Keysight NL3-Class ATE DC Electronic Loads

EL4900 Series Regenerative DC Electronic Loads

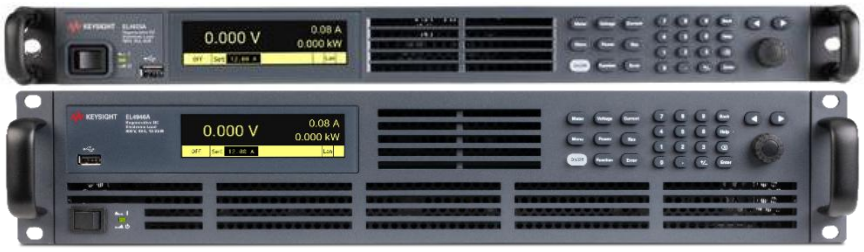
High-Power, High-Density Regenerative DC Electronic Loads

Introducing the Keysight EL4900 Series of midrange regenerative electronic loads. These single-input, programmable loads are available in compact 1U and 2U sizes, with power ratings from 1.2 kW to 12 kW. With regenerative capabilities, they efficiently return absorbed energy to the grid, reducing energy costs and minimizing cooling needs.

The EL4900 Series includes system-ready features such as multiple I/O interfaces, built-in voltage and current measurements, and operating ranges of 10 V to 1500 V and 8 A to 720 A, enabling faster test development and reliable evaluation in R&D, design validation, and production environments.

EL4900 Series models:

- 1 to 2 kW Family: EL4911A–EL4916A
- 4 kW Family: EL4921A–EL4926A
- 6 kW Family: EL4931A–EL4937A
- 12 kW Family: EL4941A–EL4947A



KEYSIGHT

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Introduction

In the global marketplace, demand is increasing for midrange power solutions to address the requirements of today's innovative high-power devices. While initial capital investments often command attention, operating expenses can play an even more critical role in the total cost of ownership. Effectively managing that cost can give your business a significant competitive advantage.

A reliable midrange power solution with the right features and a low cost of ownership can minimize your high-power test costs by reducing floor space requirements, cutting heat dissipation, and maximizing uptime. The Keysight EL4900 Series regenerative electronic load delivers these benefits, helping you improve efficiency while keeping costs under control.

Our Solution

The Keysight EL4900 Series is a family of midrange regenerative DC electronic loads. The regenerative architecture returns absorbed energy to the AC mains, reducing facility power consumption, cooling requirements, and operating costs. Available in compact 1U and 2U form factors, the EL4900 Series helps reduce energy costs, minimize floor space requirements, and shorten integration time. With flexible features and high-power density, the EL4900 Series delivers reliable performance in a compact regenerative electronic load platform.

The EL4900 Series enables you to do the following:

- Deliver regenerative load capability for a wide range of power conversion and energy storage test applications.
- Provide voltage options of 10 V, 32 V, 80 V, 300 V, 500 V, 800 V, and 1500 V, with current sinking up to 720 A for broad application coverage.
- Offer a wide 1.2 kW to 12 kW power range to address applications from low-power electronics to high-power energy systems.
- Maximize rack efficiency with industry-leading compact 1U and 2U form factors.
- Save valuable rack space with stackable parallel operations of up to 16 units.
- Reduce operating costs by regenerating absorbed energy back to the AC mains.
- Accelerate battery and power electronics testing with built-in waveform generation capabilities.
- Connect easily through LAN, USB, and CAN interfaces, with optional GPIB, RS-232, and analog control.
- Gain deeper insights with Keysight PathWave Advanced Power Suite software for power analysis, control, and emulation.

Reduce Costs for Cooling and Electricity with an Eco-Friendly Regenerative Design

The EL4900 returns 95% of the energy it absorbs to the grid cleanly, saving costs on energy consumption and cooling while not interfering with the grid. When sinking current, the EL4900 automatically returns excess power to the grid, with no programming required. To safeguard your Device Under Test (DUT), the EL4900 automatically senses that the grid is live, detects phase voltage and frequency in real time, and synchronizes safely before regenerating power to the grid.

With efficiency of more than 85%, the EL4900 lowers energy use and heat dissipation when sinking, cutting air conditioning requirements. Additionally, it helps reduce carbon emissions and their impact on the environment.

Accurately Characterize Your DUT's Power Profile with Advanced Measurements

The EL4900 provides simultaneous voltage and current measurement capabilities. Measurements can be made using two main modes: averaged or digitized. In average mode, the EL4900 delivers accurate voltage and current measurements. The digitizing capability allows you to capture dynamic current or voltage profiles.

In addition to voltage and current measurement capabilities, the EL4900 Series regenerative electronic load offers built-in power, amp-hour, and watt-hour calculations. These measurements help simplify your power efficiency and storage calculations.

Avoid Damage to Your DUT

When testing costly DUTs, integrating power protection measures into the test system is critical. Instruments with built-in or integrated protection respond faster than software-based safeguards, detecting and addressing error conditions quickly to reduce the risk of serious damage. The EL4900 provides built-in overvoltage, overcurrent, overpower, overtemperature protection, and voltage transient drop protection.

Generate Voltage and Current Transients

DUTs that operate in rugged environments, such as automotive electronics and avionics, can often experience transient behavior. To ensure your DUT stands up to these real-world transients, you must simulate worst-case power transient conditions during testing. The EL4900 provides three functionalities for simulating either voltage or current transients for testing:

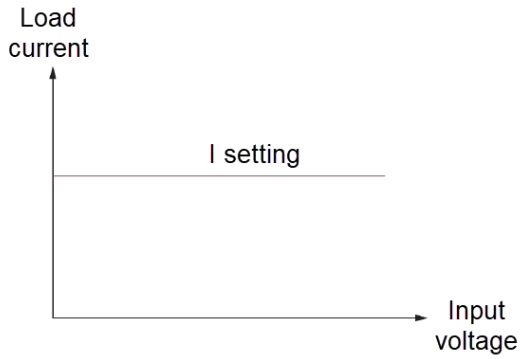
- **Step**: A one-time event steps the output voltage or current up or down in response to a triggered event.
- **Constant dwell arbitrary waveforms**: An arbitrary waveform generator (ARB) allows you to generate complex user-defined voltage or current waveforms of up to 65,535 data points. One dwell setting applies for the entire ARB, from 1 ms to 3,600 s.
- **List**: A list can consist of up to 200 steps, each step with a unique dwell time, which specifies how many seconds the list will remain at that step before advancing. Lists can also be trigger-paced, advancing one step for each trigger received.

Properly Powering Your DUT On and Off

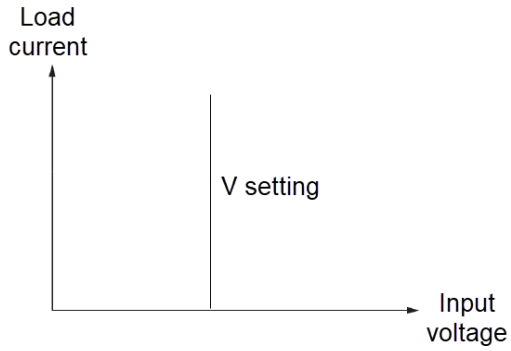
If you work with DUTs with multiple electronic load outputs, you often need to sequence each electronic load on or off at precise, repeatable times to prevent current surges and latch-up conditions. In addition, you may need to set the ramp rate of each load at turn-on or turn-off. These requirements add significant hardware and software complexity to an automated test equipment system. The EL4900 simplifies this process with built-in sequencing across multiple supplies, providing a clean, low-complexity way to properly power on or off your DUT during testing.

