



17714A

#### Applications

- Solar Power Plant
- Solar Radiation Measurements
- Solar Power Research for Location of the Solar Panels or Solar Water Heaters
- Physics and Optical Laboratories
- Meteorology
- Agriculture
- Windows Performance Calculate the Rate of Daylight Penetration

#### Features

- Solar Power Measurement with Orientation and Tilt Angle
- Measurement : Solar Power (illuminance), Orientation, Tilt Angle
- Solar Power Measurement Range : 2000 W/m<sup>2</sup> or 634 BTU / (ft<sup>2</sup>.h).
- Easy Measurement for Rate of Daylight Penetration
- Auto Change for Measuring Range
- Auto Power off with Disable Function
- Instantaneous, Average, Min/Max Values, Data Hold
- 20 Points Memory, Low Battery Indicator
- Socket for Tripod Mounting
- Operation with 9V Battery
- Magnetic Mount
- Backlit LCD and 4 Digits Triple Display

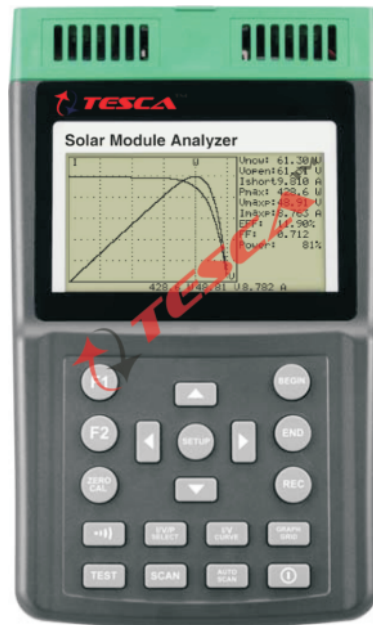
#### Specifications

Sensor	High Sensitivity Silicon Photodiode
Spectral Response	400 ~ 1100 nm
Range	0 ~ 2000 W/m <sup>2</sup> (0 ~ 634 BTU / ft <sup>2</sup> .h)
Accuracy (at 23°C, 60% RH)	± 10W/m <sup>2</sup> (± 3 BTU/ ft <sup>2</sup> .h) or ± 5% (whichever is greater)
Resolution	0.00 ~ 99.99 W/m <sup>2</sup> : 0.01 W/m <sup>2</sup> ,
	100.0 ~ 999.9 W/m <sup>2</sup> : 0.1 W/m <sup>2</sup> , 1000 ~ 2000 W/m <sup>2</sup> : 1 W/m <sup>2</sup>
	0.00 ~ 99.99 BTU/ft <sup>2</sup> .h : 0.01 BTU/ ft <sup>2</sup> .h, 100.0 ~ 634.0 BTU/ft <sup>2</sup> .h : 0.1 BTU/ ft <sup>2</sup> .h
Angular Accuracy	Cosine Corrected < 7% (angle < 60°)
Tilt Angle Range	0 ~ 90°
Tilt Angle Accuracy (at 23°C, 60% RH)	± 1.2° (≤ 60°), Additional Temperature Induced Error ± 0.1°/°C from 23°C
Sample Time	Approx. 0.4 Second
Operation Temp. & Relative Humidity	0°C ~ 50°C (32°F ~ 122°F) Less than 80% RH
Store Temp. & Relative Humidity	-10°C ~ 60°C (14°F ~ 140°F) Less than 85% RH
Auto Power Off	Enable or Disable (Auto Power off after approx. 10 minutes)
Battery Life	Approx. 30 Hours for Continuous Use
Max / Min / Avg	Yes
Data Hold	Yes
Low Battery Indication	Yes
Backlight Function	Yes
Zero Adjustment	Yes
Over Range Indication	Yes ("–HI–")
Memory	Yes ( 20 Points Memory )
Compass	Yes
Solar Transmission Measurement	Yes
Tripod Socket	Yes
Weight	220gms Including Battery (approx.)
Dimensions	Main Instrument : 140 x 49 x 29 mm (approx.)
	Sensor Probe : 83 x 54 x 26 mm (approx.)
Accessories	9V Battery, Instruction Manual, Carrying Case

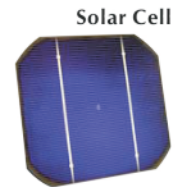
Note: Specifications are subject to change.

