Modular DC Electronic Loads

MODEL 4350 DIGITIZING DC LOADS

- ❑ 2400 Watt, 16-slot full-rack mainframe
- ❑ 150/300/600W-500V load modules
- ❑ Three voltage and current ranges
- ❑ Front connected and front loading
- ❑ 2 isolated channels of 1MS/s digitizing capability with 16-bit precision per load
- ❑ 2 isolated digital inputs per load
- ❑ 20 MHz peak-peak noise measurement per load
- ❑ Supports both multi-output and multi-UUT parallel testing strategies
- ❑ MPPT Mode for solar panels
- ❑ LED driver test with precise V-I curves
- ❑ PC/LAN control with LabVIEW and other IVI-compliant languages

Model 4350 with 150, 300 & 600 W loads

A COMPLETE TESTER WITHIN EACH LOAD

The Model 4350 Digitizing DC load combines an advanced electronic load with the latest digitizing circuits that record both voltage and current waveforms. Once digitized, that information can be quickly processed to calculate an exceptionally wide range of precision measurements. This technique typically eliminates separate, single-function measurement instruments such as a DMM, DSO, MUX and related cabling. In addition to greatly simplifying tester design, the tester-per-load functionality provides simultaneous testing on all loads, thereby significantly improving test speed and tester throughput.

CONFIGURATION FLEXIBILITY

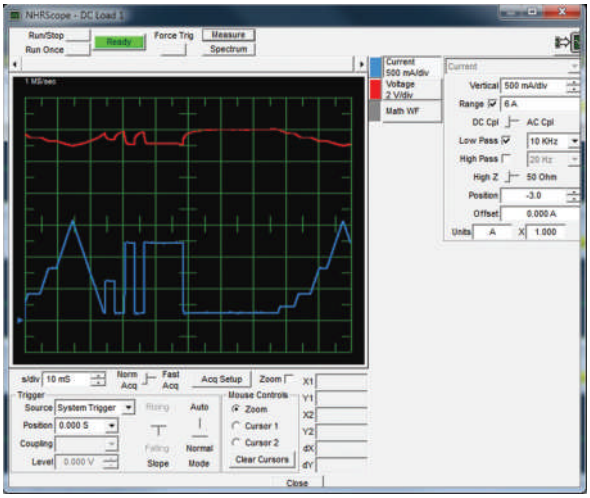
The 4300 16-slot mainframe and 4350 loads with three power levels lead the industry in configuration flexibility with 25 different combinations that can be created. Even more configuration flexibility can be gained through software combining like-loads to operate as a single virtual load. As an example, 4 of the 600 W loads can be software paralleled to behave as a virtual 2400 W load. These capabilities yield an almost limitless arrangement of load combinations ranging from sixteen 150-W modules to a single virtual 2400-W load. If test requirements dictate even higher power levels, additional mainframes or the NH Research Model 4700/4760 high-power loads can be integrated seamlessly into a complete loading test solution.

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			

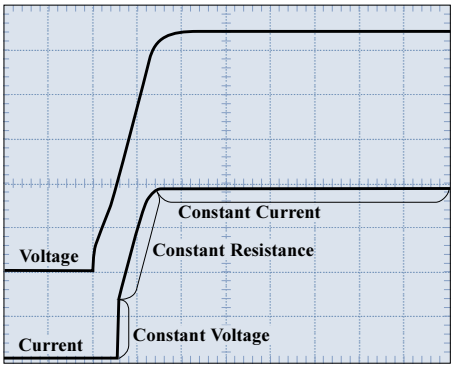
5 of the 25 possible load configurations

COMPREHENSIVE MEASUREMENTS

Each 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 and recording interface. Waveform transient measurements once only performed in the engineering laboratory are now executed at speeds that invite incorporation into production testing.



Model 4350 Power Scope



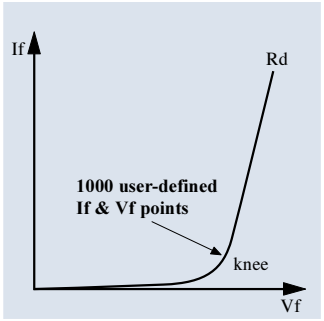
Power supply turn-on voltage & current waveforms in Auto Mode

AUTO-MODE

The Auto-Mode feature provides the capability to more accurately set the load to what the UUT will actually see at turn on. In fact, many UUTs will not turn on into a CC load. By using Auto-Mode, the user can create a minimum voltage that the UUT must achieve before the load starts drawing any current, then it will transition into a CR mode while the voltage rises, and then finally into the CC mode. This simultaneous programmability of modes prevents an accidental over-power condition that could damage the UUT.

