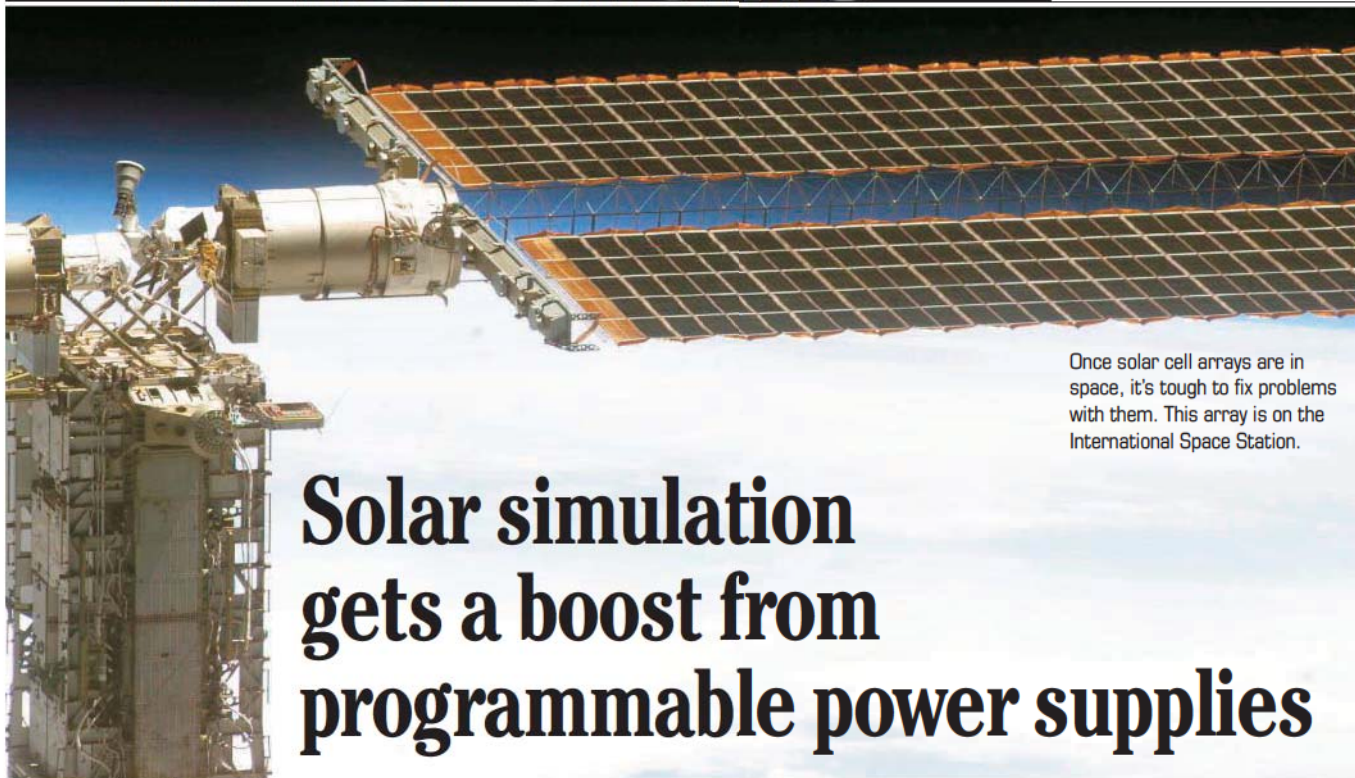




Once solar cell arrays are in space, it's tough to fix problems with them. This array is on the International Space Station.

Solar simulation gets a boost from programmable power supplies

The design of solar arrays can lead to expensive mistakes in the absence of simulation tests.

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On the 23rd of August 1997, the NASA Lewis satellite launched from Vandenberg Air Force Base. Three days later, the satellite began spinning out of control, which led to a loss of communications with ground controllers, and affected the ability of its solar arrays to generate power. The cause of the failure was later established to be a design flaw in the spacecraft's attitude control system, which was not sufficiently modified to be compatible with Lewis. The satellite reentered the earth's atmosphere and burned up on the 28th of September 1997.

The total cost to NASA of the failed Lewis mission, including its launch vehicle and one year of planned orbital operations, was over \$70 million.

