DATA SHEET

RP7900 Series
Regenerative Power System

RP7931A - RP7936A (200/208 VAC)

RP7941A - RP7946A (400/480 VAC)

RP7951A - RP7953A (200/208 VAC)

RP7961A - RP7963A (400/480 VAC)

RP7972A - RP7973A (400/480 VAC)

RP7982A - RP7984A (400/480 VAC) **NEW**

GREENTEST® TECHNOLOGIES

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Introduction

In the global marketplace, how do you gain a competitive advantage? Many manufacturers are trying to meet production ramps, quality goals and reduce the cost of test as a means of differentiation. Often the primary concern is the costs of equipment, calibration, and maintenance. Although initial capital investments always command our attention, operating expenses can play an even more critical role in total cost of ownership. Managing total cost of ownership can provide a competitive advantage for your business.

As the demand for high power grows, for example shift in automotive from 12 V battery to over 300 V for HEV/EV, it drives the need for higher power test equipment. Testing at high-power is not a simple extension of low power. As you move into high power applications in aerospace defense, infrastructure, automotive and energy, it presents unique challenges that were not relevant in low power applications. Companies now must consider site preparation necessities, and safety requirements when transitioning from low power to high power. Having a commercial off-the-shelf solution that has low cost of ownership would minimize your high-power test costs by reducing floor space usage, minimize heat dissipation, and maintain uptime. Keysight can help with the RP7900 Series regenerative power system.

Our Solution

The Keysight RP7900 Series regenerative power system is a family of bi-directional, regenerative DC power supplies with highly integrated safety features that protect both your people and your device under test. The regenerative capability enables the energy normally consumed to be returned to the grid cleanly, saving costs associated with energy consumption and cooling. In addition, by combining the seamless source and load functionality into a compact 3U-high and 5U-high package, not only do you save energy but also floor space and integration time. The RP7900 delivers a fast, accurate, integrated regenerative power system:

- Up to 2000 V, up to ± 800 A, up to 30 kW
- Operate in two-quadrant mode as power source and regenerative electronic load
- Maximize throughput with fast output speed and sub-millisecond command-processing time
- Create up to 600 kW power or loading through easy parallel connection
- Optimize inverter MPPT algorithms with photovoltaic/solar array simulation (RP7970/80 Series)
- Reduce cost for cooling and electricity with eco-friendly, regenerative design
- Save valuable rack space with compact 3U-high and 5U-high size
- A part of the EV1003A HEV/EV Power Converter Test Solution

The RP7900 is a part of Keysight's HEV/EV Power Converter Test Solutions that gives you confidence to deploy high-voltage, high-power solutions to meet the fast paced, high-growth demands of the Hybrid-Electric/Electric Vehicle (HEV/EV) market.

Reduce costs for cooling and electricity with an eco-friendly regenerative design

The regenerative capability of the RP7900 enables the energy consumed to be put back onto the grid cleanly, saving costs from energy consumption and cooling, while not interfering with the grid. When the RP7900 is sinking current either from rapid down-programming of the output or from discharging an energy source like a battery, it will automatically return the excess power back to the grid. The regenerative operation is automatic, so no programming is required. To safeguard your device under test, the RP7900 provides “anti-islanding” that senses that the grid is live before regenerating power back to the grid.

With efficiency of more than 80%, the RP7900 helps you reduce energy consumption with less electricity usage when sourcing or sinking and less heat dissipation (which means less air conditioning) when sinking. Additionally, it provides clean regenerative operation by keeping the total harmonic distortion to a minimum of 2% (typical) at full load to minimize interference with other electronics.

Continuously source and sink current

The RP7900 can continuously sink up to 100% of its rated current for an indefinite time. The two-quadrant, bidirectional sourcing and sinking capability of the DC power supply allows for seamless, uninterrupted transitions between sourcing and sinking current without changing the power supply’s output characteristics or introducing any disruptive behavior.

Figure 1. Seamless transition from sourcing current to sinking current

Autoranging output – does the job of multiple power supplies

The RP7900 power supplies' autoranging output characteristic makes it much more flexible than rectangular, or traditional, output characteristic power supplies because they expand the power curve, giving the user more voltage and current combinations in one power supply. Power supplies with rectangular output characteristics provide full power at only one voltage and current combination. The RP7900 is like having many rectangular power supplies in one.

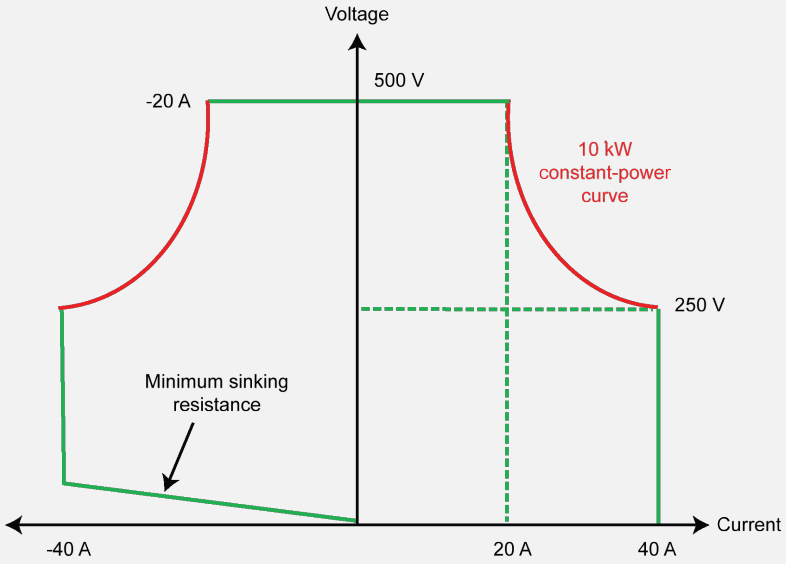


Figure 2. Autoranging output characteristic of the 10 kW RP7952A

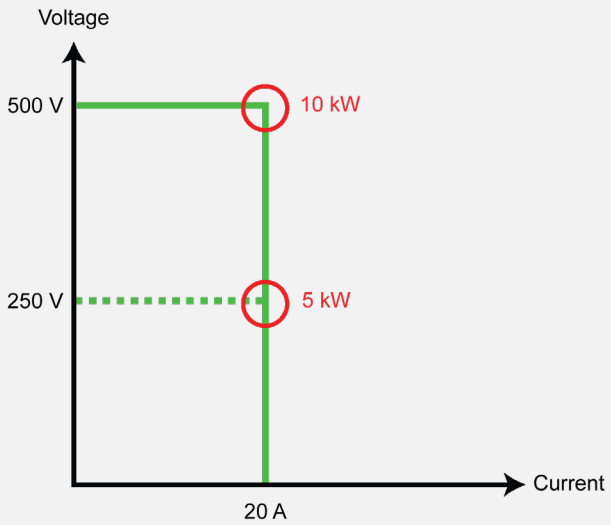


Figure 3. Rectangular output characteristic of a traditional 10 kW supply

Emulate high-power battery

With their battery emulation feature, the RP7900 Series allows you to test your devices under the same power conditions that exist in actual use. Emulating the battery is key when characterizing battery operating life and detecting early product failures. Through programable resistance up to 394 Ω (model dependent), the RP7900 DC sources simulate the effects of internal resistance of the battery, enabling them to emulate the operation of batteries in different charge states. Use the bidirectional RP7900 as a power source or an electronic load, just like a battery.

Accelerate test throughput with industry-leading specifications

Shaving seconds or even milliseconds off a test time can lead to significant savings for high-volume manufacturers, making throughput gains a never-ending quest for test system designers. The RP7900 is a valuable tool for increasing throughput. It provides fast output speed, sub-millisecond command-processing time (≤ 1 ms), and output list that can help you achieve significant throughput gains in your testing.

Accurately characterize your DUT's power profile with advanced measurements

The RP7900 provides simultaneous voltage and current measurement capabilities that deliver high accuracy and resolution. Make measurements using two main modes: averaged or digitized. In average mode, the RP7900 delivers high accuracy voltage and current measurements. The digitizing capability allows you to capture dynamic current or voltage profiles.

