



# Multi-Channel PV Power Analyzer

Type VK-MPA-100

- I-V Tracing and Maximum Power Point Tracking (MPPT) up to 6 solar cells simultaneously
- Continuously plot light intensity & temperature data along with  $P_{max}$
- Each sample can have a capacity up to 10 V & 1 A
- Comes with dedicated user friendly control software
- State-of-the-art wireless communication with PC software



## Specifications

Number of Channels	PV devices	light intensity Measurements		Temperature Measurements (K-type)	Auxiliary Outputs	
		Photodiode	Pyranometers		Relay Output (10A)	Open Drain
	6	1	3	1	1	2
Measurement Range	Voltage: 10 V – 120 mV (5 Measuring Ranges)		Current: 1 A – 20 uA (16 Measuring Ranges)			
Maximum Resolution (Max. 6½-digits)	Current		Voltage		Voltage Setting	
	3 pA		16 nV		162 μV	
Measuring Technique	This analyzer consists of 6 independent programmable-electronic-loads. Simultaneous I-V tracing is possible. During MPPT measurements, each sample is separately maintained at its maximum power point by the MPPT algorithm in the microcontroller firmware.					
Light Intensity Measurement	Incident light intensity and temperature data are continuously obtained during I-V tracing and MPPT measurements. <u>Si Photodiode Port:</u> The analyzer has a built-in trans-impedance amplifier to measure the short circuit current of calibrated Si photodiode. Si photodiode (Hamamatsu Photonics) is provided with the system. Also, customer can use their own photodiode after modifying the calibration constant value in the “Advanced Settings” section of the software. <u>Pyranometer Port:</u> Up to 3 pyranometers can be connected as the light measuring sensors.					
Sample Connecting Ports	Six set of 4-wire connectors for samples					
A/D & D/A Converters	Two separate 24-bit ADCs for simultaneous voltage and current measurements Six separate 16-bit DACs for setting cell voltages. Light Intensity data is measured using 24-bit ADC					
Control Software	Dedicated user-friendly computer software is provided to control all of the functions and data logging. Measurement data can be saved as a text file (.csv or .txt) and directly plotted as a Microsoft Excel graph. The customer should prepare a Windows-based PC (with Bluetooth) to install this control software. (If you wish to have a new laptop PC, you can order as a separate option from us)					
Communication	Measured data wirelessly transfer to PC through Bluetooth for visualize on graphs. USB connection also possible.					
Power Requirement	100 VAC (50-60 Hz) 2A , 230 VAC (50-60 Hz) 1A			Electrical Standard	CE	RoHS compliant
Dimensions, Weight	320 mm(W) x 450 mm(D) x 150 mm(H) , ~7 kg					

### Features of Solar Cell I-V Tracing Function

Up to 6 solar cells can be connected to the analyzer. User selectable START, END and STEP voltages. Plots current and power vs. voltage curves. Calculated results include  $V_{oc}$ ,  $I_{sc}$ ,  $J_{sc}$ ,  $P_{max}$ ,  $V_{mpp}$ ,  $I_{mpp}$ , FF,  $R_s$ ,  $R_{sh}$ ,  $\eta_{activeA}$ , and  $\eta_{geoA}$ . User can set the desired scan speed, scan time, or holding time. Advanced I-V option allows initial, middle, and end point holding times. I vs. t transient plot for selected data points under a selected fixed voltage. “Programmed continuous I-V” function allows user to take series of IV curves with given time intervals. Incident light intensity data also measured during I-V and used to calculate power conversion efficiencies. Also, the control software includes dedicated I-V curve fitting function.

### Features of Maximum Power Point Tracking (MPPT) Function

The analyzer search for each cell’s maximum power point (MPP) and keep tracking MPP continuously. Control software plots  $P_{max}$ ,  $V_{mpp}$ ,  $I_{mpp}$ , and conversion efficiency vs. time curves for all connected cells with the light intensity. Also display current/power vs. voltage plots for each cell in a separate graph.

