厚度的可查看的Infasil II材料密封。两个法兰，每端一个，用于提供直接对准太阳的视角管理。

· Classification: First Class

Pyrheliometer

· Response Time (95%): 10-15 seconds

· Zero Offset to 5° C/hr change in ambient temperature: 1-2 Wm⁻²

· Resolution: < 1 Wm⁻²

· Non-Stability: <0.5% / yr (typical)

· Non-Linearity: ±0.5%

· Directional Response: < 10 Wm⁻²

Spectral Selectivity: 1%

INCLUDES
SolarCert
Elements
Software for a
limited period
only.



该工具包满足以下标准所有测试项目：
《并网光伏发电系统工程验收基本要求》

CGC/GF003.1：2009

IEC62446并网光伏系统安全认证测试

MCS光伏系统安全认证测试

该工具包含以下测试功能：
1.可测试太阳辐照度
2.可测试阵列倾角
3.可测试组件及环境温度
及IEC62446要求的所有测试



Solarlink™ Connectivity



Solarlink™ connectivity enables irradiance to be displayed and for irradiance, module and ambient temperature to be recorded with the PV150 in real time as electrical tests are conducted.

太阳能设备安全测试工具包是：目前市场上技术最先进、功能最齐全、最易于使用的光伏发电系统 检测验收的工具包。该测试工具包将光伏系统验收标准中的所有光伏系统安全测试要求融合成一体，集六大测量功能于一款、便携、易于使用。

应用对象：

太阳能光伏系统检测、认证机构、业主验收

太阳能光伏系统安装施工单位



NEW

Comprehensive PV Test Kit

Faster, safer, traceable PV testing

[Click to find out more](#)

SOLAR
FROM PEABODY



Professional test solutions for the Solar PV industry.

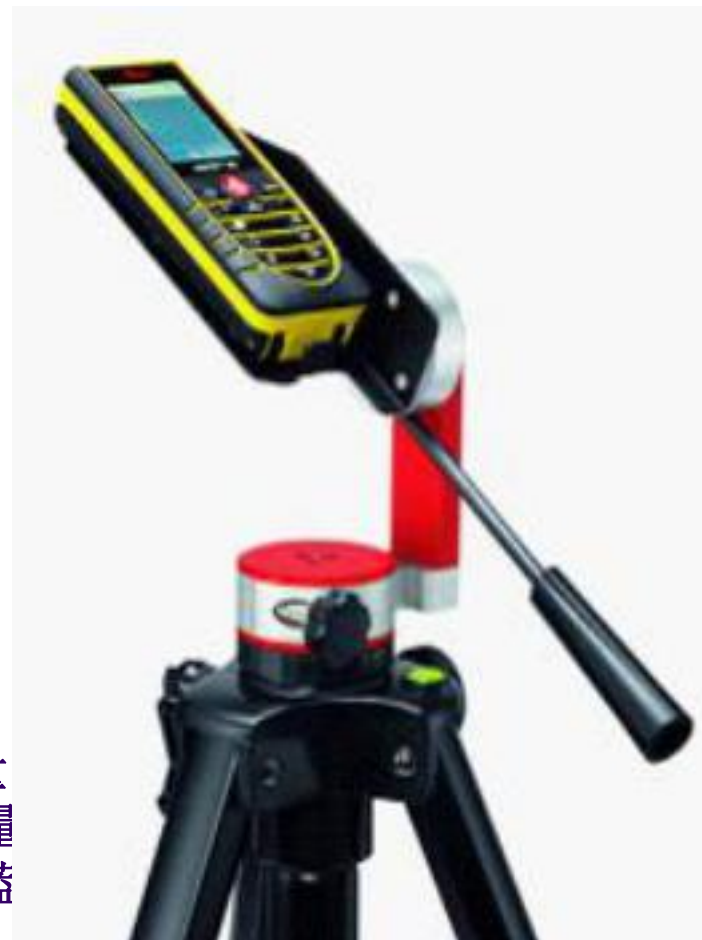
SEAWARD

V 928
365.8 V
I 8.53 A
3.12 kW
188 %

SEAWARD

SOLAR POWER CLAMP

太阳能光伏系统用测距（面积）仪 best solution for outdoor measuring



该激光测距仪广泛用于光伏系统的距离和面积的测量。还可方便的用于屋面电站（或BIPV）的面积测量。测量范围 **0.05 m ~ 200 m** 测量精度 **± 1.0 mm** 蓝牙无线传输 **360°** 倾角传感器 **4 倍数码变焦瞄准器** **2.4 英寸** 彩色大显示屏 间接测量功能 高度轮廓测量 多功能底座 梯形测量

太阳能光伏组件（光泽度、色差）测试仪



技术指标

角度	应用	测量面积
20°	高光泽	10×10mm
60°	中光泽	9×15mm
85°	低光泽	5×38mm
20°、60°、85	各种光泽	参见各角度
60°	中光泽	9×15mm
20°、60°、85°	各种光泽	参见各角度
45°	陶瓷、塑料、薄膜	9×13mm
75°	纸张、聚乙烯	7×24mm

测量范围 ¹	0-100GU	100-2000GU
重复性 ²	±0.2GU	±0.2%
重现性 ²	±0.5GU	±0.5%
光谱敏感度	用于CIE-C光源的观察器，符合CIE1931标准	
电脑连接线	USB和蓝牙Bluetooth®无线技术	
尺寸	155×73×48mm	
重量	0.4kg	

用于检测太阳能光伏组件背板的光泽度，色差等判定
以及光伏发电系统长期工作后背板材料表面老化状况

太阳能光伏系统安装工具 pv system installation k

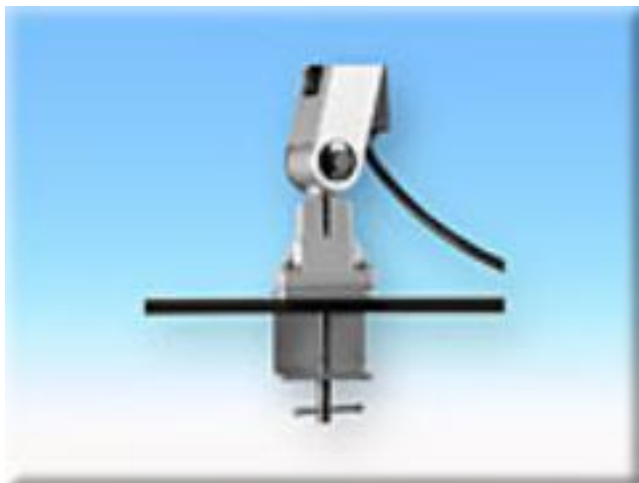


我公司供应的光伏安装工具，是根据行业客户定制研发的剪切、剥线和压接工具，特殊应用于光伏电缆和连接头，提供专业、可靠的作业效果，并确保达到相关的技术要求，能满足各种厂商的高精度需求，例如：**Ral GZ 966**等标准。

由于系统之间不能相互兼容，所以每种型号的连接头要求匹配不同的压模。可选配不同的定位器，确保快速、轻松和精密作业。



外观检查台用放大镜及光源



1、LPT放大镜光源拥有一个高透过率的放大镜，该透镜所选用的玻璃为可吸收紫外光的冕牌玻璃，该玻璃抗腐蚀和耐划伤能力强，玻璃折射系数为 $n = 1.52$ ；

2、放大镜配备的**环形光源**为被测物提供了极好的表面照明，保证观察范围不会产生阴影区；

3、方便调整透镜合适的高度和倾角。并可**全方位的**调整放大镜的观察范围。

- 臂展伸出范围: 约. 850 mm
- 下臂长: 约. 450 mm
- 上臂长: 约. 400 mm
- 桌夹张口范围: 0 - 50 mm
- 放大倍率 3x (6 dioptries)
- 透镜直径: 120 mm
- 质保期: 24 个月 (灯源除外)