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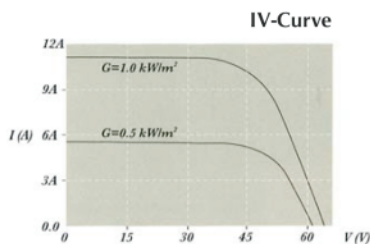
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17714B



Solar Panels



Portable analyzer used for testing, maintenance and finding efficiency of various parameters of solar panels and cells. Analyzer can be used to design Solar System to generate specific power. It can identify Solar Power System requirement, best angle of Solar Panel installation and Broken / Worn-out cells

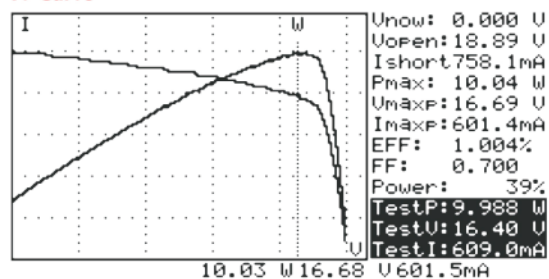
**Features**

- I-V Curve Test for Solar Panel/Module/Cell
- Max. Solar Panel/Module/Cell Power (Pmax) search by Auto-Scan: 60V, 12A z(500W Capability)
- Best Resolution: 1mV, 1mA
- Manual Single Point I-V Test
- Max. Voltage (Vmaxp) at Pmax
- Max. Current (Imaxp) at Pmax
- Voltage at Open Circuit (Vopen)
- Current at Short Circuit (Ishort)
- I-V Curve with Cursor to Display each Data Point
- Efficiency (%) Calculation of Solar Panel
- Solar Panel Area Setting: 0.001 m<sup>2</sup> ~ 9999 m<sup>2</sup>
- Standard Light Source Setting: 10 W/m<sup>2</sup> ~ 1000 W/m<sup>2</sup>
- Communicate with PC via USB Cable
- AC Adaptor and Rechargeable Lithium Battery
- Memory Size: 100 Records
- Sampling Time of Data Logging: 0 ~ 99 min.
- Large LCD with Baclight

**General Specifications**

<b>Battery Type</b>	Rechargeable Lithium Battery, 3400mAh
<b>Battery Life</b>	400 times of linear scan from 60V to 0V and 0A to 12A.
<b>Data Logging Memory Size</b>	100 records
<b>AC Adaptor</b>	AC 110 ~ 240V Input, DC 15V / 1 ~ 3A Output
<b>Dimension</b>	257 x 155 x 57mm (approx.)
<b>Weight</b>	1160gms Including Battery (approx.)
<b>Operation Environment</b>	0°C ~ 50°C, 85% RH
<b>Temperature Coefficient</b>	0.1% of full scale / °C (< 18°C or > 28°C)
<b>Storage Environment</b>	-20°C ~ 60°C, 75% RH
<b>Accessories</b>	User Manual x 1, AC Adaptor x 1, Optical USB Cable x 1, Rechargeable Lithium Battery x 1, Software CD x 1, Software Manual x 1, Kelvin Clips (12A max) x 1 Set, 4 Wire to 2 Wire Connector (10A Max, 12A for 1minute) x 1 set, Carrying Bag x 1

**IV-Curve**



**Electrical Specifications** (23°C ± 5°C, Four-Wire Measurement  
Maximum Power Limit is 500W)

**DC Voltage Measurement**

Range	Resolution	Accuracy
0 – 10V	0.001V	±1% ±(1% of Vopen ± 0.1V)
10 – 60V	0.01V	±1% ±(1% of Vopen ± 0.1V)

Vopen : Open Circuit Voltage of Solar Cell or Module

Note: Specifications are subject to change.

