

## < 태양전지 및 태양광모듈 IV곡선 및 효율 분석장치 > Model PROVA-SS1

### 1. 제품의 특징.

- 신재생에너지 중 태양광관련 광전효과에 의한 솔라셀/모듈의 전력 생산 효율 증대를 위한 설계 디자인에 대한 교육/연구/개발, 품질관리 및 현장유지보수에 있어서 다각도로 노력 중에 있으며, 이에 부응하기 위하여 본 제품은 I-V 곡선 특성화 테스트를 통한 태양전지 및 태양광모듈의 성능 및 효율을 교육현장/연구/개발 및 유지보수 현장에서 측정/분석/평가 하기위해 개발된 제품이다. 아래는 기본 구성품과 사양을 보여준다.



## 2. 기본 구성품.

### 1) 태양전지/태양광모듈 측정용 테이블장치(높이조절가능)

(Solar Cell/Panel Fixture with Halogen Lamp and Thermocouple and Pyranometer)

- 광원(할로겐램프x3), 열전대센서, 일사량센서 내장.

### 2) 광원 제어 및 전원공급기

(Solar Radiation Controller & Power supply) - Model PROVA-8300

- 할로겐램프의 광원을 테이블장치에 내장된 일사량센서와 연동제어하여 사용자가 원하는 일사량( $100\text{W/m}^2 \sim 1,500\text{W/m}^2$ )을 쉽게 디지털 숫자 버튼을 선택하면, 자동적으로 캘리브레이션이 진행되도록 고안되어 측정시작 기능을 알리는 안내문구와 함께, 바로 측정이 가능하다.
- 본 제품의 광원(할로겐램프)은 실제 일사량과는 차이가 날 수 있으므로 옵션품목인 TES-1333R과 연계하여 사용하실 것을 권장합니다.
- **옵션1** : 휴대용 일사량계/광투과율측정기(겸용) - Model TES-1333R  
(약 손바닥크기로서 자동데이터로거 및 실시간모터링 가능하도록 소프트웨어 기본제공되며, 자세한 사양은 카다로그를 참조바람)



### 3-1) 태양전지/태양광모듈 I-V Curve 특성시험 및 효율(%) 분석기

(Solar Module Analyzer) - Model PROVA 200

- 최대 개방전압(Voc) 및 단락전류(Isc) : 60Vdc / 6A

### 3-2) 옵션2 : 태양전지/태양광모듈 I-V Curve 특성시험 및 효율(%) 분석기

(Solar Module Analyzer) - Model PROVA 210

- 최대 개방전압(Voc) 및 단락전류(Isc) : 60Vdc / 12A



### 3-3) 옵션3 : 휴대용 프린터(Model PROVA-300XP)



### 4) 8채널 디지털 온도기록계

(8 input Thermometer/Datalogger) - Model PROVA-800



# PROVA SS1

## Solar Power Development System 太陽能發展系統

# PROVA®



<http://www.prova.com.tw>

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**TES**

Reliable in Quality

 $W/m^2$   
 $Btu / (ft^2 \times h)$ 

# TES-1333 Solar Power Meter

Sourcing the best efficiency of Solar Energy Reception

- Wide spectral range
- $W/m^2$  and  $Btu / (ft^2 \times h)$  units display
- MAX / MIN / AVG mode
- Solar energy measurement
- Current time setting function



# 1333/1333R SOLAR POWER METER

## FEATURE:

- Wide spectral range.
- Excellent long term stability.
- Cosine corrected.
- Automatic transmission measurements.
- Select either power or transmission.
- Solar energy measurement.
- Current time setting function.
- User calibration factor setting function.
- End-mount light sensor.
- Select either  $W/m^2$  or  $Btu / (ft^2 \times h)$  units.
- Data Hold/MAX/MIN/AVG modes.
- Data Memory and Read function. (99 sets)
- Auto Data Memory and RS232 interface to PC. (TES-1333R)

## APPLICATIONS

- Meteorology.
- Agriculture.
- Solar radiation measurement.
- Solar power research.
- Physics and optical laboratories.
- Solar transmission measurement.
- Identify high performance windows.

