





AC & DC Electronic Load Product Selector Guide




Modular DC Electronic Load With Built-In Measurements

	Model	Voltage	Current	Power
	4312	0.6 - 120V	40, 80, & 150A	150, 300, & 600W
	4350	2.3 - 500V	30, 60, & 120A	150, 300, & 600W


High Performance DC Electronic Load

	Model	Voltage	Current	Power
	4700	1.0 - 120V	200 - 7200A	1kW - 36kW
	4760	7.0 - 600V	50 - 1800A	1kW - 36kW


Programmable AC Electronic Load

	Model	Voltage	Current	Power
	4600	50 - 350VAC	30 - 180A	3kW - 36kW

Regenerative, Bi-Directional DC Source/Load

	Model	Voltage	Current	Power
	9210	40, 120 & 600V	Up to 600A	12kW
	9200	40, 120 & 600V	Up to 7200A	12kW-144kW

AC & DC Regenerative

	Model	Voltage	Current	Power
	9410	155 - 400V	Up to 800A	12kW - 96kW

4312 Series Modular 120V DC Electronic Load

NHR
NH Research, Inc.

Digitizing DC Load with Built-In Measurements

Features

- 3 Models - 150W, 300W, 600W
- 3 Voltage ranges - 6, 30, & 120V
- 3 Current ranges
- High-resolution waveform capture up to 1M Sample/Sec
- Precision voltage, current, power, & timing measurements
- Constant Loads - CV, CC, CP, CR, & in combination
- Dynamic Loading - 1000 settings
- Advanced Loading - LED, MPPT, & XY loading
- Easy-to-use PC softpanel
- Ethernet (LAN)

Advantages

- Modular load maximizes configuration flexibility
- Simplifies automated test stand development
 - Triggerable set & measurement
 - Short circuit mode & over voltage relay
 - Isolated digital inputs & outputs
 - Built-in SW watchdog & safety limits
- Software tools to shorten test development time
 - PC-based Softpanel GUI with scope display (Fig. 1)
 - Supplied LabVIEW & IVC/IVI-COM drivers
 - Optional: DC Load, **emPower**[®] or Enerchron[®] test sequencer

Benefits

- Modular - up to 16 loads or combinations in single chassis
- Built in features require fewer test devices
- Front connections simplify wiring
- Safety limits protect UUT

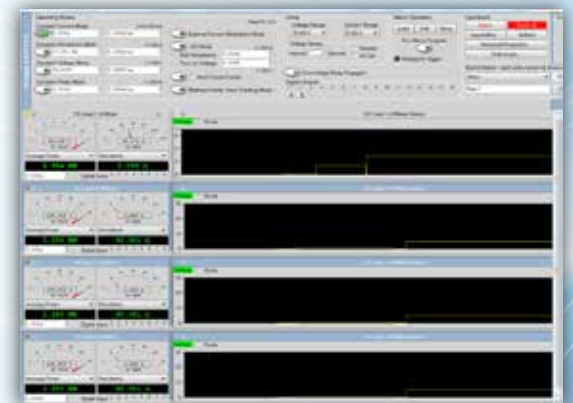


Figure 1 - DC panel graphical user interface

Model 4312 Modular 120V DC Electronic Load Specifications

Overview				(continued)			
Power	150 W	300 W	600 W	Power	IR x VR	IR x VR	IR x VR
Slots (16 per Mainframe)	1	2	4	Range	I Accuracy + V Accuracy		
Maximum Current	40A	80A	150A	Accuracy	0.0015% R	0.0015% R	0.0015% R
Maximum Voltage	120V	120V	120V	Resolution			
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			Resistance	0 - Inf	0 - Inf	0 - Inf
Other Measurements	Average Power, Peak Power, Resistance, Trigger-In Time, DIN State & Time			Range	I Accuracy + V Accuracy		
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			Accuracy	0.0015% R	0.0015% R	0.0015% R
Measurement Instrumentation				Resolution			
Current				High-Frequency PK-PK Noise			
Range (±)	0 - 0.8, 4, 40A	0 - 0.8, 8, 80A	0 - 0.8, 16, 150A	Range	0 - 0.25, 2.5VAC		
Accuracy	0.05% Rdg + 0.05% R	0.05% Rdg + 0.05% R	0.05% Rdg + 0.05% R	Bandwidth	10 Hz - 20MHz		
Resolution	0.0015% R	0.0015% R	0.0015% R	Accuracy	3% R @ 1 MHz		
DC Voltage				Resolution	0.0015% R		
Range (±)	0 - 6, 30, 120V	0 - 6, 30, 120V	0 - 6, 30, 120V	DIN Timing			
Accuracy	0.02% Rdg + 0.04% R			Range	100µS to 168 hours	100µS to 168 hours	100µS to 168 hours
Resolution	0.003% R			Accuracy	0.05% Rdg ± 100 µS	0.05% Rdg ± 100 µS	0.05% Rdg ± 100 µS
Waveform				Resolution	100 nano S	100 nano S	100 nano S
Bandwidth				Additional Features			
Voltage	DC - 500kHz			OVPS Relay	Connects programmable power supply to test UUT for over-voltage protection, relay connected and 5 A limited (Relay only)		
Current	DC - 100kHz			External Analog Input	0 - 10V signal input to modulate current		
Accuracy				External Current Monitor	0 - 10V output signal corresponding to 100% of Range Current		
Analog	1% R			Digital Inputs (DINs) per Load	2 isolated, logic level		
Time	(1/sample rate) + 0.05 % Rdg			Digital Outputs (DOUTs) per load	2 isolated, ±100VDC, 300mA		
Digitizing Rate	1 MS/s			Digital Outputs per Mainframe	12 isolated, ±100VDC, 300mA		
Record Length	256K points			Calibration	Closed cover, all adjustments are done in software and stored in on-board flash memory		
Trigger	System Trigger, DINS, Voltage						

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 Panel Overview

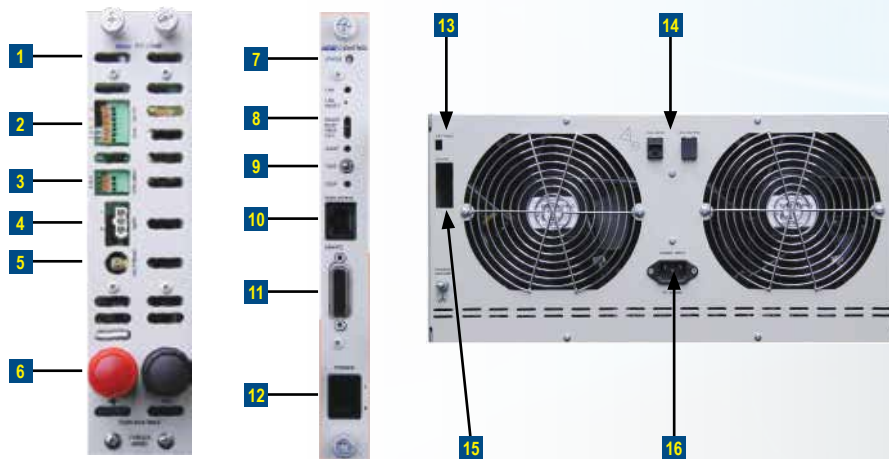


Fig. 1 - Front panel (300 W load) & Front panel control

Fig. 2 - Mainframe rear panel

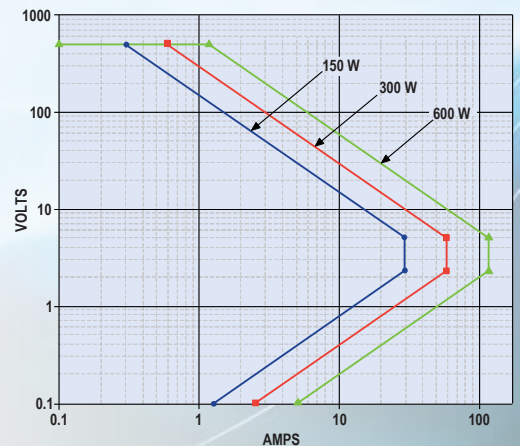


Fig. 3 - Constant Power operating envelope

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

4350 Series Modular 500V DC Electronic Load

NHR
NH Research, Inc.