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#### DC Current Measurement

Range	Resolution	Accuracy
0.01 – 10A	1mA	±1% ±(1% of Ishort ± 9mA)
10 – 12A	10mA	±1% ±(1% of Ishort ± 0.09A)

Ishort : Short Circuit Current of Solar Cell or Module

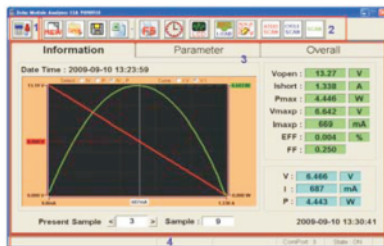
#### DC Current Simulation

Range	Resolution	Accuracy
0.01 – 10A	1mA	±1% ±9mA
10 - 12A	10mA	±1% ±0.09A

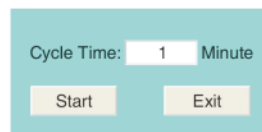
#### User Interface & Data Acquisition Software

Solar Module Analyzer is supplied with user friendly software for Data Storing and Analysis. Users can store Data (.CSV/.TAB) that can be read in MS EXCEL and Print Waveform / Graph via Printer

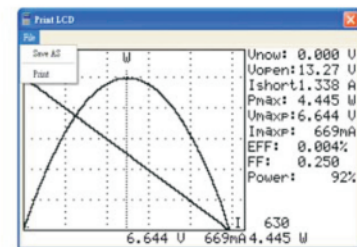
#### Software Window



#### Cycle Scan



#### Print LCD



#### Applications

- Quality Control at Production Line, Warehouse or Site of Installation
- Identify Requirements of Solar Power System
- Maintenance of Solar Panels
- Verify the Best Installation Angles of Solar Panels
- Research and Development

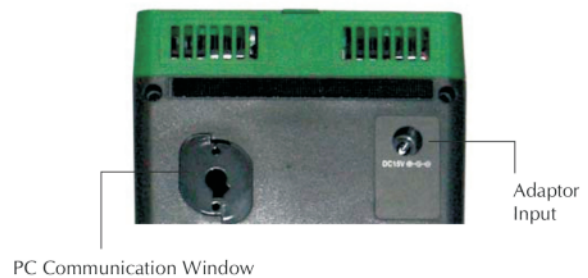
#### 4 Wire Measurement



#### Solar Panel Connections



#### Rear Panel Connections



#### Product Kit



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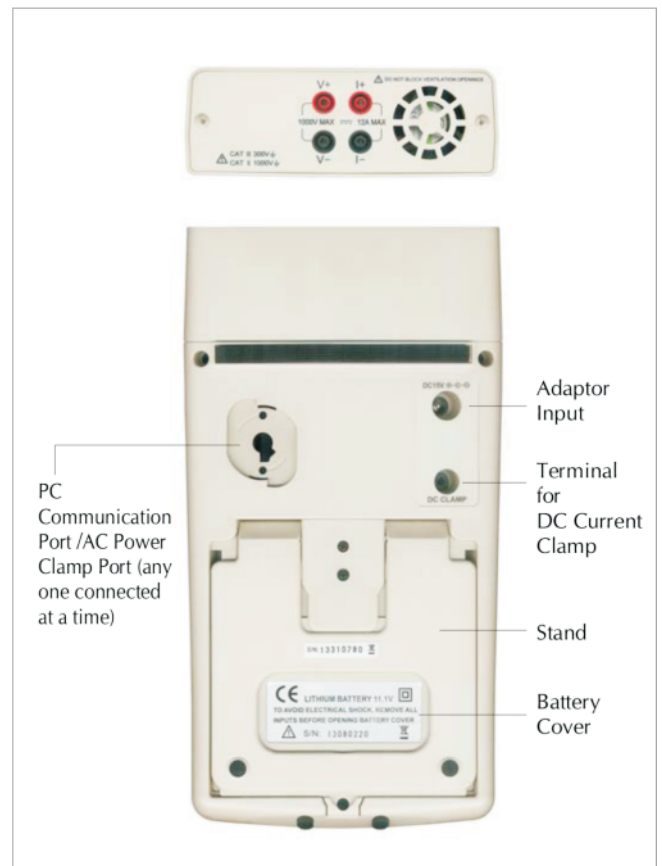


Portable Analyzer used for Testing, Monitoring, Measuring, Analyzing and Troubleshooting various parameters of Solar System. This System has Intelligent Test Logic with no personal attendance required. The System continuously monitor DC Output of Solar System and AC Power Output of Inverter, Calculate Efficiency of DC to AC Power Conversion and Maximum Output Power.