便携式USB显微镜测试系统



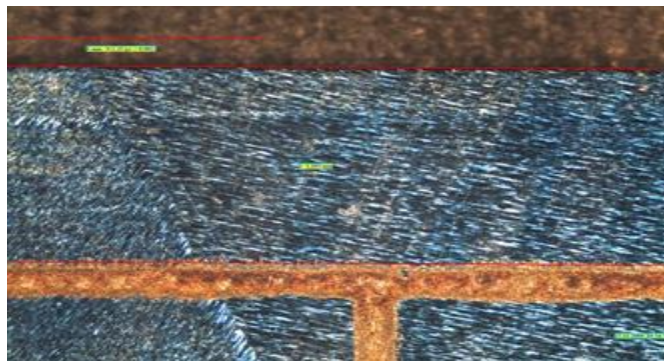
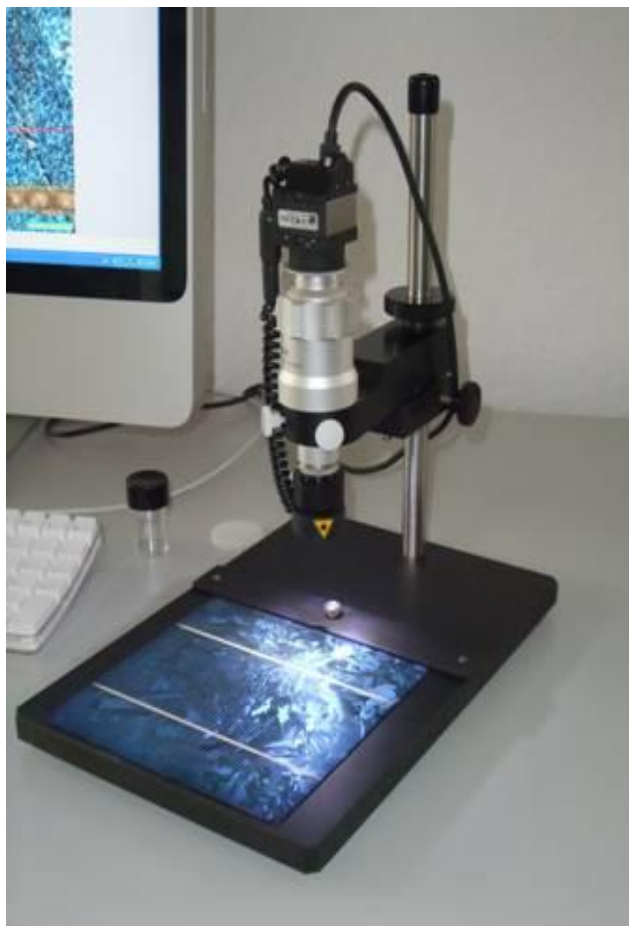
1、该显微镜便携、拍摄的图像通过USB接口快速传到电脑，并能完成量测。

2、该显微镜能方便的完成薄膜电池激光划线质量的检测，能对P1/P2/P3激光spot、激光线宽，以及激光线距的测量。



3、该显微镜可方便的携带到户外，对户外电站组件的缺陷进行排查。

小型便携式USB显微测量系统



※该便携式测量系统，可以方便带到现场对被测物体进行测量，如太阳能电池片组件。

※测量结果可通过USB接口直接将图像传到电脑进行快速方便尺寸测量。该显微镜自带照明光源。

便携式USB显微镜厚度测量系统



通过对被测物体上下表面的精确聚焦的方法，完成对被测物体厚度的测量

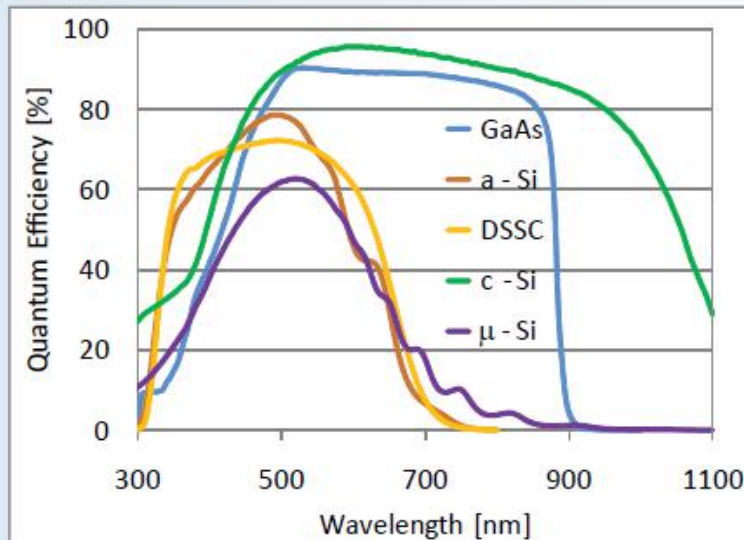
Matrix

以下参数中：视场面积的定义为水平方向。显微镜放大率的数据基于24"的显示屏，长度单位为mm。USB 2.0摄像机的像素为1600 x 1200 Pixels (1/2" Chip)

Tube length	Objective lens	2x	4x	6x	10x	15x	20x	30x
120 mm.	Working distance in mm	33	18	11	6	9	6	4
	Field of view in mm	2.4	1.2	0.82	0.5	0.33	0.23	0.17
	Magnification	90	170	260	430	640	840	1230

太阳能电池量子效率 (QE) 测试系统 Quantum Efficiency Tester

(目前该QE设备销售已超过**200**台, **冠**全球)



- ☒ Turn-key solution for solar cell analysis
- ☒ System of choice by standards laboratories
- ☒ Mature product - over 130 QE systems in the field
- ☒ Fast and easy installation
- ☒ Excellent repeatability
- ☒ Accurate measurements
- ☒ Light bias capability up to 100 mA
- ☐ DC mode measurement capability (optional)
- ☐ Measures reflectance and IQE (optional)
- ☒ ASTM Method E 1021-06 compliant

QE System Features:

目前该QE设备销售已超过**200**台, **冠**全球

- **Monochromatic light spectral bandwidth approximately 5 nm (user changeable)**
- **300 nm - 1100 nm wavelength range**
- **Selectable wavelength interval (default 5 nm)**
- **Dual grating monochromator with computer control**
- **Filter wheel with order-sorting and stray light attenuation filters**
- **Calibrated reference photodiode, NIST traceable**
- **Line filter for wavelength calibration verification**
- **Simultaneous measurement of device signal and light intensity**
- **Computer system with easy-to-use graphical user interface**
- **Data saved in text files for easy import into spreadsheets**
- **Voltage bias capability +/- 2.5 V**
- **White bias light source (up to 5 suns) with filter options**
- **Chopping speed 4 - 200 Hz**
- **Calculates Jsc estimate using reference spectrum AM1.5G or a spectrum of your choice**
- **Measures Si cells in less than 3 minutes at 10 nm interval**
- **Complete scan in less than 45 s for 12 wavelengths (minimum required for ASTM E 1021-**

06)

太阳模拟器 solar simulator



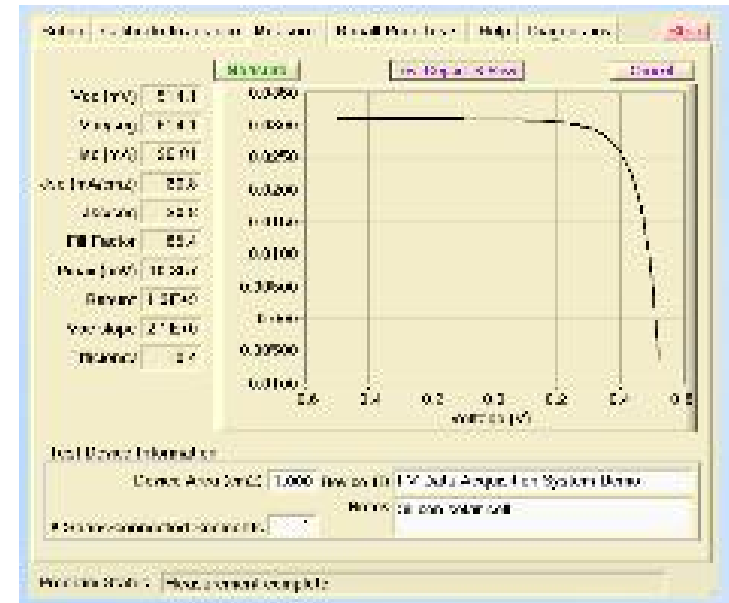
Class-ABA solar simulator with temperature control

Basic System Features

- ☑ Class-ABA solar simulator with continuous 16 x 16 cm beam
- ☑ Voltage range: ± 2.0 V
- ☑ Current ranges: $\pm 16, 10, 4$ amperes
- ☑ Computes solar cell parameters: V_{oc} , I_{sc} , J_{sc} , V_{max} , I_{max} , P_{max} , and efficiency
- ☑ Measures light and dark I-V characteristics
- ☑ Irradiance monitor to compensate for lamp flicker and drift
- ☑ 4-wire connection to customer's test device mounting and contacting fixture
- ☑ Automatic solar simulator shutter control
- ☑ Computer, LCD monitor, keyboard, printer, and I-V measurement software
- ☑ Instruction manual
- ☑ ASTM Method E 948-09 compliant

