Datos técnicos

PVA-1500HE2 I-V Curve Tracer, Clamp and Multimeter Kit


FLUKE
SOLMETRIC
PVA-1500HE2
I-V CURVE TRACER


shoals


376


MSA
FLUKE
SOLMETRIC SOLSENSOR-300V3

Características principales

- Measures and displays I-V curves up to 1500V and 30A, including on high efficiency modules
- Advanced built-in PV model provides immediate PV performance checking
- Wireless interfaces for faster setup, safer work environment, and freedom of movement during PV troubleshooting
- Automates data management, analysis, and reporting
- Validate voltage and current from individual panels or a series of panels in a PV array

Descripción general del producto: PVA-1500HE2 I-V Curve Tracer, Clamp and Multimeter Kit

Training

Fluke offers a variety of training related to PV test and measurement. Training can either be delivered as a virtual on-demand course or as a live online presentation/discussion format with a product expert (may differ regionally).

Discover PVA-1500 Training

This comprehensive toolkit includes the PVA-1500HE2 I-V Curve Tracer, 393 FC Solar Clamp Meter, and 87V Digital Multimeter, offering a complete solution for solar installation diagnostics and maintenance. The PVA-1500HE2 offers an array of advanced features, including high throughput I-V curve tracing, providing quick and detailed performance data. Its intuitive user interface enables easy navigation and real-time analysis, allowing for immediate identification of potential issues. The 393 FC Solar Clamp Meter enables precise measurement of DC current and voltage, facilitating performance testing and troubleshooting of solar panels and inverters. Additionally, the 87V Digital Multimeter provides reliable measurements of AC/DC voltage, current, resistance, and capacitance, essential for verifying system integrity and diagnosing electrical faults. From commissioning and routine maintenance to troubleshooting and performance optimization, this toolkit empowers solar professionals to ensure the efficiency and reliability of solar installations with ease.

The 393 FC is a CAT III 1500 V True-RMS Clamp Meter is designed for solar photovoltaic (PV) installation technicians and maintenance professionals who work in high voltage DC environments. Solar site electrical testing and troubleshooting with the 393 FC includes:

- Measuring current and voltage
- Conducting continuity and resistance tests
- Performing inverter efficiency tests
- Diagnosing problems like short circuits
- Conducting preventive maintenance to identify and address potential issues early

The 87V Industrial Multimeter is the ideal electrical troubleshooting solution for solar inverters, combiner boxes and battery storage systems. Solar site electrical testing and troubleshooting with the 87V includes:

- Measuring current and voltage
- Identifying issues with connections and components with continuity and resistance tests
- Identifying faulty diodes impacting system performance
- Testing capacitors in inverters and power equipment
- Monitoring component temperatures for safety

- Diagnosing problems like short circuits
- Conducting preventive maintenance to identify and address potential issues early

Measure your solar PV system performance

The PVA-1500HE2 is a cutting-edge I-V curve tracer kit designed to measure PV system performance. With this high precision testing equipment, you can reliably assess the health and performance of solar modules and arrays, making informed decisions to enhance their output and longevity.

The PVA-1500HE2 kit offers an array of advanced features, including high throughput I-V curve tracing, providing quick and detailed performance data. Its intuitive user interface enables easy navigation and real-time analysis, allowing for immediate identification of potential issues. By pinpointing problems early, you can maximize your solar energy production and minimize downtime.

Comprehensive measurements and efficient analysis

For commissioning, operations, maintenance, and troubleshooting of PV arrays, I-V curve testing is the most complete solar module performance measurement. Quick analysis of curve datasets aids in detecting outliers, and the stored data functions as a baseline for future performance inquiries.

Accurate I-V curve tracing

The PVA measures the I-V (current versus voltage) curve of a PV string or module using a capacitive load. The measurement is typically performed at the string level by connecting directly to the string or at a combiner box using the fuses to select the string under test. The number of I-V curve points can be selected at 100 or 500. Additionally, the PVA generates the P-V (power versus voltage) curve, Isc, Voc, Imp, Vmp, Pmax, fill factor, and performance factor (the ratio of measured to expected maximum power).

Time-saving interface

With a tablet or laptop (Windows only) as the user interface, perform more tests per hour and display the data in multiple, easy to read formats. Save your measurements by touching your customized array tree at the branch you are measuring. The software automatically calculates the expected I-V curve and displays the performance factor.

