Model 4300
Modular DC Electronic Load Subsystem

Configurable With 6 Load Sizes Plus a Power Analyzer Within a 16-Slot Chassis to Speed Multi-Output & Parallel Testing of Power Conversion Devices

Features

- 2 voltage maximums – 120V & 500V
- 3 power levels - 150W, 300W, 600W
- 16 slot mainframe
- 3 voltage ranges, 3 current ranges
- High-resolution waveform capture up to 1 M Sample/Sec
- Precision voltage, current, power, & timing measurements
- Modes - CV, CC, CP, CR, & in-combination
- Dynamic loading - 1000 settings
- Advanced loading - LED, MPPT, & XY loading
- Digital power analyzers
- Ethernet (LAN)

Applications

The concept of having a digital measurement system built into each DC electronic load plus being able to combine up to 16 of such DC electronic loads into a single chassis opens several new test strategy possibilities that have significant economic and quality benefits.

The most important test strategy is the ability to test multiple consumer power devices such as chargers, adapters, and LED drivers in parallel, up to 16 in a single pass. Test times for such devices are now measured in a few seconds.

The other major advantage of this distributed measurement is the ability to test each output of a multi-output power conversion device simultaneously rather than sequentially. Not only does this reduce the overall test time needed, but, it also provides far better channel-to-channel performance measurements including dynamic cross effects. In this manner quality of the devices tested takes a large step forward because the parallel tester better simulates real life conditions where all outputs are exercised together.

Yet another benefit of such a flexible, advanced DC electronic load/measurement system is the ability to easily reconfigure the loading to adapt to almost any new loading arrangement required by new UUTs in the future.

Ultimate Configuration Flexibility

As a result of designing all 3 sizes of DC electronic loads to utilize a common-sized, 16-slot mainframe containing Models 4312 and 4350 loads, a new level of configuration flexibility is achieved. There are now 25 different combinations of DC electronic loads that can be configured (Fig. 1). Should the initial DC electronic load selection ever need an updating, physically changing the configuration can be accomplished by convenient front-chassis-access or virtually through software paralleling of the existing DC electronic loads. From 16 of the 150W DC electronic loads to the 4 of the 600W DC electronic loads or any combination in between, meeting a wide variety of UUT loading demands within the 2400W mainframe rating has never been easier.

![Model 4300 mainframe with 150, 300, & 600W loads](image)

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Figure 1 - 5 of the 25 possible load configurations using 150W, 300W, & 600W DC loads.
**Extended Internal Measurements**

In almost every test application the Model 4300 loads eliminate the requirement for instruments to capture timing, power, and other dynamic measurements during UUT turn-on and turn-off. This is accomplished by incorporating the task-essential features of a DMM, DSO, transient generator, and power meter on each DC load. With this built-in capability, the Model 4300 DC loads can rapidly generate engineering-characterization-like test information at lightning test speeds. In addition, there is a significant cost saving by eliminating all single-function measurement instruments along with related cabling and switches.

**Comprehensive Measurements**

Each DC load offers 20 standard measurements plus additional graphic waveform analysis tools that provide an almost limitless range of UUT transient performance information. The tools include a programmable sample window, 256k data-point memory, and a unique graphic control/recording interface. Waveform transient measurements once only performed in the engineering laboratory are now executed at speeds that invite incorporation into production testing.

**Digital Power Analyzer**

The benefit of the Power Analyzer (Fig. 3) is that it provides precision UUT input measurements on each tester channel. In this manner a bulk AC or DC source can provide the power for all UUTs, while the Power Analyzer in combination with the loads makes critical input-to-output measurements such as efficiency.

Think of the Power Analyzer as a combination of 3 digital instruments: power meter, multimeter, and oscilloscope. The analyzer’s performance is created by state-of-the-art, dual A/D converters with a 1MHz sampling rate that provide the data to make practically any power-conversion-related static or dynamic power measurement provided by the 3 types of instruments mentioned above.

The single-card Power Analyzer fits within the chassis and is interchangeable with the 150W electronic loads. With this configuration flexibility, a single chassis can contain any mix of the two types of modular instruments up to the 16-slot limit. Should 16 slots not be sufficient, a second chassis is added to accommodate more test channels or larger, multi-slot loads.
New Multi-UUT Parallel Test Strategy Support

The simultaneous testing of multiple UUTs such as chargers, adapters, and other high-volume, consumer power electronic devices is now a competitive reality. In fact, leading manufacturers have moved from 4 or 8 to 16 UUTs tested simultaneously. Having all the measurement capability built-in to each DC load now makes this new multi-UUT parallel test strategy not only possible but relatively inexpensive. The distributed measurement architecture is also an advantage when testing the more traditional multi-output power supplies because it provides both channel-to-channel measurements and faster test speeds.

Macro Mode

The Macro Mode provides programming a sequence of up to 1000 settings including the slew rate and time between settings. It also allows for mixing load modes within the same Macro. With this flexibility, the user is able to more accurately synthesize a wide range of complex waveforms that replicate the real-world conditions the UUT will encounter.

