SPECIAL focus

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How to choose a high-voltage source

All Charged Up

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In addition to bench-top, metered, low-voltage power supplies, many laboratories also require high-voltage sources. How do you choose the one that is best for your purposes?

Universal AC input is the most versatile way to power the unit. You will have to determine if the application requires a DC voltage bias or an AC voltage bias. If you are working with DC devices, it is important to determine whether you need a positive (+) or negative (-) high-voltage (HV) output and whether it is grounded or floated (isolated) on another HV supply.

The next step is to establish the range of output voltage (V), current (I), and power (P) necessary for your application, which can be defined by

$$V_{max} \times I_{max} = P_{max}$$

Select voltage and current ranges that provide sufficient headroom for present and future applications. If there is any doubt concerning these requirements, specify more voltage, current, or power, or a combination of the three, since requirements often change. Be sure to select a unit equipped with a simple pre-set-before-bias adjustable limit for both voltage and current, so you do not have to worry about damaging your devices. The unit should also adjust down to zero and provide full current over the full voltage range. It should not require a minimum load, and should provide automatic crossover between voltage regulation and current regulation.

As lab researchers know, science, R&D, and product development performed in the laboratory are often delayed or derailed by small misinterpretations or errors in data. Specify a unit that features separate voltage and current meters for each HV output channel, with sufficient resolution to make accurate settings and measurements. Better units also feature voltage and current regulation indicators that identify the mode of operation. For basic performance applications, specify a unit with stability over temperature of 50 parts per million/°C or better, as well as one that has an eight-hour stability error of less than 0.01% after a 30-minute warm-up; in some applications, it is not uncommon to require two to 10 times better performance. Remember to have the unit calibrated at least once per year.

Two other key performance items are output ripple and noise. Ripple refers to the fundamental periodic AC imposed on the DC at the operating frequency of the HV supply. Noise refers to the low-frequency and high-frequency variations introduced by the power-stage switching components and control circuitry. Basic HV units have 0.01% to 0.15% V peak-to-peak (p-p), and units with extra filtering and shielding have 0.0005% to 0.05% V (p-p). Fixed frequency, push-pull power stages tend to suffer lower noise while remaining easier to monitor during testing. A unit designed so the power modules can be purchased separately provides a system-integration migration path that delivers equivalent performance for the end device and applications while minimizing project risk.

If you are taking data or developing a controlled process, you will want a unit with analog/digital input/output to connect your 16-bit analog-to-digital converter/digital-to-analog converter cards. More advanced units feature total computer control via isolated IEEE-488, RS-232, RS-485, or Ethernet connections.

For optimal performance, specify a unit that features separate voltage and current meters for each HV output channel, with sufficient resolution to make accurate settings and measurements.

Working with HV is inherently dangerous, so read the manual and follow good grounding practices. Remember, *always* turn off the power and use a grounding stick before servicing the devices attached to the HV power supply. Never open up the HV power supply—that's for factory-trained personnel. It is a good idea to purchase a unit with safety agency approvals such as UL, CUL, CSA, IEC, CE, or Demko.

Every project has budgets, but having the wrong piece of equipment in the latter stages of testing and development can have an impact on both budgets and timelines. The key is specifying a device that meets the application and project requirements with reasonable compromise, but without settling for something less than you need. **oe**

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