EEC EPV-500 Series
PV Module Safety Analyzer

Datasheet

Extech Electronics Co.

Four-in-One Solution
To Solarize Power Optimization

The EPV-500 series introduces the world's first four-in-one photovoltaic (PV) module safety analyzer, offering completely automatic one-step testing capability for DC Withstand, DC Ground Bond, Insulation Resistance, and Potential-Induced Degradation (PID) in a single easy-to-use solution. The series delivers superior efficiency, performance, and reliability for testing on PV panels. The EPV-500's 8KV DC Withstand output design provides the necessary power to meet current safety standards. Combining high PID current capacity and true negative voltage, the analyzer furnishes a greater operational efficiency and safer testing environment for users. Get the four-in-one advantage by taking complete control with the simple touch display and solarize your PV business.

Key Features

A one-stop solution for maximum operational efficiency

- 4-in-1 tester includes DC Withstand, DC Ground Bond, Insulation Resistance, and PID to maximize the space and cost savings.
- 8KV DC Withstand output meets the latest PV system voltage requirements.
- High 20mA PID current capacity is capable of testing up to 20 panels at once.
- Perform multiple testing criteria in one step for enhanced testing efficiency.
- Multi-connection interface includes PLC, USB, RS-232, GPIB, and Ethernet, with capability for remote management of operations via central computers.
- A true negative voltage design provides a safer environment for operators.

How To Ensure The Safety Of The Solar Panel

Safety requirements and standards are being strengthened across the PV industry as the market demands the panel system voltage as high as 1,500 Vdc. As a result, PV manufactures must ensure each panel passes critical safety tests to prevent potentially dangerous electrical hazards. There are four primary safety standards requiring testing under these conditions: IEC61730, IEC61215, IEC TS 62804, and UL1703. All solar panel must be tested through High Potential (Hipot), Insulation Resistance, and DC Ground Bond (see below table for detail testing condition). To ensure a test delivers the most accurate results, all tests must be completed under DC energy that matches the characteristics of solar panels.

Table PV Panel Safety Standards

Item	Classification	Parameter	UL 1703	IEC 61730-2	IEC 61215-2	IEC TS 62804
Hipot Test	Type Test	Test Voltage (DC)	2 times system voltage +1000V	Class II: 4 times system voltage+2000V Class 0: 2 times system voltage+1000V	500V or twice the system voltage +1000V	N/A
		Test Time	1 min.	1 min.	1 min.	
		Criteria	Leakage current < 50uA	No Dielectric Breakdown	No Dielectric Breakdown	
	Routine Test	Test Voltage (DC)	Type Test Voltage x 120%	N/A	N/A	N/A
		Criteria	Leakage current < 50uA			
		Test Time	1s			
IR Test (Wet Leakage Current)	Type Test	Test Voltage (DC)	500V	Refer to IEC 61215-2	500V or Maximum system voltage	N/A
		Resistance Limit	Module Area < 0.1m² : > 400MΩ Module Area > 0.1m² : > 40MΩ x Module		Module Area < 0.1m² : > 400MΩ Module Area > 0.1m² : > 40MΩxModule Area	
		Test Time	-	-	2 min.	
Ground Bond Test	Type Test	Test Current (DC)	2 times Fuse ampere	2.5 times the maximum over-current protection rating of the module	N/A	N/A
		Resistance Limit	< 0.1Ω	< 0.1Ω		
		Test Time	-	2 min		
	Routine Test	-	Ground Continuity	N/A	N/A	
PID Test	Type Test	Test Voltage (DC)	N/A	N/A	N/A	Maximum system Voltage (-1000V or -1500V)
		Test Time				96 Hours
		Environment				85 degree C/ 85% R.H.

The 1,500 Vdc System Voltage Trend

Since solar systems first became popular, system voltage has steadily increased from 600 Vdc to 1,000 Vdc to now 1,500 Vdc. These increases have a common goal – reducing costs while improving efficiency. According to GTM Research, the cost benefits of a 1,500 Vdc system include the following:

Figure: Current Cost Changes for 1,500Vdc System in Comparison to 1,000 Vdc System

Component	Component Count	Unit Cost	System Cost
PV Modules	— Same	↑ +1%-2%	↑ + $0.02/Wdc
Cables, Conduit, Trenching	↓ 40% ~ 45%	— Same	↓ - $0.03/Wdc
Combiner Boxes	↓ - 33%	↑ + 10% ~ 20%	↓ - $0.005/Wdc
PV Inverters	↓ - 40%	↑ + 80% ~ 100% (due to larger inverter size and limit scale)	↑ + $0.01/Wdc
AC Subsystem		↓ - 10% ~ 15%	↓ - $0.005/Wdc
Direct Labor			↓ - $0.03/Wdc