LED DRIVER TEST

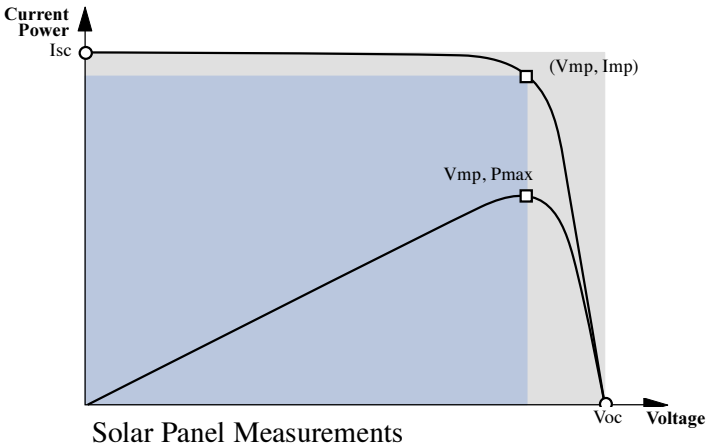
An advanced feature of the 4350 Loads is the user-defined Non-Linear LED Emulation Mode. Through this application, a precise V-I relationship, including knee, is created by the user to authentically emulate the LED. These V-I curves can be stored in memory and then called by the test program when needed.



Non-linear LED Mode

SOLAR PANEL TEST WITH MPPT MODE

The 4350 Load is capable of testing solar panels by emulating an inverter or other charge controller through a special Maximum Power Point Tracking (MPPT) Mode. In this mode, as the voltage of the panel changes, the load changes the current drawn in order to maximize power transfer. In addition to the MPPT, the load will provide data for an Excel calculation and plotting of Isc, Voc, Vmp, Imp, Pmax and FF.



Solar Panel Measurements

NEW MULTI-UUT PARALLEL TEST STRATEGY SUPPORT

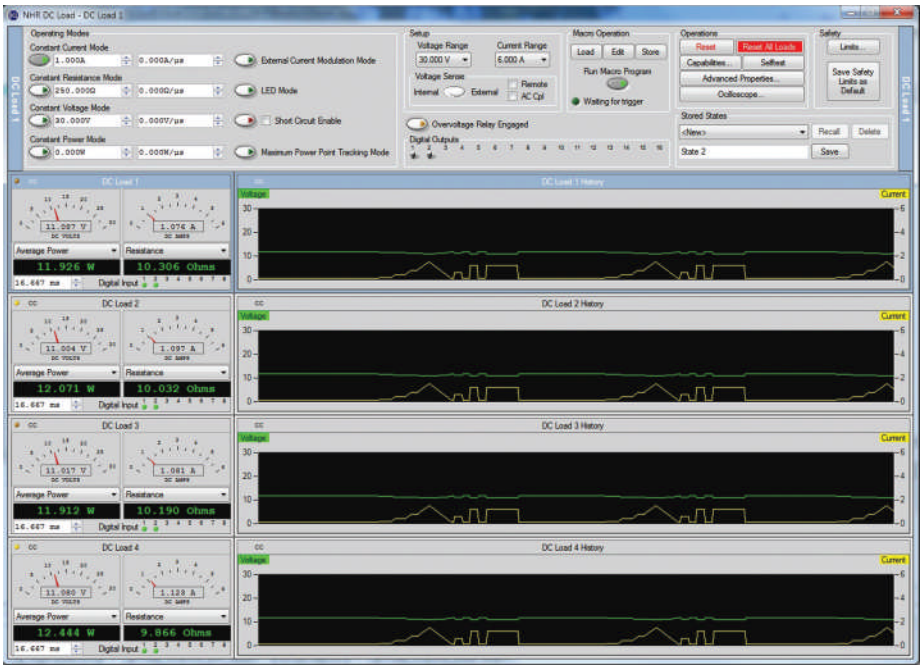
The simultaneous testing of multiple UUTs such as chargers, adapters, and other high-volume, consumer power electronic devices is now a competitive reality. In fact, leading manufacturers have moved from 4 or 8 to 16 UUTs tested simultaneously. Having all the measurement capability within each load now 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. This sequence may be synchronized to other load modules for parallel operation and may also be run in a single burst or continuous mode.

