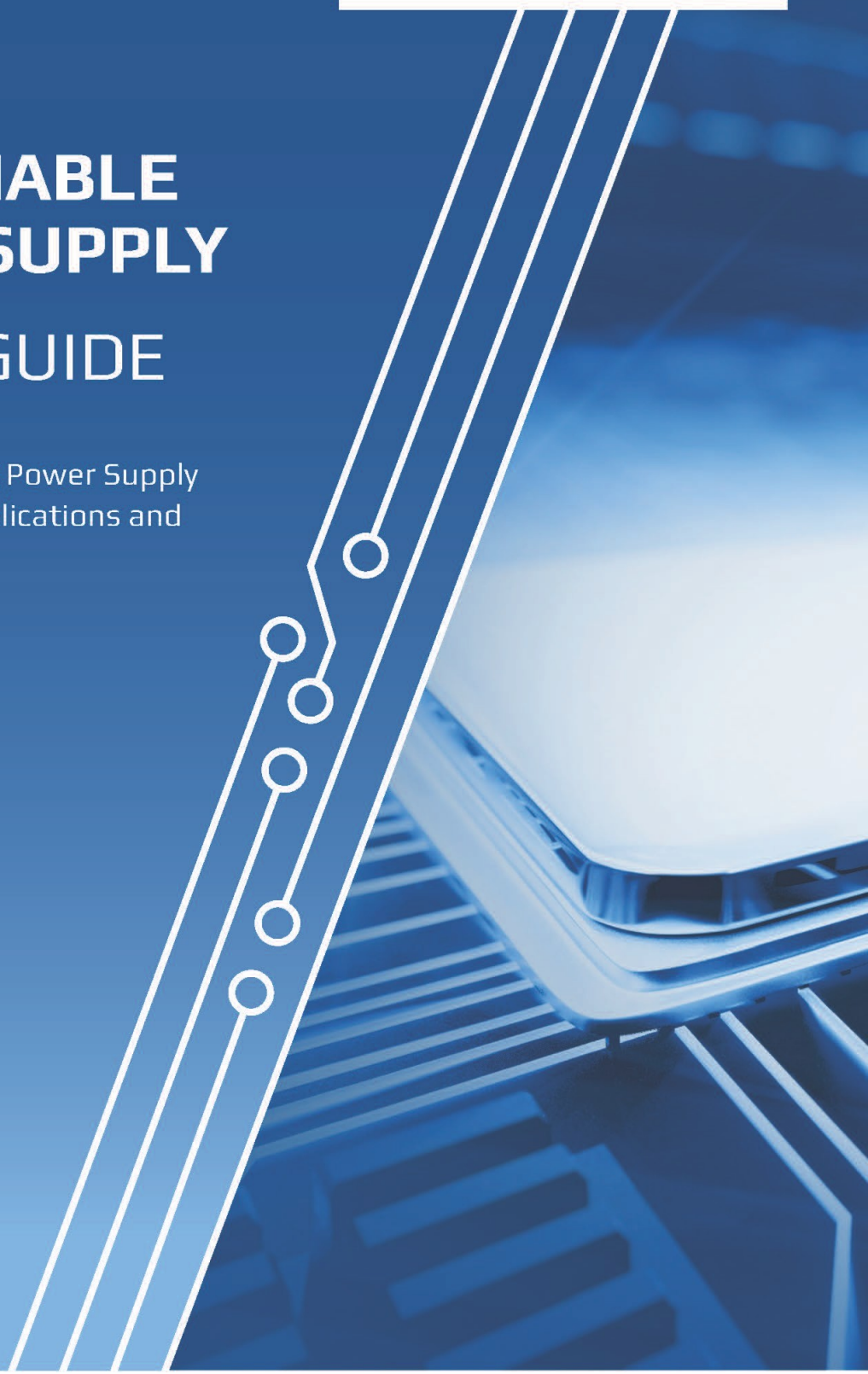
Elektro-Automatik

PROGRAMMABLE DC POWER SUPPLY

SELECTION GUIDE

How to Specify the Right DC Power Supply to Support Your Current Applications and Handle Future Test Needs