## SPD Laboratory, Inc.

2-35-1 Johoku, Hamamatsu, 432-8011, JAPAN

Tel: +81-53-474-7901 Fax: +81-53-401-7080

Email: [inq@spd-lab.com](mailto:inq@spd-lab.com)

Web: <http://www.spdlab.com/English/VK-MPA-100.html>

Select Channels

Ch.1 Ch.2 Ch.3 Ch.4 Ch.5 Ch.6

Ch.4 Ch.5 Ch.6

All Channels Ch.1 Ch.2 Ch.3

I-V Curve Settings

Use for All Channels

Auto Detect Range

Start Voltage:  mV

End Voltage:  mV

Step Value:  mV

Active Area of the Cell:  cm<sup>2</sup>

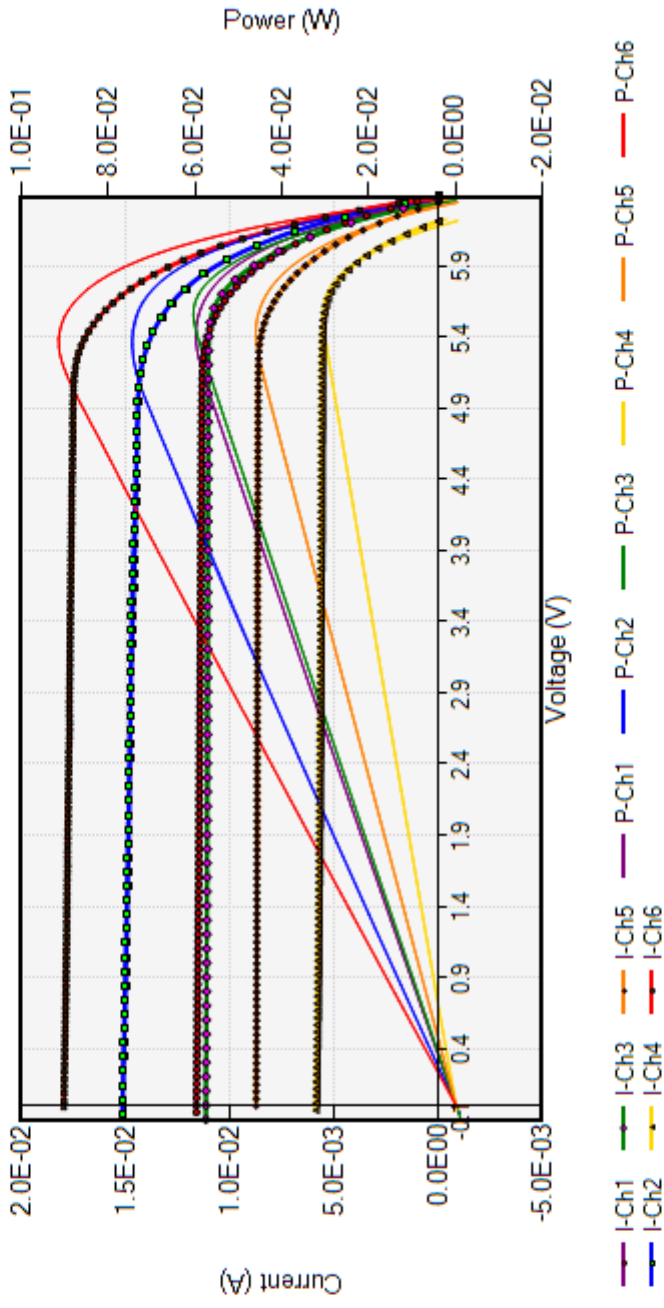
Geom. Area of the Cell:  cm<sup>2</sup>

Incident Light Intensity:  mW/cm<sup>2</sup>

Current Range:  mA

Copy to all Ch's

### All Channels - Current and Power vs. Voltage



Data Plotting Method

Live  After Collecting All Data

Power Curve  Set Y-min to 0

I-V Mode

Normal I-V  Advanced I-V

Programmed Continuous I-V

Scan Settings

Start Point Delay:  s

Retention (Holding) Time:  ms

Scan Speed:  mV/s

IV Scan Time:  s

Auto Reverse

START

CANCEL

Save Graph Image

```

=====
CHANNEL 1 Forward I-V Result
=====
Voc      = 6.38536 V
Isc      = 11.6199 mA
Jsc      = 1.16199 mA/cm2
FF       = 0.808
Eff. (A. Area) = 5.993%
Eff. (G. Area) = 5.993%
Vmpp     = 5.39983 V
Imppp    = 11.0982 mA
Max Power = 59.0769 mW
    
```