21ST CENTURY GRAPHIC USER INTERFACE

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 NHR load models would also integrate into this single soft panel.



PC CONTROL

The Model 4350 Load can be used within the NHR 5600, 5700 and S450 Automated Functional Test Systems that include the emPower™ Test Executive. The load 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.

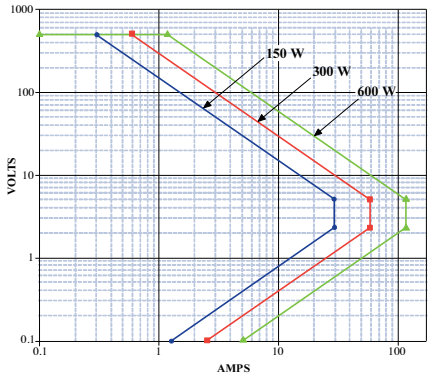
FRONT CONNECTED AND FRONT LOADING

The Model 4350 has 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 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.

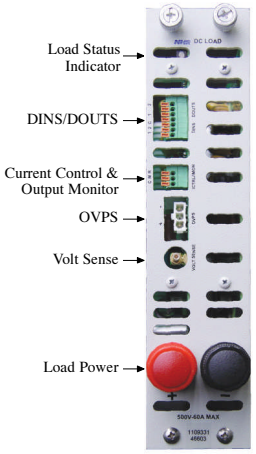
MODEL 4350 DIGITIZING DC ELECTRONIC LOAD SPECIFICATIONS

OVERVIEW			
Power	150 W	300 W	600 W
Slots (16 per Mainframe)	1	2	4
Maximum Current	30 A	60 A	120 A
Maximum Voltage	500 V	500 V	500 V
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 and Time		
PROGRAMMABLE FEATURES			
Constant Current Mode			
Ranges	0 - 0.66, 3.0, 30 A	0 - 0.66, 6.0, 60 A	0 - 0.66, 12, 120 A
Accuracy (Set)	0.06% S + 0.06% R	0.06% S + 0.06% R	0.06% S + 0.06% R
Resolution	0.0015% R	0.0015% R	0.0015% R
Constant Voltage Mode			
Ranges	0 - 30, 120, 500 V	0 - 30, 120, 500 V	0 - 30, 120, 500 V
Accuracy	0.05% S + 0.05% R	0.05% S + 0.05% R	0.05% S + 0.05% R
Resolution	0.0015% R	0.0015% R	0.0015% R
Constant Power Mode			
Range	0 - 40, 200 W	0 - 40, 400 W	0-40, 800 W
Accuracy	0.05% S + 0.05% R	0.05% S + 0.05% R	0.05% S + 0.05% R
Resolution	0.0015% R	0.0015% R	0.0015% R
Constant Resistance			
Range	150 mΩ - 35 kΩ	75 mΩ - 17 kΩ	38 mΩ - 8.7 kΩ
Accuracy (V & I > 10% R)	2 % S	2 % S	2 % S
Auto Mode	Any combination of the above 4 Modes		
LED Driver Mode	Creates V-I curves that emulate specific LEDs		
Solar PV Panel with MPPT	Emulates inverter or other charge controller with MPPT		
Mode Slew Rate			
Range	0 - 0.66, 3.0, 30 A	0 - 0.66, 6, 60 A	0 - 0.66, 12, 120 A
Maximum	0.066, 0.3, 6 A/µS	0.066, 0.6, 12 A/µS	0.066, 1.2, 24 A/µS
Rise & Fall Time			
Range	10 µS to 60 S	10 µS to 60 S	10 µS to 60 S
Accuracy	1 % ±10 µS	1 % ±10 µS	1 % ±10 µS
Resolution	<10 µS	<10 µS	<10 µS
Short Circuit			
Current	30 - 45 A	60 - 90 A	120 - 180 A
Resistance	75 mΩ	38 mΩ	19 mΩ
Macro			
Modes	Any combination of CC, CV, CR, CP and Slew		
Repetition	Single Burst or Continuous		
Settings	1000		
Total Period	50 µS - 60 Sec		
Delay	25 µS - 60 Sec		
Resolution	10 µS		
Accuracy	1% +/- 10 µS		
Triggering	System Trigger		
MEASUREMENT INSTRUMENTATION			
Current			
Range (±)	0 - 0.66, 3.0, 30 A	0 - 0.66, 6.0, 60 A	0 - 0.66, 12, 120 A
Accuracy	0.05% Rdg + 0.05% R	0.05% Rdg + 0.05% R	0.05% Rdg + 0.05% R
Resolution	0.0015% R	0.0015% R	0.0015% R
DC Voltage			
Range (±)	0 - 30, 120, 600 V	0 - 30, 120, 600 V	0 - 30, 120, 600 V
Frequency	DC - 500 kHZ	DC - 500 kHZ	DC - 500 kHZ