In addition to high-accuracy voltage and current measurement capabilities, the RP7900 Series regenerative power system offers built-in power, peak power, amp-hour, and watt-hour calculations. These measurements help simplify your power efficiency and storage calculations.

Avoid damage to your DUT

When you are testing costly DUTs, integrating power protection measures into the test system is critical. Using instrumentation with built-in or integrated protection features provides a huge benefit when DUT protection is required. With protection measures implemented in hardware rather than test system software, error conditions can be detected and handled much faster, reducing the likelihood of the DUT sustaining major damage. The RP7900 provides built-in over-voltage, over-current, and over-temperature protection. For even greater DUT protection, use the accessory SD1000A Safety Disconnect System that was exclusively designed to work with the RP795x and RP796x Series to handle faults and ensure the output is secured with a redundant safety disconnect system.

Generate voltage and current transients

DUTs that are operated in rugged environments, such as automotive electronics and avionics, can often experience transient behavior from the power source, such as voltage dropouts or surges. To ensure your DUT can stand up to these real-world transients, you must simulate worst-case power transient conditions in the test process. The RP7900 provide three different functionalities for simulating either voltage or current transients for testing:

Step: One-time event that steps the output voltage or current up or down in response to a triggered event.

Constant dwell arbitrary waveforms: An arbitrary waveform generator (ARB) allows you to generate complex user-defined voltage or current waveforms of up to 65,535 data points. One dwell setting applies for the entire ARB, from 10.24 µs to 0.30 seconds.

List: A list can consist of up to 512 steps. Each step in the list can have a unique dwell time associated with it, which specifies the time in seconds that the list will remain at that step before moving on to the next step. Lists can also be trigger-paced, in which case the list advances one step for each trigger received. List is not supported in primary/secondary mode on the 5 kW and 10 kW RP7931A - RP7963A (but is supported on the 20 kW and 30 kW RP7972A - RP7984A).

Properly powering on and off your DUT

If you work with DUTs that have multiple power supply inputs, you often need to properly sequence on or off each power supply at strictly repeatable times to prevent current surges and latch-up conditions. In addition to sequencing on or off each supply, you may need to set the ramp rate of each supply at turn-on or turn-off to a particular rate. These requirements add significant complexity to an ATE test system, both in hardware and software. The RP7900 provides built-in sequencing capability across RP7900 supplies or with Keysight's popular N6700 modular system power supplies or N6900/N7900 Advanced Power System. Also, the RP7900 provide adjustable slew rate control at turn-on or turn-off. These built-in capabilities provide a clean low-complexity way to properly power-on or off your DUT during test.

Quickly test and optimize inverter MPPT algorithms

When designing or manufacturing photovoltaic (PV) solar inverters, you may need to ensure your solar inverters are capable of converting the maximum power available from the solar array. With its PV array simulator capability, the new 20 kW and 30 kW RP7970/RP7980 Series can help you verify and maximize the performance of your inverter. It can simulate the output characteristics of a photovoltaic array under different environmental conditions (temperature, irradiance, age, cell technology, etc.) enabling you to quickly and comprehensively test inverter maximum power point tracking (MPPT) algorithms and inverter efficiency.

The RP7970 and RP7980 Series offers two PV simulation modes: curve mode where the RP7970/RP7980 quickly creates the curve mathematically using four input parameters and table mode where you can enter the precise I-V curve with up to 1024 points. In curve mode, the output I-V characteristic is created from these four input parameters:

I_{mp} – the current at the maximum power point

I_{sc} – the short-circuit current of the array

V_{mp} – the voltage at the maximum power point

V_{oc} – the open-circuit voltage of the array

When the RP7972A - 73A and RP7982A - 83A are used in combination with the accessory DG8901A Solar Array Simulator Control Software, it allows you to control from one RP7970/RP7980 unit (or one primary/secondary set) as well as easily create, visualize, and download solar/photovoltaic I-V curves to the instrument, gaining insight into your MPPT algorithm.

With up to 2000 V output, the RP7970/RP7980 is ready for emerging solar power plant technologies and allows testing to higher solar inverter input voltages.

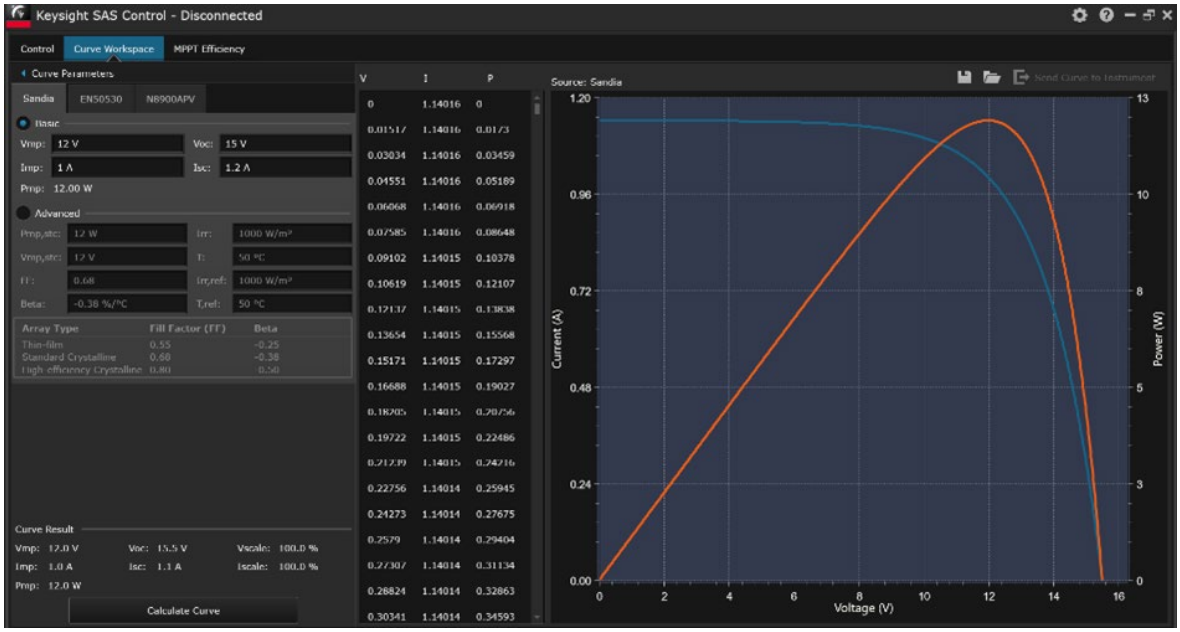


Figure 4. DG8901A Curve Workspace

Add power flexibility to your test system by paralleling multiple supplies

Paralleling multiple power supplies together is a great way to add power flexibility to your test system. The downside of paralleling power supplies together is typically you cannot get all the supplies to operate in the desired constant voltage (CV) or constant current (CC)mode. For instance, when trying to operate in CV mode with two parallel supplies, one will typically source the bulk of the current and operate in CC mode and the other supply will source only a fraction of the current and operate in CV mode. This condition can highly degrade certain power supply performance specifications such as transient response. With the RP7900 you do not have to worry about this since it has built-in paralleling capability that ensures each supply equally shares the load current, so they all remain in the desired mode, whether it is CV or CC.

The RP7900 can be operated in primary/secondary mode which enables paralleled units to be configured and programmed to look like “one” big power supply of up to 600 kW of total power; no need to program each supply individually. The RP7900 Series regenerative power system gives you the flexibility to easily parallel up to 20 units for greater output current. Any models with identical voltage ratings can be paralleled. For example, the RP7972A 1000 V, 20 kW can be put in parallel with the RP7982A 1000 V, 30 kW model. List is not supported in primary/secondary mode on the 5 kW and 10 kW RP7931A - RP7963A (but is supported on the 20 kW and 30 kW RP7972A - RP7984A).

Figure 5. Parallel operation for more power

Get lots of power in a small test-system footprint

Save valuable rack space with the RP7900 that provides up to 20 kW of sourcing and loading in a compact 3U high package and up to 30 kW in a compact 5U high package.