Select Channels

Ch.1 Ch.2 Ch.3 Ch.4 Ch.5 Ch.6

Ch.4 Ch.5 Ch.6

All Channels Ch.1 Ch.2 Ch.3

Start Direction:  From 0 V  From Voc

Auto Set StartV and I Range

Searching Start Voltage: 0 mV

Searching ΔV: 100 mV

Tracking ΔV: 2 mV

Hill Climbing  Bisection

Current Range: 20 mA

Active Area of the Cell: 0.250 cm<sup>2</sup>

Incident Light Intensity: 100 mW/cm<sup>2</sup>

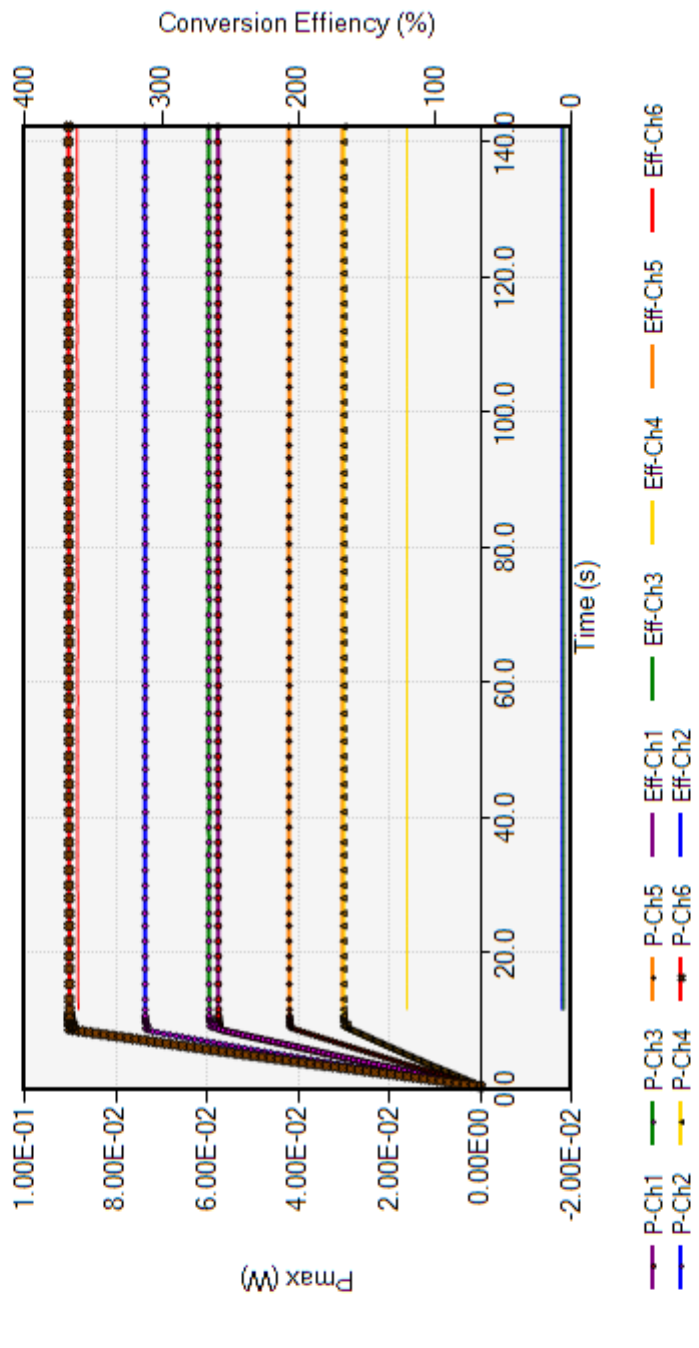
Copy This Setting to All Channels

Graph Display Options

Pmax  Efficiency and Pmax