**Features**

- I-V Curve Test for Solar System
- Max. Solar System Power (Pmax) search by Auto-Scan : 1000V, 12A (12000W Capability)
- The Analyzer and the Remote Solar Detector is connected by Bluetooth Wireless Communication (Bluetooth 2.1 + EDR Class 1)
- The Remote Solar Detector is Moisture-Proof.
- Intelligent Test Logic with no personnel attendance required in the field.
- Solar System Analyzer waits and tests the system until appropriate Sunlight Irradiance is detected.
- Max. Voltage (Vpm) at Pmax, Max. Current (Ipm) at Pmax
- Voltage at Open Circuit (Voc), Current at Short Circuit (Isc)
- Efficiency (%) Calculation of Solar System
- Temperature Measurement of Solar Panels
- Irradiance Measurement of Sun Light
- Series Resistance (Rs) Calculation of Solar Panels
- With Data Logging/Open Function, the I-V Curves of Solar System can be analysed / recorded for a period of time (e.g. 60 min.)
- Conversion of I-V Curve under OPC to data under Standard Test Condition (STC) based upon IEC Standard
- Built-in Calendar Clock
- Users can set up the Parameters of Solar Panels
- Users can set up the Series number of Solar Panels. Parameters of many Solar Panels can be Measured in One Measurement.
- The Irradiances and Temperatures of Solar Panels can be continuously Measured, Monitored and Recorded.
- Rechargeable Lithium Battery, Low Battery Warning, AC Power Adaptor
- Optical USB Cable for PC Communication
- Solar Connector (optional)
- Provide Operating Condition (OPC) and Standard Test Condition (STC) test reports for Verification of Solar Panel Performance (OK, or NO OK)
- With Power Clamps (SOLAR 15 DC Current Probe and SOLAR 21 AC Power Clamp), continuously measure / monitor / record the DC Power output of Solar System and the AC Power Output of Inverter (1 phase or balanced 3 phases); calculate the Efficiency of DC to AC Power Conversion and the Efficiency of the max. output power.

**Top & Rear Panel Connections**



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**General Specifications for Solar System Analyzer**

Battery Type	Rechargeable Lithium Battery (3400mAh)
Battery Life	400 times of linear scan (1000V ~ 1V, 0.1A ~ 12A), 8 hours for standby mode.
Memory Size	512K Bytes (3980 Mod files or 320 REC files or 3980 PWR files or 3980 IRR files)
AC Adaptor	AC 100 ~ 240V input, DC 15V / 1 ~ 3A output
Dimension	260 x 158 x 64mm (approx.)
Weight	1580gms Batteries included (approx.)
Operation Environment	50°C ~ 50°C, 85% RH
Temperature	0.1% of full scale / °C
Coefficient	(< 18°C or > 28°C)
Storage Environment	-20°C ~ 60°C, 75% RH
Accessories	Solar Irradiance Meter (Remote Solar Detector) x 1, Thermometer x1, USB power cord x1, User manual x1, AC adaptor x1, Optical USB cable x1, Rechargeable lithium battery (3400mAh) x1 (installed), Software CD x1, Software manual x1, Carrying bag x1, Thermal conductive gel x1, Testing clips (1 black & 1 red), Extension Cable x 1, 4-wire to 2-wire connecting cable x1, 4-wire testing cable x1, Solar 15 : DC current probe x1, Solar 21: AC power clamp x1, <b>Optional</b> : Solar Connector (1 black & 1 red)

**Electrical Specifications** (23°C ± 5°C, Irradiance ≥ 800W/m<sup>2</sup>, Four-Wire Measurement, Maximum Power Limit is 12000W)

**DC Voltage Measurement**

Range	Resolution	Accuracy
0 ~ 1000V	0.01 V / 0.1 V / 1 V	± 1% ± (1% of Voc ± 0.1 V)

