4 Tips for Integrating and Using an ATE System Power Supply

eBook

KEYSIGHT

INTRODUCTION

As a test system engineer, you face a constant stream of new verification requirements, plus test plans continually evolve. Confronting these challenges is difficult, but there are ways to ensure you get the most out of your system power supply while keeping your device under test (DUT) safe. This eBook provides a comprehensive look at how to protect your system power supply and use it successfully.

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TIP 1

Rack-Mount the System Power Supply Properly

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Rack-Mount the System Power Supply Properly

When planning the layout of an automatic test equipment (ATE) rack, include the energy requirements of your system power supply. While most instruments consume constant power, a power supply's consumption varies based on the load. Power supply specifications provide the worst-case max power usage. Measuring the actual power consumption allows for rightsizing the AC power distribution and cooling. Knowing the power consumption helps you select the appropriate AC voltage for your power supply. An application that requires more DC power benefits from a higher AC voltage. Using higher AC voltages reduces the current that can cause measurement interference.

Power supplies can produce more heat under higher loads. It is essential to allow room for a power supply to intake cold air and exhaust hot air. Most instruments in an ATE system are sensitive to heat; therefore, it is critical to mount sensitive equipment properly to avoid drawing in hot exhaust heat. Using the recommended rack mount kit also ensures critical heat vents are clear and not blocked. See Figure 1.

System power supplies optimize space with compact designs and enable you to reduce expensive rack space. Along with a system power supply's compact size comes higher weight density. You can improve a rack's stability by mounting heavy instruments such as power supplies at the bottom. It is essential to use the recommended rack mount kit as it holds the weight of the power supply without blocking vents.

Avoid interference by isolating low-voltage wires used for measurements, triggering, and control from the AC power mains and the DC output. Securing the cabling prevents intermittent problems in the future.

In summary, careful planning in the layout process helps avoid more significant problems when building a system. Start with the proper rackmount kit that handles the weight of the supply and ensures critical vents are clear. All instruments need to draw in cold air consistently. Plan for enough AC power by considering a supply's input power increases as it outputs more DC power. Plus, isolate low-level signal wires from significant sources of current.

Figure 1. A power supply takes in fresh air in the front and emits it in the back

TIP 2

Ensure Adequate Protection for Your DUT

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First, select a system power supply that provides adequate power without being excessive. Too large of a power supply can output excessive noise and lack resolution for protection settings. Modern system power supplies offer multiple layers of device protection.

The most common protection method is to set a current limit that causes the supply to shift from a constant voltage source to a constant current source. With a current limit set, six other types of device protection can help protect your device:

1. **Overvoltage protection (OVP):** A separate circuit monitors the output and shuts it down if an overvoltage condition occurs. When using a 4-wire remote sense, overvoltage protection continues to monitor the power supply output.
2. **Overcurrent protection (OCP):** Similar to overvoltage, OCP shuts down the output if an overcurrent condition occurs. An overcurrent transient often occurs during a change in voltage. The delayed overcurrent feature allows a known transient to occur without shutting down the output.
3. **Overtemperature (OTP):** OTP protects the power supply. An internal temperature increase above the threshold disables the outputs.
4. **Front panel lockout:** This feature protects against accidental changes to the power supply output.
5. **Interconnects / fault inhibit:** If an error occurs, this feature shuts down all channels, even across mainframes.
6. **Watchdog timer:** This feature provides protection when the test program freezes, or the controller stops communicating.

Setting a current limit is a significant first step in protecting your DUT. You can also add more layers of protection to safeguard the test device, the power supply, and the operator.

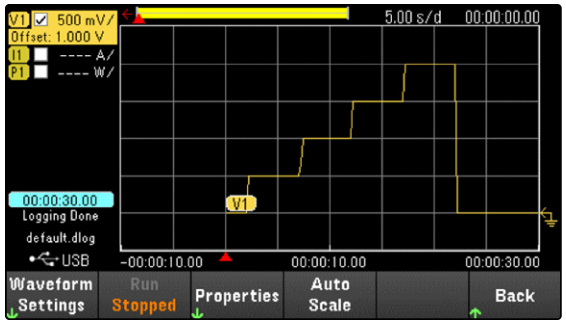

Figure 2. Output list mode increases the output voltage until the OVP level; then the output is shutdown

TIP 3

Achieve Stable Output Power Quickly

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Achieve Stable Output Power Quickly

Most applications require a power supply with a steady DC output under various load conditions. A high-bandwidth system power supply will reduce test times by responding faster when a test requires multiple voltage changes or fast activation times. However, a high-bandwidth power supply can be unstable when you test a wireless device that pulls current in bursts. You can make trade-offs to slow the power supply or add external capacitance to match the power supply's impedance with the load.