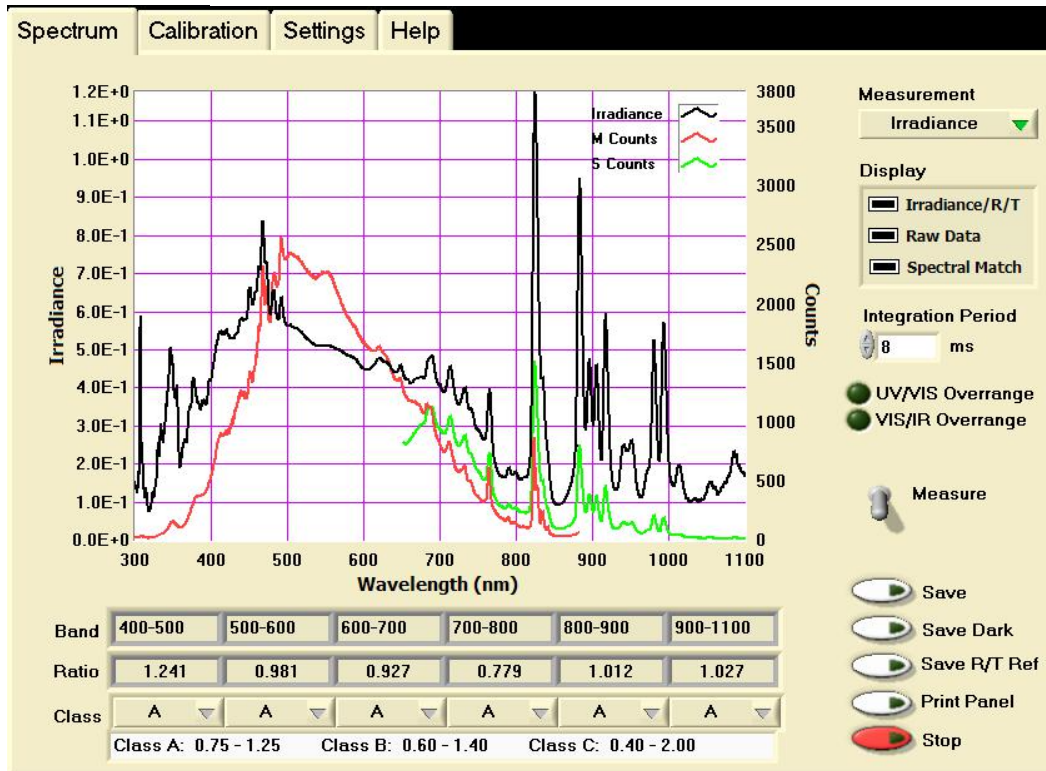
太阳模拟器 solar simulator

Model IV21



- ☑ Class-ABA solar simulator with continuous 21 x 21 cm beam
- ☑ Air Mass 1.5 Global spectral filtering
- ☑ Voltage range: ± 2.0 V
- ☑ Current ranges: 4.0, 10.0, 16.0 amperes
- ☑ Computes solar cell parameters: Voc, Isc, Jsc, Vmax, Imax, P
- ☑ Measures light and dark I-V characteristics
- ☑ Irradiance monitor to compensate for lamp flicker and drift
- ☑ 4-wire connection to customer's test device mounting and con
- ☑ Automatic solar simulator shutter control
- ☑ Computer system with I-V measurement software
- ☑ ASTM Method E 948-09 compliant
- ☑ Instruction manual

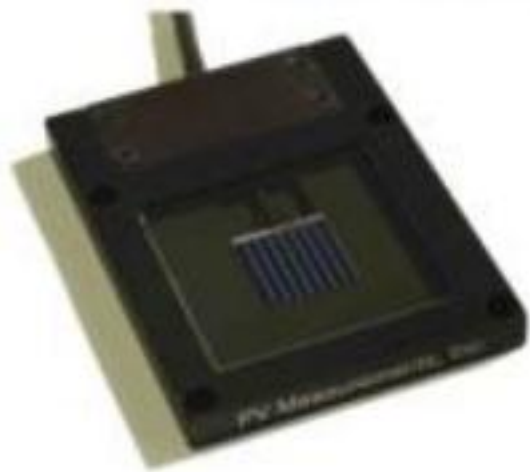
太阳光谱分析仪spectrometer (太阳模拟器等级校准设备)



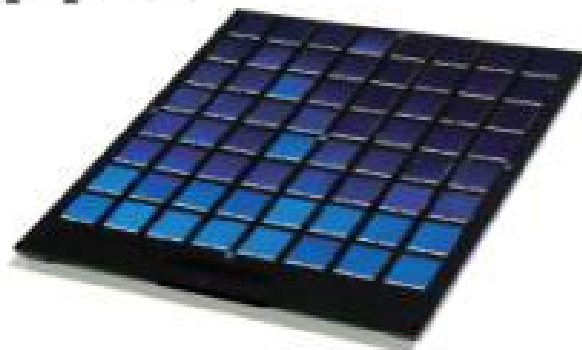
- Diode-array spectrometer with USB interface
- Sensor probe
- Notebook computer
- Custom software, including classification calculation
- Wavelength range 350 nm to 1100 nm
- Spectral bandwidth and resolution approximately 4 nm
- Instruction manual

太阳模拟器标准电池和光均匀性测试板

Reference
Cell



Uniformity
Mapper



太阳标准电池用于太阳模拟器光源光强的校准

太阳模拟器**光均匀性**测试板：太阳模拟器光源光均匀性的评估

提供或定制各类太阳能电池测试平台 substrate



Conventional Si



Substrate



DSSC

Superstrate

- 各类测试平台保证了各类太阳能电池（如晶体硅电池、DSSC）的测试需要，保证了测试的准确性

Photovoltaic (PV) IV Test Stations

Temperature monitored model series



宽光谱1800nm太阳模拟器及I-V测试系统

1800nm Solar Simulator & I-V Test System



**High Performance, 1800nm
Solar Simulator
and I-V Tester. Ideal for both
multi-junction
and standard solar cells.**

- CLASS AAA MEETS IEC, JIS, ASTM CLASS AAA SPECIFICATIONS
- BEAM SIZE.....Class AAA over entire 10 mm X 10 mm area
- ENERGY LEVEL.....Approximately 1500 Sun
- COLLIMATION ANGLE.....<30 degrees at sample
- SPATIAL UNIFORMITY Better than + 2% over entire 10 mm x 10 mm area
- SPECTRAL MATCH.....Class A 350nm-1800nm
- TEMPORAL STABILITY Better than + 1%
- WORKING DISTANCE.....1mm

CPV用太阳模拟器

CPV –Concentration PV testing



Concentration Cell tester:

up to 1000 suns

testing area $\varnothing = 6 \text{ mm}$

uniformity $\pm 5 \%$

automatic wafer sweeping and cell sorting

Concentration Module Tester:

based on one small light source and a set of different mirrors

up to ca. $1.5 \times 1.5 \text{ m}$

divergence $< \pm 1.5^\circ$

Patent pending

太阳能光伏组件用AAA级太阳模拟器

Solar simulator for pv module



Repetition rate:

30 sec.

Flash lamp lifetime:

At least 100,000 flashes (wear part). Longer flash duration values might reduce the lamp lifetime.

Spectral match:

$\leq \pm 12.5\%$ spectral match AM1.5 Class A+ /

IEC 60904-9 Ed.2 for solar simulators in conjunction with the associated spectral filter pane.



Uniformity of the illumination area:

$\leq \pm 1\%$ measured with a uniformity detector size $100 \times 100 \text{ mm}^2$ over the module in 9×7 positions, Class A+ / IEC60904-9 Ed.2.

Adjustable irradiance intensity(ies):

Multi-level flash.

e.g.: 1st level $800\text{--}1100 \text{ W/m}^2$,

2nd level 500 W/m^2

3rd level 200 W/m^2

Total flash duration:

for the customer-specific illumination area with Power-Booster cetisPV-XF2-PB:
5 ... 25 ms adjustable for single flash,
25 + 25 ms for 2 level flash.