## SPECIFICATIONS

Display	3-1/2 digits. Max. indication 1999
Range	2000 $W/m^2$ 634 $Btu / (ft^2 \times h)$
Resolution	1 $W/m^2$ 1 $Btu / (ft^2 \times h)$
Spectral response	400-1100nm
Accuracy	Typically within $\pm 10 W/m^2$ [ $\pm 3 Btu / (ft^2 \times h)$ ] or $\pm 5\%$ , whichever is greater in sunlight; Additional temperature induced error $\pm 0.38 W/m^2/^\circ C$ [ $\pm 0.12 Btu / (ft^2 \times h)/^\circ C$ ] from $25^\circ C$
Angular accuracy	Cosine corrected $< 5\%$ for angles $< 60^\circ$
Drift	$< \pm 2\%$ per year
Calibration	User recalibration available
Over-Input	Display shows "OL"
Sampling Time	Approx. 0.4 second
Manu Data Memory and Read	99 sets
Auto Data Memory	32000 sets (TES-1333R)
Battery	4 pcs size AAA
Battery Life	Approx. 100 hours
Operating Temp and Humidity	$0^\circ C$ to $50^\circ C$ ( $32^\circ F$ to $122^\circ F$ ) below 80%RH
Storage Temp and Humidity	$-10^\circ C$ to $60^\circ C$ below 70%RH
Weight	Approx. 165g
Dimension	111(L) x 64 (W) x 34(H) mm
Accessories	Carrying Case, Operation Manual, 4 pcs size AAA, RS232 cable (for TES-1333R), CD software (for TES-1333R)



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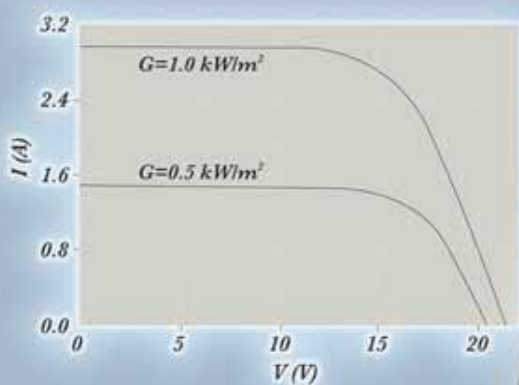
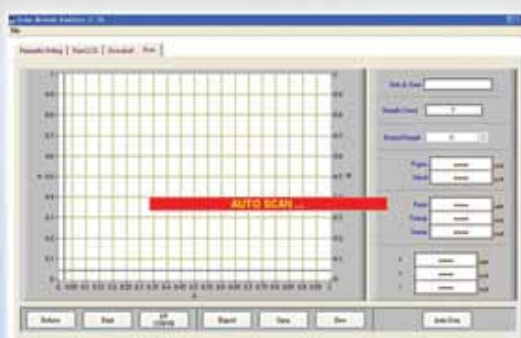
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# 200 Solar Module Analyzer

- I-V Curve Test for Solar Cell
- Maximum Solar Power (Pmax) Search by Auto-scan (60V, 6A)
- I-V Curve with cursor
- Calculation of Efficiency (%)





Reliable in Quality

# 200 Solar Module Analyzer

## FEATURES :

- I-V Curve Test for Solar Cell
- Maximum Solar Power (Pmax) Search by Auto-scan (60V, 6A)
- Maximum Voltage (Vmaxp) at Pmax
- Maximum Current (Imaxp) at Pmax
- Voltage at open circuit (Vopen)
- Current at short circuit (Ishort)
- I-V curve with cursor
- Optional printer (model: 300XP) to hardcopy I-V curve
- Calculation of Efficiency (%)
- Manual single point test

## Electrical Specifications (23°C±5°C)

### DC Voltage:

Range	Resolution	Accuracy
0 – 10V	0.001V	±1% ± 18 dgts
10 – 60V	0.01V	±1% ± 18 dgts

### DC Current:

Range	Resolution	Accuracy
0 – 1A	0.1mA	±1% ± 18 dgts
1 – 6A	1mA	±1% ± 18 dgts

## General Specifications:

Battery Type	1.2V AA rechargeable battery x 8 (2500mAh)
AC Adaptor	AC 110V or 220V input, DC 12V/ 3A output
Size	257 (L) x 155 (W) x 57 (H) mm 10.1 (L) x 6.1 (W) x 2.2 (H) inch
Weight	1160 g / 40.9 oz (batteries included)
Accessories	Users Manual x 1 1.2V AA rechargeable battery x 8 1 set of Kelvin clips (2 clips, 5A max.) USB cable x 1 AC adaptor x 1



