



PRO

**Bi-directional
Programmable
DC Power Supply**

Overview



PRD bi-directional programmable DC power supply is a power supply with source and load functions, which supports the automatic two-quadrant operation and absorbs the energy feedback of the tested equipment. It is widely used in solar cell panel simulation, energy storage battery/capacitance simulation and other occasions in the system tests of photovoltaic inverters, power conversion systems and photovoltaic/energy storage hybrid inverters. It is also applicable to simulated battery tests of bidirectional on-board chargers of new energy vehicles, DC/AC motor drivers and bidirectional DC converters.

With a built-in independent high-accuracy voltage and current measurement system, it features a new programming concept and a direct source and load nature. The dynamic characteristics as fast as microseconds bring the DC product test to a new level, enabling abnormal field conditions to be simulated in the laboratory.

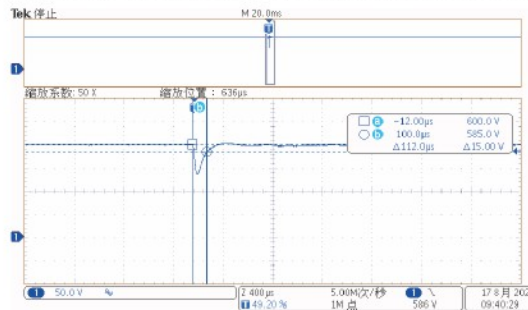
Product Series

Power	Product Model	Voltage (V)	Current (A)
30kW	PRD0224	200V	±240A
	PRD0324	360V	±240A
	PRD0518	500V	±180A
	PRD0618	600V	±180A
	PRD0808	800V	±80A
	PRD1008	1000V	±80A
	PRD1506	1500V	±60A
	PRD2006	2000V	±60A
20kW	PRD4V66E	40V	±667A
	PRD6V66E	60V	±667A
	PRD8V66E	80V	±667A
	PRD0216E	200V	±240A
	PRD0316E	360V	±240A
	PRD0512E	500V	±180A
	PRD0612E	600V	±180A
	PRD0805E	800V	±80A
	PRD1005E	1000V	±80A
	PRD1504E	1500V	±60A
	PRD2004E	2000V	±60A
	15kW	PRD4V50E	40V
PRD6V50E		60V	±667A
PRD8V50E		80V	±667A
PRD0212E		200V	±160A
PRD0312E		360V	±160A
PRD0509E		500V	±120A
PRD0609E		600V	±120A
PRD0804E		800V	±54A
PRD1004E		1000V	±54A
PRD1503E		1500V	±45A
PRD2003E		2000V	±45A

Product Advantages

High dynamic: dynamic response time of 100 μ s level

With dynamic performance as fast as 100 microseconds, PRD products bring the DC product test to a new level, enabling abnormal field conditions to be simulated in the laboratory.



Output voltage response to sudden application of 40%~90% load

High accuracy: up to 6-and-a-half-digit given and measurement system; with voltage and current accurate to mV/mA level

PRD has a built-in independent high-precision voltage and current measurement system, and its performance is comparable to that of 6-and-a-half-digit voltmeters, saving high-voltage high-precision DC voltmeters, high-precision ammeters, power meters, and impedance meters. The equipment data can serve as the basis for product performance judgment. In the case of the photovoltaic inverter test, its high-accuracy measurement system enables the tracking efficiency of the test object to be measured in a more accurate manner.



Comparison between PRD measuring voltage and 6-and-a-half-digit voltmeter

Digital matrix parallel system achieves capacity expansion without reducing accuracy

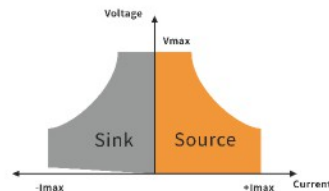
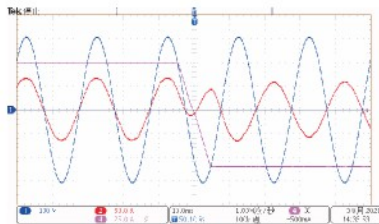
PRD product is equipped with a matrix high-speed optical fiber digital parallel system, which can integrate up to 100 products into a complete system, producing total power of up to 3000 kW. After a parallel connection, the system can still meet the performance standard of a single machine.

PRD products have the redundancy functions of parallel systems. During operation, in case of non-output or AC end protection of some slaves, the rest of PRD products can continue to run and actively distribute current to ensure the normal operation of the test.