Digitizing DC Load with Built-In Measurements

Features

- 3 Models - 150W, 300W, 600W
- 3 Voltage ranges - 30, 120, & 500V
- 3 Current ranges
- High-resolution waveform capture up to 1 M Sample/Sec
- Precision voltage, current, power, & timing measurements
- Constant Loads - CV, CC, CP, CR, & in combination
- Dynamic Loading - 1000 settings
- Advanced Loading - LED, MPPT, & XY loading
- Easy-to-use PC softpanel
- Ethernet (LAN)

Advantages

- Modular load maximizes configuration flexibility
- Simplifies automated test stand development
 - Triggerable set & measurement
 - Short circuit mode & over voltage relay
 - Isolated digital inputs & outputs
 - Built-in SW watchdog & safety limits
- Software tools to shorten test development time
 - PC-based Softpanel GUI with scope display (Fig. 1)
 - Supplied LabVIEW & IVI-C/IVI-COM drivers
 - Optional: DC Load, emPower or Enerchron test sequencer

Benefits

- Modular - up to 16 loads or combinations in single chassis
- Built in features require fewer test devices
- Front connections simplify wiring
- Safety limits protect UUT



Figure 1 - DC panel graphical user interface

Model 4350 Digitizing DC Electronic Load Specifications

Overview				(continued)			
Power	150 W	300 W	600 W	Power	IR x VR	IR x VR	IR x VR
Slots (16 per Mainframe)	1	2	4	Range	I Accuracy + V Accuracy		
Maximum Current	30 A	60 A	120 A	Accuracy	0.0015% R	0.0015% R	0.0015% R
Maximum Voltage	500 V	500 V	500 V	Resolution			
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			Resistance	0 - Inf	0 - Inf	0 - Inf
Other Measurements	Average Power, Peak Power, Resistance, Trigger-In Time, DIN State & Time			Range	I Accuracy + V Accuracy		
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			Accuracy	0.0015% R	0.0015% R	0.0015% R
Measurement Instrumentation				Resolution			
Current				High-Frequency PK-PK Noise			
Range (±)	0 - 0.66, 3.0, 30 A	0 - 0.66, 6.0, 60 A	0 - 0.66, 12, 120 A	Range	0 - 0.25, 2.5 VAC		
Accuracy	0.05% Rdg + 0.05% R	0.05% Rdg + 0.05% R	0.05% Rdg + 0.05% R	Bandwidth	10 Hz - 20 MHz		
Resolution	0.0015% R	0.0015% R	0.0015% R	Accuracy	3% R @ 1 MHz		
DC Voltage				Resolution	0.0015% R		
Range (±)	0 - 30, 120, 600 V	0 - 30, 120, 600 V	0 - 30, 120, 600 V	DIN Timing			
Frequency	DC - 500 KHZ	DC - 500 KHZ	DC - 500 KHZ	Range	100µS to 168 hours	100µS to 168 hours	100µS to 168 hours
Accuracy	0.02% Rdg + 0.04% R			Accuracy	0.05% Rdg ± 100 µS	0.05% Rdg ± 100 µS	0.05% Rdg ± 100 µS
Resolution	0.003% R	0.003% R	0.003% R	Resolution	100 nano S	100 nano S	100 nano S
Waveform				Additional Features			
Bandwidth				OVPS Relay	Connects programmable power supply to test UUT for over-voltage protection, relay connected and 5 A limited (Relay only)		
Voltage	DC - 500 KHZ			External Analog Input	0 - 10 V signal input to modulate current		
Current	DC - 100 KHZ			External Current Monitor	0 - 10 V output signal corresponding to 100% of Range Current		
Accuracy				Digital Inputs (DINS) per Load	2 isolated, logic level		
Analog	1% R			Digital Outputs (DOUTS) per load	2 isolated, ±100 VDC, 300 mA		
Time	(1/sample rate) + 0.05 % Rdg			Digital Outputs per Mainframe	12 isolated, ±100 VDC, 300 mA		
Digitizing Rate	1 MS/s			Calibration	Closed cover, all adjustments are done in software and stored in on-board flash memory		
Record Length	256K points						
Trigger	System Trigger, DINS, Voltage						

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 4350 Panel Overview

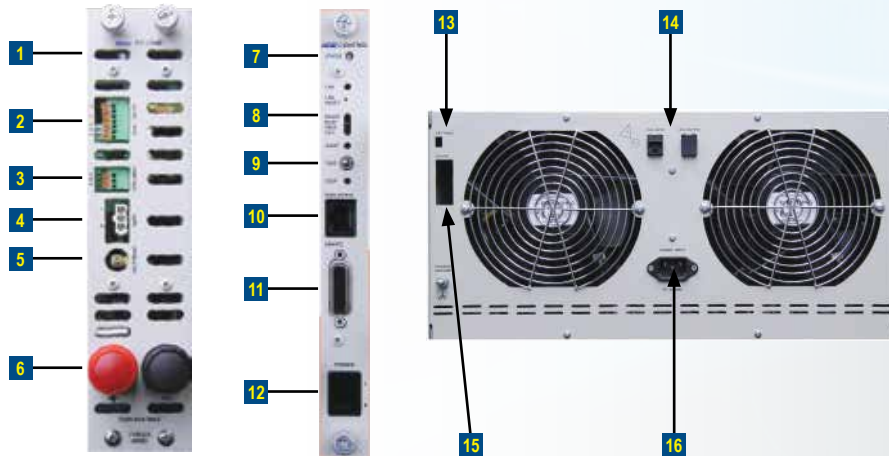


Fig. 1 - Front panel (300 W load) & Front panel control

Fig. 2 - Mainframe rear panel

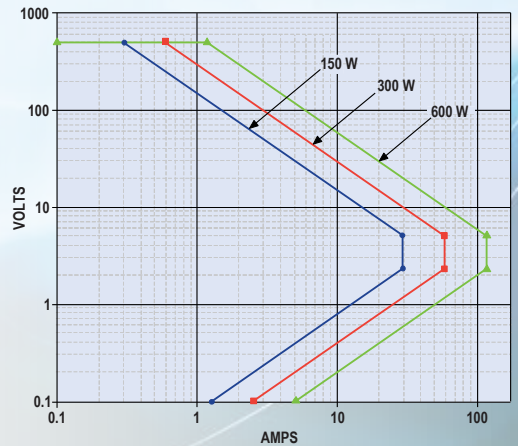


Fig. 3 - Constant Power operating envelope

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

4600 Series Programmable AC Electronic Load

NHR
NH Research, Inc.