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# PROVA<sup>®</sup>

## PROVA 210

### Solar Module Analyzer (Photovoltaic I-V Curve Tester)

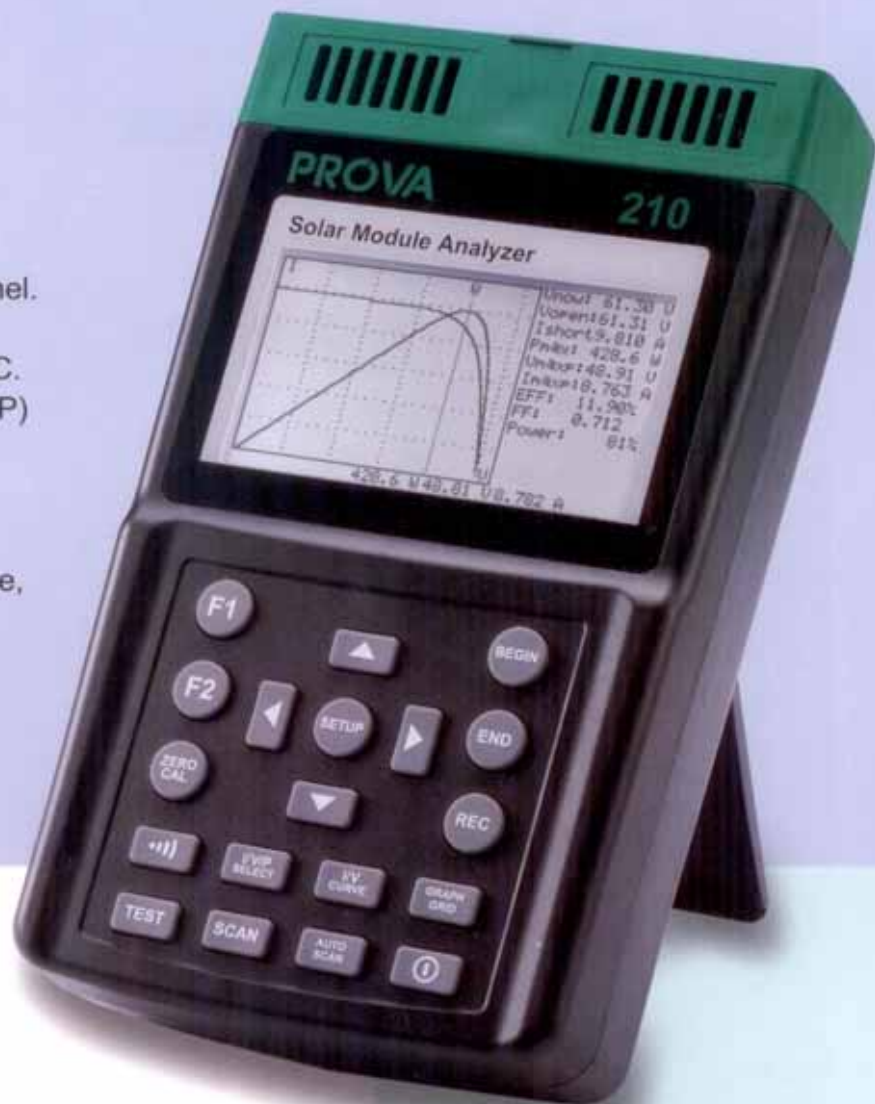
#### Features

- I-V Curve Test for Solar Cell.
- Max. Solar cell/module Power (Pmax) search by auto-scan: 60V, 12A.
- 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.
- Efficiency (%) calculation of solar panel.
- Real time data logging.
- RS232C (to USB Bridge) cable for PC.
- Optional printer (model: 300XP/310XP) to hardcopy I-V curve.

#### Application Notes

1. Quality Control in the Production Line, Warehouse, or Site of Installation.
2. Identify the Solar Power System Requirement.
3. Maintenance of Solar Panels.
4. Verify the Best Installation Angle of Solar Panels.

*Quality Control, Identification,  
Maintenance, and Verification!*



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CAT I 60V

## PROVA 210

### Solar Module Analyzer (Photovoltaic I-V Curve Tester)

#### Electrical Specifications (23°C ± 5°C, Four-wire Measurement)

##### DC Voltage Measurement :

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

Vopen : open circuit voltage of solar cell or module.