Simplify system connection

The RP7900 Series power supplies come standard with GPIB, Ethernet/LAN, USB 2.0 giving you the flexibility to use your I/O interface of choice today and safeguard your test setup for the future. There is no need to worry whether you are choosing the right interface when they all come standard. The RP7900 is compliant to 1.5 LXI Device Specification 2016 and includes a built-in Web interface. This means you can control the RP7900 remotely using a Web browser and a LAN connection.

AC input

The RP7900 series includes 21 total models. Eight have 200/208 VAC inputs and the remaining 13 have 400/480 VAC inputs. This gives the RP7900 the ability to be used anywhere in the world. When available, choose 200/208 VAC for regions such as the Americas and Japan or choose 400/480 VAC for regions such as Europe and Asia and for the 20 kW and 30 kW models.

The RP7900 uses 3-phase AC input. The 5 kW and 10 kW RP7931A - RP7963A ac mains connections are: L1, L2, L3, PE. While the 20 kW and 30 kW RP7970/RP7980 series ac mains connections are: L1, L2, L3, PE for firmware rev after B.06.03.985 and L1, L2, L3, N, PE (requires a neutral connection) for earlier firmware.

Digital control port

On the rear panel of every RP7900 power supply is a digital control port that consists of seven user configurable I/O pins that provide access to various control functions. Each pin is user configurable. Table 1 describes the possible pin configuration for the digital port functions.

Figure 6. Digital control port on rear panel

Table 1. Digital control port description

Pin function	Available configuration pins
Digital I/O and digital in	Pins 1 through 7
External trigger in/out	Pins 1 through 7
Fault out	Pins 1 through 2
Inhibit in	Pins 3
Output couple	Pins 4 through 7
Common (connected to ground)	Pins 8

Rack mount kits*

The 5 kW, 10 kW and 20 kW RP7931A - RP7973A can easily be rack mounted using the 1CP108A rack mount flange and 3U front handle kit with the RP7908A rail kit for system II Keysight instrument racks.

The 30 kW RP7982A - RP7984A can easily be rack mounted using the 1CP120A rack mount flange and 5U front handle kit with the RP7908A rail kit for system II Keysight instrument racks.

BV9200B PathWave BenchVue Advanced Power Control and Analysis Software

The BV9200B and BV9201B PathWave BenchVue Advanced Power Control and Analysis Software gives you fast and easy access to the advanced sourcing and measurement functionality of your RP7900 Series Regenerative Power System without any programming. The BV9201B will allow user to control a single instrument, while the BV9200B will allow users to control up to four instruments at once. They are flexible tools for any application and allows you to control any 5 kW to 20 kW RP7931A – RP7973A, and 30 kW RP7982A – RP7983A. The new 30 kW RP7984A is not yet supported, and LIST is not supported in primary/secondary mode on the RP7931A - RP7963A. The software can also control other Keysight power supplies including the popular N6700 modules, N6705 DC Power Analyzer, and the N7900 Advanced Power Supplies.

- Control and analyze data from up to four RP7900 Series Regenerative Power System.
- Easily create complex waveforms to stimulate or load down a DUT by inputting a formula, choosing from built-in, or importing waveform data.
- Enhanced control and analysis of data with familiar PC controls and large display.
- Data log measurements directly to a PC.
- Perform statistical analysis (CCDF) of power consumption.
- Integrate software functions into users programming environment via API (automation programming interface)

*The RP7909A rack mount slide kit can also be used to rackmount the 5 kW and 10 kW RP7931A - RP7963A.

Figure 7. BV9201B connected to a RP7933A

BV9210B PathWave BenchVue Advanced Battery Test and Emulation Software

The Keysight BV9210B Pathwave BenchVue Advanced Battery Test and Emulation application software provides a test environment for you to easily run battery tests, generate battery models and perform battery emulation using one or more Keysight two-quadrant power supplies. The emulation function allows you to quickly output the desired battery operation conditions. It allows you to cover various test scenarios without having to wait for a real battery to go through discharging or charging conditions. The BV9211B will allow user to control a single instrument, while the BV9210B will allow users to control up to four instruments at once. The software can also control other Keysight power supplies including the popular N6700 modules, N6705 DC Power Analyzer, and the N7900 Advanced Power Supplies. The new 30 kW RP7984A is not yet supported.

- Tests and emulates batteries up to 600 kW and up to 2000 V
- Supports four modes of operation: emulation, profiler, discharge/charge, and cycler
- Creates custom battery models
- Includes API functions to facilitate integration into your programming environment
- Provides advanced control capabilities - capacity rating, state of charge, constant or dynamic level selection, pulse width control
- Accurately captures voltage, current, capacity from seconds up to days
- Creates custom dynamic loading characteristics for discharging
- Import battery models

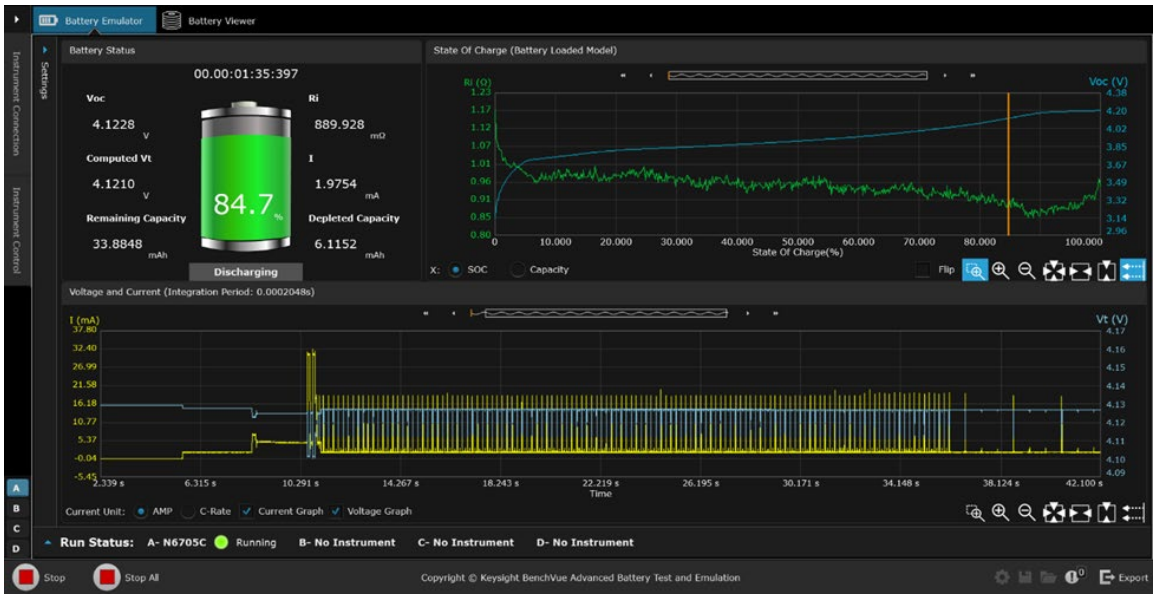


Figure 8. BV9210B connected to Keysight's advanced two-quadrant power supply

SD1000A safety disconnect system

The SD1000A safety disconnect solution was designed to work exclusively with the RP795x and RP796x Series (500 V and 950 V models only). In less than 15 ms the safety disconnect will remove the output voltage in order to safeguard your device under test and your people in response to a fault. Faults can be generated by the RP7900 or a user (emergency switch). It includes four disconnect point (relays) with two each on the positive and negative sides.

Modification service

While the RP7900 Series regenerative power system will meet most of your needs, Keysight recognizes that they may not match all needs. To better solve your specific problem, Keysight offers a special modification service. This service entails the design and manufacture of a modified version of standard RP7900 models. The modified RP7900 are designed, manufactured, and tested to Keysight's high quality and reliability standards.

Specifications - RP793x, RP794x

Unless otherwise noted, specifications are warranted over the ambient temperature range of 0 to 40 °C after a 30-minute warm-up period. Specifications apply at the output terminals, with the sense terminals connected to the output terminals (local sensing).