Linear & Non-Linear AC Loading

Features

- 10 Models - 3kW to 36kW
- Operating frequency - 45 to 440Hz
- Waveform capture up to 100k Sample/Sec
- Precision AC power measurement system
- Constant Loads - CV, CC, CP, or CR
- Dynamic Loading - 100 per-cycle settings
- User definable current waveshape
- Easy-to-use PC softpanel
- Serial (RS-232) & Ethernet (LAN)

Advantages

- Field-proven reliability
- Simplifies automated test stand development
 - Triggerable set & measurement
 - True short circuit mode
 - Built-in SW watchdog
- Software tools to shorten test development time
 - PC-based Softpanel GUI with scope display (Fig. 1)
 - Supplied LabVIEW & IVI-C/IVI-COM drivers
 - Optional: AC Load or *emPower*[®] test sequencers

Benefits

- Field upgradeable (3kW/ ϕ steps)
- Built in features reduce cost & simplifies setup
 - Requires fewer additional test devices
 - Fewer devices simplifies test stand wiring
- Sizable for 1 ϕ & 3 ϕ Configurations

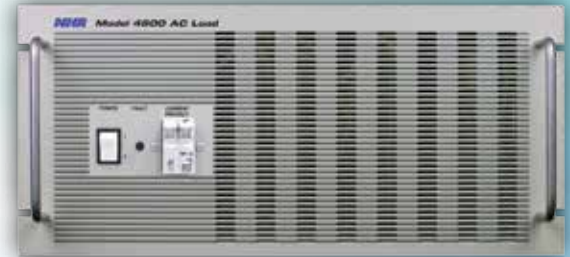


Figure 1 - AC Load graphical user interface

4600 Series Programmable AC Electronic Load Specifications¹

4600 Ratings	4600-3	4600-6	4600-12	4600-18	4600-24	4600-36 ²	Control
Power	3 kW	6 kW	12 kW	18 kW	24 kW	36 kW	User Interface
Maximum Current ³	30 A	60 A	120 A	180 A	240 A	360 A	PC
Voltage Range ³	50 - 350 V	50 - 350 V	50 - 350 V	50 - 350 V	50 - 350 V	50 - 350 V	OS
Programmable Modes							Test Executive
Constant Current							Communications
Range (RMS)	0 - 30 A	0 - 60 A	0 - 120 A	0 - 180 A	0 - 240 A	0 - 360 A	Drivers
Accuracy	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	Additional Features
Resolution	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	3-Phase Operation
Constant Voltage							Remote Voltage Sense
Range	50 - 350 V	50 - 350 V	50 - 350 V	50 - 350 V	50 - 350 V	50 - 350 V	Self Test
Accuracy	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	Performance Monitoring
Resolution	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	Calibration
Constant Power							Protection
Range	300 W - 3 kW	600 W - 6 kW	1.2 - 12 kW	1.8 - 18 kW	2.4 - 24 kW	3.6 - 36 kW	Trigger Output
Accuracy	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	Fan Noise Reduction
Resolution	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	Load Connectors
Constant Resistance							Operating Temp.
Ranges	2.5-100, 100-1000Ω	1.25-50, 50-500Ω	0.63-25, 25-250Ω	0.42-17, 17-167Ω	0.31-12.5, 12.5-125Ω	0.2-8.3, 8.3-83Ω	Input Power
Accuracy	1, 5%	1, 5%	1, 5%	1, 5%	1, 5%	1, 5%	
Resolution	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	
Short Circuit							
Max Surge Current	300 A	600 A	1200 A	1800 A	2400 A	3600 A	
A Power Factor							
Range	0 -1, lead/lag	0 -1, lead/lag	0 -1, lead/lag	0 -1, lead/lag	0 -1, lead/lag	0 -1, lead/lag	
Accuracy	1%	1%	1%	1%	1%	1%	
Resolution	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	
Crest Factor							
Range	1.414 - 4	1.414 - 4	1.414 - 4	1.414 - 4	1.414 - 4	1.414 - 4	
Accuracy	1%	1%	1%	1%	1%	1%	
Resolution	0.05%	0.05%	0.05%	0.05%	0.05%	0.05%	
Macros	Queues of up to 100 commands can be run manually or from a triggered event (phase angle, input voltage level, system trigger)						
Custom Waveforms	Full-screen graphical editor provides control of current, voltage, resistance, power, crest factor and power factor						
Measurements							
Current							
Range (RMS)	0 - 30 A	0 - 60 A	0 - 120 A	0 - 180 A	0 - 240 A	0 - 360 A	
Accuracy	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	
Resolution	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	
Peak Current							
Ranges	0 - 90 A	0 - 180 A	0 - 360 A	0 - 540 A	0 - 720 A	0 - 1080 A	
Accuracy	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	
Resolution	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	
Voltage							
Ranges	50 - 350 V	50 - 350 V	50 - 350 V	50 - 350 V	50 - 350 V	50 - 350 V	
Accuracy	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	
Resolution	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	
Peak Voltage							
Ranges	50 - 500 V	50 - 500 V	50 - 500 V	50 - 500 V	50 - 500 V	50 - 500 V	
Accuracy	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	
Resolution	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	
Frequency							
Range	45 - 440 Hz	45 - 440 Hz	45 - 440 Hz	45 - 440 Hz	45 - 440 Hz	45 - 440 Hz	
Accuracy	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	
Resolution	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	
True Power							
Range	0 - 10.5 kW	0 - 21 kW	0 - 42 kW	0 - 63 kW	0 - 84 kVA	0 - 126 kVA	
Accuracy (R+FS) ⁴	0.2% + 0.03%	0.2% + 0.03%	0.2% + 0.03%	0.2% + 0.03%	0.2% + 0.03%	0.2% + 0.03%	
Resolution	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	
Apparent Power							
Range	0 - 10.5 kVA	0 - 21 kVA	0 - 42 kVA	0 - 63 kVA	0 - 84 kVA	0 - 126 kVA	
Accuracy	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	
Resolution	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	
Reactive Power							
Range	0 - 10.5 kVA	0 - 21 kVA	0 - 42 kVA	0 - 63 kVA	0 - 84 kVA	0 - 126 kVA	
Accuracy	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	
Resolution	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	
Peak Power							
Range	0 - 45 kW	0 - 90 kW	0 - 180 kW	0 - 270 kW	0 - 360 kW	0 - 540 kW	
Accuracy	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	
Resolution	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	
Resistance							
Range	2.5-100, 100-1000Ω	1.25-50, 50-500Ω	0.63-25, 25-250Ω	0.42-17, 17-167Ω	0.31-12.5, 12.5-125Ω	0.2-8.3, 8.3-83Ω	
Accuracy	1%, 5%	1%, 5%	1%, 5%	1%, 5%	1%, 5%	1%, 5%	
Resolution	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	
Crest Factor							
Range	1.414 - 4	1.414 - 4	1.414 - 4	1.414 - 4	1.414 - 4	1.414 - 4	
Accuracy	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	
Resolution	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	
Power Factor							
Range	0 -1, lead/lag	0 -1, lead/lag	0 -1, lead/lag	0 -1, lead/lag	0 -1, lead/lag	0 -1, lead/lag	
Accuracy	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	
Resolution	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	
Waveform Display	Continuously updated, graphical display of a full cycle of current, voltage and/or power waveforms						
Physical							
Enclosure	Chassis	Chassis (2)	Cabinet	Cabinet	Cabinet, 2-Bay	Cabinet, 2-Bay	
Dimensions	8½ x 19 x 23 in	17½ x 19 x 25 in	57 x 23 x 30 in	72 x 23 x 30 in	57 x 46 x 30 in	72 x 46 x 30 in	
Weight	77 lbs/35 kg	154 lbs/70 kg	440 lbs/200 kg	650 lbs/295 kg	860 lbs/391 kg	1250 lbs/568 kg	

¹ Specifications apply at 23° +/- 5° C after a 10 minute warm up and are subject to change without notice. All Accuracies and Resolutions are % of full scale

² Higher power and custom configurations available

³ Accuracies apply when Settings and/or Measurements >10% of Range

⁴R+FS = Range + Full Scale



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4700 Series High Performance 120V DC Load

NHR
NH Research, Inc.