Multiple Operating Modes

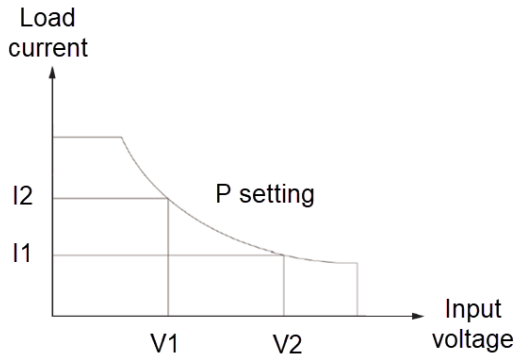
The EL4900 Series provides voltage priority mode (CV), current priority mode (CC), resistance priority mode (CR), and power priority mode (CP):



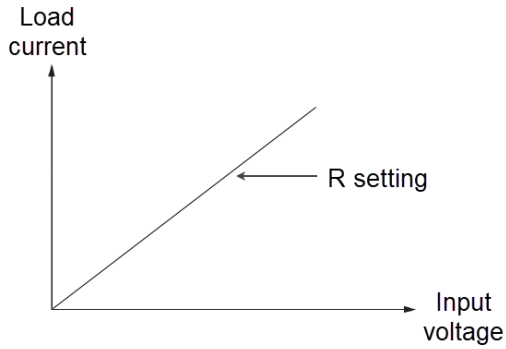
Current Priority (CC mode)



Voltage priority (CV mode)

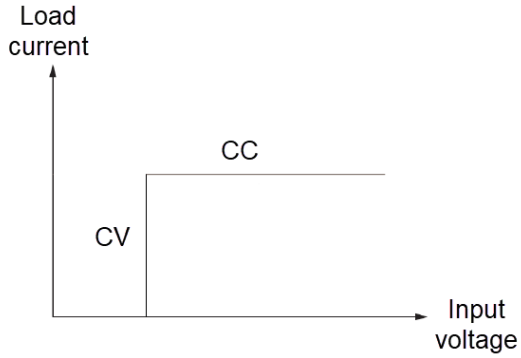


Power priority (CP mode)

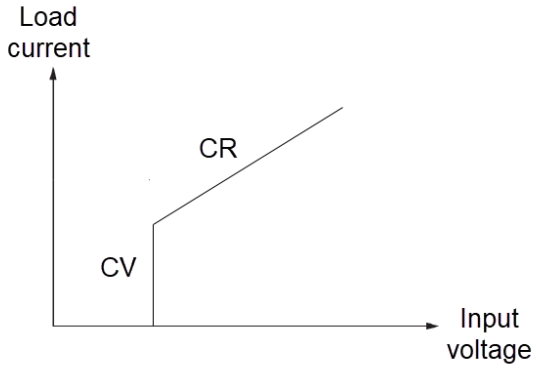


Resistance priority (CR mode)

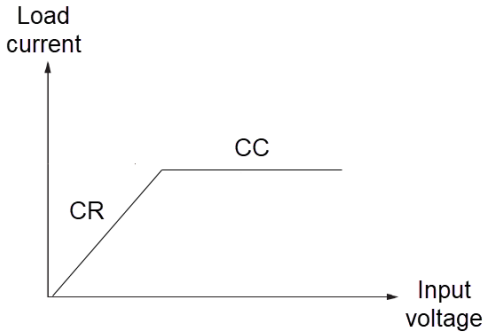
The EL4900 Series also has four other complex modes:



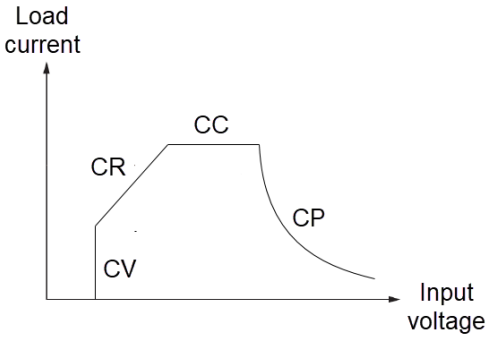
CV+CC mode



CV+CR mode



CC+CR mode



CC+CV+CP+CR mode (AUTO)

Add Power Flexibility to Your Test System by Paralleling Multiple Supplies

Paralleling multiple electronic loads together is a great way to add power flexibility to your test system. Conventional electronic loads often cannot maintain the desired Constant Voltage (CV) or Constant Current (CC) mode when paralleled. For instance, when trying to operate in CV mode with two parallel loads, one will typically sink the bulk of the current and operate in CC mode, and the other load will sink only a fraction of the current and operate in CV mode. This imbalance can significantly degrade certain electronic load performance specifications, such as transient response. The EL4900 eliminates this issue with a built-in parallel capability to ensure each load equally shares the load current, so they all remain in the desired mode — CV or CC.

The EL4900 also supports primary / secondary mode, which enables you to configure and program paralleled units as a single electronic load of up to 192 kW of total power; there is no need to program each load individually. The EL4900 Series regenerative electronic loads give you the flexibility to easily parallel up to 16 units for greater sink current. Parallel connection of mixed models with identical voltage ratings is only applicable for 6kW and 12kW models with the same firmware version. All other models require the same models of the same firmware to be paralleled.

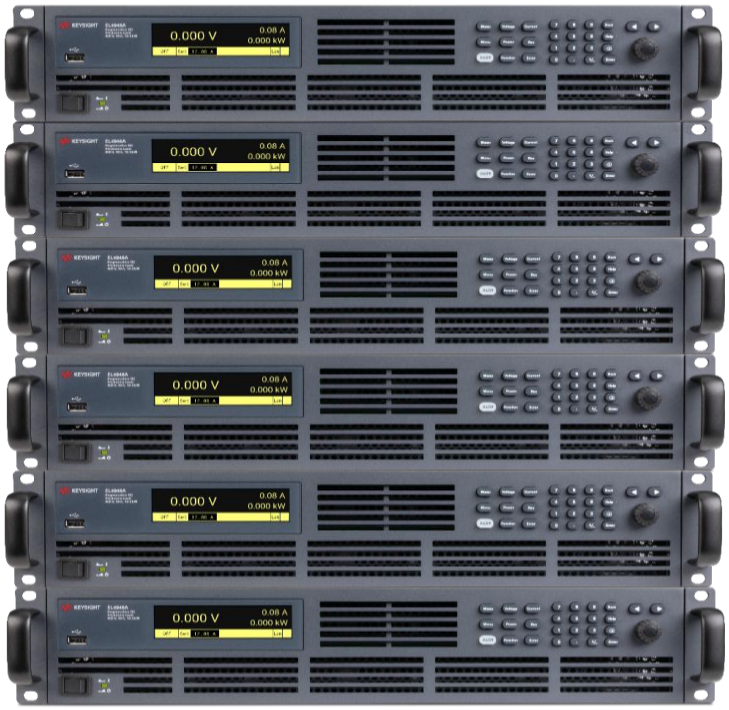


Figure 1. Parallel operation for more power

Simplify System Connection

The EL4900 Series power supplies come standard with Ethernet / LAN, USB 2.0, CAN IO interfaces, and optional GPIB, analog, and RS-232 IO interfaces, giving you the flexibility to use your I/O interface of choice today and safeguard your test setup for the future. The EL4900 is compliant with 1.5 LXI Device Specification 2016 and includes a built-in web interface. This enables you to control the EL4900 remotely using a web browser via a LAN connection.