For more detailed specifications refer to the RP7900 user's manual at: www.keysight.com/find/RPS-doc

Specification	RP7931A/ RP7941A	RP7932A/ RP7942A	RP7933A/ RP7943A	RP7935A/ RP7945A	RP7936A/ RP7946A
DC ratings					
Voltage source	0 to 20 V	0 to 80 V	0 to 20 V	0 to 80 V	0 to 160 V
Current source and sink	0 to ± 400 A	0 to± 125 A	0 to ± 800 A	0 to ± 250 A	0 to ± 125 A
Power	0 to ± 5 kW	0 to ± 5 kW	0 to ±10 kW	0 to ± 10 kW	0 to ± 10 kW
Output ripple and noise					
CV peak-to-peak [1]	30 mV	80 mV	30 mV	80 mV	200 mV
CV rms [2]	3 mV	8 mV	3 mV	8 mV	20 mV
Load regulation					
Voltage	1 mV	3 mV	1 mV	3 mV	6 mV
Current	25 mA	13 mA	50 mA	25 mA	13 mA
Voltage programming and measurement accuracy [3]					
	0.02% + 2 mV	0.02% + 8 mV	0.02% + 2 mV	0.02% + 8 mV	0.02% + 16 mV
Current programming and measurement accuracy [3]					
	0.04% + 45 mA	0.03% + 13 mA	0.04% + 90 mA	0.03% + 25 mA	0.03% + 13 mA
Transient response [4]					
Recovery Time	300 µs	300 µs	300 µs	300 µs	300 µs
Settling band	0.2 V	0.8 V	0.2 V	0.8 V	1.6 V

1. From 20 Hz to 20 MHz (-3 dB bandwidth) with resistive load, terminals ungrounded, or either terminal grounded.
2. From 20 Hz to 10 MHz (-3 dB bandwidth) with resistive load, terminals ungrounded, or either terminal grounded.
3. Percent of value + offset; at 25 °C ± 5 °C after a 30-minute warm-up; measurement NPLC=1; valid for 1 year.
4. Time to recover to within the settling band following a step change from 40% to 90% of full load with a 35 µs current rise and fall time.

Supplemental Characteristics - RP793x, RP794x

Supplemental characteristics are not warranted but are descriptions of performance determined either by design or by type testing. Supplemental characteristics are typical unless otherwise noted.

Characteristic	RP7931A/ RP7941A	RP7932A/ RP7942A	P7933A/ RP7943A	RP7935A/ RP7945A	RP7936A/ RP7946A
Output ripple and noise (from 20 Hz to 20 MHz)					
CC rms	200 mA	70 mA	200 mA	70 mA	50 mA
Voltage programming					
Range	0.02 to 20.4 V	0.08 to 81.6 V	0.02 to 20.4 V	0.08 to 81.6 V	0.16 to 163.2 V
Resolution	191 µV	800 µV	191 µV	800 µV	1.6 mV
Current programming					
Range	−408 A to 408 A	−127.5 A to 127.5 A	−816 A to 816 A	−255 A to 255 A	−127.5A to 127.5 A
Resolution	7.7 mA	2.5 mA	15.5 mA	5 mA	2.5 mA
Resistance programming					
Range	0 to 0.098 Ω	0 to 1.25 Ω	0 to 0.049 Ω	0 to 0.625 Ω	0 to 2.5 Ω
Resolution	0.8 µΩ	9.8 µΩ	0.4 µΩ	4.8 µΩ	19.6 µΩ
Accuracy	0.05% + 4 µΩ	0.05% + 32 µΩ	0.05% + 2 µΩ	0.05% + 16 µΩ	0.05% + 50 µΩ
Voltage programming speed, no load [1]					
Rise/fall time 10% to 90% of step	80 µs	75 µs	80 µs	75 µs	75 µs
Settling time to 0.1% of step	810 µs	480 µs	810 µs	480 µs	550 µs
Voltage programming speed, full load [2]					
Rise/fall time 10% to 90% of step	140 µs	130 µs	140 µs	130 µs	170 µs
Settling time to 0.1% of step	4.2 ms	1.35 ms	4.2 ms	1.35 ms	1.35 ms
Current programming speed [3]					
Rise/fall time 10% to 90% of step	300 µs	180 µs	300 µs	180 µs	190 µs
Settling time to 0.1% of step	960 µs	500 µs	960 µs	500 µs	550 µs
Line regulation					
Voltage	< 10 µV	< 10 µV	< 10 µV	< 10 µV	< 10 µV
Current	< 20 µA	< 10 µA	< 40 µA	< 10 µA	< 10 µA

1. In the CV Comp 0 range, Frequency = 100 kHz, under no load, and a step change from 10% to 100% of output rating.
2. In the CV Comp 0 range, Frequency = 2.3 kHz, with full constant current load, and a step change from 0.1% to 100% of output rating.
3. In the CC Comp 0 range, Frequency = 100 kHz, and a step change from 10% to 100% of current rating, into low impedance DC source.

Specifications - RP795x, RP796x

Unless otherwise noted, specifications are warranted over the ambient temperature range of 0 to 40 °C after a 30-minute warm-up period. Specifications apply at the output terminals, with the sense terminals connected to the output terminals (local sensing).

For more detailed specifications refer to the RP7900 user's manual at: www.keysight.com/find/RPS-doc

Specification	RP7951A/ RP7961A	RP7952A/ RP7962A	RP7953A/ RP7963A
DC ratings			
Voltage source	0 to 500 V	0 to 500 V	0 to 950 V
Current source and sink	0 to ± 20 A	0 to ± 40 A	0 to ± 20 A
Power	0 to ± 5 kW	0 to ± 10 kW	0 to ± 10 kW
Output ripple and noise			
CV peak-to-peak [1]	500 mV	500 mV	1000 mV
CV rms [2]	100 mV	100 mV	200 mV
Load regulation			
Voltage [3]	30 mV	30 mV	60 mV
Current	9 mA	17 mA	9 mA
Voltage programming accuracy [3]			
	0.03% + 60 mV	0.03% + 60 mV	0.03% + 120 mV
Voltage measurement accuracy [3]			
	0.03% + 80 mV	0.03% + 80 mV	0.03% + 160 mV
Current programming and measurement accuracy [3]			
	0.1% + 12 mA	0.1% + 24 mA	0.1% + 12 mA
Transient response [4]			
Recovery Time	500 µs	500 µs	500 µs
Settling band	1.25 V	1.25 V	2.375 V

1. From 20 Hz to 20 MHz (-3 dB bandwidth) with resistive load, terminals ungrounded, or either terminal grounded.
2. From 20 Hz to 10 MHz (-3 dB bandwidth) with resistive load, terminals ungrounded, or either terminal grounded.
3. At 25 °C ± 5 °C after a 30-minute warm-up; measurement NPLC=1; valid for 1 year.
4. Time to recover to within the settling band following a step change from 50% to 100% of full load at the maximum slew rate.

Supplemental Characteristics - RP795x, RP796x

Supplemental characteristics are not warranted but are descriptions of performance determined either by design or by type testing. Supplemental characteristics are typical unless otherwise noted.

Characteristic	RP7951A/ RP7961A	RP7952A/ RP7962A	RP7953A/ RP7963A
Output ripple and noise			
CC rms	100 mA	200 mA	100 mA
Voltage programming			
Range	0.5 to 510 V	0.5 to 510 V	1.0 to 969 V
Resolution	10.5 mV	10.5 mV	21 mV
Current programming			
Range	-20.5 A to 20.5 A	-41 A to 41 A	-20.5 A to 20.5 A
Resolution	190 µA	380 µA	190 µA
Resistance programming			
Range	0 to 25 Ω	0 to 12.5 Ω	0 to 50 Ω
Resolution	140 µΩ	70 µΩ	280 µΩ
Accuracy	0.08% + 200 µΩ	0.08% + 110 µΩ	0.08% + 280 µΩ
Voltage programming speed (Comp 0) [1, 2]			
Rise/fall time 10% to 90% of step	1 ms	1 ms	1 ms
Settling time to 0.1% of step	6 ms	6 ms	6 ms
Voltage programming speed (Comp 1) [1, 2]			
Rise/fall time 10% to 90% of step	15 ms	15 ms	15 ms
Settling time to 0.1% of step	50 ms	50 ms	50 ms
Current programming speed [1]			
Rise/fall time 10% to 90% of step	2 ms	2 ms	2 ms
Bleed resistor			
Terminal to chassis ground	1 MΩ	1 MΩ	1 MΩ

1. Up programming with full resistive load and a step change from 0.1% to 100% of rated output.
2. Down programming with no load and a step change from 100% to 0.1% of rated output.