Product Advantages

Automatic source and load

Automatic "source" and "load": All PRD series have the functions of bi-directional DC power and feedback load, as well as the capability of two-quadrant operation. They also feature online automatic and fast seamless conversion (i.e., automatic "source" and "load" conversion functions). Such conversion has no delay, effectively avoiding voltage or current overshoot.

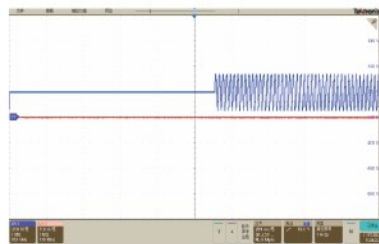


Automatic power: All PRD series have constant power characteristics, i.e. large currents can be output at low voltage or small currents at high voltage regardless of "source" and "load" conditions.

Ultra-high power ratio: Some PRD models have output capacity up to 4 times the power ratio, i.e., the rated power can be output at 1/4 of the maximum voltage; specifically, with a wide voltage and current output range, they have a wider output capacity than conventional power supplies, satisfying the electric performance test of the test object at different voltages.

Function generator function

All PRD series can be superimposed with sine wave, triangular wave, pulse wave, square wave, etc. on DC output. The frequency resolution of the expected waveform output waveform is 0.01, and the maximum output frequency is 10kHz. The DC component value of the expected output waveform has a resolution of 0.001, which satisfies the DC voltage ripple adaptability test of the test object.



DC200V superimposed with AC100V sine wave

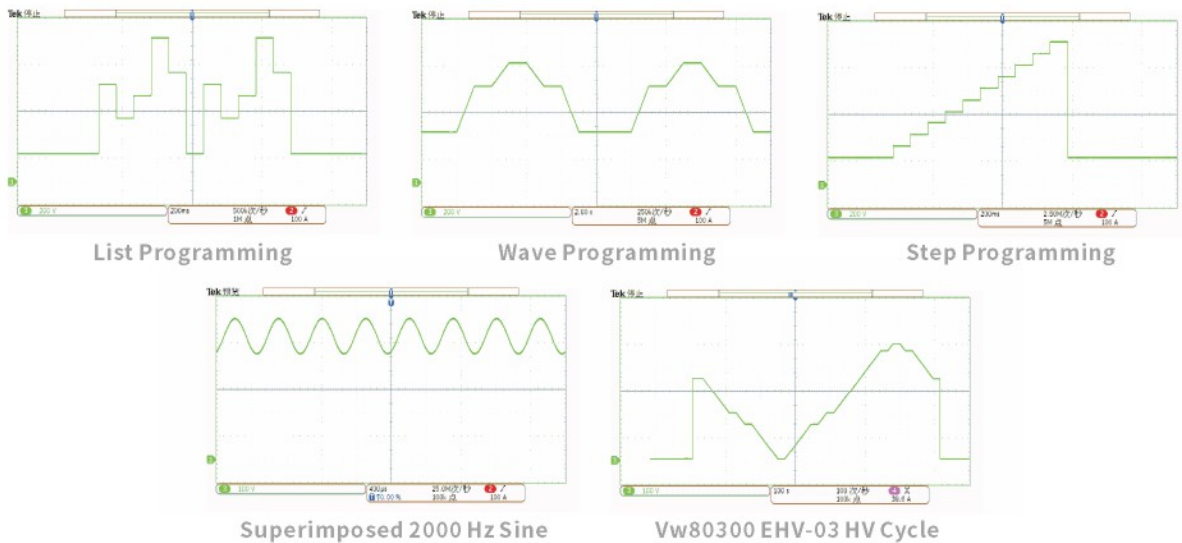
High power density: 3U/30 kW

Compared with similar products, PRD products have the highest power density and feedback efficiency. 3U cabinet has power up to 30 kW and is as light as 35 kg. A single standard 42U cabinet can be configured with a capacity of 300 kW. The matrix parallel system can be easily expanded to 3 MW capacity, greatly reducing the test floor area and satisfying the transfer, load-bearing and power distribution requirements of standard commercial office buildings.

Product Function

Function programming

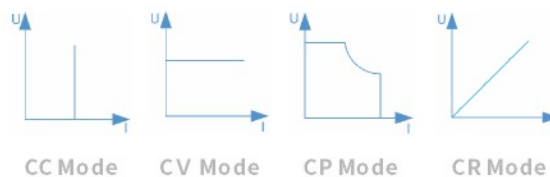
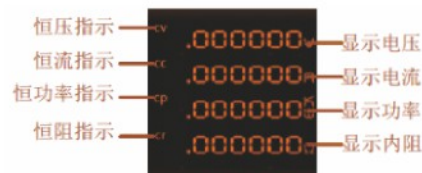
In addition to traditional programming functions such as List, Wave, Step and Advanced, PRD products also support function editing, sine wave, pulse wave, triangular wave, customized wave programming, and other programming functions, to meet the personalized demand for product R&D tests, regulatory test certification, production line tests, quality inspection and other links.