Understanding and compensating for the load keeps the power supply responsive to programmed changes in output voltages. Select a power supply with a fast output response time, down-programming response time, and transient response time for shorter test times.

Output response time measures how fast the output stabilizes after changing from one voltage level to the next. Output response time has various names — programming speed, settling time, output response time, output response characteristic, and programming response time. Figure 3 represents the output response.

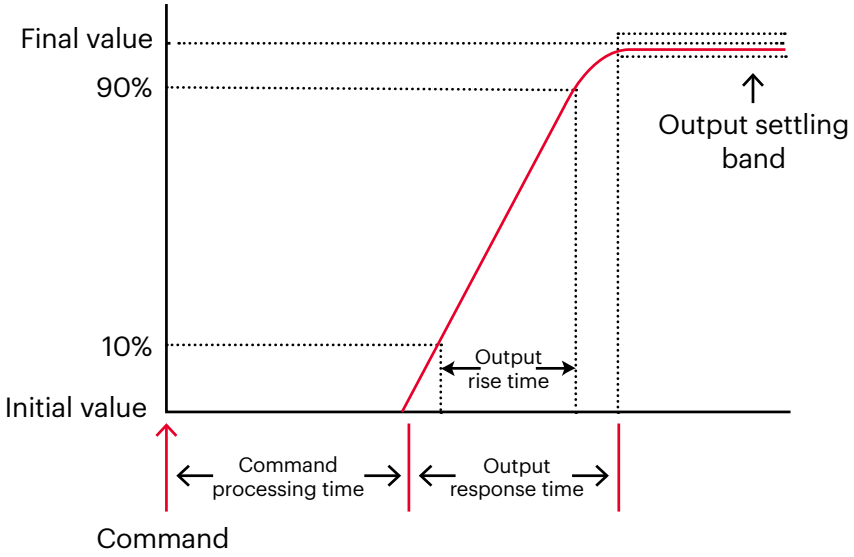

Figure 3. Output response time measures how fast a power supply changes to a different output voltage

Like output response time, down-programming response time measures how quickly a power supply output can switch to a lower voltage. Down-programming times can vary significantly between power supplies. Faster power supplies include an active down-programming circuit to speed the process. Without an active down-programmer, the response time depends on how much current the load draws.

Transient response, or load transient recovery time, is the time it takes for the power supply's output voltage to recover from a change in the load. Whenever the load current changes from a low current to a higher current, the output voltage temporarily dips down slightly and then quickly recovers back to the original value, as shown in Figure 4.

Want to Learn More?

> Understanding Transient Response Time

When selecting a system power supply, understand your test needs and choose a power supply with appropriate response times. Fast response times can shorten tests, improving throughput.

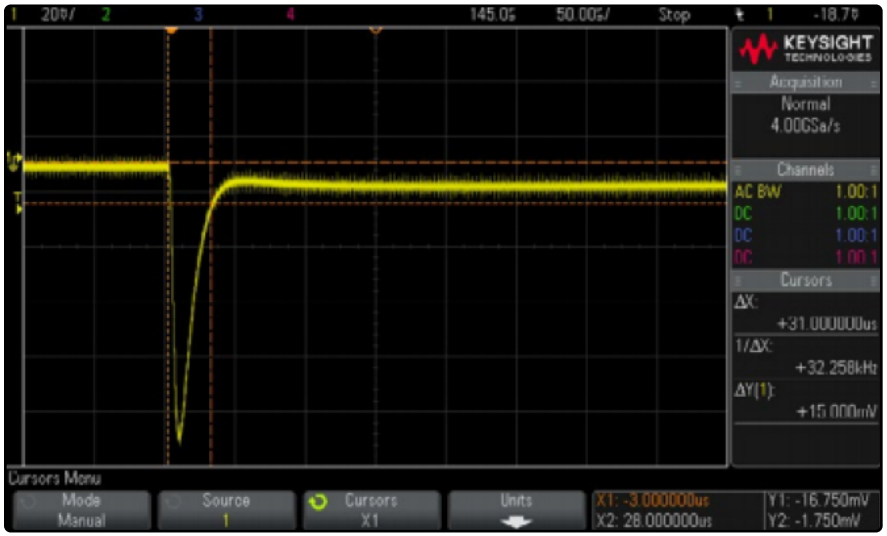

Figure 4. The output voltage drops due to a sudden change in the load's current draw