AC Input

The EL4900 Series has a nominal AC input range and frequency of 200 to 480 VAC, 50 / 60 Hz for 2 kW and 4 kW models.

The 6 kW and 12 kW models will require 380 to 480 VAC, 50 / 60 Hz to sink maximum rated current and power. You can operate these models at 200 VAC -208 VAC, with the condition that the current and power ratings are reduced by ~35%.

The EL4900 uses a three-phase AC input with AC mains connections: L1, L2, L3, PE.

Digital Control Port

The rear panel of every EL4900 power supply features a digital control port containing 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.

Pin Function	Available Configuration Pins
Digital I/O and digital in	Pins 1 through 7
Protection status	Pins 2
External trigger in / out	Pin 4
Inhibit in	Pins 5
Output couple	Pins 6 and 7
Common (connected to ground)	Pins 8

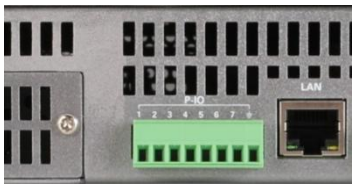


Figure 2. Digital control port on the rear panel.

Rack-Mount Kits

You can easily rack mount the EL4900 Series (EL4900 DC loads and RP5900 supplies) using the following kits:

- RP5904C for 1U models
- RP5905C for 2U models

PW9252A PathWave Advanced Power Control and Analysis Application

The PW9252A PathWave Advanced Power Control and Analysis application gives you fast and easy access to the sinking and measurement functionality of your EL4900 Series regenerative electronic load without any programming. PW9252A allows flexibility in the number of instrument connections by just purchasing the number of licenses based on the number of connecting instruments. They are flexible tools for any application and allow you to control any EL4900 Series model via LAN, GPIB, and USB interface. The software can also control other Keysight power supplies, including the popular N6700 modules, the N6705 DC power analyzer, N7900 advanced power supplies, and the RP7900 regenerative power systems.

PW9252A enables you to do the following:

- Control and analyze data from up to 10 EL4900 Series regenerative electronic loads simultaneously.
- Create complex waveforms effortlessly, enter formulas, choose from built-in patterns, or import your data, for precise DUT stimulation or load simulation.
- Enhance productivity with intuitive PC-style controls and a large, easy-to-read display.
- Log measurement data directly to your PC for fast storage, review, and reporting.
- Perform detailed CCDF statistical analysis to gain deeper insights into power-consumption patterns.
- Integrate seamlessly into your existing programming environment using the API for complete automation flexibility.



Figure 3. PW9252A interface with four channels connected

Specifications – EL491x

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 (local sensing) terminals.

Refer to the Keysight EL4900 Series documentation for the setup conditions for all performance specifications.

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

For more detailed specifications, refer to the EL4900 Series user manual at www.keysight.com/find/EL4900.

	EL4911A	EL4912A	EL4913A	EL4914A	EL4915A	EL4916A
DC Ratings						
Voltage	10 V	32 V	80 V	300 V	500 V	800 V
Current	2 A — 120 A	80 A	40 A	20 A	12 A	8 A
Power	20 W — 1.2 kW	2 kW	2 kW	2 kW	2 kW	2 kW
Programming Accuracy [1]						
Voltage	0.08% + 8 mV	0.05% + 22 mV	0.03% + 24 mV	0.03% + 90 mV	0.03% + 150 mV	0.03% + 240 mV
Current	0.3% + 510 mA	0.1% + 200 mA	0.1% + 40 mA	0.1% + 30 mA	0.1% + 12 mA	0.1% + 8 mA
Resistance	9 mΩ	12 mΩ	3 mΩ	90 mΩ	10 mΩ	10 mΩ
Power	0.5% + 8.5 W	0.5% + 10 W	0.5% + 10 W	0.5% + 10 W	0.5% + 10 W	0.5% + 10 W
Readback Accuracy [1]						
Voltage	0.08% + 8 mV	0.05% + 22 mV	0.03% + 24 mV	0.03% + 90 mV	0.03% + 150 mV	0.03% + 240 mV
Current	0.3% + 510 mA	0.1% + 200 mA	0.1% + 60 mA	0.1% + 30 mA	0.1% + 12 mA	0.1% + 8 mA
Power	0.5% + 8.5 W	0.5% + 10 W	0.5% + 10 W	0.5% + 10 W	0.5% + 10 W	0.5% + 10 W
Load Regulation [1]						
Voltage	≤ 4 mV	≤ 12.8 mV	≤ 16 mV	≤ 60 mV	≤ 100 mV	≤ 160 mV
Current	≤ 120 mA	≤ 80 mA	≤ 40 mA	≤ 20 mA	≤ 12 mA	≤ 8 mA

1. Percent of value + offset; at 23 °C ± 5 °C after a 30-minute warm-up; measurement NPLC=1; valid for 1 year.

Supplemental Characteristics – EL491x

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

Characteristics	EL4911A	EL4912A	EL4913A	EL4914A	EL4915A	EL4916A
Constant Voltage Mode Programming and Readback						
Range	0 to 10 V	0 to 32 V	0 to 80 V	0 to 300 V	0 to 500 V	0 to 800 V
Resolution	1 mV	1 mV	1 mV	1 mV	10 mV	10 mV
Temperature coefficient	≤ 30 ppm/°C	≤ 30 ppm/°C	≤ 30 ppm/℃	≤ 30 ppm/°C	≤ 30 ppm/℃	≤ 30 ppm/℃
Constant Current Mode Programming and Readback						
Range	0 to 120 A	0 to 80 A	0 to 40 A	0 to 20 A	0 to 12 A	0 to 8 A
Resolution	100 mA	10 mA	10 mA	10 mA	1 mA	1 mA
Temperature coefficient	≤ 50 ppm/°C	≤ 50 ppm/°C	≤ 50 ppm/℃	≤ 50 ppm/°C	≤ 50 ppm/℃	≤ 50 ppm/℃
Constant Resistance Mode Programming						
Load resistance range	0.009 to 5 Ω	0.012 to 1,200 Ω	0.03 to 2,400 Ω	0.09 to 9,000 Ω	0.3 to 15,000 Ω	0.45 to 22,500 Ω
Resolution	1 mΩ	1 mΩ	1 mΩ	1 mΩ	10 mΩ	10 mΩ
Constant Power Mode Programming and Readback						
Range	20W to 1.2 kW	0 to 2 kW	0 to 2 kW	0 to 2 kW	0 to 2 kW	0 to 2 kW
Resolution	1 W	1 W	1 W	1 W	1 W	1 W
Maximum Slew Rate						
Rise/Fall slope	8 A/ms	20 A/ms	10 A/ms	5 A/ms	3 kA/s	2 kA/s
Line Regulation						
Voltage	≤ 2 mV	≤ 3.2 mV	≤ 16 mV	≤ 60 mV	≤ 100 mV	≤ 160 mV
Current	≤ 72 mA	≤ 48 mA	≤ 24 mA	≤ 12 mA	≤ 7.2 mA	≤ 4.8 mA
Protection Capability						
Overvoltage	11 V	35 V	82 V	330 V	530 V	835 V
Overcurrent	121.2 A	80.8 A	42 A	20.2 A	12.5 A	8.4 A
Overpower	1,224 W	2,040 W	2,040 W	2,040 W	2,040 W	2,040 W

Specifications – EL492x

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 (local sensing) terminals.

Refer to the Keysight EL4900 Series documentation for the setup conditions for all performance specifications.