High Current DC Electronic Load

Features

- 8 Models - 1kW to 36kW
- 4 Voltage ranges - 6.6, 20, 66, & 120V
- 2 Current ranges
- High accuracy 1kW low power range
- Waveform capture up to 100k Sample/Sec
- Precision voltage, current, power, & timing measurements
- Constant Loads - CV, CC, CP, CR, & in combination
- Dynamic Loading - 100 settings
- Built-in touch-panel user interface
- Ethernet (LAN)

Advantages

- Field-proven reliability
- Simplifies automated test stand development
 - Triggerable set & measurement
 - True short circuit mode & over voltage relay
 - Digital inputs & outputs
 - Built-in SW watchdog & safety limits
- Software tools to shorten test development time
 - PC-based Softpanel GUI with scope display
 - Supplied LabVIEW & IVI-C/IVI-COM drivers
 - Optional: DC Load, emPower®, or Enerchron® test sequencer

Benefits

- Field upgradeable (6kW steps)
- Built in features require fewer test devices
- Safety limits protect UUT



4700-6 Series 6kW model



4700 Series High Performance 120V DC Load Specifications¹

4700 Models	4700-1-TP	4700-2-TP	4700-3-TP	4700-6-TP	4700-12-TP	4700-18-TP	4700-24-TP	4700-36-TP
Power	1 kW	2 kW	3 kW	6 kW	12 kW	18 kW	24 kW	36 kW
Maximum Current ²	200 A	400 A	600 A	1200 A	2400 A	3600 A	4800 A	7200 A
Voltage Range ³	1-120 V	1-120 V	1-120 V	1-120 V	1-120 V	1-120 V	1-120 V	1-120 V
Programmable Modes	Accuracies: % of Set + % of Range, Resolution: % of Range							
Constant Current								
Ranges ⁴	20, 200 A	40, 400 A	60, 600 A	120, 1200 A	240, 1200 A	360, 3600 A	480, 4800 A	720, 7200 A
Accuracy	0.12%+0.08%	0.12%+0.08%	0.12%+0.08%	0.12%+0.08%	0.12%+0.08%	0.12%+0.08%	0.12%+0.08%	0.12%+0.08%
Resolution	0.025%	0.025%	0.025%	0.025%	0.025%	0.025%	0.025%	0.025%
Constant Voltage								
Ranges	6.6, 20, 66,120 V	6.6, 20, 66,120 V	6.6, 20, 66,120 V	6.6, 20, 66,120 V	6.6, 20, 66,120 V	6.6, 20, 66,120 V	6.6, 20, 66,120 V	6.6, 20, 66,120 V
Accuracy	0.05%+0.05%	0.05%+0.05%	0.05%+0.05%	0.05%+0.05%	0.05%+0.05%	0.05%+0.05%	0.05%+0.05%	0.05%+0.05%
Resolution	0.025%	0.025%	0.025%	0.025%	0.025%	0.025%	0.025%	0.025%
Constant Power								
Range	0 - 1 kW	0 - 2 kW	0 - 3 kW	0 - 6 kW	0 - 12 kW	0 - 18 kW	0 - 24 kW	0 - 36 kW
Accuracy	1% + 1%	1% + 1%	1% + 1%	1% + 1%	1% + 1%	1% + 1%	1% + 1%	1% + 1%
Resolution	0.025%	0.025%	0.025%	0.025%	0.025%	0.025%	0.025%	0.025%
Constant Resistance								
Range	5 mΩ - 180 Ω	2.5 mΩ - 90 Ω	1.67 mΩ - 60 Ω	833 μΩ - 30 Ω	417 μΩ - 15 Ω	278 μΩ - 10 Ω	208 μΩ - 7.5 Ω	136 μΩ - 5 Ω
Accuracy ⁵	2%	2%	2%	2%	2%	2%	2%	2%
Slew Rate (10 - 90%)								
Range	1 A/s - 20 A/μs	2 A/s - 40 A/μs	3 A/s - 60 A/μs	6 A/s - 120 A/μs	12 A/s - 240 A/μs	18 A/s - 360 A/μs	24 A/s - 480 A/μs	36 A/s - 720 A/μs
Rise Time	10 μs - 20 s	10 μs - 20 s	10 μs - 20 s	10 μs - 20 s	10 μs - 20 s	10 μs - 20 s	10 μs - 20 s	10 μs - 20 s
Resolution	< 5 μs	< 5 μs	< 5 μs	< 5 μs	< 5 μs	< 5 μs	< 5 μs	< 5 μs
Accuracy	1% +/- 5 μs	1% +/- 5 μs	1% +/- 5 μs	1% +/- 5 μs	1% +/- 5 μs	1% +/- 5 μs	1% +/- 5 μs	1% +/- 5 μs
Short Circuit								
Resistance	50, 5 mΩ	25, 2.5 mΩ	17, 1.7 mΩ	8.3 mΩ - 833 μΩ	4.17 mΩ - 417 μΩ	2.78 mΩ - 278 μΩ	2.08 mΩ - 208 μΩ	1.39 mΩ - 139 μΩ
Current Max	33, 333 A	67, 667 A	60, 608 A	120, 1200 A	240, 2400 A	360, 3600 A	480, 4800 A	720, 7200 A
Macro								
Modes	Any single mode			Delay		20 μs - 20 s		
Repetition	Single burst or continuous			Resolution		10 μs		
Settings	100			Accuracy		1% +/- 5 μs		
Period	40 μs - 20 s							
Measurements	Accuracies: % of Measurement + % of Range, Resolution: % of Range							
Current								
Ranges	20, 200 A	40, 400 A	60, 600 A	120, 1200 A	240, 2400 A	360, 3600 A	480, 4800 A	720, 7200 A
Accuracy	0.12%+0.06%	0.12%+0.06%	0.12%+0.06%	0.12%+0.06%	0.12%+0.06%	0.12%+0.06%	0.12%+0.06%	0.12%+0.06%
Resolution	0.0015%	0.0015%	0.0015%	0.0015%	0.0015%	0.0015%	0.0015%	0.0015%
DC Voltage								
Ranges	6.6, 66, 166 V	6.6, 66, 166 V	6.6, 66, 166 V	6.6, 66, 166 V	6.6, 66, 166 V	6.6, 66, 166 V	6.6, 66, 166 V	6.6, 66, 166 V
Accuracy	0.01%+0.02%	0.01%+0.02%	0.01%+0.02%	0.01%+0.02%	0.01%+0.02%	0.01%+0.02%	0.01%+0.02%	0.01%+0.02%
Resolution	0.0015%	0.0015%	0.0015%	0.0015%	0.0015%	0.0015%	0.0015%	0.0015%
Power								
Ranges	Current Range x Voltage Range							
Accuracy	Current Accuracy + Voltage Accuracy							
Resolution	0.0015% Range							
Waveform Capture								
Bandwidth	25 kHz			Memory		16K Samples		
Accuracy	1%R			Timebase		10 μs - 8 s		
Channels	Voltage, Current or both MUX'd			Triggering		System or External		
Digitizing Rate ⁶	100 - 100K Samples/s							
Waveform Analysis	Voltage, Current, Power, Overshoot, Undershoot, Rise/Fall Time, Turn-On Time, Settling Time, Hold-Up Time, AC RMS, AC+DC RMS							
Control								
User Interface	PC soft panel or manual touch-panel							
PC Required/OS/Drivers	3 GHz μP with 512 MB RAM, SVGA display, 80 GB HD/Windows XP, Vista/ Active X							
Test Executive	NI LabVIEW, emPower™ with integrated datalog/test report support							
Communications	Ethernet (LXI), RS232, NHR RS485							
Physical								
Load Connectors	Bus bars with lugs							
Operating Temperature	0 - 40° C at full power and <75% duty cycle							
Input Power	115/230 ± 10% VAC, 47 - 63 Hz							
Dimensions (HxWxD)	5 1/4 x 19 x 22 in	5 1/4 x 19 x 22 in	10 1/2 x 19 x 22 in	10 1/2 x 19 x 22 in	35 x 23 x 30 in	43 x 23 x 30 in	57 x 23 x 30 in	72 x 23 x 30 in
Weight	40 lbs	50 lbs	75 lbs	100 lbs	250 lbs	400 lbs	570 lbs	815 lbs
Additional Features								
Remote Voltage Sense	2 VDC max drop between sense and load input							
Self Test	Power-up self test of all major functions including status of input, output, control and protection circuits							
Performance Monitoring	Continuous checking of performance parameters and appropriate error messages and/or LED fault indicators when necessary							
Calibration	Closed cover, all adjustments made in software and stored in EEPROM							
Protection	OP, OC, OV, OT, Reverse Voltage and Undervoltage Lockout							
Trigger Output/Input	Synchronizes external device to programmed load step/Synchronizes programmed load step to an external device							
Current Monitor	0 - 10 V external signal appropriate to 100% current for the selected range							
Analog Control	0 - 10 V external signal appropriate to 100% current for the selected range							