Specifications - RP797x, RP798x

Unless otherwise noted, specifications are warranted over the ambient temperature range of 0 to 40 °C after a 30-minute warm-up period. Specifications apply at the output terminals, with the sense terminals connected to the output terminals (local sensing).

For more detailed specifications refer to the RP7900 user's manual at: www.keysight.com/find/RPSPV-doc

Specification	RP7972A	RP7973A	RP7982A	RP7983A	RP7984A
DC Ratings					
Voltage source	0 to 1000 V	0 to 2000 V	0 to 1000 V	0 to 2000 V	0 to 1500 V
Current source and sink	0 to ± 60 A	0 to ± 30 A	0 to ± 90 A	0 to ± 30 A	0 to ± 60 A
Power	0 to ± 20 kW	0 to ± 20 kW	0 to ± 30 kW	0 to ± 30 kW	0 to ± 30 kW
Output ripple and noise					
CV peak-to-peak [1]	1.5 V	3 V	1.5 V	3 V	2.25 V
CV rms [2]	200 mV	400 mV	200 mV	400 mV	300 mV
Load regulation					
Voltage [3]	50 mV	100 mV	50 mV	100 mV	75 mV
Current	8 mA	4 mA	12 mA	4 mA	8 mA
Voltage programming and measurement accuracy [4]					
	0.04% + 75 mV	0.04% + 150 mV	0.03% + 75 mV	0.03% + 150 mV	0.03% + 100 mV
Current programming and measurement accuracy [4]					
	0.03% + 6 mA	0.03% + 3 mA	0.03% + 9 mA	0.03% + 3 mA	0.03% + 6 mA
Transient response [5]					
Recovery Time	300 µs	300 µs	300 µs	300 µs	300 µs
Settling band	10 V	20 V	10 V	20 V	15 V

1. From 20 Hz to 20 MHz (-3 dB bandwidth) with resistive load, terminals ungrounded, or either terminal grounded.
2. From 20 Hz to 10 MHz (-3 dB bandwidth) with resistive load, terminals ungrounded, or either terminal grounded.
3. Also applies when remote sensing with a ≤ 1 V drop per load lead.
4. Percent of value + offset; at 25 °C ± 5 °C after a 30-minute warm-up; measurement NPLC=1; valid for 1 year.
5. Time to recover to within the settling band following a step change from 40% to 90% and 90% to 40% of full load at Comp 0 with a 40 µs current rise and fall time.

Supplemental Characteristics - RP797x, RP798x

Supplemental characteristics are not warranted but are descriptions of performance determined either by design or by type testing. Supplemental characteristics are typical unless otherwise noted.

Characteristic	RP7972A	RP7973A	RP7982A	RP7983A	RP7984A
Output ripple and noise (from 20 Hz to 20 MHz)					
CC rms	30 mA	15 mA	30 mA	15 mA	30 mA
Voltage programming					
Range	+1 V to +1020 V	+2 V to +2040 V	+1 V to +1020 V	+2 V to +2040 V	+1.5 V to +1530 V
Resolution	10 mV	20 mV	10 mV	20 mV	15 mV
Current programming					
Range	-61.2 A to +61.2 A	-30.6 A to +30.6 A	-91.8 A to +91.8 A	-30.6 A to +30.6 A	-61.2 A to +61.2 A
Resolution	1.2 mA	0.6 mA	1.8 mA	0.6 mA	1.2 mA
Resistance programming					
Range	0 to 69 Ω	0 to 277 Ω	0 to 43.8 Ω	0 to 394 Ω	0 to 98.6 Ω
Resolution	0.55 mΩ	2.2 mΩ	0.4 mΩ	3.2 mΩ	0.8 m Ω
Accuracy	0.06% + 0.55 mΩ	0.06% + 2.2 mΩ	0.05% + 0.4 mΩ	0.05% + 3.2 mΩ	0.05% + 0.8 m Ω
Voltage up/down programming, Comp 0 [1]					
Rise/fall time 10% to 90% of step	0.2 ms	0.2 ms	0.2 ms	0.2 ms	0.2 ms
Settling time to 0.1% of step	1 ms	1 ms	1 ms	1 ms	1 ms
Voltage up/down programming, Comp 1 [1]					
Rise/fall time 10% to 90% of step	0.5 ms	0.5 ms	0.5 ms	0.5 ms	0.5 ms
Settling time to 0.1% of step	2.5 ms	2.5 ms	2.5 ms	2.5 ms	2.5 ms
Voltage up/down programming, Comp 2 [1]					
Rise/fall time 10% to 90% of step	33 ms	33 ms	33 ms	33 ms	33 ms
33 ms	110 ms	110 ms	110 ms	110 ms	110 ms
Current up/down programming, Comp 0 [2]					
Rise/fall time 10% to 90% of step	100 µs	100 µs	100 µs	100 µs	100 µs
Settling time to 1% of step	200 µs	200 µs	200 µs	200 µs	200 µs
Bleed resistor					
Terminal to chassis ground	68 MΩ	68 MΩ	68 MΩ	68 MΩ	68 MΩ

1. With no load and a step change from 0.1% to 100% of voltage rating; bandwidth frequency = 100 kHz.
2. With AC short and a step >10% of output voltage rating; bandwidth frequency = 100 kHz.

Common Characteristics - All Models

Common characteristic	All models
Command processing time	≤ 1 ms from receipt of command to start of output change. Applies to simple setting commands over the GPIB interface
Computer interfaces	
LXI	1.5 LXI Device Specification 2016
LAN	10 Mb, 100 Mb, 1 Gb LAN
USB	USB 2.0 (USB-TMC488 protocol)
GPIB	SCPI - 1993, IEEE 488.2 compliant interface
Constant dwell ARBs	
Number of points	Up to 65,535
Dwell range	One dwell setting applies for the entire ARB, from 10.24 µs to 0.30 seconds
Dwell resolution	Values are rounded to the nearest 10.24-microsecond increment
Regulatory compliance	
EMC	Complies with European EMC Directive for test and measurement products
	Complies with Australian standard and carries C-Tick mark
	This ISM device complies with Canadian ICES-001
	Cet appareil ISM est conforme à la norme NMB-001 du Canada
Safety	Complies with European Low Voltage Directive and carries the CE mark.
	Conforms to US and Canadian safety regulations.
Output terminal isolation	
For 20 VDC models	No output terminal may be more than ± 60 VDC from any other terminal or chassis ground.
For 80 and 160 VDC models	No output terminal may be more than ± 240 VDC from any other terminal or chassis ground.
For 500 and 900 VDC models	No output terminal may be more than ± 950 VDC from any other terminal or chassis ground.
For 1 kV DC models	No output terminal may be more than ± 1000 VDC from any other terminal or chassis ground.
For 1.5 kV and 2 kV DC models	No output terminal may be more than ± 2000 VDC from any other terminal or chassis ground.