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DC Power Supply Selection Guide

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Introduction

Choosing the right programmable power supply for your test system or application can feel overwhelming if you are not sure of all the considerations involved. This book by EA Elektro-Automatik (EA) will guide you through the process of selecting a DC power supply that is right for your application and paired with how you intend to use it. Defining the power requirements for your application is the first place to start, but this is only the beginning of the process. Once you know the voltages and currents that you need, you must determine how you will power your source and how you intend to control it. So, before you issue a purchase order, you would be wise to consider the following questions:

* What output do I need from my power supply?
* What should I know about line/load regulation?
* Should I consider a bidirectional power supply?
* What input am I going to give my power supply?
* Where am I going to use my power supply?
* How do I plan on controlling my power supply?

What output do you need from your DC power supply?

The first thing that you should do when specifying a power supply is determine what output voltage, output current and output power you will need for your test or power requirements. Next, you will have to consider key parameters, such as line regulation, load regulation, and transient response.

Output voltage, current and power

DC power supplies come in a variety of voltage and current combinations so naturally the key specifications are maximum output voltage, maximum output current and maximum output power. Traditional power supplies are rated at their maximum power point, which is maximum current and maximum voltage shown in figure 1 as the 'limited' power stage. Any voltage below that point will be limited to the same current, which means you only get full power out at one operating point.

Autoranging

The "extra range" or flexible performance areas on figure 1 represent the additional operating curve gained by a feature only some power supplies offer, called Autoranging. Autoranging provides a wider output of both voltage and current to maintain full power across a much larger operating range. For example, with EA programmable power supplies with true Autoranging, you can get full power out of the supply down to approximately 33% of the rated output voltage. Therefore, if you have a 10kW supply rated to 1000V and 30A, you can get full power out of the supply down to 333V@30A. A traditional 1000V, 10kW supply without Autoranging would only be able to provide 10A at 333V, or one-third the power.

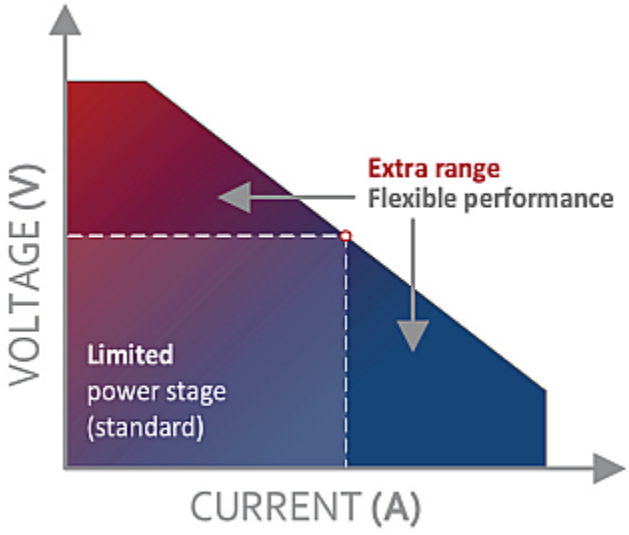

Figure 1: Autoranging Power Profile

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DC power supplies without Autoranging often require users to oversize or use multiple supplies, consuming both capital and space resources, to test a device (DUT) under varying input voltage conditions. With an auto-ranging power supply, the source automatically offers increased current at lower voltages which maximizes flexibility and allows the use of a single supply to address multiple voltage and current combinations. Therefore, if your test requirements have a lot of variation, the Autoranging capability can provide great benefit.

What should you know about line/load regulation?

Line regulation

Line regulation is the ability of a power supply to maintain its specified output voltage while there are changes in the input mains voltage. High performance power supplies typically have a line regulation specification between 0.005 and 0.02% of the maximum output voltage.