¹ Specifications apply at 23° +/- 5° C after a 10 minute warm up.

² Accuracies apply when Settings and/or Measurements >10% of Range.

³ Current linearly reduced between 1 & 0.15 V.

⁴ Models 2 - 36 kW also have a 20 A/1 kW Range with reduced accuracy.

⁵ Set 1000% to 6000% of Range = 10% Accuracy.

⁶ Single channel capture. Simultaneous Voltage and Current captures would have sample rate & memory available.

Ordering Information	Model	kW Rating	Options	Description
DC Load P/N	4700	- 6	- TP	6kW DC Load with standard Touch Panel
	4700	- 6	(blank)	6kW DC Load without Touch Panel



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4760 Series High Performance 600V DC Load

NHR
NH Research, Inc.

High Voltage DC Electronic Load

Features

- 8 Models - 1kW to 36kW
- 3 Voltage ranges - 20, 200, & 600V
- 2 Current ranges
- High accuracy 1kW low power range
- Waveform capture up to 100k Sample/Sec
- Precision voltage, current, power, & timing measurements
- Constant Loads - CV, CC, CP, CR, & in combination
- Dynamic Loading - 100 settings
- Built-in touch-panel user interface
- Ethernet (LAN)

Advantages

- Field-proven reliability
- Simplifies automated test stand development
 - Triggerable set & measurement
 - True short circuit mode & over voltage relay
 - Digital inputs & outputs
 - Built-in SW watchdog & safety limits
- Software tools to shorten test development time
 - PC-based Softpanel GUI with scope display
 - Supplied LabVIEW & IVI-C/IVI-COM drivers
 - Optional: DC Load, *emPower*[®], or Enerchron[®] test sequencer

Benefits

- Field upgradeable (6kW steps)
- Built in features require fewer test devices
- Safety limits protect UUT



4760-6 Series 6kW model



4760 Series High Performance 600V DC Load Specifications¹

4760 Model	4760-1-TP	4760-2-TP	4760-3-TP	4760-6-TP	4760-12-TP	4760-18-TP	4760-24-TP	4760-36-TP
Power	1 kW	2 kW	3 kW	6 kW	12 kW	18 kW	24 kW	36 kW
Maximum Current ²	50 A	100 A	150 A	300 A	600 A	900 A	1200 A	1800 A
Voltage Range ³	7.0 - 600 V	7.0 - 600 V	7.0 - 600 V	7.0 - 600 V	7.0 - 600 V	7.0 - 600 V	7.0 - 600 V	7.0 - 600 V
Programmable Modes	Accuracies: % of Set + % of Range, Resolution: % of Range							
Constant Current								
Ranges ⁴	5, 50 A	10, 100 A	15, 150 A	30, 300 A	60, 600 A	90, 900 A	120, 1200 A	180, 1800 A
Accuracy	0.12%+0.08%	0.12%+0.08%	0.12%+0.08%	0.12%+0.08%	0.12%+0.08%	0.12%+0.08%	0.12%+0.08%	0.12%+0.08%
Resolution	0.025%	0.025%	0.025%	0.025%	0.025%	0.025%	0.025%	0.025%
Constant Voltage								
Ranges	20, 200, 600 V	20, 200, 600 V	20, 200, 600 V	20, 200, 600 V	20, 200, 600 V	20, 200, 600 V	20, 200, 600 V	20, 200, 600 V
Accuracy	0.05%+0.05%	0.05%+0.05%	0.05%+0.05%	0.05%+0.05%	0.05%+0.05%	0.05%+0.05%	0.05%+0.05%	0.05%+0.05%
Resolution	0.025%	0.025%	0.025%	0.025%	0.025%	0.025%	0.025%	0.025%
Constant Power								
Range	0 - 1 kW	0 - 2 kW	0 - 3 kW	0 - 6 kW	0 - 12 kW	0 - 18 kW	0 - 24 kW	0 - 36 kW
Accuracy	1% + 1%	1% + 1%	1% + 1%	1% + 1%	1% + 1%	1% + 1%	1% + 1%	1% + 1%
Resolution	0.025%	0.025%	0.025%	0.025%	0.025%	0.025%	0.025%	0.025%
Constant Resistance								
Range	0.2 - 6000 Ω	0.1 - 3000 Ω	0.06 - 2000 Ω	0.03 - 1000 Ω	0.02 - 500 Ω	0.01 - 333 Ω	0.008 - 250 Ω	0.005 - 167 Ω
Accuracy ⁵	2%	2%	2%	2%	2%	2%	2%	2%
Slew Rate (10 - 90%)								
Range	0 - 5 A/μs	10 - 40 A/μs	0 - 15 A/μs	0 - 30 A/μs	0 - 60 A/μs	0 - 90 A/μs	0 - 120 A/μs	0 - 180 A/μs
Rise Time	10 μs - 20 s	10 μs - 20 s	10 μs - 20 s	10 μs - 20 s	10 μs - 20 s	10 μs - 20 s	10 μs - 20 s	10 μs - 20 s
Resolution	< 5 μs	< 5 μs	< 5 μs	< 5 μs	< 5 μs	< 5 μs	< 5 μs	< 5 μs
Accuracy	1% +/- 5 μs	1% +/- 5 μs	1% +/- 5 μs	1% +/- 5 μs	1% +/- 5 μs	1% +/- 5 μs	1% +/- 5 μs	1% +/- 5 μs
Short Circuit								
Resistance	2.0, 0.2 Ω	1.0, 0.1 Ω	670, 67 mΩ	330, 33 mΩ	167, 17 mΩ	111, 11 mΩ	83, 8.3 Ω	56, 5.6 mΩ
Current Max	8, 80 A	16, 160 A	24, 240 A	48, 480 A	96, 960 A	144, 1440 A	192, 1920 A	290, 2900 A
Macro								
Modes	Any single mode			Delay			20 μs - 20 s	
Repetition	Single burst or continuous			Resolution			10 μs	
Settings	100			Accuracy			1% +/- 5 μs	
Period	40 μs - 20 s							
Measurements	Accuracies: % of Measurement + % of Range, Resolution: % of Range							
Current								
Ranges	5, 50 A	10, 100 A	15, 150 A	120, 1200 A	60, 600 A	90, 900 A	120, 1200 A	180, 1800 A
Accuracy	0.12%+0.06%	0.12%+0.06%	0.12%+0.06%	0.12%+0.06%	0.12%+0.06%	0.12%+0.06%	0.12%+0.06%	0.12%+0.06%
Resolution	0.0015%	0.0015%	0.0015%	0.0015%	0.0015%	0.0015%	0.0015%	0.0015%
DC Voltage								
Ranges	20, 200, 600 V	20, 200, 600 V	20, 200, 600 V	6.6, 66, 166 V	20, 200, 600 V	20, 200, 600 V	20, 200, 600 V	20, 200, 600 V
Accuracy	0.01%+0.02%	0.01%+0.02%	0.01%+0.02%	0.01%+0.02%	0.01%+0.02%	0.01%+0.02%	0.01%+0.02%	0.01%+0.02%
Resolution	0.0015%	0.0015%	0.0015%	0.0015%	0.0015%	0.0015%	0.0015%	0.0015%
Power								
Ranges	Current Range x Voltage Range							
Accuracy	Current Accuracy + Voltage Accuracy							
Resolution	0.0015% Range							
Waveform Capture								
Bandwidth	25 kHz			Memory			16K Samples	
Accuracy	1%R			Timebase			10 μs - 8 s	
Channels	Voltage, Current or both MUX'd			Triggering			System or External	
Digitizing Rate ⁶	100 - 100K Samples/s							
Waveform Analysis	Voltage, Current, Power, Overshoot, Undershoot, Rise/Fall Time, Turn-On Time, Settling Time, Hold-Up Time, AC RMS, AC+DC RMS							
Control								
User Interface	PC soft panel or manual touch-panel							
PC Required/OS/Drivers	3 GHz μP with 512 MB RAM, SVGA display, 80 GB HD/Windows XP, Vista/ Active X							
Test Executive	NI LabVIEW, emPower™ with integrated datalog/test report support							
Communications	Ethernet (LXI), RS232, NHR RS485							
Physical								
Load Connectors	Bus bars with lugs							
Operating Temperature	0 - 40° C at full power and <75% duty cycle							
Input Power	115/230 ± 10% VAC, 47 - 63 Hz							
Dimensions (HxWxD)	5 1/4 x 19 x 22 in	5 1/4 x 19 x 22 in	10 1/2 x 19 x 22 in	10 1/2 x 19 x 22 in	35 x 23 x 30 in	43 x 23 x 30 in	57 x 23 x 30 in	72 x 23 x 30 in
Weight	40 lbs	50 lbs	75 lbs	100 lbs	250 lbs	400 lbs	570 lbs	815 lbs
Additional Features								
Remote Voltage Sense	2 VDC max drop between sense and load input							
Self Test	Power-up self test of all major functions including status of input, output, control and protection circuits							
Performance Monitoring	Continuous checking of performance parameters and appropriate error messages and/or LED fault indicators when necessary							
Calibration	Closed cover, all adjustments made in software and stored in EEPROM							
Protection	OP, OC, OV, OT, Reverse Voltage and Undervoltage Lockout							
Trigger Output/Input	Synchronizes external device to programmed load step/Synchronizes programmed load step to an external device							
Current Monitor	0 - 10 V external signal appropriate to 100% current for the selected range							
Analog Control	0 - 10 V external signal appropriate to 100% current for the selected range							