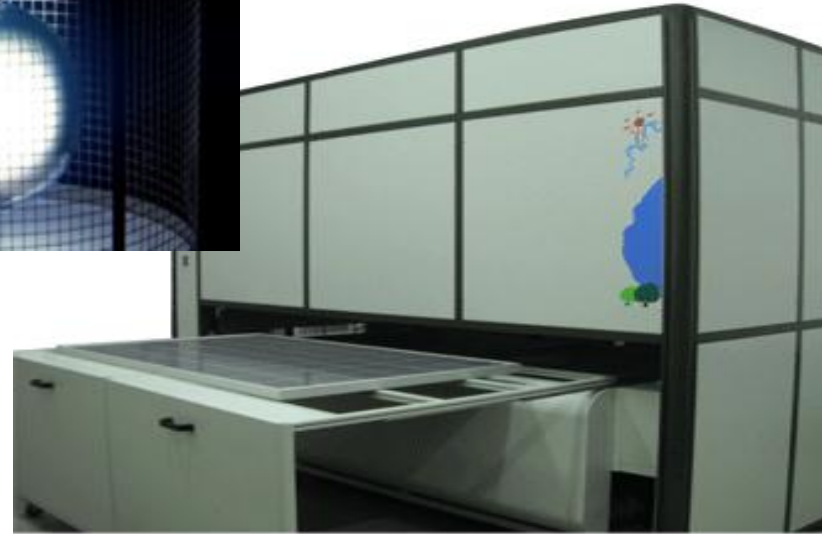
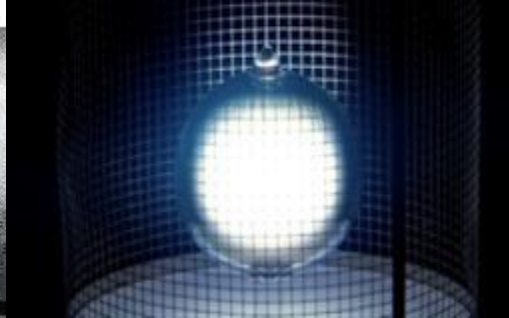
Temporal stability:

$\leq \pm 0.5\%$ ($\pm 1\sigma$ limit) Class A+ / IEC60904-9 Ed.2.

Repeatability:

$\leq \pm 0.5\%$ ($\pm 1\sigma$ limit).

长寿命(2万小时以上)等离子体薄膜太阳能电池光老化试验机 (LID太阳模拟器)



Homogeneity over the sample area (within 800-1100 W/m² operating range):
the specification is a class A, uniformity ($\pm 2\%$ as per IEC 60904-9) on the complete sample area of **2.6 x 2.2 m**.

Temporal stability (within 800-1100 W/m² operating range):
The irradiance stability (LTI and STI as per IEC 60904-9) is defined as per IEC 60904-9, 5.4.1.3.c.
The system is built to ensure $< \pm 0.5\%$ temporal stability ability.

Spectrum (within 800-1100 W/m² operating range): class A (as per IEC 60904-9)

紫外光老化模拟器 UV-Preconditioning



“UV-Preconditioning” according to
IEC 61215 10.10 / 61345



**Example:
Basic Temperature
Chamber**

稳态太阳模拟器



Irradiance:

Typically 200, 800 or 1000W/m² (between 280 - 3000nm)

- sometimes higher Irradiance levels required

• Homogeneity:

Typically +/- 2% , +/- 5% or +/-10% within target area

- class A,B,C

- UV preconditioning tests require +/- 15%

• Good spectral match

Reference Spectra: CIE 85 Table 4, IEC 904-3 AM 1.5 , ASTM G173

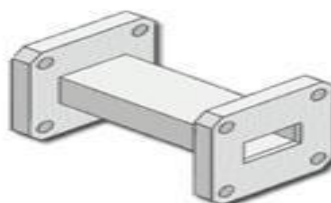
provides small to very large custom solar simulation testing and sells equipment/systems to clients for PV cell/module performance characterization and aging/durability tests

太阳能产品在室外自然环境下测试，受到气候条件影响的因素很多，经常满足不了测试要求，甚至有些地区常年不能测试。这样一来对有些地区研究太阳能技术带来阻碍。我们开发了在室内测试太阳能产品的专业设备。其精度远远大于室外的测试方法，重复性好，测试效率较高，同时在室内可以模拟各种地区的自然环境，不受使用地区的环境限制，是研究与检测太阳能的理想装备。

长寿命(2万小时以上)等离子体薄膜太阳电池光老化试验机 (LID太阳模拟器)



HV-Power &
Magnetron diode tube



Waveguide



Cavity
Resonator



MW-induced
plasma
discharge

Without filter				With 37% filter			
Setting	Icc (mA)	Spectral Mismatch (%)	Equivalent Irradiance (W/m2)	Setting	Icc (mA)	Spectral Mismatch (%)	Equivalent Irradiance (W/m2)
-50	51.41	1.04	383	-50	18.4	1.04	137
-35	74.9	1.02	569	-35	26.37	1.03	198
-15	105.72	1.02	803	-15	36.87	1.02	280
0	127.2	1.01	976	0	44.64	1.01	342
15	138.2	1.01	1060	15	48.36	1.01	371
35	149.5	1.01	1147	35	52.32	1.01	401
50	157.3	1.01	1206	50	55.24	1.01	424

四探针测试系统 Four Point Probe System

Sheet Resistance Resistivity Measuring System

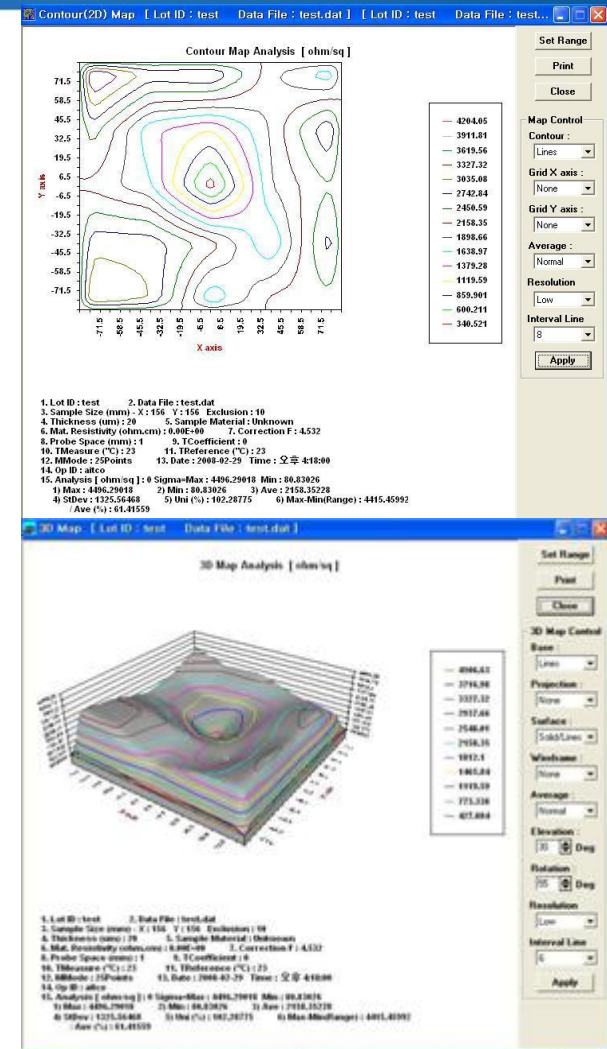


- › Measures the sheet resistance of max. 162X162mm Photovoltaic or Solar cell or square sample, max. 230mm round sample, etc.
- › Measures for sheet resistance & resistivity (ohm, ohm/sq, ohm.cm)
- › Stand alone & Operation by full remote control with operating software
- › Versatile data analysis functions (Contour / 3-Dimension map etc.)

四探针测试系统

Four Point Probe System

- Four Point Probe System for max. 162x162mm Photovoltaic or Solar cell
- Measurement Range: $1\text{m}\Omega/\text{sq} \sim 2\text{M}\Omega/\text{sq}$ (Resistivity : $10\mu\text{ohm.cm} \sim 200\text{Kohm.cm}$)
- Measurement Time: Approx. $3 \pm 1\text{sec/point}$
- Electronic Accuracy: 0.5% for V/I of 5m to 10K at an Ω ambient temperature of $23^\circ\text{C} \pm 1$
- Operating Software: Full remote control (Movement Configuration, Measurement)
- Various data analysis functions (Data map, Contour map, 3-Dimension map etc.)



薄膜表面电阻测量仪

Surface Resistance Meter



wide measurement ranges of 10^3 to 10^{13} ohms using point-to-point probes or the two-point resistance probe for small surface measurements, and 10^4 to 10^{14} ohms/square using the Trek Concentric Ring probe. The probes are purchased separately. Measured resistance values are clearly displayed on a high-contrast LCD display using scientific notation.

Meter Measurement Capability

10^3 to 10^{13} ohms
(extends to 10^{14} ohms using the Concentric Ring Probe).

Resistance/Resistivity Measurement Ranges

Concentric Ring Probe

10^4 to 10^{14} ohms/square.