Load regulation

Load regulation is the ability of a power supply to maintain a constant output voltage (or current) under light loads and under loads near the maximum current. High performance power supplies typically have a load regulation specification between 0.005 and 0.02% of the maximum output voltage.

Transient response

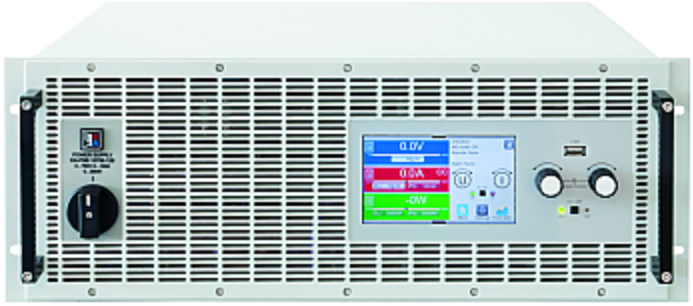
Transient response is another critical specification not to overlook. This is a measure of how well a DC power supply copes with changes in current demand or load impedance. Most DC power supplies easily handle slow load changes and maintain their output voltage, but when a fast transient occurs, the power supply's internal control loop may not be able to respond fastenough. When that occurs the output voltage will momentarily change until the control loop catches up to the load change. If your application will experience large current transients, you will need to pay close attention to this specification.

Should you consider a bidirectional DC power supply?

A bidirectional power supply is a regenerative electronic load and a power supply all in one unit. Not only can you provide power and sink power, but the power you sink goes back to the local power grid. EA bidirectional power supplies operative at up to 95% efficiency. This solution is great for battery and renewable energy applications, which not only saves valuable rack space but saves on energy and environmental cooling costs.

You should consider a bidirectional power supply if your goal is to:

- eliminate the need for an additional electronic load in your test stand,
- have a versatile piece of test equipment that can be used for multiple purposes in the future,
- make sure you get the most value for your investment.



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What input are you going to give your DC power supply?

Once you have determined what output you want from your power supply, the next question to ask is what input are you going to give it. In other words, how are you going to supply the input power to the power supply. Most supplies 1000W and below can operate on 120 VAC or 240 VAC single phase. However, the majority of power supplies over 1,500 W can't simply be plugged into a 120 VAC wall socket. You will likely have to supply 240 VAC single-phase power. As a general rule, a power supply rated 3kW and above will require some form of three-phase power. The normal three-phase variants are 208 VAC, 380VAC, 400VAC and 480VAC, depending on your region and facility. EA offers a WR input for most of their high-power DC programmable power supplies and loads. WR stands for Wide-Range and can accept voltages between 380-480Vac +/- 10%, making it easier for a power supply to be used in multiple regions around the world. This is very important as most power supply designs do not allow for reconfiguring to different input voltages.

Therefore, before you purchase a power supply, consult with your facilities management personnel to see what input power is available in your lab or production area where the supply is intended to be located. Be sure to ask the following questions:

- What power voltages are available?
- Is single-phase and three-phase power available?
- What type of power outlets are currently installed and where are they located?
- Do the power outlets available have the appropriate wire gauges required?
- What options do you have for cooling the supply?

When you have the answers to these questions, you will be able to purchase a power supply with the right input power configuration. A good practice is to download the available operations manual before purchase for more specifics to be certain. When purchasing an EA product, an EA application team is always able to provide guidance based on your specific application.

Where are you going to use your DC power supply?

Once you have determined the input of the power supply, you need to consider where you intend to use it. To answer this question, you will need to understand the mechanical and environmental specifications. The mechanical specifications will cover dimension, weight, chassis material, cooling requirements, installation details, efficiency, and output noise levels, to name a few. The power supply environmental specifications will provide operating temperature, storage temperature, relative humidity, vibration, shock, and so forth.

Keep in mind that high power DC supplies may require significant floor space and a sufficient volume of airflow to maintain a low operating temperature. Once again, consult with your facilities management personnel to discuss floor space and cooling requirements before purchasing your power supply.