Common characteristic	All models
AC input	
Connections	L1, L2, L3, PE; does not require a neutral connection (RP7931A – RP7963A)
	L1, L2, L3, N, PE; requires a neutral connection (RP7972A - RP7984A)
Phase and range	3 phase; 200 VAC ± 10% and 208 VAC ± 10% (RP7931A - RP7936A, RP7951A - RP7953A)
	3 phase; 400 VAC ± 15% and 480 VAC ± 10% (RP7941A - RP7946A, RP7961A - RP7963A)
	3 phase; 380 - 480 VAC ±10% (RP7972A - RP7973A, RP7982A - RP7984A)
Input VA	RP7931A, RP7932A, RP7941A, RP7942A, RP7951A, RP7961A: 6.5 kVA
	RP7933A, RP7935A, RP7943A, RP7945A, RP7946A, RP7952A, RP7953A, RP7962A, RP7963A: 11.5 kVA
	RP7972A, RP7973A: 23 kVA
	RP7982A, RP7983A, RP7984A: 34 kVA
Input current per phase	
200 VAC input	RP7931A, RP7932A, RP7951A: 17.3 A
	RP7933A, RP7935A, RP7936A, RP7952A, RP7953A: 35 A
Input current per phase	
400 VAC input	RP7941A, RP7942A, RP7961A: 8.66 A
	RP7943A, RP7945A, RP7946A, RP7962A, RP7963A: 17.3 A
	RP7972A, RP7973A: 36 A
	RP7982A, RP7983A, RP7984A: 52 A
Efficiency at full power	
	RP7931A, RP7932A, RP7936A, RP7941A, RP7942A: 84%
	RP7933A, RP7935A, RP7936A, RP7943A, RP7945A, RP7946A: 85%
	RP7951A, RP7952A, RP7953A: 86.3%
	RP7961A, RP7962A, RP7963A: 91.5%
	RP7972A, RP7973A: 90%
	RP7982A, RP7983A, RP7984A: 90%
Power factor	
	0.99 at nominal input and rated power
Typical weight	
	RP7931A, RP7932A, RP7941A, RP7942A: 60 lbs. (27.3 kg)
	RP7933A - RP7936A, RP7943A - RP7946A: 70 lbs. (31.8 kg)
	RP7951A, RP7961A: 60 lbs. (27.3 kg)
	RP7952A, RP7962A, RP7953A, RP7963A: 70 lbs. (31.8 kg)
	RP7972A, RP7973A: 82 lbs. (37.3 kg)
	RP7982A, RP7983A, RP7984A: 126 lbs. (57.2 kg)

Output Quadrants

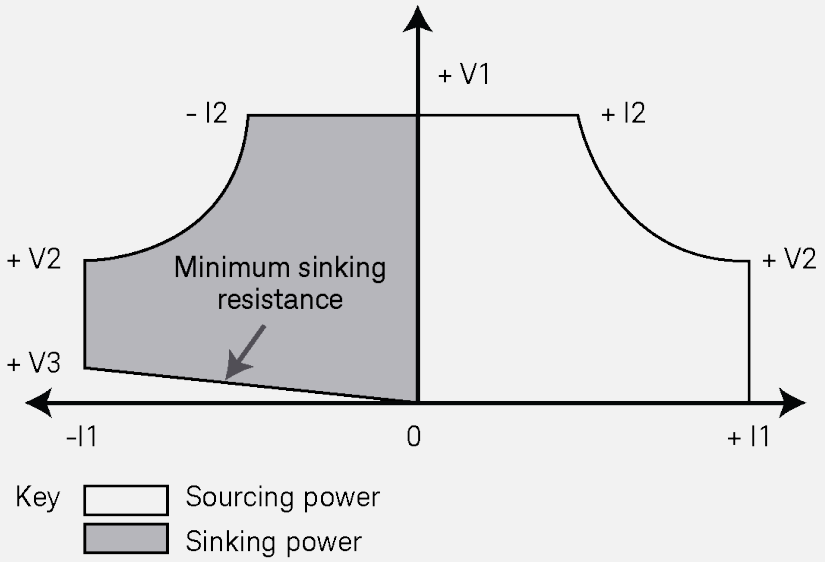
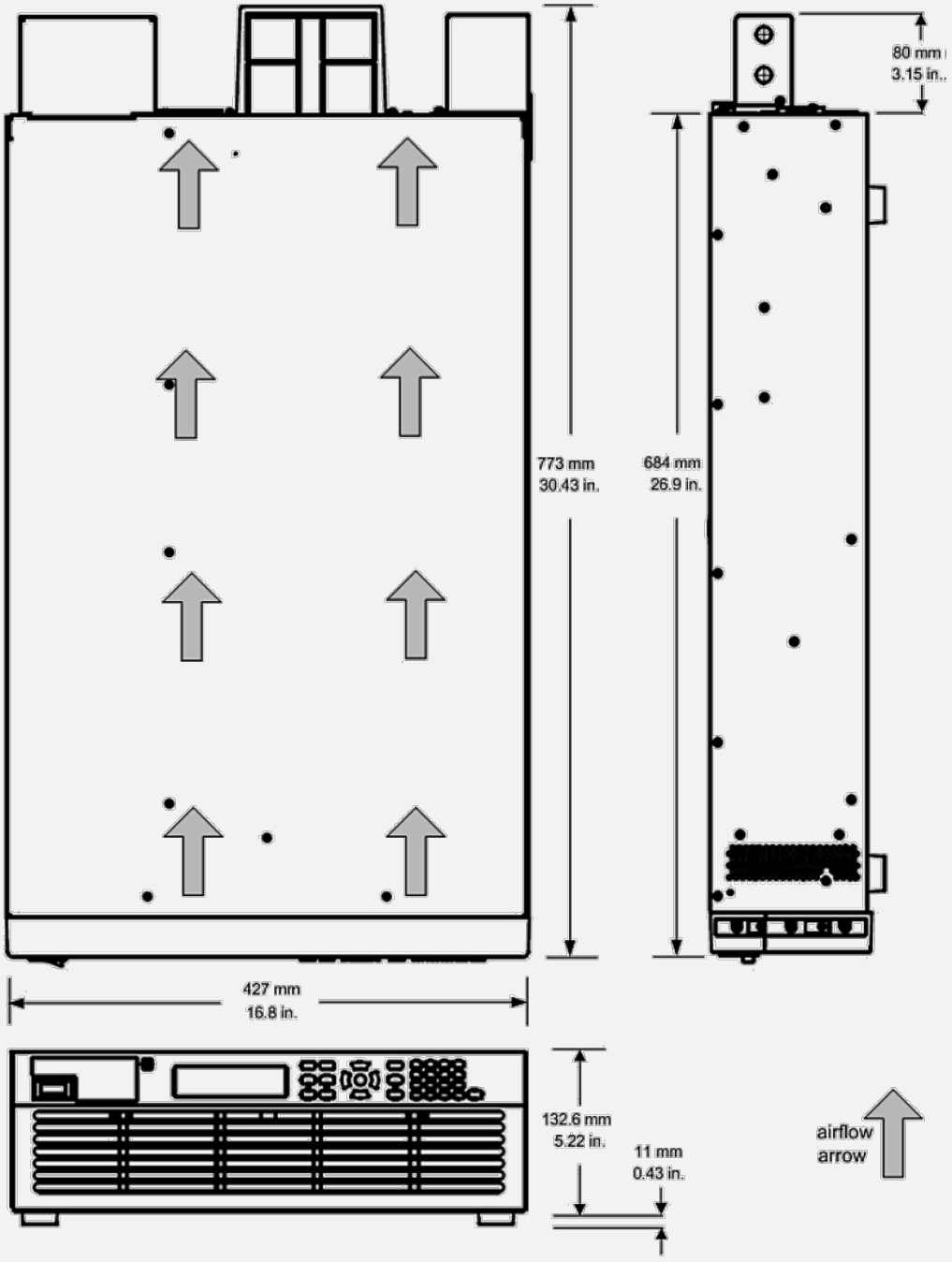