Point-to-point probes

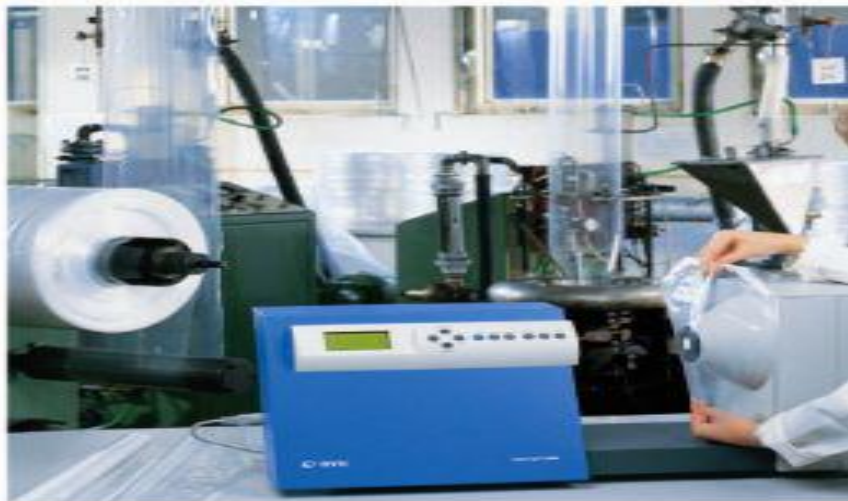
10^3 to 10^{13} ohms.

Two-point resistance probe

10^3 to 10^{13} ohms.

Measurement Accuracy (of reading)
At $25\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$, $50\% \pm 10\% \text{ RH}$:

(玻璃塑胶) 雾度 (透过率) 测量仪



测朔料薄膜的雾度、透过率等

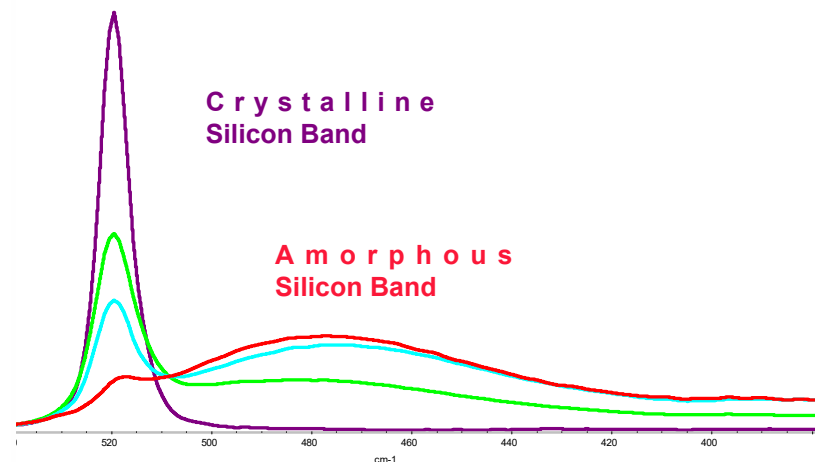


测玻璃的雾度、透过率等

技术指标

光源 CIE-C	一般用途
光源 CIE-A	汽车前挡风玻璃
光谱响应	CIE光谱函数y
测量区域	直径 18mm (0.7in)
样品口	直径 25.4mm (1.0in)
测量范围	0至100%
重复性	±0.1单位 (标准偏差)
重现性	±0.4单位 (标准偏差)
光路	0° /散射
记忆量	7×999个数值
接口	串口RS 232
电源	230V/50Hz, 115V/60Hz, 最大200瓦
工作温度	10至40°C (+50至104°F)
储藏温度	0至50°C (+32至122°F)
体积 (宽 × 高 × 深)	67×36×24cm (26×14×10in)
重量	18kg (40 lbs)

拉曼光谱仪 Raman



Raman光谱可用来检测非晶硅薄膜材料中的晶化率，对于非晶硅薄膜，其对应的Raman峰位在480处,是非晶硅的类TO模式。微晶硅薄膜对应的非晶峰和晶体峰的波数位置不一样。晶体硅对应的峰位在520处，对于晶化率比较高的微晶硅薄膜，峰位较晶体硅有些偏移，通常在517处。

材料晶化率的计算公式为： $X_c = I_c / (I_c + I_a)$,其中 I_c 和 I_a 分别为材料晶体部分和非晶部分的积分面积。

分光光度计--Spectrometer

分光光度计工作原理

样品的透射率T，反射率R，以及吸收率A。它们之前存在如下关系：

$$T + R + \text{Absorptance} = 1 \quad \text{OR} \\ \% \text{Absorptance} = 100\% - \%T - \%R$$

如果连续扫描，就可以得到在样品关于波长分布的透射率的信息，其不同波长透射率和样品的成分和结构的改变有着密切的关系。所以，根据这些信息，可以判断样品的成分和结构的变化。

主要性能指标	
波长范围（nm）	190-3300nm,190-2500nm
分辨率（nm）	紫外/可见区：0.17nm，近红外区：0.2nm
波长精度(nm)	UV-VIS 0.1nm,NIR 0.2nm
波长重复精度（±nm）	UV-VIS 0.06,NIR 0.1
基线稳定性(Abs)	0.0003A/h（峰峰值，500nm处测量）



分光光度计光伏行业中的运用

非晶硅薄膜电池材料，如TCO玻璃，PVD的AZO透明导电层以及CVD工艺中的各非晶硅薄膜电池各透明层的透过率T、吸收率A、反射率R以及材料的雾度都对电池的效率都有着重要影响。因而对这些性能的代表非常重要。对TCO的来料检验也非常重要

PVB、EVA含水量测量仪



Applications For Moisture in PVB Film

Description/Parameters

Product: pvb film
Description: translucent, colorless film
Analyte: moisture, 0-1%
Variations: color, transparency

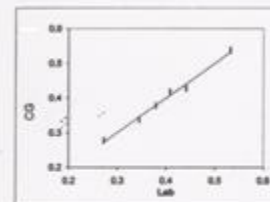
Typ. Algor.: Consult MoistTech Application Lab
RMS Error: 0.01-0.05
CG Spec: 3
Proc. Stage: finished product

Application Notes:

General: PVB film is used as the glass inner layer of windshields built for the automotive industry.
Presentation: Sensors are located over, under or beside a moving web between or over rollers.
Instrument: Angle sensor 15-20 degrees if measuring a shiny surface to reduce specular reflectance.
Calibration: The full calibration is normally done off-line, followed by an on-line zero adjustment.
Reference document # 561100-100 for off-line calibration procedure.
Benefits: Moisture content of PVB is a key variable in the control of adhesion and penetration resistance of laminated safety glass. The moisture target is normally 0.30 to 0.50%.

Applications Lab Test File Specimen:

Product: pvb film
Ref. Smpl. #: 7009
Instrument: CG1000
Conv. Coeff.: 0.995
RMS Error: 0.010
Cal. Spec: 0.38
Cal. Zero: -1.29



Cal. Data:

Sample	% Moisture Lab	CG
1	0.272	0.26
2	0.345	0.34
3	0.379	0.38
4	0.408	0.42
5	0.441	0.43
6	0.532	0.54

AC/DC耐压绝缘电阻测试仪（美国产品）



湿漏电测试以及耐压绝缘测试用以测定组件中的载流部分与组件边框之间的绝缘是否良好。

耐压试验:AC0.05kV~5.00kV DC0.05kV~6.00kV

额定电流: 0.01mA-100mA (AC) / 0.01mA-10mA (DC)

绝缘电阻: DC25V~1000V / 0.01 MΩ~9.99GΩ

耐压测量精度:电压计±(1%of reading+30V)
电流计±(3%of reading+20uA)

绝缘测量精度:电压计±(1%of reading+1V)
电阻计±2%of reading

可编程多功能光伏组件安规测试仪

Safety Tester for UL/IEC/EN 61730, 61646 and 61215



- ✓该型号是一款综合了接地电阻、**AC/DC**耐压、绝缘电阻、漏电流、接触电流、功率和负载测试的超强安规测试仪。
- ✓该型号设计采用了先进的自动化技术，可显著改善和加快电器设备安检测试过程的效率，精准而高效。
- ✓符合标准**UL/太阳能光伏组件IEC/EN 61730, 61646 and 61215**测试要求
- ✓安规验证测试是电器设备制造商确保他们的产品符合包括**CE**等标准法规所必需的。该型号几乎满足所有安规要求的标准测试，且可为需要符合**CE、EU、BS、UL**标准提供方便的证明文件。
- ✓该型号将帮助您达到您的法律规定。
- ✓可执行以下国际标准测试：

更多产品特点：www.dyesuntech.com/_d276438452.htm

可编程多功能安规测试仪：可完成Earth Bond 40A **MST 13**, DC Flash (**hipot**), Dielectric Withstand Test **MST 16**, DC Insulation Resistance Wet Leakage Current Test **MST 17** and ARC Detection等测试项目。