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How do you plan on controlling your DC power supply?

There are numerous ways to control a power supply. Many are controlled manually, and if this is how you intend to control your power supply, ensure that the front panel interface is easy to understand and intuitive. One of the most intuitive front-panel interfaces available is a touch screen, which can be found on all of EA's power supplies. Analog control is also available on many supplies, but it is usually not isolated and/or you must pay additional for an isolated interface. Avoid potential problems by using EA's standard isolated analog interface. Analog control is still used in many industrial applications, and it can still be a good choice if your control needs are simple.

For computer or remote control, you have many choices, such as Ethernet, USB, EtherCAT, ProfiNET, ProfiBUS, CAN, CANOpen, Modbus, Devicenet and RS232 interfaces. The interface you choose will depend on many different factors including the interfaces that are commonly used in your company, the data transfer rate you require, etc. With the EA "Anybus" modules you can easily swap between these communication protocols with just a few minutes and a screwdriver.

Other considerations in DC power supply selection

With so many options and features for power supplies you should also consider whether any of the following will be necessary or desired as you narrow your choices: full color touch panel interface, arbitrary waveform generation, sequencing as well as built-in test functions for your specific application, such as battery test, PV inverter test, to name a few. EA Elektro-Automatik power supplies offer all of these features and options in various forms to make testing you current application, as well as future applications, that much easier.

Summary

Taking the time to ask the right questions and be thorough in obtaining your answers will ensure you specify the appropriate DC programmable power supply for your application(s). Clever selection will help you be successful in your duties and test challenges and enable you to continue to be successful even as new test requirements arise.

To review:

- What output do I need from my power supply?
- What should I know about line/load regulation?
- Should I consider a bidirectional power supply?
- What input am I going to give my power supply?
- Where am I going to use my power supply?
- How do I plan on controlling my power supply?

For more information and personalized guidance on choosing the just the right DC power supply for all your applications, contact EA Elektro-Automatik at sales@elektroautomatik.com
or visit EApowered.com.

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OUR MAIN PRODUCT LINES

DC Programmable Power-Supplies

LO-COST	
EA-PS 2000 B (µ)	100...332W @ up to 168V & 20A
MEDIUM-GRADE	
EA-PS 3000 C (µ)	160...650W @ up to 150V & 40A
HIGH-END	
EA-PS 9000 T (µ)	320W...1.5kW @ up to 500V & 60A
EA-PSI 9000 T (µ)	320W...1.5kW @ up to 500V & 60A
EA-PSI 9000 DT (µ)	320W...1.5kW @ up to 750V & 60A
EA-PS 9000 1U (µ)	1.5kW...3kW @ up to 750V & 100A
EA-PS 9000 2U (µ)	1kW...3kW @ up to 750V & 120A
EA-PSI 9000 2U (FPGA)	1kW...3kW @ up to 750V & 120A
EA-PS & PSE 9000 3U (µ)	5/10/15kW @ up to 1500V & 510A
EA-PSI 9000 3U (FPGA)	5/10/15kW @ up to 1500V & 510A
EA-PSI 10000 4U (FPGA)	30kW @ up to 2000V & 1000A

DC Electronic Loads, Conventional & Regenerative

OVERVIEW	
EA-EL 3000 B	400W @ up to 500V & 60A
EA-EL 9000 T	300W...1.2kW @ up to 750V & 60A
EA-EL 9000 DT	300W...1.2kW @ up to 750V & 60A
EA-EL 9000 B	1.5kW...14.4kW @ up to 750V & 1020A
EA-ELR 9000 & 10000	3.5...30kW @ up to 2000V & 1000A
EA-ELR 5000	320W up to 3.2 kW @ up top 200V, up to 25A

Bidirectional Power Supplies

OVERVIEW	
EA-PSB 9000 & PSB 10000	5...30kW @ up to 200V & 1000A "Green" Recovery load (feed back into the local grid)

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