Voc : open circuit voltage of solar system

**DC Current Measurement**

Range	Resolution	Accuracy
0.1 ~ 12A	1mA / 10mA	± 1% ± (1% of Isc ± 9mA)

Isc : short circuit current of solar system

**DC Current Simulation**

Range	Resolution	Accuracy
0.1 ~ 12A	1mA / 10mA	± 1% ± 9mA

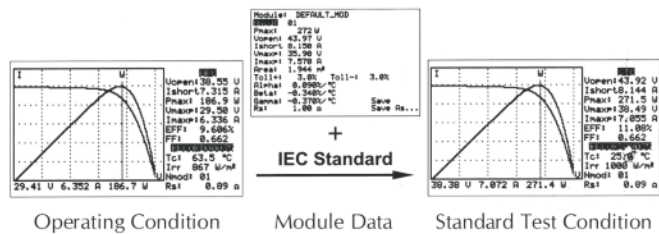
**Irradiance Measurement**

Range	Resolution	Accuracy
0 ~ 2000W/m <sup>2</sup>	1W/m <sup>2</sup>	± 3% ± 20dgts

**Temperature Measurement**

Range	Resolution	Accuracy
-22 ~ 85°C	0.1°C	± 1% ± 1°C

**Conversion of OPC Data into STC Data**



**AC Power Clamp**

**Features**

- Active (W, KW, HP), Reactive (VAR, KVAR) & Apparent (VA, KVA) Power
- Power factor (PF), Phase angle (Φ), & Energy (mWH, WH, KWH)
- Measurement of standby power consumption for IT products
- Non-interrupted AC current harmonic analysis
- 1 to 99th order of harmonics at 1.0% basic accuracy
- Total harmonic distortion (%THD-F) & crest factor (CF)
- True RMS measurement of V & A at 0.5% basic accuracy
- Fast peak function (39µs for 50Hz, 33µs for 60Hz)
- Measurement of balanced 3Φ power
- Measurement of balanced 3Φ sequence
- Programmable CT ratio from 1 to 250
- Max, Min & Data hold functions
- Leakage current measurement at 10µA resolution
- Active power in H.P.
- Shielded jaw immune to external interference

**Electrical Specifications for AC Power Clamp**

AC Watt (50 or 60Hz, PF 0.6 to 1. CT = 1, Accuracy of Readings)		
Range (0 to 30A)	Resolution	Accuracy of Readings
0.050 - 9.999W	0.001W	± 2% ± 0.025W
10.00 - 99.99W	0.01W	± 2% ± 0.25W
100.0 - 999.9W	0.1W	± 2% ± 2.5W
1.000 - 9.999KW	0.001KW	± 2% ± 0.025KW
10.00 - 99.99KW	0.01KW	± 2% ± 0.25KW
100.0 - 999.9KW	0.1KW	± 2% ± 2.5KW
1000 - 9999KW	1KW	± 2% ± 25KW

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AC Voltage (50 or 60Hz, True RMS)			
Range	Resolution	Accuracy (50 or 60Hz)	Accuracy (45 - 1KHz)
5 - 250V	0.1 V	±0.5% ± 5 dgt	±1.5% ± 5 dgt
250 - 600V			

Harmonics of AC Voltage in % & Magnitude (1 - 99th order)				
Range	Resolution in %	Accuracy in %	Resolution in Magnitude	Accuracy in Magnitude
1 - 10th	0.1 %	± 1% of reading ± 1%	0.1V	± 1% of reading ± 7 dgts
11 - 20th		± 5% of reading ± 1%		± 5% of reading ± 7 dgts
21 - 50th		± 15% of reading ± 1%		± 15% of reading ± 7 dgts
51 - 99th		± 35% of reading ± 1%		± 35% of reading ± 7 dgts