Programming data can be saved and exported to another equipment for operation, reducing users' workload.

Four output functions

PRD products operate in four modes: constant voltage (CV), constant current (CC), constant power (CP) and constant resistance (CR). CC, CV and CP modes can be automatically switched according to the formula $P=UI$, i.e., when any parameter of voltage, current and power at the output end reaches the limit first, the PRD product will work in this mode.

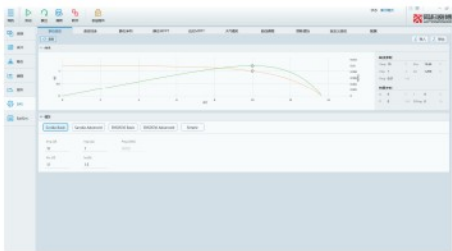


Product Function

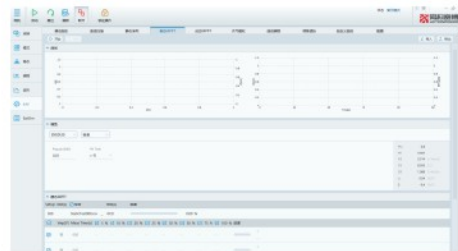
■ SAS mode

The SAS solar cell simulator function allows for accurate simulation of the output I-V characteristic curve of the solar cell panel; with a built-in SAS model as specified in EN50530, Sandia, CGC/GF004, CGC/GF035 and other standards, the product can be used to test static and dynamic MPPT of photovoltaic inverters. The built-in SAS function of the equipment only supports simple curve operation. The standard-related MPPT efficiency requires a combination of the "programmable power virtual terminal" software, so as to achieve the complete test function of the photovoltaic industry.

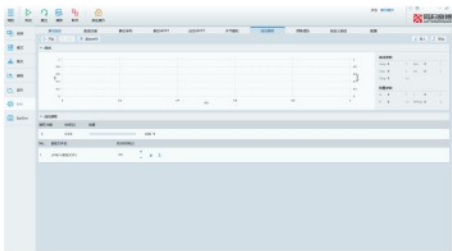
Its high-accuracy measurement and control system can test the maximum tracking efficiency of solar inverters more accurately. Parameters such as V_{oc} and I_{sc} can be set to simulate I-V curves, and various solar panel types, shadow occlusion and customized curve editing are supported. The built-in curves of up to 4096 points enable an accurate simulation of I-V curves. The functions of log and report generation allow for the recording of the curve changing.



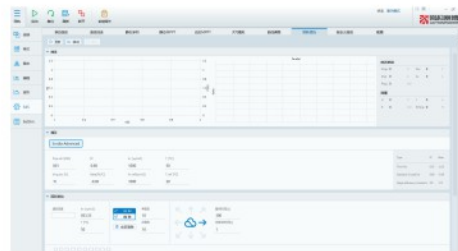
Static Curve



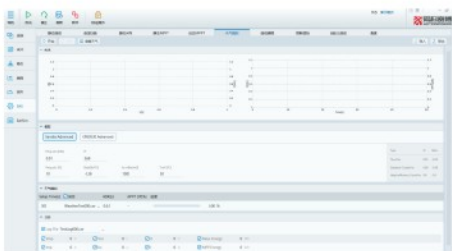
Curve Programming



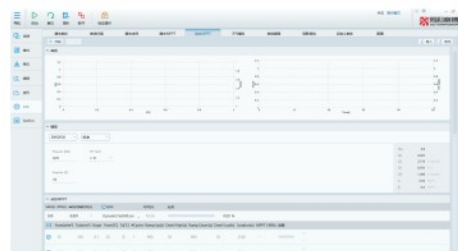
Static MPPT



Dynamic MPPT



Weather Simulation



Shadow Occlusion

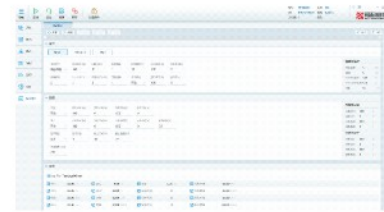
Product Function

Battery simulation

The output characteristics, charge and discharge characteristics of various battery packs such as lithium manganese, lithium cobaltate, lithium iron phosphate, nickel-hydrogen, ternary lithium, lithium titanate and lead-acid batteries can be simulated; parameters such as serial/parallel quantity, temperature, SOC, internal resistance and battery cell capacity can be set; open 1st, 2nd and 3rd order RC battery models allow for customized battery parameters; thus the characteristics of the battery pack can be simulated comprehensively.