¹ Specifications apply at 23° +/- 5° C after a 10 minute warm up.
² Accuracies apply when Settings and/or Measurements >10% of Range.
³ Current linearly reduced between 1 & 0.15 V.

⁴ Models 2 - 36 kW also have a 20 A/1 kW Range with reduced accuracy.
⁵ Set 1000% to 6000% of Range = 10% Accuracy.
⁶ Single channel capture. Simultaneous Voltage & Current captures would have sample rate & memory available.

Ordering Information	Model	kW Rating	Options	Description
DC Load P/N	4760	- 6	- TP	6kW DC Load with standard Touch Panel
	4760	- 6	(blank)	6kW DC Load without Touch Panel



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9200 Series Battery Module/Pack Test System

NHR
NH Research, Inc.

Automated Characterization, Cycling, & Emulation of Batteries

Features

- 3 Modular voltage options 40, 120, & 600V
- Parallels with other 9200 & 9210 systems
- High-resolution waveform capture up to 1.2M Sample/Sec
- Precision voltage, current, power, & energy measurements
- Cycle batteries (charge/discharge) & drive cycles
- Fast dynamic patterns - 1000 step sequence
- State of the art battery emulation mode
- Built-in touch-panel user interface
- Ethernet (LAN)

Advantages

- Battery emulation using OCV & series resistance
- Designed for testing & emulating all battery chemistries
 - Automatic energy integration (full & 1/2 cycle)
 - Multiple safety layers to protect UUT
- Software tools to shorten test development time
 - PC-based Softpanel GUI with charting
 - Supplied LabVIEW & IVI-C/IVI-COM drivers
 - Optional: Enerchron® test sequencer

Benefits

- Modular - full function tester per channel design
- Parallels for high power testing (up to 144kW)
- Safely simulate and emulate “Real World” conditions
 - Sub-mS voltage, current, & mode transition times
 - Emulate over/under charged batteries
 - Safely emulate BMS & battery failures
- Flexible configuration (any 3 modules per system)