六大功能：

- 接地电阻测试（测试电流**0.1-40A**可调）
- DC绝缘测试（测试电压**250V/500V DC**）
- AC/DC耐压测试（交流**0.1-5.0KV** /直流**0.1-6.0KV**）
- 漏电流测量和接触电流测量（漏电流**0.10mA-20.00 mA**/接触电流**0.02mA -5.00 mA**）
- 输出功率和功率因素测量（**0.02kVA-5.00kVA**）
- 电弧**ARC**测量

功能与特性：

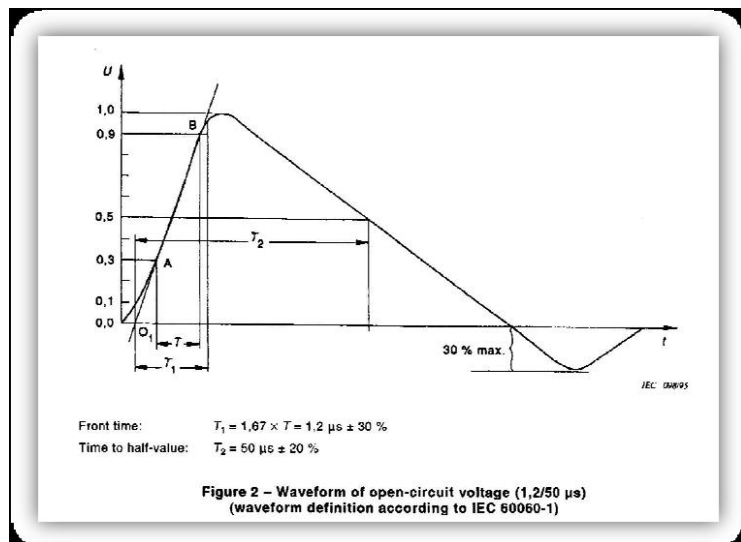
- ◇该系列可编程安规综合测试仪是一款生产线安全检验的自动化测试设备，为客户提供了一款先进的以提高产能和工作效率的综合测试仪。
- ◇其独特的隔离式绝缘耐压输出系统，确保了操作人员的绝对安全。使其成为目前市场上最安全的绝缘耐压测试仪。
- ◇该系列可以直接应用于大部分的**ISO**质量体系（包括产品安全检验,实验室试验和计量检测等）
- ◇该系列仪器可存储多达**6000**个测试结果，并可以下载到电脑中。
- ◇如果利用选配的软件和条形码扫描仪，更可将测试结果自动生成标签，使整个测试过程更精确、更高效、更快捷。测试流程可以用条形码扫描仪自动设定。
- ◇仪器包括远程遥控端口，例如借用**PLC**控制电路脚踏开始与结束测试。另有**RS232**端口，两种端口都使该成为系统集成的理想之选。
- ◇遵循**EN50191**电气试验设备的安装和操作标准

新型1500V组件脉冲耐压试验(IEC 61730 MST14)

impulse voltage test



- 脉冲发生器包含7个不同的脉冲形成网络，可产生用户所要求的波形，其电容范围符合标准中所规定的有关不同EUT组件电容值的公差。
- 高压脉冲发生器 是专门用于测试太阳能电池组件（太阳能电池板）脉冲电压而设计的。
- 发生器可产生满足IEC60060-1/2标准的浪涌电压波形1.2/50 μs ，电压可达10kV满足IEC 61730-1/2 和EN61730-1的标准要求
- 除此之外，脉冲发生器是特别根据标准规定的测试需求而设计的。它可以对不同电容值的待测组件进行测试，产生具体的脉冲波形，这是通过对不同体积大小的太阳能电池组件进行测试所得出的结论。



新型1500V组件脉冲耐压试验(IEC 61730 MST14) impulse voltage test

Complies with IEC 61730-2 Para 10.5.3 including 1500V systems, with IEC 1180 tolerances



特点: Features

Up to 16kV test voltage.

Microcontroller technologies, front panel voltage meter indicates output peak voltage.

Output voltage and polarity are controlled manually from the front panel.

Ergonomically designed for safety, speed and efficiency.

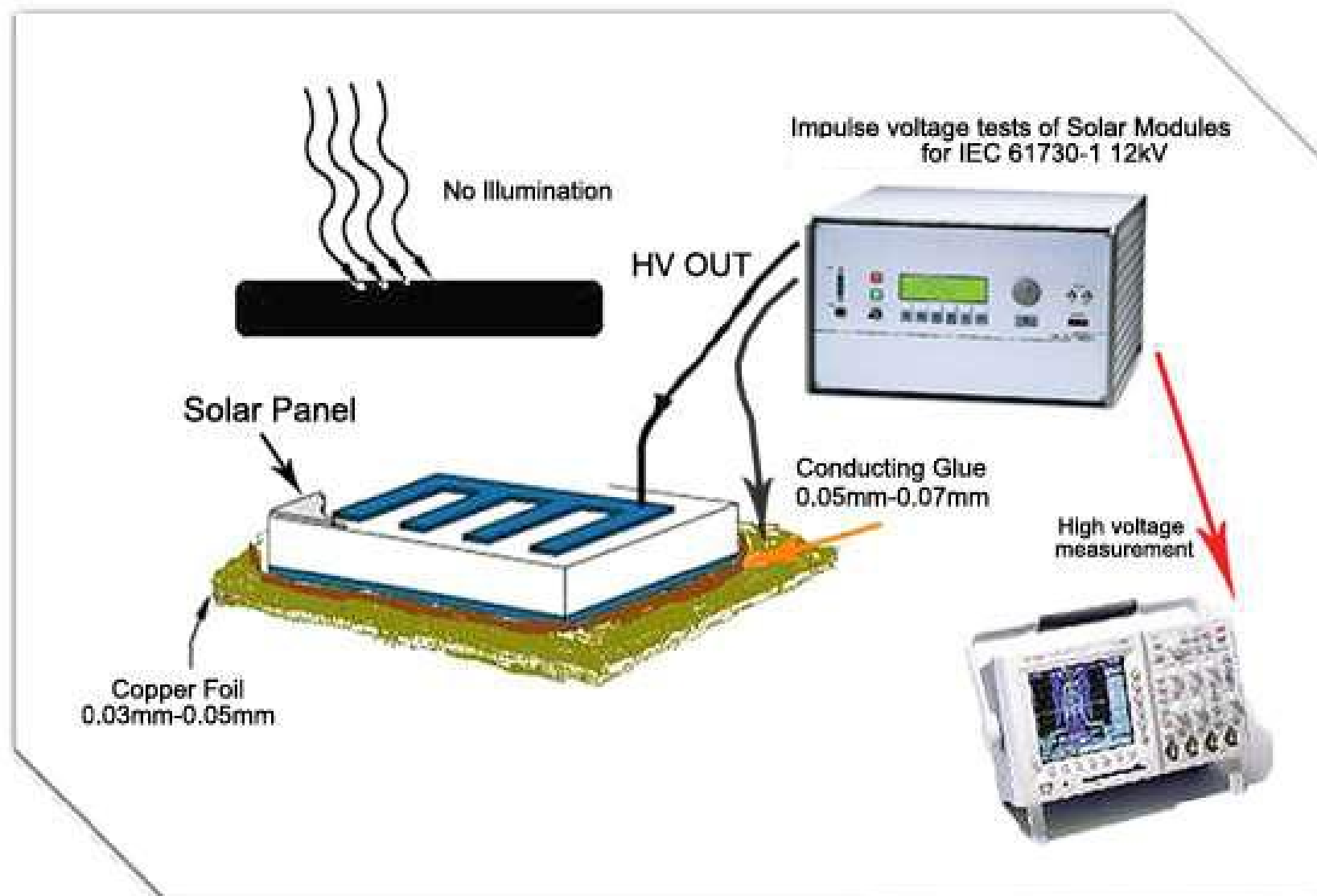
Cables, manual and calibration certificate included.