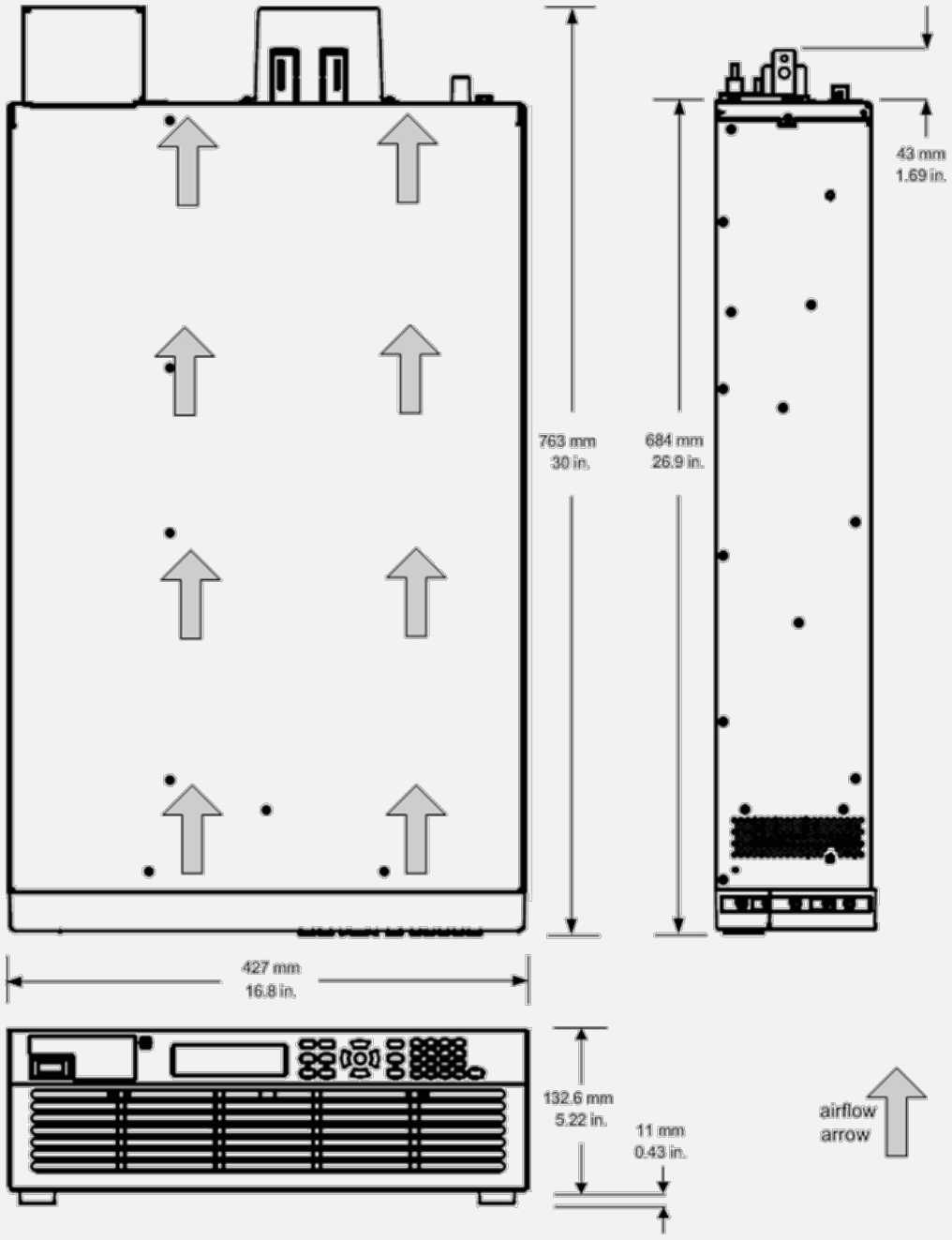
Figure 9. RP7900 output characteristic

Model	+ V1	+ V2	+ V3	± I1	± I2	Minimum sink resistance
RP7931A/RP7941A	20 V	12.5 V	0.5 V	400 A	250 A	1.25 mΩ
RP7933A/RP7943A	20 V	12.5 V	0.5 V	800 A	500 A	625 µΩ
RP7932A/RP7942A	80 V	40 V	1 V	125 A	62.5 A	8 mΩ
RP7935A/RP7945A	80 V	40 V	1 V	250 A	125 A	4 mΩ
RP7936A/RP7946A	160 V	80 V	1.5 V	125 A	62.5 A	12 mΩ
RP7951A/RP7961A	500 V	250 V	8 V	20 A	10 A	0.4 Ω
RP7952A/RP7962A	500 V	250 V	8 V	40 A	20 A	0.2 Ω
RP7953A/RP7963A	950 V	500 V	16 V	20 A	10.5 A	0.8 Ω
RP7972A	1000 V	333 V	7.8 V	60 A	20 A	130 mΩ
RP7973A	2000 V	666 V	15 V	30 A	10 A	500 mΩ
RP7982A	1000 V	333 V	7.2 V	90 A	30 A	80 mΩ
RP7983A	2000 V	1000 V	18 V	30 A	15 A	600 mΩ
RP7984A	1500 V	500 V	10.5 V	60 A	20 A	175 mΩ

