

Side-by-Side Comparison: Agilent N5700 System DC Source and Sorensen DLM Power Supply

Comparison of an Agilent N5747A (750 W)
with a Sorensen DLM60-10 (600 W)

Application Note 1502-1



Introduction

Some power supplies are better suited to system use than others. System-ready power supplies simplify the assembly, programming, debugging and operation of test systems. The key attributes of a system-ready supply go beyond versatile output capabilities to include sensing and measurement functions, a choice of interfaces, compact size and high power density. A system-ready supply will make it easier for you to develop and integrate your test system.

In this guide, we compare two system products: the Agilent N5747A 750-W system DC source and the Sorensen DLM60-10 600-W DC power supply. Agilent has verified or tested all of the features and specifications discussed in this document. Points of comparison include electrical characteristics, programming capabilities, computer interfaces, mechanical attributes and general features.

Please see page 9 for a list of the other titles in this series as well as relevant product literature.

Product Terminology

Throughout this note we use the following shorthand when referring to the various products and product families:

- **N5747A** refers to only the Agilent N5747A 60 V/12.5 A system DC power supply
- **N5700 Series** refers to the entire Agilent N57xx family of products
- **DLM60-10** refers to only the Sorensen DLM60-10 60 V/10 A DC power supply
- **DLM Series** refers to the entire Sorensen DLM family of products

Comparing electrical performance

A power supply's voltage, current and power ratings are the key factors that determine its fit with any application. If the available ratings match your needs, then it will be worthwhile to evaluate the other features the supply offers.

Voltage, current and power

Table 1 shows the models available in the Agilent N5700 and Sorensen DLM product families. It shows that the N5700 Series covers more voltages and, looking only at models of similar voltage, has higher current and power ratings than any comparable DLM model.

By offering more choices, the N5700 Series lets you meet the specific needs of your DUT today and provides greater flexibility if you need more power in the future. You can simply select another model from within the N5700 family, add it to your system and make any necessary revisions to the voltage and current values in the system software.

Agilent N5700 Series 750 W ¹				Sorensen DLM Series 600 W			
Model	Voltage (V)	Current (A)	Power (W)	Model	Voltage (V)	Current (A)	Power (W)
N5741A	6	100	600	DLM 5-75	5	75	375
N5742A	8	90	720	DLM 8-75	8	75	600
N5743A	12.5	60	750	N/A	N/A	N/A	N/A
N5744A	20	38	760	DLM 20-30	20	30	600
N5745A	30	25	750	N/A	N/A	N/A	N/A
N5746A	40	19	760	DLM 40-15	40	15	600
N5747A	60	12.5	750	DLM 60-10	60	10	600
N5748A	80	9.5	760	DLM 80-7.5	80	7.5	600
N5749A	100	7.5	750	N/A	N/A	N/A	N/A
N5750A	150	5	750	DLM 150-4	150	4	600
N5751A	300	2.5	750	DLM 300-2	300	2	600
N5752A	600	1.3	780	N/A	N/A	N/A	N/A

Table 1. Comparison of the voltage, current and power ratings of the N5700 Series and the DLM series

¹The N5700 Series also includes a family of 1500-W power supplies.

Key electrical specifications

When choosing a medium-power system supply, there are many specifications to consider. Among these, output noise and measurement accuracy can affect the DUT and the quality of your measurement results.

Output noise

Low output noise reduces the likelihood of introducing errors into the DUT or the test system. Comparing specified performance (Table 2) the DLM60-10 has lower CV noise performance (peak-to-peak and RMS); Sorensen doesn't specify output noise for constant current (RMS). For all but the most sensitive DUTs, the N5747A provides excellent noise performance.

	N5747A	DLM60-10
CV_{p-p}	60 mV	35 mV
CV_{rms}	8 mV	3.5 mV
CC_{rms}	38 mA	(not specified)

Table 2. Comparison of output noise specifications

Measurement accuracy

Table 3 shows the accuracy of voltage and current measurements when results are reported via interface bus (not the front panel readout). The products have similar specifications but the N5747A has superior offsets. The offset advantage in current measurements is actually more impressive because the N5747A can output 25% more current than the DLM60-10. Better power supply measurement accuracy can help you avoid purchasing additional hardware like a DMM and external shunt.