##### DC Current Measurement :

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

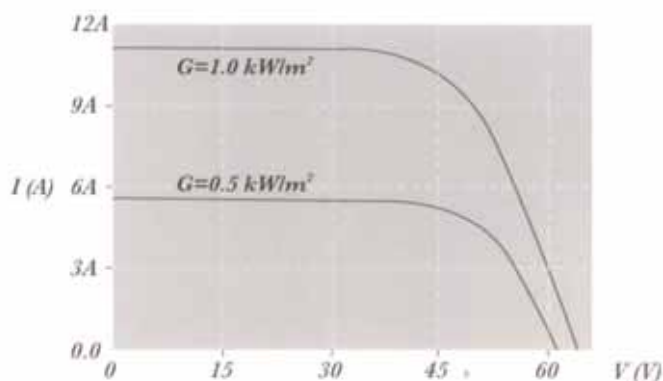
Ishort : short circuit current of solar cell or module.

##### DC Current Simulation :

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

#### General Specifications

AC Adaptor	AC 110V or 220V input, DC 15V / 3A output
Dimension	257(L) x 155(W) x 57(H) mm 10.1" (L) x 6.1" (W) x 2.2" (H)
Weight	1160g / 40.9oz (Batteries included)
Operation Environment	0°C ~ 50°C, 85% RH
Storage Environment	-20°C ~ 60°C, 75% RH
Accessories	User Manual x 1, Software Manual x 1 Lithium battery 11.1V (Rechargeable) x 1 RS232C (to USB Bridge) Cable x 1 Software CD x 1, AC adaptor x 1, Kelvin Clips (2 clips, banana plugs) x 1 set (10A max, 12A for 1 minute)



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Kelvin Clips



CAT I 60V



# PROVA<sup>®</sup>

## 300XP Portable Thermal Printer

- Portable Field Printing for Certificate
- Text and Graphics
- Two Selectable Fonts (5x7 and 8x16)
- Programmable Text Header and Footer
- Battery and AC Power Adaptor
- RS-232C Interface (Optional RS-232C to USB Bridge)
- Fixed Interval Continuous Printing (5, 30, 60, 300 seconds)