Advanced High Efficiency PV Testing Capabilities

Accurate measurement of high efficiency modules up to 30A: Highly efficient modules (>19% module efficiency) possess high
capacitance, posing a challenge for some I-V curve tracers that may not be able to measure them. The PVA-1500HE2 is uniquely
designed to measure all string types, even those with high efficiency modules, up to 30A.
Rapid performance in high temperature environments: The PVA-1500HE2 operates with a swift sweep-to-sweep delay of 9 seconds (at Voc<1350V). This results in the ability to measure 3.5 MW within an hour, even in high-temperature settings where standard curve tracers often fail due to overheating.

SolSensor™ Wireless PV Reference Sensor

The SolSensor™ provides irradiance, module temperature, and array tilt data to the PV model. The model uses this information to predict the I-V curve shape at these operating conditions and to translate the measured curve to standard test conditions. The SolSensor™ clamps to the module frame, automatically orienting the irradiance sensor to the plane-of-array.

The spectral response of the silicon photodiode sensor in the SolSensor™ is corrected for the PV technology under test. Special
factors are provided for multi- and mono-crystalline cells as well as cadmium telluride (CdTe) and other thin film technologies. The
sensor is temperature compensated and the angular response of each unit is calibrated for rotation and elevation. As a result, the SolSensor™ is accurate over a broad range of technologies, sky conditions, and sun angles, allowing I-V curve measurements earlier and later in the day.

The SolSensor™ provides two external thermocouple inputs for measuring module backside temperatures. Effective cell temperature can also be calculated directly from the measured I-V curve per IEC 60904-5. The PVA's SmartTemp™ feature, optionally, blends these two methods for best accuracy.

The PVA and SolSensor™ communicate wirelessly with your PC via WiFi with a line-of-sight wireless range of 100m. That means no wires underfoot, quick setup, the ability to move around while troubleshooting strings, and flexibility to measure multiple combiner boxes with a single SolSensor™ setup.

Turn PVA data into key insights, visualizations, and customizable reports

Capture data in the field with the PVA Application and validate the results with the Data Analysis Tool (DAT), a Microsoft Excel™-based solution streamlining the analysis of PVA I-V curve data. It presents analysis results in multiple formats. It compiles key PV parameters in a string table, flags non-conforming strings, and delivers a statistical overview of the entire array. Additionally, it visually combines string I-V curves at the combiner box level, offering a clear depiction of consistency and identifying atypical strings. The tool also generates histograms for PV parameters across the string population, and this data can be added to a customizable report exported as a PDF. The Data Analysis Tool (DAT) can be downloaded for free use with any PVA.
Supported languages: English, French, Spanish, German, Italian, Traditional Chinese, Simplified Chinese, and Brazilian Portuguese.

Download the PVA Application and Data Analysis Tool

Especificaciones: PVA-1500HE2 I-V Curve Tracer, Clamp and Multimeter Kit

Thermal Capacity	
# sweeps at 18 s sweep-to-sweep delay	unlimited (25 °C, 77 °F ambient) 550 (45 °C, 113 °F ambient)
# sweeps at 9s sweep-to-sweep delay	unlimited (25 °C, 77 °F ambient) 330 (45 °C, 113 °F ambient)
I-V Trace Points	100 or 500 (selectable)
I-V Sweep Duration	0.05 to 2 seconds (typically 0.2 seconds for PV strings)
Operating Temperature Range	0 °C to 45 °C, 32 °F to 113 °F
Storage Temperature Range	-20 °C to 65 °C, -4 °F to 149 °F
Operating Humidity	<90 % RH, non-condensing. Avoid exposing a cold instrument to warm and humid air as condensation will result. Store the instrument in the same conditions in which the instrument will be used.