	N5747A	DLM60-10
Voltage	0.1% + 60 mV	0.1% + 90 mV
Current	0.1% + 37.5 mA	0.1% + 40 mA

Table 3. Comparison of interface measurement accuracy

From the table, the accuracy range for an N5747A current measurement would be the measured value (I_{meas}) in milliamps plus or minus ($I_{meas} \times 0.001 + 37.5$).

Parallel output for higher current

Connecting two or more power supplies in parallel increases the current available to test a device. Making this capability work properly and predictably, however, requires more than simply wiring the units together. The linked units must be able to communicate and provide the control necessary to ensure safe, accurate operation and easy programming.

Using the “auto-parallel” capability, up to four N5700 power supplies with the same voltage and current ratings (identical models) can be connected in a master/slave relationship to provide up to four times the current of a single unit. With auto-parallel, you simply program the master, and it uses a single insulated wire to control each of the other units.

The DLM has similar capability but uses a special six-pin, four-wire connection to enable master-to-slave communication. In larger systems, implementing this technology can be expensive and time-consuming.

Electrical performance summary

While the N5747A has a small advantage in terms of measurement accuracy and the DLM60-10 has slightly better output noise specs, these differences are unlikely to impact your ability to test most DUTs effectively. A more important difference between the two is the wider range of voltage, current and power available in Agilent power supplies. The Agilent N5700 Series is a family of 24 affordable 750-W and 1500-W single-output power supplies. With numerous voltage choices, excellent measurement accuracy and easily configured parallel output capabilities, the N5700 Series lets you address a wide range of applications—now and in the future. This flexibility ultimately saves you time and money and simplifies system design. In addition, the Agilent power supply’s auto-parallel feature makes it easier to program your system when you need higher current.

Evaluating programming capabilities

In this portion of the note we consider several aspects of instrument programming that can affect development time, system performance, software reuse and more.

Choice of interfaces

For decades, GPIB has been the *de facto* standard for test system input/output (I/O). In the computer world, cost-effective, easy-to-use LAN and USB interfaces have become pervasive—to the extent that most current-generation PCs include both types of ports. To give test system developers the advantages of LAN and USB, these ports are becoming more common in test equipment.²

Every model in the N5700 Series includes GPIB, LAN and USB interfaces as standard equipment. All three are active at all times and may be used simultaneously, though not for the same task (only

one can be used for instrument control). Having all three built in lets you choose the best interface for today's requirements and makes it easy to switch in the future—with no additional cost.

The DLM series is much less flexible, forcing you to choose either GPIB/RS-232 or analog programming interfaces. USB and LAN are not available.

Single-command configuration

In a test system, the ability to store and recall frequently used configurations with a single command reduces setup time and makes testing more efficient. The N5700 Series can store and recall up to 16 different instrument states, each with a single command. The DLM series doesn't offer this capability, meaning it could take hundreds of milliseconds to set up or change a complex configuration via GPIB.

Browser-based interface

The N5700 Series has a built-in Web server that provides a graphical user interface (GUI) and the ability to use a Web browser for configuration, control and monitoring (Figure 1). This capability is accessed through the LAN interface. However, because all three interfaces are active at the same time, you can control a unit via GPIB or USB and monitor it via the LAN port. This can be very useful when debugging a test program or monitoring a test from a remote location.

The DLM also has a GUI, but it is only accessible via GPIB. This is useful for monitoring and control of many DLM series capabilities; however, you must choose either the GUI or a test program as the point of control. This is less versatile than the simultaneous capabilities of the N5700 Series.



² Agilent is a leader in offering LAN and USB in its instruments, but we also offer devices such as the Agilent E5810A LAN/GPIB gateway and the 82357A USB/GPIB interface to ensure easy connectivity to legacy equipment. We recognize the pervasiveness of GPIB in existing test systems and will continue to support it.

Emergency shut down

When a fault or emergency occurs, the ability to inhibit or shut down the power supply via external control is an important safety feature.

The N5700 provides this capability through its shutdown feature, which is triggered by an external signal. The N5700 Series can also provide a shutdown signal for other devices that support this feature. You can configure multiple N5700 power supplies to shut down when a fault occurs in any one of the power supplies.

In the DLM series, remote shutdown is possible only with the analog programming interface installed (not GPIB). The only exception is in parallel operation of up to four units: a fault in one DLM will shut down all of the other units.