Based on the lessons learned from the Lewis disaster, manufacturers of Solar Array Simulators (SAS) for satellite test systems offered upgrades to their software to let manufacturers better simulate the effect of 'satellite

spin' on the control electronics. A SAS is essential for testing because satellite PV arrays are designed for low gravity. And sometimes "sunshine on demand" is unavailable, even in southern California.

The photovoltaic cell industry continues to expand with a variety of production testing requirements. Simulation and test equipment has responded in kind. Even the once-humble

Resources

information about Z+ programmable supplies: <http://www.us.tdk-lambda.com/lp/products/zplus-series.htm>

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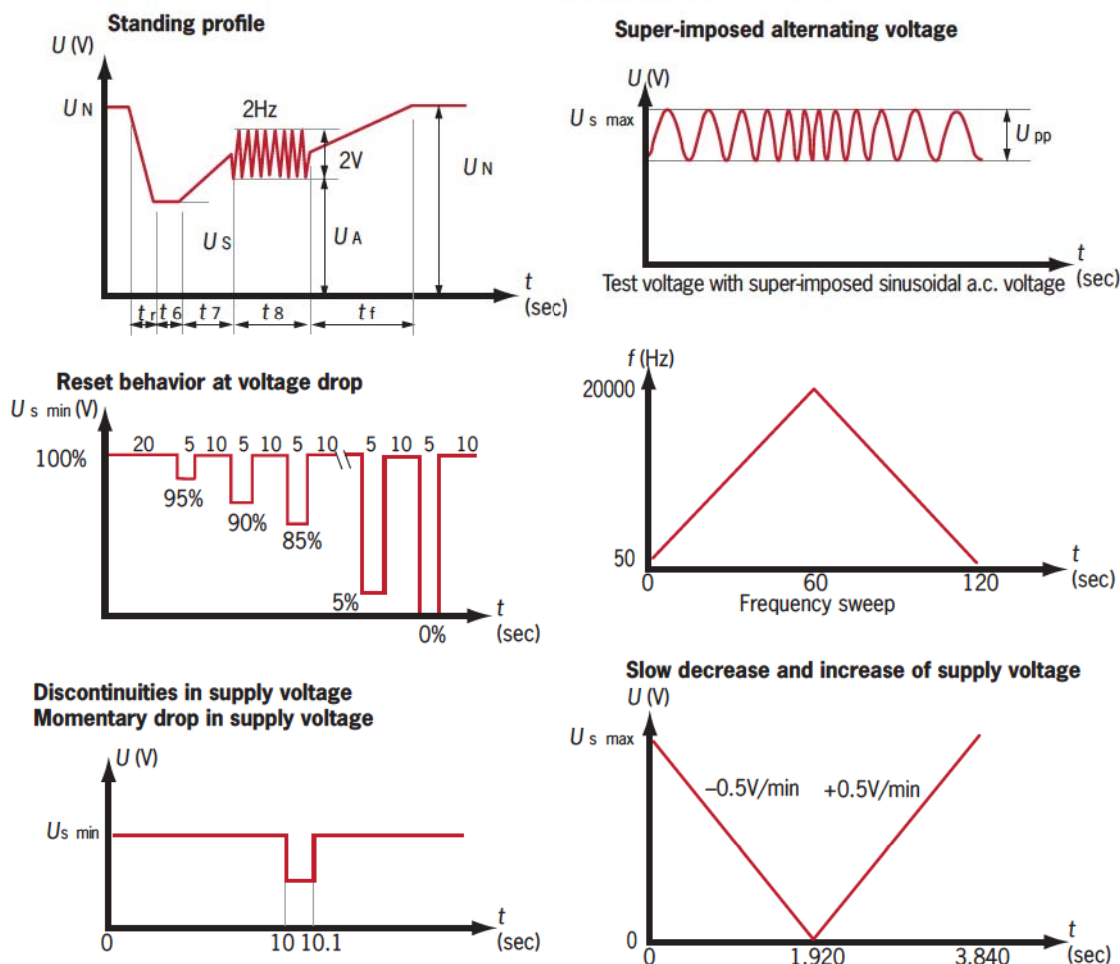
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bench programmable power supply is now undergoing a renaissance. It is no longer just a constant voltage or constant current power supply with metering.