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

For more detailed specifications, refer to the EL4900 Series user manual at www.keysight.com/find/EL4900.

	EL4921A	EL4922A	EL4923A	EL4924A	EL4925A	EL4926A
DC Ratings						
Voltage	10 V	32 V	80 V	300 V	500 V	800 V
Current	4 A — 240 A	160 A	80 A	40 A	24 A	16 A
Power	40 W — 2.4 kW	4 kW	4 kW	4 kW	4 kW	4 kW
Programming Accuracy [1]						
Voltage	0.08% + 8 mV	0.05% + 22 mV	0.03% + 24 mV	0.03% + 90 mV	0.03% + 150 mV	0.03% + 240 mV
Current	0.3% + 1.02A	0.1% + 400 mA	0.1% + 80 mA	0.1% + 60 mA	0.1% + 24 mA	0.1% + 16 mA
Resistance	6 mΩ	6 mΩ	3 mΩ	65 mΩ	10 mΩ	10 mΩ
Power	0.5% + 17 W	0.5% + 20 W	0.5% + 20 W	0.5% + 20 W	0.5% + 20 W	0.5% + 20 W
Readback Accuracy [1]						
Voltage	0.08% + 8 mV	0.05% + 22 mV	0.03% + 24 mV	0.03% + 90 mV	0.03% + 150 mV	0.03% + 240 mV
Current	0.3% + 1.02A	0.1% + 400 mA	0.1% + 120 mA	0.1% + 60 mA	0.1% + 24 mA	0.1% + 16 mA
Power	0.5% + 17 W	0.5% + 20 W	0.5% + 20 W	0.5% + 20 W	0.5% + 20 W	0.5% + 20 W
Load Regulation [1]						
Voltage	≤ 4 mV	≤ 12.8 mV	≤ 16 mV	≤ 60 mV	≤ 100 mV	≤ 160 mV
Current	≤ 240 mA	≤ 160 mA	≤ 80 mA	≤ 40 mA	≤ 24 mA	≤ 16 mA

1. Percent of value + offset; at 23 °C ± 5 °C after a 30-minute warm-up; measurement NPLC=1; valid for 1 year.

Supplemental Characteristics – EL492x

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

Characteristics	EL4921A	EL4922A	EL4923A	EL4924A	EL4925A	EL4926A
Constant Voltage Mode Programming and Readback						
Range	0 to 10 V	0 to 32 V	0 to 80 V	0 to 300 V	0 to 500 V	0 to 800 V
Resolution	1 mV	1 mV	1 mV	1 mV	10 mV	10 mV
Temperature coefficient	≤ 30 ppm/°C	≤ 30 ppm/°C	≤ 30 ppm/℃	≤ 30 ppm/°C	≤ 30 ppm/℃	≤ 30 ppm/℃
Constant Current Mode Programming and Readback						
Range	0 to 240 A	0 to 160 A	0 to 80 A	0 to 40 A	0 to 24 A	0 to 16 A
Resolution	100 mA	10 mA	10 mA	10 mA	1 mA	1 mA
Temperature coefficient	≤ 50 ppm/°C	≤ 50 ppm/°C	≤ 50 ppm/°C	≤ 50 ppm/°C	≤ 50 ppm/°C	≤ 50 ppm/°C
Constant Resistance Mode Programming						
Load resistance range	0.006 to 2.5 Ω	0.006 to 600 Ω	0.015 to 1,200 Ω	0.065 to 4,500 Ω	0.15 to 7,500 Ω	0.22 to 11,250 Ω
Resolution	1 mΩ	1 mΩ	1 mΩ	1 mΩ	10 mΩ	10 mΩ
Constant Power Mode Programming and Readback						
Range	40W to 2.4 kW	0 to 4 kW	0 to 4 kW	0 to 4 kW	0 to 4 kW	0 to 4 kW
Resolution	1 W	1 W	1 W	1 W	1 W	1 W
Maximum Slew Rate						
Rise/Fall slope	16 A/ms	40 A/ms	20 A/ms	10 A/ms	6 kA/s	4 kA/s
Line Regulation						
Voltage	≤ 2 mV	≤ 6.4 mV	≤ 16 mV	≤ 30 mV	≤ 100 mV	≤ 160 mV
Current	≤ 144 mA	≤ 96 mA	≤ 48 mA	≤ 12 mA	≤ 14.4 mA	≤ 9.6 mA
Protection Capability						
Overvoltage	11 V	35 V	82 V	330 V	530 V	835 V
Overcurrent	242.4 A	161.6 A	84 A	40.4 A	25 A	16.8 A
Overpower	2,448 W	4,080 W	4,080 W	4,080 W	4,080 W	4,080 W

Specifications – EL493x

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 (local sensing) terminals.

Refer to the Keysight EL4900 Series documentation for the setup conditions for all performance specifications.

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

For more detailed specifications, refer to the EL4900 Series user manual at www.keysight.com/find/EL4900.

	EL4931A	EL4932A	EL4933A	EL4934A	EL4935A	EL4936A	EL4937A
DC Ratings							
Voltage	10 V	32 V	80 V	300 V	500 V	800 V	1500 V
Current	6 — 360 A	240 A	120 A	60 A	36 A	24 A	12 A
Power	60 W — 3.6 kW	6 kW	6 kW	6 kW	6 kW	6 kW	5 W — 6 kW
Programming Accuracy [1]							
Voltage	0.08% + 8 mV	0.05% + 22 mV	0.03% + 24 mV	0.03% + 90 mV	0.03% + 150 mV	0.03% + 240 mV	0.03% + 900 mV
Current	0.3% + 1.53A	0.1% + 600 mA	0.1% + 120 mA	0.1% + 90 mA	0.1% + 36 mA	0.1% + 24 mA	0.2% + 24 mA
Resistance	3 mΩ	5 mΩ	3 mΩ	50 mΩ	10 mΩ	10 mΩ	500 mΩ
Power	0.5% + 25.5 W	0.5% + 30 W	0.5% + 30 W	0.5% + 30 W	0.5% + 30 W	0.5% + 30 W	0.5% + 30 W
Readback Accuracy [1]							
Voltage	0.08% + 8 mV	0.05% + 22 mV	0.03% + 24 mV	0.03% + 90 mV	0.03% + 150 mV	0.03% + 240 mV	0.03% + 900 mV
Current	0.3% + 1.53A	0.1% + 600 mA	0.1% + 200 mA	0.1% + 90 mA	0.1% + 36 mA	0.1% + 24 mA	0.2% + 24 mA
Power	0.5% + 25.5 W	0.5% + 30 W	0.5% + 30 W	0.5% + 30 W	0.5% + 30 W	0.5% + 30 W	0.5% + 30 W
Load Regulation [1]							
Voltage	≤ 4 mV	≤ 12.8 mV	≤ 16 mV	≤ 60 mV	≤ 100 mV	≤ 160 mV	≤ 300 mV
Current	≤ 360 mA	≤ 240 mA	≤ 120 mA	≤ 60 mA	≤ 36 mA	≤ 32 mA	≤ 12 mA