Altitude	2000 m max	
Baery Charging Time	6 hr	
Baery Run Time	Approx. 8 hr	Approx. 7 hr
Safety and Regulatory	CAT III 1500V IEC 61010-1: Pollution Degree 2	
Waing Features	Over-voltage, over-current, over-temperature, reverse polarity	
PV Connector	Staubli MC4-EVO2	Banana Jacks
Charging/Charged LED	Yes	
In-the-field firmware update-ready	Yes	
Interface to Tablet/Laptop	Wi-Fi interface between user tablet or laptop, I-V unit and SolSensor™	
Weight	6.6 kg, 14.55 lb	7.3 kg, 16.09 lb
Height	43.2 cm, 1.41 ft (including test lead and strain reliefs)	53.3 cm, 1.74 ft
Width	21.6 cm, 8.50 in	
Depth	15.2 cm, 5.98 in	

PVA-1500 Test Lead and Clip Specifications	
Voltage Range	0 to 1500V DC
Current Range	0 to 30A DC
Temperature	0 °C to 45 °C, 32 °F to 113 °F
Humidity	Maximum relative humidity of 80% for temperatures up to 31 °C (87.8 °F) decreasing linearly to 50% relative humidity at 40 °C (104 °F)
Pollution Degree	2
Altitude	2000 m, 6561 ft maximum
Lead Length	152 cm, 59.84 in
Lead Colors	Positive=red, negative=black
Manufacturer (Test Leads and Alligator Clips)	Staubli
Note: Use only test leads and clips provided by Fluke for the PVA-1500.	

SolSensor™ Specifications	
Irradiance	
Sensor Type	Silicon photodiode with corrections for temperature, spectral, and angular effects
Measurement Range	100 W/m^2 to 1500 W/m^2

Accuracy	±2 % when used to predict the performance of well characterized poly- and monocrystalline PV modules with direct irradiance >600W/m^2
Resolution	1 W/m^2
Measurement Interval	Typically, 3.5 s
Temperature	
Sensor Type	Type K thermocouple, two inputs
Measurement Range	0 °C to 100 °C, 32 °F to 212 °F
Accuracy	±2 °C, 35.6 °F (not including limits of error of thermocouple)
Resolution	0.1 °C, 32.18 °F
Measurement Interval	Typically, 3.5 s
Tilt	
Sensor Type	Electronic
Measurement Range	0 to 90° from horizontal
Accuracy	±2° typical (0 to 45°)
General	
Measurement Cynchronization with I-V Curve	Typically, <1 s
Wireless Range (open line of sight)	100 m, 328 ft
Operating Temperature Range	0 °C to 45 °C, 32 °F to 113 °F
Storage Temperature Range	-20 °C to 65 °C, -4 °F to 149 °F
Operating Humidity	<90% RH, non-condensing. Avoid exposing a cold instrument to warm and humid air as condensation will result. Store the instrument in the same conditions in which the instrument will be used.
Baery Charging Time	6 hr
Baery Run Time	>16 hr typical use

Specifications:			
General			
Maximum voltage between any Terminal and Earth Ground			
AC	1000 V		
DC	1500 V		
Baeries	2 AA IEC LR6 alkaline		
Display	Dual display with backlight		
Automatic Power Off	20 minutes		
Electrical			

Accuracy			
Accuracy is specified for 1 year after calibration, at operating temperatures of 18 °C to 28 °C, relative humidity at 0 % to 75 %. Accuracy specifications take the form of: ±([% of Reading] + [Number of Least Significant Digits]).			
Temperature Coefficients	Add 0.1 x specified accuracy for each °C > 28 °C or < 18 °C		
AC Current: Jaw			
Range	999.9 A		
Resolution	0.1 A		
Accuracy	2 % + 5 digits (10 Hz to 100 Hz)		
	2.5 % + 5 digits (100 Hz to 500 Hz)		
Crest Factor (50/60 Hz)	2.5 @600.0 A		
	3.0 @500.0 A		
	1.42 @999.9 A		
	Add 2 % for C.F. >2		
AC Current: Flexible Current Probe			
Range	999.9 A		
	2500 A		
Resolution	0.1 A (□999.9 A)		
	1 A (□2500 A)		
Accuracy	3 % RD + 5 digits (10 Hz to 500 Hz)		
Crest Factor (50/60Hz)	2.5 @1400 A		
	3.0 @1100 A		
	1.42@2500 A		
	Add 2 % for C.F. >2		
Position Sensitivity			

