Elektro-Automatik

APPLICATION NOTE:
MAKE A WISE CHOICE FOR YOUR NEXT DC PROGRAMMABLE POWER SUPPLY

Consider these important features

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As with any instrument purchase, a power supply's performance requirements and specifications dictate which manufacturers' products will be under consideration. The selected product must meet all the requirements for either the R & D application, a manufacturing test system, a test lab such as a quality control lab, or a process control system. Overlooking a feature (or features) can be an expensive error. The result can be a delay in a project schedule or a delay in the shipment of a new product. Additional costs can be needed to exchange the purchased power supply for a more appropriate one. This application note will recommend the features and specifications for DC programmable power supplies that one should consider to ensure the appropriate instrument is selected and avoid unplanned project delays and costs.

SPECIFICATION: POWER, VOLTAGE AND CURRENT RATINGS

The first consideration is selecting a power envelope with sufficient voltage and current output. Start by selecting a power supply to output the maximum power required for powering the device-under-test (DUT) and the load circuit. Selecting equipment with a 10% or 20% excess power capacity provides a safety margin in case load conditions unexpectedly exceed expected or specified values. The same approach applies to specifying the maximum voltage and maximum current. As with power, some excess capacity for the maximum voltage and current outputs will provide a margin for accurate testing and equipment safety.

You may also want to consider future-proofing against power needs in the future. For example, if you know your organization is developing higher-power equipment, hedge against needing further capital investment by selecting a DC power supply that meets the requirements of the planned products. Considering the growth and design plans for the next year or two will go far in delaying testing and avoiding additional costs.

The decisions on power, voltage, and current are the most important decisions to avoid selecting an inadequate instrument. Other features are essential as well.

SPECIFICATION: ACCURACY

Suppose a test procedure requires that the device-under-test (DUT), voltages across the load have a specific accuracy. In that case, the test engineer must understand the accuracy of a power supply's output. DC power supply accuracy is not just a single parameter. Total instrument accuracy includes multiple parameters. Here is a look at specifications and quality measures, starting with the most essential:

- Output accuracy or display accuracy
- Load regulation
- Stability and consistency
- Standards compliance
- Calibration and traceability

All these parameters are additive.

When accuracy is important, the supply's output voltage must be fully applied to the load, and voltage must not be lost across test leads. Remote sensing is the technique that ensures that the programmed voltage is applied to the load.

Remote sensing employs two inputs in addition to the Source output terminals, as shown in Figure 1. The Sense input terminals monitor the voltage across the load and feed the voltage back to the power supply's control/power amplifier circuitry. If the sense connections are not used, then the voltage drop, 2·VLead, reduces the voltage at the load across the resistance of the test lead wires. The Sense inputs connect to a high input impedance voltage measuring circuit that draws a negligible current from the load. The feedback voltage causes the power supply to compensate for the voltage drop across the test leads and output V= VProgrammed + 2·VLead. The power supply compensates for the voltage drop across the test leads by outputting a higher voltage. Remote sensing is crucial if the load requires a large current, resulting in a large voltage drop in the test leads.

For optimum voltage accuracy at the load, use a power supply with remote sensing. To determine the total accuracy, evaluate all the specifications that impact accuracy.

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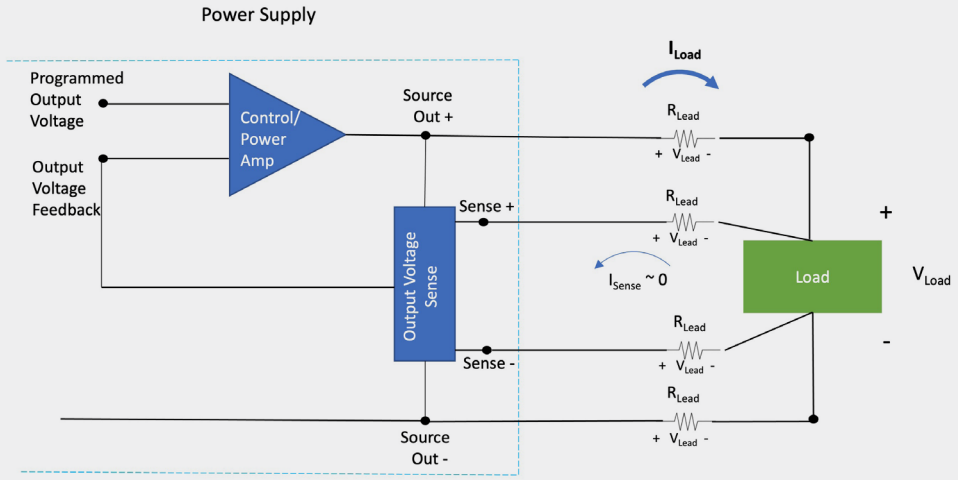