1. Percent of value + offset; at 23 °C ± 5 °C after a 30-minute warm-up; measurement NPLC=1; valid for 1 year.

Supplemental Characteristics – EL493xA

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

Characteristics	EL4931A	EL4932A	EL4933A	EL4934A	EL4935A	EL4936A	EL4937A
Constant Voltage Mode Programming and Readback							
Range	0 to 10 V	0 to 32 V	0 to 80 V	0 to 300 V	0 to 500 V	0 to 800 V	0 to 1500 V
Resolution	1 mV	1 mV	1 mV	1 mV	10 mV	10 mV	10 mV
Temperature coefficient	≤ 30 ppm/℃	≤ 30 ppm/℃	≤ 30 ppm/℃	≤ 30 ppm/℃	≤ 30 ppm/℃	≤ 30 ppm/℃	≤ 30 ppm/℃
Constant Current Mode Programming and Readback							
Range	0 to 360 A	0 to 240 A	0 to 120 A	0 to 60 A	0 to 36 A	0 to 24 A	0 to 12 A
Resolution	100 mA	10 mA	10 mA	10 mA	1 mA	1 mA	1 mA
Temperature coefficient	≤ 50 ppm/°C	≤ 50 ppm/°C	≤ 50 ppm/℃	≤ 50 ppm/°C	≤ 50 ppm/℃	≤ 50 ppm/℃	≤ 50 ppm/°C
Constant Resistance Mode Programming							
Load Resistance Range	0.003 to 1.67 Ω	0.005 to 400 Ω	0.01 to 800 Ω	0.05 to 3,000 Ω	0.1 to 5,000 Ω	0.15 to 7,500 Ω	0.5 to 7,500 Ω
Resolution	1 mΩ	1 mΩ	1 mΩ	1 mΩ	10 mΩ	10 mΩ	10 mΩ
Constant Power Mode Programming and Readback							
Range	60W to 3.6 kW	0 to 6 kW	0 to 6 kW	0 to 6 kW	0 to 6 kW	0 to 6 kW	0 to 6 kW
Resolution	1 W	1 W	1 W	1 W	1 W	1 W	1 W
Maximum Slew Rate							
Rise/Fall slope	24 A/ms	60 A/ms	30 A/ms	15 A/ms	9 kA/s	6 kA/s	3 A/ms
Line Regulation							
Voltage	≤ 2 mV	≤ 3.2 mV	≤ 16 mV	≤ 60 mV	≤ 100 mV	≤ 160 mV	≤ 300 mV
Current	≤ 216 mA	≤ 144 mA	≤ 72 mA	≤ 36 mA	≤ 28.8 mA	≤ 14.4 mA	≤ 7.2 mA
Protection Capability							
Overvoltage	11 V	35 V	82 V	330 V	530 V	835 V	1590 V
Overcurrent	363.6 A	242.4 A	26 A	60.6 A	37 A	25.2 A	12.12 A
Overpower	3,672 W	6,120 W	6,120 W	6,120 W	6,120 W	6,120 W	6,120 W

Specifications – EL494x

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 (local sensing) terminals.

Refer to the Keysight EL4900 Series documentation for the setup conditions for all performance specifications.

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

For more detailed specifications, refer to the EL4900 Series user manual at www.keysight.com/find/EL4900.

	EL4941A	EL4942A	EL4943A	EL4944A	EL4945A	EL4946A	EL4947A
DC Ratings							
Voltage	10 V	32 V	80 V	300 V	500 V	800 V	1500 V
Current	12 A — 720 A	480 A	240 A	120 A	72 A	48 A	24 A
Power	120 W — 7.2 kW	12 kW	12 kW	12 kW	12 kW	12 kW	10 W — 12 kW
Programming Accuracy [1]							
Voltage	0.08% + 8 mV	0.05% + 22 mV	0.03% + 24 mV	0.03% + 90 mV	0.03% + 150 mV	0.03% + 240 mV	0.03% + 900 mV
Current	0.3% + 3.06 A	0.1% + 1.2 A	0.1% + 240 mA	0.1% + 180 mA	0.1% + 72 mA	0.1% + 48 mA	0.2% + 48 mA
Resistance	1.5 mΩ	4 mΩ	3 mΩ	100 mΩ	10 mΩ	10 mΩ	250 mΩ
Power	0.5% + 51 W	0.5% + 60 W	0.5% + 60 W	0.5% + 60 W	0.5% + 60 W	0.5% + 60 W	0.5% + 60 W
Readback Accuracy [1]							
Voltage	0.08% + 8 mV	0.05% + 22 mV	0.03% + 24 mV	0.03% + 90 mV	0.03% + 150 mV	0.03% + 240 mV	0.03% + 900 mV
Current	0.3% + 3.06 A	0.1% + 1.2 A	0.1% + 380 mA	0.1% + 180 mA	0.1% + 72 mA	0.1% + 48 mA	0.2% + 48 mA
Power	0.5% + 51 W	0.5% + 60 W	0.5% + 60 W	0.5% + 60 W	0.5% + 60 W	0.5% + 60 W	0.5% + 60 W
Load Regulation [1]							
Voltage	≤ 4 mV	≤ 12.8 mV	≤ 16 mV	≤ 60 mV	≤ 100 mV	≤ 160 mV	≤ 300 mV
Current	≤ 720 mA	≤ 480 mA	≤ 240 mA	≤ 120 mA	≤ 72 mA	≤ 64 mA	≤ 24 mA

1. Percent of value + offset; at 23 °C ± 5 °C after a 30-minute warm-up; measurement NPLC=1; valid for 1 year.

Supplemental Characteristics – EL494x

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

Characteristics	EL4911A	EL4942A	EL4943A	EL4944A	EL4945A	EL4946A	EL4947A
Constant Voltage Mode Programming and Readback							
Range	0 to 10 V	0 to 32 V	0 to 80 V	0 to 300 V	0 to 500 V	0 to 800 V	0 to 1500 V
Resolution	1 mV	1 mV	1 mV	1 mV	10 mV	10 mV	10 mV
Temperature coefficient	≤ 30 ppm/°C	≤ 30 ppm/°C	≤ 30 ppm/℃	≤ 30 ppm/°C	≤ 30 ppm/℃	≤ 30 ppm/℃	≤ 30 ppm/°C
Constant Current Mode Programming and Readback							
Range	0 to 720 A	0 to 480 A	0 to 240 A	0 to 120 A	0 to 72 A	0 to 48 A	0 to 24 A
Resolution	100 mA	10 mA	10 mA	10 mA	10 mA	10 mA	1 mA
Temperature coefficient	≤ 50 ppm/°C	≤ 50 ppm/°C	≤ 50 ppm/℃	≤ 50 ppm/°C	≤ 50 ppm/℃	≤ 50 ppm/℃	≤ 50 ppm/°C
Constant Resistance Mode Programming							
Load resistance range	0.0015 to 0.83 Ω	0.004 to 200 Ω	0.005 to 400 Ω	0.1 to 1,500 Ω	0.05 to 2,500 Ω	0.08 to 3,750 Ω	0.25 to 3,750 Ω
Resolution	1 mΩ	1 mΩ	1 mΩ	1 mΩ	10 mΩ	10 mΩ	10 mΩ
Constant Power Mode Programming and Readback							
Range	120W to 7.2 kW	0 to 12 kW	0 to 12 kW	0 to 12 kW	0 to 12 kW	0 to 12 kW	0 to 12 kW
Resolution	1 W	1 W	1 W	1 W	1 W	1 W	1 W
Maximum Slew Rate							
Rise/Fall slope	48 A/ms	120 A/ms	60 A/ms	30 A/ms	18 kA/s	12 kA/s	6 A/ms
Line Regulation							
Voltage	≤ 2 mV	≤ 3.2 mV	≤ 16 mV	≤ 30 mV	≤ 100 mV	≤ 160 mV	≤ 300mV
Current	≤ 432 mA	≤ 288 mA	≤ 144 mA	≤ 36 mA	≤ 57.6 mA	≤ 28.8 mA	≤ 14.4 mA
Protection Capability							
Overvoltage	11 V	35 V	82 V	330 V	530 V	835 V	1590 V
Overcurrent	727.2 A	484.8 A	252 A	121.2 A	75 A	50.4 A	24.24 A
Overpower	7,344 W	12,240 W	12,240 W	12,240 W	12,240 W	12,240 W	12,240 W