Harmonics of AC Current in % & Magnitude (1 - 99th order)				
Range	Resolution in %	Accuracy in %	Resolution in Magnitude	Accuracy in Magnitude
1 - 10th	0.1 %	± 1% of reading ± 1%	0.01mA/ 0.1mA/ 0.001A/ 0.01A	reading in mA : ± 1% of reading ± 2mA reading in A : ± 1% of reading ± 0.3A
11 - 20th		± 5% of reading ± 1%		reading in mA : ± 7% of reading ± 2A reading in A : ± 7% of reading ± 0.3A
21 - 50th		± 15% of reading ± 1%		reading in mA : ± 15% of reading ± 3mA reading in A : ± 15% of reading ± 0.3A
51 - 99th		± 35% of reading ± 1%		reading in mA : ± 35% of reading ± 3mA reading in A : ± 35% of reading ± 0.3A

Frequency (Hz)			
Range	Resolution	Accuracy of Readings	Allowed Input
mA (45 - 65Hz)	0.1 Hz	±0.5Hz	20mA - 1.2A
A (45 - 65Hz)			1A - 100A

Power Factor (PF, ACV > 4V, AC mA > 1mA, AC A > 0.04A, Watt > 50dgts) & Phase Angle (Φ, 50 or 60Hz)			
Range	Resolution	Accuracy	
0.000 - 1.000	0.001	±0.04	
-180° to 180° & 0° to 360°	0.1°	±2°	

AC Watt (50 or 60Hz, PF 0.6 to 1. CT = 1, Accuracy of Readings)		
Range (30 to 50A)	Resolution	Accuracy
0.050 - 9.999W	0.001W	± 2% of VA ± 5 dgts
10.00 - 99.99W	0.01W	
100.0 - 999.9W	0.1W	
1.000 - 9.999KW	0.001KW	
10.00 - 99.99KW	0.01KW	
100.0 - 999.9KW	0.1KW	
1000 - 9999KW	1KW	

**Product Kit**



Total Harmonic Distortion (THD-F, 1 - 50th order)		
Range (45 to 65Hz)	Resolution	Accuracy
0.0 - 10.0%	0.1%	± 2%
10.0 - 40%		± 5% of reading ± 5%
40 - 100%		± 10% of reading ± 10%
100 - 999.9%		± 20% of reading

Peak Value of AC Periodic Voltage or AC Periodic Current		
Range	Sampling Time	Accuracy of Readings
50Hz	39µs	± 5% ± 30 dgts
60Hz	33µs	

Crest Factor (C.F., Accuracy of Readings)		
Range	Resolution	Accuracy of Readings
1.00 - 99.99	0.01	± 5% ± 30 dgts

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**DC Current Probe**

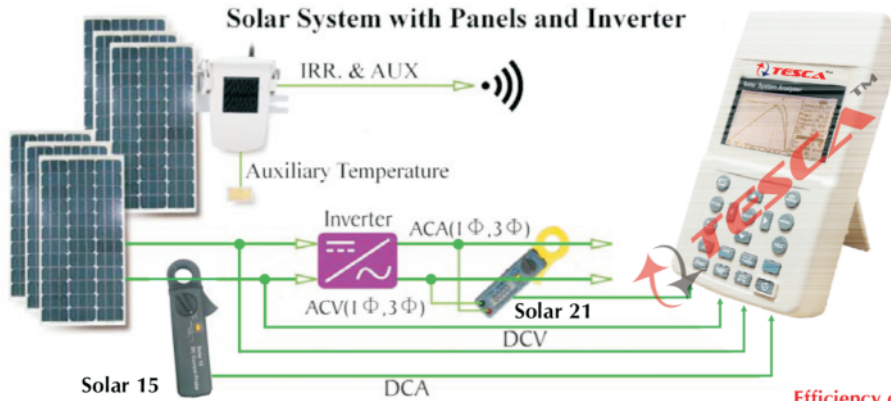
**Features**

- Accurate DC Current Probe for Current Measurement
- One Touch Zero for DCA adjustment
- 23mm Diameter Jaw

**Electrical Specifications** for DC Current Probe

Range	Resolution	Accuracy
DC 12A	1mA / 10mA	± 2.0% ± 30mA

**Applications**



**A. Quality Control at Production Line, Warehouse or Site of Installation**

- Manufacturers of solar panels can test the characteristics for quality control purpose at the production line.
- Installation engineers can randomly test samples of solar panels at site to verify the quality of solar panels used at site of installation.