Pmax (mW)	Energy (mWh)	Eff. (%)	Vmpp (V)	Imp (mA)
57.703	2.186	5.77%	5.299	10.8886
73.784	2.795	7.38%	5.274	13.9889
59.754	2.264	5.98%	5.474	10.9152
30.171	1.143	120.68%	5.466	5.5198
42.105	1.595	168.42%	5.413	7.7787

### All Channels Pmax & Eff vs. Time



MPPT Ending Options

Manual Stop: 1 2 3 4 5 6

Time: 60.0 min  If Efficiency drops 1.000 %

Energy: 0.00001 Wh  If current drops 0.100 mA

Retention t: 100 ms

Plot Interval: 2 s

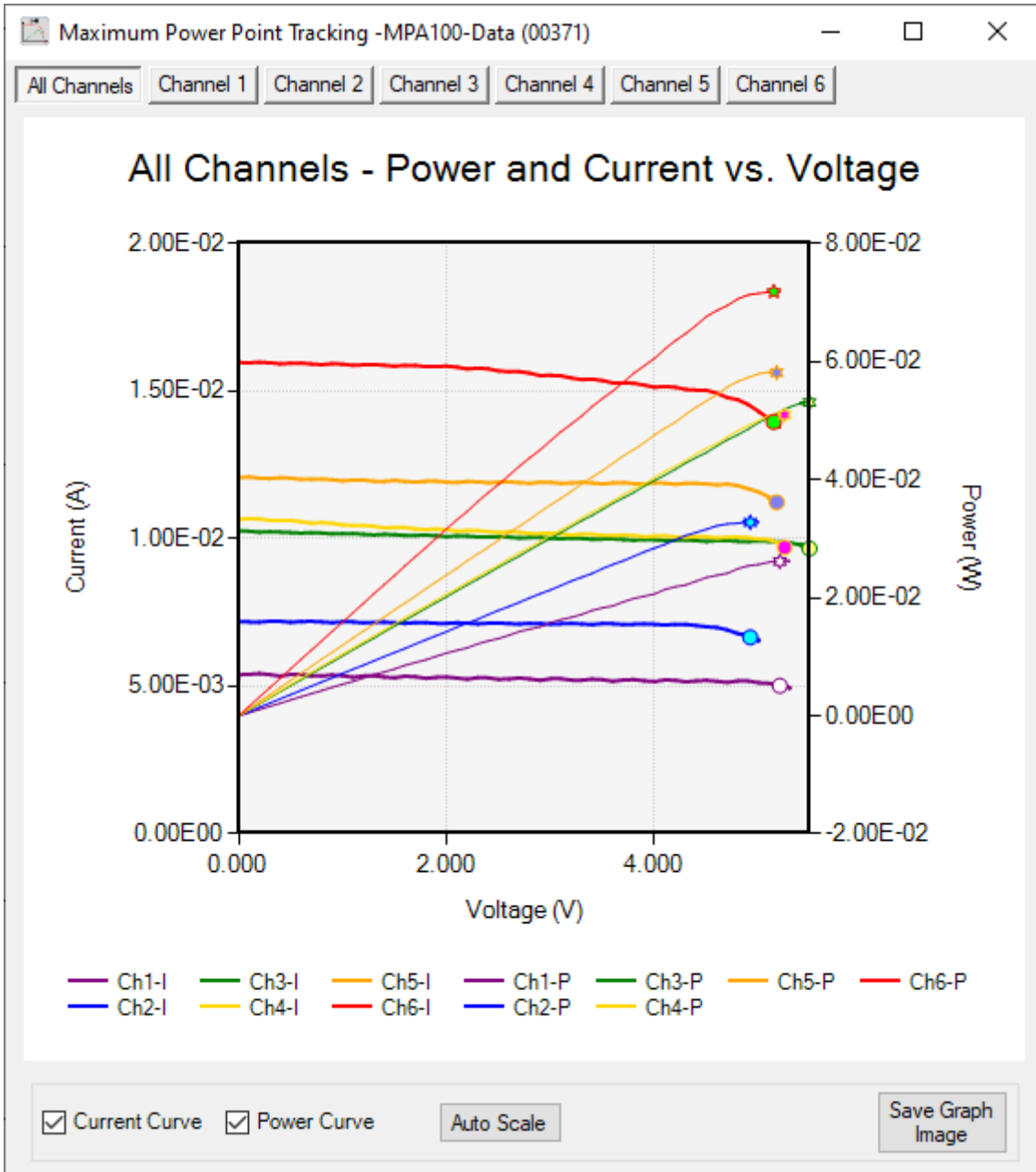
MPPT Algorithm:  Hill Climbing  Bisection

