▲ EA Elektro-Automatik EA-PSB 10000 Series bidirectional programmable power supply.

SPECIAL REPORT

SOURCES AND LOADS OPTIMIZE POWER ACROSS THE APPLICATIONS GAMUT

By Rick Nelson, Contributing Technical Editor

Whatever project you are working on, power will be a key aspect. Whether you have a battery powering a mobile device or a wind turbine powering a smart grid, you will need the ability to simulate power sources and the systems they power to make sure the two play well together. Fortunately, vendors offer a variety of programmable power supplies and loads—including regenerative loads—to help you achieve an optimal design. They offer a variety of voltage and power levels as well as flexible interface options.

EA Elektro-Automatik serves a variety of applications areas, including conventional and electric vehicles, PV and wind energy generation, and energy storage (batteries and fuel cells), according to Zeke Pietsch, applications and customer care manager. Pietsch said the company leverages SiC high-frequency switching technology as well as the latest FPGAs, microcontrollers, and digital-to-analog converters to develop programmable supplies and loads to serve such applications.

Supplying 10s of kilowatts

EA Elektro-Automatik's products include the EA-PSB 10000 Series bidirectional programmable power supplies. "The PSB 10000, being bidirectional, fully integrates a high-performance autoranging programmable power supply with a regenerative, programmable electronic load capable of 95% energy recovery," said Pietsch, adding that the series delivers 30 kW in a 4U chassis with 40-A to 1,000-A and 60-V to 2,000-V ratings. Furthermore, he said, the PSB 10000 also has a hermetically sealed, water-cooled option that dissipates 95% of heat into the water circuit, with only 5% dissipating into the air (conventional losses).

"In addition to the advanced arbitrary waveform generator included, the PSB 10000 comes with battery-simulation software," Pietsch continued, explaining that many thousands of test data sets for lithium and lead-acid battery testing were created using modeling software to emulate real battery performance in artificial environments for hardware-in-the-loop tests.

Keysight Technologies in June introduced the RP7971A and RP7972A 20-kW regenerative power supplies. "The new bidirectional supplies are ideal for testing energy storage and inverter/converter electronics," said Bill Griffith, power product marketing. "Traditional solutions convert dissipated power to heat. Regeneration eliminates excessive heat by returning energy to the grid."

For testing commercial string inverters, Keysight offers the PV8921A and PV8922A 20-kW photovoltaic array simulators. "The PV8900 Series offers up to 2,000 V and the ability to test up to 12 MPPT inverters,"

▲ Keysight Technologies RP7900 Series regenerative power system.

Griffith said. "Next-generation inverters increase efficiency and reduce installation costs with higher voltages and multiple MPPT inputs. Keysight's test solution includes the DG9100 Series advance inverter test software. Application software makes it easier to download PV curves and track measurements."

Delivering 10s of kilovolt-amperes

Preen AC Power has recently introduced a new AFV+ Series programmable AC power supply, which delivers 10 kVA to 2,000 kVA, said a spokesperson, who added that AFV+ series features low THD, high reliability, multiple programming features, and intuitive operation. "This latest high-power programmable AC power source…can simulate different power-line disturbances and record error logs," the spokesperson said. "The AFV+ Series can support up to an 840-Hz frequency range that can be used for aircraft, defense, and EV test industries." The AFV+ Series can output up to 400-V line to neutral or 690-V line to line or, optionally, 600-V line to neutral or 1,039 V line to line.

The spokesperson cited another feature: "In the factory or laboratory, there is often a certain distance in the configuration of power and load. The Remote Voltage Drop Compensation of the AFV+ Series is able to compensate the voltage drop caused by the cable length, so the user can avoid the inconvenience of adjusting the voltage." The spokesperson also said the AFV+ can test electric motors, which can draw high startup currents. "As a result, users need to purchase a power supply with much higher capacity than the UUT itself," the spokesperson said, explaining that the AFV+ Series has an optional 200% overload capacity.

