

Agilent Specifying and Buying a Bench Power Supply

Application Note



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Introduction

Having problems deciding which DC bench power supply you need? Are you confused with the vast number of power supplies available in the market?

Firstly, it is important to note that all power supplies are not created equally. While there are many power supplies to choose from, they might not be worth the price you pay. Agilent itself has more than 150 power supplies and each one has its own advantages to suit a certain usage.

When selecting a general purpose bench power supply, there are a lot of aspects to consider in choosing the optimum power supply for a particular application. Typical applications include:

- General purpose testing in R&D
- QC & QA inspection
- Bias power for circuits
- Production testing where throughput is not critical
- Sub-assembly testing
- Teaching lab experiments
- General circuit troubleshooting

In each application, obtaining a clean and stable DC power output is essential. Since these supplies are meant for general use, it is important that they are affordable and easy to use. In addition, they should not consume too much space and do not damage the device under test (DUT).

This application note provides the fundamental considerations in specifying and buying a DC power supply. It addresses questions like: “Which power supply will suit my application needs? Am I paying too much for my power supply? What features should I look for? Which characteristics should I place greater weight and consideration upon?”

Topics include:

- Output & power requirements
- Performance characteristics
- Protection features
- Packaging density
- Total cost of ownership

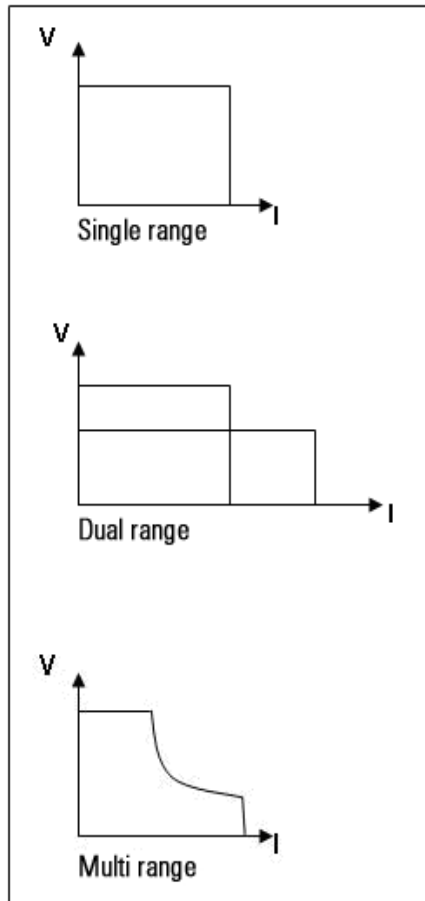


Figure 1 Power supply output V-I characteristics

Output & Power Requirements

Consider the devices (DUTs) that need to be tested? How much power is required? Will they need maximum power at one specific point? Do you need to supply maximum power at various voltage and current configurations? What is the range of power that you would like to supply in your applications? For instance, a range of 30 - 200 W can be supplied by Agilent E3600 Series bench power supplies.

Multiple outputs are vital when a supply is used to test multiple devices at the same time. When choosing a multiple output power supply, do consider if you need the outputs to be isolated from one another, and also the supply's tracking capabilities.

When selecting a power supply, you may want to consider room for growth. While choosing a higher power model may give you extra power margin for future expansion, there are other tradeoffs including extra size, higher weight, and greater AC power consumptions.

Another point to consider is the type of load this supply will provide power to - resistive, inductive or capacitive. This is because the nature and behavior of the load would inherently affect the voltage programming response time.

Performance Characteristics

Once the amount and type of power have been established, the features and specifications of these supplies need to be considered.

One of the first misconceptions many have is that any number which appears on a data sheet is a guaranteed specification. However, there are in fact, two different types of specifications – guaranteed and typical.

A guaranteed, or warranted, specification is a specification that the manufacturer has determined that comes with a complete error analysis, accounting for all the sources of uncertainty that can affect performance of the product. Such a specification is also sometimes referred to as a worst-case specification. In other words, even with the combination of worst-case parameters expected to occur, the measurement still remains within the specification.

A typical specification is as its name suggests. It is an average or normal value of what the product is capable of, usually based on test results from a predetermined set of measurements taken from a number of product units.

In reality, it is acceptable to have the measurement value to be above or below the stated typical specification, however a product is considered to have failed once its measurement value is above the stated guaranteed specifications.