Command compatibility

Command compatibility increases software reuse, simplifies instrument interchange and reduces system development time. The N5700 Series is compatible with the widely used Agilent 603x series power supplies. Commands are also compatible with the most frequently used functions of the DLM series, making it easy for DLM users to switch to Agilent supplies that offer greater power and current. The main compatibility gap is in the calibration procedure, which must be performed as described in the N5700 user's guide.

Analog programming

The N5700 Series and DLM series both offer analog programming. The N5700 supports simultaneous use of analog programming and any of the digital interfaces. In contrast, a DLM series power supply can be configured with either the analog programming interface or a GPIB/RS-232 interface, but not both.

Programming capabilities summary

The system-ready N5700 Series provides a complete package, offering multiple interfaces, rapid configuration capabilities, browser-based monitoring and control, command compatibility with other products, and more. The N5700 Series power supplies' PC-standard interfaces give you a significant advantage over the DLM series, which offers only GPIB/RS-232 or analog programming interfaces. The more flexible browser interface on the N5700 also contributes to faster system programming and debugging, while the ability to recall setups with a single command allows faster system operation.

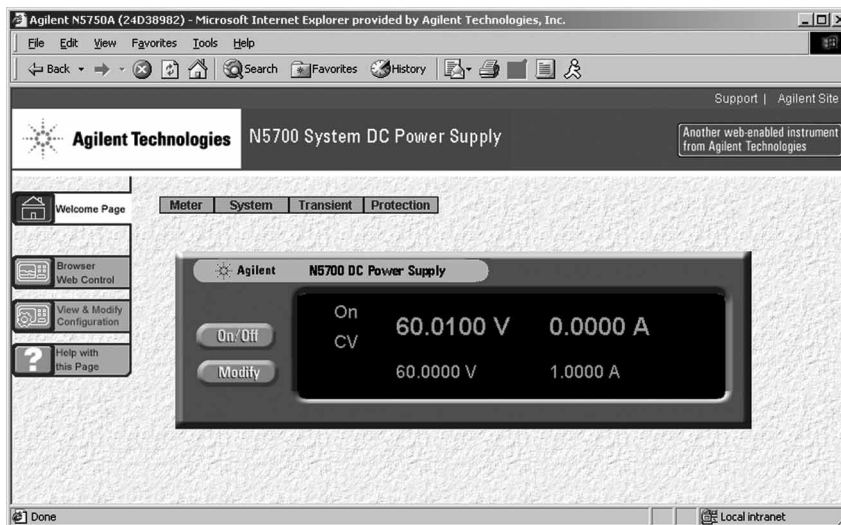


Figure 1. Browser-based GUI for remote access and control of the N5700 Series

Appraising mechanical characteristics

Mechanical attributes such as power per unit volume, airflow and physical size are good measures of a power supply's suitability for system applications.

Power density and airflow

Power density is the amount of power available per unit volume. The ability to put more power into a smaller package opens up space in the system rack for other instruments. For example, the N5747A can source up to 750 W in a true 1U, full-rack package. “True 1U” means that other instruments can be mounted directly above and below the unit without affecting the cooling or operation of the stacked instruments. The N5700 draws air from the front and exhausts it through the rear panel, avoiding interference with adjacent instruments.

In contrast, the DLM60-10 delivers 600 W in a 1U, half-rack package that has front and side air intakes and rear and side exhaust ports. This intake/exhaust configuration could potentially draw heat from (or blow heat into) instruments mounted next to the half-rack DLM.