Pacific Power Source just announced the availability of a new line of advanced regenerative programmable AC and DC power sources, according to Herman vanEijkelenburg, director of marketing at PPST Solutions, the corporate affiliate distribution channel for Pacific Power Source and other power test-equipment manufacturer product lines. "Available at power levels from 30 kVA to 200 kVA, these AZX Series bidirectional AC and DC sources offer four-quadrant operation with the ability to recycle energy from the load back to the utility grid for energy-efficient operation," he said, adding that the sources can be operated using the front-panel color LCD touchscreen or any of the standard remote-control interfaces including LXI, GPIB, and USB; a built-in web server allows operation via any network-connected PC or Wi-Fi tablet.

▶ Pacific Power Source AZX Series bidirectional AC and DC source. Courtesy of Pacific Power Source Inc.

"Key features include dual constant-power-mode voltage ranges up to 360 VAC line to neutral or 624 VAC line to line in three-phase mode and an output frequency range from 15 Hz to 1,000 Hz, which is wider than most regenerative AC source on the market today," vanEijkelenburg continued. "The use of SiC power devices in all power-conversion stages of the AZX results in higher power density."

500 VA to 4 kVA at 5 to 1,200 Hz

Nicholas Piotrowski, product manager at Ikonix USA, said Associated Power Technologies, a division of Ikonix USA, is introducing its 8500 Series AC power sources on Sept. 1. The series includes the 500-VA Model 8505, 1.25-kVA Model 8512, 2-kVA Model 8520, and 4-kVA Model 8540. Output voltage extends to 310 VAC with frequencies from 5 to 1,200 Hz. He said the sources cover a variety of applications, providing, for example, a 310-VAC output for LED ballasts.

Piotrowski cited a trend toward higher power density (smaller, lighter sources per VA output), noting that sources are often part of a larger system where rack space comes at a premium. "The 8505, 8512, and 8520 all are 2U rack-mountable sources," he said. "The 8540 is 4U rack-mountable at 62 lbs. That's a 33% reduction in rack-mount size and 25% reduction in instrument weight from our previous series," he said.

Other features of the series include THD ≤ 0.3% at 50/60 Hz (offering low total harmonic distortion for functional testing); LIST, STEP, and PULSE modes to cover

Associated Power Technologies 8500 Series AC power source.

a variety of testing to introduce the sweep of voltage, frequencies, transients, and DC bias; and 14 built-in custom waveforms to simulate abnormal testing conditions.

"We've also seen a shift towards more automated transient and waveform synthesis testing," Piotrowski said. "With automation, giving flexibility to customize programming is key. We've moved toward not only offering out-of-the-box software (PowerTRAC), but also offering LabVIEW drivers and implementing SCPI protocol on the APT 8500 Series."

Piotrowski said the company "...implemented a unique modular switching-supply approach..." for its APT 8500 Series. "This allows us to not only offer the advanced features we've discussed, but also reduce the size and weight of the sources." He added that the sources can serve in MIL/aerospace, LED, appliance, motor, and medical-test applications and help perform EMC test in accordance with IEC 61000.

*F rmerly T& Solutions

Versatile Power has recently released its new 1,500-W RACK programmable power supply, according to Mark C. Brown, manager of sales and marketing. "All Versatile Power supplies come standard with LXI," he said, adding that other standard features include analog, USB, and Ethernet inputs and wireless remote sense.

Brown continued, "Versatile Power's BENCH and RACK Series both offer extended range,[1] which allows the end user to use one power supply to cover a larger range of voltages and currents, thus reducing the number of units that are need to be purchased for their applications or testing and can be used on cross platform projects that our customers are working on currently or that are in the pipeline."

He also noted that BENCH and RACK Series products use the 1U footprint while delivering high power, adding that the products' digital design contributes to the small formfactor. He also commented, "ATE, burn-in, and avionics are a few of the markets Versatile Power serves."

New 5,000-W and 3-kVA products

"Despite unprecedented challenges faced this year, B&K Precision released the new MR Series programmable DC power supplies and 9830B Series programmable AC sources," said Aaron Fernando, product marketing engineer. Both products target system integrators.

"The MR Series features an LXI-compliant LAN interface and delivers 5,000 W in a compact 2U form factor," he said. "Furthermore, these power supplies are B&K Precision's first cTUVus approved instruments, fulfilling equivalent CSA and UL safety standards."