- Ready for PROVA products

6830 Power and Harmonics Analyzer

8500 Energy-saving Tester

3003/3005 Flexible Power Quality Tester

WM-01/WM-02 Power Analyzer

- Ready for \*Agilent<sup>®</sup> 34401A Multimeter

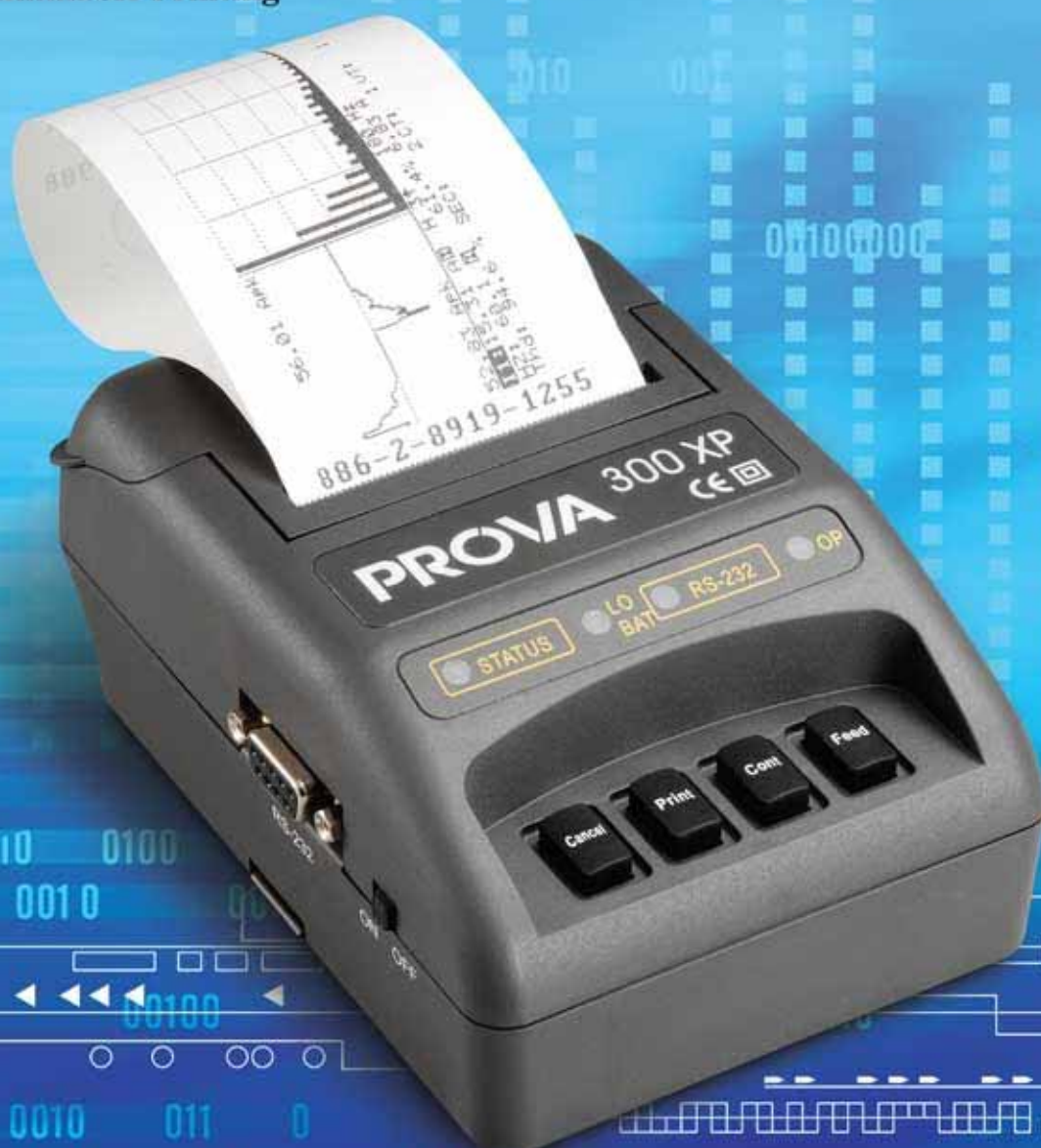
- User Programmable Printing

6200 Clamp-on Graphic Power Quality Analyzer

6300 Flexible Graphic Power Quality Tester

803/901/903 Dual Channel DMM

AVM-07/AVM-303 Flow Anemometer



\*Agilent is a trade mark of Agilent Technologies.



# 300XP Portable Thermal Printer



## Printing Mechanical Specification:

Method: Thermal Dot Printing  
Dot Per Line: 8 (vertical) x 166 (horizontal)  
Fonts: 5 x 7 and 10 x 15  
Dot Pitch: 0.35mm (vertical), 0.28mm (horizontal)  
Character Size: 1.4 x 2.4mm (5x7), 2.8 x 4.6mm (10x15)  
Characters per Line: 27 (5x7), 16 (10x15)  
Printing Contrast: Auto and User Selectable  
Printing Width: 46mm  
Printing Speed: 0.8 lines / second  
Printing Life: 500,000 lines  
Paper Width: 57mm

## Communication:

Interface: RS-232C (9600, 8, 1, N)  
Receiving Buffer: 9K bytes  
Character set: ASCII International  
Graphics: Bit Map  
Option: USB to RS-232C Bridge

## Mechanical and Environmental Specification

Operating Temperature: -10 to 50°C  
Storage Temperature: -20 to 60°C  
Humidity: 0 to 90%RH (Non-condensing)  
Batteries: 8 x 1.5V  
AC Power Adaptor: DC 12V  
Dimension: 95mm (W) x 135mm (D) x 55mm (H)  
Weight: 440g (8 batteries included)

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# PROVA 800

## 8 Input Thermometer / Datalogger

### Features

- 8 input temperature measurement/logging (°C/°F)
- Graphic display of each input
- 11 types of thermocouple (K, J, E, T, R, S, N, L, U, B, C)
- Easy thermocouple mini connector
- Basic accuracy 0.05% ± 1°C (K type)
- Sampling rate: 1 sec. / 8 inputs
- Programmable Hi-Lo alarm for 8 inputs
- Display of max and min values of 8 inputs
- Standard 2G SD memory card (stores 3.8-year data)
- Optional 8G SDHC memory card
- SD card directly read by PC
- Easy data file management (Read and Delete functions)
- Built-in calendar clock
- Independent Input Setup (type of thermocouple, Hi-Lo alarm values, name of Engineering Unit)
- Isolated Input Protection of 350Vp-p between any two inputs
- Programmable Engineering Unit (E.U.) to integrate Analog Output (-50 to 50 mV) from instruments (e.g. Sound level meter, Humidity meter, Current adaptor)
- Screen hardcopy into files
- Paperless Recorder