Rack mounting and dimensions

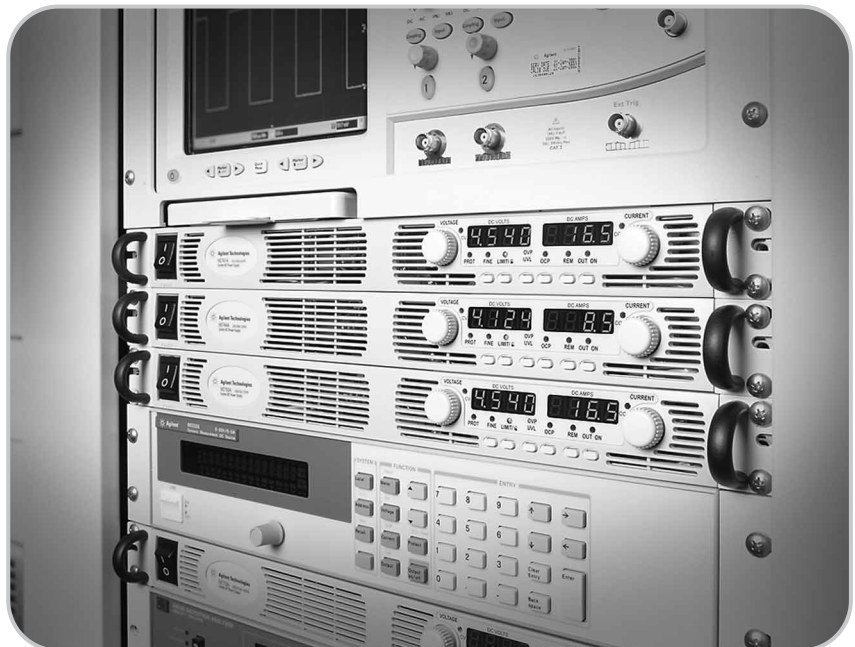
Both the N5700 Series and the DLM series offer optional rack mounting kits for system installations. The N5747A uses a full-rack, 1U case while the DLM60-10 uses a half-rack 1U package (Table 4).

Mechanical characteristics summary

N5700 Series supplies are designed to conserve rack space and simplify the physical aspects of system integration. The N5747A delivers 750 W in a full-rack, “True 1U” configuration, while the DLM60-10 delivers 600 W in a half-rack 1U package that presents potential intake/exhaust configuration challenges. If rack space or rack configuration is a critical factor in your test system, you will need to evaluate which configuration best meets your needs.

	N5700 Series	DLM Series
Height	43.6 mm	44.5 mm
Width	422.8 mm	216.0 mm
Depth	432.8 mm	460.0 mm

Table 4. Physical dimensions of product cases



Reviewing general attributes

The general features and capabilities of a power supply can further define its overall value, versatility and serviceability.

Price per watt

Price is always a factor when evaluating different instruments, but a simple cost comparison may not capture the value per unit price. Instead, a normalized figure such as “price per watt” can provide a more meaningful comparison:

- N5747A: about \$3.07*/watt (750 W) with GPIB, USB, LAN and analog programming all standard
- DLM60-10: about \$3.14*/watt (600 W) with GPIB only

* As of the printing of this document

Universal AC input

Advances in product design make it possible to connect test instruments to a wide range of AC input voltages without the inconvenience of changing jumpers and fuses or selecting region-specific product options. However, clean, efficient operation with this type of universal AC input depends on the power factor rating of the device’s internal power supply.

The N5700 Series was designed with active power factor correction (PFC), which allows operation to its full specifications across a continuous range of voltage that spans 85 to 265 Vac.

With PFC, the N5700 has a power factor of 0.99, which indicates efficient power consumption and minimal emission of current harmonics onto the power line.

The DLM has neither a universal input nor PFC. Instead, it operates in one of two ranges—90 to 132 Vac or 180 to 264 Vac—and must switch between them. Problems may arise if the AC line voltage approaches the gap between 132 V and 180 V, which may occur in areas with frequent brownouts or power spikes. Also, with a power factor of 0.60, the DLM series tends to draw a high input current and may cause problems on the power line.

Customer-downloadable firmware

To help minimize product downtime, you can download firmware updates for the N5700 Series from the Agilent Web site and install them in your power supply. To ensure a successful update, the N5700 Series utilizes primary and backup copies of the firmware. If problems such as power outages or installation errors occur during the update process, the unit reverts to the backup version and continues to function properly.

The manual for the DLM’s M9 option mentions “field-upgradeable firmware via RS-232,” but there is no information about the update procedure documented. Furthermore, updates are not available through the Sorensen website. We did learn, however, that the DLM must be returned to the factory if the firmware update fails or is interrupted before the process is complete.

General attributes summary

The N5700 Series offers more value and more flexibility than the DLM series. The economical N5700 Series supplies can operate from any AC mains input voltage in the world—no switch or fuse changes. You can download firmware updates from www.agilent.com, and when you need service and support, Agilent’s global network of service centers makes it easy for you to get the help you need, anywhere in the world.

