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

NH Research

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.

***Model 4300** mainframe with 150, 300, & 600W loads*

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.

150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
300		300		300		300		300		300		300		300	
600				600				600				600			
150	150	150	150	150	150	150	150	300		300		600			
150	150	150	150	300		300		600				600			

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

There is a significant cost saving by eliminating all single-function test instruments along with related cabling and switches.

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.

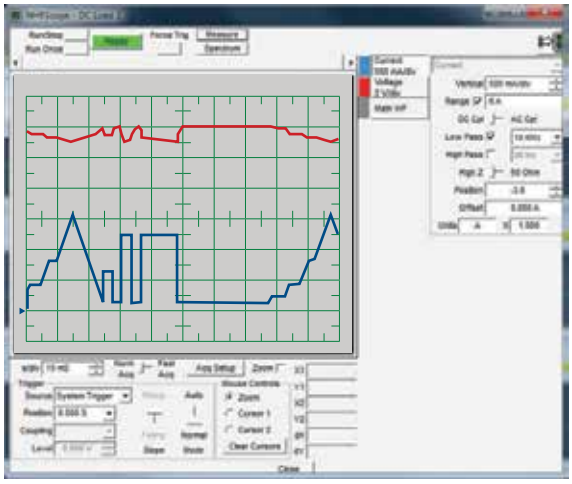


***Figure 2** - Model 4300 Waveform Display*

The benefit of the Power Analyzer is that it provides precision UUT input measurements, such as efficiency, on each tester channel.

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.

***Figure 3** - Model 4301 Digital Power Analyzer*

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.

Leading manufacturers have moved from 4 or 8 to 16 UUTs tested simultaneously.

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.

Information is now logically organized on a single screen with drop down menus to select various performance options

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.

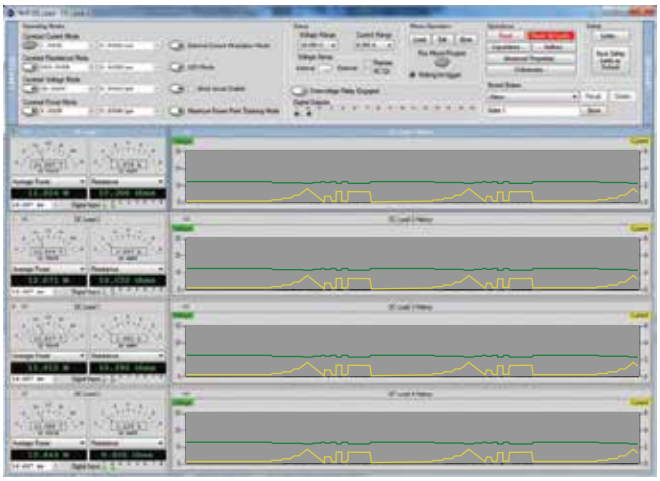


***Figure 4** - Constant Power operating envelopes*

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 *em*Power® 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.

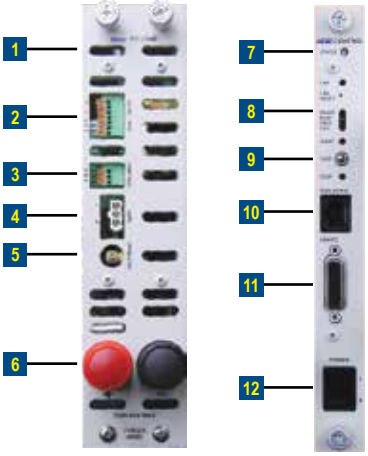
Model 4300 Modular DC Electronic Load Subsystem Specifications

Model Number	4312/4350-150	4312/4350-300	4312/4350-600
Power	150W	300W	600W
Slots (16 per Mainframe)	1	2	4
Maximum Current	40A / 30A	80A / 60A	150A / 120A
Maximum Voltage	120V / 500V	120V / 500V	120V / 500V
Voltage & Current Measurements	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		
Other Measurements	Average Power, Peak Power, Resistance, Trigger-In Time, DIN State & Time		
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			
Current			
Range (±) - 4312 / 4350	0-0.8, 4, 40A / 0-0.66, 3.0, 30A	0-0.8, 8, 80A / 0-0.66, 6.0, 60A	0-0.8, 16, 150A / 0-0.66, 12, 120A
Accuracy	0.05% Rdg + 0.05% R		
Resolution	0.0015% R		
DC Voltage			
Range (±) - 4312 / 4350	0-6, 30, 120V / 0-30, 120, 600V		
Accuracy	0.02% Rdg + 0.04% R		
Resolution	0.003% R		
Waveform			
Bandwidth			
Voltage	DC - 500kHZ		
Current	DC - 100kHZ		
Accuracy			
Analog	1% R		
Time	(1/sample rate) +0.05 % Rdg		
Digitizing Rate	1MS/s		
Record Length	256K points		
Trigger	System Trigger, DINS, Voltage		