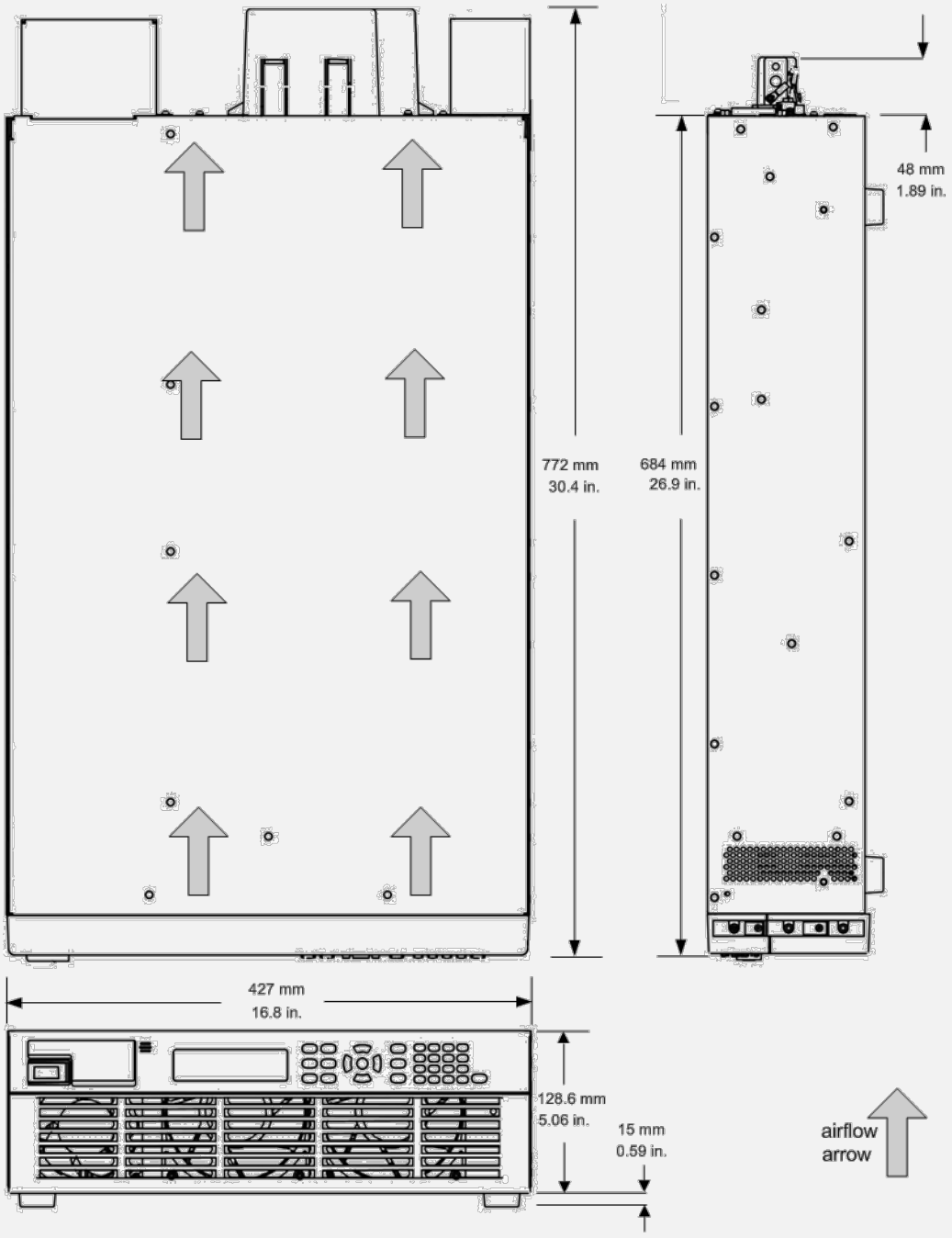
Outline Diagrams – RP793x, RP794x



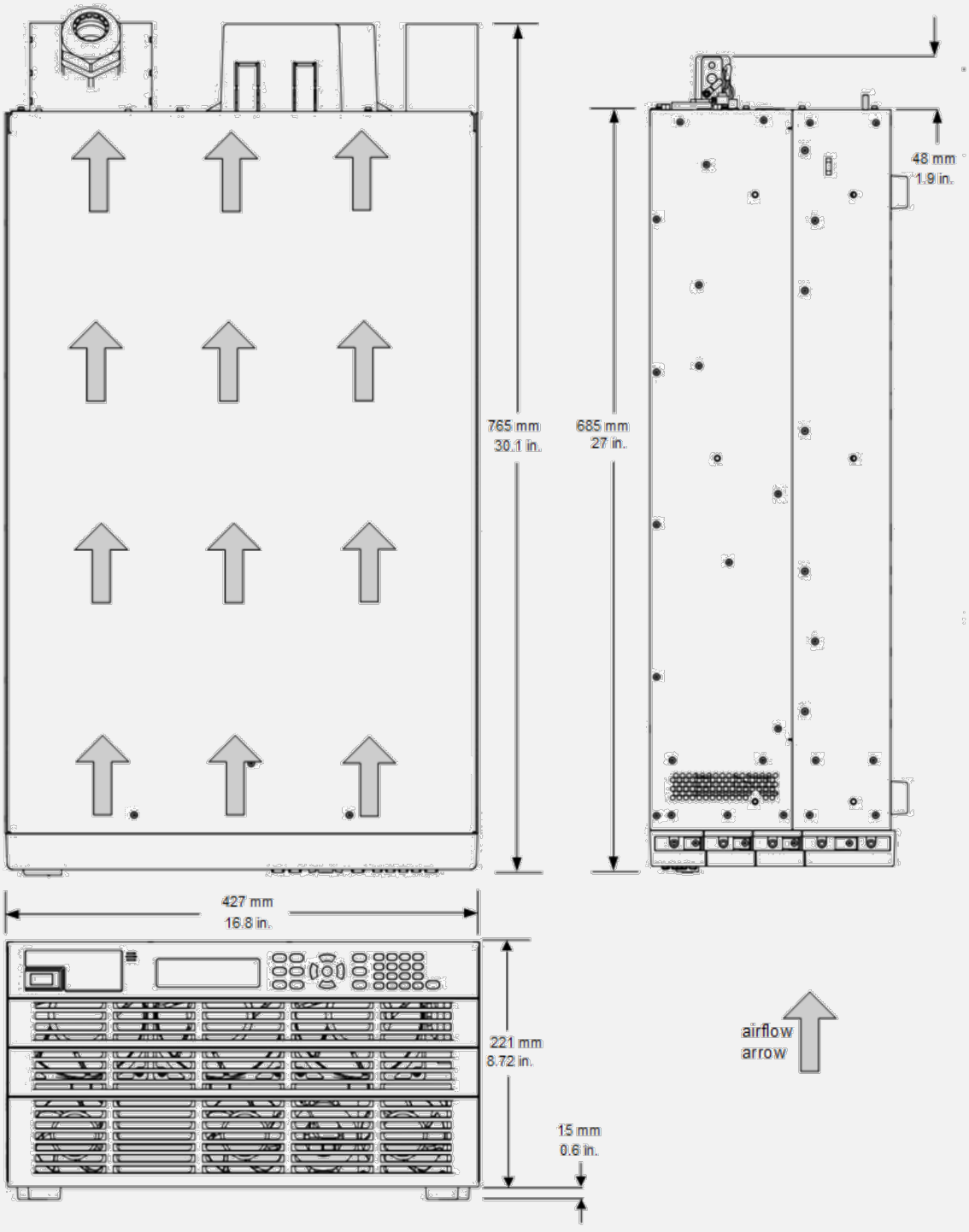
Outline Diagrams – RP795x, RP796x



Outline Diagrams – RP797x



Outline Diagrams – RP798x



Ordering Information

Available models

200/208 VAC models		
RP7931A	Regenerative Power System	20 V, ± 400 A, 5 kW, 200/208 VAC
RP7932A	Regenerative Power System	80 V, ± 125 A, 5 kW, 200/208 VAC
RP7933A	Regenerative Power System	20 V, ± 800 A, 10 kW, 200/208 VAC
RP7935A	Regenerative Power System	80 V, ± 250 A, 10 kW, 200/208 VAC
RP7936A	Regenerative Power System	160 V, ± 125 A, 10 kW, 200/208 VAC
RP7951A	Regenerative Power System	500 V, ± 20 A, 5 kW, 200/208 VAC
RP7952A	Regenerative Power System	500 V, ± 40 A, 10 kW, 200/208 VAC
RP7953A	Regenerative Power System	950 V, ± 20 A, 10 kW, 200/208 VAC
400/480 VAC models		
RP7941A	Regenerative Power System	20 V, ± 400 A, 5 kW, 400/480 VAC
RP7942A	Regenerative Power System	80 V, ± 125 A, 5 kW, 400/480 VAC
RP7943A	Regenerative Power System	20 V, ± 800 A, 10 kW, 400/480 VAC
RP7945A	Regenerative Power System	80 V, ± 250 A, 10 kW, 400/480 VAC
RP7946A	Regenerative Power System	160 V, ± 125 A, 10 kW, 400/480 VAC
RP7961A	Regenerative Power System	500 V, ± 20 A, 5 kW, 400/480 VAC
RP7962A	Regenerative Power System	500 V, ± 40 A, 10 kW, 400/480 VAC
RP7963A	Regenerative Power System	950 V, ± 20 A, 10 kW, 400/480 VAC
RP7972A	Regenerative Power System PV Mode	1000 V, ± 60 A, 20 kW, 400/480 VAC
RP7973A	Regenerative Power System PV Mode	2000 V, ± 30 A, 20 kW, 400/480 VAC
RP7982A	Regenerative Power System PV Mode	1000 V, ± 90 A, 30 kW, 400/480 VAC
RP7983A	Regenerative Power System PV Mode	2000 V, ± 30 A, 30 kW, 400/480 VAC
RP7984A	Regenerative Power System PV Mode	1500 V, ± 60 A, 30 kW, 400/480 VAC

Line cords and terminations (plugs)

If the AC input voltage where the power supply will be used is:

- 180 to 229, 3-phase, please choose a 200/208 VAC model (RP7931A - RP7936A, RP7951A - RP7953A)
- 340 to 528, 3-phase, please choose a 400/480 VAC model (RP7941A - RP7946A, RP7961A - RP7963A)
- 342 to 528, 3-phase, please chose a 400/480 VAC model (RP7972A - RP7973A, RP7982A - RP7984A)

Line cords and terminations (plugs)

Due to the number of different line cords and terminations around the world, the RP7900 power supplies do not come with line cords or terminations. Users will need to supply their own dependent on the local laws and codes of the country/region where the power supply will be used.

Option

Option UK6	Commercial calibration with test results data

Accessories

BV9200B	Advanced Power Control and Analysis Software - 4 instrument connection
BV9210B	Battery Test and Emulation Software - 4 instrument connection
1CP108A [1]	Rack Mount Flange and 3U Handle kit (for RP7931A - RP7973A)
1CP120A [1]	Rack Mount Flange and 5U Handle kit (for RP7982A - RP7984A)
RP7908A	Rail Kit for System II Keysight Instrument Racks

1. Requires RP7908A rail kit.

GREENTEST® TECHNOLOGIES

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