Source: GTM Research

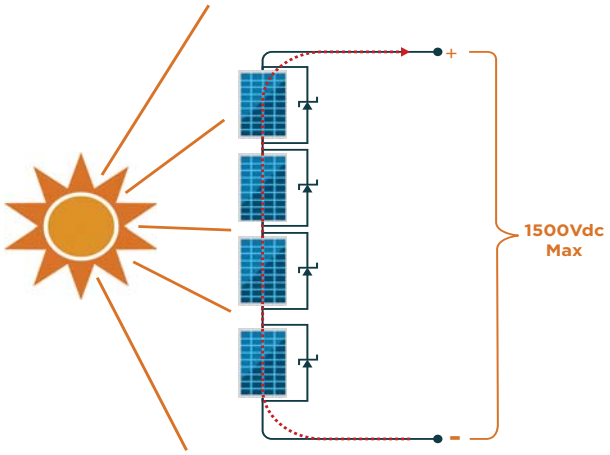
"The most immediate opportunity that we see for utility-scale PV system cost reduction is the installation of 1,500 Vdc systems. Higher-voltage systems enable longer strings, which allow for fewer combiner boxes, less wiring and trenching, and therefore less labor." Quoted by GTM Research.

The Future Hipot Solution

The future trend will be solutions capable of handling 1,500 Vdc systems. The IEC61730-2 standard regulates Hipot tests of Class II systems:

"4 * system voltage + 2000Vdc"

This means the system voltage of 1,500 Vdc must be tested and passed under 8000 Vdc Hipot.



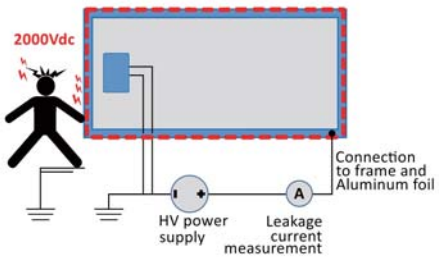
What Is Potential Induced Degradation

Potential Induced Degradation (PID) is a common form of performance degradation in photovoltaic (PV) modules. The major factors that result in PID are voltage, heat, and humidity, which are present in all PV systems. PID may cause power loss of up to 30 percent in just few years. As such, more demanding environmental conditions are necessary for PID testing, which includes high reversed-voltage input within a high heat and humidity chamber to identify defective panels.

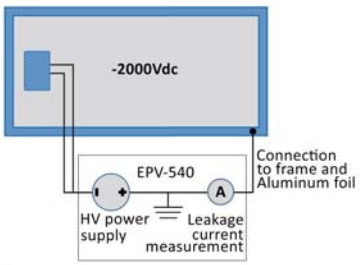
True Negative Voltage For The Safer Operation

In accordance with technical testing regulations, PID tests musts be performed under negative voltage because PID occurs most often under such conditions. However, due to the lack of negative-voltage output testers, manufactures frequently connect the high-voltage input to the DUT chassis instead of a power terminal, which electrically charges the testing environment (touchable DUT chassis). This can cause serious harm if the operator accidently touches it.

The true negative voltage deign offers the best solution for countering this safety concern. It would only leave the power terminal electrically charged, thus eliminating the risk to the operator.



Danger! High Voltage Surrounds the DUT Chassis



Safe! High Voltage with the DUT Power Terminal Only

Easy and Friendly Operation

- 4.3” color touchscreen with intuitive system interface provides simple system operation.
- Large system memory stores up to 2000 sets of unique conditions.
- Strict user account management allows multiple levels of user permissions with varying authority.
- Smart GFI design automatically cuts off power when detecting abnormal currents to ensure user safety all times.