Model 9200 Battery Module/Pack Test System Specifications

	Model 4904	Model 4912	Model 4960
Functional Capability			
Operating States	Charge (Source), Discharge (Load), Standby, Battery		
Charge/Discharge Modes	Constant-Voltage(CV), Current (CC), Power (CP), Resistance (CR)		
Charging Envelope	0 - 40V, 8kW, 600A	0-120V, 8kW, 200A	0-600V, 8kW, 40A
Discharging Envelope	1 - 40 V, 12 kW, 600 A	4-120 V, 12 kW, 200 A	10-600 V, 12 kW, 40 A
Slew Rate	0.011V/S - 30kV/S, 0.0165A - 600kA/S	0.033V/S - 120kV/S, 0.055A - 200kA/S	0.165V/S - 600kV/S, 0.011A/S-40kA/S
Current Change Time	Less than 5mS		
Current Reverse Time	Less than 10mS		
Parallelability	Synchronous control for up to 12 channels (144kW)		
Macro Test Profiles			
Development Source	Touch-Panel, Import from Excel or User's System Controller		
Maximum Steps	1000		
Minimum Time Delay	50uS		
Maximum Step Delay	1mS - 7 Days		
Programming	Range Accuracy ¹ Res. ¹	Range Accuracy ¹ Res. ¹	Range Accuracy ¹ Res. ¹
Voltage	0-40V 0.1% + 0.1% 0.005%	0-120V 0.1% + 0.1% 0.005%	0-600V 0.1% + 0.1% 0.005%
Current	±600A 0.2% + 0.2% 0.005%	±200A 0.2% + 0.2% 0.005%	±40A 0.2% + 0.2% 0.005%
Power	±8/-12kW 0.4% + 0.4% 0.005%	±8/-12kW 0.4% + 0.4% 0.005%	±8/-12kW 0.4% + 0.4% 0.005%
Resistance	0 - 34Ω 2% 0.005%	0 - 100Ω 2% 0.005%	0 - 500Ω 2% 0.005%
Slew Rate			
Voltage	0.011V/s – 80V/ms	0.033V/s – 240V/ms	0.165V/s – 600V/ms
Current	0.17A/s – 3000A/ms	0.055A/s – 1000A/ms	0.011 A/s – 40A/ms
Resistance	0.01Ω/s – 34Ω/ms	0.028Ω/s – 100Ω/m	0.14Ω/s – 500Ω/ms
Power	2W/s – 8kW/s	2W/s – 8kW/s	2W/s – 8kW/s
Test Measurement (4-Wire)	Range Accuracy ¹ Res. ¹	Range Accuracy ¹ Res. ¹	Range Accuracy ¹ Res. ¹
Voltage, DC Average	0 -40V 0.05% + 0.05% 0.005%	0 -120V 0.05% + 0.05% 0.005%	0 -600V 0.05% + 0.05% 0.005%
Current, DC Average, Amp-Hr	0 - 600A 0.1% + 0.1% 0.005%	0 - 200A 0.1% + 0.1% 0.005%	0 - 40A 0.1% + 0.1% 0.005%
Power, Ah, kWh	± 12kW 0.2% + 0.2% 0.005%	± 12kW 0.2% + 0.2% 0.005%	± 12kW 0.2% + 0.2% 0.005%
Time	1ms - 1Yr 0.1% 0.005%	1ms - 1Yr 0.1% 0.005%	1ms - 1Yr 0.1% 0.005%
Control			
Local User Interface	Touch-Panel with graphic meters and controls plus Macro development/execution screens		
Ext. System Communication	LAN (Ethernet)		
Drivers (Win XP or Win 7)	LabVIEW, IVI-COM, IVI-C		
Analog Current Monitor	0 to +10V charge/0 to -10V discharge		
Analog Voltage Monitor	0 to +10V full scale voltage		
Safety			
Isolation AC Input	1000 V AC to DC Output / 1000 V AC Input to chassis		
Isolation UUT Input	600 V UUT to chassis	1000 V UUT to chassis	1000 V UUT to chassis
Programmable Safety Limits	Over-Voltage (OV) / Under-Voltage (UV), Over-Current (OC), Over-Power (OP)		
Internal Protection	Over/Under-Voltage, Over-Current, Over-Power, Internal Over-Temperature		
Interlocks	External user input, emergency stop, and rear service door		
Watchdog Timer	Continuously monitors control communications		
Physical			
Test Channel Connectors	Buss Bars	Anderson EBC A32	Anderson SBS75X
Cabinet ² Dimensions	72" H x 28" W x 31" D		
Cabinet Weight (3 Channels)	1475 Lbs		
Operating Temperature	0 - 35°C full power		
Input Power ³ per Module	3 Ø, 50 - 60 Hz, 200VAC/30A, 208VAC/30A, 220VAC/29A, 380VAC/17A, 400VAC/16A, or 480VAC/13A		
Calibration	Semi-Automatic , closed cover with standard lab equipment		

¹ All Accuracies are % of Set + % of Range, All Resolutions are % of Range unless otherwise indicated, ² Standard cabinet contains 1,2 or 3 Modules, ³ Input Voltage set at placement of order

Ordering Information

Typical Configurations	9200-4904-36	9200-4912-36-2	9200-4960-36-3	9200-4960-36-4
Number of Test Channels ³ Maximum Test Power	3 @ 12 kW 36 kW	6 @ 12 kW 72 kW	9 @ 12 kW 108 kW	12 @ 12 kW 144 kW
Power Modules Voltage Maximum Current	4904 40 V 1800 A	4912 120 V 1200 A	4960 600 V 360 A	4960 600 V 480 A
Number of Cabinets Floor Space Required Cabinet Height	One 28"W x 31"D 72"	Two 56"W x 31"D 72"	Three 84"W x 31"D 72"	Four 112"W x 31"D 72"
Part Number Construction	9200-4912-36-2 4912 – Power Module Selection 36 – kW per cabinet (1 module = 12 kW, 2 modules = 24 kW, 3 modules = 36 kW) 2 – Number of Cabinets			



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9210 Series Single Channel DC Test System

NHR
NH Research, Inc.

Automated Characterization, Cycling, & Emulation of Batteries

Features

- 3 Modular voltage options 40, 120, & 600V
- Parallels with other 9200 & 9210 systems
- High-resolution waveform capture up to 1.2M Sample/Sec
- Precision voltage, current, power, & energy measurements
- Cycle batteries (charge/discharge) & drive cycles
- Fast dynamic patterns - 1000 step sequence
- State of the art battery emulation mode
- Built-in controller with touch-compatible interface
- Ethernet (LAN)

Advantages

- Battery emulation using OCV & series resistance
- Designed for testing & emulating all battery chemistries
 - Automatic energy integration (full & 1/2 cycle)
 - Multiple safety layers to protect UUT
- Software tools to shorten test development time
 - PC-based Softpanel GUI with charting
 - Supplied LabVIEW & IVI-C/IVI-COM drivers
 - Optional: Enerchron® test sequencer

Benefits

- Modular - full function tester per channel design
- Parallels for high power testing (up to 252kW)
- Safely simulate and emulate “Real World” conditions
 - Sub-mS voltage, current, & mode transition times
 - Emulate over/under charged batteries
 - Safely emulate BMS & battery failures
- Small footprint for easy movement



Model 9210 Individual Power Module Specifications

	Model 9210-4904			Model 9210-4912			Model 9210-4960		
Programming Capability									
Operating States	Charge (Source), Discharge (Load), Standby, Battery								
Charge/Discharge Modes	Constant-Voltage(CV), Current (CC), Power (CP), Resistance (CR)								
Charging Envelope	0 - 40 V, 8 kW, 600 A			0-120 V, 8 kW, 200 A			0-600 V, 8 kW, 40 A		
Discharging Envelope	1 - 40 V, 12 kW, 600 A			4-120 V, 12 kW, 200 A			10-600 V, 12 kW, 40 A		
Programming	Range	Accuracy ¹	Resolution ¹	Range	Accuracy ¹	Resolution ¹	Range	Accuracy ¹	Resolution ¹
Voltage	0-40 V	0.1% + 0.1%	0.005%	0-120 V	0.1% + 0.1%	0.005%	0-600 V	0.1% + 0.1%	0.005%
Current	±600 A	0.2% + 0.2%	0.005%	±200 A	0.2% + 0.2%	0.005%	±40 A	0.2% + 0.2%	0.005%
Power	±8/-12 kW	0.4% + 0.4%	0.005%	±8/-12 kW	0.4% + 0.4%	0.005%	±8/-12 kW	0.4% + 0.4%	0.005%
Resistance	0 - 34 Ω	2%	0.005%	0 - 100 Ω	2%	0.005%	0 - 500 Ω	2%	0.005%
Slew Rate									
Voltage	0.011 V/s – 80 V/ms			0.033 V/s – 240 V/ms			0.165 V/s – 600 V/ms		
Current	0.17 A/s – 3000 A/ms			0.055 A/s – 1000 A/ms			0.011 A/s – 40 A/ms		
Resistance	0.01 Ω/s – 34 Ω/ms			0.028 Ω/s – 100 Ω/m			0.14 Ω/s – 500 Ω/ms		
Power	2 W/s – 8 kW/s			2 W/s – 8 kW/s			2 W/s – 8 kW/s		
Test Measurement (4-Wire)	Range	Accuracy ¹	Resolution ¹	Range	Accuracy ¹	Resolution ¹	Range	Accuracy ¹	Resolution ¹
Voltage, DC Average	0 -40 V	0.05% + 0.05%	0.005%	0 -120 V	0.05% + 0.05%	0.005%	0 -600 V	0.05% + 0.05%	0.005%
Current, DC Average, Amp-Hr	0 - 600 A	0.1% + 0.1%	0.005%	0 -200 A	0.1% + 0.1%	0.005%	0 - 40 A	0.1% + 0.1%	0.005%
Power, Ah, kWh	± 12 kW	0.2% + 0.2%	0.005%	± 12 kW	0.2% + 0.2%	0.005%	± 12 kW	0.3% + 0.2%	0.005%
Time	1ms - 1 Yr	0.1%	0.005%	1ms - 1 Yr	0.1%	0.005%	1ms - 1 Yr	0.1%	0.005%
Physical									
Test Channel Connectors	Buss Bars			Anderson EBC A32			Anderson SBS75X		
Cabinet2 Dimensions	43.5" H x 28" W x 31" D (including casters)								
Cabinet Weight	500 Lbs								
Operating Temperature	0 - 35°C full power								
Input Power ² per Module	3 Ø, 50 - 60 Hz, 200VAC/30A, 208VAC/30A, 220VAC/29A, 380VAC/17A, 400VAC/16A, or 480VAC/13A								

¹ All Accuracies are % of Set + % of Range, All Resolutions are % of Range unless otherwise indicated, ² Input Voltage set at placement of order



Model 9210-4904



Model 9210-4904 w/ Door Open



Compare to 9200 Height (Right)



9200 Series

9410 Series Regenerative Grid Simulator

NHR
NH Research, Inc.