Common Characteristics – All Models

Common Characteristic	All Models
Command processing time	≤ 0.1 ms from receipt of command to start of output change. Applies to simple setting commands over the GPIB interface
Parallel capability	Up to 16 units can be connected in primary / secondary mode
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
CAN	CAN 2.0A and CAN 2.0B compatible (CANopen protocol)
Analog	0 to 10 V full scale
Web server	Support remote control, transfer screen, screenshot, upgrade program, and so on.
Constant Dwell ARBs	
Number of points	Up to 65,535
Dwell range	One dwell setting applies for the entire ARB, from 1ms to 3600 seconds
AC Input	
Connections	L1, L2, L3, PE
Nominal AC Input range and frequency	EL4911A, EL4912A, EL4913A, EL4914A, EL4915A, EL4916A, EL4921A, EL4922A, EL4923A, EL4924A, EL4925A, EL4926A: 3-phase; 200 to 480 VAC, 50/60 Hz EL4931A, EL4932A, EL4933A, EL4934A, EL4935A, EL4936A, EL4937A, EL4941A, EL4942A, EL4943A, EL4944A, EL4945A, EL4946A, EL4947A: 3-phase; 380 to 520 VAC, 50/60 Hz NOTE: 6 kW and 12 kW models can be operated from 200 VAC to 208 VAC AC mains input; however, the current and power ratings are reduced by 35%.
Input VA	Max. Apparent Power: EL491xA Models:2.25 kVA, EL492xA Models: 4.5 kVA, EL493xA Models: 6.5 kVA, EL494xA Models: 13 kVA
	Max. AC Current: EL491xA, EL492xA, EL493xA Models: 12.5 A EL494xA Models: 25 A
Power factor	0.99 at nominal input and rated power
Environmental	
Operating environment	Indoor use, installation category II (for AC Input), pollution degree 2
Operating temperature range	0 -40 deg C
Programming temperature coefficient	Voltage: ≤ 30 pp m / °C Current: ≤ 50 pp m / °C
Measurement temperature coefficient	Voltage: ≤ 30 pp m / °C Current: ≤ 50 pp m / °C
Relative humidity	20% to 80% relative humidity (non-condensing)
Storage temperature	-10 – 70 deg C
Altitude	Up to 2000 m
Acoustic statement (European Machinery Directive)	Acoustic noise emission 1U Models: LpA ≤ 69.2 dB at Operating position; LpA ≤ 66.7 dB at Bystander position; LpA ≤ 74.3 dB at Worst-case fan speed

	2U Models: LpA ≤ 78.5 dB at Operating position; LpA ≤ 75.1 dB at Bystander position; LpA ≤ 75.4 dB at Worst-case fan speed Normal operating mode per ISO 7779
ESD immunity	Up to ±8kV contact discharge Up to ±12kV air-gap discharge
Digital Port	
Max voltage rating	5V
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 conforme a 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 Declarations of Conformity for this product may be downloaded from the Web. Go to http://www.keysight.com/go/conformity and click on “Declarations of Conformity”
Typical Weight	
	EL491xA: 26.5 lbs. (12 kg)
	EL492xA: 29.8 lbs. (13.5 kg)
	EL493xA: 33.1 lbs. (15 kg)
	EL494xA: 66.2 lbs. (30 kg)
Dimensions	
EL491xA, EL492xA, EL493xA models	1U, full rack width (see Outline Diagrams for details)
EL494xA models	2U, full rack width (see Outline Diagrams for details)

Input Characteristics

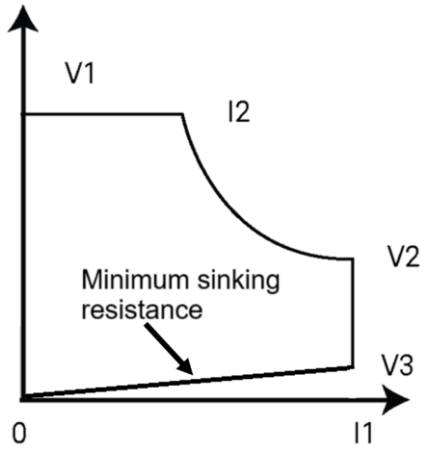
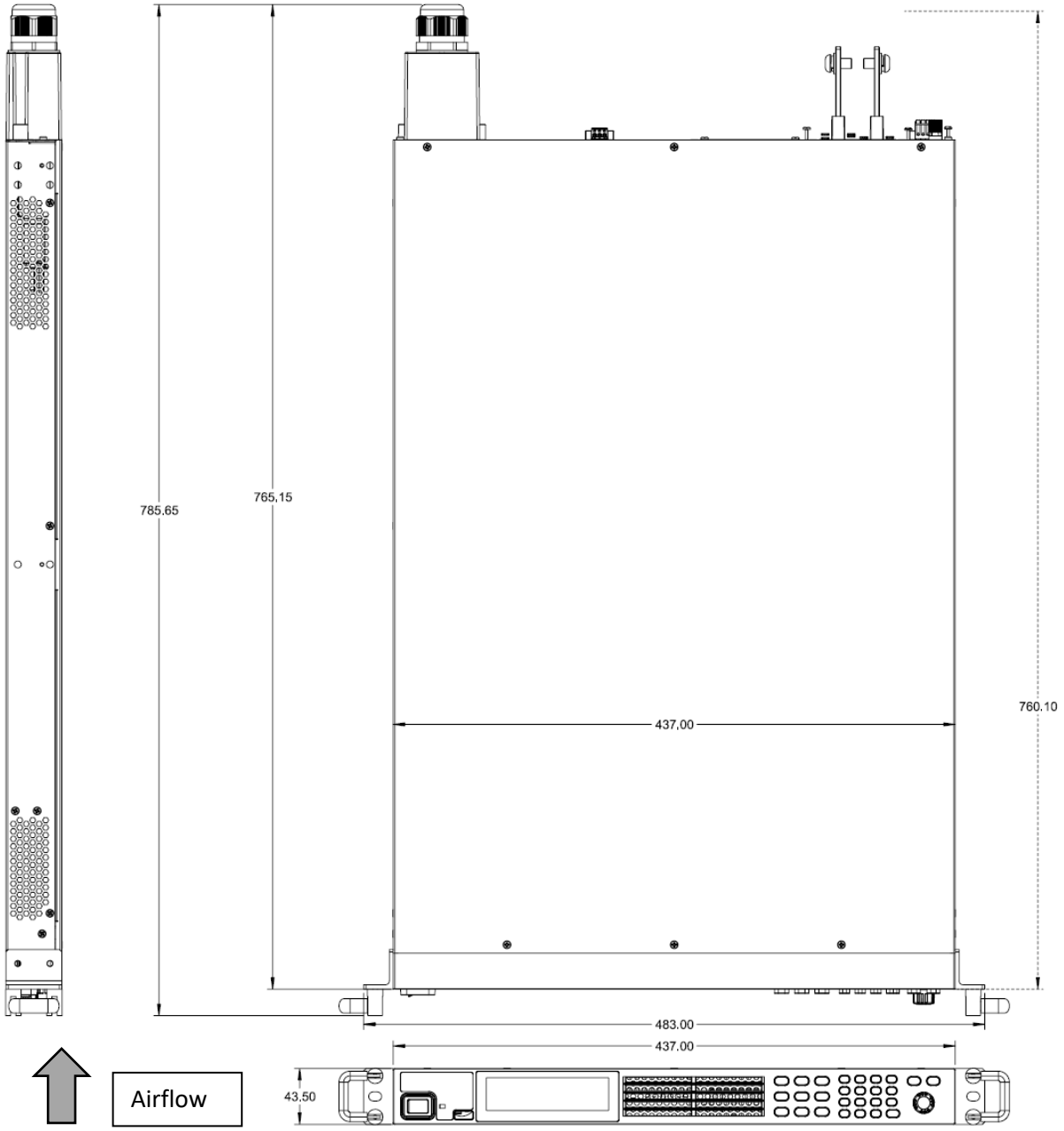