MODEL		EPV-540	EPV-530
INPUT			
Voltage		100 - 120Vac / 200 - 240Vac ±10% Auto Range	
Apparent Power		1200 VA	
Frequency		50 / 60Hz ± 5%	
DC WITHSTAND VOLTAGE			
Output Rating		8000 Vdc / 20mA max.	
Output Voltage Range		0 - 8000 Vdc	
Voltage Resolution		1 Vdc	
Voltage Accuracy		± (1% of Setting + 0.5% Range)	
Current Measurement Range		0.0 - 20.00 mA	
Current Resolution	0.0 - 349.9 µA	0.1 µA	
	0.350 - 20.00 mA	0.001 / 0.01 mA	
Current Accuracy		± (1% of Reading + 0.5% Range)	
Ramp Up Timer		0.1 - 999.9 s	
Ramp Down Timer		0 , 1.0 - 999.9 s	
Dwell Time		0, 0.4 - 999.9 s (0=Continuous)	
Timer Resolution		0.1 s	
Timer Accuracy		± (0.1% of Setting + 0.05s)	
Ramp-HI, DC Current		0.0 - 20000 µA	
INSULATION RESISTANCE			
Output Rating		6k Vdc / 50,000 MΩ	
Output Voltage Range		100 - 6000 Vdc	
Voltage Resolution		1 Vdc	
Voltage Accuracy		± (1% of Setting + 0.5% Range)	
Resistance Measurement Range		0.100 - 50,000 MΩ	
Resistance Resolution		0.001 / 0.01 / 0.1 / 1 MΩ	
Resistance Measurement Accuracy	0.100 - 999.9 MΩ under 100 – 499Vdc	±(8% of Reading+0.1% Range)	
	0.100 - 999.9 MΩ under 500 – 6000 Vdc	±(2% of Reading+0.1% Range)	
	1,000 - 9,999 MΩ under 500 – 6000 Vdc	±(5% of Reading+0.1% Range)	
	10,000 - 50,000 MΩ under 500 – 6000 Vdc	±(15% of Reading+0.1% Range)	
Ramp Up Timer		0.1 - 999.9 s	
Ramp Down Timer		0.0, 1.0 - 999.9 s	
Dwell Time		0, 0.5 - 999.9 s (0 = Continuous)	
Delay Timer		0.5 - 999.9 s	
Timer Resolution		0.1 s	
Timer Accuracy		± (0.1% of Setting + 0.05s)	
GROUND BOND			
Output Rating		40A / 600mΩ / 8Vdc Max.	
Output Current, dc		3.00 - 40.00 A	
Current Resolution		0.01 A	

MODEL		EPV-540	EPV-530
Current Accurary		± (2% of Setting + 0.5% Range)	
Output Voltage		3.00 - 8.00 Vdc	
Voltage Resolution		0.01 Vdc	
Voltage Accurary		± (2% of Setting + 0.5% Range)	
Lead Resistance Offset		0 - 100 mΩ	
Resistance Measurement		0 - 150 mΩ Under 30.1-40.0A	
		0 - 200 mΩ Under 10.1-30.0A	
		0 - 600 mΩ Under 3.0-10.0A	
Resistance Resolution		1 mΩ	
Resistance Accuracy		± (2% of Reading + 0.5% Full Range)	
Dwell Timer		0, 0.5 - 999.9 s	
		(0 = Continuous)	
Timer Resolution		0.1 s	
Timer Accuracy		± (0.1% + 0.05s)	
PID			
Output Rating		-2000 - 2000 Vdc / 20mA	**Not Provided This Function**
Output Voltage, Vdc		-2000 - 2000 Vdc	
Voltage Resolution		1 Vdc	
Voltage Accuracy		± (1% of Setting + 0.5% Range)	
Current Measurement Range		0.00 - 20.00 mA	
Current Resolution	0.0 - 349.9 µA	0.1 µA	
	0.350 - 20.00 mA	0.001 / 0.01 mA	
Current Accuracy		± (1% of Reading + 0.5% Range)	
Ramp Up Timer		0.1 - 999.9 s	
Ramp Down Timer		0.0, 1.0 - 999.9 s	
Dwell Time (Unit: Hour, Minute or Second)		0, 0.1 - 999.9, (0=Continuous) (Minimum Time 0.4 Second)	
Timer Resolution		0.1(Unit: Hour, Minute or Second)	
Timer Accuracy		± (0.1% of setting + 0.05s)	
GENERAL			
Memory		2000 Steps (1 File with 200 Steps)	
Display		4.3" Color Display (Touch Panel)	
Interface		Standard: USB , RS232, PLC Remote , Option: GPIB, Ethernet	
External Scanner Port		Yes	
Language		English	
Environment		0 - 40°C, 20 - 80%RH	
Dimension (W × H × D), mm		430 × 133 × 400	
Weight		25.1KG	

Models and Options

Model	Option
EPV-540 Solar Module Specific Insulation Analyzer (4-in-1)	Opt.731 GPIB Interface Card
EPV-530 Solar Module Specific Insulation Analyzer (3-in-1, no PID feature)	Opt.758 Ethernet Card

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