Figure 1. DC power supply with remote sensing ensures the programmed voltage is applied to the load.

SPECIFICATION: OUTPUT CHARACTERISTIC

The next important feature that requires consideration is the requirement for delivering maximum power to the DUT. If the design and test of the DUT requires delivering full power at varying voltages, then the output characteristic must have that capability. Power supplies have two types of output characteristics. They can have a rectangular characteristic or an autoranging output characteristic. The IV curve on the left of Figure 2 shows an auto-ranging output curve. The IV Curve on the right of Figure 2 shows a rectangular output curve overlayed on the autoranging curve.

Figure 2 illustrates a couple of essential points. The autoranging curve bounds the IV output's maximum voltage and current values for a 5 kW EA Elektro-Automatik (EA) power supply. Note that the autoranging supply can deliver the full rated output power from the maximum rated voltage, 500 V, down to 1/3 of that voltage. The righthand plot shows that a rectangular output delivers maximum power only at the corner point, V_{Max}, I_{Max}. Furthermore, the auto-ranging supply can deliver three times the current of an equivalently powered rectangular output power supply. Doubling the power of a supply with a rectangular output characteristic only doubles the maximum current that the power supply can deliver.

If either full power delivery at multiple voltages or a wide span of current is required, then select a power supply with an autoranging output characteristic. An autoranging power supply can save on capital costs. Figure 2 shows that the 10 kW rectangular output supply cannot deliver as much current as a 5 kW autoranging supply. The 5 kW supply provides substantial savings compared with the 10 kW rectangular output supply. In addition, only EA true autoranging power supplies allow full power delivery down to 1/3 of the rated output voltage.

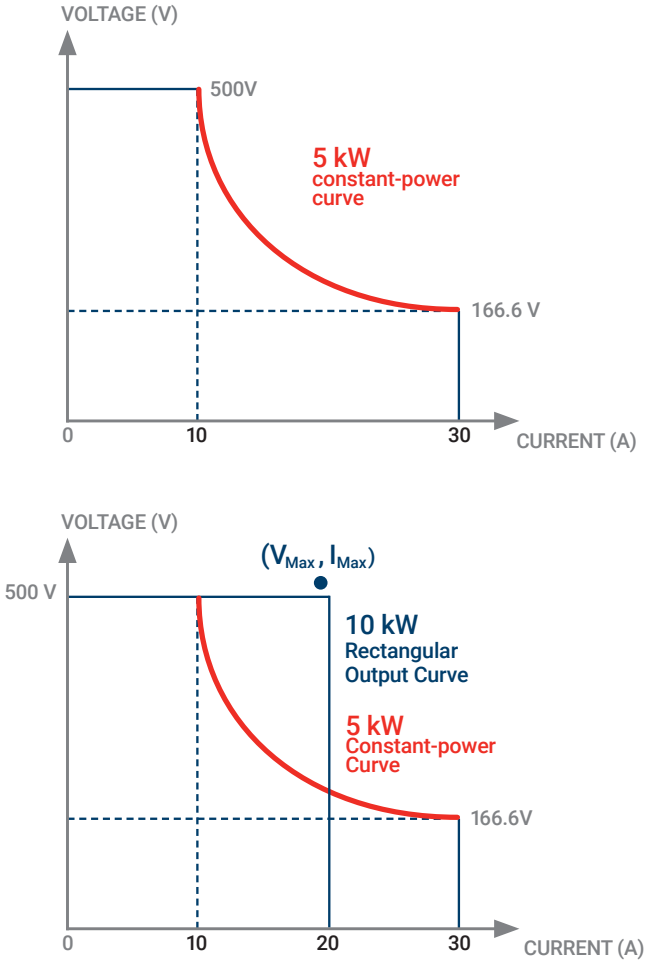

Figure 2. The autoranging characteristic of EA power supplies compared with a higher power rectangular output power supply.