### General Specifications

<b>Battery Type:</b>	1.2V AA alkaline batteries x 8
<b>AD Adapter:</b>	110V or 220V input, DC 12V / 300mA output
<b>Dimension:</b>	257(L) x 155(W) x 32(H) mm 10.1" (L) x 6.1" (W) x 1.2" (H)
<b>Weight:</b>	110g / 40.5oz (Batteries included)
<b>Operation Environment:</b>	0°C ~ 50°C, 85% RH
<b>Storage Environment:</b>	-20°C ~ 60°C, 75% RH
<b>Accessories:</b>	User manual x 1, 1.2V AA alkaline batteries x 8 AC adapter x 1, USB cable x 1 Software CD x 1, Software manual x 1 SD card (2GB) x 1, Carrying bag x 1 K-type thermocouples (Matopen: 2Mx1pc., 5Mx1pc.)
<b>Option:</b>	SDHC card (8GB)



# PROVA 800

## 8 Input Thermometer / Datalogger

### Applications

#### Temperature Distribution/Profile Analysis

- PCB Reflow, and Reflow Oven
- Temperature & Humidity Chamber
- Environmental Test Chamber
- Burn In Room (e.g. Motherboard)
- Thermal Shock Tester
- Aging Test Oven
- Metal Heating Machine
- Automotive Air Conditioning, Engine Compartment
- Air Conditioning, Refrigeration, Ventilation
- Bakery Oven (Food Industry)

#### Temperature Control Analysis

- Environmental Test Chamber
- Temperature Controller
- Plastic Injection Molding Machines: Temperature Distribution, Process Temperature
- Long term record and monitor of Humidity, Wind velocity and Temperature (e.g. Preservation by Low Temperature)
- Environmental Protection: Study of Noise, Air quality and Environment

### Electrical Specifications (23°C ± 2°C) (5.1°C, 0.1°F Resolution, Accuracy is of reading.)

Type	Range	Accuracy	Range	Accuracy
K	-200 ~ -100	±2.0°C	-328 ~ -148	±3.6°F
	-100 ~ -50	±0.05% ±1.0°C	-148 ~ -248	±0.05% ±1.8°F
	-50 ~ -10	±2.3°C	-328 ~ -148	±3.3°F
J	-100 ~ 100	±1.3°C	-148 ~ 212	±2.7°F
	100 ~ 1000	±0.05% ±1.0°C	212 ~ 1832	±0.05% ±1.8°F
	-50 ~ -10	±2.0°C	-238 ~ -148	±3.6°F
E	-100 ~ 700	±0.05% ±1.0°C	-148 ~ 1400	±0.05% ±1.8°F
	-200 ~ -100	±1.3°C	-328 ~ -148	±2.7°F
	-100 ~ 400	±0.1% ±0.3°C	-148 ~ 752	±0.1% ±0.9°F
T	0 ~ 500	±3.0°C	32 ~ 932	±9.0°F
	100 ~ 300	±3.0°C	312 ~ 572	±3.6°F
	300 ~ 1400	±0.05% ±2.0°C	572 ~ 2552	±0.05% ±3.6°F
N	0 ~ 1300	±0.1% ±1.0°C	32 ~ 2352	±0.1% ±1.8°F
	-200 ~ 900	±0.1% ±1.0°C	-328 ~ 1632	±0.1% ±1.8°F
	0 ~ 400	±0.1% ±1.0°C	32 ~ 752	±0.1% ±1.8°F
B	600 ~ 1620	±0.05% ±2.0°C	1112 ~ 2930	±0.05% ±3.6°F
	0 ~ 2310	±0.1% ±1.3°C	32 ~ 4190	±0.1% ±2.7°F
	-30 ~ 30	±0.05% ±20 µV	-30 ~ 30	±0.05% ±20 µV

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