Distance from Optimum	**i2500-10 Flex**	**i2500-18 Flex**	**Error**
A	0.5 in (12.7 mm)	1.4 in (35.6 mm)	±0.5 %
B	0.8 in (20.3 mm)	2.0 in (50.8 mm)	±1.0 %
C	1.4 in (35.6 mm)	2.5 in (63.5 mm)	±2.0 %
Measurement uncertainty assumes cealized primary conductor at optimum position, no exteal electrical or magnetic field, and within operating temperature range.			
DC Current			
Range	999.9 A		
Resolution	0.1 A		
Accuracy	2 % RD + 5 digits[1]		
	[1]When using the ZERO (B) function to compensate for offsets.		
AC Voltage			
Range	600.0 V		
	1000 V		
Resolution	0.1 V (□600.0 V)		
	1 V (□1000 V)		
Accuracy	1 % RD + 5 digits (20 Hz to 500 Hz)		

DC Voltage			
Range	600.0 V		
	1500 V		
Resolution	0.1 V (□600.0 V)		
	1 V (□1500 V)		
Accuracy	1 % RD + 5 digits		
mV dc			
Range	500.0 mV		
Resolution	0.1 mV		
Accuracy	1 % RD + 5 digits		
Amps Frequency: Jaw			
Range	5.0 Hz to 500.0 Hz		
Resolution	0.1 Hz		
Accuracy	0.5 % RD + 5 digits		
Trigger Level	5 Hz to 10 Hz, □10 A		
	10 Hz to 100 Hz, □5 A		
	100 Hz to 500 Hz, □10 A		
Amps Frequency: Flexible Current Probe			
Range	5.0 Hz to 500.0 Hz		
Resolution	0.1 Hz		
Accuracy	0.5 % RD + 5 digits		
Trigger Level	5 Hz to 20 Hz, □25 A		
	20 Hz to 100 Hz, □20 A		
	100 Hz to 500 Hz, □25 A		
Voltage Frequency			
Range	5.0 Hz to 500.0 Hz		
Resolution	0.1 Hz		
Accuracy	0.5 % RD + 5 digits		
Trigger Level	5 Hz to 20 Hz, □5 V		
	20 Hz to 100 Hz, □5 V		
	100 Hz to 500 Hz, □10 V		
DC Power			
Range	600.0 kVA (600.0 V dc range)		
	1500 kVA (1500 V dc range)		
Resolution	0.1 kVA		
	1 kVA		
Accuracy	2 % RD + 2.0 kVA		
	2 % RD + 20 kVA		
Resistance			
Range	600.0 Ω		
	6000 Ω		
	60.00 kΩ		
Resolution	0.1 Ω (□600.0 Ω)		
	1 Ω (□6000 Ω)		
	0.01 kΩ (□60.00 kΩ)		
Accuracy	1 % RD + 5 digits		
Capacitance			
Range	100.0 µF		

	1000 µF		
Resolution	0.1 µF (□100.0 µF)		
	1 µF (□1000 µF)		
Accuracy	1 % RD + 5 digits		
Inrush Trigger Level	5 A		
Mechanical			
Size (L x W x H)	281 mm x 84 mm x 49 mm		
Weight (with baeries)	520 g		
Jaw Opening	34 mm		
Flexible Current Probe Diameter	7.5 mm		
Flexible Current Probe Cable Length			
(head to electronics connector)	1.8 m		
Environmental			
Operating Temperature	-10 °C to 50 °C		
Storage Temperature	-40 °C to 60 °C		
Operating Humidity	Non condensing (<10°C)		
	□90 % RH (at 10 °C to 30 °C)		
	□75 % RH (at 30 °C to 40 °C)		
	□45 % RH (at 40 °C to 50 °C)		
Operating Altitude	2000 m		
Storage Altitude	12 000 m		
Ingress Protection (IP) Rating	IEC 60529: IP54 non-operating		
Electromagnetic Compatibility (EMC)			
Inteational	IEC 61326-1: Portable, Electromagnetic Environment, IEC 61326-2-2 CISPR 11: Group 1, Class A		
	Group 1: Equipment has intentionally generated and/or uses conductively-coupled radio frequency energy that is necessary for the inteal function of the equipment itself.		
Class A: Equipment is suitable for use in all establishments other than domestic and those directly connected to a low-voltage power supply network that supplies buildings used for domestic purposes. There may be potential difficulties in ensuring electromagnetic compatibility in other environments due to conducted and radiated disturbances.			
Caution: This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.			
Korea (KCC)	Class A equipment (Industrial Broadcast & Communications Equipment)		
	Class A: Equipment meets requirements for industrial electromagnetic wave equipment and the seller or user should take notice of it. This equipment is intended for use in business environments and not to be used in homes.		
USA (FCC)	47 CFR 15 subpart B. This product is considered an exempt device per clause 15.103.		
Safety			
General	IEC 61010-1, Pollution Degree 2		
Measurement	IEC 61010-2-032: CAT III 1500 V / CAT IV 600 V		
	IEC 61010-2-033: CAT III 1500 V / CAT IV 600 V		
Wireless Radio			
Radio frequency certification	FCC ID: T68-FBLE, IC: 6627A-FBLE		
Wireless Radio Frequency Range	2400 MHz to 2483.5 MHz		
Output Power	<100 mW		
SIMPLIFIED EU DECLARATION OF CONFORMITY			
Hereby, Fluke declares that the radio equipment contained in this Product is in compliance with Directive 2014/53/EU.			
The full text of the EU declaration is available at the following Inteet address:			
www.fluke.com/en-us/declaration-of-conformity			