**B. Identify Requirements of Solar Power System**

- The unit can measure actual max. power (Pmax), voltage (Vpm) and current (Ipm) at max. power.
- Instead of the rated max. power, system designers need to be aware of the actual solar power from solar panels under actual operating conditions.

**C. Maintenance of Solar Panels**

- Maintenance engineers can store the characteristics data of solar panels in the beginning. And compare the characteristics data in weekly, monthly or yearly maintenances.

**D. Verify the Best Installation Angles of Solar Panels**

- Engineers can collect data of the installation angles at different dates and time by using the unit at site of installation.
- The data can be used as a reference to design the automated angle adjustment system or the data can be used to select an optimal angle for a fixed angle installation.

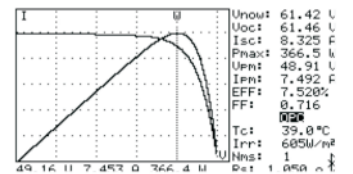
**E. Measure / Monitor / Record the DC Power Output & Efficiency**

- Continuously Measure / Monitor / Record the DC power output of solar system and the AC power output of inverter (1 phase or balanced 3 phases)
- Calculate the efficiency of DC to AC power conversion and the efficiency of the max. output power

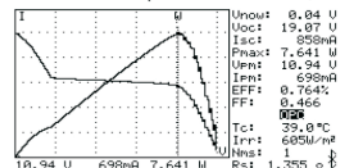
**Efficiency of Power Mode**

DC POWER	AC POWER1P2W
Uoc: 82.15 V	Uoc: 335.2 V
Isc: 5.888 A	Isc: 389.3 A
Pmax: 347.3 W	Pmax: 112.8 W
Vpm: 78.43 V	Vpm: 2.750 V
Ipm: 4.931 A	Ipm: 0.997 A
EFF(Pmax): 96.5%	EFF(DC-AC): 92.3%
EFF: 97.2%	EFF: 93.1%
F: 337.2 W	F: 313.2 W
PF: 0.997	PF: 0.997
Battery: 100%	Battery: 100%
Phi: 76.1 MWh	Phi: 76.1 MWh

**Normal I-V Curve**

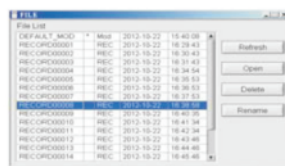


**Abnormal I-V Curve (Cells at the corner of solar panel are defected)**

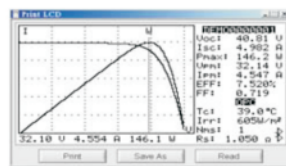


**User Interface and Data Acquisition Software**

**File List**



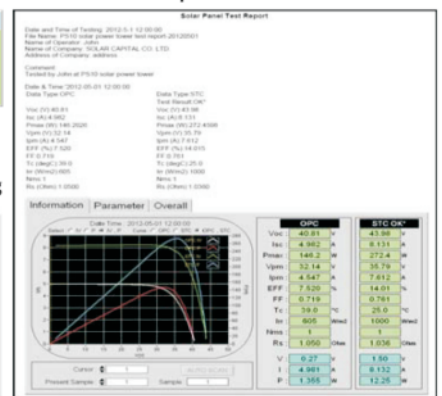
**Print LCD**



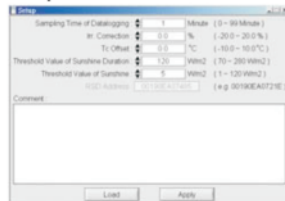
**Cycle Scan**



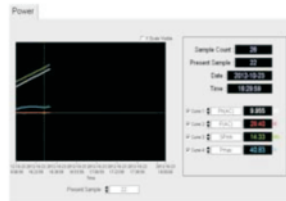
**Solar Panel Test report**



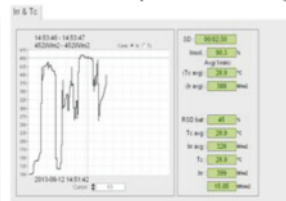
**Setup**



**Power Curves**



**Irradiance / Temperature Recording**



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