Advanced Graphic User Interface (GUI)

The several-decades-old manual instrument interface consisting of tiny knobs and 3-line LCD, while perhaps acceptable for a single load in a bench-top application, is simply inadequate for the control and reporting information generated by a multi-load/measurement system. That voluminous information is now logically organized on a single screen with drop down menus to select various performance options together with graphic oscilloscope-like panels to view and extract waveform measurements on up to 16 channels in each mainframe. Additional higher-power NH Research, Inc. load models would also integrate into this single softpanel.

PC Control

The Model 4300 Digitizing DC Electronic Loads can be used within the NHR 5600, 5700, and S600 Automated Functional Test Systems that include the emPower® Test Executive. The Model 4300 Loads can also be used within a customer’s test system where it would be controlled through a LAN (Ethernet) interface, and is compatible with programming environments such as LabView, LabWindows/CVI, and other IVI-conforming languages.

Front Connected & Front Loading

The Model 4300 Digitizing DC Electronic Loads have input connections on the front panel, which allows shorter cable lengths to the test fixture and UUT. In turn, this results in less cable-induced inductance and potential dynamic instability. Removal of a load is as easy as unfastening the 4 front-panel screws and then sliding out the load. This facilitates faster load module reconfiguration, test fixture change-over, and load repair when necessary.
**Model 4300 Modular DC Electronic Load Subsystem Specifications**

<table>
<thead>
<tr>
<th>Model Number</th>
<th>4312/4350-150</th>
<th>4312/4350-300</th>
<th>4312/4350-600</th>
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<tbody>
<tr>
<td>Power</td>
<td>150W</td>
<td>300W</td>
<td>600W</td>
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<tr>
<td>Slots (16 per Mainframe)</td>
<td>1</td>
<td>2</td>
<td>4</td>
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<tr>
<td>Maximum Current</td>
<td>40A / 30A</td>
<td>80A / 60A</td>
<td>150A / 120A</td>
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<tr>
<td>Maximum Voltage</td>
<td>120V / 500V</td>
<td>120V / 500V</td>
<td>120V / 500V</td>
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<td>Voltage &amp; Current Measurements</td>
<td>Overshoot, Undershoot, AC RMS, AC+DC RMS, Positive Peak, Negative Peak, Peak-Peak, High-Frequency Peak - Peak (Noise), Rise Time, Fall Time, Settling Time, Hold-Up Time</td>
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<tr>
<td>Other Measurements</td>
<td>Average Power, Peak Power, Resistance, Trigger-In Time, DIN State &amp; Time</td>
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**Programmable Features**
- Constant Current Mode, Constant Voltage Mode, Constant Power Mode, Constant Resistance, Auto Mode, LED Driver Mode, Solar PV Panel with MPPT Mode, Slew Rate, Macro, Triggering

**Measurement Instrumentation**

<table>
<thead>
<tr>
<th>Current</th>
<th>Range (A) - 4312 / 4350</th>
<th>0-0.8, 4, 40A / 0-0.8, 8, 80A / 0-0.8, 16, 150A / 0-0.66, 3.0, 30A / 0-0.66, 6.0, 60A / 0-0.66, 12, 120A</th>
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<tr>
<td>Accuracy</td>
<td>0.05% Rdg + 0.05% R</td>
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<tr>
<td>Resolution</td>
<td>0.0015% R</td>
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<tr>
<td>DC Voltage</td>
<td>0-6, 30, 120V / 0-30, 120, 600V</td>
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<td>Accuracy</td>
<td>0.02% Rdg + 0.04% R</td>
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<tr>
<td>Resolution</td>
<td>0.003% R</td>
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<tr>
<td>DIN Timing</td>
<td>Range</td>
<td>100μS to 168 hours</td>
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<tr>
<td>Accuracy</td>
<td>0.05% Rdg ± 0.0 μs</td>
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<tr>
<td>Resolution</td>
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**Waveform**
- Bandwidth: DC - 50kHz, DC - 10kHz
- Voltage: 1MS/s
- Time: (1/sample rate) +0.05 % Rdg
- Digitizing Rate: 256K points
- Trigger: System Trigger, DINS, Voltage
- Dimensions (HxWxD): 5/8 x 19 x 22/222 x 483 x 559mm

**High-Frequency PK-PK Noise**
- Range: 0 - 0.25, 2.5VAC

**Additional Features**
- OVPS Relay
- Connects programmable power supply to test UUT for over-voltage protection, relay connected and 5 A limited (Relay only)

**Other Measurements**
- Average Power, Peak Power, Resistance, Trigger-In Time, DIN State & Time
- DIN Timing: 100μS to 168 hours
- Accuracy: 0.05% Rdg + 0.05% R
- Resolution: 100 nano S

**Diagrams**

- Fig. 6 - Front panel (300W load) & Front panel control
- Fig. 7 - Mainframe rear panel control

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**Model 4312 & 4350 Panel Overview**

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