Accuracy	0.02% Rdg + 0.04% R	0.02% Rdg + 0.04% R	0.02% Rdg + 0.04% R
Resolution	0.003% R	0.003% R	0.003% R
Waveform			
Bandwidth			
Voltage	DC - 500 kHZ		
Current	DC - 100 kHZ		
Accuracy			
Analog	1% R		
Time	(1/sample rate) +0.05 % Rdg		
Digitizing Rate	1 MS/s		
Record Length	256K points		
Trigger	System Trigger, DINS, Voltage		
Power			
Range	IR x VR	IR x VR	IR x VR
Accuracy	I Accuracy + V Accuracy	I Accuracy + V 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	I Accuracy + V Accuracy	I Accuracy + V Accuracy
Resolution	0.0015% R	0.0015% R	0.0015% R
High Frequency Pk-Pk Noise			
Range	0 - 0.25, 2.5 VAC		
Bandwidth	10 Hz - 20 MHz		
Accuracy	3% R @1 MHz		
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
SYSTEM CONTROL			
Communications	LAN (Ethernet), 100BaseT RJ45 8 pin connector		
Drivers	LabVIEW, IVI-COM, IVI-C		
Logic-level Input Signals	Reset, Trigger, Start, Stop, Interlock		
Open-Collector Output Signals	Trigger, Start, Stop, Pass, Fail, Ready, DC Present		
SAFETY			
Load Protection	Over-voltage, over-current, over-power, over-temperature, reverse voltage		
UUT Protection	Over-voltage, under-voltage, over-current, over-power, loss of communication shutdown		
Isolation	±1000 VDC from AC power input to load or chassis ground, ±600 VDC from load to chassis ground		
Self Test	Power-up test of input, output, control and protection mechanisms		
Watchdog	Continuous performance monitoring for measurement ambiguities, over/under-current ranges, and heat sink temperature limits		
PHYSICAL			
Mainframe Size	Height: 8 3/4" (222 mm), Width: 19" (483 mm), Depth: 22" (559 mm)		
Weight	86 lbs (39 kg) fully loaded		
Operating Temperature	0 - 35° C at full power and 100% duty cycle		
Input Power	90 - 264 VAC , 47 - 63 Hz		
ADDITIONAL FEATURES			
Over-Voltage Power Supply	Programmable power supply to test UUT for over-voltage protection, relay connected and 5 A limited		
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		
Digital Inputs (DINs) per Load	2 isolated, logic level		
Digital Outputs (DOUTs) per Load	2 isolated, ±100 VDC, 300 mA		
Digital Outputs per Mainframe	12 isolated, ±100 VDC, 300 mA		
Calibration	Closed cover, all adjustments are done in soaftware and stored in on-board flash memory		

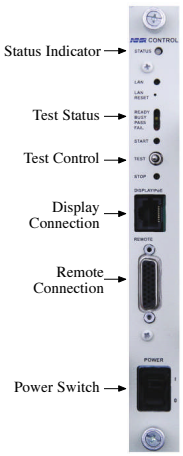
R = Range, S = Set Point, Rdg = Readings • Specifications apply at 25°± 5° C after a 10 minute warm up and are subject to change without notice.
Accuracies apply when settings and/or measurements >10% of Range



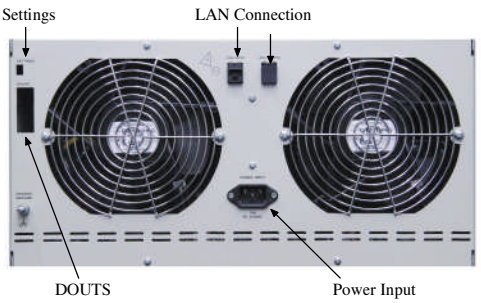
Constant Power Operating Envelopes



300 W Load Front Panel



Control Front Panel



Mainframe Rear Panel

NH Research, Incorporated • 16601 Hale Avenue, Irvine, California 92606 • Tel: 949-474-3900 • Fax: 949-474-7062 • E-mail: sales@nhresearch.com