Battery Simulation Status Interface



Battery Simulation Parameter Setting Interface

Curve importing and exporting

After a valid USB storage device is connected, click the "USB" button to switch to the data import interface.

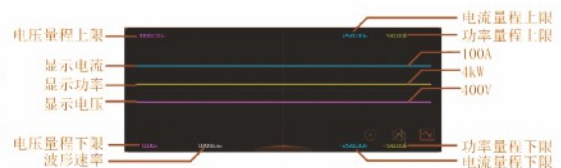
Press "Export" to export the static curve data on the device to an external USB storage device. At this time, "Data is being exported..." are displayed on the screen. If the operation is successful, "Data exported successfully!" will be displayed. After successful export, the display screen will refresh the file list.

Press "Import" to import the files in the currently selected external USB storage device into the equipment. At this time, the parameters in the file are displayed on the screen. "Data is being imported..." will be displayed on the screen. If the operation is successful, "Data imported successfully!" will be displayed.



Waveform reproduction

The unique waveform reproduction function enables the equipment to briefly display the output status on its own without the presence of an oscilloscope, helping customers temporarily view the output waveform.



Large aspect ratio touch screen

PRD product uses an 8.8-inch, high-resolution LCD touch display screen, which runs fast and is touch sensitive. Users can operate and control PVD by touching the display screen.



Application Scenarios

General programming

step experiment and R&D test;
laboratory general programming and function generation.

Photovoltaic tes

static curve and curve scanning;
standard static MPPT efficiency test, dynamic
MPPT efficiency test, weather simulation, cloud occlusion.

Vehicle test

driver and OBC R&D test power supply;
component test and certification.

Production line aging

feedback load and programming inspection;
Automatic tooling and aging measurement of production line.

Metering calibration

low-accuracy equipment calibration;
High-accuracy voltage source & load;

Battery

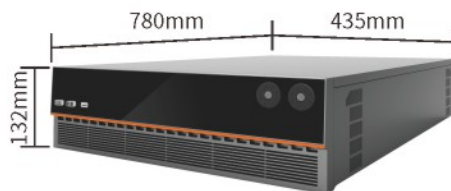
battery simulation and test;
Battery model importing.



Overall Dimensions

With the exterior consistent with the standard 19-inch chassis structure, PRD products can be used for standard cabinet systems or desktop applications. The dimension of a single module is 435 mm × 132 mm × 781 mm (W×H×D).

The shape of the product is as follows:



26U cabinet

42U cabinet

Optional models of cabinet: PRD-26U, PRD-42U

Cabinet specifications	Dimensions (width × depth × height) (mm)	Scope of application
26Ucabinet	600×800×1338	Applicable to parallel operation of 2-5 power supplies
42Ucabinet	600×800×2050	Applicable to parallel operation of 5-8 power supplies

Technical parameters

Indicators	Technical parameters				
Output Voltage	40V/60V/80V	200V/360V	500V/600V/	800V/1000V	1500V/2000V
AC Input					
Voltage Range	304Vac~480Vac/380V±20%				
Frequency	47Hz~63Hz				
Wiring mode	3ph+PE				
Impulse current	<50A				
Efficiency	93.5%	94%	95%	94%	95%
Power factor	0.99				
DC parameters					
Overvoltage protection range	0V ~ 110% of the rated value (±1% F.S.)				
Overcurrent protection range	0V ~ ± 110% of the rated value (±1% F.S.)				
Overpower protection range	0V ~ ± 110% of the rated value (±1% F.S.)				
Voltage parameters					
Programming accuracy	± 0.02%F.S.				
Programming resolution	± 1mV	± 10mV			
Display accuracy	± 0.02%F.S.				
Source regulation (±10% Uac)	± 0.01%F.S.				
Load regulation (0V~100%F.S.)ΔIOUT	± 0.01%F.S.				
Effective value of voltage ripple	25mVrms	60mVrms	200mVrms	200mVrms	400mVrms
Voltage ripple (peak-to-peak)	300mVpp	480mVpp	1000mVpp	1200mVpp	2400mVpp
Remote compensation	Max.Voltage±1V	Max.Voltage and 2%F.S.±1V			
Rise time(10~90%)F.S.	2.5ms	500μs			
Voltage slew rate	150V/ms	200V/ms	1500V/ms	600V/ms	5000V/ms
Recovery time (50%F.S.)	Recovery to steady state ±0.75% F.S. within 2.5 ms, 25% to 50% or 50% to 25% load variation		Recovery to steady state within ±0.75%F.S. in 500μs, 50% to 100% or 100% to 50% load variation		
Discharge time	≤20s	≤20s	≤30s	≤20s	≤30s
Current parameters					
Programming accuracy	± 0.15%F.S.	± 0.02%F.S.			
Programming resolution	± 100mA	± 10mA			
Display accuracy	± 0.15%F.S.	± 0.02%F.S.			
Display resolution	± 10mA	± 1mA			
Source regulation (±10% Uac)	± 0.01%F.S.				
Load regulation(0V~100%F.S.)ΔUOUT	± 0.05%F.S.				
Rise time (10~90%) F.S.	3ms	1ms	500μs	1ms	500μs