OnF Tab included for open circuit waveform evaluation

- **1.2x50 waveform output, 800-16kV**
- **Tests panels up to 120nF**

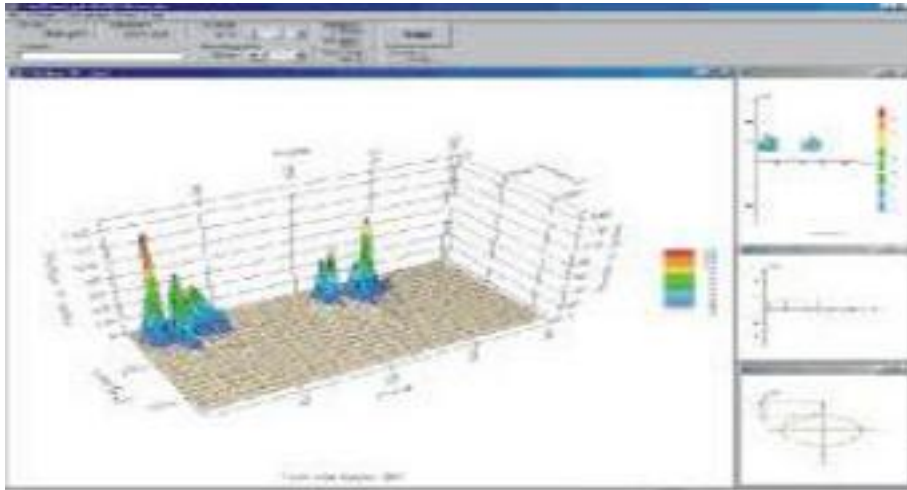
脉冲耐压试验 (IEC 61730 MST14)

impulse voltage test



局部放电测试

Partial discharge test



← Adapter for back sheet foils of photovoltaic (PV) modules

逆变器测试系统（可编程直流电源、交流电源、RLC负载） test system for solar inverter



太阳能逆变器测试系统

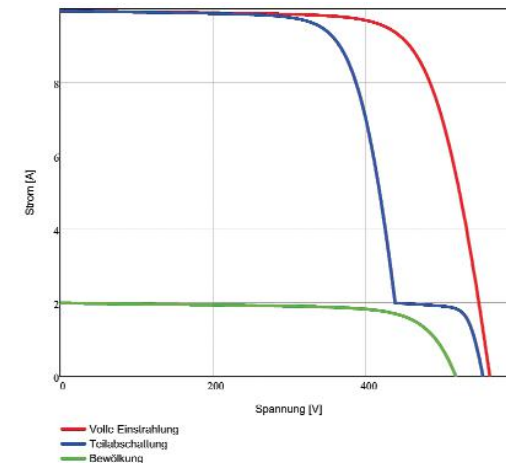
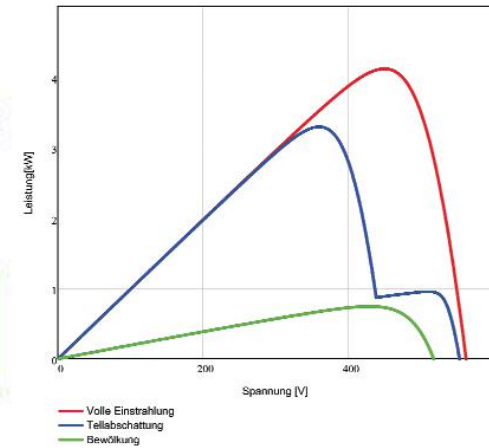
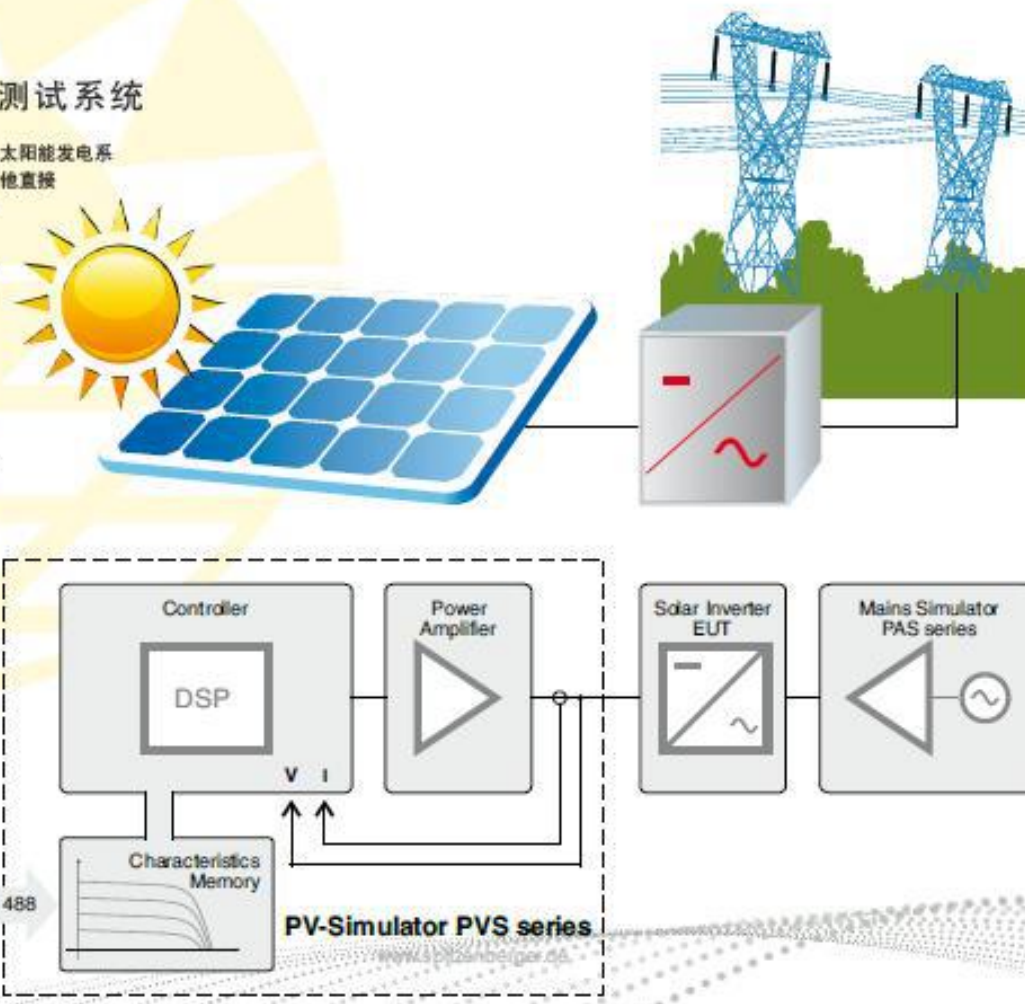
- ☀ MPP跟踪实时分析
- ☀ 1024 V/I 特征存储深度
- ☀ 评估静态和动态MPPT效率
- ☀ 全天候模拟
- ☀ 输入实测特征
- ☀ 快速响应时间 $< 100 \mu s$

除了模拟太阳能逆变系统，我们的系统能够模拟各种太阳能逆变系统相关的电源波动现象（如电压频率波动，相位波动等），相应的测试单元可以进行精密的电源谐波及闪烁测试。太阳能逆变系统可以进行完全的反孤岛抑制检测。是目前世界上最为先进的逆变器检测系统。

逆变器测试系统（可编程直流电源、交流电源、RLC负载） test system for solar inverter

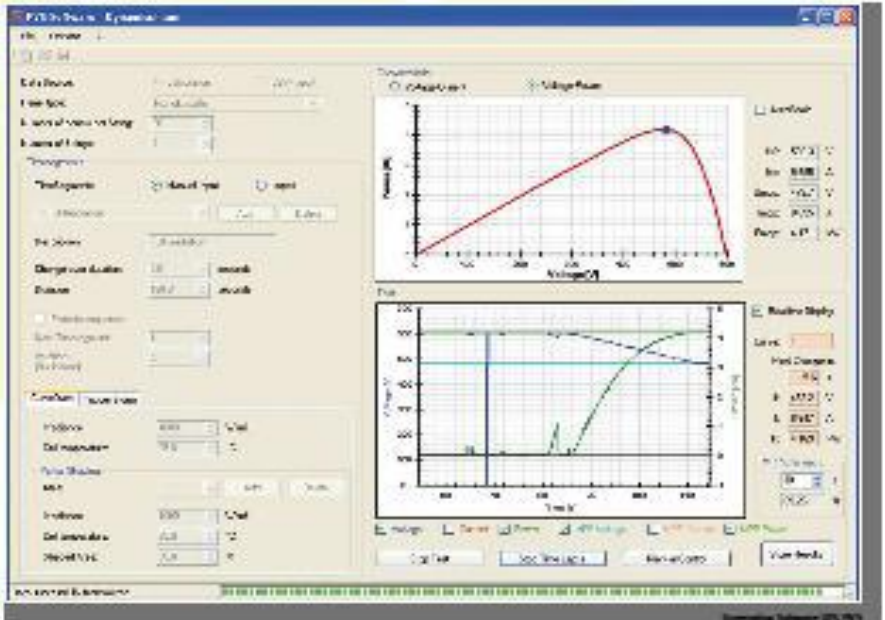
太阳能逆变器测试系统

太阳能逆变器在对整个太阳能发电系统里起着至关重要的作用，他直接影响着发电系统的效率及所带来的经济效益。好的太阳能逆变器可以匹配不同照射条件下的太阳光，能为公共电网输入更多的电能。因此优化太阳能逆变器效率和测试其在不同光照条件下的性能是非常重要的。PVS系列太阳能光伏逆变器测试模拟系统，可以无需实际太阳能电池的条件下，模拟各种实际使用情况，以便对逆变器进行测试。