**STOP**


Open I-V Window


Save Graph

Show Searching Data



Communication Port

COM5  

USB  Bluetooth 

Measuring Range

Channel	Voltage Range	Current Range
Channel 1	10 V <input type="checkbox"/> Auto	20 mA <input type="checkbox"/> Auto
Channel 2	100 mV <input type="checkbox"/> Auto	20 mA <input type="checkbox"/> Auto
Channel 3	100 mV <input type="checkbox"/> Auto	20 mA <input type="checkbox"/> Auto
Channel 4	100 mV <input type="checkbox"/> Auto	20 mA <input type="checkbox"/> Auto
Channel 5	100 mV <input type="checkbox"/> Auto	20 mA <input type="checkbox"/> Auto
Channel 6	100 mV <input type="checkbox"/> Auto	20 mA <input type="checkbox"/> Auto
PhotoDiode		400 uA <input checked="" type="checkbox"/> Auto
Pyranometer 1	1.25 V <input type="checkbox"/> Auto	<input type="button" value="Read"/>
Pyranometer 2	2.5 V <input type="checkbox"/> Auto	<input type="button" value="Set"/>
Pyranometer 3	150 mV <input type="checkbox"/> Auto	

Auxiliary Outputs Control Panel

Photo Diode and Pyranometer Calibration Constants

Photo diode calibration constant (Current at 1 sun)  mA

Pyranometer 1 Sensitivity   $\mu\text{V}\cdot\text{m}^2/\text{W}$

Pyranometer 2 Sensitivity   $\mu\text{V}\cdot\text{m}^2/\text{W}$

Pyranometer 3 Sensitivity   $\mu\text{V}\cdot\text{m}^2/\text{W}$

System Reset

ADC Conversion Time

Auto Select

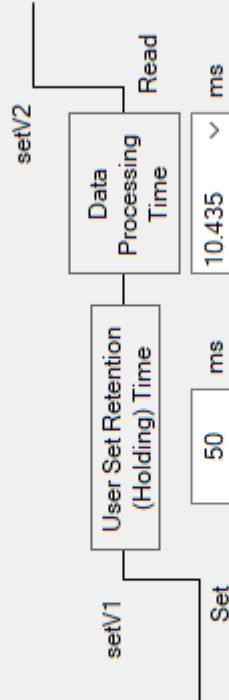
Go to Service Mode

Auto Correct Offset

Enter Password :

Please enter the password to enable service mode. Please refer to service manual for more detail

Set and Read Timing Diagram



Error Reporting :

Select Channels

Ch.1 Ch.2 Ch.3 Ch.4 Ch.5 Ch.6

Ch#	Voltage	Current
1	499.839 mV	979.653 $\mu$ A
2	1.00011 V	920.443 $\mu$ A
3	1.50031 V	652.917 $\mu$ A
4	1.9993 V	633.439 $\mu$ A
5	2.49799 V	983.337 $\mu$ A
6	3.00029 V	795.343 $\mu$ A