Most of the Agilent E3600 series power supply primary specifications are guaranteed specifications, ensuring that the performance of the power supply is as it is stated in the data sheet.

The key characteristics are as follows:

- Load regulation - the variability in the output V/I due to change in load. Some loads will not tolerate voltage variations greater than a few percent
- Line regulation - the variability in the output V/I due to change in AC input
- Programming accuracy - the quality of the programmed value being near to the actual V/I
- Read back accuracy - the quality of the displayed value being near to the actual V/I
- Resolution - the smallest value of V/I that can be programmed
- Output noise - consists of common mode and normal mode
- Transient response - time taken for the output voltage to return to the programmed state after a disruptive change in load current
- Sense connections - local and/or remote sense capability
- Interface - front panel and/or remote (GPIB, USB, RS232, etc)

Low noise, excellent regulation and remote sensing capability that reduces the voltage drop across load leads, are the desired characteristics in a power supply. The Agilent E3600 series, E3631A - E3634A and E364xA come with GPIB and RS232 standards that provide remote interface on top of full-featured front panel interface.

Protection Features

When dealing with power, safety comes first. Sometimes when devices fail, it may be catastrophic. It is important that a power supply not only protects itself but also protects the DUT. Protection circuits in the power supply can limit the voltage or current to a preset level or shut down the power supply when an overvoltage or overcurrent condition occurs. Some power supplies also have a down programmer circuit to quickly discharge the DUT while some, upon receiving a fault trigger, are able to open a relay and isolate the DUT from the source of the power. For instance, the Agilent E3600 Series power supplies offer a host of protection features, including overvoltage, overcurrent and current limit protection.

Packaging Density

How much space do you have on the bench? Do you plan to place this supply close to an oscilloscope or computer monitor? Will you be carrying it around? Power supplies come in various sizes and weights. Higher power usually means more space, AC power and cooling. DC power supplies are in either linear or switch mode. Each offers significant advantages over the other based on the intended application.

Linear power supplies have the following advantages:

- Low output noise
- Fast transient response
- High programming speed

However, they also come with a series of disadvantages:

- Low efficiency
- More cooling required
- Higher level of low frequency magnetic radiation causes flicker in CRTs
- Larger in size

Switch mode power supplies offer the following benefits:

- Smaller in size
- High efficiency
- Less cooling required

While the benefits of a switch mode power supply are attractive, some power supplies vendors make switch mode power supply products with the following drawbacks:

- Slower transient response
- Higher output noise
- Slower programming speed
- Availability 150 W and above

Note that Agilent switch mode power supplies, available primarily for ATE and advanced, higher power bench applications, offer excellent transient response, low noise outputs and fast response time.

Power supplies, that are compact, lighter and with smaller footprints, are desired especially without trading off output noise and transient response qualities.

The Agilent E3600 Series bench power supplies achieve this by implementing hybrid regulation techniques, which combine the size and efficiency of a switch mode power supply with the low noise and fast speed of linear power supply.

Total Cost of Ownership

When you purchase a power supply, you should take into account not only the price of the power supply but the whole product experience. This includes the cost of downtime for calibration and repair, protection for your DUT and test instruments, and the reliability you will get out of the power supply.

Besides maintenance, you would want a dedicated support team to back you up during setup and usage, to ensure smooth integration of the supply to your application.

At the end of the day, what you need is a supply that can provide clean power day in and day out, while being able to protect itself and the DUT. In the event of a failure, it would be ideal that a solid, efficient and committed service and support team gets the supply up and running as fast as possible. Consistent performance with Agilent's trade mark reliability are Agilent E3600 series bench power supplies.

Related Agilent Literature

Publication title	Publication type	Publication number	Web address
<i>E3631A, E3632A, E3633A, and E3634A Bench Power Supplies</i>	Data Sheet	5968-9726EN	http://cp.literature.agilent.com/litweb/pdf/5968-9726EN.pdf
<i>E3640A - E3649A DC Power Supplies</i>	Data Sheet	5968-7355EN	http://cp.literature.agilent.com/litweb/pdf/5968-7355EN.pdf
<i>E3610A - E3630A Manual Power Supplies</i>	Data Sheet	5968-9727EN	http://cp.literature.agilent.com/litweb/pdf/5968-9727EN.pdf

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