Figure 9. EL4900 characteristic

Model	V1	V2	V3	I1	I2	Minimum Sink Resistance
EL4911A	10 V	10 V	0.6 V	120 A	75 A	9 mΩ
EL4912A	32 V	32 V	0.5 V	80 A	40 A	12 mΩ
EL4913A	80 V	50 V	0.8 V	40 A	25 A	20 mΩ
EL4914A	300 V	300 V	3 V	20 A	13 A	90 mΩ
EL4915A	500 V	167 V	2.5 V	12 A	4 A	208 mΩ
EL4916A	800 V	250 V	4 V	8 A	2.5 A	500 mΩ
EL4921A	10 V	10 V	0.6 V	240 A	150 A	6 mΩ
EL4922A	32 V	32V	0.5 V	160 A	80 A	6 mΩ
EL4923A	80 V	50 V	0.8 V	80 A	50 A	10 mΩ
EL4924A	300 V	300 V	3 V	40 A	27 A	65 mΩ
EL4925A	500 V	167 V	2.5 V	24 A	8 A	104 mΩ
EL4926A	800 V	250 V	4 V	16 A	5 A	250 mΩ
EL4931A	10 V	10 V	0.6 V	360 A	225 A	3 mΩ
EL4932A	32 V	32 V	0.5 V	240 A	120 A	5 mΩ
EL4933A	80 V	50 V	0.8 V	120 A	75 A	6.7 mΩ
EL4934A	300 V	300 V	3 V	60 A	40 A	50 mΩ
EL4935A	500 V	167 V	2.5 V	36 A	12 A	70 mΩ
EL4936A	800 V	250 V	4 V	24 A	7.5 A	166 mΩ
EL4937A	1500 V	500 V	7.5 V	12 A	6 A	500 mΩ
EL4941A	10 V	10 V	0.6 V	720 A	450 A	1.5 mΩ
EL4942A	32 V	32 V	0.5 V	480 A	240 A	4 mΩ
EL4943A	80 V	50 V	0.8 V	240 A	150 A	3.3 mΩ
EL4944A	300 V	300 V	3 V	120 A	80 A	100 mΩ
EL4945A	500 V	167 V	2.5 V	72 A	24 A	35 mΩ
EL4946A	800 V	250 V	4 V	48 A	15 A	83 mΩ
EL4947A	1500 V	500 V	7.5 V	24 A	12 A	250 mΩ