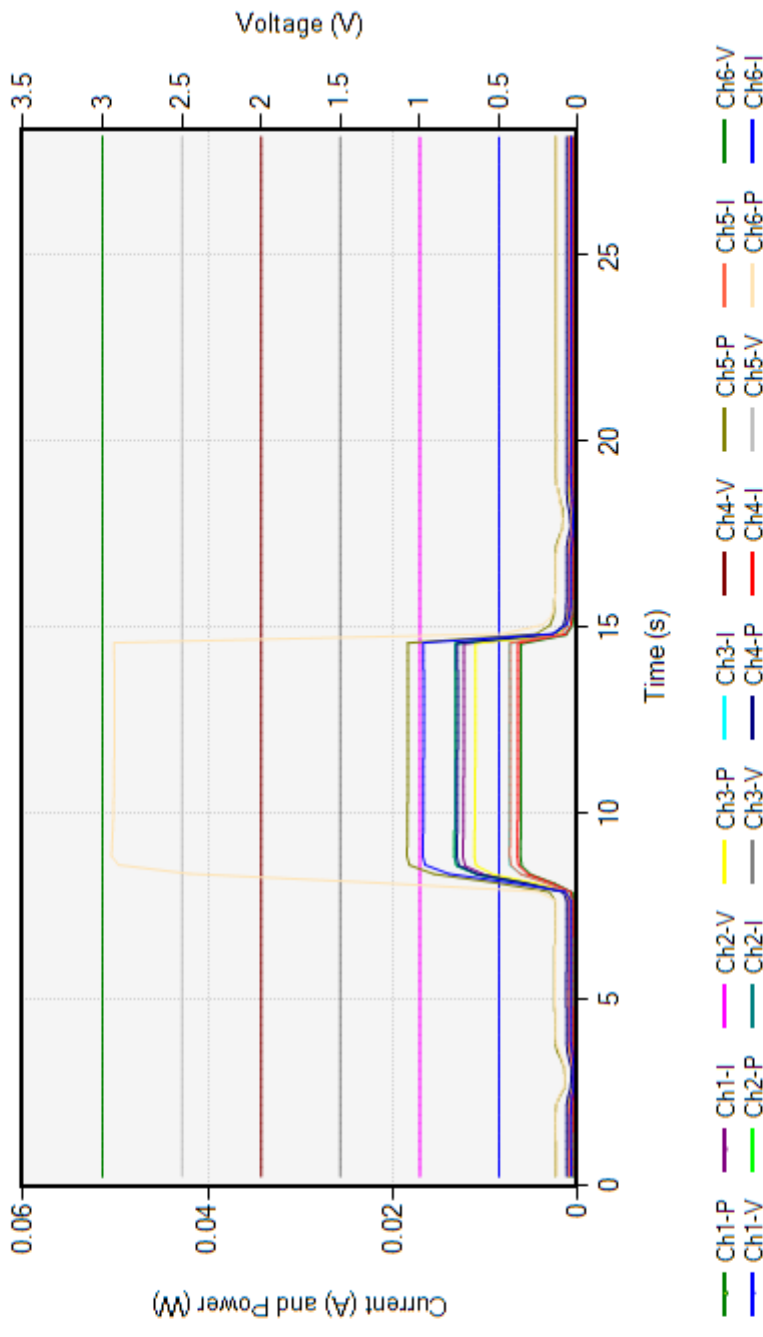
Measure Open Circuit Voltage

Measure Short Circuit Current

Plot Voc and Isc

Auto  
 t\_Voc: 5.000 s   
 t\_Isc: 10.000 s   
 t\_Total: 60 s   
 Interval: 0.5 s  
 Plot Interval: 1 s

### Current vs. Time at Fixed Voltage



Set Voltage For Each Channel

Ch.1:	0.5 V	Ch.2:	1 V
Ch.3:	1.5 V	Ch.4:	2 V
Ch.5:	2.5 V	Ch.6:	3 V

Auxiliary Outputs

ADC Conversion Time: 800  $\mu$ s

Data Reading Interval: 0.2 s

Plot Current vs. Time at constant V

Status: Ready

Total Scanning Time: 0.000 s Scan Speed: 0000 mV/s