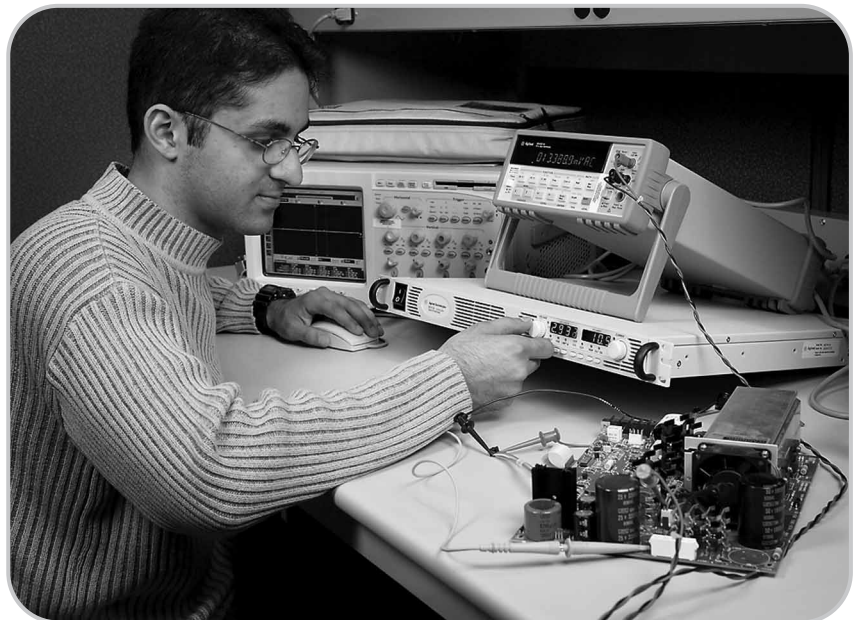
Conclusions

In our comparison of the two individual products—the N5747A and the DLM60-10—the N5747A showed advantages over the DLM60-10 in three key areas: output choices and performance; programming capabilities and I/O interfaces; and value in terms of price per watt and overall functionality.

- **Output:** The N5700 Series provides a wider range of voltage choices and, among units with comparable output voltage, offers higher current and power ratings.
- **Flexible I/O:** N5700 Series supplies include GPIB, LAN, USB and analog interfaces. DLM units include either GPIB or analog programming; LAN and USB are not available.
- **Value:** Comparing price per watt, the N5747A has a slight advantage—about \$3.07/watt versus \$3.14/watt—and provides greater functionality, making it a better value. Agilent's worldwide service and support strengthens the value advantage.

The N5700 Series embodies our commitment to making system integration faster and easier. Agilent's system-ready instruments, open software, PC-standard I/O and global support can truly help you simplify and accelerate test system development. Our worldwide resources let you access the startup assistance, training classes and update services you need to develop and maintain your test systems—virtually anywhere they may be deployed.

To discover more ways to simplify system integration, accelerate system development and apply the advantages of open connectivity, please visit our Web site at www.agilent.com/find/system-components.



Related literature

The other notes in this series will help you compare Agilent system DC sources with power supplies from other manufacturers:

- *Side-by-Side Comparison: Agilent N5700 Series System DC Source and Xantrex XFR System DC Power Supplies*, AN 1502-2 (pub no. 5989-1630EN)
<http://cp.literature.agilent.com/litweb/pdf/5989-1630EN.pdf>
- *How to Convert from a Sorensen DLM to an Agilent N5700*, AN 1503-1 (pub no. 5989-1629EN)
<http://cp.literature.agilent.com/litweb/pdf/5989-1629EN.pdf>
- *How to Convert from a Xantrex XFR to an Agilent N5700*, AN 1503-2 (pub no. 5989-1631EN)
<http://cp.literature.agilent.com/litweb/pdf/5989-1631EN.pdf>

Agilent product literature can help you select the best system DC source for your application:

- *Agilent N5700 Series Data Sheet*, pub no. 5989-1330EN
<http://cp.literature.agilent.com/litweb/pdf/5989-1330EN.pdf>
- *Trends in Medium Power (~ 1 kW) DC Power Supplies*, pub no. 5989-1331EN
<http://cp.literature.agilent.com/litweb/pdf/5989-1331EN.pdf>
- *Agilent N5700 System DC Power Supply User's Guide*, pub no. 5969-2917EN
- *Agilent N5700 Product Reference CD-ROM*, pub no. 5969-2918EN

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