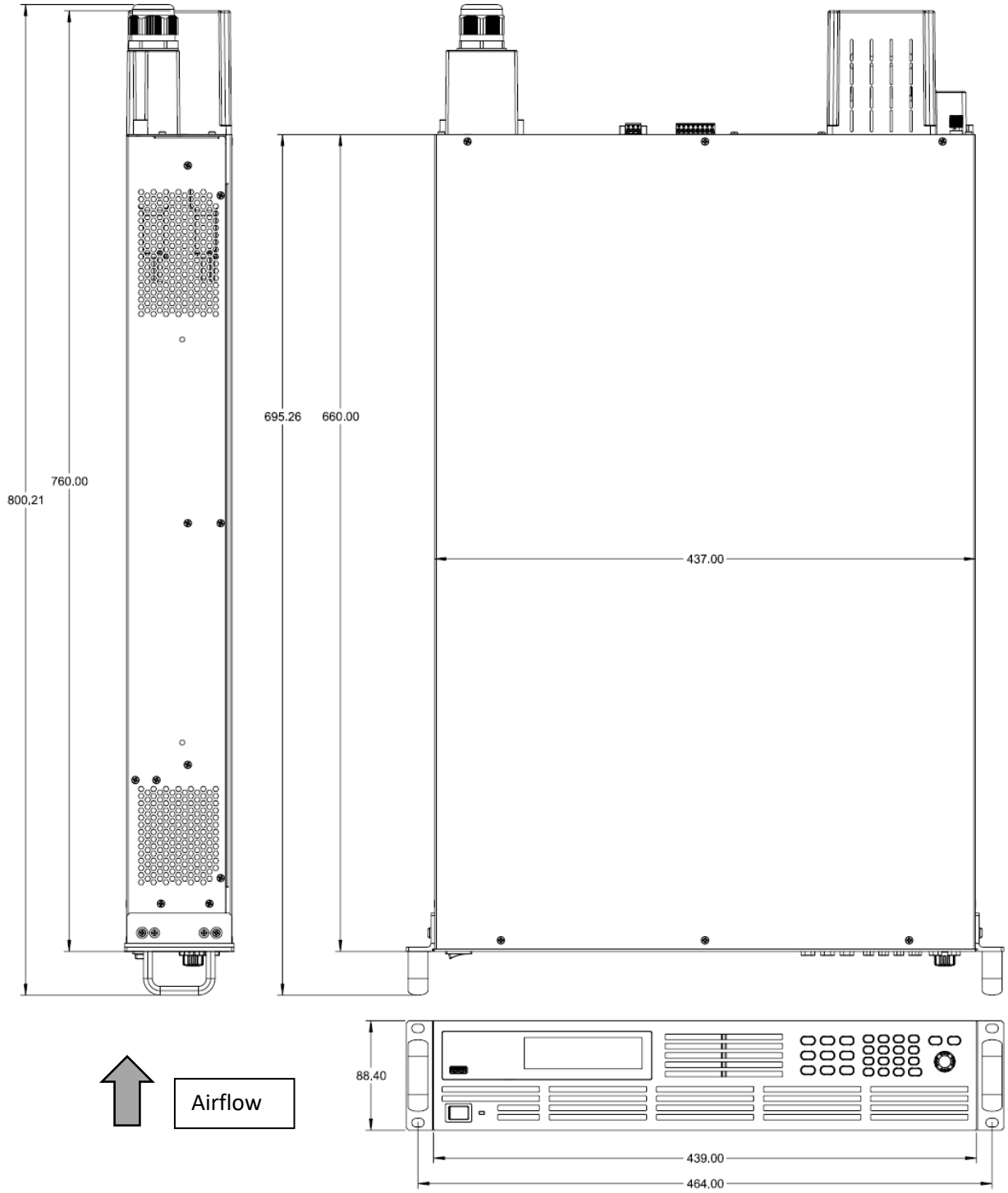
Outline Diagrams – 1U Models

EL491xA, EL492xA, EL493xA



Outline Diagrams – 2U Models

EL494xA



Ordering Information

Available Models

Regenerative Electronic Load Models

EL4911A	Regenerative DC electronic load	10 V, 120 A, 1.2 kW
EL4912A	Regenerative DC electronic load	32 V, 80 A, 2 kW
EL4913A	Regenerative DC electronic load	80V, 40 A, 2 kW
EL4914A	Regenerative DC electronic load	300 V, 20 A, 2 kW
EL4915A	Regenerative DC electronic load	500V, 12 A, 2 kW
EL4916A	Regenerative DC electronic load	800 V, 8 A, 2 kW
EL4921A	Regenerative DC electronic load	10 V, 240 A, 2.4 kW
EL4922A	Regenerative DC electronic load	32 V, 160 A, 4 kW
EL4923A	Regenerative DC electronic load	80 V, 80 A, 4 kW
EL4924A	Regenerative DC electronic load	300 V, 40 A, 4 kW
EL4925A	Regenerative DC electronic load	500 V, 24 A, 4 kW
EL4926A	Regenerative DC electronic load	800 V, 16 A, 4 kW
EL4931A	Regenerative DC electronic load	10 V, 360 A, 3.6 kW, 380/480 VAC
EL4932A	Regenerative DC electronic load	32 V, 240 A, 6 kW, 380/480 VAC
EL4933A	Regenerative DC electronic load	80 V, 120 A, 6 kW, 380/480 VAC
EL4934A	Regenerative DC electronic load	300 V, 60 A, 6 kW, 380/480 VAC
EL4935A	Regenerative DC electronic load	500 V, 36 A, 6 kW, 380/480 VAC
EL4936A	Regenerative DC electronic load	800 V, 24 A, 6 kW, 380/480 VAC
EL4937A	Regenerative DC electronic load	1500 V, 12 A, 6 kW, 380/480 VAC
EL4941A	Regenerative DC electronic load	10 V, 720 A, 7.2 kW, 380/480 VAC
EL4942A	Regenerative DC electronic load	32 V, 480 A, 12 kW, 380/480 VAC
EL4943A	Regenerative DC electronic load	80 V, 240 A, 12 kW, 380/480 VAC
EL4944A	Regenerative DC electronic load	300 V, 120 A, 12 kW, 380/480 VAC
EL4945A	Regenerative DC electronic load	500 V, 72 A, 12 kW, 380/480 VAC
EL4946A	Regenerative DC electronic load	800 V, 48 A, 12 kW, 380/480 VAC
EL4947A	Regenerative DC electronic load	1500 V, 24 A, 12 kW, 380/480 VAC

Line Cords and Terminations (Plugs)

Due to the number of different line cords and terminations around the world, the EL4900 power supplies do not come with line cords or terminations. Users will need to supply their own, depending on the local laws and codes of the country/region where the power supply will be used.

Accessories

Accessories	
PW9252A	PathWave Advanced Power Control and Analysis application
RP5901C	GPIB interface board for EL4900 Series DC loads and RP5900 Series supplies
RP5902C	Analog / RS-232 interface board for EL4900 Series DC loads and RP5900 Series supplies
RP5903C	Parallel kit — Fiber optics cable and transmitter module
RP5904C	Rack-mount kit 1U for EL4900 Series DC loads and RP5900 Series supplies
RP5905C	Rack-mount kit 2U for EL4900 Series DC loads and RP5900 Series supplies

Keysight Support Services

Accelerate your learning curve, enhance your test uptime, and confidently guarantee your instrument accuracy with Keysight Support Services. Keysight Services are here to support your test needs with expert technical support, instrument repair and calibration, training, alternative acquisition program options, and more.

A KeysightCare agreement provides dedicated, proactive support through a single point of contact for an extensive group of instruments, software, and solutions to ensure optimal uptime, with fast response times and resolution. Explore the services that are right for you.

Keysight Services

Offering	Benefits
KeysightCare 	KeysightCare provides elevated support for Keysight instruments and software, with access to technical support experts who respond within a specified time and ensure committed repair and calibration turnaround times (TAT). KeysightCare offers multiple service agreement tiers, including KeysightCare Assured, Enhanced, and Application Software Support. See the KeysightCare data sheet for details.
KeysightCare Assured	KeysightCare Assured provides a commitment to respond to your engineer's technical needs quickly. When unexpected repairs are necessary, you can count on a committed repair service turnaround time to get you back up and running.
KeysightCare Enhanced	KeysightCare Enhanced includes all the benefits of KeysightCare Assured plus Keysight's accurate and reliable Calibration Services, accelerated and committed TAT, and technical response.
Keysight Support Portal & Knowledge Center	All KeysightCare tiers include access to the Keysight Support Portal, where you can manage support and service resources related to your assets, such as service requests and status, or browse the Knowledge Center.
Education Services	Build confidence and gain new skills to make accurate measurements, with flexible Education Services developed by Keysight experts, including Start-up Assistance.
Alternative Acquisition Options	
KeysightAccess	Reduce budget challenges with a lease-based subscription service that offers low monthly payments, enabling you to get the instruments, software, and technical support you want for your test needs.

Recommended services

Maximize your instrument uptime and confidently make accurate measurements by securing technical support, repair, and calibration services with committed response and turnaround times. High-performance instruments include 1 year of KeysightCare Assured. Obtain multi-year KeysightCare upfront to eliminate the need for lengthy and tedious paperwork and yearly requests for maintenance budget. Plus, you benefit from secured service for 2, 3, or 5 years.

Service	Function
KeysightCare Enhanced*	**Includes Tech Support, Warranty, and Calibration**
R-55B-001-1	KeysightCare Enhanced – Upgrade 1 year
R-55B-001-2	KeysightCare Enhanced – Extend to 2 years
R-55B-001-3	KeysightCare Enhanced – Extend to 3 years (Recommended)
R-55B-001-5	KeysightCare Enhanced – Extend to 5 years (Recommended)
KeysightCare Assured	**Includes Tech Support and Warranty**
R-55A-001-2	KeysightCare Assured – Extend to 2 years
R-55A-001-3	KeysightCare Assured – Extend to 3 years
R-55A-001-5	KeysightCare Assured – Extend to 5 years
Start-Up Assistance	
PS-S40-01	Included – instrument fundamentals and operations starter
PS-S40-04	Recommended – instrument fundamentals and operations starter
PS-S40-02	Optional, technology & measurement science standard learning

* Available in select countries. For details, please view the datasheet. R-55B-001-2/3/5 must be ordered with R-55B-001-1.

Definitions

Specification (spec)

The warranted performance of a calibrated instrument that has been stored for a minimum of two hours within the operating temperature range of 0 to 55 ºC and after a one-hour warm-up period. All specifications account for the effects of measurement and calibration-source uncertainties and were created in compliance with ISO-17025 methods. Data published in this document are specifications (spec) only where specifically indicated.

Typical (typ)

The characteristic performance that 80% or more of manufactured instruments will meet. This data is not warranted, does not include measurement or calibration-source uncertainty, and is valid only at room temperature (approximately 23 ºC).

Nominal (nom)

The mean or average characteristic performance, or the value of an attribute that is determined by design, such as a connector type, physical dimension, or operating speed. This data is not warranted and is measured at room temperature (approximately 23 ºC).

Measured (meas)

An attribute measured during product development for the purpose of communicating expected performance. This data is not warranted and is measured at room temperature (approximately 23 ºC)

T_{CAL}

The temperature at which the instrument was calibrated.

For More Information

Visit www.keysight.com/find/EL4900.

Keysight enables innovators to push the boundaries of engineering by quickly solving design, emulation, and test challenges to create the best product experiences. Start your innovation journey at www.keysight.com.

KEYSIGHT

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