SPECIFICATION: NOISE

The lowest possible power supply output noise minimizes disturbance to the DUT. Noise increases with higher power and higher voltage output. Manufacturers will specify noise as the two parameters, ripple and noise. Specifications will define noise in rms values, peak-peak values or a combination if two parameters are specified.

It may be challenging to compare noise specifications among manufacturers. However, if having the lowest noise is critical, carefully study a manufacturer's specifications. Checking with a manufacturer directly can help narrow down which DC programmable power supply can achieve your noise specifications. EA power supplies specify ripple with rms values; and, noise is typically around 0.02% of the rated power supply voltage.

SPECIFICATION: WAVEFORM GENERATION

Does the manufacturing test procedure require applying a waveform other than a pure DC level? Testing may require a generation of a custom power waveform or simulation of a power source.

The most common solution is to add a function generator to your test circuit. This solution adds the complexity of combining a low-power function generator with a power supply. An alternative is selecting a power supply that has a built-in function generator. The single instrument eliminates the complexity and cost associated with adding an additional instrument to the test system.

Versions of EA power supplies have built-in arbitrary waveform function generators that can combine with any DC level. Figure 3 shows an example of a complex output waveform. The waveform generation capability enables EA power supplies to test a wide scope of product types thoroughly.

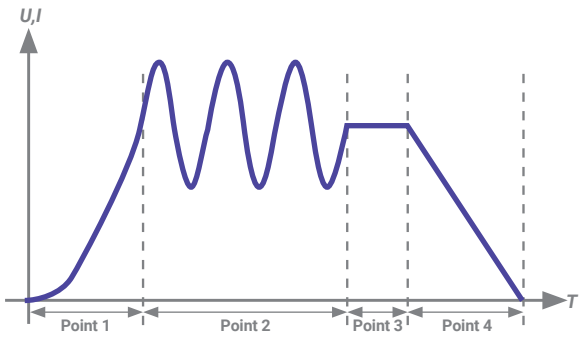

Figure 3. Example waveform generated by an EA supply with a built-in function generator.

SPECIFICATION: PROTECTION FEATURES

For maximum reliability of the power supply and the test system, ensure the selected power supply has the necessary protection functions. All power supplies will have overcurrent protection, which limits the maximum current the supply delivers. Many also have overvoltage, overtemperature, and overpower protection functions. These functions provide additional protection for both the power supply and the DUT. In most EA power supplies, all four features are standard protection functions.

SPECIFICATION: USER INTERFACE

The power supply should display the information needed to enable monitoring of the test status. The display should have a sufficiently wide viewing angle. Having a comprehensive user interface will save time and efficiency by being able to program and make changes directly on the power supply front panel.

Ask manufacturers to demonstrate their user interfaces, including the functions you know you will use, and ask them to show you other functions. Front panel access to most features and functions facilitates test development and troubleshooting.

EA uses a 12.7 cm color TFT Gorilla® glass touchscreen display. EA uses the same format for all their displays for a consistent presentation of information.

SPECIFICATION: ABILITY TO SAFELY PARALLEL OUTPUTS

If flexibility is needed to permit higher current output, look for a power supply that can safely and conveniently parallel multiple supplies. EA supplies have a master-auxiliary bus that allows one supply to control multiple power supplies. In addition, a Share-Bus ensures that all paralleled instruments carry an equal portion of the load so that one supply does not get overburdened.

SPECIFICATION: DUAL-PURPOSE OPERATION

Many test systems require both sourcing and sinking. If the test system does not need to source and be a load simultaneously, then one power instrument can perform both functions and eliminate the cost of an extra instrument in the test system. Power supplies that can source and sink operate in two quadrants on an IV output plot.