TIP 4

Learn to Use Output Characteristics

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Learn to Use Output Characteristics

System power supplies with auto-ranging are popular because they provide higher current capabilities over a voltage range versus a power supply with a single maximum voltage and current. Test plans evolve frequently, and the need for a specific voltage and current can change. Flexibility in the available voltage and current combinations ensures that the power supply meets your future needs.

It is pretty easy to spot an auto-ranging or dual-range power supply as they provide voltage and current specifications as “up to.” It is also clear from their maximum power rating that multiplying their maximum voltage and maximum current yields much greater power than the power supply’s capabilities.

Output characteristics provide a graphical representation of the valid voltage and current combinations. Any voltage-current combination inside the graph is a valid operating point for that supply.

The three common output characteristics:

1. **Rectangular output:** The most common output characteristic is rectangular or single range. All voltage and current combinations are valid up to the maximum voltage and maximum current; see Figure 5.
2. **Dual-range output:** A dual-range power supply provides more flexibility in voltage-current combinations. A high voltage range provides lower current, and a low voltage range delivers more current; see Figure 6.
3. **Auto-range output:** An auto-range output provides the most flexibility in voltage and current combinations, allowing more combinations within the power limit of the supply; see Figure 7.

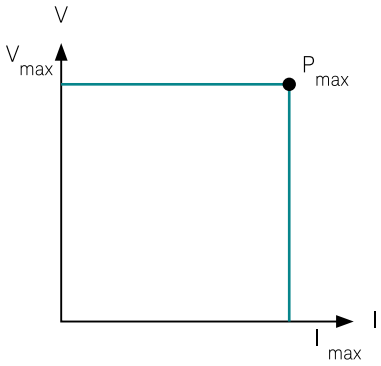

Figure 5. A rectangular output characteristic has a single maximum power point

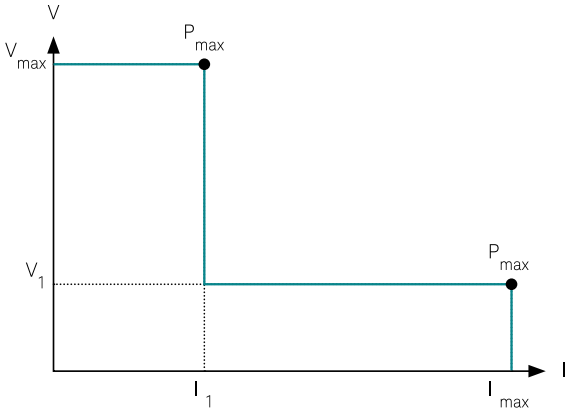

Figure 6. A dual-range output characteris c provides more voltage-current combinations than a rectangular output

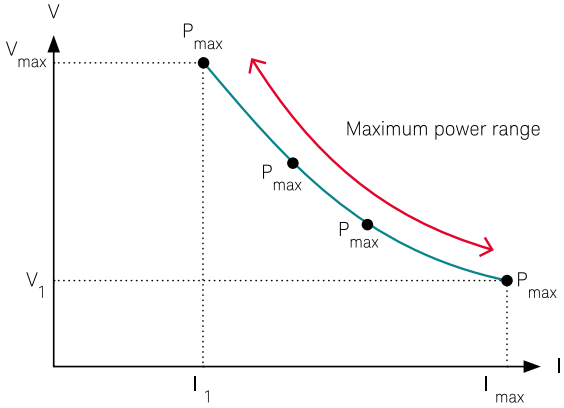

Figure 7. An auto-ranging output characteristic provides the most voltage-current combinations

Want to Learn More?

White Paper: *Improve Voltage Regulation Using Remote Sense*

WANT TO LEARN MORE?

Get our Power Supply Selection Guide

Whether you need a simple power supply or one with more sophisticated features for specific applications, the guide will help you select the power supply that suits your needs. It includes indexes that list power supplies by output voltage, power, and series. It is designed to make it easy to see all the available choices and select the supply that is best suited for your application.

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