(continued)			
Power			
Range	IR x VR	IR x VR	IR x VR
Accuracy	I Accuracy + V Accuracy		
Resolution	0.0015% R	0.0015% R	0.0015% R
Resistance			
Range	0 - Inf	0 - Inf	0 - Inf
Accuracy	I Accuracy + V Accuracy		
Resolution	0.0015% R	0.0015% R	0.0015% R
High-Frequency PK-PK Noise			
Range	0 - 0.25, 2.5VAC		
Bandwidth	10Hz - 20MHz		
Accuracy	3% R @ IMHz		
Resolution	0.0015% R		
DIN Timing			
Range	100µS to 168 hours	100µS to 168 hours	100µS to 168 hours
Accuracy	0.05% Rdg ± 100 µS	0.05% Rdg ± 100 µS	0.05% Rdg ± 100 µS
Resolution	100 nano S	100 nano S	100 nano S
Additional Features			
OVPS Relay	Connects programmable power supply to test UUT for over-voltage protection, relay connected and 5 A limited (Relay only)		
External Analog Input	0 - 10 V signal input to modulate current		
External Current Monitor	0 - 10 V output signal corresponding to 100% of Range Current		
DINs (Digital Inputs) per Load	2 isolated, logic level		
DOUTs (Digital Outputs) per load	2 isolated, ±100 VDC, 300 rnA		
DOUTs per Mainframe	12 isolated, ±100 VDC, 300 rnA		
Calibration	Closed cover, all adjustments are done in software and stored in on-board flash memory		
Dimensions (HxWxD)	8 3/4 x 19 x 22"/222 x 483 x 559mm 86lbs/39kg (fully loaded)		

R = Range, S = Set Point, Rdg = Readings • Specifications apply at 25°± 5° C after a 10 minute warm up & are subject to change without notice. Accuracies apply when settings and/or measurements >10% of R

Model 4312 & 4350 Panel Overview



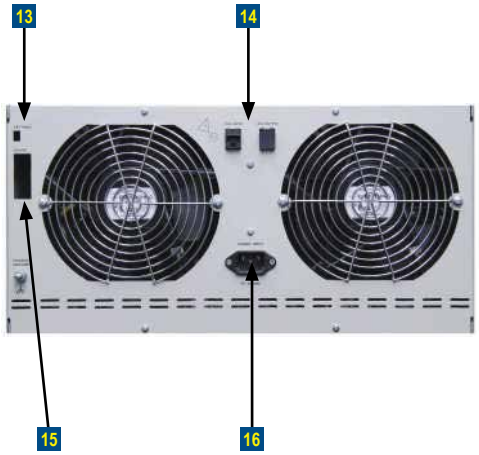


Fig. 6 *- Front panel (300W load) & Front panel control*

Fig. 7 *- Mainframe rear panel*

1 Load Status Indicator
2 DINS/DOUTS
3 Current Control
4 OVPS
5 Volt Sense
6 Load Power
7 Status Indicator
8 Test Status
9 Test Control
10 Display Connection
11 Remote Connection
12 Power Switch
13 Settings
14 LAN Connection
15 DOUTS
16 Power Input

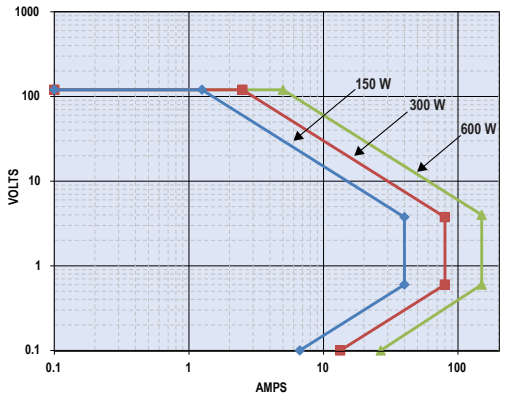


Fig. 8 *- Constant Power operating envelope (4312)*

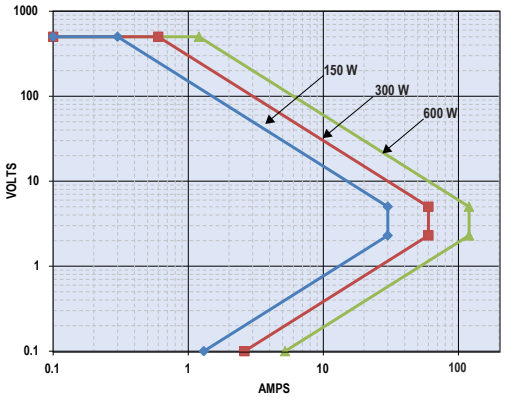


Fig. 9 *- Constant Power operating envelope (4350)*

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