WHITE PAPER

Save Energy in your High-Power Test Applications

Increasing Energy Efficiency While Making the Planet Greener

In the effort to make the earth a greener place for the next generation, while simultaneously lowering costs, technology companies are striving to play their part in creating innovative eco-friendly products. A comprehensive approach is necessary to enable conservation of energy to achieve the design goal. From the initial design of energy-efficient products to recycling energy waste back to the grid, high-power test applications take into consideration utilization of power supply systems that produce efficient and clean power to include regenerating unused power back to the source.

This paper discusses:

- The definition of regenerative power and why it matters
- Benefits of the seamless source and sink
- How to reduce energy consumption

What Does Regenerative Means?

Before we try to understand the term regenerative, let's review the definition for a two-quadrant power supply. While a two-quadrant power supply can source and sink current; a power supply acts as a load when in sink mode.

Whenever a two-quadrant power supply is sinking current, either from rapid down-programming of the output or from discharging an energy source such as a battery, usually some resistive load is used to dissipate the energy.

KEYSIGHT TECHNOLOGIES

Regenerative power supplies direct excess power back to the AC mains through the power cord. The discharging energy does not turn into heat in a resistive load but instead feeds back to the grid. Disabling the regenerative operation is not possible; the regenerative operation is automatic and requires no programming on the part of the user.

Implementation during the regenerative operation has a maintained power factor of 0.99, and sinewave current distortion is less than two percent at full load.

During a power failure, the AC main senses the dropout, and galvanic relays automatically disconnect the AC mains. The unit shuts down since the energy does not have anywhere to disperse.

When the AC mains returns to normal, the unit automatically restarts.

Compliance regulations for the operation and connection to the public grid of energy back-feeding equipment is critical. During installation of a regenerative power supply, connections are made by a qualified electrician who understands the energy back-feeding equipment to ensure the applicable safety requirements are applied, and all necessary conditions met.

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Why Regenerative Power is Important

Power requirements for some applications are evolving, and many drive the need for high-power. The automotive industry, heavy industries such as elevators, and conveyors drive the electrification of new markets. Current consumption soared from a few amps to tens and even hundreds of amps.

How do we achieve energy efficiency while the power demand increases? Is it possible to utilize kinetic waste and heat energy? By using a regenerative power supply system to test those applications in an R&D or manufacturing environment, the energy efficiency increases, and waste energy is returned to the grid by the harvesting process.

Current Sinking

Current sinking also refers to the power supply capability to pull or sink current into the positive terminal whenever a lower output voltage is programmed. This is necessary because stored energy from the power supply's output capacitor and external capacitance from the load (includes the wiring) must discharge to lower the voltage at the output terminals. This function is known as down-programming.

The ability to rapidly transition from a higher to a lower constant voltage level improves the power supply’s output response time. This is the most commonly used function of the built-in down-programmer, which is automatic and completely transparent to the user.

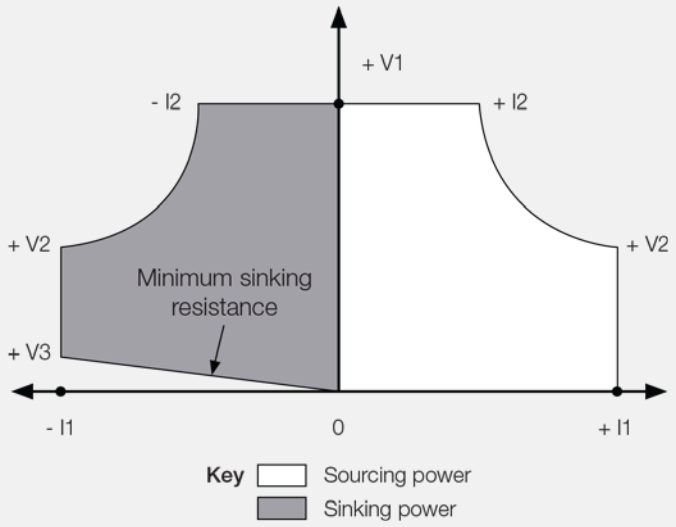

Figure 1. Sourcing and sinking output quadrants.

Seamless Source and Sink

For a regenerative power supply system to work without interruption, a seamless source and sink transition is critical. A suitable power supply should continuously sink up to 100% of its measured current for an indefinite time.

The two-quadrant, bidirectional sourcing and sinking capability of a DC power supply allow for seamless, uninterrupted transitions between sourcing and sinking current without changing the power supply's output characteristics or introducing any disruptive behavior.

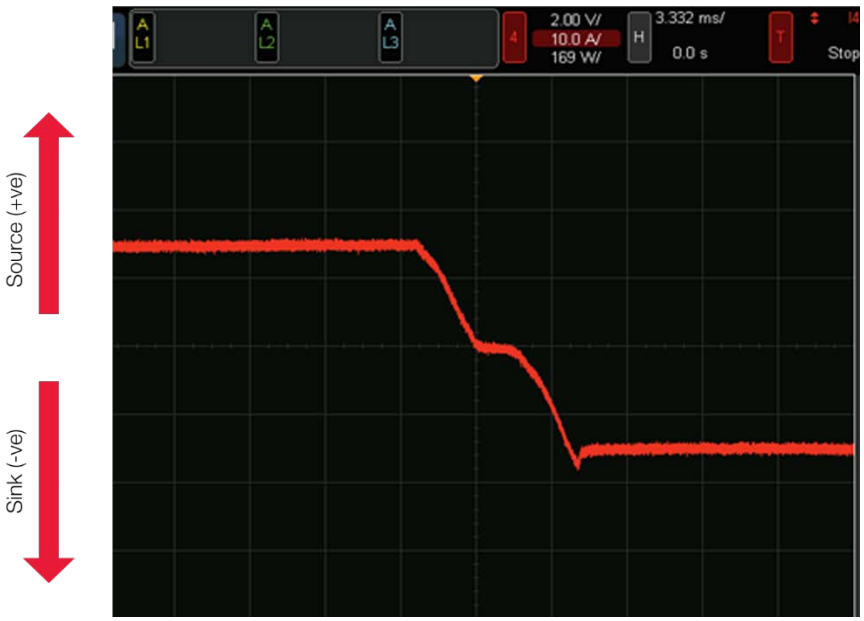

Figure 2. Seamless transition from sourcing current to sinking current.

Conclusion

When the power supply sinks current from either the rapid down-programming of the output or discharge from an energy source like a battery, it automatically returns the excess power to the grid. The regenerative operation is automatic, so programming is not required. The power supply provides anti-islanding which senses if the grid is live before regenerating power back to the grid to safeguard your device under test.

For information on how Keysight's solutions can help you address your regenerative power implementation challenges, kindly visit Keysight RP7900 product family.

Learn more at: www.keysight.com

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: www.keysight.com/find/contactus

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