Specifications

Voltage DC	**Maximum voltage**	1000 V
	Accuracy	±(0.05% + 1)
	Maximum resolution	10 µV
Voltage AC	**Maximum voltage**	1000 V
	Accuracy	±(0.7% + 2) True RMS
	AC bandwidth	20 kHz with low pass filter; 3 dB @ 1 kHz
	Maximum resolution	0.1 mV
Current DC	**Maximum amps**	10 A (20 A for 30 seconds maximum)
	Amps accuracy	±(0.2% + 2)
	Maximum resolution	0.01 µA
Current AC	**Maximum amps**	10 A (20 A for 30 seconds maximum)
	Amps accuracy	±(1.0% + 2) True RMS
	Maximum resolution	0.1 µA
Resistance	**Maximum resistance**	50 MΩ
	Accuracy	±(0.2% + 1)
	Maximum resolution	0.1 Ω
Capacitance	**Maximum capacitance**	9,999 µF
	accuracy	±(1% + 2)
	Maximum resolution	0.01 nF
Frequency	**Maximum frequency**	200 kHz
	Accuracy	±(0.005% + 1)
	Maximum resolution	0.01 Hz
Duty cycle	**Maximum duty cycle**	99.9%
	Accuracy	±(0.2% per kHz + 0.1%)
	Maximum resolution	0.1%
Temperature measurement	–200.0 °C – 1090 °C –328.0 °F – 1994.0 °F excluding probe	
80 BK temperature probe	–40.0 °C – 260 °C –40.0 °F – 500 °F, 2.2 °C or 2% whichever is greater	
Conductance	**Maximum conductance**	60.00 nS
	Accuracy	±(1.0% + 10)
	Maximum resolution	0.01 nS
Diode	**Range**	3 V
	Resolution	1 mV
	Accuracy	±(2% + 1)

Duty cycle range	**Accuracy**	Within ±(0.2% per kHz + 0.1%)
Environmental Specifications		
Operating temperature	–20 °C to + 55 °C	
Storage temperature	–40 °C to + 60 °C	
Humidity (without condensation)	0% – 90% (0 °C – 35 °C) 0% – 70% (35 °C – 55 °C)	
Operating Altitude	2000 m	
Safety Specifications		
Overvoltage category	EN 61010–1 to 1000 V CAT III, 600V CAT IV	
Agency approvals	CE, CSA, RCM	
Mechanical and General Specifications		
Size	201 x 98 x 52 mm (with holster)	
Weight	355 g 624 g – with holster	
Display	**Digital**	6000 counts updates 4/sec. 19,999 counts in high–resolution mode
	Analog	32 segments, updates 40/sec
	Frequency	19,999 counts, updates 3/sec at > 10 Hz
Warranty	Lifetime	
Baery Life	**Alkaline**	~400 hours typical, without backlight
Shock	1 Meter drop per IEC 61010–1:2001	
Vibration	Per MIL–PRF–28800 for a Class 2 instrument	

Fluke. *Manteniendo su mundo en marcha.*

Fluke Corporation
Everett, WA 98206 EE.UU.

Para obtener información adicional En EE. UU.
(800) 443-5853
En Europa/Medio Oriente/África
+31 (0)40 267 5100
En Canadá (800)-36-FLUKE
www.fluke.com

Latin America
Tel: +1 (425) 446-5500
www.fluke.com/es-bo

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