The voltage is always positive, but current can be either positive (sourcing) or negative (sinking). EA offers an extensive line of bidirectional power supply models. A bidirectional or 2-quadrant power supply is worth considering when both DC supply and electronic load functions are needed.

SPECIFICATION: INTERFACES FOR AUTOMATED CONTROL

Ensure the selected power supply has the automated interface defined by test system requirements. EA power supplies have multiple interfaces, such as Ethernet and USB, for connection to a PC. Furthermore, EA supplies have numerous field installable, optional interfaces, many of which, such as CAN, Profibus, and Modbus, can interface to a programmable logic controller (PLC). With EA supplies, engineers have the flexibility to program in either PC mode using SCPI code or PLC mode using Modbus commands. Most DC power supplies do not offer the programming and interfacing flexibility that EA possesses.

SPECIFICATION: ENERGY-SAVING EFFICIENCY

Pay attention to the efficiency of a DC power supply. Look for power supplies with active power correction and a very large power factor to minimize the total apparent power the supply draws from the AC power line. Some manufacturers specify the efficiency of power delivery to directly indicate how well AC input is converted into DC output.

Also, if selecting a bidirectional power supply, select one with regenerative energy recovery. Regenerative bidirectional supplies return absorbed energy to the power grid and reduce utility costs. EA power supplies with a regenerative electronic load function lead other manufacturers by returning up to 96.5% of absorbed energy to the power grid. Such a high efficiency reduces the cooling requirements for the supply when it is sinking power. Also, absorbing less heat allows the supply to operate with less heat stress and ensures higher reliability. The utility savings from using regenerative power supplies will often provide a significant payback over the instrument's life.

SPECIFICATION: AC INPUT POWER RANGE

For test systems used worldwide, select a power supply that accommodates a wide range of AC input voltages. The supply should also be able to operate on 50 Hz or 60 Hz power with some tolerance around those values. The wide voltage operating range and the tolerance around the AC source frequency enable a power supply to maintain its specifications when used in manufacturing locations where AC power delivery is less reliable. Models of EA power supplies can operate over ranges as wide as 208 VAC to 480 VAC 3 phase, with a 10% variation on those values.

SPECIFICATION: SPACE CONSUMPTION

If a test rack will require many instruments, investigate DC power supplies that take up the least amount of rack space with the required power. Consider EA supplies for saving test rack space. EA power supplies can pack as much as 30 kW in a 4U full rack enclosure and 60 kW in a 6U enclosure to provide the highest power density available.

FUTURE-PROOFING DC PROGRAMMABLE POWER SUPPLIES

As stated earlier, power supplies need to work not only for current needs but also those in the future. Ideally, you are investing in power supplies that will last at least 7-8 years, depending on use, including operating temperature. How will power testing needs change in the coming years?

Consider industry advancements and organizational innovation goals and what supplies will be required to carry out testing during this time. Some industries, such as EV batteries, hydrogen energy, and other renewable energy industries, are rapidly changing. Power supplies sufficient for today's testing may be wholly inadequate in a few years. Over-buying may not be the answer or be approved for purchase. However, modular systems give the option of upgrading as needed.

THOROUGH RESEARCH YIELDS A WISE DECISION

The features discussed provide the primary factors for specifying a power supply. Considering these features will enable the selection of the most cost-effective power supply for the intended application. EA has an extensive power supply product line that can meet the requirements for most DC power delivery applications. To obtain complete information on EA power supplies, visit www.eapowered.com. For in-depth assistance, contact EA at sales@elektroautomatik.com.

SERVICE FOR YOU WORLDWIDE.

At the headquarter in Germany in the industrial centre of North Rhine Westphalia more than 300 qualified associates, in a facility of 21000 m², research, develop and manufacture high-tech equipment for laboratory power supply, high power mains adaptors and electronic loads with or without power feedback. The sales network includes branches in China and USA, sales office in Spain and an extensive partner network.

www.elektroautomatik.com