For The Testing of Grid-Tied Inverters, V2G & Other AC Power Products

Features

- 8 models - 4kW/8kVA to 96kW/192kVA
- 2 Voltage Ranges - 155 & 310V (400V Option)
- 2 Current Ranges
- Operating frequency - DC, 30 to 100Hz
- Waveform capture up to 125k Sample/Sec
- Precision voltage, current, power, & energy measurements
- Fully programmable per phase voltage & phase angle
- Immediate or phase angle triggerable set control
- User definable waveshape (arbitrary & harmonics)
- Built-in touch-panel user interface
- Ethernet (LAN)

Advantages

- Bi-directional AC - Inverter testing & μ grid simulation
- More reactive power per kW
- Simplifies automated test stand development
 - Software selectable 1, 2, or 3 Phase operation
 - Isolated digital inputs & outputs
 - Built-in SW watchdog & safety limits
- Software tools to shorten test development time
 - PC-based tools & NI certified drivers
 - NI certified LabVIEW & IVI-C/IVI-COM drivers
 - Optional: Enerchron test sequencer

Benefits

- Field upgradeable to higher power
- Fully emulate any utility/grid condition
- Simulate non-ideal Phase phase angles (A-B & A-C)



Model 9410 Regenerative Grid Simulator Specifications

Model Number	9410-4	9410-8	9410-12	9410-24	9410-36	9410-48	9410-72	9410-96	
AC Output Ratings									
Phases/Output Channels	1		1 or 2		1, 2, or 3				
Power, Max (1 ϕ or 3 ϕ)	4kW/8kVA	8kW/16kVA	12kW/24kVA	24kW/48kVA	36kW/72kVA	48kW/96kVA	72kW/144kVA	96kW/192kVA	
Current Ranges (RMS per ϕ)	6, 30 A/ ϕ	6, 30 A/ ϕ	6, 30 A/ ϕ	12, 60 A/ ϕ	18, 90 A/ ϕ	24, 120 A/ ϕ	36, 180 A/ ϕ	48, 240 A/ ϕ	
Current Ranges (RMS 1 ϕ)	6, 30 A	12, 60 A	18, 90 A	36, 180 A	54, 270 A	72, 360 A	108, 540 A	144, 720 A	
Peak Current	3 X Max RMS								
Frequency	40 – 70Hz								
Voltage Ranges, L-N	155, 310 V, 400 V Option								
Accuracy	0.2% Set + 0.2% Rng								
Resolution	0.005% Rng								
Distortion (THD)	<1% @ 50/60 Hz (Full power into resistive load at 480 VRMS (L-L))								
Response Rate	1 V/ μ S (10% to 90% measured at 90 degree turn-on into resistive load)								
Custom Waveforms	Sine, n-Step Sine, Triangle, Clipped-Sine, Arbitrary (user defined)								
Phase Angle Control	0 to 359 degrees / 1 degree resolution								
DC Output Ratings									
Power Max (1ch or 3ch)	4kW	8kW	12kW	24kW	36kW	48kW	72kW	96kW	
Current Ranges (Per Ch.)	6, 30 A/CH	6, 30 A/CH	6, 30 A/CH	12, 60 A/CH	18, 90 A/CH	24, 120 A/CH	36, 180 A/CH	48, 240 A/CH	
Current Ranges (Per System)	6, 30 A	12, 60 A	18, 90 A	36, 180 A	54, 270 A	72, 360 A	108, 540 A	144, 720 A	
Voltage Ranges	200, 400 VDC								
Accuracy	0.2% Set + 0.2% Rng								
Ripple	< 800mV RMS								
AC & DC Measurements									
Peak Voltage	250, 500V								
Accuracy (AC RMS)	0.1% Rdg + 0.06% Rng.								
Accuracy (DC)	0.1% Rdg + 0.1% Rng.								
Accuracy (Peak)	0.5% Rdg + 0.2% Rng.								
Resolution	0.005% Rng								
Peak Current (per Ch.)	20, 100 A	20, 100 A	20, 100 A	40, 200 A	60, 300 A	80, 400 A	120, 600 A	180, 800 A	
Accuracy (AC RMS)	0.2% Rdg + 0.06% Rng.								
Accuracy (DC)	0.2% Rdg + 0.06% Rng.								
Accuracy (Peak)	0.5% Rdg + 0.2% Rng.								
Resolution	0.005% Rng								
Peak Power	V range x I Range								
Accuracy (kW or kVA)	0.3% Rdg + 0.025% Rng.								
Resolution	0.005% Rng								
Additional Measurements	Energy (Ah, kWh, kVAh), AC Crest Factor, AC Power Factor, Waveform Capture								
Waveform Digitizer									
Data Acquisition	Output Voltage and Current								
Sample Rate	125 kSamples / sec								
Memory Depth	64 kSamples								
Aperture Time	DC to 64s								
Accuracy/Resolution	0.5% Rng / 0.05%								
Control									
Local User Interface	Built-in Touch-Panel and PC-Based software tools including graphical user interface								
External System Comm	LAN (Ethernet) supporting SCPI or VX-11								
Drivers	NI-Certified LabVIEW Drivers, IVI-C, IVI-COM								
Safety									
Module Protection	Self-protecting for over-voltage, over-current, over-power, and over-temperature								
Physical	Emergency Stop and remote E-Stop connection								
Programmable Limits	Min/Max Voltage, Current (per direction), and Power (per direction) with separate limits and time delay values								
Software Watchdog	Programmable								
Physical									
Connectors	Terminal Block				Bus Bars				
Form	Chassis				Single Cabinet		Double Cabinet		
Dimensions (WxDxH)	19"x15 3/4"x24"				23"x30"x43"		23"x30"x78"		46"x30"x78"
Weight	105 lbs	120 lbs	135 lbs	370 lbs	505 lbs	855 lbs	1340 lbs	1610 lbs	
Operating Temp	35°C								
Isolation	Facility to Chassis – 1,000V, Output to Chassis – 500 V, Facility to Output Internal Isolation – 2,000 V								
Input Power									
Voltage	Universal Input – 380V to 480V \pm 10% (L-L, 3 Phase, 50/60Hz)								
Efficiency/Power Factor	> 85% / > 0.95								
Current per ϕ @ 380 V	9 A	17 A	25 A	49 A	73 A	97 A	144 A	192 A	
Current per ϕ @ 400 V	9 A	17 A	24 A	47 A	69 A	92 A	137 A	183 A	
Current per ϕ @ 480 V	8 A	14 A	20 A	39 A	58 A	77 A	114 A	152 A	
Ordering Information									
Grid Emulator P/N	Model	kW Rating	Options						
	9410	-12	-HV						



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