Higher efficiencies, thanks to advanced switching topologies, have let designers dramatically reduce the overall size of the power supplies. A typical 800-W supply once was 80% efficient, but today that number has risen to 83%. This may not seem like a large increase, but it translates into 44 W less heat dissipated internally.

The size of TDK-Lambda's new 800-W Z+ series supplies, for example, has dropped from 4.9 (H) x 5.5 (W) inches to just 3.27 x 2.76 in. This lets six units, for a total of 4.8 kW, fit inside a 2U-high 19-in. rack, compared with the prior design that required three units in a 3U-high



The use of the latest controllers has helped make these new bench-top power supplies

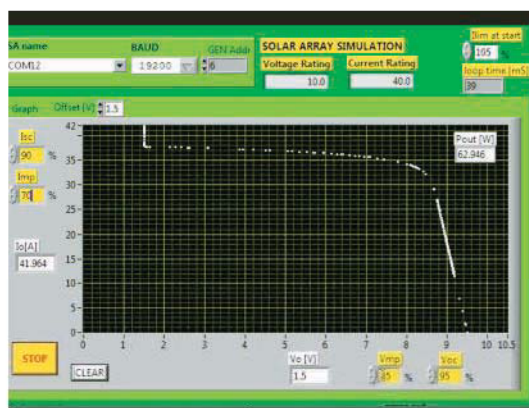
smaller. Sophisticated LAN controllers now are available as a single IC, replacing multiple ICs and shrinking the interface PCBs dramatically.

Many programmable power supplies now carry a USB interface as standard equipment in addition to the traditional RS232/485 ports. LAN and IEEE 488.2, SCPI-compliance and GPIB are also available as options. These en-

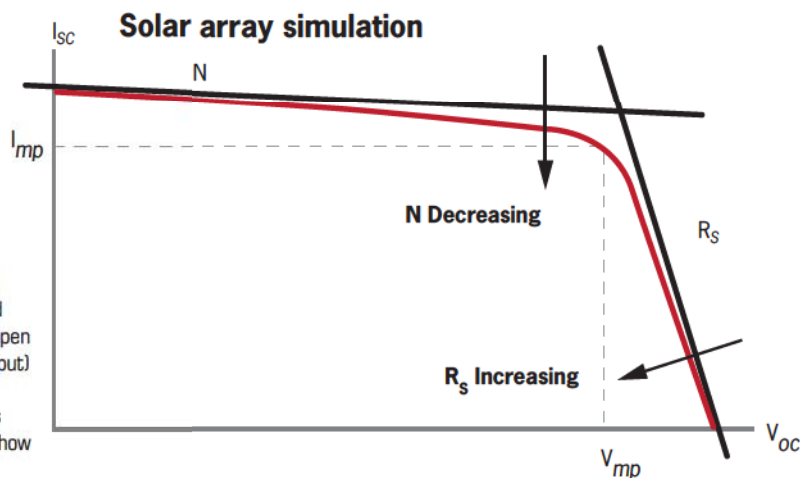
Bench top power supplies today do more than just provide DC levels. Here are examples of the complex waveforms that can be synthesized by the latest-generation of programmable supplies.

able one master unit to control as many as 31 slave units by using RS-485 cables.

It's now possible to simulate solar array load-



It is now possible to simulate solar array loading with programmable power supplies that are able to generate various current/voltage (I/V) solar demand curves. Values for I_{sc} (short circuit current), V_{oc} (open circuit voltage), I_{mp} (current at the peak power output) and V_{mp} (voltage at peak power) are loaded into the power supply, which in turn automatically cycles through the various load conditions. A display can show what's happening in real time.





Programmable power supplies today such as this Z series unit are relatively compact.

ing using algorithms pre-programmed into the new-generation of programmable power supplies. These routines approximate various solar current/voltage (IV) demand curves.

Values for I_{sc} (short circuit current), V_{oc} (open circuit voltage), I_{mp} (current at the peak power output) and V_{mp} (voltage at peak power) are loaded into the power supply, which in turn automatically cycles through the various load conditions.



The industry supplying third-party test simulation software and hardware is enjoying the benefits of the additional capabilities these new-generation programmable power supplies provide, which can even include wireless controls. It is expected that

electronic distributors who can provide value-added solutions will get involved as the need for full-system simulation solutions emerge. **EE&T**