Fernando described the 9830B Series as a high-performance single-phase AC source delivering output power up to 3,000 VA with low harmonic distortion. The frequency range is 45 to 1200 Hz. "In addition to AC, these models can output DC or AC+DC signals," he said. Other features include a power meter with 12 measurement functions, built-in and user-defended THD waveforms, and an amplifier mode with a 1.2-kHz bandwidth.

"The 9830B Series programmable AC sources represent our first 3-phase-capable products, Fernando continued. "3-phase is accomplished by using three AC sources connected to small synchronization adapters. The adapters and connecting cables are included in a convenient kit. The synchronized AC signals

B&K Precision MR Series programmable DC power supply.

result in a 3-phase power system. Most specifications and capabilities are maintained with a usable frequency range up to 600 Hz. Positive or negative DC voltage offsets and individual phase control are still available."

Fernando said B&K Precision's DC loads are used for testing and evaluating DC sources including DC power supplies, DC/DC converters, and batteries. "The latest 8500B Series is uniquely suited for battery testing applications at a value price point," he said. "One specific application involves charge/discharge cycle testing where the primary objective is to determine the usable battery life. B&K Precision offers battery charge/discharge software to meet this specific battery testing method. The software combines source capabilities of our 9115 or 9200 Series DC power supplies with the 8500B Series DC loads to evaluate batteries." Users can log both charge and discharge data, create custom test sequences, and calculate battery capacity using the software, he added.

2-kW supply and 20-kW load

Kikusui offers the PWR-01 Series DC power supplies and PLZ-5WH2 Series electronic loads. A spokesperson said the company developed the PWR-01 as versatile range of power supplies for benchtop applications, adding that the supplies when rack-mounted make it easy to create large synchronized networks. The company recently added a 2-kW model, which can test electronics for 48-V mild hybrid vehicles.

The PLZ-5WH2 is high-voltage (1,000 V) and high-power-capacity (20 kW) load. "Some of the target industries include battery suppliers, high-voltage UPS suppliers, electric-vehicle applications, and any other applications that are in the higher

▼ Kikusui PLZ-5WH2 Series electronic loads.

voltage range, up to 1,000 VDC," the spokesperson said. "We put a lot of work into the built-in measurement capabilities specifically for the use of power-supply test. Integrated measurement, custom sequences, and cutoff settings can all be programmed from the front panel, which make it a very powerful as an electronic load and as a standalone power-supply evaluation tool."

The spokesperson said that in anticipation of its use in battery-testing applications, it features built-in functions to make charge-discharge tests easier for engineers. For example, a cutoff function can automatically shut off the load when meeting a specified Ah, Wh, elapsed-time, or terminal-voltage condition.

400-W and 800-W supply series

Rohde & Schwarz's latest addition is the R&S NGP800 DC power supply series, comprising five models with ratings of 400 W or 800 W, according to Philipp Weigell, director, product management, power products. "The two or four 200-W outputs can each supply up to 64 V or up to 20 A," he said. "Electrically equivalent and galvanically isolated outputs can be wired in series or parallel for up to 250 V or 80 A. Its software features many tools intended to boost the user's efficiency."

Other supplies the company offers, Weigell said, include the R&S NGL200 and R&S NGM200, which enable engineers to analyze and optimize their battery-powered designs, and the R&S NGP800 and the R&S HMP4040, which offer the high

▲ Rohde & Schwarz R&S NGP800 DC power supply.

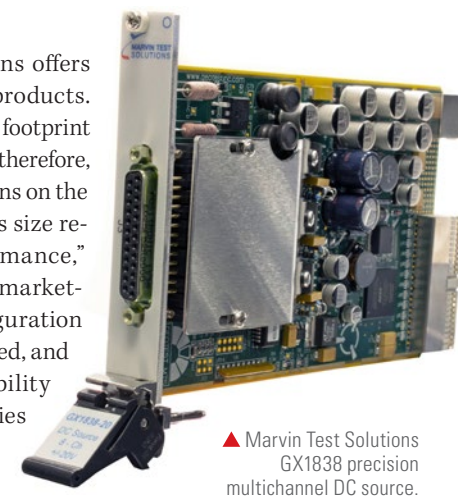
channel count and power density to serve applications involving modern high-end FPGAs that demand high power distributed over several lines.