Technical parameters

Indicators	Technical parameters				
Output Voltage	40V/60V/80V	200V/360V	500V/600V/	800V/1000V	1500V/2000V
Power parameters					
Programming accuracy	± 30W	± 3W	± 0.01%F.S.	± 3W	± 0.01%F.S.
Programming resolution	± 10W	± 1W			
Display accuracy	± 30W	± 3W			
Display resolution	± 10W	± 1W			
Resistance parameters					
Regulation range	0.003~100Ω	0.05~100Ω	0.5~3000Ω	0.05~100Ω	0.5~3000Ω
Programming accuracy	1mΩ	0.01Ω	0.1Ω	0.01Ω	0.1Ω
Programming resolution	1mΩ	0.01Ω	0.1Ω	0.01Ω	0.1Ω
SAS					
Short-circuit current setting range	0A~Ie				
Simulation fill factor range	0.3~0.95				
Photovoltaic panel type selection	c-si, Thin-film, user-defined				
I-V curve update rate	Typical time: 1 ms, with online curve switching function				
IV curve standards	EN50530、Sandia、simple				
IV curve functions	Static curves; curve scanning; static sequence; static MPPT; dynamic MPPT; weather simulation; shadow occlusion; curve programming; customized curves, etc.				
Curve setting	1) IV curves can be user-defined using parameters such as Voc, Isc, FF and Pm; 2) Environmental impacts such as temperature change and irradiance can be considered in the dynamic operating mode, and IV curves in different environments can be continuously output; 3) The dynamic I-V curve test program under EN50530/Sandia is built-in;				
Battery Simulation					
Battery type	Different battery types such as lithium manganate, lithium cobaltate, lithium iron phosphate, nickel-hydrogen, ternary lithium, lithium titanate, and lead-acid batteries can be simulated; User-defined battery types and open first, second and third-order RC battery models are supported;				
Parameter settings	Number of batteries in series connection, number of batteries in parallel connection, initial SOC, initial temperature, internal resistance, cell capacity and other parameters				
Interface	Import of CSV user-defined model is supported.				
Real-time performance	200 μs command update rate				

Technical parameters

Indicators	Technical parameters				
Output Voltage	40V/60V/80V	200V/360V	500V/600V/	800V/1000V	1500V/2000V
Programming					
Programming mode	List、Wave、Step、Advanced				
Programming steps	200				
Cycle range	0~9999999次				
Minimum programming time step	100μs				
Operation mode	Load, end, and trigger				
Multifunctional Interface/Anyport					
Functions and definitions	See “Anyport interface specification”				
Isolation	707VDC				
Interface					
Rear panel	Type-B USB、LAN、Share Bus、Magic-BUS、Magic-BOX DC terminal、AC supply、Remote sensing、Analog interface				
Front panel	Type-A USB、ON/OFF Button、Out Button、Touch screen、Rotary knob				
Environment					
Operating temperature (°C)	0 ~ 50 (power derating above 35°C)				
Storage temperature (°C)	-20 ~ 70				
Humidity	≤ 80%. Not condensing				
Height	Output current derating 2%/100 m or Ta derating 1°C/100 m above 2000m				
Insulation					
Negative pole - PE	±500 V DC	±1500VDC	±1500VDC	±1500VDC	±1500VDC
Positive pole - PE	+500 V DC	+1500VDC	+2000VDC	+1500VDC	+2000VDC
Input - PE	2.5 kV AC				
Others					
Dimensions	W435mm×H132mm×D781mm				
Weight	40kg	35kg			

Note: The above accuracy test conditions are all 25°C ± 5°C

Ripple voltage/Ripple (peak) @20MHz bandwidth;

Ripple voltage/Ripple (rms) @300kHz LF;

Voltage slew rate/Slew rate (Without load);

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