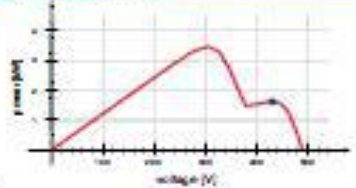
逆变器测试系统（可编程直流电源、交流电源、RLC负载） test system for solar inverter

高速光伏测试模拟器



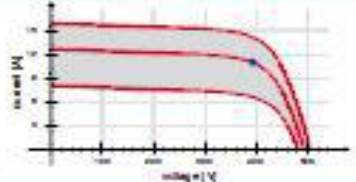
测试过程的编排为内置的测试软件所控制。软件能够计算或读取CSV格式的不同的V/I特征。间隔及瞬态时间均可由客户进行定义。设置太阳能光伏模拟系统的实时分析测试软件可以在其图形界面上完成。软件的实时控制和采集功能可以保证快速MPP跟踪及MPP效率准确读取。

任意V/I特征生成



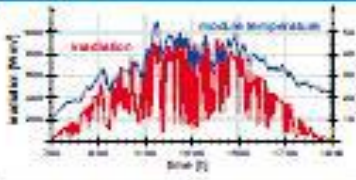
太阳能光伏模拟系统可以生产任意V/I特征。因此太阳能电池不同气候工作条件的任何特性都可以模拟出来。各种特征是通过软件进行计算的。软件也可直接读取外部测试或计算的V/I数据。

动态变化



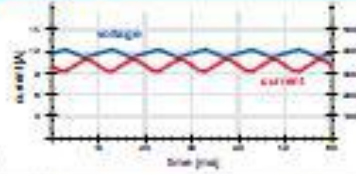
太阳能电池的V/I特征是随着不同太阳光照条件、温度条件变化的。存储单元可以存储+328条不同的变化曲线。V/I特征测试的顺序可以任意编辑。不同测试曲线的过渡都可通过过渡曲线补充完成。

全天模拟测试



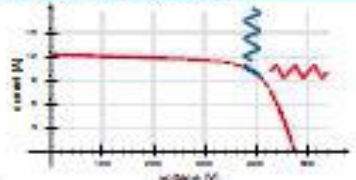
在一天之中，天气条件是不断变化的。为了测试太阳能逆变器在实际条件下的工作情况，全天模拟的光照及温度条件存储在系统之中。

100Hz纹波



太阳能逆变器向电网输入一种近似正弦波形的电流。是一种包含100Hz纹波的工频电流。因为我们的太阳能光伏模拟系统的高动态能力，100Hz的电压、电流纹波能够如实的模拟。

太阳能光伏模拟系统的速度

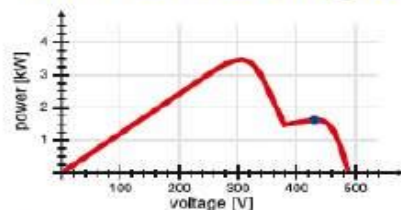


对于太阳能光伏模拟系统来说，高速响应能力是非常重要的。这能够确保逆变器及太阳能光伏模拟系统能够快速跟踪V/I特性曲线。



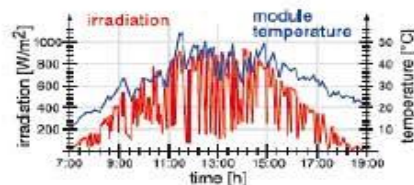
微型太阳能逆变器测试系统

MPPT Realtime Analysis



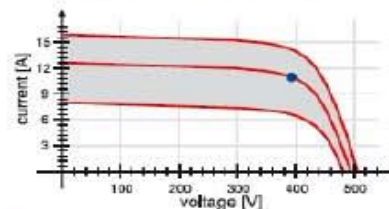
- ✓ Arbitrary V/I characteristics
- ✓ Simulation of any technologies
- ✓ Import function for measured values

Course of a Day



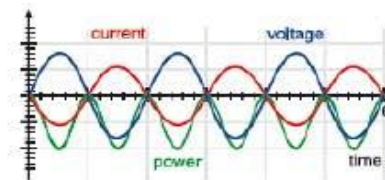
- ✓ Testing under real conditions
- ✓ Simulation of complete irradiation and temperature profiles
- ✓ Import from CSV files

Dynamic Changes



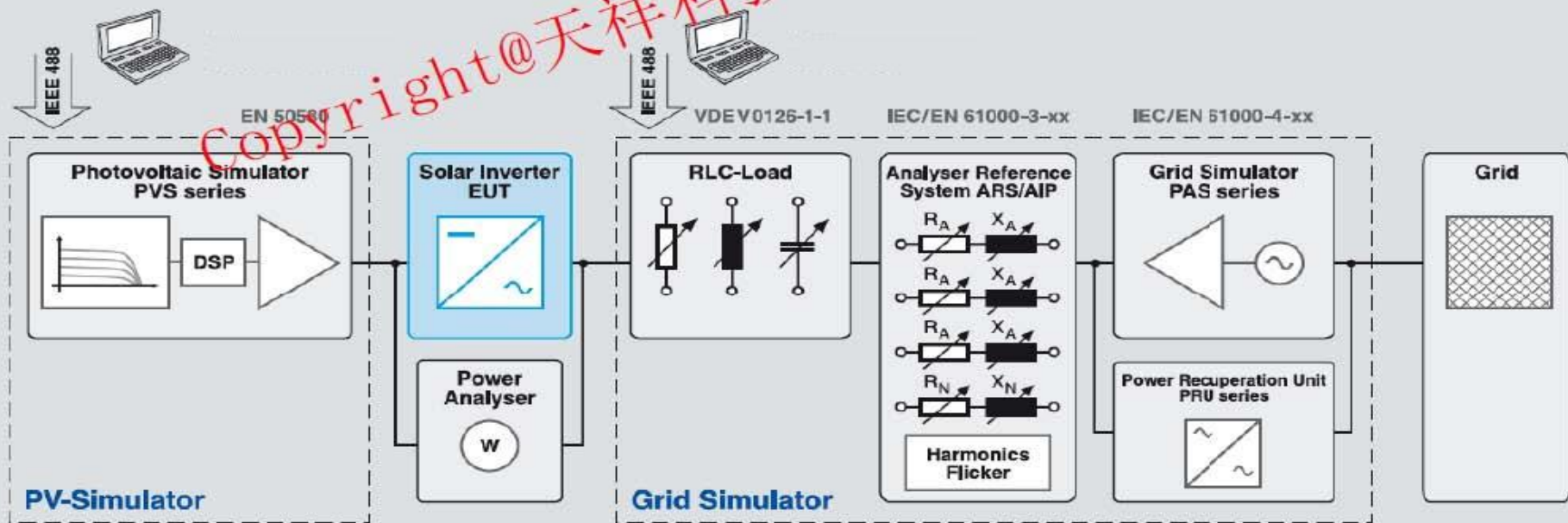
- ✓ 1024 V/I characteristics memory
- ✓ Freely programmable time sequences
- ✓ Continuous transition between various curves

High Control Speed



- ✓ Transient time < 100µs
- ✓ Realistic reproduction of 100 Hz-Ripple
- ✓ Evaluation of static and dynamic MPPT efficiency

PV-Simulator with Mains Simulation System up to 200kW



微型逆变器测试系统性能特点

- ✓低电压光伏模拟器系统，用于微逆变器测试，拥有三种电压范围：**37.5VDC**，**75VDC** 和**150VDC**，可广泛覆盖现代微型逆变器。
- ✓可对**I/V** 特性进行自由编程，可模拟不同的太阳能电池，即使太阳能电池板被遮罩时，仍可对光伏发电机进行模拟。
- ✓对负载变化的快速响应时间 **< 100μs**；
- ✓可逼真再现单相逆变器的电流和电压上的**100Hz** 纹波。
- ✓可非常精确地模拟 **I/V** 曲线；
- ✓可模拟动态辐照度和温度；
- ✓可对多云或晴朗天气状况下的光伏发电机的特性进行模拟评估静态和动态**MPPT** 效率；
- ✓完全符合**IEC/EN 50530** 标准要求

更多信息，www.dyesuntech.com/_d274517807.htm

卓越性能
确保设备和系统的
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