"The specialty power supplies offer two-quadrant architecture: this feature allows them to function both as a source and a sink and simulate batteries or loads," Weigell said. "The power supply automatically switches from supply mode to load mode. As soon as the externally applied voltage exceeds the set nominal voltage, current flows into the power supply. This is indicated by a negative current reading."

In addition, the supplies offer galvanically isolated, floating channels. "The Rohde & Schwarz power-supply family consists of instruments with up to four channels," Weigell said. "The circuitry of each single channel is completely isolated from the others; there is no connection to chassis ground. This makes it easy to combine the channels to drive bipolar circuitries that might need ±12 V, for example, and avoids any ground problems in complex DUTs."

Power in PXI

Marvin Test Solutions offers several PXI power products. "Test-system size and footprint are always a concern; therefore, implementing solutions on the PXI platform delivers size reduction and performance," said Jon Semancik, marketing director. "Configuration flexibility is also valued, and PXI provides the ability to expand capabilities with minimal impact to overall system layout."



▲ Marvin Test Solutions GX1838 precision multichannel DC source.

Specific products include the GX3104 source-measure unit (SMU) with four isolated, common-ground SMU channels; 4-quadrant operation (±20 V, ±1 A); seven current ranges (±2.5 µA to ±1 A full scale); up to 1-A capability on one channel; and 24-bit ADCs and 18-bit DACs.

The company also offers the GX1838 precision multichannel DC source, which Semancik described as ideal for avionics and high-voltage applications. It features eight high-density discrete outputs, and three programmable voltage rails (14-bit resolution).

It offers two output configurations: -10 V to +32 V (GX1838) or -20 V to +20 V (GX1838-20). Maximum current output is 500 mA.

And finally, MTS offers the GX7404 power interface, which features +3.3 V, +5 V, +12 V, and -12 V outputs; software-controlled on/off switching; remote monitoring of voltage and current; an external power-inhibit line; and an on-board prototyping area.

Distributor offerings

Specific products that Newark offers include the GW Instek ASR-2100 compact programmable AC/DC power source, which provides an output rating of 0 to 350 VRMS AC and 0 to ±500 V DC and output capacity of 1,000 VA. "The ASR-2100 Series provides users with waveform output capabilities to meet the test requirements of different electronic component developments, automotive electrical devices, and home appliances," said Maureen Lipps, product manager, Test & Tools, Newark, adding that the instrument offers three modes: a sequence mode generates waveform fallings, surges, sags, changes, and other abnormal power-line conditions; the arbitrary waveform function allows users to store/upload user-defined waveforms; and the simulate mode imitates power outages, voltage rise and fall, and frequency variations.

Newark also offers the B&K Precision 8514 DC electronic load, which Lipps described as an affordable, laboratory-grade programmable instrument suited for testing and evaluating a variety of DC power sources. "It can operate in CC, CV, CR, or CP mode while voltage/current or resistance/power values are measured and displayed in real time," she said, adding that the unit is fully programmable via the RS-232 or USB interface and operates between 0 and 120 VDC, 1 mA to 240 A at 1,200 W maximum. A battery testing mode provides the Ah rating of battery.

Newark also offers the MP710259 US 300-W programmable DC load from Multicomp Pro, Newark's private label brand. Lipps described the MP710259 US, "It is a versatile instrument for static and dynamic testing of power supplies, batteries, DC/DC converters, and battery chargers," she said. "The MP710259's test modes include automatic test, OPP test, OCP test, and battery-test functions."

Challenges, trends, applications

Several SMEs who provided input for this article elaborated on the challenges customers are facing, industry trends, and applications. EE

The complete version of the Programmable Power Special Report is available on the EE-Evaluation Engineering *website at evaluationengineering.com/21149411*

REFERENCE

1. 4 Reasons Why You Need to Use Extended Range Programmable Power, Versatile Power, October 10, 2017.